Some Reflections on PACE 2009

The fifth PACE conference was held in New Orleans, LA, and while the show had its challenges, I feel it was a success. The biggest hurdle we faced was the current economic crisis. Many companies and individuals have cut their business travel budgets; these cuts were reflected in lower attendance than last year.

Although reduced budgets are a reality of the times, the show did far better than what was expected. I have received many comments from attendees who said that our technical sessions were much better than in some previous years. Several exhibitors told me that while the traffic was down, the visitors they did have were decision makers, not just "tire kickers."

As in all shows, our primary focus is to give our members and attendees a forum where they may learn from our training sessions, workshops, and other presentations. We also want to give attendees and exhibitors a place where they may educate each other about their specific needs and about products available in the industry.

Another focus of this and all trade shows is to make a profit that runs the association and subsidizes those programs that are not revenue generators, such as standards development and government affairs. I assure you that we will review the comments we receive from attendees, exhibitors, and others to make next year's show even better. I have learned over the years at SSPC that the show is a yearly work in progress.

As I announced at the Annual Meeting at PACE 2009, next year's PACE show in Phoenix, AZ, will be our last joint convention with PDCA. We are going to return to our own show in 2011. The Board of Governors made this decision at their meeting in May 2008. The 2011 SSPC show, set for February at the Mandalay Bay Hotel in Las Vegas, will focus exclusively on protective, marine, industrial, and architectural coatings technology, products, and services. The focus embodies the interests and desires of SSPC's core members and supporters, and it returns the organization to its roots of providing a dynamic venue for industrial coatings professionals to network and discover the latest developments in the industry.

Here are a few other highlights from PACE 2009. We had a superb keynote speaker in Mr. Michael Broome, who challenged us to find ways to deal with these turbulent economic times while maintaining a sense of humor. He provided many historic examples of how folks have dealt with similar situations. As one of the attendees told me after the talk, "It was right on target, and you seem to get better speakers year after year." Those were nice words to hear.

At our annual meeting, our president, Bruce Henley, and I gave a "state of the association" briefing. You can read on page 61 about the accomplishments and the financial health of SSPC during 2008. Let me assure you that although the association remains strong, as is the case with everyone, we continue to watch the economic situation closely. Training and certification are now our largest revenue generators.

Also at the annual meeting, we recognized authors of some of our best *JPCL* articles from the past year, and we gave awards for achievements in education, technical work, chapter programs, and other contributions to the industry. You can read more about these awards on pages 57-59. We are also very proud to have given the Crone Knoy, Charles Munger, William Johnson, and George Campbell Awards for Achievement in the painting of industrial and commercial structures. A photo essay about the winning projects begins on page 50.

I want to thank all the attendees who came to New Orleans; the exhibitors who displayed their products and services; the volunteers on all the committees and special task groups; the sponsors, whose support allowed us to put on the show we wanted to host; and the SSPC Board of Governors for their guidance and direction. I want to conclude with a special thank you to the staff. They are small in number but big in heart. They care about the members as well as the products and services we provide. The Board is constantly amazed by how much this small group accomplishes.

Bill Shoup
Executive Director, SSPC

Stimulus Bill: $8 Billion Released for Public Transit

Vice President Joe Biden and U.S. Transportation Secretary Ray LaHood announced on March 5 that $8.4 billion in stimulus funds from the American Recovery and Reinvestment Act (ARRA) was released for repairing and building the public transportation infrastructure.

California and New York were the only two states to receive more than $1 billion each, with a combined amount of approximately $2.3 billion. Overall, the 50 states, the District of Columbia, Guam, N. Mariana Islands, Puerto Rico, and the Virgin Islands split $7,476,200,000 of the money. Oversight, tribal transit, discretionary energy funding, and new starts brought the grand total to $8.4 billion.

"Investments in public transportation put people to work, but they also get people to work in a way that moves us towards our long term goals of energy security and a better quality of life," said Secretary LaHood. "That is why transit funding was included in the ARRA and why we think it is a key part of America's transportation future."

For more information on where ARRA money is being allocated, visit www.recovery.gov.

BidTracker Issues Market Report for Painting Contracts

Paint BidTracker, a product of Technology Publishing/PaintSquare (Pittsburgh, PA), announces the launch of "Markets for Industrial Painting in Public Works Contracting, National and Regional Statistics." The report is a review and in-depth analysis of industrial coatings work on bridge, water storage, and wastewater facilities. It focuses on Paint BidTracker data from 2008, illustrating in what sectors money is being spent.

The report is intended for use by companies who are assessing the validity of pursuing marketing and contracting efforts in a particular industry or region. It includes information on the total number of painting projects and dollar volume of coating contract awards, a national and regional breakdown, a breakdown by industry, and a breakdown of projects with lead abatement.

"We're very excited…This report is a tremendous tool for identifying which markets secured and spent the most public works funding during 2008, which is highly indicative of future spending," said Brian Churray, Paint BidTracker product manager.

The "Markets for Industrial Painting in Public Works Contracting, National and Regional Statistics" can be downloaded instantly at www.paintsquare.com/bidtracker/marketdata for $300.

Paint BidTracker is a construction reporting service focused on industrial coatings work in publicly-funded contracting. It is the only project leads service designed specifically for the coatings industry.

Technology Publishing/PaintSquare is the publisher of *JPCL, JAC,* and *PWC,* as well as web and other

CoatingsTech Looks to Future

The new CoatingsTech conference, sponsored by the recently fully-merged NPCA/FSCT, will be held in Indianapolis, IN, from April 28–29. The theme is "Embracing the Future," and the conference will highlight innovations in technology that will drive the future industry and ways to plan for changes to survive a competitive environment.

For details, visit www.coatingstech.org.

Carboline Acquires Chinese Licensee

Carboline Company (St. Louis, MO), a subsidiary of RPM International Inc., has announced that it will acquire 49% interest in its Chinese Licensee, Carboline Dalian Paint Production Co., headquartered in Dalian City, Liaoning Province, People's Republic of China. The remaining 51% of the company will be owned by UniChemical Company, a partner of Carboline in another joint venture, Carboline Korea Ltd.

Carboline Dalian manufactures corrosion control coatings and linings for a variety of industries, including offshore drilling, oil and gas, petrochemical, and nuclear and conventional power.

RPM is a holding company with subsidiaries that specialize in corrosion control coatings, flooring coatings, sealants, and specialty chemicals for industrial and consumer markets.

IP Germany Receives Meyer Werft Award

Shipyard Meyer Werft GmbH (Papenburg, Germany) has named IP Germany (International Farbenwerke GmbH), in Hamburg, Germany, its Shipbuilding Partner of the Year 2008. Hans Thieke, senior purchaser for Meyer Werft, noted that coatings from IP Germany have helped the shipyard reduce emissions of volatile organic compounds, improve operator fuel efficiency, and reduce operator maintenance costs.

SSPC Adds Qualification Program for Commercial Contractors

SSPC has introduced the SSPC-QP 9 Program, "Standard for Evaluating Qualifications of Painting Contractors Who Apply Architectural Paints and Coatings." QP 9 addresses the qualifications of contractors who apply architectural coatings on commercial or institutional structures and defines a minimum standard for qualification. QP 9 complements SSPC's industrial contractor certification programs such as SSPC-QP 1 (field painting of steel structures and ships) and SSPC-QP 3 (shop painting of steel for industrial and marine applications).

The objective of QP 9 is to determine if a painting contractor has the management structure, organization structure, qualified personnel, technical capability, quality management system, and safety and environmental compliance programs in place to perform surface preparation and architectural coating application of the required quality under the conditions specified by the owner.

Four functional areas are evaluated in QP 9.

- Management Procedures
- Technical Capabilities
- Job Quality Procedures
- Safety, Health and Environmental Compliance

The standard defines four qualification categories. However, SSPC offers "full" certification for Category 1 only and qualification certificates for Categories 2 and 3 for contractors who do not meet the requirements for full status certification but who wish to obtain "interim" qualification leading eventually to full certification (Category 1).

- Category 1—Full Certification: The contractor has demonstrated a minimum of five years of successful experience applying architectural paints and coatings in the commercial or institutional property markets and is compliant with all requirements of this procedure. Category 1 qualification requires both an office and a jobsite audit.
- Category 2: The contractor has demonstrated a minimum of three years of successful experience applying architectural paints and coatings in the commercial or institutional property markets and is in compliance with all requirements of this procedure, except full implementation of a Job Quality Monitoring System in the field. Category 2 qualification requires an office audit only.
- Category 3: The contractor has a minimum of two years of successful experience applying architectural paints and coatings in the commercial or institutional property markets and is in compliance with all requirements of this procedure, with the exception of the development and implementation of a Job Quality Monitoring System and an Environmental Compliance Program in accordance with requirements of Sections 3.3.3 and 3.4.2. A detailed submittal is required to achieve Category 3 qualification. No site audit is required to qualify for this Category.

The one-time qualification period for both Categories 3 and 2 expires after three years. Contractors entering the program at Categories 3 or 2 are expected to advance to the next higher category before the three-year qualification expires. A contractor who has achieved Category 1 qualification is certified for three years with annual audits as determined by SSPC. At the end of these three years, the certification expires and the contractor may re-apply for a new three-year term.

For full details and application forms, visit www.sspc.org.

The Case of the Yellowed Water Tank Lining

By James D. Machen, KTA-Tator, Inc.
Richard Burgess, KTA-Tator, Inc., Series Editor

The new lining in this 10-million-gallon water tank gave everyone a surprise. Photos and figure courtesy of the author.

Many coating contractors make a living by removing and replacing lining systems in potable water storage tanks. Water storage tanks, and often systems of multiple tanks, serve the water consumption needs of every town, city, municipality, and township throughout the country.

The size of the population being served, the available terrain, and the elevation at which the tank is constructed often dictate the capacity and design of these storage tanks. The design of water storage tanks generally falls into two types: ground storage and elevated water sphere type. Tanks providing the water for small communities may have smaller capacities (e.g., 50,000 gallons), while water demands of larger populations often necessitate tanks with multi-million gallon capacities.

As with any construction project, the logistics of field relining work on smaller tank projects is generally less demanding than that on larger tanks. Correspondingly, when the tank to be relined is large, the capability, efficiency, and equipment requirements for the coating contractor increase.

And so a relining project on a 10-million gallon water tank, the subject of this article, was no simple undertaking. But because of the ingenuity, experience, and state-of-the-art equipment used, a reputable painting contractor was able to proceed smoothly with the project. The best-laid plans, however, often have unforeseen circumstances that can disrupt the project flow. This

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became evident when the epoxy lining system applied to the abrasive blast cleaned steel began to turn multiple shades of an amber/yellow color (Fig. 1).

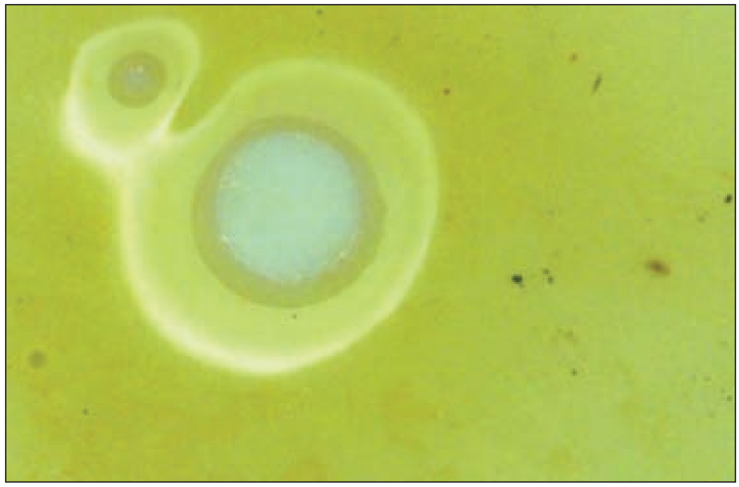
Fig. 1: Discoloration in the coating was eventually determined to be amine blush.

Background

A municipal water works company located in the northeast United States hired a local engineering firm to design an interior relining project for a 10-million-gallon water storage tank. The tank was of a ground storage design. Because the tank was an essential component of the community's water delivery system, it was necessary that the project be performed when water demand was lowest. The project was therefore scheduled to begin in November and run through spring of the following year.

Because of the schedule, it was obvious that cooler temperatures would be encountered over the work period. As a result, considerable care was taken to design the project so that the contractor was required to maintain strict environmental and work controls (e.g., on ambient air, surface, material, and dew point temperatures; relative humidity; ventilation; and containment).

In fact, the contractor's detailed plan for environmental and work control was a pre-job submittal requirement that was carefully reviewed by the project designer for adequacy. In addition to the engineer's inspector, a third-party coating inspection company was hired by the owner to monitor specification compliance.

The contractor cut a large overhead door and entryway through the shell liner and installed a temporary sealed door. This allowed the contractor to stage equipment within the vast interior of the tank. Exhaust hoses were attached to all diesel power equipment and exhaust was ventilated outside through the tank shell. Individual pie-shaped containment enclosures were built within the tank. The containment enclosure made it easier to maintain acceptable environmental conditions and contain work debris during abrasive blast cleaning and lining installation. The pie-shaped containment structure was moved as work progressed.

The interior tank steel was blast cleaned in accordance with SSPC-SP 10/NACE No. 2 Near-White Metal, and a two-coat, ANSI/NSF Standard 61-certified epoxy lining system was applied. Because of the cooler ambient temperatures, a faster curing epoxy coating, tolerant of low application temperatures, was specified. After multiple moves of

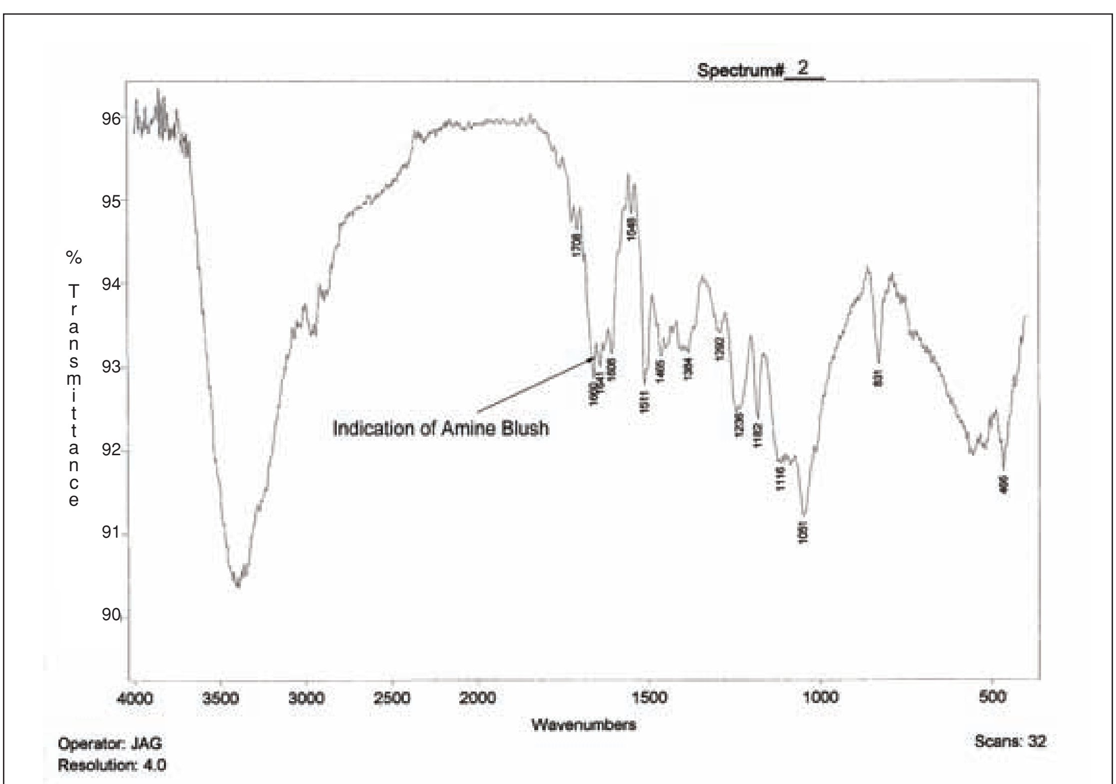

Fig. 2: Infrared spectroscopy analysis indicated amine blush.

the pie-shaped containment, the coating applied to one section of the tank had discolored into various shades of amber/yellow that were not present in other coated sections.

Site Investigation

An investigation of the discoloration problem was conducted. The residue was somewhat “tacky” to the touch in areas where the darker amber/yellow discoloration was present, and “oily” or greasy in areas where the discoloration was lighter in color. The amber/yellow discoloration was a surface phenomenon only and could be totally or partially removed by hand rubbing the paint surface with a clean white cloth and warm deionized water. The amber/yellow discoloration/residue transferred to the cloth. Multiple areas were cleaned (i.e., the areas of darker amber/yellow discoloration and lighter colored areas) and the cloths were sealed in plastic sample bags. The samples were forwarded to a laboratory, where an analysis was performed to identify the residue on the cloth.

Laboratory Investigation

The laboratory investigation consisted of infrared spectroscopic analysis to identify and characterize the amber/yellow residue that had transferred to the clean cloth. The analysis of several samples revealed that the amber/yellow residue consisted of a hydrocarbon material and an amine carbonate with associated bound water. (The amine carbonate results from a chemical reaction between the [curing agent] amine functional group with carbon dioxide from the air, under moist [humid] cool conditions. Bound water refers to the water molecules adsorbed to amine functional groups [held by hydrogen bonding] and are distinct from free water in that they do not evaporate under ambient conditions.)

The presence of the amine carbonate

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indicated that a portion of the amber/yellow residue was actually an amine exudate, or what is commonly referred to as "amine blush" (Fig. 2, p. 10). Amine blush is caused by the presence of un-reacted amine on the surface of the epoxy coating reacting with carbon dioxide and moisture in the air to form an amine carbamate. Industry experience has shown that the blushing reaction can be propagated by cool temperatures and exacerbated by increased film thickness and excess carbon dioxide (e.g., airborne combustion products from diesel engines). If undetected, the presence of amine blush (in sufficient quantities) can cause intercoat delamination when the "blushed" coating is painted over.

A review of daily inspection reports from the owner's third-party inspector revealed that all environmental (ambient) conditions were acceptable at the time of coating application and curing. In addition, all the dry film thickness measurements were within the specified limits. This essentially ruled out the possibility that the amine blush reaction was caused by cool temperatures or increased film thickness. At this point, the investigation turned to the hydrocarbon material that was identified by the infrared spectroscopic analysis.

Because amine compounds are very efficient scavengers of atmospheric carbon dioxide, they are sensitive to increases in the amount of carbon dioxide in the surrounding atmosphere. After reviewing the project inspection reports and work records, it was determined that the presence of the hydrocarbon contaminant was a significant clue to solving the yellowed lining problem.

The work records documented the identification and repair of a leak in the ventilation system for the diesel-fired compressor and lighting systems. The leak had apparently gone undetected for several hours before being discovered. Even more interesting is that the second coat of epoxy was being applied in the area that discolored at the same time the leak occurred. Problem solved: the leak in the exhaust ventilation system for the diesel engines allowed combustion products, including carbon dioxide, to escape into the interior tank atmosphere. The recently applied and incompletely cured epoxy coating reacted with the carbon dioxide and an amine carbonate (amine blush) formed on the epoxy surface. In addition, hydrocarbon contamination from the diesel exhaust deposited on the painted surface.

Recommendations

Once the cause of the discoloration was determined, the question became whether the amine blush could be removed and if the applied coating could be salvaged. It was also questioned if there would be any long term effects on the integrity of the installed lining. To answer these questions, the contractor performed a series of cleaning tests to determine the best method for removing the amine exudate. Cleaning tests, based on the results of the field investigation, revealed that the amber/yellow discoloration was somewhat water-soluble. Ultimately, it was discovered that the amine blush residue could be completely removed by applying a proprietary chemical cleaner, followed by stiff bristle brushing and thorough water rinsing. As a result, the entire effected surface was thoroughly cleaned to completely remove the blush, rinsed, and allowed to dry.

The question of what longer-term effects (if any) that the amine blush might produce was addressed through a protocol of adhesion and cure test procedures. The first step was to obtain baseline information from the coating manufacturer on the adhesion and cure characteristics of a properly cured and serviceable lining system. Once that was established, adhesion testing (per ASTM D 3359, Standard Practice for Measuring Adhesion by Tape Test) and cure testing (per ASTM D 5402, Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs) were performed at strategic locations over the entire surface area. In addition, areas where the lining system had not exhibited any amine blush were tested for comparative purposes. The results of all adhesion and cure tests met or exceeded the manufacturer's baseline data and the comparative data from unaffected areas. It was concluded that the probability of any future problems once the amine blush was removed were unlikely. However, to completely close the loop, a series of annual inspections of the effected area was agreed to by the contractor. If any longer term effects were apparent, the contractor warranted the repair.

In summary, even the best-laid coating project plans can be affected by a seemingly minor upset in the operating system. However, cooperation between the painting contractor, tank owner, third-party inspector, and project engineer in resolving the problem—based on scientific facts and a logical approach to remediation—can overcome such obstacles.

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Aging Pilings Get Their First Protective Coating

By Eric Van Draege
Acotec NV, Belgium

The phenomenon of concentrated low water corrosion of submerged steel structures has been observed and addressed in Europe and Japan since the 1980s. Until recently, in the U.S., most steel pilings, such as quay walls and jetty pilings, have never or rarely been protected against corrosion.

But in light of concerns about unprotected steel pilings, the U.S. Army Corps of Engineers (USACE) took a close look at coating such structures in a recent research project involving the U.S. Naha Military Port on the island of Okinawa, Japan.

Fig. 1: The USACE knew little about the condition of the steel underwater at the U.S. Naha military port on Okinawa until the area was dewatered
Photos courtesy of the author

Today, owners are careful with major repair costs. In modern maintenance, good life cycle management has become a major approach to preserving the infrastructure and the environment. Ignoring the necessity of periodic maintenance will result in rebuilding, and because the manufacture of new steel is one of the most polluting industrial processes, preservation of in-situ unprotected steel has also become a prime concern from an environmental perspective.

Background

The mechanisms of corrosion on steel pilings differ from normal atmospheric corrosion. Several years ago, scientists proved that microbiologically induced corrosion (MIC) is the form of this underwater corrosion.

In MIC, aerobic and anaerobic colonies of certain types of bacteria combine and produce acids that consume millimeters of steel per year. The affected zone extends from the splash zone down to two meters or more under water. It is difficult to tell where or when MIC will occur. Unfortunately, the damage (holing) underwater is only discovered when the symptoms, such as sink holes in a dock, appear.

The USACE Takes on Aged Sheet Pilings

Researchers at CERL, the Construction Engineering Research Laboratory of the USACE in Champaign, IL, decided to carry out a test project for in-situ repair and protection of such corroded sheet piled quay walls. Researchers chose for this project a sheet piled bulkhead at the U.S. Naha Military Port on the island of Okinawa, Japan. The pilings were installed after World War II and were never coated, according to USACE. CERL's intention was to explore the rehab possibilities of using a mobile dewatering device, like a cofferdam, so workers could repair, clean, and apply a high-tech protective coating to the bulkhead.

The prime contractor for the refurbishment project commissioned a Belgian company that developed, manufactures,

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Fig. 2: Modular cofferdam that was shipped in containers to the site and installed for work at the bulkhead.

Fig. 3: After the initial cleanup process, virtually all loosely adhered material was removed.

supplies, and applies the specialized protective coating. This Belgian company worked with a division of the prime contractor. The budget for the work was $400,000.

Initial Condition of the Bulkhead

The steel in the atmospheric zone, about ~1 m to the underside of the capping beam (the layer of concrete above the pilings that protects them when ships dock and offload), was in very bad condition, with the steel virtually disintegrated. From 1 m under the capping beam to the low water line (splash and tidal zone), the piles seemed to appear in sound condition, but this was in fact not the case. Little was known about the condition of the steel under water (Fig. 1).

Refurbishment

A modular cofferdam and all auxiliary equipment to operate it were shipped in two 40-foot containers, and a crew of 4 specialists flew to Okinawa to carry out the work (Fig. 2). The task was to deploy the cofferdam and dewater the bulkhead in sections so that refurbishment could be done on site. The cofferdam is 5 m wide and 5.5 m high, allowing dry access to the sheet piling wall from the underside of the capping beam down to ~3 m below the mean water level.

The typical work procedure included the cleanup process, measurement of the steel thickness and remedial work as needed, and coating application.

Cleanup involved several steps: removing vegetation (fouling) by pneumatic tools; high-pressure water washing (at 3,280 psi); manually removing rust scale in the splash zone to ~2 m under the capping beam; closing perforated holes in the exposed zone; and abrasive blasting to SSPC-SP 7 (NACE 4), Brush-Off Blasting. Once cleanup was completed, virtually all the loosely adhered material was removed (Fig. 3).

Steel thickness measurement and remedial work required the following.

- Measuring the remaining steel thickness using ultrasonic

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Fig. 4: Filling holes and voids with polyurethane foam and remodeling the surface with special cement

Fig. 5: Welding new steel plates over holes in the steel and over steel less than 5 mm thick

equipment following a grid of ~0.45 x 0.45 m and recording minimum thickness in areas of high corrosion

• Welding new steel plates over holes in the steel and areas where steel thickness was less than 5 mm

• Filling holes or voids on the deteriorated upper parts of the piling with polyurethane foam, and remodeling the surface with a special cement (Fig. 4). Prefabricated steel plates (~1 m high and 8 mm thick, fabricated to fit the original shape of the piling profile as closely as possible) were welded to the original piling (Fig. 5).

As described below, coating application included further cleaning and preparing of the substrate as well as installing the coating on the piling.

• The steel surface was checked for soluble salts. There is no defined safe level for salts, but the coating manufacturer/contractor set the limit to be equivalent to 60 milligrams of salt/m^2 of steel surface. If the concentration was found to be higher than the limit, the surface would be washed with fresh water, the concentration re-measured, and the steps repeated until the limit was reached.

• The whole surface was abrasive blasted to SSPC-SP 10 (NACE 2), Near-White Metal, and, as the final prep step, all dust was removed from the surface.

• Sharp edges of doubler plates, seams of the clutches between steel elements, and crater pits were stripe-coated or joint-filled with two of the coating manufacturer's products that are compatible with the special coating system.

Fig. 6: The coating can cure underwater at relatively low temperatures.

• The specialized system is a single-layer, solvent-free epoxy formulated for this kind of application and spray applied in one layer. Coating thickness is set at a minimum of ~400 microns (16 mils) on new steel and up to ~600 microns (24 mils) on heavily corroded steel. The coating was formulated to cure underwater at relatively low temperatures, which meant that for this specific type of project, the cofferdam did not need to stay in place for the curing process and could be moved to the next position (Fig. 6).

• After spraying, the inspector checked the work for imperfections and for insufficient layer thickness (with a wet film thickness gauge).

The End Result

This difficult work was successfully completed to full satisfaction of the principal, and the repaired section of bulkhead is looking at an extended service life of several decades (Fig. 7). The proprietary coating applied has a 25-year claim-free track record. More than 278,000 sq m of steel have been protected with it since 1985. The manufacturer/contractor provides a 10-year insurance warranty on the work.

Fig. 7: The applied coating

Acknowledgements

Al Beitelman, researcher for the USACE at CERL and director of its Paint Technology Center, headed the project. Acotec of Belgium is the inventor, manufacturer, and contractor for this specialized type of protective work. Mandaree Enterprise Corporation was the prime contractor, and Larry Clark was Acotec's contact person with Mandaree's division, The Warner Robins Site (GA), on the project.

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New Directions in Specialty Coatings: A Sampling of Trends and Products

By Daryl Fleming, Assistant Editor, JPCL

The introduction of new specialty coatings may occur years apart due to the costs of product development associated with regulatory compliance and testing per standards published by organizations such as ASTM International and Underwriters Laboratory.

In February 2009, *JPCL* contacted manufacturers of specialty coatings—fire-resistive, anti-graffiti, heat-resistive, and insulating—for information on their latest products and for insights into the significant trends in the formulation and use of these products. *JPCL* identified companies through its September 2008 *Annual Buying Guide* and contacted them through email and telephone. This article reports on trends and products described by companies who responded to the survey.

Courtesy of the Quantum Group

Fire-Resistive Coatings

Cementitious coatings, typically comprised of gypsum or cement-based materials, are one of several types of fire-resistive coatings that remain in use. They are supplied in powder form, mixed with water, and spray-applied at the job site.

Although cementitious fireproofing continues to play a role in the protection of structural steel in commercial and industrial applications, the use of intumescent coatings (which expand when exposed to fire, forming a heat-blocking protective char) is gaining. According to Bill Dempster, High Value Infrastructure (HVI) Market Director, North America, of International Paint LLC (Houston, TX), the better durability and weather resistance of epoxy intumescents accounts for why they have "almost totally displaced cement-based fire protection in the offshore oil and gas exploration and production industry."

According to a representative of a major manufacturer of fire-resistive coatings, the most significant trends in intumescent coatings for structural steel are aesthetic improvement for architectural applications and cost reduction achieved by formulating coatings to be applied at reduced thicknesses.

For architectural applications, particularly exposed structural steel, the rough finish of cementitious fireproofing is a factor in the increasing use of thin-film intumescents, which provide a more attractive finish.

One significant way to decrease the cost per square foot of construction, the representative says, is to reduce the dry film thickness (dft) of the coating, thereby reducing material costs. For this strategy, coating formulations are being developed to achieve a specified fire rating with less applied coating material. (Fire rating refers to the amount of time the steel may be exposed to flame before losing structural integrity.) The representative estimates that the latest intumescent formulations are designed for application at dfts 30 to 50% lower than their counterparts of only five to ten years ago.

The representative adds that these thin-film intumescents are most commonly applied in the field, which also reduces costs per square foot because it avoids the costs associated with the field repair of shop-applied coatings that may have incurred damages related to handling, transportation, and weather.

On the other hand, International Paint recommends shop application of its epoxy intumescent systems, which it describes as more durable than thin-film intumescents and designed to with-

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stand handling, transportation, construction, and weather damage. According to Dempster, "the true value of shop-applied epoxy intumescent fireproofing is not necessarily the applied cost per foot, but the total savings to the building owner during the construction phase and over the life of the building."


Courtesy of Bayer MaterialScience

As for new products in the fireproofing arena, a new patent-pending product for intumescent flooring in passenger rail, transit, and subway cars, Precidium™ 550D-FR, has been introduced by the Quantum Group (Edmonton, AB). The company says that the product, a spray-applied, rapid-cure, seamless polymer system, also has potential in marine and aerospace applications. Applied at a recommended dft of 100–125 mils, the product meets or exceeds all federal fire safety standards for mass transit, according to the company. Typical applications call for priming with Precidium P-180D, followed by several coats of 550D-FR to achieve the desired appearance, and finishing with a clear coat for depth of image and light fastness.

Quantum also manufactures a number of thin-film intumescent systems for structural steel fire protection and is currently conducting R&D on a patent-pending product, Precidium TFI, a zero-VOC system. The product is designed to reduce the application time of what the company describes as an often labor-intensive process. According to the company, the product's major advantages are spray application to virtually any thickness, rapid cure, good flexibility, and suitabilty for interior and exterior applications. www.quantumcoatings.com

Anti-Graffiti Coatings

Tom Schwerdt, Lead Paint Chemist for the Texas Department of Transportation (DOT), identifies three types of coatings that are commonly specified for anti-graffiti applications. These types of coatings are classified by their functional characteristics.

Type I is a sacrificial coating, typically solid hydrocarbon (wax). Graffiti is easily removed from Type I products by high-pressure hot water, but coating reapplication is required after each cleaning, thus making this type more labor-intensive than the following two types. Type II is a non-sacrificial anti-graffiti coating, typically a polyurethane available in both solvent and waterborne formulations, and requires a solvent or chemical cleaner to remove graffiti. Type III is a non-sacrificial coating, typically formulated with silicone- or siloxane-based resin chemistry, that is water cleanable with a damp rag or at relatively low spray pressures. Schwerdt notes that one advantage of Type III coatings is that that they are "self-recoatable," i.e., no surface preparation is needed for recoats or touchup repair.

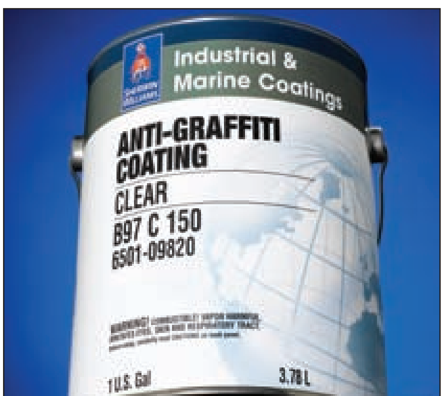
Schwerdt says that, although each type of coating continues to be specified in Texas for various anti-graffiti applications, the trend at the Texas DOT is to specify the Type III coatings as more of such products become available on the market.

At PACE 2009, Bayer MaterialScience (Pittsburgh, PA) discussed its development of a new line of anti-graffiti coatings: two-component waterborne polyurethanes designed for concrete. According to Bayer, these ultra-low VOC (0–20 g/L), permanent coatings differ from other products on the market because they can be formulated to create a matte finish (whereas gloss and semi-gloss are more common); and because the surface tension of the coatings is higher than the surface tension of the graffiti paint/markings (with typical formulations, the low surface tension of the coatings makes it difficult for graffiti to adhere to the coating). www.bayermaterialsciencenafta.com

KiON Specialty Polymers (Charlotte, NC) has recently added G-Shield™ Sealer/Primer to its G-Shield Anti-Graffiti Coatings product line. The product is a clear, waterborne, heavy-duty sealer and primer designed for superior topcoat adhesion. According to the company, it fills air pockets, cracks, and pores in concrete block and other concrete surfaces to which the G- Shield Anti-Graffiti Coating can be applied. The protected material can be cleaned numerous times without reapplication, the company says. www.thegshield.com


Courtesy of International Paint LLC

Sherwin-Williams Protective & Marine Coatings (Cleveland, OH) has introduced Anti-Graffiti Clear Coat. The company describes the single-component, non-sacrificial elastomeric siloxane coating for new or previously coated concrete as having superior cleanability and weatherability properties. Intended for use on structures such as bridges, overpasses, concrete fences, and railcars, the coating requires the use of a solvent wipe or use of a 3,000 psi pressure wash to remove graffiti. www.sherwin-williams.com



Courtesy of Sherwin-Williams Company

Graffiti Shield from United Coatings (Spokane, WA) consists of a clear protective coating and a separately sold spray-on cleaner, Graffiti Shield Cleaner. The coating, a two-component, waterborne product, seals previously painted substrates; the cleaner requires only minimal effort to remove graffiti paint and markers, the company says. The system is intended for most vertical surfaces. www.unitedcoatings.com

Heat-Resistant and Insulating Coatings

A consultant for the European coatings industry identified two trends in heat-resistant and insulating coatings: the increased use of inorganic systems, which withstand much higher temperatures than organic coatings; and the increased use of thin-film coatings, which are prone to less cracking and embrittlement than thick-film epoxies and polysiloxanes. Several companies also submitted literature for single systems designed to perform some of the functions of both heat-resistant and insulating coatings.

Houston-TX-based International Paint LLC has introduced Intertherm® 898 CSA, which the company describes as a two-component, cold-spray aluminum coating formulated to protect piping from corrosion, corrosion under insulation (CUI), and from temperatures ranging from -265 to 1050 F (-165 to 566 C). According to the company, the metallic-flake pigmented coating eliminates the need to specify different paint systems when coating high volumes of

Continued on page 76

Continued from page 23

insulated and uninsulated pipes. The coating can be applied with standard spray equipment and cures at ambient temperatures, thereby eliminating the need for stoving (i.e., baking), as needed for some CUI systems, the company says. www.internationalpaint.com

Flame Control Coatings, LLC (Niagara Falls, NY) has announced the commercialization of TermperKote® CUI-HS, a high-build coating for metal substrates designed to prevent CUI on metal substrates. According to the company, the coating withstands thermal cyclic conditions to 1,200 F (649 C), boiling water immersion, and wet-dry-wet thermal cycling. The company also says the coating can be applied to hot surfaces (to 400 F [204 C]), thus enabling the repair and maintenance of hot equipment without its complete shutdown. www.flamecontrol.com


Courtesy of Mascoat Products

Acton, MA-based Hi-Temp Coatings now offers its Hi-Temp Coatings 707 Thermal Interface coating system. According to the company, the system is suitable for substrate operating temperatures up to 350 F (177 C), sprays on like a high-build paint, is applied with standard industrial spray equipment, and provides an insulation K value of .60. The system is designed for insulating piping and storage and process equipment where a relatively low level of insulation is sufficient and cost effective; for personnel protection per ASTM C1055; and for prevention of condensation, mold growth, and dirt retention on the exteriors of piping and equipment carrying cold product. www.hitempcoatings.com

Mascoat Products (Houston, TX) describes its Delta T Industrial product as a multiple-purpose coating formulated to replace or enhance conventional thermal insulating systems in a variety of applications. Intended applications for the spray-applied coating include controlling radiant heat gain, protecting workers who work near insulated substrates, and reducing or eliminating condensation for a variety of structures, including heat exchangers, rail cars, and tanks. The company says the composite ceramic coating provides an excellent corrosion barrier as well as extreme temperature differentials (subzero to 400 F [204 C]). For carbon steel applications, a primer is recommended. www.mascoat.com

Industrial Nanotech, Inc. (Naples, FL) has introduced EPX-K, an addition to its waterborne Nansulate® EPX line of epoxy coatings formulated for thermal insulation, corrosion prevention, lead encapsulation, and chemical and flame resistance. Compared to the company's EPX-4 product, EPX-K offers increased thermal resistance and greater ease of application due to lower viscosity, the company says. The product is recommended for a variety of industrial and commercial applications, and in particular, jobs where brush application may be preferred due to limited access to


Courtesy of Industrial Nanotech, Inc.

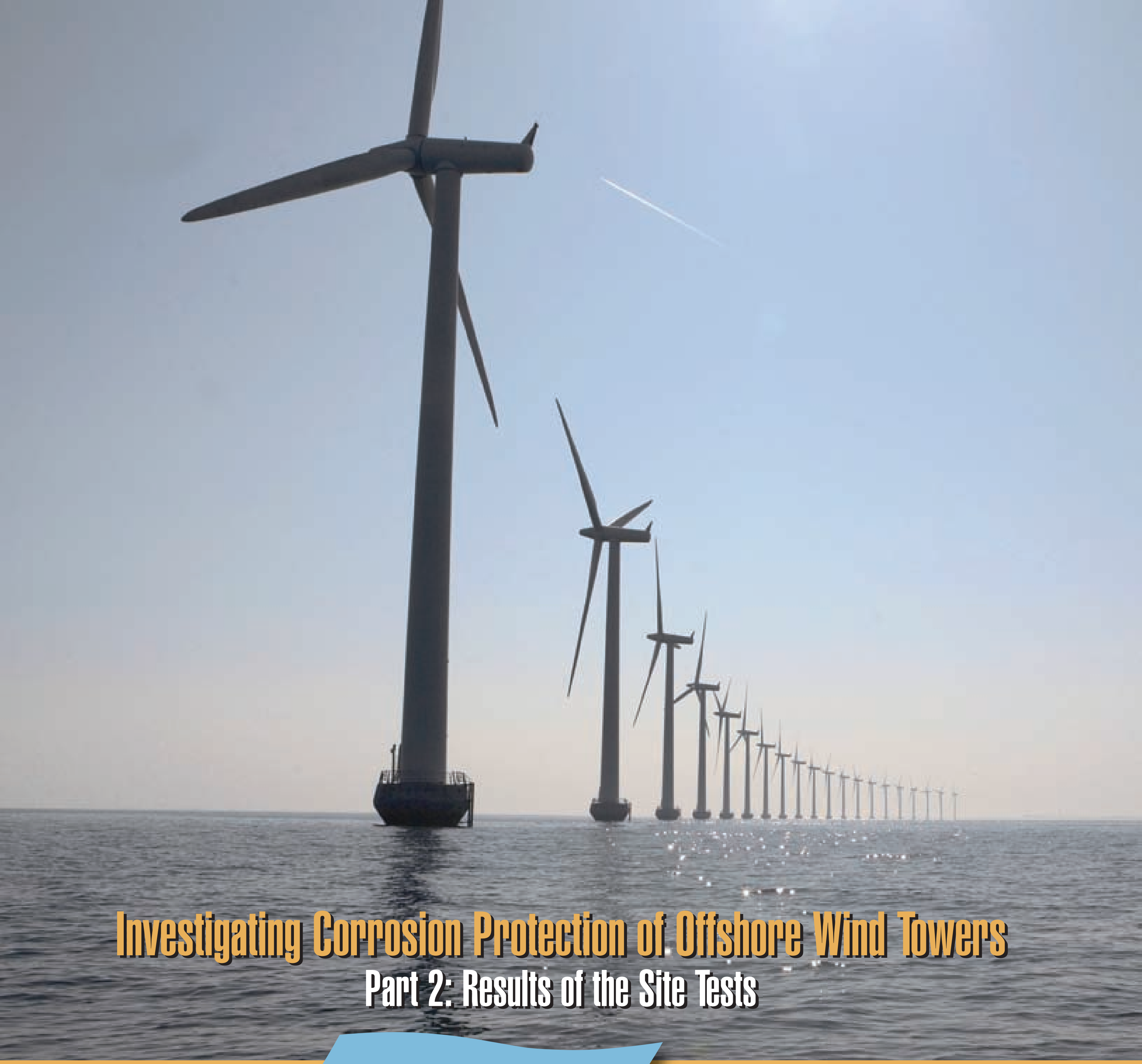
specialized spray equipment. www.nansulate.com.

Gemite Products, Inc. (Mississauga, ON) predicts that the most significant development in insulating coatings is the potential of the new generation of Novel Inorganic Materials (NIM), which, according to the company, exhibit exceptional resistance to strong acids and can withstand very high temperatures—in excess of 2,550 F (1,400 C). NIMs are produced by the chemical activation of inorganic particles (mostly “waste” materials). Gemite says the high natural alkalinity of NIMs results in excellent corrosion protection of steel, and that NIMs resist failure because they are water-based and thus insensitive to the moisture present on the steel surface. www.gemite.com

Conclusion

For information about the trends and products described above, contact the manufacturers.

All manufacturers of specialty coatings for industrial use are welcome to continue to send literature on new products to dfleming@protectivecoatings.com for news in *JPCL* and on our website, www.paintsquare.com. ■



Investigating Corrosion Protection of Offshore Wind Towers

Part 2: Results of the Site Tests

Editor's Note: This article is the second part of the authors' report on testing coating performance on offshore wind towers. The first part, "Investigating Corrosion Protection of Offshore Wind Towers," was published in the April 2008 *JPCL* (pp. 30–43) and won SSPC's highest editorial honor, the Outstanding Paper Award, which was announced at PACE 2009, held February 15-18, 2009, in New Orleans. (See also "Awards" story, pp. 57–59, of this issue.) Part 1 described the rationale behind the authors' test program as well as its setup. In addition to appearing in the print edition of the April 2008 *JPCL*, Part 1 can also be accessed in the online edition of the April 2008 *JPCL*, found in the "Publications" section of *JPCL*'s electronic home, www.paintsquare.com. Part 3 of the report will be published in an upcoming issue of *JPCL*.

This article is the second part of a report on a nationally funded project on the performance testing of different corrosion protection methods for offshore wind towers under site and laboratory conditions. Part 1, published in the April 2008 *JPCL*, reported on the rationale behind, and setting up of, the test program. The present article discusses the test results.

Background

Testing was conducted for performance of coatings in the underwater, intermediate, and splash zones. Six coating systems were tested, although not all systems were tested in all three zones. The coatings were applied over steel blast cleaned with steel grit and in accordance with ISO 8504-2. Uncoated steel with cathodic protection was also tested. The systems tested are shown in the box on the opposite page.

Coating Systems Tested (Composition and dft)*

System	Primer	2. Layer	3. Layer	4. Layer	Total dft
1	Zn-EP (80 µm)	EP (300 µm)	EP (300 µm)	PUR[1)] (70 µm)	750
2	Zn-EP (80 µm)	EP (450 µm)	EP (450 µm)	-	980
3	Zn/Al (85/15)[2)] (100 µm)	EP[3)] (20 µm)	EP (450 µm)	EP (450 µm)	1,020
4	Zn/Al (85/15)[2)] (100 µm)	EP[3)] (20 µm)	EP[4)] (450 µm)	EP[4)] (450 µm)	1,020
5	EP[5)] (1,000 µm)	-	-	-	1,000
6	Al/Mg (95/05)[2)] (350 µm)	EP[6)] (40 µm)	-	-	390

*µm÷25.4=mils 1) topcoat; 2) metallization; 3) primer + pore filler; 4) particle reinforced; 5) applied in one layer; 6) (pore filler)

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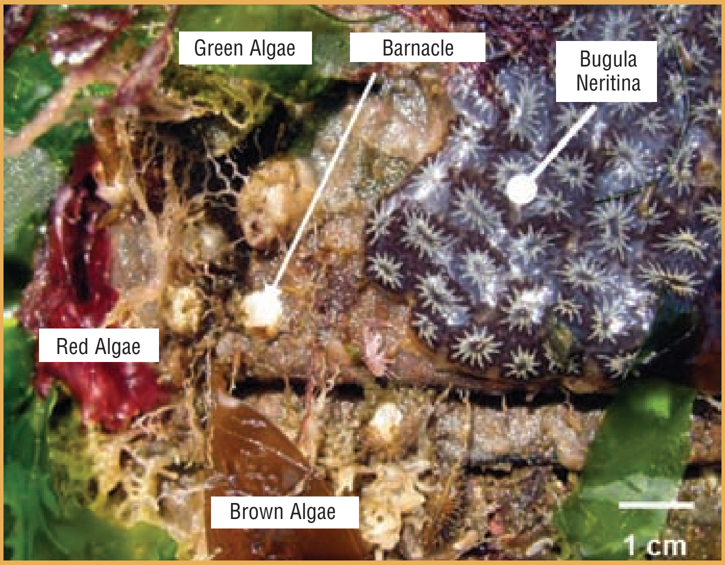


Fig. 1: Fouling at an underwater zone (UZ) specimen
Photos and figures courtesy of the authors

Fouling and Biological Growth

Fouling on offshore structures is a well-known phenomenon. In the sector of offshore gas and oil extraction, various studies have been performed.[1,2,3] Some studies on the fouling on offshore wind energy towers have also been reported.[4,5,6]

The type and quantity of fouling species will depend on certain environmental conditions, namely, temperature, water composition, and the kinematics of the water. Nutrient concentration, in particular, is affected by the season.[3] Therefore, results of fouling assessment may to some extent depend on the season.

The samples in this study were released in the summer season (July). Some environmental conditions applying to the test site are listed in Table 1.

Fouling can affect the corrosion of

Table 1: Site-Specific Environmental Conditions (Ref. 3)

Parameter	Range
Salinity	29 – 33 PSU
Turbidity	Low – moderate
Light (PAR)	100 – 2,000 mol/m"·s
Wave exposure	Exposed
Flow velocity	0.3 – 1.5m/s
Specific wave Height	0.5 – 4m
Temperature	2 – 20 C

Fig. 2: Great crab, domiciliated in the underwater zone (UZ)

Table 2: Visual Appearance of Underwater (UZ) Specimens under Various Conditions

Condition	System				
	3 (+ 5) [1)]	4 (+ 5) [1)]	1 (+ 5) [1)]	2 (+ 5) [1)]	6
After 5 months (total fouling)					
After 13 months (total fouling)					
After 36 months (total fouling)					
After 36 months (first cleaning)					
After 36 months (final cleaning for assessment)					

[1)] Lower section of the specimen is System 5 (red, respectively gray)

steel in several ways: creation of areas of trapped water; oxygen concentration cells; sites for aerobic bacteria; removal of metal.[7] It is, however, not clear if fouling and marine growth can affect the performance of protective coatings.

Fouling in the Underwater Zone (UZ)
All UZ samples were heavily fouled (as shown in the upper three rows of Table 2). Species found on the test specimens included brown algae (*Laminaria*) with large brown leafs up to 2 m long. They appeared predominantly in the upper region of the UZ. Further on, green algae (*Ulva*) were found, as were at least three species of red algae, which were not classified (Fig. 1). Moreover, the following types of species were identified: sponges, mussels (common mussel, oyster-type mussel), anemones, bryozoan (very striking was the species *Bugula neritina*) and sea firs. One special kind of barnacle (*Balanus crenatus*) could be found in the UZ only. This species features a calcareous basal plate, which could not be dislodged completely, even when the barnacles were removed from the specimens (Table 2). This species was reported to likely occur in the UZ of wind towers in the North Sea.[4] Vagile (mobile) species were detected as well, among them worms, some crabs (Fig. 2), and small fish (up to 20 cm long). The settling of numerous species of crabs and fish at submerged wind tower sections in the North Sea was also reported.[6] Algae could not be detected at the rear side of the sample plates because of lack of sunlight in that area.

Fouling in the Intermediate Zone (IZ)
All IZ samples were heavily fouled (see the upper two rows of Table 3). Species detected included green algae (*Enteromorpha*) and brown algae (among others, *Ventricaria ventricosa*). Algae could not be detected at the rear side of the sample plates because of lack of sunlight in that area. Two species of barna-

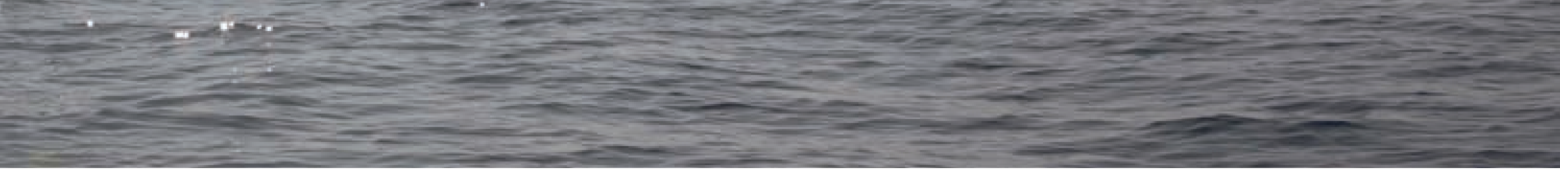
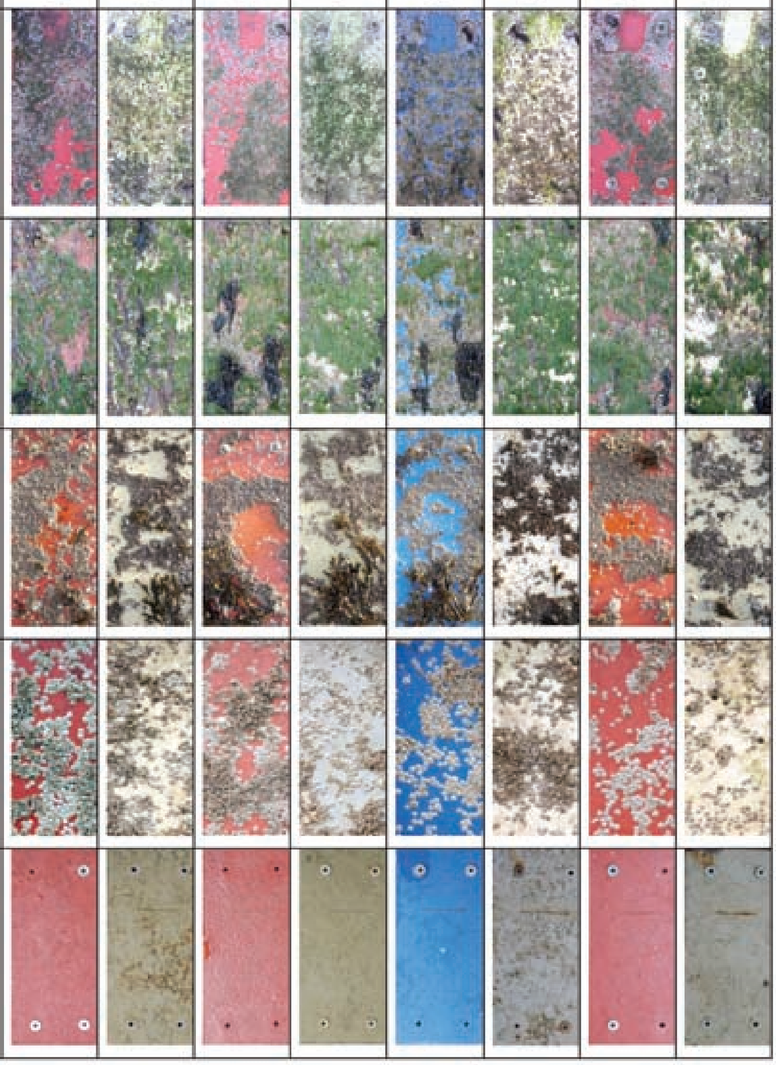


Table 3: Visual Appearance of Intermediate Zone (IZ) Specimens under Various Conditions



Condition	System 3		System 4		System 1		System 2	
	3a	3b	4a	4b	1a	1b	2a	2b
After 5 months (front area with total fouling)								
After 36 months (front area with total fouling)								
After 36 months (front area; algae removed)								
After 36 months (Rear side)								
After 36 months (front area cleaned for assessment)								

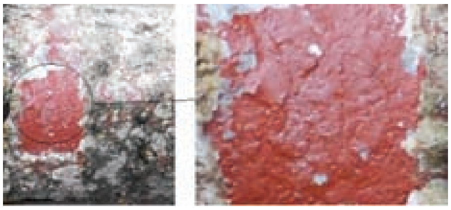


Fig. 3: Coating delamination at System 5 after 36 months of UZ exposure

cles also grew intensely over the samples (row 3, Table 3). One species was *Elminius modestus* (small species), which is known to attach to artificial structures. This species was reported to likely occur in the intermediate zone of wind towers in the North Sea.[4] The other species was *Semi balanus* (larger, well-adhering). This species is known to be very well aligned to tides, but it cannot survive very well under permanently submerged conditions. In contrast to the barnacles found in the UZ, these species feature a membranous basal plate. Some vagile species (worms, crabs) were also found. There was no relationship between fouling and generic paint type. For System 1, which has a PU top layer, the sample 1a exhibited the least fouling, whereas the sample 1b was as heavily fouled as the systems with an EP-based upper coat. It was noted, however, that the rear areas of the panels were much less populated compared to the front. Basically, only barnacles settled in the rear areas (row 4, Table 3), most likely because of the lack of UV light.

Coating Performance in the Underwater Zone

Performance after 5 and 13 Months

The samples were assessed after 5 months and after 13 months. Results of these surveys are reported elsewhere.[8,9] The results obtained after 13 months are briefly recapitulated here. A striking, and rather unexpected, feature was heavy fouling on the underwater samples (upper two rows, Table 2). The fouling consisted of small barnacles and a dark biofilm (algae, sponges). The severity of the fouling differed notably. The sample with System 6 showed the most severe fouling; it was almost completely covered with barnacles. System 5 exhibited the least severe coverage with barnacles but was covered extensively with biofilms. The coating performance could not be assessed in detail. At a few small areas, the fouling was carefully removed, and the coatings were visually inspected. No signs of deterioration were detected.

Performance after 36 Months

The samples were mechanically cleaned with a wood scraper and subsequent high-pressure water washing to visually assess the conditions of the coatings (Table 2).

System 3 showed slight delamination at the front after cleaning, perhaps due to mechanical damage and subsequent deterioration. The steel/primer interface exhibited initial delamination. System 4 did not show any damage to the surface. Slight initial delamination at the steel/primer interface was noted.

Table 4: Assessment of Bond between Steel (Weld Seam) and Applied Coating Systems, Based on Polished Cross Sections

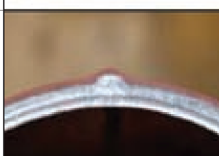
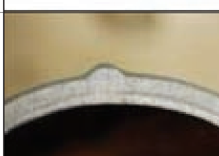
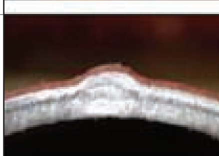
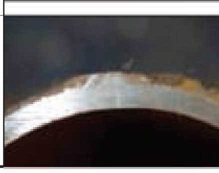
System	Image	Remarks
1	No image available	Excellent bond over the entire length.
2		Excellent bond over the entire length. Reduction in DFT at the right weld section.
3		Excellent bond over the entire length.
4		Excellent bond over the entire length. Reduction in DFT at the right weld section.
5		Excellent bond over the entire length. Coating partly broken due to cutting.
6		Coating failed.

Table 5: Assessment Scheme for Underwater Zone (UZ) Specimens after 36 Months of Exposure

	Assessment					
System	Coating general (blisters, defects)	Coating at weld seam[1)]	Delamination steel / primer	Delamination primer / topcoat	Adhesion (pull-off test)[2)]	Remarks
1a	+++	+++	++	+++	4.18 MPa B/C 70% C 30%	Steel/primer interface: very preliminary delamination Transition to single coat: no delamination No damage to surface
2b	+++	+++	++	+++	7.41 MPa A/B 100%	Steel/primer interface: slight intial delamination Transition to single coat: no delamination No damage to surface
3a	+++	+++	++	+++	6.31 MPa A/B 70% B 30%	Delamination at the front surface after cleaning (maybe due to mechanical damage with subsequent corrosion and delamination) Steel/primer interface: initial delamination Transition to single coat: no delamination
4b	+++	+++	++	+++	9.41 MPa A/B 80% Y/Z 20%	Steel/primer interface: no delamination Transition to single coat: no delamination No damage to surface
5	+++	+++	++	Does not apply	Not measured	Steel/coating interface: slight initial delamination No damage to surface
6	–	–	–	–	Not measured	Assessment was performed at fixing points only Large-scale blistering and coating delamination[3)]

Conditions: –bad; +acceptable; ++good; +++very good [1)] See Table 4; [2)] Average of three measurements (ISO 4624); [3)] See Fig. 3

Systems 1 and 2 performed the same as System 4.

System 6 exhibited large-scale blistering and severe coating delamination. This sample could not be cleaned properly because high-pressure washing would have removed the deteriorated coating. The sample showed white corrosion products, which were identified as the corrosion product of the metallization. The total system could be removed by scratching it slightly with a fingernail (Fig. 3). Because metallization with adequate sealers (at least Al/Zn metallization) is usually an effective and proven method for protecting offshore steel structures,[10,11,12] the result was surprising. No conclusive explanation can be delivered at the moment, and this issue will be the topic of a subsequent study. It is not clear whether fouling effects contributed to that failure. The compatibility of this coating system with cathodic protection under laboratory conditions was good (See Part 3 of this series, to be published in an upcoming issue).

The UZ specimens were cut into two pieces, and the cross sections of the cuts were inspected in terms of coating. Examples of the cross cuts are shown in Table 4. Even in the critical range over the weld seam, shown in the images in Table 4, most of the coatings featured good, tight adhesion to the steel substrate. The exception was System 6, which failed totally.

Table 5 lists results of pull-off tests. The pull-off strength values were between 4.18 MPa and 9.41 MPa. With the exception of System 1, the values are still well above the value of 6.0 MPa, which is recommended in ISO 20340 for newly applied coatings for immersion service.[13] On the other hand, only System 1 showed fractures in the coating system alone, not in the steel-primer interface.

The internal areas, originally filled with seawater, were inspected as well. They showed signs of oxidation, but, in general, the corrosion was not severe, and pitting was not detected. Signs of more severe oxidation were recognized along a stripe that ran exactly along the weld seam (see image for System 4, Table 4). This feature was interesting because the weld seam was attached only to the external surface. Metallurgical changes in the steel, originating from the welding process, might have caused this phenomenon.

The results of the assessment procedure are listed in Table 5, which shows that they did not allow for a reliable ranking of the systems in terms of coating performance (except for

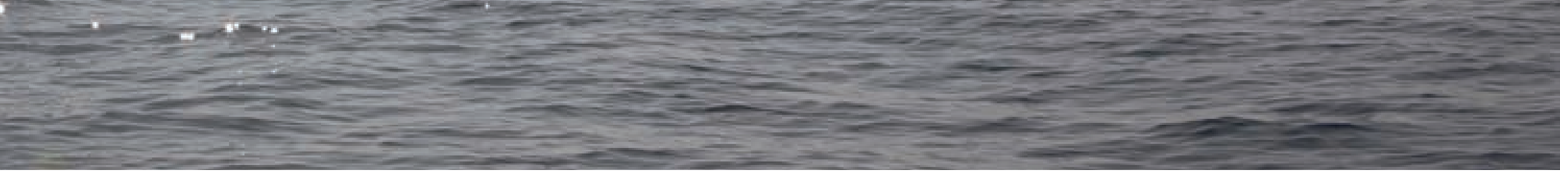


Table 6: Assessment Scheme for Intermediate Zone (IZ) Specimens after 36 Months of Exposure

Assessment					
System	Coating general	Scribe: corrosion[1]	Scribe: delamination[1]	Adhesion (pull-off test)[2]	Remarks [1]
1a	++	–	–	9.78 MPa B/C, C, C/Y	Neither delamination nor blistering at the area. Notable corrosion and delamination at the scribe and blistering (up to 10mm away from the scribe).
1b	++	+	+	6.70 MPa A/B 20% B 80%	Neither delamination nor blistering at the area. Notable corrosion and delamination (ca. 1mm) at the scribe.
2a	++	+	+	11.9 MPa B 30% C/Y 70%	Neither delamination nor blistering at the area. Limited corrosion and delamination (ca. 2mm) at the scribe.
2b	++	+	+	Not measured	Neither delamination nor blistering at the area. Limited corrosion and notable delamination (ca. 3mm) at the scribe.
3a	++	+++	+++	8.99 MPa B 80% B/Y 20%	Neither delamination nor blistering at all.
3b	++	+++	+++	11.6 MPa B 10% B/Y 90%	Neither delamination nor blistering at all.
4a	++	+++	+++	2.35 MPa B/C 100%	Neither delamination nor blistering at all. Compared to SZ, no chalking and less metallic appearance.
4b	++	+++	+++	Not measured	Neither delamination nor blistering at all.

Conditions: – bad; +acceptable; ++good; +++very good [1] See Table 7; [2] Average of three measurements (ISO 4624)

System 6).

Coating Performance in the Intermediate Zone (IZ)

Performance after 5 and 13 Months

The samples were assessed after 5 months and after 13 months. Results of these surveys are reported elsewhere.[8,9] The results obtained after 13 months are briefly recapitulated here. Similar to the UZ samples, the samples exposed to alternate immersion showed strong deposition of, and fouling with, biological species such as algae, barnacles, and other species (first row, Table 3). The intensity and kind of species differed notably, depending on the coating system and the immersion period. Explanations for the latter effect are the influence of the season in which the specimens were assessed and the individual life and growth cycles of the species. The coating performance could not be assessed in detail. At a few small areas, the fouling was carefully removed, and the coatings were visually inspected. No signs of deterioration were detected.

Performance after 36 Months

The samples were mechanically cleaned with a wood scraper and subsequent high-pressure water washing to visually assess the conditions of the coatings. Table 6 lists the results of the assessment procedure. Generally, the coated areas of the specimens were in good condition, with no signs of severe corrosion, degradation, or delamination. Corrosion and degradation effects were observed only in the sections around the artificial scribes. The delamination from the artificial scribe was measured with high-resolution optical microscope images, taken from polished cross sections (e.g., lower images, Table 7).

Notable effects were found for Systems 1 and 2. The scribe delamination was about 2 mm for sample 1a and about 1 mm for sample 1b. The sample 1a exhibited severe corrosion at the scribe (Table 7). Scribe delamination was about 2 mm for sample 2a and about 3 mm for sample 2b. Both samples for System 2 showed limited corrosion at the artificial scribe. Sample 1a exhibited blistering up to a distance of 10 mm from the scribe.

As shown in Table 6, values for pull-off strength varied between 2.35 MPa and 11.9 MPa. With the exception of System 4a, the values were higher than the values estimated for the UZ specimens (Table 5), and are well above the value of 4 MPa, which is recommended in ISO 20340 for newly applied coating systems in C5-M service.[13] Typical fracture types were fractures in the paint system and in the glue. These fractures are in contrast to the observations of the UZ specimens, where the fracture was primarily adhesive.

According to the results of the assessment, summarized in Table 6, coating performance among the systems could be ranked as follows: 3, 4, 2, 1.

Coating Performance in the Splash Zone (SZ)

Performance after 5 and 13 Months

After 13 months of immersion, the splash zone samples were in good condition in terms of degradation and corrosion (second row, Table 8). The front of the metallized surface of the flanges appeared grayish due to the development of a protective oxide layer, typical for zinc. Generally, the metallization at the rear section of the flanges was in good condition. No negative interaction with the high-alloyed screws was observed. Also, the angled steel panels did not contribute to any

Table 7: Corrosion (upper image) in, and Paint Delamination (lower image; cross section view) at, the Artificial Scribe at the IZ Specimens

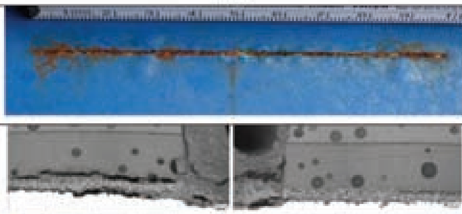
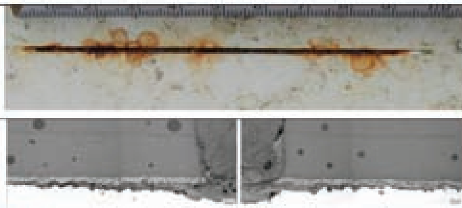
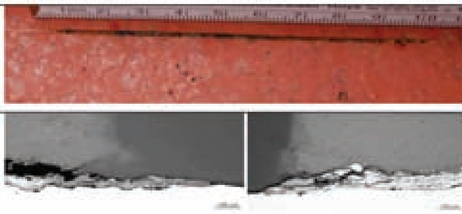
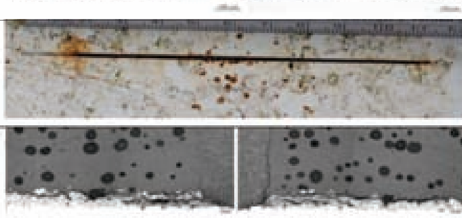
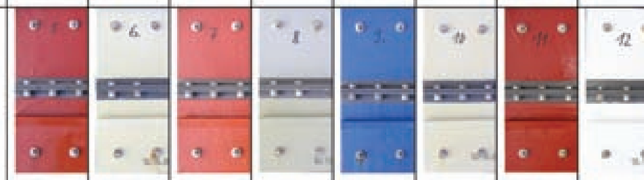
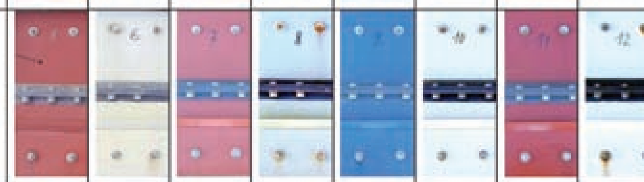
Sample	Image
1a	
2b	
3a	
4b	

Table 8: Visual Appearance of Splash Zone (SZ) Specimens under Various Conditions

Condition	System 3		System 4		System 1		System 2	
	3a	3b	4a	4b	1a	1b	2a	2b
After 5 months								
After 13 months								
After 36 months								
Flanges rear section (lower part)								No image available

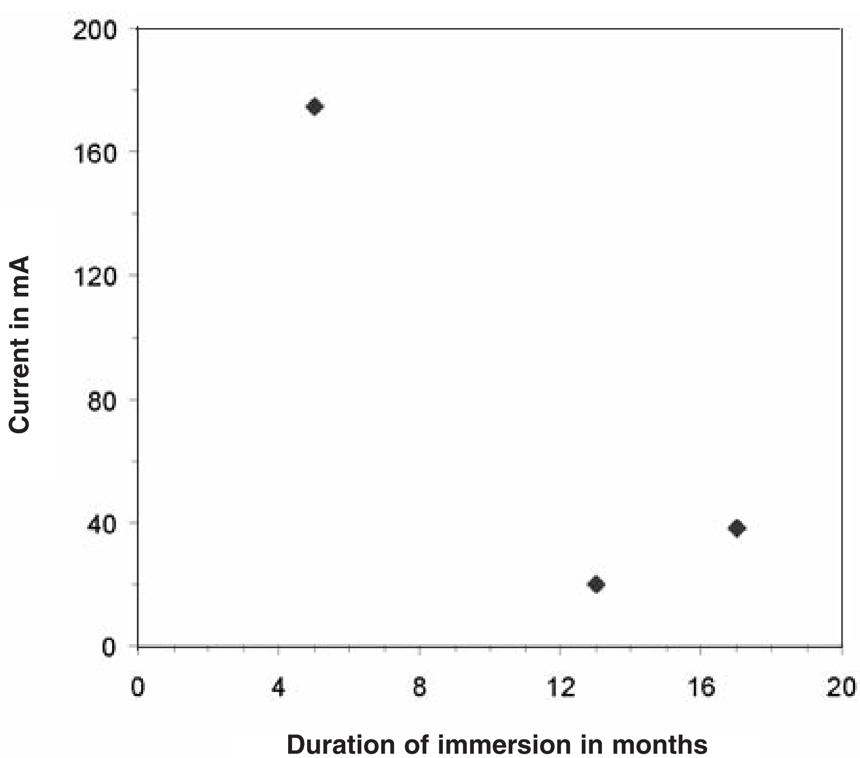


Fig. 4: Current consumption of cathodic protection of UZ samples

notable negative effects.

Performance after 36 Months

Table 8 lists the results of the visual assessment. All coating systems were generally in good condition. Chalking was observed on almost all samples, with the exception of System 1, which featured a PU-based topcoat. Chalking was most pronounced for System 4. Yellowing of the topcoat was observed for two samples. Sample 1a showed some gloss loss.

No severe corrosion or degradation effects could be detected. Delamination was not observed in the organic coating or in the transition zone between organic coating and sprayed metal. Only some slight white rust formation on the metal-sprayed layer was observed. As the results of the assessment for the coatings in Table 9 show, the systems could not be distinguished in terms of a clear ranking.

The rear sides of the metallized flange sections exhibited corrosion (Table 8). The way the flanges were affixed to the structure promoted crevice corrosion.

Table 9: Assessment Scheme for Splash Zone (SZ) Specimens after 36 Months of Exposure

Assessment						
System	Coating	Zinc metalization front section of flange	Screws	Flange areas	Zinc metalization rear section of flange[1]	Remarks
1a	+++	+++	+++	++	–	Gloss loss No chalking
1b	++	+++	+++	++	–	Yellowing of the coating Good adhesion in the range of paint chippings
2a	++	+++	+++	++	–	Slight chalking
2b	+++	+++	+++	++	–	No chalking; slight yellowing Good adhesion in the range of paint chippings
3a	++	+++	+++	++	–	Slight chalking
3b	++	+++	+++	++	–	Slight chalking
4a	++	+++	+++	++	–	Notable chalking
4b	++	+++	+++	++	–	Notable chalking

Conditions: – bad; +acceptable; ++good; +++very good   [1] See lower two rows in Table 8

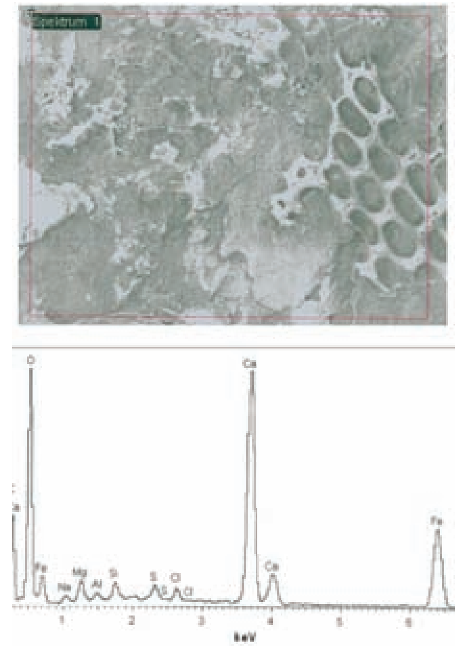


Fig. 6: SEM image (upper image; image width: 5 mm) and EDX plot (lower diagram) of the corroded external wall of UZ specimen 2 after 36 months exposure

The corrosion was mainly characterized by the formation of white rust, but the formation of red rust on the substrate was also observed at places. It could be shown that the amount of corrosion depended on the location on the flanges and on the system. Critical areas were the slits between the individual flange sections, across from the weld seams, where the most severe corrosion was observed at all specimens. Again, crevice corrosion might have caused this phenomenon. Corrosion was always more severe at the lower part of the flange, where thick, loose layers of white rust as well as partial red rust developed (Table 8, lowest row). The two abutting faces with inserted nuts did not show severe corrosion. Slight white rust formation was observed at places.

The AISI 304 steel screws showed good compatibility with the metal-sprayed layers. The boreholes for the screws were usually in good condition, although white rust formation occurred at a few locations. Grommets and screw nuts were in good condition.

Fig. 5: Unprotected section of a UZ specimen after 36 months of exposure

Cathodic Protection of Uncoated Sections

Figure 4 shows results from the cathodic protection measurements. During the first months, the sample remained unprotected for technical reasons. The current had rather high values, which may have been caused by initial corrosion of the unprotected samples. After the cathodic protection was introduced, the value for the current dropped, and it seemed to be constant for the entire exposure phase. Coverage by fouling and the precipitate of alkaline earth salts are two probable reasons for the continuously low values for the protective current. Unfortunately, part of the cathodic protection device was destroyed due to heavy wave load after 17 months, and it did not work properly. Therefore, the cathodic protection failed, and the uncoated sections of the specimens started to corrode.

The uncoated sections featured two layers of corrosion products (Fig. 5). The layer next to the steel was a black, loosely adherent layer, which was identified as Fe-oxide, more specifically, Fe-hydroxide with a low oxidation number. The top layer was the typical red rust, also loosely adherent. Figure 6 provides an SEM image and an EDX spectrum taken from the external corroded wall of the uncoated section of an UZ specimen. It can be seen that the rust was already cracked. Crack lengths ranged from 0.25 to 1.5 mm. Rust flakes were partly separated and only loosely adhering to the steel. The honeycomb structure in the far right region of the photograph is residue of fouling, and may be the origin of Si and partly of S and Na, occurring in the

EDX spectrum. The Fe-peaks in the spectrum originate from the corrosion products formed at the surface. The elements Al, Cl, Ca, Mg, S, and Na are constituents of the seawater.

Summary

• Fouling did not seem to affect the corrosion protection performance of the coating systems. From the point of view of effects on the habitat in the vicinity of the towers, fouling in the UZ and the IZ may become an issue in running offshore wind energy towers in the North Sea.

• The results of the long-term site tests gave the following ranking of the protection capability of the coating systems: 3, 4, 2, 1. Thus, Zn/Al metallization, followed by two intermediate layers of EP-based paint, is a good choice. The assessment is based mainly on the results obtained from the artificially damaged IZ samples.

• In the SZ, the flange connection was a critical structural part in terms of corrosion. Notable crevice corrosion was observed at places. Therefore, a suitable sealant between abutting faces may be considered for additional protection against corrosion.

• The corrosion zones showed no effect on the performance of the coating systems. In contrast to plain steel, which showed accelerated corrosion in the SZ of offshore structures,[14,15] the coatings performed equally well, as long as the undamaged areas of the samples were considered.

• Mechanical damage to the coating initiates paint delamination and corrosion. A recommended coating system, therefore, should be either very resistant to impact or able to compensate for corrosion of the steel.

• Cathodic protection of uncoated sections in the UZ is an interesting alternative to passive coating systems.

Acknowledgement

The classification of the biological fouling was performed by Dr. Maja Wiegemann, Alfred-Wegner Institute for Polar and Marine Research, Bremerhaven, Germany.

References

1. A. Wolfson, G. van Blaricom, N. Davis, G.S. Lewbel, "The marine life on an offshore oil platform," *Marine Ecology*, Vol. 1, pp. 81-89 (1979).
2. P. Whomersley, G.B. Picken, "Long-term dynamics of fouling communities found on offshore installations in the North Sea," *J. of the Marine Biological Assn. of the UK*, Vol. 83, pp. 897-901 (2003).
3. B.H. Buck, C.M. Buchholz, "The off shore-rig: a new system design for the open ocean aquaculture of macroalgae," *J. of Appl. Phycology*, Vol. 16, pp. 355-368 (2004).
4. K. Hiscock, H. Tayler-Walters, H. Jones, "High level environmental screening study for offshore wind farm developments – marine habitats and species project," Project Report W/35/00632/00/00, AEA Technology, Harwell, UK (2002).
5. J. Birklund, A.H. Petersen, "Development of the fouling community on turbine foundations and scour protections in Nysted off shore wind farm," Survey Report, Energi E2 A/S, Copenhagen, Denmark (2004).
6. R. Frederiksen, M. Bech, S.B. Leonhard, "Hard bottom substrate monitoring Horns Rev offshore wind farm," Survey Report No. 1, Elsam Engineering A/S, Fredericia, Denmark (2004).
7. R.G. Edyvean, "The influence of marine macrofouling on corrosion," *Bioextraction and Biodeterioration of Metals* (Eds.: C.C. Gaylarde, H.A. Videla), Cambridge University Press, pp. 169-196 (1995).
8. M. Schneider, V. Stenzel, A.W. Momber, "Vergleichende Untersuchungen von Korrosionsschutzkonzepten für Offshore-Windenergieanlagen," Proc. Workshop Korrelation von Labortests mit Praxisbedingungen im schweren Korrosionsschutz, DECHEMA, Frankfurt, pp. 81-97 (2005).
9. A.W. Momber, V. Stenzel, P. Plagemann, M. Schneider, "Combined field-laboratory studies on corrosion protection conceptions for offshore wind energy towers," *Proc. 4th International Symposium on Protective Coatings*, Mumbai, pp. 62-70 (2006).
10. M. Cornago, "Improving performance using thermal spray coatings for off shore structures," *Protect. Coatings Europe*, Vol. 4, No. 9, pp. 28-32 (1999).
11. Li, Y., Liu, J., Duan, J., Hou, B., "Thermally sprayed aluminium and zinc coatings for tidal zone cathodic protection of offshore platform pile legs," *Materials Perform.*, Vol. 45, No. 12, pp. 16-19 (2006).
12. K.P. Fischer, W.H. Thomason, T. Rosbrook, J. Murali, "Performance history of thermal sprayed aluminium coatings in offshore service," *Materials Perform.*, Vol. 34, No. 4, pp. 27-35 (1995).
13. ISO 20340, "Performance requirements for protective paint systems for offshore and related structures," International Organisation for Standardisation, Geneve (2005).
14. M. Smith, C. Bowley, L. Williams, "In situ protection of splash zones," *Materials Perform.*, Vol. 41, No. 10, pp. 30-33 (2002).
15. P. Ault, "The use of coatings for corrosion control on offshore oil structures," *Protect. Coatings Europe*, Vol. 11, No. 4, pp. 42-46 (2006).

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JPCL

Coating Sheet Pile Structures: *An Overview*

Uncoated sheet pile Courtesy of the U.S. Army Corps of Engineers

By Timothy Race, Kaked LLC

Sheet piling is commonly used in construction. Piles are commercially available in a variety of shapes, sizes, and materials. Common piling materials include steel, aluminum, concrete, FRP-composite, and vinyl. Steel is by far the dominant material, although the use of corrosion-resistant composite and vinyl piling is increasing. Because of their inherent corrosion resistance, composite and vinyl piles are not painted. In theory, these materials can be advantageous in a corrosive marine environment. In practice, however, their use is limited to light and medium duty applications, such as marine and freshwater bulkheads and smaller retaining walls. This article gives an overview of steel piling and its uses; reasons for coating it; shop coating of new steel piling; and ways to access, inspect, and perform maintenance coating of installed steel piling.

Steel Piling and Its Uses

Steel piling is available in a variety of shapes, lengths, thicknesses, and alloys. Several ASTM standards describe some of the salient characteristics of steel pilings: ASTM A857/A857M-07, Standard Specification for Steel Sheet Piling, Cold Formed, Light Gage; ASTM A328/A328M-07, Standard Specification for Steel Sheet Piling; and

ASTM A6/A6M-08a, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.[1]

Steel piling comes in many shapes, including H, U, Z, and flat sections. Combinations of shapes can be used to fulfill specific engineering and aesthetic requirements. Piles typically have integral interlocks that allow the piles to be connected as they are installed in the field. Optional interlock bars and corners facilitate the installation of virtually any configuration, but interlocks have a small degree of play and are not watertight. Sealants and seal welding are used for applications that require the structure to be water-impermeable. Performed after field installation, seal welding creates a simple continuous weld that provides a watertight seal. Alternatively, flexible organic sealants are applied to piling structures prior to field installation, which also facilitates future maintenance painting.

Piling is used for many structures, both temporary and permanent. Examples include retaining walls, quay walls, bridge abutments, seawalls, bulkheads, cofferdams, basements, underground parking garages, in-ground hazmat containment barriers, load bearing foundations (e.g., water tanks), groin walls for beach erosion, and wing walls for bridges and culverts. Sheet piling has even been installed as a barrier along sections of the shared border between the U.S. and Mexico.

To Coat or Not to Coat

Pilings used for temporary structures are not typically coated. In fact, the vast majority of piling for both temporary and permanent structures is installed without a coating system or any other means of corrosion protection.

Paints are sometimes used for visibility and aesthetics, such as on the pile walls of basements and underground parking garages, land-sited retaining walls, and water storage tank foundations. In general, atmospheric exposed sheet piling is coated to improve appearance.

For pilings installed in corrosive environments, piling manufacturers suggest that protective coatings, thicker steel, or higher yield strength steel be used to ensure that the design life of the structure is met. Higher yield strength steel compensates for loss of section caused by corrosion but does not prevent corrosion itself. For piling installed in corrosive environments, often only a relatively small area is exposed to highly corrosive elements. For example, consider a marine bulkhead constructed of 50-foot-long piles. If the combined depth of the low water, tidal, and splash zones (the most corrosive areas) is a modest 5 feet, then only 5% of the total area of the piles will be subject to high rates of corrosion. Coating, sometimes supplemented with cathodic protection, can be a more cost-effective approach than over-engineering the structure in part or as a whole.

Alternatively, thicker piles overall or piles reinforced with additional sectional thickness in the zone of greatest corrosion can also be used. (A pile can be reinforced by welding plates or another section of piling onto the main piling to add thickness just to the area where the corrosion rate is highest. Reinforcement eliminates the need to use a thicker pile over the entire length [height] of the piles.)

Selecting a higher yield strength steel can effectively increase section thickness. For example, a higher yield strength steel that increases section thickness by 30% may only modestly increase the cost by approximately 2%. In some cases, the zones of greatest corrosion may not match the areas that are most highly stressed. Piles have bending forces from side loads, but the loads are not equal. So the bending forces in piles are not like those caused by grabbing a stick at both ends and bending it. In the latter case, the maximum load is at the center, right where you expect the stick to break. The static and dynamic loads on a pile will vary with height based on how deep the pile is driven, whether it has tiebacks and where they are, the relative depth of the water, tidal height changes, and wave action. So the maximum bending force that will collapse

Driving piles coated with CTE Courtesy of the U.S. Army Corps of Engineers

Corroded pile revealed during levee inspection. Courtesy of the U.S. Army Corps of Engineers

the wall is not necessarily at the center of the pile. The area with the highest corrosion rates may or may not coincide with the location of highest loading.

Designers are encouraged to use cost engineering to aid in the decision process. Major suppliers of sheet piling have compiled general information and tools to assist the designer in selecting the most cost-effective approach to achieve the desired durability.

The general order of environmental corrosiveness is: saltwater > freshwater > soil > atmospheric. This rank order is a broad generalization, and, within these categories, the severity can be further subdivided, yielding overlaps and disorder within the generalized ranking.

Sheet pile installed in undisturbed natural soils does not need to be coated. In practice, pilings used to construct seawalls, bulkheads, and retaining walls will be backfilled on the soil side, which may increase the corrosion rate and require protective coatings or design compensation. (Corrosion rates are higher for backfilled areas due to soil aeration, affecting about the first 10 feet below soil grade.) Some soils, such as aggressive natural soils and fills, may be as corrosive as or more corrosive than seawater and will also warrant the use of protective coatings or corrosion compensation through design. In its guide specification for engineering in tropical regions, the U.S. Navy has specific guidelines for protecting sheet pile in tropical marine environments, with special consideration given to pile driven in coralline soils with low resistivity.[2] In this case, coatings are used to protect the soil side of pile structures.

Sheet pile continuously immersed in seawater has a low enough corrosion rate that painting is not required. However, mill scale on sheet piling may facilitate pitting of bare steel in seawater immersion. Therefore, piling to be immersed in seawater is usually painted for corrosion protection and sometimes supplemented by application of either impressed current or sacrificial cathodic protection. If the piling is to be coated for immersion service, the mill scale is first removed as part of surface preparation.

The marine tidal zone and, especially, the low water level, are quite aggressive, so piling in these areas is usually coated for protection and may again be supplemented by cathodic protection. The marine splash zone is also very aggressive, and piling in the splash zone is usually painted; however, cathodic protection is not applicable. Exposed pile above the splash zone is typically treated the same as the splash zone.

Coating of New Sheet Piling

If a new sheet pile structure is to be coated, application almost always occurs within a shop facility. Surface preparation and shop coating offer tremendous cost savings over field coating. Piles are typically cleaned using centrifugal blast machines to achieve either an SSPC-SP 6, Commercial Blast Cleaning, or SSPC-

Stimulus Funds for Corps of Engineers Projects

The American Reinvestment and Recovery Act (ARRA) of 2009, which includes approximately $130 billion in stimulus funding for construction, allots $4.6 billion for U.S. Army Corps of Engineers (USACE) construction, maintenance, operations, and related activities, some of which may involve work on steel pilings on Corps projects. Here's the general breakdown of the money for the USACE.

- Construction: $2 billion
- Operation and Maintenance: $2.075 billion
- Mississippi River and its Tributaries: $375 million
- Formerly Utilized Sites Remedial Action Program: $100 million
- Investigations: $25 million
- Regulatory Program: $25 million

For details about ARRA funding, visit www.recovery.gov.

SP 10, Near-White Blast Cleaning.

Shop-applied coating systems are usually two- or three-coat systems. The types of products used are variable, but generally they are the same types used for any similar industrial application. Epoxy primers and intermediate coats are typical, with polyurethane topcoats used for preservation of appearance. Coating suppliers and end users have not conferred royal status to any single coating material or system. Most systems offered and specified for immersion and soil applications have film builds of 12 mils and up.

The only U.S.-based standard for coating sheet pile is ASTM A950/A950M-99 (2007), Standard Specification for Fusion-Bonded Epoxy-Coated Structural Steel H-Piles and Sheet Piling.[1] The powdered coating is electrostatically applied and heat cured. Fusion-bonded epoxy (FBE) coatings have good edge retention and few pinholes in the finished product. Like other epoxy coatings, FBE is tough and well-suited to the rigors of shipping and field installation. FBE has only fair resistance to cathodic disbondment and is not the best choice for use with cathodic protection.

The traditional workhorse coating for protecting sheet piling is coal tar epoxy (CTE), covered under the standard SSPC-Paint 16. CTE is well-suited to buried soil, freshwater and marine immersion, and tidal and splash zone exposures. CTE does not perform well in direct sunlight and is available only in black and dark reds; it is not used for its aesthetic properties. CTE is more flexible and impact-resistant than many epoxy coatings, and it retains these properties even at low temperatures. Coating flexibility and impact resistance help reduce coating damage before and during piling installation. The U.S. Army Corps of Engineers (USACE) and other owners specify CTE for use on permanent sheet pile structures. USACE also specifies an epoxy zinc-rich primer for marine applications. The nominal two-coat thickness of CTE is 18 mils. USACE also allows the use of two- and three-coat epoxy polyamide systems on sheet pile. Polyamide systems may also be enhanced by application over an epoxy zinc-rich primer.[3]

Other coating materials have been shown to be well-suited to protect sheet piling. One study showed that the long-term performance of flame-sprayed aluminum with a topcoat sealer gave the best protection in a cold water marine environment, and a polyester glass flake coating gave the best protection in a warm water marine exposure. CTE with a zinc-rich primer performed well at both of the locations.[4]

A research program sponsored by the American Association of State Highway and Transportation Officials in cooperation with the Federal Highway Administration produced a report that provides recommendations for metallizing systems to use on sheet piling and provides a standard practice.[5] USACE recommends aluminum thermal spray coatings for piling exposed to seawater.[6]

In addition to metallized coatings, hot-dip metal coated pilings, including zinc, zinc/aluminum alloy, and aluminum are commercially available. Hot-dip metal coatings on sheet piling offer the same economies as for other applications. Interested specifiers should refer to literature available from the American Galvanizers Association.[7] The designer should consider the size of piling that will be used on a project because there are practical limits on the overall length of a sheet that can be dipped into the galvanizing bath. The designer should also consider whether the added cost of providing corrosion protection to both soil and water sides is warranted.

The world's largest steel producer recommends CTE at a nominal 18-mil thickness or glass-filled epoxy for seawater immersion.[8] For freshwater immersion, the company recommends a 12-mil-thick system of epoxy polyamine primer and epoxy polyamide topcoat. For aesthetic purposes, the system can be supplemented with an aliphatic polyurethane topcoat. The company also recommends epoxy/polyurethane systems for atmospherically exposed piling.

Inspection and Maintenance of Coated Sheet Piling

All coatings eventually reach the end of their service life when they no longer protect the underlying surface. Maintenance schedules and repair options are evaluated by means of inspection.

Access and Inspection of Sheet Pile

Inspection of coated sheet pile is challenging because direct access to the coated surface is generally limited. In practice, inspection is often performed by trained divers, but devices have been developed for remote inspection, including robotic crawlers and manually positioned instruments. Divers and remote instruments can conduct visual observations as well as perform physical measurements, including pit depth, ultrasonic steel thickness, film thickness, and electrochemical processes.

Soil side inspection is generally not possible; however, the soil side is usually the area of least concern because of the generally low rate of steel corrosion in most soils (except as noted earlier). In some cases, soil resistivity is measured as a means of assessing the relative severity of the soil side exposure.

Direct inspection may be conducted if the structure can be dewatered. Direct access allows evaluation by qualified non-diving inspectors in a dry environment. With few exceptions, dewatering of a structure is seldom a practical alternative. Portable limpet dams (essentially miniature portable cofferdams) have been developed to facilitate inspection as well as maintenance of sheet piling in the dry. The width and depth of access are limited by practical considerations. Installation and movement of the device is straightforward and fairly rapid. The limpet dam must be customized to match the specific shape and profile of the piling. When the limpet dam is configured with straight sidewalls and a bottom with a toothed design matching the piling profile, the dam can be securely attached to the pile wall, and the contained area is dewatered by pumping it dry.

The results of the inspection can be used to determine the necessary course of action. Sometimes the pile structure may warrant structural repair, rather than just maintenance painting. In such a case, structural repair may be accomplished by welding additional steel plate to the affected piles to increase sectional thickness and strength. Sometimes, a new sheet pile wall must be installed, typically by driving new piles in front of the existing piles. The new and old walls can be connected with tie rods to take advantage of the existing anchorage of the old piling structure.

Access and Maintenance Painting

Access for maintenance painting has the same limitations as for inspection. Dewatering may be accomplished with a limpet dam or other damming devices that allow the water elevation to be lowered to the extent necessary to perform maintenance operations in the dry. Earthen, rock, pile, and inflatable dams may be suitable for blocking inlets or isolating sections of canals. Dewatering is accomplished by pumping out water. From a practical standpoint, the water does not need to be removed all of the way to the mud line. In fact, complete dewatering may compromise the integrity of the piling walls and may harm the local animal and plant life. Most repairs will be performed in the zones of highest corrosion, which is near the waterline in freshwater and from the low waterline through the splash zone in seawater.

The dewatering of open water structures such as seawalls and other waterfront structures may require the construction of a cofferdam. This practice can be quite expensive and may negatively impact commerce or security. Where dewatering cannot be accomplished, it may be necessary to utilize divers to perform surface preparation and coating application underwater.

While many types of coatings are suitable for use on new sheet piling, the same is not true for the maintenance of sheet pile structures. If dewatering is a practical alternative, and if dry conditions can remain long enough, then most of the coatings mentioned for shop application on new piles may be used.

Coating selection is limited however, when productivity is paramount and coated surfaces must be returned rapidly to wet service. Suitable systems are those that either cure very rapidly or cure underwater. Such products may include 100% solids epoxy, polysulfide-modified epoxy, and polyurea applied by plural-component spray. If it is not sealed, metallizing may be used to return piling to service immediately. If sealed with a fast-cure product, metallized piling may be returned to service rapidly.

Caribbean resort bulkhead repainted in the dry to just below low waterline. Dewatering was accomplished by damming canal inlet and lowering water level using pumps. Courtesy of the author

Products specifically formulated for underwater application are not widely available. There are perhaps six to eight manufacturers of such products. Applying coatings underwater is both difficult and slow because of the surface preparation quality required; poor initial adhesion; and potential application defects, including floating, lifting, and sagging.

Underwater surface preparation may include hand cleaning, grinding, and water and abrasive blasting with zero-thrust equipment. Removal of all loose coating and loose rust as well as all marine organisms is generally specified.

Underwater coatings are applied by roller, brush, or trowel. Older products, referred to as splash zone putties, were mixed and applied with a gloved hand. The putty-like coatings worked but were very slow to apply. Newer products are applied using pressure-fed rollers and brushes. Products available for underwater application are 100% solids, including epoxy polyamine and polysulfide-modified epoxy coatings. The addition of fiber reinforcement to these products reportedly improves application properties by reducing floating.[9]

Summary

Permanent sheet pile structures are either designed with a corrosion allowance or coated to achieve the required design life. Surface preparation and coating are best accomplished in the fabrication shop. Techniques are available to inspect sheet pile structures installed in seawater and freshwater. If maintenance coating is necessary, operations should be performed in the dry, but if dewatering is impractical, underwater-applied coatings may be used.

References

1. ASTM International, West Conshohocken, PA.
2. U.S. Navy, UFC 3-440-05N Tropical Engineering.
3. U.S. Army Corps of Engineers, UFGS 09965 Painting: Hydraulic Structures.
4. A. Kumar, V. L. Van Blaricum, and A. Beitelman, "Twenty Year Field Study of The Performance of Coatings in Seawater," U.S. Army Construction Engineering Research Laboratories, IL, and Boy, J.H., Oak Ridge Institute for Science and Education and U.S. Army Construction Engineering Research Laboratories, IL.
5. James A. Ellor, Walter T. Young, and John Repp, "Thermally Sprayed Metal Coatings to Protect Steel Pilings: Final Report and Guide."
6. U.S. Army Corps of Engineers, UFGS-09971 Metallizing: Hydraulic Structures.
7. www.galvanizeit.org.
8. ArcelorMittal, Piling Handbook, 8th Edition, www.arcelormittal.com.
9. Jeff Longmore, "The Development and Evolution of Underwater Coatings," *CoatingsPro* November 2006.

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Field Maintenance of Coating Systems

By Peter P. Bock and Michael F. MeLampy, Hi-Temp Coatings Technology, Acton, MA

In general, insulation is applied to the hot surfaces of vessels, processing units, and piping systems to provide heat retention for process flow and control or to protect workers who may come into contact with these hot surfaces.

Typical insulation systems are mechanically applied onto painted or otherwise corrosion-protected substrates and are generally clad with sheet metal to prevent mechanical damage and stop water from entering the insulation material. Otherwise, water, and, potentially, its contaminants, such as salts, can reduce the thermal performance of the insulation and increase the opportunity for corrosion.

Over the past several decades, evaluation of coating systems for use under insulation has been a painful learning curve based on unsatisfactory experience. A NACE Report from 1986 notes that engineers did not expect problems with corrosion under insulated carbon steel when plant construction increased significantly in the 1960s. Typical for the time, steel to be insulated was not coated or at most had a coat of primer over mill scale. Later, engineers found significant corrosion on insulated steel and determined that the development of corrosion could be reduced by improving the surface preparation of the steel, the primer specified, or the maintenance of the cladding or other waterproofing used to protect the insulation.[1]

Thus, the root cause of corrosion under insulation (CUI) was found to be leaky insulation. Upgrades to coating systems used to protect steel against leaky insulation have included inorganic zincs, elevated-temperature coal tar epoxies, phenolic and novolac epoxy tank linings, thin-film silicones, and thermal spray aluminum. These systems are significant because most old insulated equipment in the field today is protected by one or the other of them, and many of the coating systems are at the end of, or past, their service lives. Saving what can be saved and upgrading such

under Insulation

(Opposite page) Three different styles of poorly installed and poorly (or not at all) maintained insulation and cladding.

(This page, above) Looking straight up the ladder on a small vertical vessel. Insulation has been removed and the vessel is scaffolded and tented, but there is no CUI coating left to save.

(This page, below) A 24-story process vessel in the early stages of CUI remediation work.

Photos courtesy of the authors.

systems can produce significant cost savings without requiring complete removal and replacement. In many cases, such upgrades will give additional service life equal to, or longer than, that of the original CUI system.

This article describes issues associated with coatings under insulation, typical systems in place now, and ways to maintain them.

Aging Infrastructure and Limited Budgets

Many older refineries and chemical plants have been upgraded to make higher quality products, improve efficiency, or simply expand. Typically, upgrades require higher temperature processes and improved coating materials. Maximum temperature limits of existing coating materials may be exceeded as a result, reducing the protection that existing coatings have provided the workers as well as the vessels, pipes, and processes.

Equipment owners want cost-effective, long-life protective coating systems that will survive ever-higher operating temperatures. Each process has unique needs, which are being addressed through a series of innovative coating solutions at reasonable, though not low, cost. Mainly, the costs of labor and downtime for repairs drive the economics of repair. Repairs can include replacement of the substrate, the coatings, and the insulation. The costs can be especially high when they include downtime, which lowers productivity and therefore revenues. A key to developing cost effective repair is to do as much of it as possible while the facilities are in operation. In some cases, facilities may reduce surface temperatures of equipment being prepared and coated to the maximum hot-surface application limit of the specified coatings.

New Construction Issues

Although this article is primarily concerned with repair and in-place replacement of existing CUI systems, it is ideal to have the same systems on existing and new equipment if the existing systems meet performance and service life requirements, and are cost effective over the life cycle of the equipment.

Plant expansions and upgrades continue under relentless pressure to simplify construction processes and squeeze the budget. Applying traditional coating systems is often considered too slow, too cumbersome, and too expensive. Design engineers demand one- or two-coat systems with extremely fast dry characteristics that allow both coats to be applied at the fabricator's yard. The applied system must survive transportation to the final site, installation, and assembly. Field touchup must be quick and easy.

Field Maintenance, Surveys, and Inspection

Maintenance painting in refineries and chemical plants also faces ever-shrinking budgets and time. Additional factors in the cramped surroundings of an operating refinery or chemical plant limit the ability to effectively prepare surfaces and perform high-quality maintenance coating work. The key word here is "operating." Most plant turnarounds have become too brief, too intense, and too crowded for conventional maintenance painting and insulation work.

Inspection, maintenance, and repair of in-service CUI coating systems are difficult and expensive. The coated substrates are almost entirely hidden by insulation and cladding, so that observation of corrosion as soon as it occurs is impossible. The usually bright metal cladding actually gives a false sense of security. Until rivers of rust run out the bottom of an insulation termination, "Looks good" is the usual operational evaluation of the CUI coating system underneath (Fig. 1).

Fig. 1: Corroded sheet metal cladding, soaked-through insulating blanket, and extensive rust on the exposed flange indicate potential problems under the insulation.

Surface Preparation and Inspection

Surface preparation is one of the most important parts of coating system selection. It is generally a more costly portion of the work, and choice of coating systems often dictates the surface preparation requirements. Some of the new technology CUI coating systems do not require the typical SSPC-SP 5, White Metal, surface preparation and can perform well over a less than optimally prepared surface. With the overall cost of maintenance painting, thinking and specifying in terms of life cycle are crucial in choosing a coating system to meet performance expectations, and inspecting to ensure proper application helps meet the expectations.

Appropriate surface preparation techniques range from hand tool cleaning to abrasive blasting (to various degrees of cleanliness) and high-pressure water cleaning and jetting. Detailed discussion of these options is beyond the scope of this article, but readers must keep in mind that each option has an implied cost along with an effect on the coating's expected life cycle. The largest cost is typically that of shutting down the process if the maintenance coating system specified cannot be applied on operating equipment.

Selecting a Replacement CUI Coating System

Selecting a CUI system for maintenance repair requires evaluation of existing coatings on the substrate and of the cost-effectiveness of saving some of the old system or removing it completely. Washing and spot surface preparation versus a full abrasive blast can save time and labor costs only if the remaining portions of the existing coating system are stable enough to survive a long time or if overcoating them can significantly extend their service life. Otherwise, full removal is most cost-effective.

Typical CUI Coating Systems in the Field

Thin-Film Silicones

Until the development of the first generation of polysiloxane high-build coatings for elevated temperatures in the mid 1990s, thin-film silicones were standard for service above 399 C (750 F) and for topcoating inorganic zinc for elevated temperature service.

Thin-film silicones are still occasionally encountered as a topcoat over inorganic zinc in CUI environments (Fig. 2).

Fig. 2: Insulation blanket is folded back to show failed silicone aluminum over relatively intact aged inorganic zinc.

Residues of aged, thin-film silicones are usually scattered smears of aluminum on an otherwise uniformly rusted substrate. Such residues that remain after high-pressure waterjetting and spot surface preparation may be overcoated with one of the newer high-temperature coatings described later in this article.

Inorganic Zincs

Inorganic zincs became the workhorse of many CUI programs because of the stability of the ethyl silicate matrix to 399 C (750 F). A catalogue of failures followed, but the bottom line was that water leaked into the insulation, the water contained electrolytes, and the anodic zinc coating sacrificed itself.[2] In fact, most inorganic zincs under insulation are crosshatched by narrow lines of corrosion that coincide with joints in the block insulation where water has intruded. At these joints, the zinc coating sacrificed itself, usually allowing pitting along the narrow lines.

Repair of aged inorganic zinc in CUI situations can now be cost effective (Fig. 3). Previously, removing the remaining relatively intact zinc (which stayed dry in dry areas) and corrosion by abrasive blasting and then replacing the entire CUI coating system was required. It is now possible to pressure wash the surface to remove zinc salts and other contaminants, spot prepare the areas of corrosion, and then overcoat the entire area with one of the new-technology, high-build, elevated temperature coating systems (described later).

Thermal Spray Aluminum

Thermal spray aluminum wire has a proven track record of more than two decades on sheet piling, bridge sections, dam gates, and, in some instances, under insulation. Moreover, thermal spray aluminum technology has advanced to the point where it can be applied in the field, not just in the shop. Surface preparation requirements for field-applied thermal spray aluminum are, however, every bit as stringent as for shop application (SSPC-SP 5, White Metal, or SSPC-SP 10, Near-White Metal). Application equipment, however, does not allow for difficult-to-reach or inaccessible areas.

Unfortunately, aluminum is anodic to carbon steel, and a thermal spray aluminum-coated system in a mild acid environment (typical of older refineries) is simply one gigantic anode. Once any portion of the thermal spray aluminum is completely depleted and sufficient water is present, the system becomes a huge electrolytic cell that corrodes. Although thermal spray aluminum cannot be spot repaired with itself, areas of bare rusty steel that remain after the aluminum has anodically sacrificed can be spot repaired with newer systems described later. Disagreement continues over whether the entire thermal spray aluminum surface and areas of bare steel should be overcoated, or whether the repair coating should be applied only to areas where the aluminum has been completely depleted.

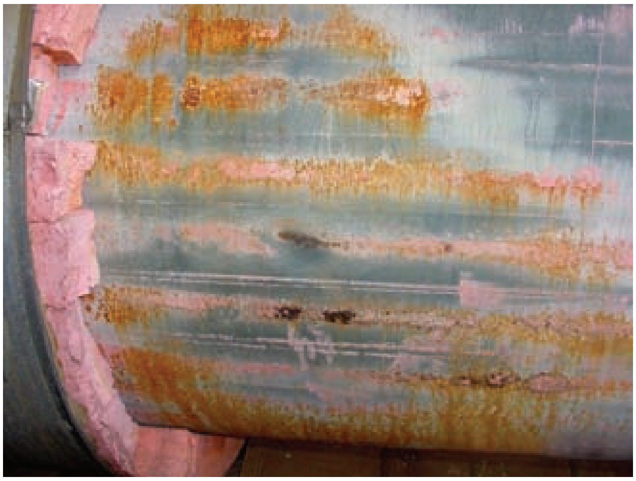


Fig. 3: Partially failing but repairable 20-year-old inorganic zinc coating with calcium silicate insulation removed.

Phenolic and Novolac Epoxies

Coating systems for application to hot steel include a family of high-temperature phenolic and novolac epoxies, which are also the coating system of choice when process temperatures are "never" going to exceed the maximum service temperature of the epoxies. These products have multiple-year successful track records as tank linings in service equal to or more severe than the CUI environment. The epoxies typically have peak service temperatures in the 204 C (396 F) range and may be applied to surfaces up to 149 C (300 F), according to manufacturers' data sheets. The high-temperature phenolic epoxies are relatively low solids by volume (usually around 65%), require stringent surface preparation, and are recommended for thin-film application (two coats, 4 to 5 mils per coat).

Dry film thickness (DFT) and recoat interval between the two coats of high-temperature phenolic epoxies are critical. DFT must be kept in a relatively narrow range. DFT below the recommended range leaves a porous film, while DFT above the recommended range will crack and delaminate at normal operating temperatures. When applied to elevated temperature surfaces, these products have a very short maximum recoat interval, which must be strictly observed to assure intercoat adhesion.

The shortcoming of phenolic epoxies under insulation is peak temperature tolerance. The maximum single peak for most coatings in this category is 218 C (426 F), according to manufacturers' product data sheets. After a single short time above this temperature, the film can embrittle, crack, and no longer provide protection. In many instances, when refiners raise their process temperatures and increase their "CUI range" from 65 C–149 C (149 F–300 F) to 65 C–204 C (149 F–396 F), the safe margin of phenolic epoxies for thermal spikes, cleanouts, and even slight process variations is no longer viable. Owners need to re-think the use of these products in these instances.

Phenolic and novolac epoxies can be used to overcoat clean, aged epoxy films as long as the aged epoxy has not been embrittled by heat stress. Epoxies are also suitable for overcoating clean, aged inorganic zinc, but the composite system's maximum operating temperature is reduced from 399 C (750 F) to 204 C (396 F).

New Generation CUI Coatings

Many paint manufacturers have brought out new lines of high-temperature products with data sheets that provide for application to elevated temperature substrates and that indicate an elevated or cyclic peak operating temperature. Two such types of products are inert, multi-polymeric matrix and high-build, silicone-based primers. Both are suitable for new construction or on-site major maintenance. These new coatings offer greater temperature and cyclic tolerance, longer service life, and ease of application, without containing lead or chromium. They also offer much higher DFT, less permeable films, and a wider service temperature range than any other liquid-applied, high-temperature coating for CUI. In maintenance situations, many of the new-generation coating systems can be applied while units are in service, often near or at the unit's peak temperature operation. Typical DFTs are in the 5- to 6-mil range per coat, assuring that permeability and porosity from low DFT are not problems, and allowing a wide tolerance for DFTs above the recommended range. A wide latitude in maximum recoat interval also allows for better scheduling of work, ease of touchup, and related factors.

The inert multipolymeric matrix primers have allowable application surface temperature ranges up to 260 C (500 F), so nearly all process equipment, including stainless steel components, can be coated while in operation and at

Table 1: Relative Comparison of CUI Systems

	Inert Multipolymeric Hi-Build Primer	Thermal Spray Aluminum	Traditional Elev-Temp Silicones	New-Technology Si-Based Hi-Build Primers	Inorganic Zinc	Novolac Elev-Temp Epoxies
Max. Operating Temperature	1200 F Cont. 1400 F Peaks	1170 F	1000 F	800 F	750 F	425 F
Surface Tolerant (Preparation)	Yes SSPC-SP 2	No	No	No	No	No
User Friendly Mix/Application	1 Comp easy app	Specialized application	1 Comp thin film	2 Comp easy app	2 or 3 Comp dry spray	2 Comp dft critical
Max. DFT Per Coat	6 mils(x2)	8 mils(x1)	1.5 mils(x3)	6 mils(x2?)	3 mils(x1)	4 mils(x2)
Recoatable with Self for CUI Max Total DFT	Yes 12 mils+	No 8 Mils	Yes 4.5 mils	Yes 8 mils	No 3 mils	Yes 8 mils* *Max dft critical *Recoat interval critical
Hot Apply to Max Temp F	Yes 500 F	Yes no limit	Yes 200 F	Yes 250 F	No	Yes 300 F
Anodic–Metal Sacrifices in Electrolyte	No	Yes	Yes (aluminum)	Yes (aluminum)	Yes (zinc)	No
Intermt Immersion in Hot Salt Water	Yes	Fails	Fails	Not recommended	Fails	Yes
Stainless Steel Application	Yes	No	No	Yes	No	Yes
Protects at Ambient Temps	Yes	Yes	No	Yes	Yes	Yes
Cryogenic Temps Service	Yes	Yes	No	Yes	No	Yes
Repair Aged Inorganic Zinc	Yes	No	Yes** **Fails in immersion	Yes	No	Yes*** ***Reduces max temp

higher temperatures. (The primers are formulated without chlorides, sulfides, or halides, each of which could cause stress corrosion cracking on austenitic stainless steel surfaces.)

This class of CUI coatings is truly surface tolerant. It can be applied over salt-free but rusted surfaces, over new or aged but tightly adhering inorganic zinc, over tightly adhering and otherwise clean residues of thin-film silicones, and over aged films of itself.

High-build, silicone-based, elevated-temperature primers can also be used to overcoat clean, aged inorganic zinc, but surface preparation for this class of products is a bit more precise, preventing application over aged rusted steel, or over steel which has turned after washing or wet abrasive blast preparation. Consultation with the appropriate manufacturer's technical service staff is needed for specific preparation and application procedure recommendations.

Table 1 summarizes conventional and new generic high-temperature coating materials for CUI service in new construction and field maintenance. Coatings are listed by maximum operating temperature, decreasing left to right. Negative characteristics are indicated in blue type; favorable characteristics are indicated in black type.

Conclusions

Owners and specifiers have several system options when selecting coating materials for CUI service, either new building or maintenance. Before selecting the best product for an application, the owner and specifier should also evaluate not only the products' performance properties but also factors such as the level of preparation required, compatibility, ease of use, number of components (one or two), standard application equipment, application to hot surfaces, and cure times.

The costs of any CUI work are significant, but a properly selected coating system over the proper level of surface preparation can minimize total cost, and can give the best ratio of cost per unit of expected service life.

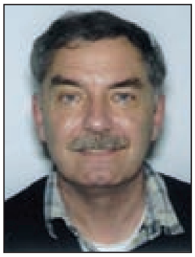
Notes

1. C. Steely, W. Pollock, "A State of the Art Report of Protective Coatings for Carbon Steel and Austenitic Stainless Steel Surfaces Under Thermal Insulation and Cementitious Fireproofing," NACE Publication 6H189, 1986.
2. E.G. Haney, "The Zinc-Steel Potential Reversal in Cathodic Protection," NACE Paper No. 216/1981, p. 4.

Other Sources Consulted

Knudsen, O., Rogne, T., and Rossland, T., "Rapid Degradation of Painted TSA," NACE Paper No. 04023, 2004, p. 6.

Mitschke, H., Informal Technology Exchange presentation at NACE Corrosion 2007.



Peter Bock is currently the corrosion under insulation specialist and senior account manager at Hi-Temp Coatings Technology in Houston, TX. He has 32 years of experience in oilfield and petrochemical coatings, primarily in the Gulf of Mexico area. Active in several industry associations, Mr. Bock has published and presented papers for SSPC and NACE.

Michael MeLampy is currently the Vice President of Global Sales at Hi-Temp Coatings Technology in Boxborough, MA. He has over 20 years of experience in the industry and is active in SSPC, NACE, CSI, and related industry groups.

JPCL

SSPC Salutes 5 Coating Projects for 3rd Annual Structure Awards

For the third year in a row, SSPC recognized excellence in coatings projects representing a wide range of structures that require the work of professionals with expertise in the use of high-performance coatings.

This year's recipients were announced at the association's Annual Meeting on February 15, 2009, at PACE 2009. SSPC President Bruce Henley presented the awards to representatives of teams of contractors, designers, owners, and other personnel for excellence of their teams' coatings projects.

Photos of the winning structures and representatives of each project's team are featured on pages 50–54. SSPC received the award nominations for the structures in 2008. Information about companies contributing to each project came from SSPC.

Charles G. Munger Award: The "Hats Off" Jet Fuel Storage Tanks

"Hats Off" Fuel Tanks, Calgary, AB. Courtesy of Dr. Michael O'Donoghue (Below, l–r) Dr. Michael O'Donoghue, Devoe Coatings; Douglas Wade, NWS Inspection, Inc. (representing the Devonian Foundation Inc.); Gerald Petker, Petker Coatings; and Vijay Datta, standing in for Sean Adlem, Devoe Coatings.

The "Hats Off" Calgary Airport Tanks won this year's Charles G. Munger Award for the outstanding industrial or commercial coatings project that demonstrates the long service life of the original coating.

The award was named in honor of the late Charles Munger, who advanced the use of zinc-rich primers and wrote prolifically for the coatings industry.

During the winter of 1995, the jet fuel storage tanks located beside the main road leading to the Calgary International airport terminal were chosen to create a form of greeting to tourists arriving at the airport. Adhesion tests were performed on the existing coating of red lead primer overcoated with a self-chalking topcoat that was 27 years old. The adhesion tests revealed the existing coating system had suitable adhesion for encapsulation.

All surfaces to be coated were power washed at 5,000 psi. The surfaces showing bare substrate or rust were spot primed with a surface-tolerant epoxy. All surfaces were then coated with an aliphatic polyurethane by airless spray application. The artwork was completed by a team of artists employed from Ontario, who applied the same aliphatic polyurethane for all of the "cartoons" with two- and four-inch brushes.

After 12 years in the Alberta climate, these storage tanks are still in excellent condition.

Courtesy of SSPC

Location:
Calgary, AB, Canada

Structure Owner:
Devonian Foundation

Contractor:
Petker Coatings

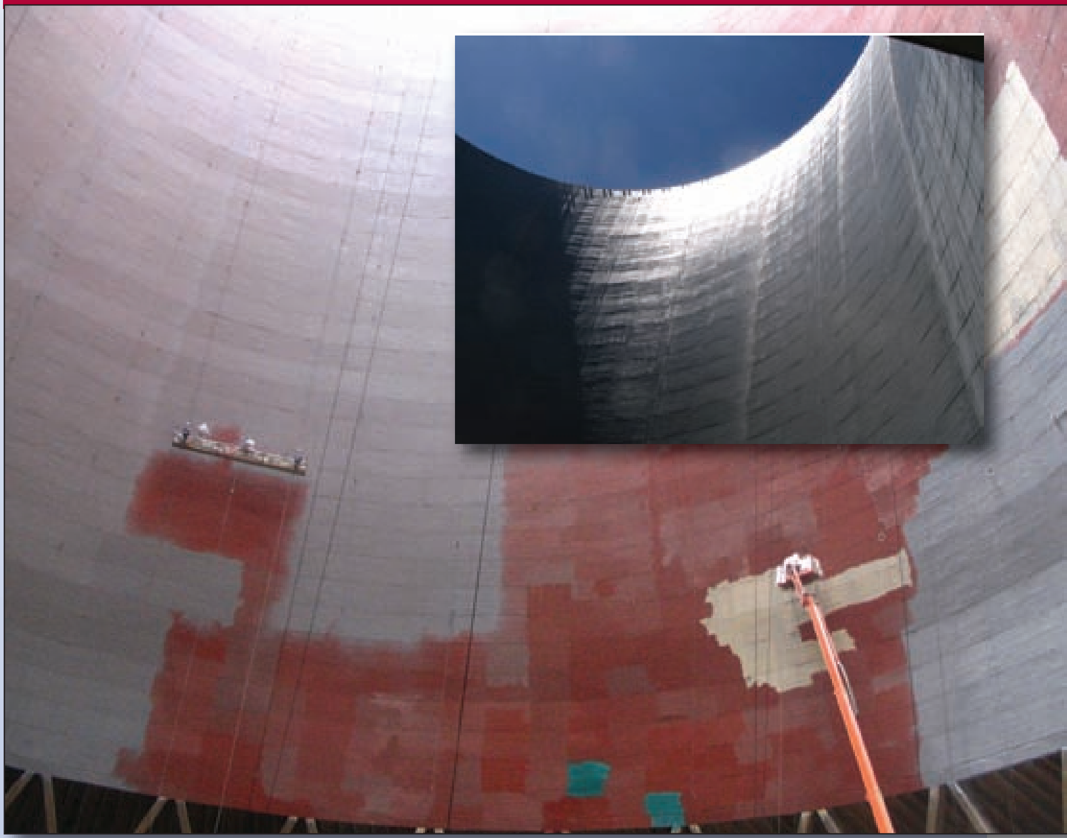
Coatings Inspector:
NWS Inspection

Coating Material Supplier:
Devoe Coatings

Start Date:
Summer 1996

Completion:
Summer 1997

Crone Knoy Award: Cardinal Unit #3 Cooling Tower



Cardinal Unit #3 Cooling Tower, Brilliant, OH, during coating work. (Inset) The tower after coating work completed. Courtesy of John Courtien, IUPAT (Below, l–r) Michael Volman and Robert Johnson, The Sherwin-Williams Company; Doc Roberts and John Mainieri, American Electric Power; and Glenn Baughman, Cannon Sline Industrial

Named for the late founder and president of Tank Industry Consultants, the Crone Knoy Award recognizes an outstanding achievement in industrial or commercial coatings work that demonstrates innovation, excellence in craftsmanship, or the use of state-of-the-art techniques or products to creatively solve problems or provide long-term service.

A 630-megawatt coal-fired electric generation unit, the Cardinal Unit #3 Cooling Tower in southern Ohio is being retrofitted with a new flue gas desulfurization (fgd) system that will reduce its SO_x emissions.

The project was unique because of the size, height, and hyperbolic configuration of the cooling tower. The tower has a top inside diameter of 180 feet and is 430 feet above grade. The hyperbolic configuration complicated the already difficult rigging plan and implementation.

The cooling tower was constructed in 1974, so the project required the coating system to bond well to aged concrete and maintain adhesion over the 30-year planned remaining service life of the structure. The concrete surface was prepared with high-pressure water cleaning at a target pressure of 6,000 psi. The surface cleaning procedure removed all surface contamination and all but very sound concrete from the surface, while opening many concrete pores on the surface, typically one-quarter inch to one-half in diameter. A 100% solids epoxy primer and a trowel-applied epoxy surfacer were applied over the entire surface to fill all cracks and surface pores, and the coating system was completed with two coats of a high-build, high-solids, glass-filled epoxy finish.

Courtesy of SSPC

Location:
Brilliant, OH

Structure Owner:
Buckeye Power (Managed by American Electric Power)

Contractor/Applicator:
Cannon Sline Industrial

Coating Material Supplier:
The Sherwin-Williams Company

Start Date:
March 28, 2008

Completion:
May 23, 2008

William Johnson Award: Georgia Dome

The William Johnson Award recognizes outstanding achievement demonstrating aesthetic merit in industrial or commercial coatings work. The award was named for the late consultant with KTA-Tator whose work in coatings formulation, failure analysis, and surface preparation was instrumental in advancing the industry.

The Georgia Dome, the largest cable-supported domed stadium in the world, is the home venue for the NFL's Atlanta Falcons and has hosted many events, including Super Bowls XXVIII and XXXIV and the gymnastics and basketball events for the 1996 Olympic Games.

Courtesy of SSPC

Location:
Atlanta, GA

Structure Owner:
Georgia World Congress Center Authority

Contractor:
Specialty Finishes

Coating Material Supplier:
Tnemec Company, Inc.

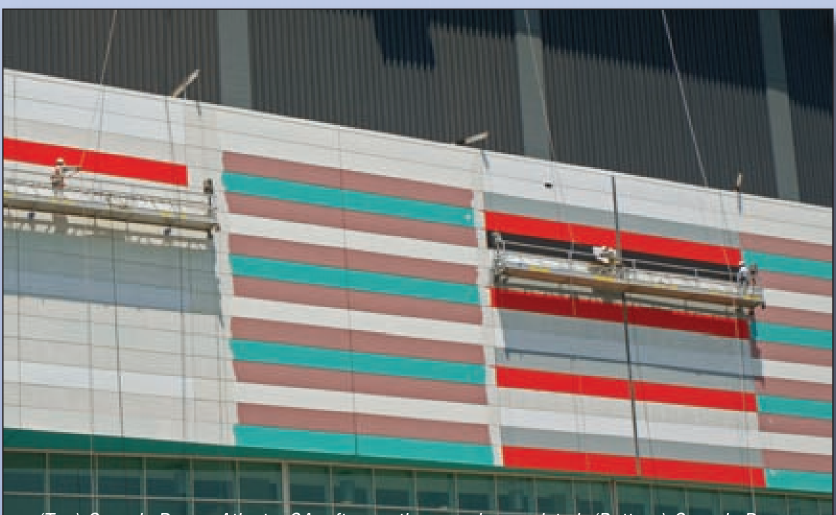
Start Date:
March 2008

Completion:
July 2008

The exterior skin of the dome consists of unpainted architectural concrete masonry units (CMUs), flat metal panels, and corrugated panels.

Preparation of both coated and uncoated substrates consisted of washing the surface with a pre-paint cleaning chemical at a pressure of 3,000 psi and a temperature of 180 F.

The coating work began on the flat metal panels with a polyamide epoxy primer. A semi-gloss, high-solids fluoropolymer finish coat was used for the exterior coating of the dome; it consisted of five colors—white, red, black, and two shades of gray. A single coat was applied to all panels except the red panels, where two coats were required to ensure adequate hiding. A modified waterborne acrylate that provides elastomeric protection against driving rain, alternate freeze-thaws, and ultraviolet light was used for concrete surfaces. Given the proximity of the stadium to moving traffic, nearby parking, and office buildings, the coatings were brush-and-roller-applied in order to avoid damage from overspray.



(Top) Georgia Dome, Atlanta, GA, after coatings work completed. (Bottom) Georgia Dome during coatings work. Courtesy of Tnemec Company, Inc. (Middle, l–r) Stephen Collins of Air Products and Chemicals, Inc. for the Georgia World Congress Center Authority; SSPC President Bruce Henley; and Eddie Borne, Tnemec Company.

Courtesy of SSPC

George Campbell Award: Berth Two East and West Potash Ship Loaders

Location:
Vancouver, BC

Owner:
Neptune Bulk Terminals Canada Ltd

Contractor:
Certified Coating Specialists, Inc.

Coating Material Supplier:
Camcoat Industries, a distributor for International Paint

Start Date:
May 5, 2008

Completion:
June 2, 2008

Two structures tied for the George Campbell Award: the Berth Two East and West Potash Ship Loaders, and the Liard River Bridge.

The award, which honors outstanding achievement in the completion of a difficult or complex industrial or commercial coatings project, is named for the late George Campbell, founder of Campbell Painting Company in New York.

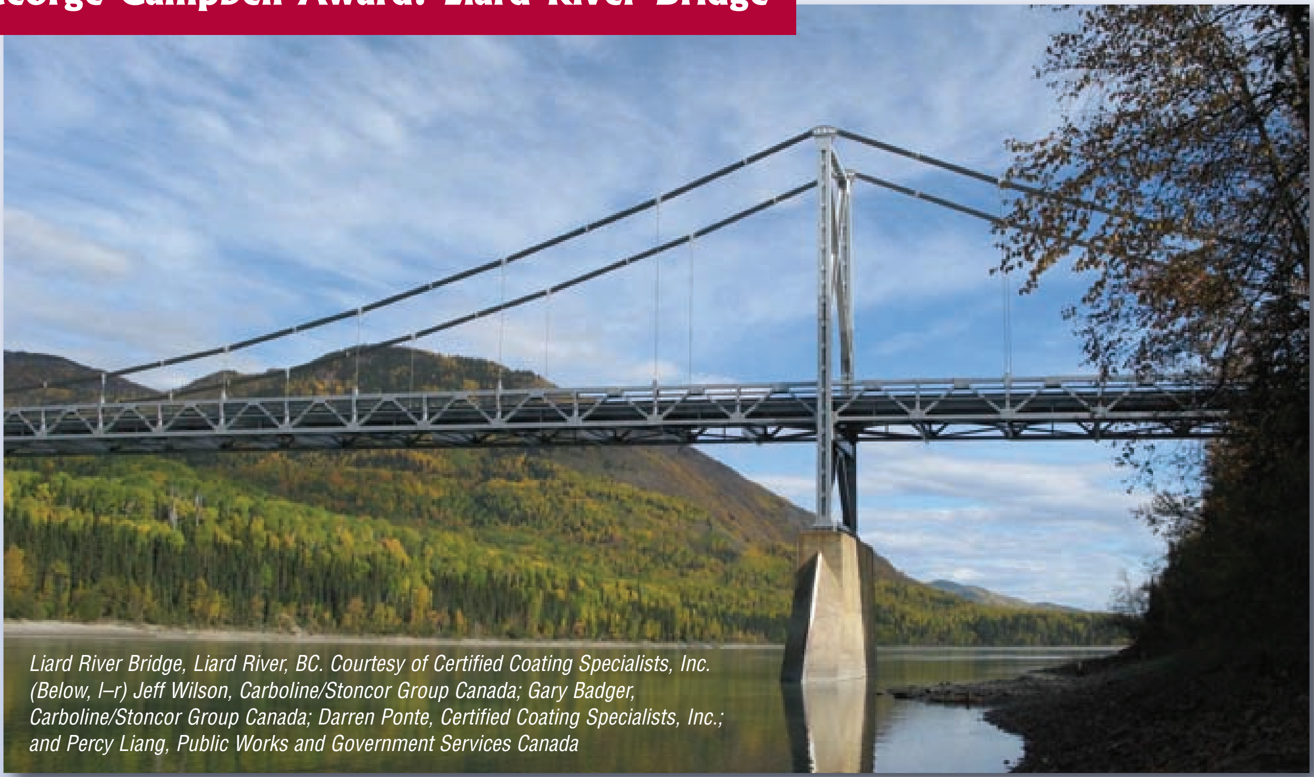
The ship loaders project required full lead abatement and containment of the two 34,000 sq ft ship loaders. The work was completed in 21 days during a 28-day shut down. The contractor had to comply with regulations of multiple regulatory bodies, including B.C. Fisheries, Ministry of Environment, and Worksafe BC.

(Top, left) Darren Ponte, Certified Coating Specialists, Inc.; Jim Anderson, Neptune Bulk Terminals Canada, Ltd. (Above, top to bottom) Berth Two East and West Potash Ship Loaders, Vancouver, BC—before coatings work; ship loader fully contained by 12-mil polyethylene shrink-wrap system; ship loader after coatings work completed. Courtesy of Certified Coating Specialists, Inc.

The installation of scaffolding was needed to provide clear and safe access to the substrate, and the containment was a 12-mil polyethylene shrink-wrap system. The specification required the removal of existing coatings, salts, soils, oils, grease, and organics. Working around the clock, a crew of 24 workers, using 8 UHP water pumps with up to 12 lances, completed this work in just 7 days. During the job, the contractor had to screen all wastewater for removal of large matter such as paint chips, corroded steel, grease, potash, and other foreign contaminants before the waste entered the customer's water filtration system.

Before paint operations, 20,000 cfm dehumidificaton was run for 48 hours. A two-coat system consisting of aluminum and lamellar micaceous iron oxide primer with a topcoat of a surface-tolerant epoxy was then applied.

George Campbell Award: Liard River Bridge



Liard River Bridge, Liard River, BC. Courtesy of Certified Coating Specialists, Inc. (Below, l–r) Jeff Wilson, Carboline/Stoncor Group Canada; Gary Badger, Carboline/Stoncor Group Canada; Darren Ponte, Certified Coating Specialists, Inc.; and Percy Liang, Public Works and Government Services Canada

Also receiving the George Campbell Award is the Liard River Bridge. Located in a pristine wilderness area that spans a major fish-bearing river, it is the last cable-stayed bridge on the Alaska Highway. Mechanical snow clearing operations in the winter months had caused extensive damage to the upper trusses of the bridge as well as severe corrosion problems due to the salt used in the operations.

The contractor faced many problems on the project. The original coating contained lead-based paint and full containment of the 1,000-foot-long structure was required. All wash water and blast media had to be fully contained and all waste had to be trucked away over 400 miles. The window of opportunity allowed by the weather to complete the work was two months. Even when the weather conditions were optimum, the use of heaters and dehumidification equipment was needed. And because one lane of the bridge had to be open at all times, the work had to be performed in four hundred foot sections.

70,000 sq ft of structural steel was prepared to SSPC-SP 10, and a four-coat system was applied. It was primed with a zinc-rich epoxy, and a rust bond penetrating sealer was applied to all crevices, seams, packrust, and intersections. The structure was then stripe coated with a polyamide and topcoated with an acrylic polyurethane.

Courtesy of SSPC

Location:
Liard River, BC (Milepost 476)

Owner:
Public Works and Government Services Canada

Contractor:
Certified Coating Specialists, Inc.

Coating Material Supplier:
Stoncor Group Canada/ Carboline/Plasite Coatings Group

Start Date:
June 2007

Completion:
July 2008

Awards Presented at SSPC Annual Meeting

Awards for individual achievements, SSPC chapters, and publications were presented at SSPC's Annual Meeting, held at PACE 2009 on Sunday, February 15, in New Orleans, LA.

Accepting Eric Kline's award as SSPC Honorary Life Member are his daughter, Mary Beth Kline, and son, Michael Kline.

SSPC Chapter Awards

Terry Sowers, SSPC Director of Member Services, announced the winners of SSPC's Annual Chapter Awards at the Annual Meeting and Awards Program.

• The 2008 Outstanding Chapter award was given to the Northern California/Nevada Chapter. The chapter had a successful year of meetings with strong member turnout, according to Ms. Sowers. The programs held were Ask the Pros II; Optically Active Pigment Technology; and Inspection of Coatings and Linings (with 147 attendees, an all-time attendance for any chapter event, notes Sowers); in addition, the SSPC C-3, Supervisor Competent Person for Lead Paint Removal Course was held. The chapter also held a tour of the Kleen Blast Abrasive Warehouse and a golf outing.

The officers for the Northern California/Nevada chapter are Chair Ron Robison of Redwood Painting; Vice-Chair Dan Zavesky of Carboline; Secretary Arthur Grice of The Sherwin-Williams Company; and Treasurer Burt Olhiser of Vantage Point Consulting.

SSPC President Bruce Henley presents the Annual SSPC Chapter Awards. (Left): Ron Robison, Redwood Painting Co. Inc., accepts the Outstanding Chapter Award. (Below): Charlie Harvilicz, Northrop Grumman, receives the Educational Excellence award. (Right):William Hansel, Caltrans Lab, accepts the award for the Most Diverse Program.

• The Hampton Roads chapter has won the 2008 Educational Excellence award for a second year in a row. Sowers says that the chapter, "has excelled in the area of providing frequent and relevant educational opportunities to chapter members." Four dinner meetings were held, as well as six SSPC training courses. The chapter has also "demonstrated their commitment to... giving back to the coatings community" by giving four student scholarships in 2008.

Hampton Roads chapter officers are Chair Terry New, Rapid Deployable Systems, Inc.; Vice-Chair Frank Saunders, The Sherwin-Williams Company; Secretary Dan Kaidel, Munters Corporation; and Treasurer Gary Duschl, Virginia Materials.

• The 2008 Most Diverse Program award was given to the Southern California/Southern Nevada chapter. The chapter opted for several facility tours instead of the usual dinner meeting programming, according to Sowers. Sowers also added, "The programs had a distinct owner focus that included a presentation on bridge painting by Caltrans, a tour of the Metropolitan Water District Plant, and a tour of the Long Beach Aquarium." The year's events were rounded out by the 5th Annual Chapter Barbeque, which was attended by 65 members.

The officers for the Southern California/Southern Nevada chapter

Continued

are Chair Patrick Sweeney, CSI services, Inc.; Vice-Chair Jay Kranker, Munters Corporation; Secretary Linda Schlein, Commercial Sandblasting; and Treasurer William Hansel, Caltrans.

Individual Honors

SSPC Past-President Doni Riddle, recipient of the SSPC Certificate of Appreciation

Several awards were given for individual achievements in support of the coatings industry.

- Honorary Life Member: Eric S. Kline, KTA-Tator, Inc.
- Certification of Appreciation—SSPC Past-President Doni Riddle (The Sherwin-Williams Company)
- Coatings Education Award: Peter P. Judt, Todd Pacific Shipyards; Abdul S. Rashid, AR786 Engineering Consulting; Alexander Wijaya, WHW Consulting Services
- Technical Achievement Award: Allan DeLange, North American Coatings CL Coatings Division

President's Lecture

SSPC President J. Bruce Henley selected a paper written by Dr. Mike O'Donoghue, Peter Rob-erts, and Vijay Datta, all of ICI Devoe Coatings, and Terry McManus of McManus Inspection, Ltd. as one of two papers to be presented in the President's Lecture Series at PACE 2009. PACE presents the President's Lecture Series every year, bestowing this honor on one education session each from the PDCA Business and SSPC Technical Programs. Those chosen to deliver the lectures are also presented with a certificate of commendation.

O'Donohue presented the paper, titled "Modern Marvels: Overcoating Lead Based Paint on Penstocks: Practical Experience Using a High Ratio Calcium Sulfonate Alkyd (HR SCA) System." He discussed the chemistry behind the overcoating system, as well

Vijay Datta and Dr. Mike O'Donohue of ICI Devoe Coatings display their certificate of commendation for presenting the SSPC President's Lecture.

SSPC Director of Member Services Terry Sowers and President Bruce Henley display Abdul Rashid's and Alexander Wijaya's SSPC Coatings Education Awards. Peter Judt also received this award, although his plaque is not pictured.

Allan DeLange of North American Coatings CL Coating Division receives the SSPC Technical Achievement Award.

Bauman and Summers Are PCS Certified

SSPC has announced the certification of Tim A. Bauman (Cleveland, OH) and Malcolm Summers (Sriracha, Chonburi, Thailand) as Protective Coatings Specialists (PCS).

SSPC's PCS Certification recognizes industrial coating professionals for their extensive knowledge in the principles and practices specific to industrial coatings technology. Each coatings professional is evaluated on his/her mastery of coatings type, surface preparation, coatings application and inspection, contract planning/management, development of specifications, and the economics of protective coatings.

To be certified under the PCS Certification Program, each industrial coatings professional is first evaluated for their education and work experience to determine the extent of training to be completed prior to taking the comprehensive written exam. The training courses are the SSPC's C1, Fundamentals of Protective Coatings for Industrial Structures, and SSPC's C2, Specifying and Managing Protective Coating Projects, or courses of a similar content. The final step in certification is a comprehensive examination of the coating professional's use and knowledge in those areas.

Bauman has been in the protective coatings industry for over 20 years, and Summers has over 17 years of industry experience. Both have been trained in the evaluation and selection of coating, lining, and non-metallic materials. They are both experienced in failure analysis, on site audits for coating/lining work at manufacturing plants and in the field, and writing technical specifications for offshore maintenance coating work.

as viscosity, inhibition, and flexibility performance levels, followed by a case study on the use of the system.

Honors for Authors

SSPC's 2008 Outstanding Publication Award went to "Investigating Corrosion Protection of Offshore Wind Towers" by Andreas W. Momber, Muehlhan AG; Peter Plagemann and Volkmar Stenzel, Fraunhofer Institute for Manufacturing and Applied Materials Research; and Michael Schneider, Fraunhofer Institute for Ceramic Technologies and Systems. The article appeared in the April 2008 *JPCL*.

Four articles received the 2008 *JPCL* Editors' Awards.

- "Laboratory Evaluation of Cargo Hold Coatings" by Trevor Parry, Scientific & Technical Services, Ltd. (July 2007 *JPCL*)
- "The Golden Gate: A History of Maintenance Practice" by Noel Stampfli, Dennis Dellarocca, Golden Gate Bridge, Highway and Transportation District (January 2008 *JPCL*)

Noel Stampfli (left) and Dennis Dellarocca (right) receive the JPCL Editors' Award.

- "Assessing Coatings & Linings for Wastewater: Accelerated Test Evaluates Resistance to Severe Exposures" by Vaughn O'Dea, Remi Briand, Tnemec Co., and Linda Gray, KTA-Tator (Canada); (April 2008 *JPCL*)
- "Steel Bridges: Corrosion Protection for 100 Years" by Eric Kline, KTA-Tator, Inc. (May 2008 *JPCL*)

SSPC: The Society for Protective Coatings Annual Report (January 1, 2008 to December 31, 2008)

PART I: INTRODUCTION

This annual report gives an overview of the activities, plans, and status of SSPC: The Society for Protective Coatings from January 1, 2008 through December 31, 2008. The information enclosed gives the most current figures for all programs.

SSPC had another successful year. The fourth annual PACE conference (January 2008), the launching of many new training programs, and continued progress on the strategic marketing plan were the highlights for SSPC in calendar year 2008. In 2011, SSPC will be conducting its own show. PACE, as we know it, will no longer exist. Our partnership with PDCA was a learning experience for both organizations. PACE was not a failure. You may hear that comment, but that is far from the truth. The model that SSPC and PDCA developed did not meet the needs of the members of either association. We still feel that with reduced resources and time, people are looking for ways to economize their activities. If they can attend one show instead of many and return those saved days to their employer, that would be a huge benefit to their organization. As we move down the road, we may try to partner with other associations using a different model. As the old saying goes, "If you don't change, how do you expect to change?" and how do you improve?

We continue to look at foreign markets as a way to expand SSPC and the message we are trying to deliver, which is that the use of protective coatings is the best solution to corrosion control. We continue to explore potential inter-

Audience at Annual Meeting

Continued

Bruce Henley (right), SSPC president, and Bill Shoup, SSPC executive director, deliver the annual report at the Society's Annual Meeting held February 15 in New Orleans, LA, at PACE 2009.

national markets.

We are moving forward on our strategic marketing plan. The plan was accepted by our governing body in January 2006 and is scheduled to be reviewed in 2009. Major elements of the plan are: improve SSPC technology capabilities; enhance our brand (formulating an identity or a name recognition); improve marketing (selling or promoting the identity); develop partnerships with other organizations; develop more in-house expertise and capability to develop, produce, and deliver high quality and relevant programs and services; create a true Council of Facility Owners with support services; and use the Chapter System as one of the delivery modes for SSPC programs and services. Last year we updated our database, which includes a customer relationship management module to improve member account management, a new online store (The SSPC MarketPlace), reward points tracking, and restricted member areas. We are continuing to improve our internal capabilities on our new database by making modifications to make it user-friendlier and to continue training the staff so they may take advantage of this new technology. We have continued to focus our marketing certification efforts to coating concrete and the water/wastewater industries with direct ad campaigns promoting training and certification programs. If you would like to acquire a copy of the strategic marketing plan, please contact us. It is available to our members.

Part II: Achieving SSPC's Vision

We continue to progress in implementing our present marketing plan to achieve the Society's vision. That vision is: "SSPC will be the worldwide acknowledged resource and authority for protective coatings technology and information."

At all Board Meetings, the Governors review our operational objectives to ensure they are in line with our strategic goals. The document that bridges our strategic plan and operational goals is that strategic marketing plan, which includes a major emphasis on technology upgrades. This upgrade in technology will move the Society ahead with the ultimate goal of making the staff proactive rather than reactive. We need to continue that long-term focus so we do not stray from the mission and the purpose for which SSPC was created in 1950.

Two overall significant accomplishments for the year are the accreditations of SSPC's standards development process by The American National Standards Institute (ANSI), and our Protective Coatings Inspector (PCI) program by the American Bureau of Shipping (ABS).

In the area of Public Policy Advocacy, SSPC submitted comments jointly with American Institute of Steel Construction (AISC) on Area Source Rule (Metal Fabrication) in May 2008. SSPC also submitted comments to OSHA on Confined Space Rule for Construction in February and submitted comments to EPA on the proposed NAAQS revisions for lead emissions in June. SSPC also posted 60 headlines on our web site relating to government activities that may affect the coatings industry.

In the area of providing information, we had 648 technical information inquiries in 2008. This is up more than 75 from 2007. We remain a superb resource of information for our members and the industry and we invite you to make use of the staff capability we have.

PART III: MEMBER PROGRAMS

SSPC is a member-based organization. We are evaluated on how well our programs and services meet the needs of our members and the protective coatings industry.

Standards and Publications

Our core product is our standards. The standards completed in FY 2008 are listed below in Table 1.

Certification

The past year saw an increase in the total number of certified contractors under the PCCP and certified individuals under the Protective Coatings Specialist Certification program. Two hundred forty-eight contractors have

Continued

TABLE 1: Standards and Publications Completed in Year Ending December 2008

1. SSPC-PA Guide 10, Guide to Safety and Health Requirements for Industrial Painting Projects
2. SSPC-PA Guide 11, Guide to Protection of Edges, Crevices, and Irregular Surfaces by Stripe Coating
3. SSPC-QP 9, Standard Procedure for Evaluating Qualifications of Painting Contractors Who Apply Architectural Paints and Coatings

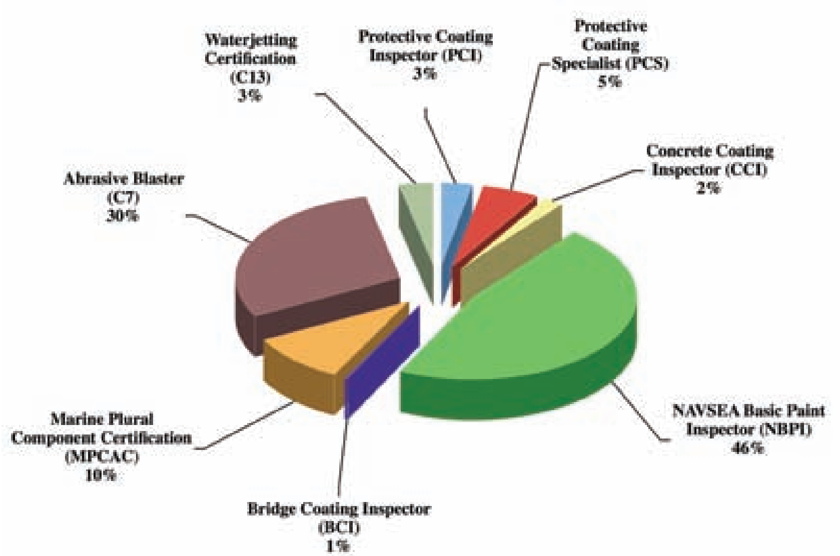


Fig. 1: Individual Certification Program

TABLE 2: Board of Governors

NAME	COMPANY	REPRESENTING
J. Bruce Henley* President	The Brock Group Beaumont, TX	Coating Contractors
Steven Roetter* President-Elect	Tank Industry Consultants, Inc. Indianapolis, IN	Other Service Providers
Russ Brown* Vice-President	Munters Corporation Indianapolis, IN	Other Product Suppliers
Doni Riddle* Immediate Past-President	The Sherwin-Williams Company Cleveland, OH	Coating Material Suppliers
Derrick Castle	Kentucky Transportation Cabinet Frankfort, KY	Facility Owners
Stephen Collins	Air Products and Chemicals, Inc. Thomaston, GA	Coating Material Suppliers
Benjamin S. Fultz	Bechtel Corporation Houston, TX	Facility Owners
Steven Hagman	CanAm Minerals/Kleen Blast Abrasives San Ramon, CA	Other Product Suppliers
Bob McMurdy	R.P McMurdy Enterprises LLC Houston, TX	Other Product Suppliers
Jeff Theo	Vulcan Painters, Inc. Bessemer, AL	Coating Contractors
Gail A. Warner	Northrop Grumman Shipbuilding Newport News, VA	Facility Owners
Robert Ziegler	Ziegler Industrial Park Nauvoo, IL	Coating Contractors
Carl Angeloff, P.E. Ex-Officio	Bayer MaterialScience LLC Pittsburgh, PA	Coating Material Suppliers

** Indicates Board Officers*

achieved certification, an increase of 7.3%. We have three companies QP-5 certified. In the Protective Coatings Specialists Certification (PCS) program, we have 245 participants certified, an increase of 6.0%. A breakdown of the certification programs is shown in Figure 1 (p. 63).

Training

The PCS certification has continued to spur an increased interest in the two courses on Fundamentals of Protective Coatings (C-1) and Specifying and Managing Coating Projects (C-2), with over 435 students trained during the year. The C-1 eCourse trained 75 personnel. The C-2 eCourse had 54 students trained. For Lead Supervisor/Competent Person Training (C-3 and C-5), 1,352 students received training. The C-7 Abrasive Blasters course had 299 personnel trained. The NAVSEA Basic Paint Inspector training course had 410 students complete the course. For the NBPI course, graduates receive a certificate, which is good for four years, qualifying them to be paint inspectors for that agency. Marine Plural Component Applicator Certification (MPCAC) had 134 students trained. Coating and Surfacing

Concrete for Contractor Personnel had 95 trained. Concrete Coating Inspector Program and Certification had 85 trained and certified. The Bridge Coatings Inspection Course had 52 students trained. The Quality Control Supervisor Course had 7 personnel trained, and the Lead Worker course had 60 students trained. The Marine Coatings course had 134 students trained. The Applicator Train-the-Trainer program had 63 students trained, and finally, the Waterjetting course had 106 students trained.

International Training

SSPC has done a substantial amount of international training in 2008. Several C-1, C-2 courses, and PCS exams were held in Canada. In China, we held a C-2 and PCS exam in conjunction with our local chapter, SSPC-C. Also,

Continued

TABLE 3: Revenue Versus Expense (Unaudited)

REVENUE	FY 07	FY 08
Memberships	$1,009,000	$966,000
Standards and publication	$456,000	$521,000
Conferences	$692,000	$631,000
Certification & training	$2,115,000	$2,719,000
Other*	$336,000	($69,000)
Total Revenue	$4,608,000	$4,768,000
EXPENSE	FY 07	FY 08
Memberships	$695,000	$696,000
Standards and publications	$405,000	$447,000
Conferences	$529,000	$503,000
Certification & Training	$1,936,000	$2,198,000
Other**	$755,000	$736,000
Total Expense	$4,320,000	$4,580,000
Net Surplus (Loss)	$288,000	$188,000

** Includes revenue from royalties, interest and external projects.*
*** Includes expenses for SSPC chapters, governance, regulatory advocacy, knowledge center, external projects, general administration, and strategic plan implementation.*

Table 4: Statement of Financial Position as of 12/31/08 (Unaudited)

	Total all Funds	General Operating Fund	Reserve Fund
Assets - Current Assets			
Cash	$106,000	$106,000	
Investments	$3,722,000	$1,897,000	$1,825,000
Accounts receivable	$232,000	$232,000	
Inventory	$163,000	$163,000	
Total	**$4,223,000**	**$2,398,000**	**$1,825,000**
Furniture, Fixtures and Equipment			
Equipment, Leasehold improvements at cost less: Accumulated Depreciation	$456,000 <$186,000>	$456,000 <$186,000>	
Total	**$270,000**	**$270,000**	**-0-**
Other Assets			
Prepaid expenses	$169,000	$169,000	-0-
Total Assets	**$4,662,000**	**$2,837,000**	**$1825,000**
Current Liabilities			
Accounts payable	$45,000	$45,000	
Accrued expenses	$209,000	$209,000	
Deferred revenue	$479,000	$479,000	
Total Liabilities	**$733,000**	**$733,000**	**-0-**
Net Assets - Unrestricted	$3,929,000	$2,104,000	**$1,825,000**
Total Liabilities and Net Assets	**$4,662,000**	**$2,837,000**	**$1,825,000**

in China Moody International held our first Protective Coatings Inspector (PCI) course. Southeast Asia has been an area of major growth for SSPC in 2008. SSPC's local chapter in Indonesia sponsored several PCI courses in Batam and Singapore as well as an Applicator Train-the-Trainer in Jakarta. In Japan, the SSPC Local Chapter and the shipyards in the Sasebo area held the Airless Spray program, Abrasive Blasting, Waterjetting, Marine Plural Component, Lead Abatement, and several NAVSEA Basic Paint Inspector courses. Insignia, our newest licensee in Dubai, held a Concrete Coating Inspector Course and has an ambitious schedule planned for 2009. We have also held a C-1 in Trinidad and a C-2 offering in Mexico.

Website

SSPC's goal is to enhance and maintain SSPC Online for the benefit of its members. We continue to offer the popular Tech Features (excerpts from SSPC publications), "Ask SSPC" questions and answers, downloadable standards on SSPC's MarketPlace, regulatory news as it happens, SSPC certification (PCCP and PCS) news and information, up-to-date information on SSPC training, and the new downloadable standard benefit mentioned previously.

We continue to offer Featured Links on the homepage for "data mines" where individuals from transportation agencies can readily find coatings information. We have enhanced the system enabling members to set their own password and user ID and fill out individual profile information.

Many of the online forms offered by SSPC have been revised to accommodate newer Internet capabilities and several of the forms are now offered in downloadable PDF format. We also added an Onsite Training request form to enable individuals to bring SSPC training courses to their own facilities. New forms for PCS, NBPI, and PCCP have been added for member convenience. We've also updated the online Tools and Links section and email groups targeting specific market interests.

The number of unique visitors to our site tops 11,964 per month, an increase from last year.

PART IV: MEMBERSHIP AND ADMINISTRATION

Membership

During the reporting period, SSPC organizational membership (OM) grew to 762, an increase of 1%. Individual membership decreased from 8,185 in December 2007 to 8,148 in December 2008, a 0.5% decrease. A breakdown of individual members' demographics is shown in Figure 2 (p.68); however, it remains nearly the same as the previous year. We are pleased with the progress in increased organizational membership in these tough economic times and will continue to push individual membership.

Table 5: Changes in Net Assets (Unaudited)

	Total all Funds	General Operating Fund	Reserve Fund
Unrestricted net assets - December 31, 2007	$3,743,000	$1,888,000	$1,855,000
Change in net assets as a result of current operation	$188,000	$444,000	$<256,000>
Transfer from general operating fund to reserve fund		<$226,000>	$226,000
Unrestricted net assets - December 31, 2008	$3,931,000	$2,106,000	$1,825,000

Bill Shoup addresses Annual Meeting

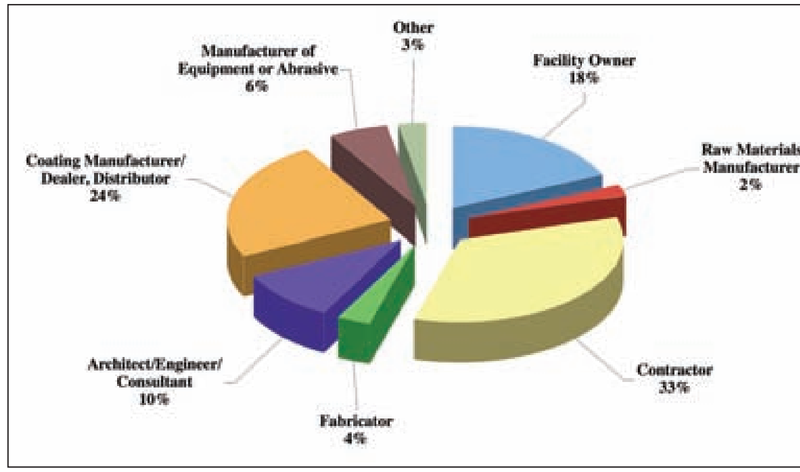


Fig. 2: Individual Membership Demographic

Governance

The Board of Governors changed in 2008. The Board welcomed Mr. Derrick Castle from the Kentucky Transportation Cabinet, Mr. Benjamin Fultz from Bechtel Corporation, and Ms. Gail Warner from Northrop Grumman Shipbuilding-Newport News. All three individuals represent the Facility Owner's demographic. The present Board is shown in Table 2.

Administration

Key staff members remained the same. They are: Bill Shoup, Executive Director; Michael Damiano, Director of Product Development; Barbara Fisher, Controller; Mike Kline, Director of Marketing; and Terry Sowers, Director of Member Services.

PART V: FINANCES

We are pleased to report that SSPC again met its financial goals for the FY, which ended December 31, 2008. The reserve fund now stands at $1,825,000, which represents about 38% of the average annual operating revenue. The surplus is up 1.06% from last year. SSPC has met its financial goals by increasing revenue by $160,000. This was a 3.4% increase from last year. We must be cautious since expenses rose 3%, so they must be managed more closely. As noted previously, the Society is anticipating growth based on the increased interest in training caused by all of our new training programs. The financial details for the last fiscal year and the prior fiscal year are presented in Tables 3 through 5. Those charts demonstrate that SSPC continues to be a financially sound organization and all of our financial indicators and ratios are healthy.

Respectfully submitted:

William L. Shoup, Executive Director

SSPC Submits Position Paper to EPA on Lead NAAQS

In response to the Environmental Protection Agency's reduction of the National Ambient Air Quality Standard (NAAQS) for allowable airborne lead, SSPC's Government Affairs Committee has submitted to EPA a position paper on the potential impact of the change on industrial coating operations, according to Heather Bayne, SSPC's Protective Coating Professional.

Effective January 12, 2009, EPA reduced the allowable level of airborne lead from 1.5 micrograms per cubic meter of air to 0.15 micrograms per cubic meter of air as a rolling three-month average. EPA gave states out of attainment a phase-in period beginning in October 2009. The rule was signed on October 15, 2008 (http://www.epa.gov/air/lead/standards.htm).

The rule was discussed in a January 2009 *JPCL* article, "EPA Tightens Limits on Airborne Lead," Kaelin, pp. 9–13 (online at www.paintsquare.com under "Publications").

Although the tenfold reduction is intended for stationary sources and does not directly include industrial maintenance coating work in the field right now, the change could eventually encompass lead paint removal operations (Kaelin, pp. 9-13).

The SSPC Government Affairs Committee position paper addresses potential effects of the change on industrial maintenance coating work, such as whether current technologies are sufficient to achieve compliance with the new lead NAAQS. For details on the position paper, contact Ms. Bayne at bayne@sspc.org.

2007 Confined Space Proposal for Construction on Hold

Along with most proposed and final regulations not published by January 20, 2009, the day President Obama took office, a proposed rule on confined space work in the construction industry was placed under internal review by order of the President. The Occupational Safety and Health Administration (OSHA) had proposed the rule on November 28, 2007.

In response to an inquiry from *JPCL* about the status of the proposal, Richard DeAngelis of OSHA said, "The Department is currently reviewing all pending regulatory proceedings to determine what action is appropriate under the memorandum issued by the Chief of Staff on January 20, 2009."

The proposed rule for construction called for a step-by-step approach to confined space safety, including assessing hazards, classifying the space in accordance with OSHA criteria, and implementing procedures for protecting workers. The proposal also required contractors who control a job site to coordinate confined space operations among a site's multiple employers.

With the proposed rule now under review, the construction industry will continue to have no comprehensive standard for work in confined spaces. Currently, the most directly relevant construction industry requirements from OSHA for confined space are in 29 CFR 1926.21(b)(6)(i) and (ii) of Safety Training and Education. Section (b)(6)(ii) defines "confined or enclosed space." Section (b)(6)(i) states only that "[a]ll employees required to enter into confined or enclosed spaces shall be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required. The employer shall comply with any specific regulations that apply to work in dangerous or potentially dangerous areas."

OSHA also provides other guidance and regulations that may be enforced on confined space work in construction. For example, the comprehensive confined space rule for General Industry, 29 CFR 1910.146, can be required by a painting or other construction contract. Even though it is not specific to construction work, 1910.146 also can be used as a guideline for good practice by companies in the construction industry. It should be noted that Appendix E (a) (8) of OSHA's Compliance Directive for 1910.146 states that some confined spaces undergoing maintenance would be subject to 1910.146. (Compliance directives outline OSHA enforcement policy for particular standards.)

Editor's Note: Maintenance painting (and other construction) contractors should consult relevant legal, regulatory, and safety authorities about standards and good practice for confined space work.

Some Electronic Resources about Confined Spaces

- Proposed rule, confined space in construction, November 28, 2007: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGISTER&p_id=20174
- Existing Construction Industry rule, 29 CFR 1926.21(b)(6)(i) and (ii), Safety and Education: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10607&p_table=STANDARDS
- OSHA resources for confined space work in the construction industry: www.osha.gov/SLTC/confinedspaces/construction.html
- General Industry rule, Permit-required confined spaces, 29 CFR 1910.146: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9797
- Compliance Directive, CPL-02-00-100, Appendix E (a) (8) (for 29 CFR 1910.146) http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=1582

associations

Coatings Short Course Offered

The University of Minnesota (Minneapolis, MN) will hold a Coating Process Fundamentals Short Course on June 2–4, 2009. The course provides coating engineers with an understanding of the principles of the processes by which liquid coatings are applied and solidified. It is designed for engineers who are engaged in coatings work and wish to have a deeper understanding of the processes and problems.

For more information, visit www.cce.umn.edu/coatingprocess.

Abstracts Invited for ABRAFATI 2009

The 11th International Coatings Congress, part of ABRAFATI 2009 (Associação Brasileira dos Fabricantes de Tintas), has set a May 15 deadline for abstracts for lectures at the Congress, to be held September 23–25, 2009, in São Paulo, Brazil. This year's theme is "The Coatings of the Future."

Abstracts should include a 20- to 30-line summary in Portuguese, English, or Spanish; a title; the author and co-authors' names; and the speaker's name. Entries can be submitted at www.abrafati2009.com.

PRA To Hold Coatings Conference

The PRA will hold a two-day international conference and mini-exhibition May 12–13, 2009, in Birmingham, UK. It will cover the latest innovations in measurement and testing for the coatings industry, as well as papers, and a mini-exhibition showcasing the latest equipment.

For full details, visit www.pra-world.com/conferences.

Two Flash Rust Workshops Scheduled

Twice this summer Dr. Lydia Frenzel will discuss how to inspect flash rust at a workshop titled, "How to Inspect Flash Rust—Practical Solutions for Practical Problems." Both workshops will cover four practical ways to evaluate flash rust in the field. All audience levels are welcome.

The first workshop will be held during MegaRust in Norfolk, VA, on June 8. In addition to addressing flash rust, the four-hour workshop will cover how waterjetting affects surface characteristics and how the method impacts the ideas about surface preparation. Visit www.nstcenter.com for more information on the MegaRust workshop.

The second workshop is on August 18 in Houston, TX, at the WJTA Conference. This workshop is only two hours long, but is part of a full-day workshop on waterjetting. Visit www.wjta.org for information.

ASTM Plans Symposium, Workshop on Structures, Corrosion

ASTM has announced two events on structural integrity and corrosion of steel in concrete structures.

The Ninth International ASTM/ESIS Symposium on Fatigue and Fracture Mechanics will be held May 20–22 in Vancouver, BC, Canada. ASTM International Committee E08 on Fatigue and Fracture and the European Structural Integrity Society (ESIS) are sponsoring the event. The symposium will be held in conjunction with the May 18–19

Continued

standards development meetings.

The symposium will provide a forum to discuss analysis methodologies and testing techniques in the areas of fatigue and facture mechanics to estimate the design and remaining lives of structures.

ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys will hold a day-long workshop, Corrosion Mitigation and High Strength Steel in Concrete Structures, on May 18 in Vancouver, BC, Canada.

Attendees will learn about continuing research in corrosion mitigation and high strength steel as well as the future development of revised and new standards.

Registration for both events is open until May 13. For details, visit www.astm.org.

Langill Receives ASTM Award of Merit

ASTM International (Washington, D.C.) presented Thomas Langill, Ph.D., with the ASTM International Award of Merit and the accompanying title of fellow. According to ASTM, Dr. Langill received the award "for major contributions to the development of corrosion test methods for metals in the atmosphere and for construction materials as well as coated steel hardware standards in Committees G01 on Corrosion of Metals and A05 on Metallic-Coated Iron and Steel Products."


Thomas Langill

Dr. Langill, who joined ASTM in 1994, is secretary of Committee G01 and chairs subcommittees G01.04, Atmospheric Corrosion, and G01.14, Corrosion of Metals in Construction Materials. He is also chair of Committee A05's Subcommittee A05.13, Structural Shapes and Hardware Specifications, and he serves on Committees A01 on Steel, Stainless Steel, and Related Alloys; B02 on Nonferrous Metals and Alloys; D01 on Paint and Related Coatings, Materials, and Applications; and F16 on Fasteners.

Dr. Langill is the technical director at the American Galvanizers Association in Centennial, CO. His work focuses mainly on metal coatings, corrosion control, and material properties, as well as failure diagnosis related to metals and metal coatings. He is a member of SSPC, ASM International, NACE, American Society of Civil Engineers, the American Welding Society, and the Association for Iron and Steel Technology.

ASTM Approves Thermo-Diffusion Standard

The ASTM International Committee A05 on Metallic-Coated Iron and Steel Products has approved a new standard, ASTM A1059/A1059M, Specification for Zinc Alloy Thermo-Diffusion Coatings (TDC) on Steel Fasteners, Hardware, and Other Products. The new standard is under Subcommittee A05.13 on Structural Shapes and Hardware Specifications.

For information, contact Moshe Moked, president of M-Tech Inc. and an A05 member, at moshe@mtechwire.com.

companies

Sto Corp. Names CFO

Sto Corp. (Atlanta, GA) has named Christopher M. Thomas as the new chief financial officer (CFO). Thomas has 13 years of domestic and international experience in corporate finance and accounting.

Thomas has a BS in accounting from Auburn University and a MBA from Emory University. He is also a certified public accountant (CPA) and a certified merger and acquisition advisor.

Sto Corp. is a producer of a broad

range of cladding and coating systems for building construction, maintenance, and restoration.

Eagle Mascot Wins Tank of the Year

The Lake Villa tank, in Lake Villa, IL, was named the winner of the Tnemec Company's 2008 Tank of the Year contest. The tank features the local high school's eagle mascot and logo, thanks to the fundraising of the Lakes Community High School Booster Club.

Courtesy of www.bozellpr.com/tnemec

"The eagle artwork wasn't part of our original contract," said Jim Bowles, superintendent of Sewer and Water for the Village of Lake Villa. "...but then the boost-er club raised money for the upgrade."

The tank has a three-coat exterior that consists of a two-component, zinc-rich primer; an aliphatic acrylic polyurethane intermediate coat; and an advanced fluoropolymer finish coat. The tank's interior was primed and then coated with a fast-curing polyamide epoxy certified to ANSI/NSF 61 for interiors of potable water storage tanks. The artwork was drawn by Kenneth Brend of Jetco, Ltd, who duplicated the mascot by drawing it directly onto the tank in pencil.

Headquartered in Kansas City, MO, Tnemec specializes in industrial coatings for steel, concrete, and other substrates for new construction and maintenance.

Industrial Scientific Achieves ISO Certification

Industrial Scientific Oldham, located in Arras, France, has been certified to the ISO14001:2004 standard, which focuses on how an organization manages its environmental impact and improves its environmental performance.

The certification was issued by AFAQ AFNOR International, a certification body in France, after a three-day audit. The company also achieved renewal of ISO 9001:2000, which it has held since 2001. The standard is for effective quality management and customer satisfaction.

Industrial Scientific manufactures gas detection equipment, software, and services. It has operations in Pittsburgh, PA; Arras, France; Dortmund, Germany; and Shanghai, China.

Barton Group Gets LEED Platinum Honor

The New York State Energy Research and Development Authority (NYSERDA) has announced that the U.S. Green Building Council (USGBC) designated the Barton Group's corporate headquarters in Glens Falls, NY, as LEED® Platinum.

The rating is the highest in the USGBC's system for the world's greenest, most energy efficient, and highest performing buildings. The Barton Group building is the seventh in New York and the 105th in the U.S. to receive the designation.

Barton's headquarters is a renovated three-story brick building dating back to 1865. It has a panelized green roof, a geothermal heating and cooling system, energy-efficient windows, a raised floor system to allow air distribution, and a rainwater collection system.

The Barton Group is the parent company of Barton Mines Company, LLC; Virginia Abrasives Corporation; B-L Holding Company; and Barton International Inc.

JPCL

Certified Coatings Wins Bridge Painting Project

By Brian Churray, PaintSquare

Certified Coatings (Concord, CA) was awarded a contract of $1,194,000 by the California Department of Transportation to clean and recoat structural steel surfaces on the 2,731-foot-long West Branch Feather River Bridge in Butte County. The contract, which required SSPC-QP 1 and QP 2 certification, includes containment of the existing lead-bearing coating system. The steel will be steam-cleaned or pressure-washed, followed by spot-abrasive-blast-cleaning and priming of 10,395 square feet of corroded surfaces. The structural steel will be primed and finished with an aluminum system.

J&A Secures Water Line Rehabilitation Contract

J&A Coating (Hughes Springs, TX) won a contract from the City of Seabrook, TX, to rehabilitate two water line crossings. The rehabilitation includes repairing and recoating 85 linear feet of eight-inch-diameter steel piping and 461 linear feet of 12-inch-diameter steel piping. The piping will be abrasive blast-cleaned to a Near-White finish (SSPC-SP 10) and recoated with a four-coat epoxy-urethane system. The contract, which includes erecting full containment for the coatings work, is valued at $94,656.

Ohio DOT Lets Two Bridge Painting Projects

The Ohio Department of Transportation recently signed two contracts for bridge painting services. APBN, Inc. (Campbell, OH) was awarded a contract of $2,585,948 to recoat a total of 172,550 square feet of steel on eight bridges. Panther Industrial Painting, LLC (Mishawaka, IN) was awarded a contract of $1,513,143.50 to recoat a total of 106,782 square feet of steel on six bridges. The steel on all 14 bridges will be abrasive blast-cleaned to a Near-White finish (SSPC-SP 10) and recoated with an organic zinc-rich primer, an epoxy intermediate, and a urethane finish.

Bridges ‘R’ Us to Recoat Carter Glass Bridge

Bridges ‘R’ Us Painting Company (Campbell, OH) secured a contract of $1,234,567 from the Virginia Department of Transportation to recoat structural steel surfaces on the Carter Glass Memorial Bridge, which spans the James River between Lynchburg and Amherst County. Approximately 1,739 tons of structural steel will be abrasive blast-cleaned and recoated with an inorganic zinc-rich primer, an epoxy intermediate, and a polyurethane finish. The contract includes containment and disposal of the existing lead-based coatings.

Maryland Highway Administration Awards Bridge Coating Contract

The Maryland State Highway Administration awarded a contract of $1,499,000 to K&K Painting (Baltimore, MD) to recoat structural steel surfaces on ten bridges at various locations in Prince Georges County. The project includes full coatings removal and zinc-epoxy-urethane system application on a portion of the steel, as well as moisture-cured urethane overcoating system application on the remainder of the steel. The contract, which required SSPC-QP 1 and QP 2 certification, includes lead-based paint abatement within Class 2A containment structures (SSPC-Guide 6).

Tarpon Industrial Awarded Seven Contracts by Iowa DOT

Tarpon Industrial (Tarpon Springs, FL) was awarded seven contracts with a combined value of $907,250 by the Iowa Department of Transportation to perform abrasive blast surface preparation and coatings application on a total of 16 bridges. The contractor was awarded $69,000 for work on a 324-foot-long by 36-foot-wide bridge over the East Nishnabotna River; $91,400 for work on a 408-foot-long by 48-foot-wide bridge over the West Nishnabotna River; $64,500 for work on a 292-foot-long by 32-foot-wide bridge over the West Nishnabotna River; $239,950 for work on two 523-foot-long by 36-foot-wide bridges and two 408-foot-long by 36-foot-wide bridges over the North Racoon River; $130,000 for work on two 327-foot-long by 36-foot-wide bridges over Indian Creek; $71,400 for work on a 263-foot-long by 43-foot-wide bridge over Mosquito Creek; and $241,000 for work on two 304-foot-long by 36-foot-wide bridges, two 244-foot-long by 42-foot-wide bridges, and two 160-foot-long by 42-foot-wide bridges over the West Nishnabotna River.