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JPCL
JOURNAL OF PROTECTIVE COATINGS & LININGS
The Voice of SSPC: The Society for Protective Coatings

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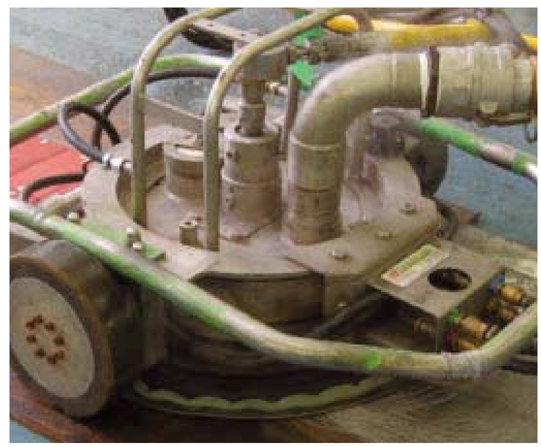
See story, pp. 11-15.



Also this month

From the Offices of SSPC

The Society For Protective Coatings

SSPC recently launched an all-new sspc.org! For quick access, use your smart phone to capture this barcode.

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Specifications

Before I talk about specifications, enclosed with this month's *JPCL* is the preliminary program for SSPC 2012, to be held in Tampa, FL, from Jan. 30 to Feb. 2, 2012. We are planning a superb technical and educational program, where you will learn while having fun. Please take a look at the program and see what the speakers and presenters have to offer. We are convinced you will find something that will help you in your daily work. And, for those of you in cold climates, what better way to also take a break from the elements than to come to vibrant and warm Tampa?

The specification is the most important document in any coatings project. SSPC has recently published a document called "Preparing and Using Protective Coating Specifications." Available on the website as a Technical Insight Report, it describes some best practices for preparing and administering a quality specification for applying high-performance protective coatings and linings to industrial structures. This report focuses on developing an appropriate set of requirements for applying coatings and linings to obtain maximum coating system performance, service life, and protection of substrates in the prevailing service environment. A well-prepared and administered specification will help ensure that the contractor performs the work according to the requirements in the allotted time.

The report focuses on the preparation and administration of specifications for competitively bid contracts, frequently called "low bid" contracts. This is the most common type of contract, at least in the public sector, and is widely seen throughout the coating community. Competitively bid contracts are generally the most difficult for which to develop specifications (more detail required), and arguably, are the most difficult to administer, although when designed and administered appropriately, they can produce consistent, predictable, and cost-effective results. This report is also applicable to direct selection, best value, and other negotiated contracts, but some tailoring of the requirements discussed in the body of the report may be prudent.

This report has two main parts:

- Part I. The Contracting Environment and
- Part II. Items Commonly Required in Coating Specifications.

In addition, five appendices accompany the report to illustrate and elaborate on it.

We hope that this will help owners and specifiers write clear, concise specifications. In my many years here at SSPC, I have heard owners, specifiers, and suppliers say that many specifications are too general and too loose. This gives opportunity for those who have any connection with the work to cut corners, do substandard work, or provide substandard products. Then the owners are not getting what they paid for and the structures will not have the service life that the owners expect. It is well known that some contractors read the specifications in great detail and go through them "with a fine tooth comb." They then bid on work based on poorly written specifications, knowing that a good job will require many change orders. After the contract is signed and the work is done, the owner will tell the contractor what was expected. The contractor's response is that the expectations were not in the specification, so for the contractor to fulfill the owner's wish, a change order and thus additional cost to the owner are needed. And some contractors deviate from the work, telling the owner after it is too late so that the owner has to accept the work because of production schedules. The contractor asks for forgiveness, not permission, causing conflict between the contractor and the owner. The price of this type of deviation may not be seen until years after the fact, once the item begins to show signs of corrosion.

In the June 2011 editorial, I referred to the Brandon and Damiano article about the importance of a work plan. My last sentence in that editorial was "better planning yields better execution and as a result, a coatings job that is done right, every time." You could substitute "specification" for "planning" in that sentence and understand that to me, the specification is the keystone to that work plan. A clear and concise specification leads to a thorough and complete work plan.

Bill Shoup
Executive Director, SSPC

SSPC/*JPCL* Plans Busy Fall Webinar Schedule

SSPC/*JPCL* Education Series Webinars in October will begin with Randy Nixon, president and founder of Corrosion Probe, presenting, "Selecting Coatings for Wastewater Facilities," on Oct. 12 from 11:00 a.m. to Noon EST; subsequently, Jay Helsel, an engineer and coating specialist with KTA-Tator, will present the webinar, "Quality Control of Abrasive Blast Cleaning Operations," on Oct. 19 from 11:00 a.m. to Noon EST.

November will see the presentation of three webinars. "Rigging and Containing Debris in Water Tower Painting" will be presented on Nov. 2 from 11:00 a.m. to Noon EST by Mike Reina and Robert Lanterman of KTA-Tator. On Nov. 16, from 11:00 a.m. to Noon EST, Tony Sardenes of Greenman-Pederson will present "Spot Repair and Priming as an Alternative to Full Coating Removal." The final November webinar, set for Nov. 30 from 11:00 a.m to Noon EST, will be "Aerial Lift and Scaffold Safety," presented by Stan Liang of KTA-Tator.


Randy Nixon (left) and Jay Helsel (right) are presenting two SSPC/JPCL Education Series Webinars in October.

JPCL SSPC Webinar Education Series

Nixon's webinar on selecting coatings for wastewater facilities will describe the coatings systems that are typically recommended for the main exposure conditions in wastewater service and will explain the pros and cons for each system. The webinar is co-sponsored by Induron and WIWA.

The webinar on quality control of abrasive blast cleaning operations will deal with industry standards for abrasive blast cleaning, monitoring the quality of equipment, monitoring abrasive quality, monitoring ambient conditions, assessing surface cleanliness, and assessing profile. Atlantic Design is the sponsor.

"Rigging and Containing Debris in Water Tower Painting" will cover SSPC-Guide 6 containment requirements, containment system components, engineering calculations, dust collection, and overcoming difficulties encountered when rigging water towers.

The webinar on spot repair will review the design of this coating option and will describe the benefits in terms of economics, corrosion control, and esthetics.

"Aerial Lift and Scaffold Safety" will address highlights of the OSHA Scaffold Standard, including scaffold requirements, aerial lift requirements, and training requirements.

SSPC is an accredited training provider for the Florida Board of Professional Engineers (FBPE). PEs in Florida can now submit SSPC Webinar Exam CEUs to the FBPE. If interested in submitting Webinar Exam CEUs to the FBPE, you must download the FBPE CEU form and successfully pass the Webinar Exam.

Participation in the webinar is free, but for those who wish to receive continuing education credits from SSPC, a test is available after the webinar. Cost of the test service is $25. You can register through the SSPC MarketPlace.

These fall webinars are part of the 2011 SSPC/*JPCL* Education Series, providing continuing education for SSPC recertifications as well as technology updates on important topics.

Center Showcases Instant Curing R&D

RadTech International: The Association for UV & EB Technology will mark its silver anniversary with a new research, development, and industrial testing center.

RadTech's uv.eb East 2011 Conference, to be held Oct. 4-5 in Syracuse, NY, will highlight the new center's capabilities while introducing and promoting UV/EB technology to a variety of industries. Ultraviolet (UV) and Electron Beam (EB) technologies cause inks and paints to dry nearly instantly, speeding industrial production.

The UV/EB center will advance the development and adoption of formulas that produce few or no emissions in the manufacture and application of inks, paints, and coatings, as well as resin binders used in the fabrication of composite materials such as those used to make wind turbine blades. It will also serve as a center of expertise with equipment and analytical laboratory capabilities to help manufacturers independently test these technologies.

JPCL to Launch Coating eBook Series

JPCL: Journal of Protective Coatings & Linings will expand its veteran coatings buying guide this fall into a new series of 10 eBooks featuring selection and specifying advice for unique industry segments.

The annual *JPCL Coating Systems Buying Guide* will be published Oct. 13 in print, with a searchable version posted on paintsquare.com and updated as needed. The guide will feature thousands of coatings options from hundreds of manufacturers, as well as company profiles of participating suppliers.

Those resources will also be incorporated into the eBook series, enhanced by customized selection and specification advice targeting bridge, marine, wastewater, water, chemical, power, offshore, transmission pipeline, and other industry segments.

"By customizing *JPCL*'s protective and marine coatings expertise for unique industry segments and delivering these digital resources free, we will support every facet of the industry, including our regular *JPCL* readers," said Karen A. Kapsanis, editor in chief of *JPCL,* the voice of SSPC: The Society for Protective Coatings.

The series will be available in early October. The eBooks will be provided free to large groups of facility owners, contractors, and engineers, numbering in the thousands, in each industry.

They will also be offered free by eblast to new *JPCL* readers, who will be able to download them from the link provided. Each eBook, about 30 pages long, will also be offered for sale on paintsquare.com at a later date.

The guide will include coatings for bridges, highways, waterworks, locks, dams and other public works, as well as wastewater treatment in municipal facilities. Private industry segments include chemical-petrochemical, marine, power, offshore, food and pharmaceutical, and railcar.

Additionally, there are several specialty function areas, such as antifoulings, fire-resistive coatings, and anti-graffiti coatings.

The guide is organized by industry, then by substrate, and finally by exposure environments. Under each exposure environment, participating suppliers list the coating system they recommend for the exposure.

Coatings selection and specifying advice in the eBooks will be derived from articles published previously in *JPCL.* These articles tend to be broad guides on selecting coatings by generic type to match their performance profiles with exposure conditions in an industry.

A typical example is "From New Construction through Plant Operation: An Overview of Protecting Chemical Plants," by Luke Clark, a NACE-certified Coatings Inspector and SSPC Certified Protective Coatings Specialist. The article details evaluation parameters, condition assessment, project-specific procedures, maintenance painting, and coatings for new construction.

For more information about the *Buying Guide,* contact Anita Socci at 800.837.8303, ext. 136, or asocci@protectivecoatings.com.

ASTM Crafting First Dry Fall Standard

ASTM International is seeking input as it develops the first standard for determining the dry-fall properties of protective coatings.

ASTM WK34014, Practice for Determining the Dry Fall (Fog) Properties of Protective Coatings, is being developed by Subcommittee D01.46 on Industrial Protective Coatings, which is part of ASTM's Committee D01 on Paint and Related Coatings, Materials and Applications.

Overspray particles that attach to unintended surfaces can result in property damage and insurance claims. Dry-fall coatings are formulated so that the overspray particles dry as they move through the air, before they land on horizontal surfaces.

For more information, ASTM staff contact Jeffrey Adkins can be reached at 610-832-9738 or jadkins@astm.org. Bill Corbett, KTA-Tator, is the technical contact, and can be reached at 412-788-1300, ext. 223, or bcorbett@kta.com.

IMO Panel Adopts Biofouling Guidelines

An International Maritime Organization committee has adopted the first set of international recommendations to address biofouling of ships to minimize the transfer of invasive aquatic species.

IMO's Marine Environment Protection Committee (MEPC) approved the guidelines, which are voluntary for now, in July at its 62nd Session, held in London.

The new guidelines focus on four areas: a biofouling management plan and recordbook; antifouling coatings system selection, installation, and maintenance; in-water inspection, cleaning, and maintenance; and ship design and construction.

Remedying Excessive Profile

This Month's Question: What is the remedial action if a blaster produces too high a surface profile for the required primer thickness?

From Jesse Chasteen
Schriener Construction
The surface requires rework. You should find out what the surface profile was on the test plate. What was the spec on the abrasive? If the manufacturer stated that a specific profile range at a certain psi at the nozzle would result in the appropriate profile, but it didn't, then the rework should be subsidized.

It is important to answer many questions about why the excessive profile was created to ensure that a repeat performance doesn't happen. If the reason was an out of spec, pre-existing profile issue, the change to the abrasive after inspection of the test plate would have been grounds for a change order, and the contractor would have appeared to be more professional. Always put the horse in front of the cart; it's the best way to move forward.

From Richard D. Souza
Stoncor Middle East LLC
When such a case arises, people re-blast with a fine grade sand or garnet abrasive to try to reduce the profile because it is always assumed that re-blasting with a finer abrasive will bring down the profile to the desired profile range. However, I am very sure that, at best, you may be able to bring the profile down by 10–15 microns by knocking off the high profile peaks, but it is almost impossible to change a 100-micron profile to a 50-micron profile with this technique.

The same problem exists if there is an excessive pre-existing profile under the existing coating being removed and if there is existing rust pitting on the surface. In such case, all parties involved must reach an agreement and take appropriate steps to account for such variables, changing the coating system and/or increasing the total dft to meet or exceed the specification requirements.

From Barry Barman
Barry Barman & Associates
Reblast using a finer abrasive. The finer abrasive will result in the cold flow of surface steel, creating a greater density of peaks and valleys per unit of surface area but with a shallower profile.

From Carl Havemann
www.corrosioneducation.co.za
Check that the measurements are statistically representative. Use emery paper of suitable roughness to abrade the surface to reduce the high points. Establish this method by experiment. This method, however, may be suitable only for small areas. An altenative is to replace the primer with one having a higher film build to accommodate the profile.

Editor's Note: *The above Problem Solving Forum (PSF) question was posted on the free daily electronic newsletter,* PaintSquare News (PSN), *on behalf of* JPCL. *PSF responses submitted through* PSN *as well as those sent directly to* JPCL *are selected and edited to conform to* JPCL *style and space limitations.* JPCL *invites additional responses to the question; you may send your answer directly to Karen Kapsanis, editor,* JPCL, *kkapsanis@protectivecoatings.com.*

In-Situ Coating of Corroded Pipelines in the Canadian Oil Patch

By Mike O'Donoghue, Ph.D., and Vijay Datta, MS, International Paint LLC

The Canadian oil patch has long been accustomed to internal coatings applied to new steel pipe in heated fabrication shops, where the abrasive blast is carried out according to well-defined SSPC, NACE, or ISO standards, and the steel is provided the appropriate deep and jagged profile prior to coating application. Just what the doctor ordered.

Photos courtesy of Nathan Campbell, EnerClear
Fig. 1: Pig launcher setup

Fig. 2: Pig receiver setup

So, in marked contrast, when in September 2010 some 2.9 km of vintage 1986 uncoated, buried, and corroded 8-inch diameter pipe in Kerrobert, Saskatchewan, were chemically cleaned and coated *in-situ,* using only the steel profile gained from the corroded steel itself, the project drew considerable attention. How well did the application go? Were any obstacles or problems encountered? What kind of coating was used? And ultimately how long would the coating last?

Penn West Exploration, a major oil producer in Calgary, elected to adopt this corrosion mitigation program given that the pipeline geometry was prohibitive for a freestanding or polyethylene liner. Penn West chose a Red Deer, Alberta-based contractor specializing in in-situ lining applications to apply in-situ a thin-film, low-temperature cure, epoxy lining.

This article discusses two aspects of the *in-situ* coating project: existing pipeline assessment and the *in-situ* process.

Existing Pipeline Assessment

Before deciding whether a pipeline is suitable for in-situ coating, an assessment process has to be undertaken, which includes a review of the historical corrosion issues in the production field combined with an evaluation of the long-term infrastructure needs in terms of existing infrastructure and future development plans. A thorough integrity assessment is then performed on the pipeline, which typically includes an in-line inspection, evaluation, and repairs if necessary to ensure that the pipeline is fit for continued service.

"Once we understand the damage mechanisms and physical attributes of the pipeline, and have evaluated all risks associated with continued use as an in-situ coated pipeline, we proceed with coating selection and project execution," said Dean Jenson, supervisor of pipeline integrity for Penn West. Coating selection and testing is a critical step to ensure the success of the project. Coatings must be easily applied, readily cured under field conditions, and they must be compatible with existing chemical treatment schemes, which could involve demulsifiers, scale inhibitors, corrosion inhibitors, and other specialty chemicals. For some projects, candidate coatings are tested using actual production fluid. The coating for this project was tested for Penn West at two independent laboratories.

In this case, inspection had shown

Continued

Fig. 3: Pipe wall internals after scale build up and majority of wax removed. Some wax remains and mill scale is also evident around the weld areas.

Fig. 4: Pipe wall internals after removal of wax, deposits, and mill scale.

Fig. 5: Final inspection of pipe wall internals prior to running drying agents in preparation for first coat.

that an oil emulsion/5% water cut process fluid with 10,000 ppm chlorides and 0.5% gaseous CO_2, running at 15 C and 300 kPa, had caused extensive corrosion of this small uncoated section of Penn West's overall 35,000 km of pipeline inventory.

"Ordinarily, chemical inhibitors have been the mainstay to protect any of our uncoated pipe sections," commented Jenson, "but with this section of pipe being one of two 8-inch pipelines, which are critical pieces of long-term infrastructure in a mature field being revitalized with horizontal, multi-stage drilling development, we decided to trial a harmonized approach where a corrosion inhibitor program and an in-situ applied epoxy lining would work together."

The epoxy lining system chosen was already known to possess a widely acclaimed history of success in tank, vessel, and pipeline applications in the oil patch. Interestingly, the tandem inhibitor-lining approach for pipe internals was envisaged as somewhat analogous to the combination of coatings and cathodic protection that work together to control corrosion on the external surface of a pipeline.

The reasons for the in-situ approach broadly included aspirations of increased pipeline flow, reduced pipeline pressure, reduced use of inhibitors, reduced maintenance pigging, and clean product delivery. Most importantly, this offered an extension of pipeline life and the ability to delay the significant capital expenditure associated with constructing new or replacement pipelines. In areas with marginal economics, the decision to in-situ coat versus pipeline replacement can literally extend the operating life of an entire production field.

The In-Situ Process

While in-situ coating applications had hitherto been rather more prevalent in Alberta for water conveyance, according to Nathan Campbell, president of the coating applicator, "Pigging process and technology is at the heart of the matter for an in-situ epoxy lining project." Indeed, it has been demonstrated to be a viable maintenance strategy for petrochemical fluids in oilfield applications and has been deployed for a whole host of other pipeline applications, including aviation fuel lines, gas lines, and potable water lines.

"We use the in-situ process with a variety of pipeline pigs to introduce equipment and liquids for pipeline cleaning and subsequent lining," Campbell continued. "During this application process in the Kerrobert area, we were exposed to uncharacteristic amounts of rainfall, which made access difficult and caused pipe ends to require pumping before inspection. On-site shelters were erected as longer force-cure times were required to complete this project. In fact, in this particular project of an 8-inch pipe, numerous variances in wall thickness were observed. As a result, the paint pig selection (i.e.,

Continued

Fig. 6: Worker monitoring back pressure on receiving end as coating run is in progress.

size/durometer) became extremely important to achieve the coating manufacturer's specifications for dry film thickness," said Campbell.

The equivalent of an SSPC-SP 10 or NACE No. 2 finish was specified and readily achieved. The *in-situ* process was comprised of three main stages:

- Stage 1: The pipe internals were mechanically cleaned using scraping pigs. The process began with the use of the least aggressive and softer durometer pigs and finished with the use of more aggressive, harder durometer pigs. (The harder the durometer, the better a pig will scrape the pipe internals; the softer the durometer, the closer the seal of the pig to the wall.) This process was followed by solvent and water flushes to remove foreign material from the pipe wall, such as waxes and asphaltines.

Fig. 7: First coat averaged 3 mils DFT, an additional 2 coats were applied to achieve the required 10-12 mils DFT.

- Stage 2: A thorough chemical cleaning of the pipe internals was carried out using inhibited hydrochloric acid (HCl) to dissolve and remove scale. The inhibited HCl was batched between special acid-resistant pigs and shuttled until the acid was spent, the effluent pH was stabilized, and the test samples had become visually free of debris or discoloration.

After verifying the pipeline had achieved the SSPC-SP 10 standard, the pipeline was then rinsed and dried with methanol and desiccants.

- Stage 3: A batch of the epoxy lining was mixed, pumped into the pipe at the pig launcher station, and batched between two coating pigs before being sent down the line against back pressure (using dried air).

A solvented, modified phenalkamine epoxy was applied in three pig runs to achieve 10–12 mils total dry film thickness (DFT). The latter was calculated as opposed to being measured. While testing for holidays was not carried out, it is possible at inspection points at the client's request.

Sean Adlem, Alberta regional sales manager for the coatings manufacturer, stated that, "The chemical resistance of the modified phenalkamine epoxy is well-suited to projects of this type." He also noted its advantages of high surface tolerance, fast cure, and ease of use.

Because the selection of the coating is of critical importance for an *in-situ* application in the oil patch, it is important to use a chemical-resistant coating, tested in third party independent laboratories, proven in the oilfield, and with balanced attributes of low viscosity, appropriate pot life, and good film build capabilities. In this way both owner and applicator requirements can be met.

Project Success

Fast forward to recap in the present day. How well did the application go? All parties were impressed. Were any obstacles or problems encountered? Yes—inclement weather. But none that were out of the ordinary or insurmountable. What kind of coating was used? A low-temperature curing, modified phenalkamine epoxy.

Ultimately how long would the coating last? Jenson is optimistic about a long service life, stating, "The risks associated with an *in-situ* coating application were carefully weighed against the risks associated with alternative internal corrosion mitigation measures such as long-term economics and likelihood of success. After nearly a year's service and bi-monthly pig runs, we have not seen any signs of problems."

International Paint LLC supplied the high performance epoxy lining for the pipe internals. EnerClear Services was the contractor and also custom-made the mixing equipment. Pipeline Pigging Specialties made the pigs.

Mike O'Donoghue, Ph.D., is the director of engineering and technical services for International Paint LLC. Vijay Datta, MS, is the technical manager for International Paint LLC.

Fig. 8: EnerClear personnel inspecting the final application of coating for DFT adhesion and cure at mid-point spool.

Cases from the F-Files:

The Shop-Coated Pipeline That Cracked

By Valerie D. Sherbondy, Senior Chemist, KTA-Tator, Inc.
Richard A. Burgess, Series Editor, KTA-Tator, Inc.

Gas transmission pipelines are often coated in a shop using fusion bonded epoxy (FBE) coating systems. These coatings are chosen for their resistance to chemicals in soil and excellent impact resistance, which means less damage during the transportation and installation of the pipe sections and less mechanical damage during backfilling. Shop operations for abrasive blast cleaning and coating application are automated, and the resulting applied films are generally uniform. One drawback is that the weld areas and joints that connect pipe sections must be prepared and coated in the field are generally not as uniform and consistent from "joint to joint" as are the "stick to stick" shop-applied coatings. A second drawback with the same FBE coating materials applied in the shop is that they are more difficult to apply in the field due to widely variable environmental conditions.

Additional resources must be devoted to inspection of the field-applied coating. In this case from the F-Files, the added field inspection resources paid off when unexpected defects in the shop-applied coatings were discovered. Inspection of the joint areas indirectly extended to the neighboring FBE coated pipe, which revealed occasional cracking and blistering. A failure investigation was initiated, and several pipe sections were removed for examination and laboratory analysis of the coating.

Background

The specification provided for coating the pipe sections required that the steel surfaces be prepared in accordance with SSPC-SP 10, Near-White Blast Cleaning, and that the resultant profile

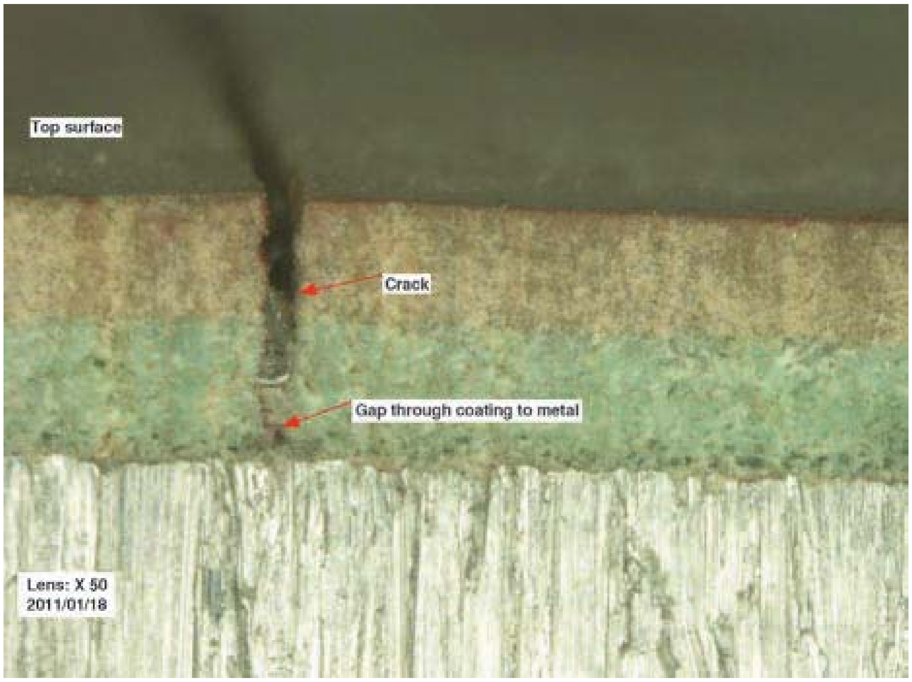

Fig. 1: Cross-section at 50X, crack and porosity at interface. Photos courtesy of KTA-Tator, Inc.

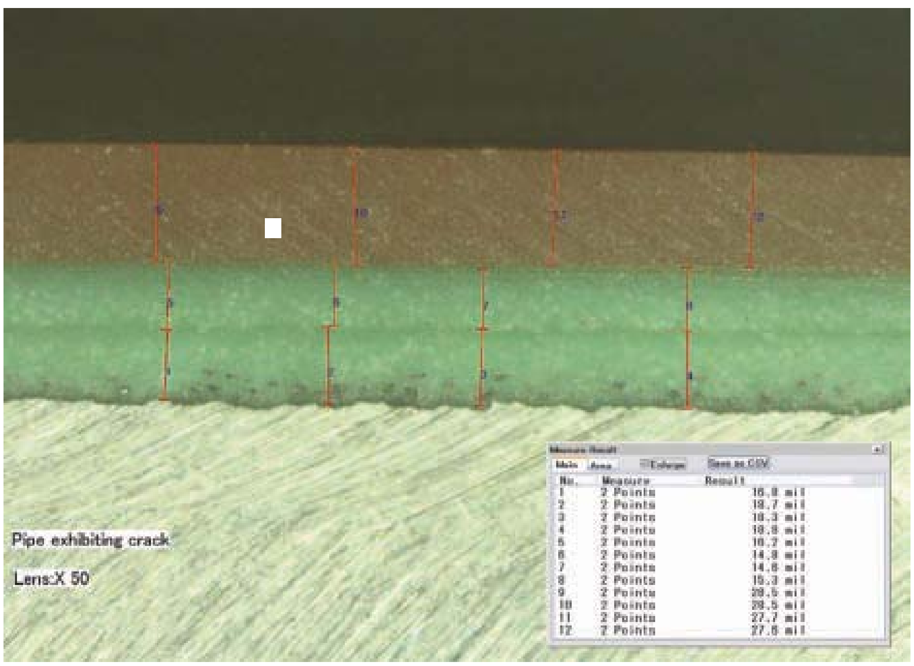

Fig. 2: Cross-section at 50X, away from crack, polished.
Note the striation in the green layer, causing the appearance of two layers.

be angular with a depth of 1.5 to 3.5 mils. Once prepared for coating, the pipe sections were to be heated to between 460 F and 500 F, not exceed 500 F. A two-coat FBE coating system was specified. The primer was specified to be applied to achieve a dry film thickness (DFT) of 16–20 mils, with an average of 18 mils. The topcoat, or outer jacket, was to be applied immediately after the first coat. The topcoat was to be applied to achieve a DFT of 30–36 mils. The total system DFT was specified to be in the range of 46–56 mils. The primer was green, and the topcoat was brown. The pipes were prepared and coated in a shop and then shipped to a single location for installation.

The field observations included isolated blisters in the coating on the exterior of the pipe and cracks in the FBE coating film at the field bend locations. It was reported that only four or five initial blisters were observed in the field before the pipe sections were installed and welded. Additional blisters were observed on the pipe sections after field installation. The blisters were repaired in the field, with the exception of those on a blistered pipe section sent to the laboratory for examination. In addition, cracks at field bend locations were holiday tested and repaired in the field shortly after the bending procedure. It had been noted that in some instances cracks were not apparent after bending and had appeared the following day.

The total FBE thickness around defective areas was measured using a nondestructive electronic coating thickness gage. The thickness readings were obtained in a minimum of six areas on each pipe sample. The average coating system thickness measurements revealed a range of 54.8–60.6 mils. The nondestructive measurements were consistent with the overall thickness determined by microscopy and confirmed that the total system thickness exceeded the specified range of 46–56 mils.

Laboratory Investigation

Coated samples were cut from larger pipe sections at the field site by the contractor and submitted to the laboratory. The samples were to be representative of the typical FBE coating defects observed in the field and included a section of the cracking that was reportedly occurring at the installation site and a pipe section containing blisters observed during installation. Properly heated and cured control samples of the specified primer and topcoat materials were provided by the coating manufacturer.

High voltage holiday testing was performed on the pipe sections received by the laboratory prior to sectioning for laboratory testing. This testing was performed to determine if the cracks in the coating sample extended through the FBE coating film to the substrate. It was confirmed that the cracks did extend through the coating, or at least sufficiently deep enough to result in detection of the discontinuity.

The laboratory used a plasma cutter to section the pipe samples and isolate the areas exhibiting defects for examination. During the plasma cutting process, additional blisters formed in the FBE coating in the heat-affected zone. The blistering occurred when the coating surface temperature adjacent to the cut line was in the range of 210 F to 220 F. As the surface cooled, most of the blisters that had developed during the cutting process dissipated.

The laboratory examined sections of the pipe displaying a crack and a large blister using a digital microscope with magnification to 200X. Both sample sections had two coating layers, and each layer (primer and topcoat) measured 25–30 mils. The average total thickness of the coating system was 60–63 mils. From this information it can be concluded that the green primer was thicker than specified (16–20 mils, with an average of 18 mils), and that the thickness of brown topcoat, which was to be applied at 30–36 mils, was slightly less than specified. Since the total specified thickness was 46–56 mils, the laboratory microscopic measurements of film thickness demonstrated that not only was the green primer applied considerably thicker than specified, but it also caused the entire system thickness to be higher than specified.

A cross-sectional cut through a cracked area of the coating system was viewed to determine if the crack went all the way through the coating system to the steel substrate beneath. The cracked coating was viewed at several locations, and in all instances, the crack extended through to the steel surface (Fig. 1). This view also revealed voids in the green layer close to the metal interface. Additionally, there was a noted separation between the coating and the metal substrate at the interface. It is not known if this was the result of laboratory sample removal and preparation or if it had occurred during the field bending.

The cross-sectional view of an area away from the crack also revealed voids at the metal interface and a visual layering effect within the green layer (Fig. 2). The back surface of a coating blister cap was examined at 200X magnification and exhibited variations in color and scaling of coating consistent with a cohesive disbondment within the green FBE layer. This same view of the back surface of the blister cap also exhibited several circular voids or shallow craters.

Microscopic examination of the steel substrate below the blister revealed a thin layer of green coating marked with shallow craters that appeared to be the bottom half of the circular voids observed on the back side of the blister cap. The coating appeared to be cohesively split, causing lighter and darker variations of the green color. There were also areas where the metal was clearly visible. In these areas, the metal did not reveal signs of a surface profile from abrasive blast cleaning (Fig. 3).

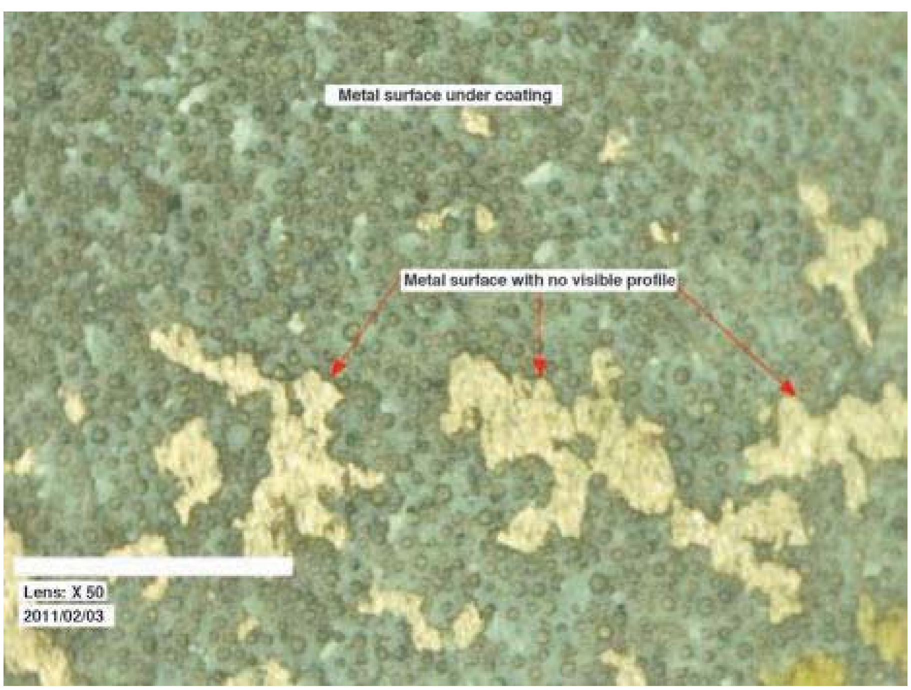

Fig. 3: Metal surface beneath coating at 50X.
Note the circular void pattern and "smooth" spots on the metal surface.

The view of the cross-section of the blistered coating material revealed two coating layers. Again, as in the previous sample, the green primer contained striations, giving the appearance of three layers of green coating (Fig. 4). Also, the porosity of the coating layers is visible as the lighter spherical areas in the polished view.

No discrete foreign material (liquid or solid) was visible in the blisters. However, since blistering often occurs when there are contaminants present, samples of the coating and the underly-

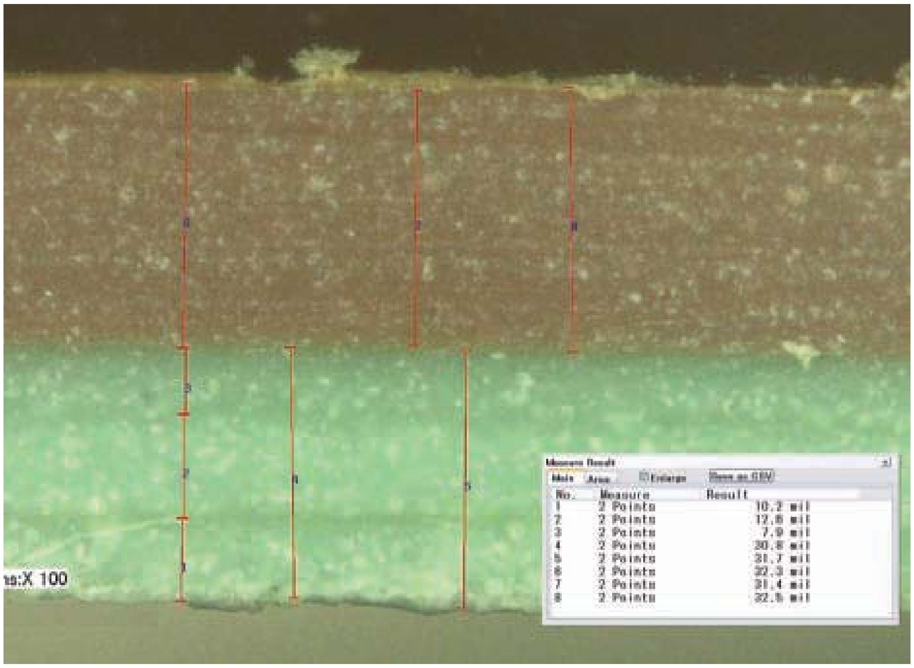

Fig. 4: Cross-section at 100X, polished coating in blistered area. Note appearance of three layers in the green primer. White areas represent voids in the film.

ing surface were examined by scanning electron microscope (SEM) to analyze for elemental differences that may be indicative of contamination of the metal surface or the coating material.

A control sample of the coating material was scanned and revealed the presence of high levels of carbon, with lower levels of silicon and calcium as well as oxygen. The back surface of the coating where the blistering had occurred was analyzed for comparison. The analysis revealed the sample was similar to the original scan of the intact coating, as it also showed the presence of silicon and calcium, as well as carbon and oxygen. Additionally, a small particle that was evident in the base of a void was scanned to determine if a contaminant was present. The resulting scan was similar to the scan of the control sample. No contamination was identified by this technique.

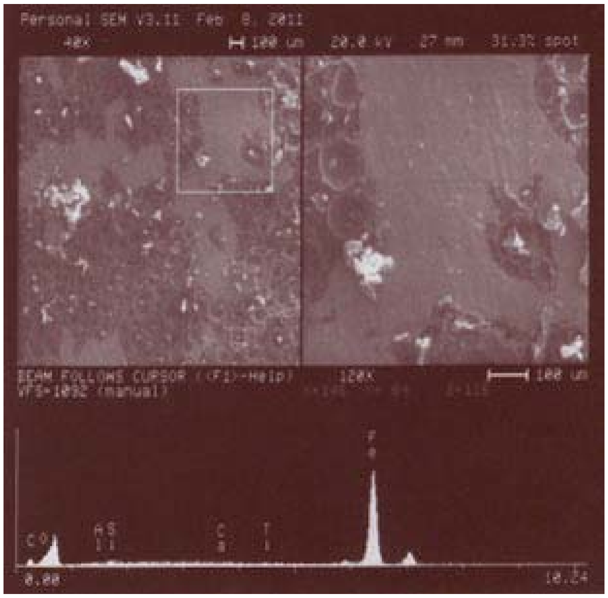
Fig. 5: Area of metal surface exhibiting no profile at 120X.

SEM analysis was employed on the metal surface identified by light microscopy as "smooth" since it did not exhibit the profile texture evident on the other areas of the pipe (Fig. 5). The analysis revealed the presence of iron with a small amount of oxygen. Elements associated with the coating, such as silicon and calcium, were not detected, which indicated that no coating was adhering to the metal surface in this area.

Differential scanning calorimetry (DSC) was performed to assess the degree of cure of the coating system. The glass transition temperature (Tg) was determined for each of the manufacturer supplied control samples, as well as the green primer and the brown topcoat that were removed from the pipe. The samples were subjected to a single dynamic heating step from −20 C to 210 C, increasing by 10 C/minute.

When a coating resin sample (e.g., epoxy) is heated, the heat flow into or out of the sample is monitored as a function of time by the DSC and is graphed. The pattern of the temperature graph changes when the molecules use the heat energy to change form. For example, monitoring a piece of ice in a similar manner would show profile changes when the water transitions from a solid to a liquid and from a liquid to a vapor; however, resins and plastics are more complex. The resulting graph is used to establish the Tg.

The analyses revealed the onset Tg of the control samples was similar to the onset Tg of the samples from the pipe. Differences of greater than 5 C onset Tg are considered significant. The data obtained showed that there was little to no significant difference between the degrees of cure of the pipe coating samples compared to the manufacturer supplied control samples. Therefore, it appeared that the FBE coating system applied to the pipe was adequately cured.

However, several differences in the temperature graph pattern unrelated to the measured Tg occurred in the duplicate analysis of the coating samples. The discrepancies suggest non-uniformity of the coating system cure and included variable coating decomposition temperatures and inconsistent melt events evidenced by endothermic peaks.

Conclusions

The findings from the laboratory investigation determined that the FBE coating on representative pipe samples varied from the coating specification. These variations, when combined with environmental factors, were enough to cause the visual defects (blisters and cracking) seen in the coating. In the process of the analytical work, it was observed that the green first layer of FBE contained a significant quantity of voids, also referred to as "porosity," within the applied film. Additionally, the layering pattern of the green coating indicated that the final film characteristics may have also been affected by the thick application of the material. DSC test data indicated that the Tg of the pipe coating was consistent with the cured control samples, and there were some inconsistencies elsewhere in the patterns.

Curing of the FBE Coating

Proper curing of an FBE is critical for optimal performance. To determine if lack of proper cure may have contributed to the observed coating problem, the cure of the coating was assessed using DSC. The information obtained by this method suggested that the FBE coating system had achieved proper cure. Some variations noted between replicates may indicate that the excessive thickness hindered the consistency of the cure in some areas. However, there were no clear indications of film property deficiencies.

Cracking of FBE Coating

In the process of field pipe bending, project personnel reported that cracking of the FBE coating system occurred on the outside radius (stretched portion) of the bend. The cracks were reportedly field repaired as they occurred. Field personnel also reported that some cracks appeared approximately one day after bending took place. Holiday testing and microscopic examination of the cracked area both confirmed that the crack penetrated the entire coating system thickness to the steel substrate.

Since this coating system should be able to withstand bending operations, differences in application and variations from the specification were considered. Laboratory microscopic measurements of film thickness revealed that the green primer layer was nearly two times thicker than specified (16.0–20.0 mils vs. 32.9–34.0 mils). Field reports later confirmed that the cracking problems were associated with the bending pipe sections where the green coating layer was greater than 20 mils.

Thick coating films develop greater internal stresses than thinner films. Thus, the applied FBE that was thicker than specified developed even greater stress than coatings of proper thicknesses when stretched and/or flexed. When the stress became too great, the coating cracked to relieve the excess stress. In addition to the increased coating thickness, cold temperatures (field bending was reportedly performed in cold weather) will further reduce the flexibility of the coating. A thick, cold coating film is more prone to cracking than a thinner, warm coating film. The evidence suggests that the combination of excessive thickness and cold temperatures were major contributing factors to the cracking problem observed during field pipe bending.

Blistering of FBE Coating

Blister formation in a coating system is typically caused by several well known phenomena. Because the phenomena (mechanisms) are known, determining the actual cause of blistering often becomes a process of elimination.

One mechanism for blister formation starts with some form of water soluble contamination (i.e., sodium chloride or other soluble salts) on the bare pipe surface at the time of FBE application. Virtually all coating systems, FBE included, transfer moisture vapor back and forth through the film to some degree. As long as moisture vapor transfer remains in equilibrium, the coating system is generally fine. However, when water soluble or contaminants are present at the interface of the metal substrate and the coating, moisture vapor is attracted to these areas. As a result, water accumulates and dissolves the contaminant, creating pressure at the substrate/coating interface. As additional water is attracted to these areas, the pressure increases, pushing out the coating film to form a blister. This process is commonly referred to as osmotic blistering.

The blistering process can also be driven by differences in temperature, or "thermal gradients," over a coated surface. Blisters may also be the result of problems with cathodic protection systems (cathodic blistering or cathodic disbondment). Because many of the factors that can lead to blistering are known, reviewing information from the field data and laboratory work can be used to test those variables or rule them out. For example, cathodic blistering can be eliminated as a potential cause because the cathodic protection system was not yet in service.

In keeping with this approach, the microscopic examination identified areas of the metal pipe surface that were "smooth" and did not exhibit a roughened surface profile. This finding suggests that there were very small areas where the surface profile produced by abrasive blast cleaning was somehow smoothed out, which can be a result of shop grinding processes that are used after abrasive blast cleaning to remove small base metal protrusions (laminations), or from contact with metal rollers along the production line. While these small areas represented spots of weakened adhesion, which could allow blister-like disbonding to occur, their contribution, if any, to the observed blistering problem was believed to be minimal. Had these small areas played a significant role, it would be expected that blister formation would have been more prevalent across the pipe surface rather than at a few isolated areas.

With regard to thermal gradients as a cause of blister formation, the possibility of the contribution to this coating failure existed. Because field welding of pipe took place in periods of colder weather, significant temperature differentials on limited areas of the pipe were a possibility.

Recall that a plasma cutter was used to cut smaller samples from the pipe sections in the laboratory at room temperature. It was observed that blisters formed in the FBE coating in the heat affected zone. The blisters occurred when the surface temperature around the sample cut was in the 210–220 F range. After cooling, most blister sites were not visible, but a few shallow blisters did remain and were removed for further laboratory analysis. In all instances, the laboratory analysis (microscopic and SEM) did not detect any contaminants (i.e., chlorides or other soluble salts) that would suggest a cause for osmotic blister formation. However, as with other blistered samples, a microscopic examination of the back surface of the blister cap did reveal the presence of significant concentrations of bubble-like voids or "porosity" in the FBE film. Furthermore, an examination of the pipe surface beneath the blister revealed that a thin and porous film of FBE remained on the surface. On the blistered samples, the FBE layer fractured within the porosity such that half of the bubble void was visible on the back surface of the blister cap and half remained on the metal surface. This finding indicated that porosity produced a weakness in the FBE coating film.

The significance of the porosity in the FBE film is discussed next.

Porosity of the FBE Coating

Porosity in an FBE film is not uncommon and, if minimized, will not adversely impact overall performance. However, higher concentrations of porosity within an FBE film can be problematic. Many specifications (including the one for this project) reference a porosity rating chart to quantify the permissible level of porosity for a particular application.

Cross-sections of the samples were compared to the reference materials. The level of porosity noted on the samples was higher than allowed by the specification. The excess porosity could lead to a weakened area within the coating layer.

Porosity formation can be a result of the interaction of multiple variables during the application process. Moisture in the FBE powder is often a significant cause, but other variables such as the powder coating formulation, the temperature at which the powder is applied, spray gun position, application rate, contamination on the substrate, or outgassing from the steel can also contribute to porosity. Determination of the cause of excess porosity requires careful consideration of all possible variables in order to more precisely identify the cause.

Unfortunately, porosity of the coating applied for this project was not a concern until it was observed in the laboratory samples. Therefore, any application related issues (i.e., moisture in the powder, actual gun arrangement, application temperature and rate, surface contamination, etc.) had likely changed and were no longer available for study. Some of the information can be obtained by a retrospective review of

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quality control documents completed during application, but the available information is often limited.

In addition to porosity, the microscopic view of the cross-section of the green coating layer revealed striations. Although the striations do not necessarily indicate a defect in the coating, their appearance can be associated with variability in the application/curing process.

Striations occur when the FBE is not at the proper gel stage of cure when additional coating is deposited. When the underlying coating is at the proper gel stage, the application of additional powder coating does not produce visible striations and the total application appears as a single homogenous layer. The absence of any delamination or separation at these striated areas indicates that the FBE powder had sufficiently melted, cured, and bonded with the underlying material to form a layer. In addition, the integrity of the coating film did not appear to be compromised since the layer was tightly adhered.

The striation issue would need to be discussed with the FBE powder manufacturer in order to determine if any longer-term performance issues would be anticipated. In this case, the striations may have been associated with the additional thickness of the applied coating, changing the heat absorption capacity of the coating layer.

Recommendations

The isolated blisters and cracks that formed during bending operations were field repaired and coated. Because latent cracking was sometimes not apparent until the day after bending operations, there was concern that some cracks in the FBE may have inadvertently been missed. Therefore, additional inspections (including holiday testing) at bend areas were recommended prior to backfilling. However, if the pipe was already buried, careful monitoring of the cathodic protection (CP) current demand would be the only way to monitor FBE performance without excavation. The same would be true in attempting to determine if the level of porosity observed in field samples was present on other buried pipe surfaces, having a negative impact on the coating system performance.

For future applications, it was suggested that the application parameters be controlled more diligently and that the porosity of the film be checked at various times to verify that the coating meets the specified requirements prior to field installation.

JPCL

How Coatings Perform over Waterjetting in New Construction

As a follow-up to their May 2011 *JPCL* report on waterjetted surfaces in new construction, the authors summarize results of coating performance over waterjetted surfaces.

By Philippe Le Calvé, DCNS, France, Jean-Pierre Pautasso, Direction Générale pour l'Armement, France, and Nathalie Le Bozec, French Corrosion Institute, France

In the naval industry, especially for new construction, conventional surface preparation by abrasive cleaning is becoming more and more costly because of environmental regulations that require collection and disposal of the spent abrasive and paint debris.

Surface preparation processes influence the performance and lifetime of coating systems applied to steel substrates. Thus, the state of the steel surface immediately before painting is crucial. The main factors influencing the performance are the presence of rust and mill scale; surface contaminants including dust, salts and grease; and surface profile. For aggressive environments such as marine atmospheres of C5M corrosivity category and high-performance coatings that require cleaner and/or rougher surfaces, blast cleaning is often preferred (see ISO 8501-1 or SSPC-VIS 1). It is well known that surface preparation using abrasive cleaning in particular can produce a considerable amount of waste, mainly containing blasting media, paint debris, and rust products.

It is desirable to replace abrasive blasting with a technique that creates less waste in the environment. Among the alternative methods, UHP waterjetting appears to be the most promising one.

Ultra high-pressure (UHP) waterjetting may be a promising strategy for surface preparation as long as the performance of the coatings on steel structures is not adversely affected. UHP waterjetting technology has been described intensively in previous papers,[1-3] and the surface

Editor's Note: "Performance of Paint Sysems after UHP," was first published in *Protective Coatings Europe (PCE)*, July-September 2011, pp. 24-29. It is the second article the authors have published on their research findings about the use of UHP waterjetting in new ship construction. The first part, "Characterisation of Surfaces after UHP (Ultra High Pressure) Waterjetting of Shop Primer Coated Steel Substrates for New Construction in the Naval Sector," also was first published in *PCE*, April-June 2011, pp. 16-21, and then in the May 2011 *JPCL*.

Photos courtesy of the authors

quality of steel substrates prepared by UHP waterjetting has been characterized in terms such as flash rust, salt contaminants, and surface roughness. The influence of these characteristics on coating performance, as studied with accelerated corrosion tests and field exposures, has been reported.[4-6]

UHP waterjetting has become widely used for maintenance; there are, however, some questions about the use of this technique for new construction. The questions arise about the durability of commonly used paint systems on a new state of surface preparation.

Against this background, a project was initiated with the aims of increasing the knowledge about coating systems for highly corrosive marine atmospheres and, in particular, of assessing the performance of UHP waterjetting as a method of secondary surface preparation compared to the traditional abrasive blasting of zinc-rich shop primer coated steel. The first part of this study, reported previously in *PCE* and *JPCL*,[7] focused on the characterization of surfaces after UHP waterjetting of a shop primed steel surface.

This article reports on the performance of commonly used paint systems for the protection of ship exterior topsides applied on zinc shop-primed steel after abrasive cleaning (Sa2½ of ISO 8501-1) and after UHP waterjetting (DHP4 of NF T35-520). The article describes the condition of seven paint systems after salt spray test, artificial cycling test, and natural ageing at a site qualified for a C5M corrosivity category. In addition, the two artificial tests are compared.

Table 1: Description of the steel samples

Reference	T1	T2
Type of steel	DH36	DH36
Initial state	Blasted to Sa2½ and shop primed	Blasted to Sa2½ (mix grit and shot) and shop primed
Surface preparation	Blasting to Sa2½ (ISO 8501-1) Medium Grit (ISO 8503-1)	Waterjetting (cf. table 2)
Roughness (Ra) After UHP cleaning	10 - 12 µm	7 µm

Table 2: Description of UHP waterjetting using a robot

Parameters	Robot
Degree of cleanliness according to NF T35-520	**DHP4**
Level of flash rusting according to NF T35-520	**<OF1**
Pressure of cleaning	2730 bar
Water flow	34 liter/min
Material	Rotating water jet head with 10 nozzles
Angle of cleaning	90 degrees
Conductivity of water	400 µS/cm
Distance of jet from surface	Between 20 and 30 mm

Experimental

Samples

Steel panels (DH36, commonly used in naval constructions) were prepared with different surface preparations to represent different practical cases that may be found on a structure. As shown in Table 1, the steel panels (100 x 175 mm) were abrasive blasted (metallic abrasives) to grade Sa2½ and coated with a zinc-rich shop primer (zinc silicate, 10-15 µm) as initial conditions. Further surface preparation consisted of robotic UHP waterjetting. Table 2 gives details on the UHP waterjetting to get a degree of cleanliness of DHP4 according to NF T35-520 and a flash rust level less than OF1 as defined in the same standard. More details on the surface properties may be found in reference.[8]

As shown in Table 3, seven commercial paint systems for new construction—identified as P1, P2, P3, P4, P5, P6, and R—were selected to represent the three main corrosion protection mechanisms of coatings: the barrier effect, the galvanic effect, and the inhibiting effect. The coatings were also selected based on knowledge of their behavior in marine field exposure. Among the selections was one reference paint system (R), of known performance (data from field exposure and from accelerated ageing in lab tests and in service). R is composed of a vinyl epoxy primer coat (100 µm), a vinyl epoxy intermediate layer (80 µm), and a silicone alkyd topcoat (2 x 30 µm). The primer had a corrosion inhibitor.

The painted samples were conditioned for three weeks (under laboratory conditions, i.e., at 20-25 C and 55% relative humidity, or RH) before being exposed in accelerated corrosion tests and at a natural weathering site. Before exposure, a 100 x 0.5 mm vertical scribe, parallel to the longest side of the panel, of was applied to each panel using the same scribing tool equipped with a rectangular blade 0.5 mm wide. Two duplicate samples were exposed in the different testing conditions.

Accelerated Corrosion Test and Field Exposure

Corrosion performance of the different paint systems and their surface preparation was determined in the laboratory

Table 3: Coating category and thickness applied on steel substrates

Paint label	Category of protection Barrier	Cathodic (Zn)	Inhibiting	Dry film thickness, µm
P1		X		340
P2		X		400
P3			X	340
P4			X	450
P5	X			350
P6	X			350
R			X	240

by cyclic ageing resistance in accordance with a modified version of ISO 20340 (Fig. 1) for 25 weeks, i.e., 4,200 hours. Details on the development of the test may be found elsewhere.[5] In addition, the samples were exposed in a neutral salt spray test according to ISO 9227 for 1,440 hours.

Outdoor exposure was carried out at the marine site of Brest Saint Anne, which is classified as corrosivity category C5M for steel according to ISO 9223. Two duplicate samples of each system were exposed at 45 degrees facing south for a minimum of four years with intermediate annual evaluations.

Evaluation

Visual Examination

The evaluation of the coating degradation was performed according with the ISO 4628 series of standards, in particular ISO 4628-2 for blistering, ISO 4628-3 for rusting and ISO 4628-8 for scribe creep. The degree of flaking, cracking, and chalking was also evaluated when such defects were detected. Intermediate evaluations were conducted during the accelerated corrosion tests as well as in marine exposure.

Based on Hochmannova's works,[9] a parameter representing the main paint defects, called anticorrosive effect (AE), was calculated using the following equation:

AE = (BD+SD+2RD)/4 (1)

Where:

BD is the blistering degree in accordance with ISO 4628-2 (density),

SD is the scribe delamination (in mm) in accordance with ISO 4628-8,

RD is the rust degree in accordance with ISO 4628-3. For Ri0, RD=0 while for Ri5, RD = 5.

In the present study, the scribe delamination corresponds to the maximum scribe creep, minus the scribe width, divided by 2.

An anticorrosive effect (AE) with a

Fig. 1: Basic artificial weathering cycle used in this study[5]

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
UV/Condensation ISO 11507		Neutral Salt Spray Test NaCl 1wt% - 35°C			Ambiant 22°C, 55%RH	Low temperature -20°C

Table 4: Assessment of the test panels as defined for this study

Criteria	Standard	Thresholds of acceptance established after the weathering cycle (ISO 20340)	Remarks
Defects before and after weathering	ISO 4628-2 ISO 4628-3	0 (S0) Ri 0	Comparison with the reference on Sa2½
Delamination- corrosion from the scribe line	ISO 4628-8	• Mx < 3 mm for zinc-primed coating system • Mx < 8 mm for non-zinc-primed coating system	Comparison with the reference on Sa2½
Adhesion **before** artificial weathering test C5M	ISO 4624	Minimum pull off test value: – 3 MPa for zinc primed coating system – 4 MPa for non zinc primed coating system No adhesive failure between the substrate and the first coat unless pull-off values ≥ 5 MPa	
Adhesion **after** artificial weathering test C5M	ISO 4624	Minimum pull off test value = 50% initial value with a minimum value of 2 MPa No adhesive failure between the substrate and the first coat unless pull-off values ≥ 5 MPa	

Table 5: Anticorrosive effect (AE) after 1440 h of salt spray test: influence of surface preparation given in Table 1.

Paint system	Surface preparation	
	T1 Blasting Sa2 ½	T2 UHP waterjetting
P1	2.7	2.0
P2	0.1	0.1
P3	0.7	1.3
P4	0.9	0.8
P5	0.8	0.6
P6	1.5	1.2
R	0.8	0.8
Mean	**1.1±0.8**	**1.0±0.6**

Table 6: Anticorrosive effect (AE) after 4200 h of cyclic corrosion test: influence of surface preparation given in Table 1

Paint system	Surface preparation	
	T1 Blasting Sa2 ½	T2 UHP waterjetting
P1	0.5	0.8
P2	0.5	2.8
P3	4.8	5.5
P4	5.1	6.8
P5	2.5	2.3
P6	4.0	4.0
R	3.8	3.8
Mean	**3.0±1.9**	**3.7±2.0**

low value characterizes a good performance of the coating while high values indicate poor behaviour.

Adhesion Testing by Pull-Off

The adhesion pull-off strength was determined according to ISO 4624 with a Posi-Test AT-M on the test samples before artificial ageing, at the mid-cycle (2100 hours) and after completion of the test (4200 h). Thus, one replicate was withdrawn at mid-test.

Assessment–Requirements

For accelerated corrosion tests, the assessment of the panels prepared by UHP waterjetting was conducted according to the acceptance requirements defined in ISO 20340 (Table 4) and compared to the performance of the reference system (R) after abrasive blasting (T1).

However, the ultimate test remains the performance of coating systems in comparison to the reference coating after natural weathering in highly corrosive marine atmospheres.

Results

Salt Spray Test

Most of the coated systems presented no defects on the overall surface, e.g., no rusting or blistering after 1,440 hours of exposure in the salt spray test, except paint systems P6, which showed blistering level 3S2 and 4S2 for abrasive blasted and waterjetted surfaces, respectively. Paint system P3T1 also showed some red rust (Ri). However, creep from the scribe line was observed to a variable extent, depending on the coating system (Fig. 2). The largest scribe creep was found on coating system P1 with more than 8 mm, while less than 1 mm of delamination was measured on system P2, despite both having the same mode of protection, i.e., cathodic because of a zinc-rich primer. For the other paint systems, the scribe creep ranged between 2 and 4 mm with insignificant differences between abrasive blasting and UHP waterjetting preparation. In general, similar behavior was observed regardless of the surface preparation, e.g., blasted Sa2½ or UHP treated, despite a surface state slightly different in terms of roughness Ra (See Table 1). The anti-corrosive effect (AE) presented in Table 5 was mainly based on the delamination from the scribe line because only one system showed damage other than scribe creep. Nevertheless, this parameter is interesting because it summarizes in one value the main defects usually observed on painted steel in service. Similar observations as those drawn for the scribe creep may be observed. Except for paint systems including zinc-rich primers, the anticorrosive effect was very similar, apart from a higher AE for system P6 because of the presence of blisters.

Excluding coating systems with a zinc-rich primer, the results highlighted the poor ability of the salt spray in discriminating between different paint systems. This finding is in agreement with previous works.[5, 10]

Fig. 2: Effect on surface preparation on scribe creep for different coating systems after 1440h of salt spray test

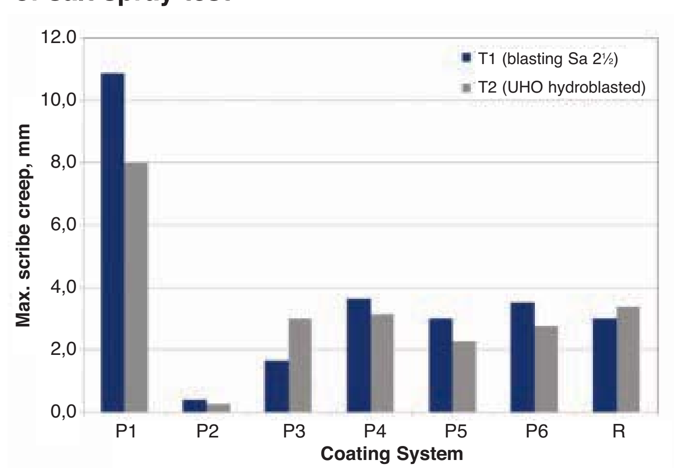
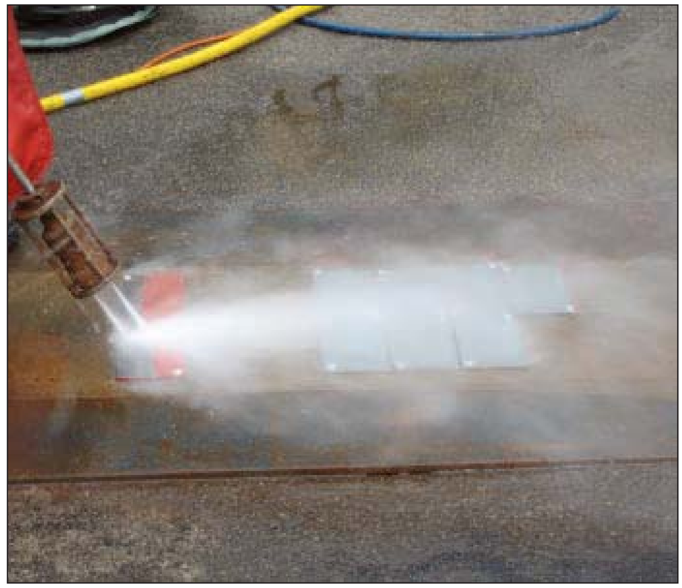


Table 7: Pull-off test values after 4200 h of cyclic corrosion test. (T1: Sa2½, T2: UHP treated)*: adhesive fracture

Paint system	Pull-off test value, MPa After ageing (Cycle C5-M)	
	T1	T2
P1	7.7±3.0	4.5±1.3*
P2	10.0±3.7	10.4±3.0
P3	7.2±1.1	13.6±0.6
P4	15.7±1.1	12.6±0.4
P5	12.2±3.2	10.3±1.1
P6	10.4±1.9	11.7±2.6
R	12.8±1.9	13.0±2.8
Mean	**10.9±3.0**	**10.9±3.0**

Table 8: Anticorrosive effect (AE) after 12 months of outdoor exposure in marine atmosphere C5M: influence of surface preparation given in Table 1. The scribe creep is given in brackets.

Paint system	Surface preparation	
	T1 Blasting Sa2 ½	T2 UHP waterjetting
P1	0	0
P2	0	0.0
P3	0.3 (1.3)	3.4 (13.5)
P4	1.2 (4.9)	3.0 (12)
P5	0	0
P6	0.9 (3.9)	0.3 (1.1)
R	0.3 (1.3)	0.2 (0.8)



Manual UHP waterjetting test panels.

Cyclic Corrosion Test

Similar paint inspections were carried out after finishing the 4,200 hours of exposure in the cyclic corrosion test, and the anti-corrosive effect was calculated. The results are presented in Table 6. The coating systems P1 and P2 with zinc-rich primers performed particularly well after the cyclic corrosion test. Only scribe creep was observed as a defect. For system P1, comparable results were observed on abrasive blasted and UHP-treated surfaces while a poorer behavior was observed on UHP waterjetted panels for system P2.

The AE was significantly more important for all the other paint systems using either barrier or inhibiting primers. Indeed, in addition to scribe creep, blistering and rusting were also observed on some of the systems. Regarding the influence of surface preparation, similar performances were noticed on systems P5 and P6 (barrier primers) and the reference paint R (inhibitive primer). Concerning paint systems P3 and P4, both containing an inhibiting primer, UHP-treated panels were slightly more affected than the abrasive blasted ones. It is interesting to note that, contrary to the salt spray test, the present cyclic corrosion test is able to rank the different paint systems placing both paint systems using a cathodic primer as the best systems. This was not true after the salt spray test.

Adhesion was investigated by pull-off testing according to ISO 4624. All paint systems satisfied the qualification criteria, showing adhesion strengths above 5 MPa and less than 50% of reduction in the adhesion strength after the accelerated corrosion test. One exception was observed for paint system P1 applied on UHP-treated samples, where an adhesive fracture was found. For the other paint systems and for both surface preparations, mixed cohesive and adhesive fractures were detected before and after the accelerated test. In general, the effect of the surface preparation on the adhesion strength is not significant. This can be seen when considering the mean value of the adhesion strength for each surface preparation (Table 7).

Outdoor Exposure in Marine Atmosphere C5M

As indicated in the experimental section, all samples were exposed in an outdoor marine atmosphere of C5M corrosivity category for steel, for a minimum of 4 years. The first inspection of the samples, conducted after 12 months of exposure, revealed delamination from the scribe line on some coatings systems. Nevertheless, the anticorrosion effect was calculated to compare it with data from the laboratory. The AE from the 12 months of outdoor exposure is summarized in Table 8. From the results, no visual defects were observed on coating systems P1, P2 and P5 while moderate delamination was found on paint systems P6 and R for both surface preparations. Concerning coating systems P3 and P4, more damage was found on UHP treated samples in comparison to blasted ones at least after 12 months of exposure. However, the development of paint degradation should be examined after a longer exposure duration. It should be mentioned that defects were already observed after 6 months of exposure on paint systems P3 and P4, which reflects the poor performance of these paint systems.

The product ranking in terms of performance after 12 months of outdoor exposure was compared to that obtained after artificial ageing in the neutral salt spray test and in the cyclic corrosion test (Table 9). The ranking was made by comparing the anticorrosion effect. The results indicate comparable ranking between field exposure and the cyclic corrosion test while the salt spray test definitely gives a different classification of the coating systems. As an example, coating system P1 was the poorest after the salt spray test, while it shows very good performance in the field after 12 months. These observations are in agreement with previous work.[5,10-11] They should, however, be consolidated with results from longer outdoor exposures, as is indeed scheduled in the present work.

From the first results of the present study, UHP waterjetting seems to be a rather promising technique for secondary steel surface preparation in new construction. UHP waterjetting generally induces a notable reduction of soluble salts, contaminants, and dust at the steel surface because of an effective water flow. The water from UHP waterjetting can enter pores and pits and sweep the contaminants away. The level of cleanliness is thus better than that obtained on blasted steel. Despite a slightly different surface state in terms of roughness, no significant differences were observed in the performance of the coatings applied. From a study aiming to characterize steel surface after UHP waterjetting of zinc primer-coated steel, it was shown that with water pressure between 2,560 and 3,000 bar, and regardless of the waterjet-

Table 9: Material ranking after cyclic corrosion test (4200 h), salt spray test (1440 h), and 12 months of outdoor exposure in marine atmosphere

Paint system	Cyclic corrosion test 4200h	Salt spray test 1440h	Outdoor 12 months
P1	1	7	1
P2	2	1	1
P3	6	3	6
P4	7	5	7
P5	3	2	1
P6	5	6	5
R	4	3	4

ting tool (gun or robot), traces of the zinc shop primer were always detected on such steel surfaces.[8] Similarly, traces of zinc on steel were also measured after abrasive blasting the zinc shop primer. From the results obtained in the present work, the presence of remaining zinc on steel substrate does not seem to affect the performance of the coating.

This study highlights the need to adapt and improve the standardization related to surface preparation by UHP waterjetting for new construction. Most of the existing standards address surface preparation of painted steel for maintenance. Among standards related to UHP waterjetting, initial conditions involving zinc shop primers are defined in ISO 8501-4 (conditions PRZ) and SSPC-VIS 4/NACE VIS7 (condition F, zinc-rich paint applied over blast cleaned steel). More details are needed, however, to help the operators and the project manager to be able to require a guarantee of the result.

UHP waterjetting is becoming more widely used for maintenance, but there are some questions on the use of this technique for new construction. Questions arise specifically about the influence of surface roughness, which is known to be a key parameter affecting the adhesion of the coating and thus its durability. In particular, it is known that UHP waterjetting is not efficient in eliminating mill scale, which limits the use of the technique. Thus, in addition to classical abrasive blasting, the surface preparation with waterjetting may be an alternative, but more work is needed to validate this new use of the technique.[1]

Other aspects related to real structures have to be carefully considered, such as the effect of waterjetting on welded areas and further coating performance. Research on these and other aspects is still in progress at this writing. Additional results will be available later.

Conclusions

The aims of the study were to assess the performance of different coating systems applied on UHP waterjetted zinc-rich shop primer coated steel, as secondary surface preparation in new construction. The results were compared with traditional abrasive blasted surfaces (Sa2½.) Two accelerated corrosion tests (a neutral salt spray test and a cyclic corrosion test based on C5M corrosivity) were carried out in order to evaluate the performance of the coatings. The results were compared to field data obtained on a natural ageing site qualified for a C5M corrosivity category.

UHP waterjetting seems to be a promising technique in new construction for secondary surface preparation of steel with a zinc-rich shop primer, and the technique gives comparable behavior to traditional abrasive blasted surfaces.

Despite a slight difference in roughness and the presence of traces of zinc remaining (at a similar level as that with abrasive cleaning), the performance of the coatings does not seem to be significantly affected.

The results also indicated quite similar material rankings between field exposure and the cyclic corrosion test, while the salt spray test definitely gave a different classification of the paint systems, confirming previous results.

Other aspects related to real structures have to be carefully considered such as the effect of hydroblasting on welded areas and longer term coating performance. This work was still in progress when writing the paper, and will be reported later.

References

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SSPC 2012 Offers Full Technical Program for Tampa

SSPC 2012 featuring GreenCOAT, the annual conference of SSPC: The Society for Protective Coatings, will take place in Tampa, FL, on Jan. 30 to Feb. 2, 2012. SSPC 2012 is the only conference and exhibition dedicated 100% to protective, marine, and industrial coatings.

SSPC 2012 will offer a full schedule of training courses, workshops, technical presentations, exhibitors, special events, award ceremonies, networking opportunities, and much more.

The following is a list of all planned technical presentations, times, presenters, and company affiliations. All details are current as of press time. For updated information, visit www.sspc.org. A future issue of *JPCL* will provide abbreviated abstracts and any known updates about the technical program. Turn to *JPCL* each month from now until show time for special features on SSPC 2012 and a full-scale Advance Program in the December issue.

MONDAY, JANUARY 30

Session 1: Improving Your Business Through Strategic Planning

- 1:30–2:30 p.m., “Industrial Marketing & Sales in a Digital Age,” by Nicole Eisenhauer, Eisenhauer Creative Group
- 2:30–3:00 p.m., “Succession Planning,” by Robert Zeigler, BBZ Contracting
- 3:00–3:30 p.m., “Everyone Wins: Driving Value and Profitability for the Painting Contractor and the Owner,” by Dee McNeil, The Sherwin-Williams Company
- 3:30–4:30 p.m., “Writing a Good Process Control Procedure,” by Rick Smith, PCS, Wheelblast

Session 4: Nanotechnology—Enhancing the Performance of Coatings

- 1:30–2:30 p.m., “Nano-Structured Particles to Enhance Primer Performance Properties,” by Maria Nargiello, Evonik Degussa Corporation
- 2:30–3:00 p.m., “Corrosion Resistant Nanocomposite Pretreatment Coating for Marine Structures,” by Dr. Robert A. Iezzi, NEI Corporation
- 3:00–3:30 p.m., “Nanotechnology for Enhanced Coating Performance,” by Dr. Mark Morrison, The Sherwin-Williams Company
- 3:30–4:00 p.m., “Multi-Walled Carbon Nanotubes for Polymeric Coatings and Composites,” by Serkan Unal, Bayer MaterialScience

TUESDAY, JANUARY 31

Session 1: Architecture

- 10:00–10:30 a.m., “An Architect’s Call for Paint Standards,” by Walter Scarborough, HALL Building Information Group
- 10:30–11:00 a.m., “Extending the Life Cycle of Coatings Applied to Commercial Buildings,” by Barry Law, Master Painters Institute (MPI)
- 11:00–11:30 a.m., “Fundamentals of Making Good Decisions in Coating Selection,” Allen Zielnik, Atlas Material Testing Technology (an AMETEK company)

• 11:30 a.m.–Noon, “New Architectural Wall Coatings Technology Targeted at Stricter Hospital Infection Protocols,” by Steven Reinstadtler, Bayer MaterialScience

Session 2: Women in the Industry

• 10:00–10:30 a.m., “Women in Coatings: The Present State and Glimpse of Our Future,” by Cynthia L. O’Malley, PCS, KTA-Tator, Inc.

• 10:30–11:00 a.m., “Success Factors for Women’s Career Advancement in Chemical Industry,” by Dr. Sharon Feng, Bayer Material Science

• 11:00–11:30 a.m., “How Do You Balance Work and Family?” by Sarah Olthof, Corrosion Control Consultants & Labs, Inc.

• 11:30 a.m.–Noon, TBD, by Audrey de Morales, The Sherwin-Williams Company, El Salvador

• Noon–12:30 p.m., “The Gender Gap: Impact or Innovation,” Elizabeth Haslbeck, NAVSEA

Session 3: Coatings in Marine Environments

• 10:00–10:30 a.m., “NSRP Surface Preparation and Coatings Panel, Update,” by Steve Cogswell, BAE Systems Southeast Shipyards

• 10:30–11:00 a.m., “Epoxy/Silicone: The Ecological Evolution of Speed, Efficiency, and Durability in High Performance Marine Coatings,” by Duane Palmateer, Ian R. Germain, and John Kilger, Ph.D., Greenfield Manufacturing, Inc.

• 11:00–11:30 a.m., “Zinc Rich Primers for Corrosion Protection,” by J. Peter Ault, P.E., PCS, Elzly Technology Corporation

• 11:30 a.m.–Noon, “Ship Hull Performance in the Post-TBT Era,” by Boud van Rompay, The Hydrex Group

Session 4: Advancing Green Technology

• 10:00–10:30 a.m., “New Solvent-Free Waterborne Epoxy Resin Dispersion for Low VOC 2-Pack Protective Coatings,” by Ming Tsang, Cytec

• 10:30–11:00 a.m., “Green Blasting Technology with Focus on HSE and

Quality," by Kjetil Roksvag, Pinovo
- 11:00–11:30 a.m., "Green—Just Another Color in Mechanical Surface Preparation?" by Kumar Balan, Wheelabrator Group
- 11:30 a.m.–Noon, "Cartridge Technology for Spray Applied Coatings—Low Cost, Reliable, Portable, and Green," by Peter Kuzyk, Plas-Pak Industries
- Noon–12:30 p.m., "Access Solutions for Wind Turbines," by Clint Ramberg, Spider

Session 1: *Durability + Design* Commercial Coating and Floor Symposium
- 1:30–2:00 p.m., "Moisture Vapor Emission Rates of Concrete Floors—Can Moisture Meters be Used Instead of Anhydrous Calcium Chloride?" by Kevin Brown, KTA-Tator, Inc., and George Holz, AIA
- 2:00–2:30 p.m., "Hard Truths About Concrete Polishing," by Joe Reardon, PROSOCO Concrete Products Group
- 2:30–3:00 p.m., "The Impact on the Painting Industry by New Building Codes and Standards for Air/Vapor Barriers," by Kevin Knight, Architectural Testing
- 3:00–3:30 p.m., "Air Barrier Testing of Concrete Masonry Assemblies and the Effects of Surface Coatings on Air Permeance," by Nicholas R. Lang and Jason J. Thompson, National Concrete Masonry Association (NCMA)
- 3:30–4:00 p.m., "Use of Atlas Test Cells to Assess the Performance of Coatings over CMU with Varied Permeance," by Cynthia L. O'Malley, PCS, KTA-Tator Inc.; Chuck Duffin, Sto Corp.; and Steve Revnew, The Sherwin-Williams Company
- 4:00–4:30 p.m., "The New SSPC Commercial/Light Industrial Committee," by Ken Trimber, KTA-Tator

Session 4: Real World Coating in Action
- 1:30–2:00 p.m., "Experiences with Coating Systems Selection for the World Trade Center Transportation Hub," by John Bullard, PCS, Port Authority of NY & NJ

SSPC 2012 EXHIBITORS

The following is the most recent list of companies currently planning on exhibiting at SSPC 2012 featuring GreenCOAT. All information is accurate as of press time. The December *JPCL* will provide brief descriptions, contact information, and booth numbers for known exhibitors.

- Advanced Recycling Systems, Inc.
- Aggreko LLC
- Air Systems International
- Arid Dry by CDIMS
- Atlantic Design
- Axxiom Manufacturing Inc./Schmidt
- Carboline Company
- CESCO/Aqua Miser
- Chlor*Rid international Inc.
- Church & Dwight (ArmaKleen)
- Clemco Industries Corp.
- Clothes Cleaning System
- *Coatings Pro* Magazine
- The Comex Group
- Croda
- CSI Services, Inc.
- Cytec Industries
- Defelsko Corporation
- Dehumidification Technologies, Inc.
- DESCO Manufacturing Co., Inc.
- Detroit Tarp Inc.
- Doosan Portable Power
- DRYCO, LLC
- DUSTNET by EMI
- E.D. Bullard
- Eagle Industries
- EcoQuip Inc.
- Elcometer Instruments Ltd.
- EnTech Industries LLC
- Ervin Industries
- Evonik Degussa Corporation
- Farrow Systems
- Fischer Technology Inc.
- Forecast Sales Inc./Pirate Brand
- GMA Garnet (USA) Corp.
- Graco Inc.
- Granite Mountain Quarries
- Greenman-Pedersen, Inc.
- Guzzler Manufacturing, Inc.
- Hanes Supply Inc.
- Harsco Minerals
- HippWrap Containment
- Hi-Temp Coatings Technology
- HoldTight Solutions Inc.
- Hydrex Underwater Technology
- Indian Valley Industries
- Industrial Vacuum Equipment Corp.
- International Paint LLC
- ITW Industrial Finishing
- JAD Equipment Co.
- KTA-Tator, Inc.
- Longhai Duoling Saw Blade Co., Ltd.
- Marco
- Mascoat
- Midwest Rake
- MMLJ (Sanstorm)
- Mohawk Garnet, Inc.
- Monarflex by Siplast
- Montipower, Inc.
- NACE
- National Equipment
- Nelson Industrial Svcs (BlastProMfg)
- NexTec, Inc./Pretox
- Novatek Corp.
- Novetas Solutions
- Olimag Sand
- OPTA Minerals, Inc.
- Painters & Allied Trades
- Paul N. Gardner Co.
- Pinnacle Central Company
- Polygon
- PPG Protective & Marine Coatings
- Ring Power Corporation
- SAFE Systems
- Sauereisen
- The Sherwin-Williams Company
- Spider
- Sponge-Jet Inc.
- Surface Prep Supply
- Tarps Manufacturing, Inc.
- Technology Publishing/PaintSquare
- Telsa Nanocoatings
- Thomas Industrial Coatings
- ThyssenKrupp SAFWAY Services
- Tnemec Company
- Tomoric Technology Inc.
- Tractel Inc. Griphoist Division
- Trimaco LLC
- TSE-Okulen Americas, LLC
- Van Air Systems
- VRSim
- The Warehouse Rentals & Supplies
- Western Technology
- WIWA LP

* Wooster Brush

• 2:00–2:30 p.m., "Cross-Linking Performance to Mechanism," by Andrew Recker, International Paint LLC
• 2:30–3:00 p.m., "Flame Retardancy in Coatings," by Mark Anater, Dow Chemical Co.
• 3:00–3:30 p.m., "Colored Pigments for Coatings—Chemistry & Performance," by Romesh Kumar, Clariant Corporation
• 3:30–4:00 p.m., "Ultra-Violet Curable Coatings from Highly Functional Acrylated Biobased Resins," by Alina Paramarta, Xiao Pan, and Dean C. Webster, North Dakota State University
• 4:00–4:30 p.m., "Portable Plural Component Equipment Utilizing Synergistic Chemistry," by Chas Weatherford, Specialty Products, Inc.

Session 5: Protecting the Military
• 1:30–2:30 p.m., "Leadership in Corrosion Prevention and Mitigation," by Dan Dunmire, Office of Under Secretary of Defense Acquisition, Technology & Logistics
• 2:30–3:00 p.m., "The Importance of Coatings to the Department of the Navy," by Steve Spadafora, Department of the Navy
• 3:00–3:30 p.m., "Coatings Technical Warrant Holder Update," by Mark Ingle, NAVSEA
• 3:30–4:30 p.m., "With Great Power Comes Great Responsibility," by Rodger Hamerlinick, U.S. Army Office of the Assistant Secretary of the Army (Acquisitions, Logistics, and Technology)
• 4:30–5:00 p.m., "United States Marine Corps Corrosion Prevention and Control Office (CPAC) Program Overview," by Andrew Sheetz, NSWCCD

WEDNESDAY, FEBRUARY 1

Session 1: Coatings for Concrete
• 10:00–10:30 a.m., "Waiting for the Concrete to Dry at Johnston Memorial Medical Building in Arlington, VA," by David Simkins, Polygon
• 10:30–11:00 a.m., "With Novel 2K Water Based Polyurethane Systems You Can Walk Where Traditional Systems Cannot Tread," by Leo Meilus, Navcor, Inc.
• 11:00–11:30 a.m., "Case History: Primary Care Physicians Office Refurbished with Sustainable Self Leveling Coating and a UV Curable Topcoat," by Bob Seman, Seman Flooring
• 11:30 a.m.–Noon, "The History of Sealers and Coatings in Decorative Concrete," by Chris Sullivan, ChemSystems Inc.

Session 3: Extending the Life of a Bridge

• 10:00–11:00 a.m., "A KYTC Study of the Effects of Chlorides on Bridge Coatings Performance," by Bobby Meade, Kentucky Transportation Center

• 11:00–11:30 a.m., "QC for the VTB: Overcoating the East Tower," by William Hansel, California Department of Transportation

• 11:30 a.m.–Noon, "Next-Generation Polyaspartic Topcoat: Matching Throughput with Performance," by James McCarthy, PPG Protective and Marine Coatings

Session 4: Waterborne Performance

• 10:00–10:30 a.m., "Performance Comparison of Waterborne and Solvent Borne Epoxy Primers," Tim Miller and Yong Zhang, The Dow Chemical Company

• 10:30–11:00 a.m., "Factors Influencing the Stay-Clean Properties and Service Life of New Fluoropolymer Coatings," by Dr. Kurt Wood, Arkema, Inc.

• 11:00–11:30 a.m., "Enova Aerogel Additives for Next Generation Water Borne Insulative Coatings," by Dhaval Doshi, Cabot Corporation

Session 1: Environmental, Health, and Safety

• 3:00–3:30 p.m., "Regulatory Update: Current and Emerging Trends in Occupational and Environmental Health," by Alison B. Kaelin, CQA, KTA-Tator, Inc.

• 3:30–4:00 p.m., "A Review of the Elements of the EPA's Chemical Action Plan on MDI and TDI Containing Products," by Barbara Cummings, Bayer MaterialScience

• 4:00–5:00 p.m., "Identifying Potential Inhalation and Other Hazards Associated with Abrasive Blasting Operations," by Thomas E. Enger, MS, CSP Chmm, Clemco Industries, Corp.

Session 3: Texas-Sized Bridge Problem

• 3:00–3:30 p.m., "Overcoating—Texas DOT Perspective," by Johnnie Miller, Texas Department of Transportation

• 3:30–4:00 p.m., "Suspended Scaffold for Bridge Access," by Clint Ramberg, Spider

• 4:00–5:00 p.m., "Two-Component Polyurethane Topcoats—Formulating Variables Affecting Performance in the Heavy Duty Corrosion Protections

Market," Kurt Best & Edward P. Squiller, Bayer MaterialScience

Session 4: Keeping It Clean—Coatings for Wastewater

• 3:00–3:30 p.m., "Wastewater Treatment Plants—Bring Your 'A' Game," by Eric Brackman, RFI Consultants LLC

• 3:30–4:00 p.m., "Manhole Rehabilitation—The Role Played by Linings," Kevin Morris, The Sherwin-Williams Company

• 4:00–4:30 p.m., "Design Considerations for Lining Concrete Sludge Mixing and Storage Tanks in Wastewater Treatment Plants: Issues That Do Not Meet the Eye," by R. A. Nixon, Corrosion Probe, Inc.

• 4:30–5:00 p.m., "A Practical Approach to the Rehabilitation of a Wastewater Treatment Facility: Utilizing Case Histories to Demonstrate 'Real-Life' Applications," by Lake H. Barrett Jr., Tony J. Oswald, and Pete J. Jansen, Sauereisen

THURSDAY, FEBRUARY 2

Session 1: Field and Laboratory Testing

• 10:00–10:30 a.m., "Slip Coefficient and Tension Creep Testing of Coatings Used in Slip-Critical Bolted Connections," by William D. Corbett, PCS, KTA-Tator, Inc.

• 10:30–11:00 a.m., "Easy Inspection Form Creation for Dry Film Thickness and Related Test Measurement Requirements," by Paul Lomax, Fischer Technology, Inc.

• 11:00 a.m.–Noon, "When Undercover Agents Can't Stand the Heat: The CIA and the Netherworld of Corrosion Under Insulation (CUI)," by Dr. Mike O'Donoghue, International Paint LLC

• Noon–12:30 p.m., "High Voltage Porosity Testing Continuous DC vs. Pulsed DC," by John F. Fletcher, Elcometer Limited

Session 1: Maintenance Painting—The Fountain of Youth for Structures

• 3:00–4:00 p.m., "Rehabilitation of National Water Storage Landmark," by Gregory R. "Chip" Stein, P.E., Tank Industry Consultants

• 4:00–4:30 p.m., "Galvanize It," by Kevin Irving, AZZ Galvanizing Services

• 4:30–5:00 p.m., "Maintenance Painting of Galvanized Mast Arms: A Project Performed Despite Budget Constraints," by Richard A. Burgess, PCS, and Greg Richards, KTA-Tator, Inc.

Session 3: Sink or Swim—Protecting Marine Structures

- 10:00–10:30 a.m., “Coatings for Zebra/Quagga Mussel Control, 3rd Year Evaluation,” by Dr. Allen Skaja and Dr. David Tordonato, U.S. Bureau of Reclamation
- 10:30–11:00 a.m., “Non-Toxic Novel Silicone Foul-Release Marine Coatings,” by Rob Thomaier, Nusil Technology
- 11:30 a.m.–Noon, “Copper Antifouling Coatings—Greener than the Headlines: The Latest Regulatory Happenings and How They Can Affect You,” by Neal Blossom, American Chemet

Session 2: Polyurea and Thick Film Coatings

- 3:00–3:30 p.m., “Drinking Down Under: Great Idea, Second Thoughts, The Right Path,” by Dudley J. Primeaux II, PCS, Primeaux Associates LLC
- 3:30–4:00 p.m., “Polyurea Great Wall: Beijing-Shanghai High Speed Railway Polyurea Protection Project,” by Professor Weibo Huang, Qingdao Technological University
- 4:00–4:30 p.m., “Polyurea Applied Over 30 Gage Galvanized Flashing,” by Ernst Toussaint, E.I.T., Sherwin-Williams Protective & Marine Coatings
- 4:30–5:00 p.m., “New Developments in Aliphatic Polyurea Coatings,” by Paul Wiggins, Albemarle Corporation

Session 3: Corrosion Protection and Protective Coatings

- 3:00–3:30 p.m., “Life Expectancy of a Paint System,” by Al Beitelman, U.S. Army ERDC-CERL
- 3:30–4:00 p.m., “An Organometallic Ester Corrosion Inhibitor for Use in Direct-to-Metal Paints,” by John Hughes, Croda Inc.
- 4:00–4:30 p.m., “Coatings Used in Conjunction With Cathodic Protection,” by Richard Norsworthy, Polyguard Products, Inc.
- 4:30–5:00 p.m., “Chemical Oxidative Polymerization of Polyprole on the Inorganic Flake Surface for Corrosion Inhibition of Aluminum 2024-T3,” by Victoria Gelling, North Dakota State University

Check next month’s *JPCL* for more information on the SSPC 2012 Technical Program.

Training Courses Prepared for SSPC 2012

In addition to dozens of educational opportunities at SSPC 2012 featuring GreenCOAT, a full line up of training courses will be offered. The following is a current list of SSPC Training Courses scheduled for the show. SSPC 2012 runs from Jan. 31 to Feb. 2, but some courses start as early as Jan. 27 and can last until Feb. 4. All classes run from 8:00 a.m. to 5:00 p.m., except for PCI (7:30 a.m. to 6:00 p.m.) and PA 2 and Estimating (8:00 a.m. to 2:00 p.m.). A future issue of *JPCL* will provide more details on the training courses. To speak to someone about training, contact Dee Boyle at boyle@sspc.org or 877-281-7772 ext. 2202. For more information, visit www.sspc.org.

- Navigating Standard Item 009-32: Jan. 27
- Protective Coatings Inspector Program (PCI): Level 1, Jan. 27-31; Level 2, Jan 27-Feb. 2; Level 3, Jan. 27-Feb. 2
- Concrete Coating Inspector Program (CCI): Basic Level, Jan. 27-28; Tech Level, Jan. 27-31; Cert Level, Jan. 27-Feb. 1
- Bridge Coatings Inspector Program (BCI): Level 1, Jan. 27-31; Level 2, Jan. 27-Feb. 1
- Fundamentals of Protective Coatings (C1): Jan. 28-Feb. 1
- Planning & Specifying Industrial Projects (C2): Jan. 28-Feb. 1
- NAVSEA Basic Paint Inspector (NBPI): Jan. 28-Feb. 1
- Basics of Estimating Industrial Coatings Projects: Jan. 28
- Lead Paint Removal (C3): Jan. 29-Feb. 1
- Evaluating Common Coating Contract Clauses: Jan. 29
- Using SSPC-PA 2 Effectively: Jan. 29
- Airless Spray Basics (C12): Jan. 29-30
- Introduction to Polyurea for the Applicator and Contractor: Jan. 30
- Lead Paint Removal Refresher (C5): Jan. 31
- Protective Coatings Specialist (PCS) Program: Feb. 2
- Protective Coatings Paperless QA and Digital Data Collection: Feb. 3-4
- Abrasive Blasting Program (C7): Feb. 3-4
- Quality Control Supervisor (QCS): Feb. 3-4
- Project Management for the Industrial Painting Contractor: Feb. 3-4

SSPC at PDMAEC 2011

Patrick Tan, SSPC's Secretary of Regional Development, South East Asia, and Boyet Pangan from the SSPC Philippines Chapter staffed the SSPC Booth at the 5th Annual PDMAEC Show. The Philippine Die & Mold Machineries, Accessories, Equipment Exhibition & Convention (PDMAEC) was held August 17–20 in Manila, Philippines. The show is held every two years.

SSPC Publishes New Report: Preparing and Using Protective Coating Specifications

SSPC's new report, "Preparing and Using Protective Coating Specifications," describes some best practices for preparing and administering a quality specification for application of high-performance protective coatings and linings to industrial structures. It highlights the importance of developing an appropriate set of requirements for applying coatings and linings to obtain maximum coating system performance, service life, and protection of substrates in the prevailing service environment.

The searchable PDF document is designed for facility owners, both public and private; coating program managers and engineers; and architecture-engineering firms responsible for preparing coatings specifications for clients. A more detailed description of the document will appear in an upcoming issue of *JPCL*.

The new report is part of SSPC's Technical Insight Report Series, which includes, "The SSPC Guide for Planning Coatings Inspection" and "SSPC's Development and Use of Quality Control Forms in Coatings Contracting." It is available online through the SSPC Marketplace as a free member download and for sale to non-members for $40.

SSPC Issues Revised Glossary of Acronyms and Terms

SSPC has issued a revised electronic version of its protective coatings glossary. This searchable, electronic document includes over 1,500 technical and general industry terms.

General coating terms and terms associated with failure analysis, bridges, marine structures, and concrete work, as well as pertinent terms from health, safety, and environmental protection regulations that affect coating operations, are found in the glossary. A comprehensive acronym list complements the glossary of terms.

The glossary is only available to SSPC Members, and can be accessed in the Members Only section of the SSPC website.

Finding Cures for Repairing Buried Wastewater Structures

Stephen M. Wierzchowski, Technical Director, RS Technik

Many water and wastewater system owners and managers are continually seeking high-quality materials as well as reliable technology and support to cost effectively rehabilitate and maintain their conveyance systems. Trenchless technology—which minimizes or eliminates excavation to repair buried structures—opened up a new world for these owners over 40 years ago with innovations for rehabilitating aging, damaged, and deteriorated collection and distribution systems. Many types of trenchless rehabilitation materials and techniques have been developed to meet performance demands based on identified deteriorated conditions of the infrastructure while reducing the economic and social impact with less construction time, less above grade interference, and less damage or disruption to adjacent infrastructure. With aging water and wastewater systems in the U.S. and elsewhere, the demand has increased for further development of materials and processes to lessen environmental, social and economic impact with sustainable solutions for buried infrastructure.

Many trenchless technologies use liquid resin systems, including protective coatings, cured-in-place pipe (CIPP), point repairs, and grouting. And many of the technologies have relied on polyurethane, ureas, polyester, and vinyl ester resins because of their handling advantages, low cost, and acceptable mechanical properties.

Table 1 – Resin Use by Application Environment

Service Environment	Epoxy	Vinyl Ester	Polyester
General	X	X	X
Industrial	X	X	
Pressure	X	X	
High Temperature	X	X	

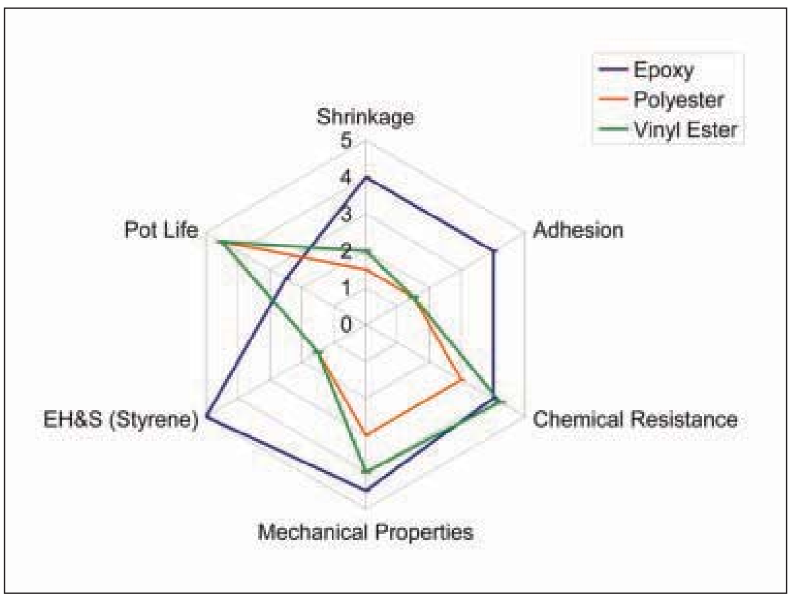

Chart 1 – CIPP Resin System Characteristics

However, growing concerns about the potential effects of styrenated and isocyanate-based resin systems on health, safety, and the environment, have led to increased regulatory enforcement. These concerns, coupled with the demand to increase quality controls for delivery of more consistent performance results, exposed a need for safer, cleaner, and stronger resin systems to transform buried infrastructure rehabilitation by minimizing its social, economic and environmental disruption.

Although epoxy re-sins have been used to build, secure, protect, and repair all types of infrastructure for the past 75 years, their use in underground rehabilitation was limited by handling constraints and high cost. Today, evolving chemistry and process technology enable the use of epoxy resins packaged with mobile equipment, removing many restraints with earlier systems, including a further reduction in carbon footprint.

This article presents an overview of three generic types of CIPP systems for

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Editor's Notes: This article was first presented at SSPC 2011, the conference of SSPC: The Society for Protective Coatings, held January 31-February 2, 2011, in Las Vegas, NV, and is published in the conference Proceedings *(www.sspc.org).*

An article detailing an EPA report on rehabilitating and repairing wastewater systems will be published in an upcoming JPCL.

their health and safety characteristics, long-term performance capabilities, and delivery mechanisms. Installation technologies are also analyzed for their energy efficiencies, environmental impact, performance consistency, ease of use, and cost. Overall, the article is intended to provide a basis for selecting materials and installation practices to achieve long-term protection of buried wastewater infrastructure with CIPP, while also protecting humans, animals, and the environment.

Background

The use of coatings for the protection and renewal of underground infrastructure has been a steadily growing market over the past 20 years. In the early 1990s, a transformation of the underground rehabilitation market began through the emergence of non-toxic, VOC-free, higher-performing polymers. Epoxies quickly took the lead with their previous difficulty in handling and use issues becoming not only manageable but also efficient and effective, especially for manholes, lift stations, and other corroding wastewater structures. The epoxies were 100% solids, solvent-free, ultra-high-build, sprayable systems. Systems designed specifically for high strength were capable of structurally enhancing or renewing severely deteriorated concrete, masonry, and metal infrastructure. Such developments led to the use of these types of polymers elsewhere within the underground infrastructure rehabilitation niche.

The Environmental Protection Agency (EPA) estimates the United States needs to spend over $390 billion over the next 20 years to update or replace existing systems and build new ones to meet increasing demand.[1] Cured-in-place pipe technology was first installed in the United Kingdom in 1971, and introduced to the North American market in the late 1970's. Over the next 20 years, this technology revolutionized the sewer pipeline repair industry, providing a reliable solution to rehabilitating sewer pipelines without the need to excavate. CIPP technology is still evolving to remain competitive with other liner systems and within the CIPP market itself, especially as patents

Table 2 – CIPP Resin System Advantages and Disadvantages

Characteristic	Epoxy Systems	Vinyl Ester Systems	Polyester Systems
Material Composition	Thermosetting plastic Felt-resin composite consisting of needle-punched polyester felt and epoxy resin system	Thermosetting plastic Felt-resin composite consisting of needle-punched polyester felt and vinyl ester resin system	Thermosetting plastic Felt-resin composite consisting of needle-punched polyester felt and polyester resin system
Resin Composition	Two-part, 100% solids, solvent-free Bisphenol-A or Bisphenol-F based epoxy resin and hardener	Bisphenol- A epoxy-based resin vinyl ester resin dissolved in styrene	Unsaturated filled or unfilled polyester resin, catalysts and styrene monomer
Manufacturing Process	• CIPP wet out performed at the jobsite in a mobile system with a controlled temperature environment • Proper resin saturation rates and roller gap settings are achieved every time • CIPP liner is installed immediately after wet out	• CIPP wet out performed at the contractor's facility or wet-out liner supplier's facility • Proper resin saturation rates and roller gap settings may or may not be achieved – Owner not able to monitor or verify • Wet-out CIPP stored in refrigerated truck at controlled temperature of 30–40 F and transported to jobsite • Shelf life prior to installation varies with resin used, diameter, and thickness of the CIPP	
Volatiles or HAPs	None	Styrene	Styrene
Chemical Resistance	Excellent; resistant to broad pH spectrum of 2–14	Excellent; resistant to flows with pH of 0.5–10.5	Good; generally resistant to flows with pH of 5–9
Thermal Resistance	Very good; up to 180 F exposure	Very good; up to 200 F exposure	Good; generally up to 140 F exposure
Abrasion Resistance	Excellent; best of all thermosetting plastics	Good	Good
Shrinkage	Very low; linear and circumferential shrinkage is minimal	Resin selection (filled vs. unfilled) and following of proper cool down procedures are critical to minimize shrinkage	
Adhesion	Excellent; bonds to all types of materials in wet and dry conditions	Good	Poor; does not bond well to dissimilar materials
Moisture Absorption	Very resistant	Very resistant	Poor resistance
Toughness	Excellent, high impact resistance	Good	Poor

have expired and "off the shelf, low quality, commodity type products"[2] have come to market driving down prices of CIPP. However, during 2008, CIPP surpassed all other technologies to be recognized as the number one repair technology for sanitary sewer pipelines in North America. According to a recent EPA report, "Recent innovations applicable to the U.S. market are in the introduction of UV-cure liner systems, the increased use of steam cure in place of water cure, the refinement of site operations to recycle hot water used for curing, the introduction of composite liner technologies, and the expansion of the number of industry providers of CIPP installations. The challenges are the increasingly stringent controls on chemicals that may enter the aqueous or air environment and to maintain high levels of QC in a more commodity-driven business environment."[3] Several chemical and coating manufacturers, including the author's company, are addressing these challenges to deliver safer, efficient, and durable products for repairing and renewing global water and wastewater infrastructure.

Traditionally, unsaturated polyester resins have been utilized for CIPP applications in wastewater pipelines. Over the past several years, continued controversy over the potential toxicity and harmful affects of these styrene-based resins has opened the door for the next generation of CIPP products.

The three resin systems used in CIPP are polyester, vinyl ester, and epoxy. These systems are known for their capabilities to perform well in certain application environments and correlating features/limitations, including those listed in Table 1 (p. 51).

Technology advances over the past 15 years, originating in Germany, have established the safety, durability, and high performance of epoxy resins used in CIPP. Because of their relatively short pot life and higher cost compared

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to polyester resins, epoxies have generally been reserved for aggressive municipal and industrial wastewater applications. However, as concerns grew regarding the potential harmful effects of styrene, and as the demand increased for higher-performing, more durable CIPP systems, epoxies became a logical choice. The desired system characteristics included the following.

Minimized social impact:

- odor free and safe for humans and animals
- improved installation with less disruption to residents, businesses, and traffic

Minimized environmental impact:

- no styrene and odor-free
- no VOCs
- reduced carbon footprint with systems that are not harmful or toxic to the environment

Minimized economic impact:

- increased life of installed system—improved mechanical properties, chemical resistance, fit to host pipe
- cost-sensitive but with value added through improvements

Through development trials with equipment and processes, the evolution of polymer chemistry, and the diligent pursuit of sustainable solutions, epoxies were found to offer the most advantages among the main CIPP systems (Table 2, p. 52).

Basic characteristics of a resin system determine its viability for use within a CIPP composite system. As displayed in Chart 1 (p. 51), the potential for performance is ranked by characteristic for each resin. Although each system has its strengths, epoxy ranks high in key areas with pot life being a challenge for viable CIPP use. Today's chemistry and formulation knowledge has enabled the extension of epoxy pot life in ambient conditions (20-25 deg C) up to 24 hours without degradation of physical properties after cure.

Mechanical properties determine the performance and long-term durability of the lining. Typically, short-term properties are required for qualification to meet minimum values but do not necessarily portray long-term system performance. Table 3 provides industry minimum values for cured-in-place composite made with resin-impregnated polyester felt and corresponding results when using representative resin systems. Long-term performance is predominantly determined by the resin system no matter what liner material is used. Each resin is affected by many factors, including chemical resistance, water absorption, and other service environment stresses. Industry accepted and standardized test methods are available to ascertain long-term durability of a CIPP system through relatively short-term testing. These methods include ASTM D2990, ASTM D5813 and DIN EN 761. Careful consideration should be made to evaluate durability while selecting a resin system for use. Many uncontrollable factors contribute to the variability of results when tested in laboratory conditions compared to "real world" use, including resin choice, equipment, cure process, and installer experience. Qualification of the resin system is an important factor in designing sustainability, but all variables should be considered. Long-term flexural modulus values of the charted resin systems typically yield a loss of 27-50% over a 50-year period for consideration in design.

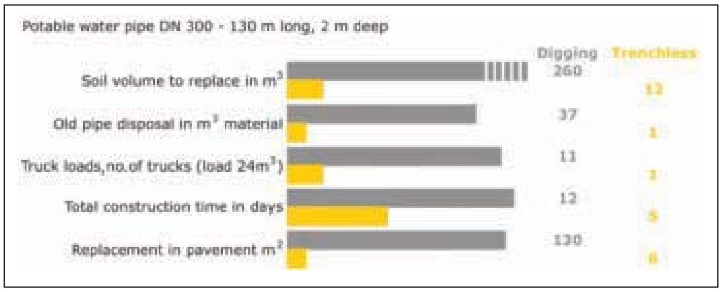

Chart 2 – Example of Carbon Emissions Reduction Using Trenchless Process

Table 3 – Physical Properties for CIPP with Different Resins

Test Properties	Minimum	Polyester (unfilled)	Vinyl Ester	Epoxy
Tensile Strength, psi	3,000	3,000	4,000	4,000
Flexural Strength, psi	4,500	4,500	5,000	5,000
Flexural Modulus, psi	250,000	250,000	300,000	300,000

Governments across the globe are focusing on ways that require municipal managers and business owners to evaluate carbon loading as an integral element of their construction projects. For the repair of water and wastewater pipelines, the decision to move from traditional dig to trenchless technology such as CIPP can reduce CO_2 emissions by as much as 85% (Chart 2).

Alternative epoxy CIPP technologies utilizing mobile wet-out can further reduce the carbon footprint with energy-efficient processes and reduce the number and use of vehicles and equipment. Innovative mobile technology removes the need for a wet-out facility, reduces the number of vehicles required at the job, and reduces the time for equipment required for curing of the liner through the use of epoxy resins. Collectively, on a single short pipe repair of 1,000 meters, an additional 3–5% reduction of CO_2 emissions could easily be expected. Other variables that would affect further reductions may include

- projects that require multiple mobilizations;
- project sites located in remote areas distant from a wet-out facility; and
- disposal of styrene-laden process water and/or condensate from polyester resins.

Resin technology for infrastructure repair, especially buried infrastructure, still strives for improved durability as well as for long-term sustainable solutions that minimize social, environmental, and economic impact. The good news is opportunities exist to use and improve upon technologies available now. The future is bright with higher performing, longer-lasting, safer polymers which answer the global needs and demands for energy efficient, environmentally friendly solutions to failing buried infrastructure. Advances in epoxy technology and refinements in installation equipment and processes have shown that innovation in the CIPP market continues to move forward towards these demanding goals.

References

1. ASCE's Report Card for America's Infrastructure, 2009.
2. Muenchmeyer Associates, LLC, "The American Evolution of Cured-in-Place Pipe from Small Difficult Specialty Projects to Being the Technology of Choice for Many Very Large Sewer Renewal Projects."
3. EPA, Rehabilitation of Wastewater Collection and Water Distribution Systems – State of Technology Review Report, May 2009.

Steve Wierzchowski is the Technical Director for RS Technik, supporting operations in the Americas. Steve is a NACE-certified inspector and has over 17 years of experience with the use of polymer coatings and linings in the water and wastewater markets.

He is an active member of SSPC, NACE, ASTM, and NASTT. He has authored and instructed many papers and workshops over the past 15 years focused on epoxies and their safe use in protecting and rehabilitating infrastructure.

WEFTEC Takes 84th Annual Show to Los Angeles

Los Angeles Convention Center. Photo courtesy of LA Inc.

The 84th Annual Water Environment Federation Technical Exhibition and Conference (WEFTEC) will take place at the Los Angeles Convention Center in Los Angeles, CA, on October 15–19. The conference portion is scheduled for October 15–19, and the exhibition is scheduled for October 17–19.

According to the Water Environment Federation (WEF), WEFTEC is the largest annual event in North America for water quality professionals. WEFTEC 2011 will feature over 25 workshops, 114 technical sessions, more than 800 presentations and posters, continuing education credits, professional development hours, and more.

Education is focused in 12 tracks, which include: Emerging Research and Innovation; Industrial Issues and Treatment Technology; Municipal Wastewater Treatment Process and Design; Facility Operations; Residuals and Biosolids Management; Collection Systems; Stormwater Management; Watershed Resources Management and Sustainability; Utility Management;

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Exhibition

The exhibition hall will be open on Oct. 17–19, from 9:00 a.m. to 5:00 p.m. each day. Almost 1,000 exhibitors are expected at WEFTEC 2011. The following is a list of exhibitors known to *JPCL* that might be of interest to protective coatings professionals. The list is current as of press time.

- AW Chesterton Company .... 225, South Hall
- AP/M Permaform/ ConShield Technologies .... 2849, South Hall
- Arizona Instrument, LLC .... 1021, South Hall
- Atlas Copco Compressors LLC .... 4400, West Hall
- C.I.M. Industries Inc. .... 1515, South Hall
- Carboline Company .... 5628, West Hall
- Denso .... 9039, Kentia Hall
- Gardner Denver, Inc. .... 431, South Hall
- Induron Coatings Inc. .... 2267, South Hall
- Insituform Technologies Inc. .... 1931, South Hall
- International Paint .... 8805, Kentia Hall
- Kerneos Inc. .... 4112, West Hall
- LaMotte Co. .... 416, South Hall
- NACE International .... 8121, Kentia Hall
- PPG Protective & Marine Coatings .... 8631, Kentia Hall
- Raven Lining Systems .... 4338, West Hall
- Sauereisen, Inc. .... 1929, South Hall
- The Sherwin-Williams Company .... 4326, West Hall
- Spectrashield Liner Systems .... 4357, West Hall
- Sprayroq, Inc. .... 2725, South Hall
- SSPC: The Society for Protective Coatings .... 8214, Kentia Hall
- Sunbelt Rentals .... 149, South Hall
- Tnemec Company, Inc. .... 1711, South Hall
- Wasser Corporation .... 438, South Hall

Water Reclamation and Reuse; Future Insights, Global Issues, and Sustainability; and Government Affairs/Exhibitor Forum. Several programs may be of interest to professionals in the industrial maintenance coatings field.

W109: Is Your Utility Effective Inside and Out? Effective Utility Management Through Assessment and Benchmarking takes place on Saturday, Oct. 15 from 8:30 a.m. to 5:00 p.m. The day-long workshop will focus on assessment of utility operations, the basics of benchmarking, organizational improvement, and more. It is designed for utility leaders, top managers, consultants, and supervisors.

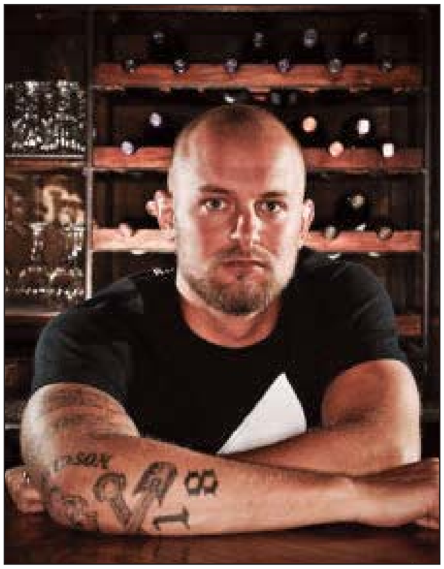
Dr. Rita Colwell

On Monday, Oct. 17, TS018: Quantifying the Benefits of Green Infrastructure, will have three presentations from 1:30 p.m. to 3:00 p.m. The session focuses on some of the largest programs that are incorporating green infrastructure and how green infrastructure is being evaluated for use.

Also on Monday, from 1:30 p.m. to 5:00 p.m., is TS030: National Environmental Priorities. At this time, senior U.S. Environmental Protection Agency and state officials will present and discuss how the U.S. can address its most pressing environmental and water quality issues. Federal, state, and private sector roles and responsibilities will be discussed, as well as current national and state water quality priorities.

Several facility tours are planned for Monday, Tuesday, and Wednesday. Tours include the following.

- Los Angeles County Sanitation Districts' Joint Water Pollution Control Plant
- Collection Systems Tour: Los Angeles Sewer Tour—Discovering What Lies Beneath
- City of Los Angeles' Terminal Island Water Reclamation Plant



Doc Hendley

• Orange County Sanitation District's Reclamation Plant #1 and Orange County Water District's Groundwater Replenishment System Advance Water Purification Facility
• City of Santa Monica's Charnock Well Field Restoration Project
• City of Los Angeles' Hyperion Treatment Plant
• Stormwater Management Tour: Green Stormwater Infrastructure
• West Basin Municipal Water District's Edward C. Little Water Recycling Facility

In addition to the educational opportunities and tours, there is a full schedule of meetings, luncheons, receptions, and other events scheduled. The Opening General Session takes place on Monday, Oct. 17, at 8:30 a.m. and will feature two speakers. Dr. Rita Colwell, distinguished professor at the University of Maryland and Johns Hopkins University's Bloomberg School of Public Health, will deliver the technical keynote address. Dr. Colwell has contributed to controlling the spread of cholera, a waterborne pathogen. She is expected to discuss her insights into the necessity of clean water and sanitation.

The second speaker is Doc Hendley, founder and president of Wine to Water and one of CNN's 2009 Heroes. Wine to Water is a non-profit focused on providing clean water to people around the world.

Visit www.weftec.org for more information or to register.

2012 Call for Papers

WEFTEC 2012 will take place in New Orleans, LA, on Sept. 29 to Oct. 3, 2012. WEF is currently accepting abstracts. Pre-proposal forms must be submitted by Sept. 30, 2011. They can be emailed to smerther@wef.org.

Texas Bridge Partners to Recoat Sunshine Bridge Approaches

The Louisiana Department of Transportation and Development let a contract of $6,223,574 to Texas Bridge Partners, LLP (Humble, TX) to perform superstructure and substructure painting and repairs on the Sunshine Bridge. The contract required SSPC-QP 1 and QP 2 certification. The project involves cleaning and recoating structural steel surfaces on a 3,160-foot-long segment of the east approach and a 1,444-foot-long segment of the west approach to the Sunshine Bridge, an 8,236-foot-long cantilever bridge over the Mississippi River. The project also includes repairing 61 trestle bent base plates that are coated with lead-based paint. The steel will be abrasive blast cleaned to a Near-White condition (SSPC-SP 10) and coated with an inorganic zinc-rich primer, an epoxy intermediate, and a polyurethane finish. Since the existing coatings contain lead, the use of Class 1 containment structures (SSPC-Guide 6) is necessary. The contractor must furnish NACE-certified coatings inspectors as part of its quality control plan.

Seacor Awarded Tower Painting Project

Seacor Painting Corporation (Campbell, OH) won a $62,400 contract from the city of Virginia Beach, VA, to perform coatings application and related maintenance on four radio communication towers that range in height from 150–400 feet. The project includes spot-coating corroded surfaces with a rust-converting primer, coating galvanized surfaces with a zinc primer, and coating all tower surfaces, including structural steel, antenna mounts, waveguide ladders, coax/waveguide surfaces, and conduit, with an orange- and white-striped pattern according to FAA standards.

Lindner Secures Power Plant Painting Work

Courtesy of the facility owner

Lindner Painting, Inc. (Seward, NE) secured a contract of $73,370 from the city of Grand Island, NE, to recoat exterior surfaces of a combustion turbine enclosure at the Burdick Generating Station. The enclosure components, which include an 80-foot by 11-foot by 12-foot building, a 40-foot by 19-foot by 12-foot air

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inlet housing, a 7-foot by 6-foot by 9-foot substation, turbine discharge and cooling air stacks, metal grating walkway and step surfaces, a roof access ladder, piping, conduit, and junction boxes, will be abrasive blast cleaned, followed by application of a zinc-epoxy-urethane system on buildings and metals, an acrylic coating on composite roofing, and a silicone system on stack surfaces. The contract includes erecting containment due to low levels of lead (55.6 ppm) in the existing finishes.

Groome to Recoat Marine Terminal Cranes

Groome Industrial Service Group (Waldwick, NJ) secured a $1,624,970 contract from Broward County (FL) to clean and recoat five existing cranes at the Port Everglades Southport Terminal. The non-corroded crane surfaces will be high pressure water-blasted at 7,500-10,000 psi, while corroded surfaces will be ultra-high-pressure waterjetted or commercial grade power-tool cleaned (SSPC-SP 15). The cranes will then be recoated with an epoxy spot-primer, an epoxy intermediate, and a polyurethane finish. The project calls for the use of Class 2W containment (SSPC-Guide 6.)

Spartan Contracting Awarded Ozark Bridge Painting Project

Spartan Contracting (Campbell, OH) won a contract of $890,000 from the Arkansas Highway and Transportation Department to recoat the 473-foot-long steel through arch section on a 1,536-foot-long bridge over the Arkansas River. The steel will be recoated with an inorganic zinc primer, an epoxy intermediate, and a polyurethane finish. The contract, which requires SSPC-QP 1 and QP 2 certification, includes erecting Class 2 containment (SSPC-Guide 6) to capture the existing lead-bearing coatings.

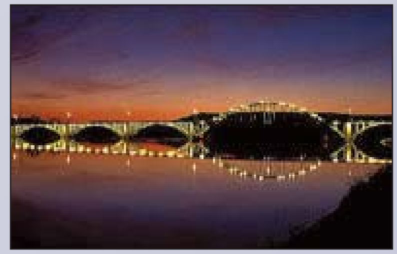

Photo courtesy of Arkansas Dept. of Parks and Tourism

Pioner Waterproofing Wins Lighthouse Painting Job

Courtesy of the town of Port Orford

The Oregon Department of Parks and Recreation awarded a $41,300 contract to Pioneer Waterproofing Co. (Portland, OR) to perform maintenance painting and related work at the Cape Blanco Lighthouse. Built in 1870, the lighthouse is listed on the National Register of Historic Places. The project includes cleaning and coating existing wood and metal surfaces; the metal will be coated with a zinc-epoxy-urethane system, while the wood will receive an oil-based primer and latex enamel finish. The exterior masonry walls will also be coated with an elastomeric finish, as well as a sacrificial wax anti-graffiti coating. The contract, which requires SSPC-QP 1 and QP 2 certification, includes erecting containment structures.