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The Voice of SSPC: The Society for Protective Coatings
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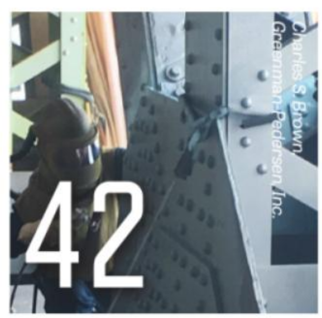
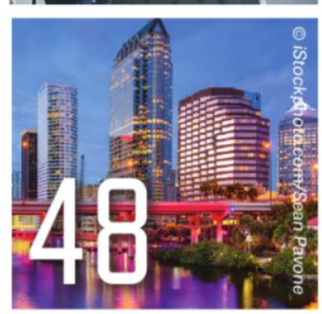
FEATURES





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The Society For Protective Coatings

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SSPC 2017 Registration Now Open

SSPC 2017 featuring GreenCOAT, SSPC's annual conference and exhibition and the only conference dedicated 100-percent to protective, marine, industrial and commercial coatings, will be held at the Tampa Convention Center in Tampa, Fla., from January 30 to February 2, 2017.

Registration for SSPC 2017 is now open. A number of registration options are available for SSPC 2017 attendees and their spouses and guests. For complete information, visit www.sspc2017.com.

A preview of the SSPC 2017 technical program can be found on p. 48 of this issue. Other aspects of SSPC 2017, including training and certification programs, special events and awards and more will also be previewed in *JPCL* in the upcoming months.

Nine New SSPC PCS Certifications Awarded

Nine individuals recently joined SSPC's worldwide base of certified coatings professionals by earning the Society's highest level of certification, the Protective Coatings Specialist (PCS).

The PCS certification recognizes industrial coatings professionals for their extensive knowledge in the principles and practices specific to industrial coatings technology. Each individual has been evaluated for his or her mastery of coating type, surface preparation, coatings application and inspection, contract planning and management, development of specifications and the economics of protective coatings. SSPC congratulates these individuals for their achievements.

The recently certified Protective Coatings Specialists are as pictured. For more information on the PCS certification, www.sspc.org/training.


Alfonso Gamboa, coatings professional (Round Rock, Texas)


Steven Roetter, senior consultant, Corrosion Probe Inc. (Indianapolis, Ind.)


Pitchamuthu K, technical sales executive, Jotun Paints UAE Ltd. (Kuwait)


Tom Schwerdt, chemist IV, Texas DOT (Austin, Texas)


Paulson Chelliah, sales & specification manager, WR Grace (Qatar)


Carlton Catalani, president, Travis Industries, LLC (San Antonio, Texas)


Michael Drsydale, vice president, ADF Industrial


Miralem Kulovic, coating inspector, BP Offshore


Pradeep Kumar Talampally, coating specialist (India)

Waterborne, Water/Wastewater and Waterjetting Webinars Offered in September

jpcl SSPC The Society For Protective Coatings
Webinar Education Series

September will feature three new, free installments of the 2016 SSPC/*JPCL* Webinar Education Series — one focused on troubleshooting waterborne and direct-to-metal (DTM) coatings, one on coating systems for the water and wastewater industry, and one on ultra-high-pressure (UHP) waterjetting in newbuilding.

"Overcoming Performance Challenges with Waterborne Primers and DTM Coatings," will be presented by Lori Boggs, technical team leader, BASF, on Tuesday, September 20 from 11:00 a.m. to 12:00 noon, EDT. This webinar is sponsored by BASF.

Formulation of waterborne coatings designed to prevent corrosion presents many challenges to the coatings formulator. New developments in waterborne resins continue to improve coating performance at reduced VOC levels. The corrosion protection provided by these coatings is highly dependent on proper selection of the resin, solvents, additives and pigments. This webinar will focus on the formulation technique, application and testing of light-duty waterborne primers and DTM coatings. It will include a recent evaluation of additives for improving block resistance and their effect on the salt spray resistance of a DTM formulation. In addition, primer and DTM corrosion performance will be compared using salt spray (ASTM B117) and prohesion (ASTM G85) testing.

Boggs has over 25 years of experience at BASF in automotive and industrial coatings and has spent much of her career observing the spray application of automotive topcoats to determine what rheological measurements can be related to the final color and appearance of the film. She has a Ph.D. in chemical engineering from the University of Michigan, where she studied the mechanism of rheology control of coatings containing microgels.

"Water and Wastewater Treatment Plant Coating Systems," will be presented by Randy Nixon, president, Corrosion Probe, Inc., on Wednesday, September 21 from 11:00 a.m. to 12:00 noon, EDT. This webinar is sponsored by CHLOR*RID International, Inc. and will provide performance requirements for coatings and linings used on sound concrete substrates in principal service environments of areas of a municipal wastewater treatment facility, including the following.

- Collection systems (manholes, lift stations, pump stations, tunnels and interceptors).
- Preliminary treatment systems (grit chambers, headworks and screening structures).
- Primary treatment systems (sedimentation tanks and primary clarifiers).

Lori Boggs

Randy Nixon

Nuno Cipriano

- Secondary treatment systems (aeration basins, secondary clarifiers, chlorine contact chambers and oxygenation chambers).
- Advanced treatment systems (filtration units).
- Solids handling areas (digesters and dewatering structures).
- Chemical storage: secondary containment structures.

Nixon is the founder of Corrosion Probe, Inc., which has been in business for over 30 years and offers corrosion and materials engineering, consulting, testing and inspection services. He has over 35 years of experience in the industry and has published over 60 technical papers and articles through SSPC, NACE, WEF, AWWA and TAPPI. Nixon is widely recognized in the water and wastewater industry for his expertise and extensive experience in piping corrosion, concrete degradation evaluation, protective coatings and linings, and overall materials performance.

"UHP Waterjetting and Surface-Tolerant Coatings in New Building Applications," will be presented by Nuno Cipriano, partner and technical consultant, Narus Auditoria & Consultoria on Wednesday, September 28 from 11:00 a.m. to 12:00 noon, EDT. This webinar is sponsored by NLB Corp.

After about 20 years of research and development, the use of wet surface-tolerant coatings is well-established, allowing the expansion of waterjetting facilities into both maintenance and new building shipyards. The presenter will share his experience from over a decade using ultra-high-pressure hydroblasting and wet surface-tolerant coating for the Brazilian petroleum corporation Petrobras on several projects around the world.

Cipriano has over 10 years of experience in newbuilding and ship repair as a paint inspector on Petrobras projects in Singapore, China, Brazil, Bahrain, Dubai, Vietnam, Portugal and Italy. He holds a Bachelor's degree in chemical engineering from the Instituto Politécnico de Lisboa and a post-graduate qualification in project management from the Instituto Superior de Gestão.

Tarp Fire Closes Pittsburgh Bridge

A major bridge under renovation in Pittsburgh was shut down immediately following a fire that broke out on Sept. 2, putting the structure at risk of collapse.

The 88-year-old Liberty Bridge, a heavily traveled route over the Monongahela River connecting downtown Pittsburgh with its southern suburbs, caught fire at about 1:00 p.m. in a construction tarp used as containment for the painting operation and spread to plastic piping, according to Steve Cowan, a spokesman for the Pennsylvania Department of Transportation (PennDOT).

Photo: twitter.com/IannottiRalph

Although the exact cause of the fire is under investigation, a spark from equipment is thought to have ignited a tarp used for containment, the *Pittsburgh Post-Gazette* reported. No one was injured in the incident, but officials from PennDOT indicated that heat from the blaze caused a 30-foot beam, or compression chord, to buckle.

If not replaced, the beam could fail, putting the whole structure at risk, PennDOT Executive Director Dan Cessna told the local paper. "The bridge would be at risk for catastrophic failure," Cessna said. The damaged chord required a thorough inspection and around-the-clock monitoring, PennDOT said in a statement issued Sept. 3.

The bridge has been undergoing an $85 million rehabilitation that includes cleaning and recoating of all structural steel surfaces on the bridge and approaches. Joseph B. Fay of Tarentum, Pa., was awarded the contract in October 2015. Fay subcontracted the coating work to Avalotis Corporation of Verona, Pa. Work began in the spring.

Cessna noted that sparks would have been emitted as workers were cutting steel and using blowtorches, adding that as part of its investigation the agency would determine whether the tarp should have been fireproof. "That's something that we need to investigate," he said. "I've been doing bridge repairs for 25 years, and I've never seen anything like this."

By Sept. 4, PennDOT officials revealed that they believe the bridge was just "minutes away" from collapsing, if the fire, said to have reached temperatures exceeding 1,200 degrees F, had not been extinguished when it was.

PennDOT district bridge engineer Lou Ruzzi explained to the *Post-Gazette* that the fire had shrunk the beam, which put it 6 inches out of place and increased pressure on the remaining chords supporting the bridge. Describing the deformation as an "S shape," Ruzzi noted that when a steel element like this is no longer straight, stabilizing forces are redirected through other elements of the bridge. "The worst-case scenario was the whole section could fall," he said.

Since the fire, PennDOT engineers and inspectors worked with staff from Fay, consultant engineers and inspectors from SAI Consulting Engineers Inc., HDR Inc. and Michael Baker International, as well as faculty and research staff from Lehigh and Carnegie Mellon Universities, on investigating, stabilizing, inspecting, designing and preparing for the repair of the Liberty Bridge, Cessna said.

At a news conference Sept. 4, PennDOT revealed its plan includes installing a plate over the damaged section and creating a strut to allow installation of a new beam on both sides of the weakened chord. "We will ultimately be jacking the bridge to redistribute that load correctly back off of that damaged support," Cessna said. The costs of the repairs will be covered by Fay's insurance company and not taxpayer dollars, Cessna noted. Fay faces more than $200,000 in fines per day that the bridge is closed.

Registration, CEU Credits

These programs are part of the SSPC/*JPCL* Webinar Education Series, which provides continuing education for SSPC re-certifications and technology updates on important topics. SSPC is an accredited training provider for the Florida Board of Professional Engineers (FBPE), and Professional Engineers in Florida may submit SSPC Webinar Continuing Education Units to the board. To do so, applicants must download the FBPE CEU form and pass the webinar exam, which costs $25. Participants will also be eligible to receive credits from SSPC. Register for these online presentations at www.paintsquare.com/webinars.

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NASA Thinks Pink with Pressure-Sensitive Paint

(Aug. 18)

Hot pink is not a color most people would associate with the National Aeronautics and Space Administration, but it happens to be the hue of a special paint the agency relies on when it comes to understanding performance characteristics of a new aircraft design.

For the past 25 years, NASA engineers have used a bright pink pressure-sensitive paint (PSP) on models being tested in wind tunnels.

With the information collected through the use of PSPs, NASA hopes to identify new aircraft designs that could cut fuel use in half, pollution by some 75 percent and noise to nearly one-eighth of what it is today, the agency explains.

When it comes to reading how pressures are distributed across a surface in a wind tunnel, PSP has an advantage over traditional methods, such as pressure taps, because it takes up much less space.

When prepping a model for wind tunnel testing, engineers spray it with a thin coat — about one-and-a-half thousandths of an inch thick — of the special paint and allow it to dry, NASA says.

As air flows across the model in the wind tunnel and different surface areas experience a range of air pressures, blue LED lights stimulate molecules known as luminophores within the paint, causing them to fluoresce, or shine.

Because of the paint chemistry, oxygen molecules "quench" the luminophores and allow NASA to interpret the distribution of pressure. High-pressure areas have more oxygen, which causes the pink to have a dimmer glow in that area. Lower-pressure areas have less oxygen, so the pink shines brighter.

The camera captures the difference in fluorescence, and the black-and-white images are then used for analysis. The intensity of the different shades of gray are converted to a color scale indicating the varying pressure levels.

PSN TOP 10 *(as of Aug. 31)*

1. Painter Dies Following 50-Foot Fall
2. Snooper Truck Tip Leaves Workers Stranded
3. Trump's Huge Plan for Infrastructure Spending
4. Bridge Painter Faces Multiple Charges
5. Feds Say 7 Duped $350M from Government
6. Footage Captures Tappan Zee Progress
7. Paint Used as Sealer Exposes Scheme
8. CA City Bans Use of Galvanized Pipes
9. Engineers Study Bridge Failure
10. SCDOT Workers Face Corruption Charges

STUMPER OF THE MONTH

(PaintSquare Daily Quiz, Aug. 3)

What name is sometimes given to a coating system composed of galvanizing together with an organic coating?

Galvalume system	7.0%
Organozinc system	11.0%
Hot dip-cold spray system	7.0%
Duplex system	75.0%

Answer: Duplex system.

About the Answer: Duplex systems are often good choices for very long-term corrosion protection, according to the *JPCL* article, "How To ... Prepare Hot-Dip Galvanized Coating Surfaces for Painting."

On Defects in Epoxy Midcoats Applied over Zinc-Rich Primers

WHAT CAUSES BUBBLING OR CRATERING OF AN EPOXY INTERMEDIATE COAT WHEN APPLIED OVER AN EPOXY ZINC-RICH PRIMER?

Om Prakash Jat
Tech International
The cause is most often solvent entrapped in the primer film. During the curing process, solvent is evaporating through the paint film, which is the main cause of blistering and bubbling. This defect can also occur if the surface is contaminated.

Thomas Elsbernd
Army Fleet Support
The most likely cause is solvent popping due to trapped solvent under the partially cured paint film. This becomes prevalent when applying a thick layer of product that causes a skim to form on the surface, entrapping solvent pockets underneath. As the pressure builds, the solvent escapes, producing a ballooning of the surface. As the solvent dries, it leaves a weak film that is easily crushed by touching. It can also cause craters if the solvent pressure is enough to clear the surface tension, punching holes in the surface of the coating.

Charles S. Brown
Greenman-Pedersen, Inc.
The main cause is solvent entrapment from applying the intermediate coat before the zinc primer has cured. One of the most critical aspects of applying any coating is to review and understand all the information presented on the paint manufacturer's product data sheet prior to application. This will help to eliminate these kinds of problems.

Dwight Weldon
Weldon Laboratories
First of all, it should be recognized that bubbling and cratering are two different things. In fact, visually, they are virtually the opposite of one another. It is well known that coatings, such as the epoxy mentioned in this question, can pinhole when applied over inorganic zinc-rich primers. This is because inorganic zinc primers, with their very high loading of zinc dust, tend to be somewhat porous. This allows both air and perhaps moisture to be trapped in the pores. When a relatively viscous, high-solids coating such as an epoxy is applied over such a surface, it will flow into the porosity of the primer and try to displace the air and/or moisture. The most common problem associated with this is pinholes in the intermediate coat, although perhaps under certain conditions of temperature and humidity, it might be possible for bubbles to form. This is usually avoided by applying a thin mist coat of the intermediate (usually by thinning the epoxy). Not only can this thin coat of low-viscosity material more effectively displace the air/moisture in the zinc primer, but because it is of low thickness, the air/moisture can more readily escape through it. Furthermore, being of low viscosity, it can flow out and "heal" any pinholes that might have been formed by the escaping air/moisture. While the above phenomenon is somewhat common for inorganic zinc-rich primers, it is much less so for epoxy zinc-rich primers. This is because epoxy zinc-rich primers tend to contain significantly less zinc dust than do the inorganic variety, and hence are less porous.

On rare occasions, it is possible for solvent trapped in a lower coat to cause bubbles or blisters in an upper coat, if the upper coat has been applied too soon. This is very dependent on the chemistry of the two coatings, the application parameters and the environmental conditions. However, under most circumstances, the solvent from the lower coat will very slowly migrate out of the coating system over time, without causing bubbles.

Part of the reader's question involved cratering. If actual craters are occurring, as opposed to bubbles or voids, this is almost always due to some form of low surface tension contamination on the surface of the primer. For one coating to wet and flow over another, the surface tension of the applied coating must be equal to or less than the surface tension of the lower coat. Minute amounts of low surface tension contamination (oils and silicones come to mind) on the surface of the primer will prevent this, leading to craters.

Post your problems and solutions at www.paintsquare.com/psf

HOW TO PROPERLY MONITOR TEMPERATURE AND HUMIDITY ON AN INDUSTRIAL COATING PROJECT

By Don J. Schnell, Polygon US

Since dehumidification was first introduced to our industry three decades ago, many articles, white papers and presentations that approach the subject from different directions have been produced. Consequently, there is confusion and misconception surrounding the measuring of temperature and humidity on an industrial coating job site. This article will attempt to clarify and simplify these monitoring practices by review of the most common questions and the most misunderstood concepts.

WHAT IS THE DIFFERENCE BETWEEN DEW POINT TEMPERATURE AND RELATIVE HUMIDITY AND WHY IS THIS IMPORTANT TO MEASUREMENTS?

Relative humidity (RH) is the most common and the least useful concept when discussing humidity measurements. Relative humidity is *relative* to temperature. The warmer the air, the more capacity it has to hold moisture. RH is expressed as a percentage: the moisture in the air as a percentage of the moisture the air could hold at that temperature. As air heats up in the morning, its capacity to hold water increases and the RH goes down.

Conversely, when air is cooled, its capacity to hold moisture goes down and the RH rises. If the air continues to cool, the RH will eventually be 100 percent as the air cannot hold any more moisture at that temperature. The air has then reached its dew point temperature. If the air is cooled below the dew point temperature, some of that moisture must leave the air because it's already at 100-percent RH (holding all the moisture that it possibly can), or as we say in psychrometrics, the air is saturated.

So where does the moisture go when we cool the air below the dew point temperature? It goes to any convenient surface. In the atmosphere, it accumulates on particles of dust to form droplets that eventually fall as rain. At a coating project job site, the convenient surface can be a tank roof or any cool object.

That said, RH is virtually meaningless when taking job site condition readings. What *is* important is the dew point temperature. Dew point and surface temperature readings are the only readings necessary to determine if surfaces are condensing or if your blast will turn.

RH is an important factor, but not as far as measurements are concerned. If the dew point temperature is far enough above the surface temperature, the RH at the surface will be acceptable.

WHEN MEASURING AND MONITORING CONDITIONS ON THE JOB, WHAT IS MOST IMPORTANT AND WHY?

To answer this question, it should be understood that there are three primary reasons why we are concerned about temperature and humidity.

1. Preserving a freshly blasted steel surface or "holding the blast."
2. Preventing condensation from forming during coating application and cure.
3. Maintaining proper temperature and at times, humidity, for coating application and cure.

In all instances, surface temperature is critical to these measurements. To avoid condensation or flash rusting, remember that coating applied to a surface *and* the air adjacent to that surface assume the temperature of the surface. Therefore, air temperature itself is quite insignificant.

The relationship between dew point temperature and surface temperature will reveal whether condensation is possible and whether or not the blast is preserved.

As an example, if the surface of the steel is 50 F and the dew point temperature surrounding the steel is 40, the relative humidity at the surface is 68 percent, regardless of the air temperature. This is important because corrosion accelerates above 50-percent RH so there is a risk here of losing the blast. If the sun warms the steel to 70 F, the RH at the surface drops to 33 percent. The blast is now being preserved. At night, the steel loses its heat to the atmosphere and the surface temperature could drop below 40 degrees. Condensation will begin to be visible at this point as the surface drops below the dew point temperature.

WHAT ARE THE MOST EFFECTIVE INSTRUMENTS AND HOW SHOULD THEY BE USED?

Because we're primarily concerned with dew point temperature and surface temperature, accurate instruments are necessary to measure both. The most common instruments traditionally used include the sling psychrometer and the magnetic surface thermometer.

Measuring Dew Point: Sling Psychrometers

The sling psychrometer is a hand-held device that is used to determine humidity in the air. It holds two thermometers and measures the dry-bulb temperature and the wet bulb temperature. With these two readings, the user can determine the dew point temperature as well as the RH.

One of the thermometers has a cotton wick over the bulb at the base. Before use, this wick is wetted with clean, distilled water that is close to the dry bulb air temperature. The user then spins or "slings" the thermometer in the air, getting air to pass over the wetted wick at an adequate velocity to cause maximum evaporation. This evaporation cools the wick, and consequently the thermometer, which then reads the wet-bulb temperature.

The most accurate wet bulb reading is the lowest reading — not the average of multiple readings — taken at the point where maximum evaporation is occurring, just before the temperature begins to rise again. It is impossible to get a wet bulb reading that is too low on a sling psychrometer if it's used properly and the thermometers are accurate.

These devices also have a convenient sliding scale that reveals the RH when the dry bulb and wet bulb temperatures are aligned. To determine the dew point one can use a table or psychrometric chart and there are smartphone apps available too.

The two most common mistakes made with the sling psychrometer are using dirty water to wet the wick and failing to choose the lowest wet-bulb reading. As stated earlier (but worth repeating), the wet-bulb reading cannot be too low. Moisture can only evaporate so fast and therefore the wetted bulb can only get so cold from the evaporation.

Dirty water or a dirty wick will slow the evaporation, causing the wet bulb reading to be higher. Spinning the device too slowly can also decrease the rate of evaporation and cause an inaccurate reading.

Regarding calibration of sling psychrometers, the author asked consultant and respected humidity expert Mickey Lee if one should, or could, calibrate a sling psychrometer. "In almost all cases, they do not need to be calibrated. If it is a good thermometer when it was made, it will be accurate years from now and does not drift. It's pure physics. The only time it may not be accurate is if the temperature scales are printed on the mounting instead of being printed on the individual thermometer itself. On the less expensive model, the thermometer may loosen over time and move in the holder and the readings could be off. All good sling psychrometers will have the scale on the tube itself and therefore would never need calibrating."

Measuring Dew Point: Digital Psychrometers

More often today we are seeing handheld electronic devices — digital psychrometers — used to measure temperature and humidity. These are simple to use and can be very accurate when calibrated. Some have surface temperature probes as well, allowing the user to view the dew point and surface temperatures on a screen. The sensors on these devices are quite durable; however, extreme RH (high or low) or dirt can throw them out of calibration. These tools may cost a little more but they take much of the mystery out of condition monitoring.

Calibration of digital psychrometers is key to their accuracy and effective use. The author's company regularly calibrates each of its units against a benchmark device that is located at the company's quality control center. This particular device is referred to as a portable transfer standard and it attains National Institute of Standards and Technology (NIST)-traceable calibration annually. Also once a year, this benchmark device is sent to a third-party calibration laboratory to be calibrated with NIST-traceable certification. In the field, however, the sling psychometer is often used for spot calibration of digital psychrometers.

Measuring Surface Temperature

For surface temperature readings, the magnetic thermometer is an option. It's a simple bi-metallic dial thermometer with magnets on the back to hold it close to the metal surface.

In recent years, infrared guns have also become quite popular. They are accurate, fast and have become very affordable.

conditions or employ monitoring and alerts when conditions are out of spec. There are devices available that will monitor and record surface temperature, dry-bulb temperature, dew point and even equipment performance at the job site. These devices also transmit this information to a website and relay alarms when conditions deteriorate or when climate-control equipment fails. These remote monitoring devices can be valuable on projects when the following conditions exist.

- The schedule is critical and it is important to know that the blasted surfaces are being preserved.
- Additional documentation of conditions during application or cure is desired.
- The job site is left unmanned for extended periods of time.
- Documentation of dehumidification or temperature control equipment performance is required.

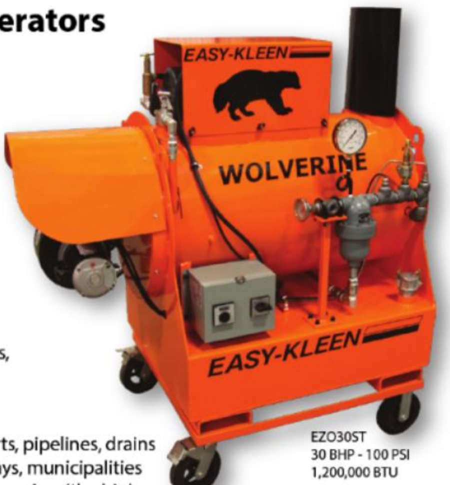
CONCLUSION

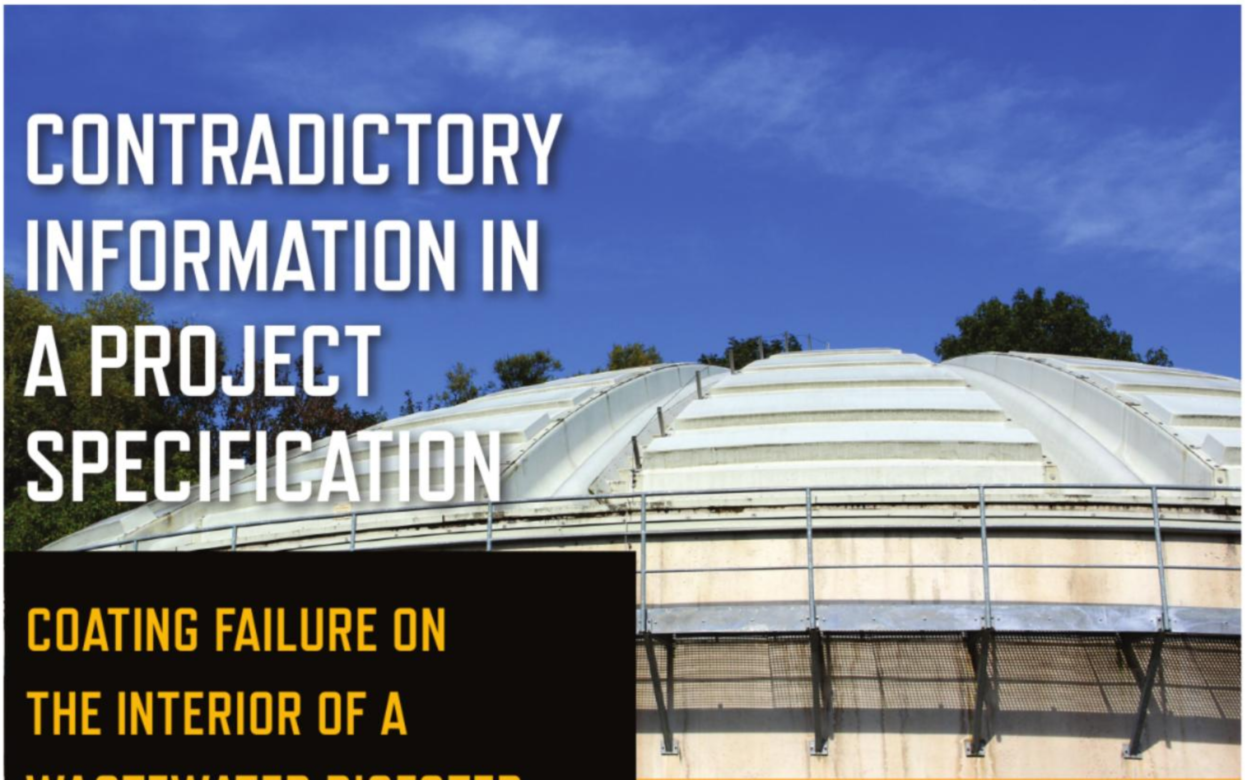
Monitoring climatic conditions effectively at a coating project job site can mean the difference between success and coating failure. Knowing what to measure and when, as well as what equipment to use and how to use it are key.

ABOUT THE AUTHOR

Don Schnell has rejoined the company where he began his career in the climate control and restoration business. As regional sales director for the eastern region of the U.S. for Polygon US (formerly Munters Moisture Control Services), his focus is the construction drying business in the eastern region of the U.S. Schnell has worked in the climate control and industrial coatings businesses for over 30 years. He attended North Dakota State University and is involved in multiple professional organizations including the Society for Protective Coatings (SSPC), NACE International, Construction Specifications Institute (CSI) and Property Loss Research Bureau (PLRB).

The author would like to acknowledge Mickey Lee (mlee@munters.com) and Loyd Krueger (loyd.krueger@polygongroup.com) for their contribution to this article.





CONTRADICTORY INFORMATION IN A PROJECT SPECIFICATION

COATING FAILURE ON THE INTERIOR OF A WASTEWATER DIGESTER

BY CHRISSY M. STEWART, PCS
SENIOR CHEMIST, KTA-TATOR, INC.

All photos courtesy of KTA-Tator, Inc.

The wastewater industry poses some of the most significant corrosion protection challenges for industrial protective coatings. In this case study, coating failure in the form of peeling and delamination (on concrete) and blistering (on steel) was observed on the interior of a digester at a wastewater treatment facility after only five years of service. Removal of sludge from the digester revealed disbonded pieces of coating, which alerted the facility owner to the failure. Due to the relatively short period of coating performance and the importance of a properly protected substrate, an investigation into the cause of the premature coating failure was undertaken.

The digester consisted of a concrete shell with a steel skirt plate situated at the top of the shell. A steel dome was attached to the skirt plate. The specification indicated that the operating temperature of the digester ranges from 95-to-131 F, and that a single coat was to be applied at a dry film thickness (DFT) of 125 mils on the concrete and 60 mils on the steel substrates. The specification listed several polyurethane coating materials that were deemed suitable for this environment. The coating selected for installation was one of the materials listed in the specification. The manufacturer's product data sheet (PDS) listed a maximum service temperature of 120 F for immersion service and 180 F for dry conditions.

Because the contents in the digester were composed of sludge from a wastewater treatment plant, the environment would be considered immersion. The sludge included a mixture of organic and inorganic solids, grit, grease, scum and industrial solvents. Reportedly, small quantities of hydrogen sulfide, hydrogen and nitrogen gases were likely to be present as well. The design engineer for the digester reported that the contents were uniformly mixed to maintain consistent pH and temperature throughout the digester. Since the time that the selected coating material had been applied, the pH readings were reasonably close to 8 and the temperature ranged from 122-to-126 F.

SITE INVESTIGATION

The investigator was granted access to the digester approximately two months after failure of the coating was first recognized. The investigation consisted of visual assessments, adhesion tests and sample collection for laboratory analysis. The investigation was performed from accessible areas on the floor of the digester and from scaffolding. The floor had deep troughs, so the investigation of the concrete shell was limited to the peak of the troughs. Scaffolding was erected to investigate the condition of the coating on the roof and skirt plate.

Fig. 1: Cross section of sample removed below operating level.

The coating material above the operating level on the steel substrate was pale yellow, smooth, glossy and tough. The coating material, which was white upon original application, was extremely difficult to cut into with a utility knife. Adhesion was evaluated in these areas according to ASTM D6677, "Standard Test Method for Evaluating Adhesion by Knife" and was rated excellent (10).

In stark contrast, the areas below the top of the operating level on the concrete shell were amber or brown in color, had a somewhat rough appearance and exhibited reduced gloss, creating a matte appearance. The amber or brown coloration of the coating indicates a more extreme case of discoloration noted in the pale yellow coating observed above the operating level. When the coating in this area was cut with a utility knife, it fractured along the cut and was more brittle than tough. The majority of the adhesion tests performed below the operating level revealed poor results. The coating exhibited a cohesive break within itself leaving a layer of coating on the concrete substrate.

There was significant coating delamination along horizontal bands on the concrete shell that appeared to correspond with various operating levels of the digester. When these delaminated areas were examined, they typically revealed a thin delaminating layer, with a heavier intact white, rough layer remaining on the concrete. The coating was white when installed, indicating a relatively recent cohesive break. Two areas were examined at existing delamination locations. The top surface of the coating material in these areas appeared to have discolored to a brown shade while the material just under the top exposed surface of the coating was much lighter in color.

Nine knife adhesion tests were performed on the coating applied to the concrete substrate, and eight of the nine tests revealed poor adhesion. Six of the eight areas where poor adhesion was observed revealed a break within the coating layer itself. Two of the eight failing adhesion tests revealed a separation between what appeared to be two layers of white coating, suggesting that multiple coats had been originally applied to this area.

To observe the condition of the substrate, the investigator attempted to remove the coating which proved difficult, reinforcing previous findings that the bond between the coating and the substrate was strong.

The coating on the steel skirt plate had a pale yellow appearance above the operating level as previously mentioned, and was amber or brown in color below the top of the operating level, similar to the changes in color of the coating applied to the concrete. Approximately 70 percent of the coating on the steel surfaces below the operating level on the skirt plate was blistered or delaminating. There was fluid present in some of the blisters. In contrast to the areas examined on the concrete substrate, the cohesive separation of the coating occurred close to the substrate and left a thin layer on the steel. The coating was removed and the steel substrate was examined. The surface profile depth was measured and conformed to the coating manufacturer's recommendations. Representative failing and non-failing samples were removed. Additionally, samples of the fluid present in the blisters on the steel skirt plate were obtained and all samples were submitted for laboratory analysis.

LABORATORY INVESTIGATION

Detailed microscopic examination was performed to determine the number and thickness of the coating layers, as well as to look for the presence of contamination or other objectionable properties.

The microscopic examination revealed that the samples obtained from the areas with the concrete substrate consisted of one-to-three coating layers, while the samples obtained from the steel substrate revealed only one coating layer. In some cases, it is difficult to determine if more than one coating layer is present, which is common when the same coating material is applied in successive layers.

Samples obtained from the concrete shell containing the entire coating system were approximately 120 mils thick. The specification required a film thickness of 125 mils on concrete, so this sample was slightly below the specified thickness range. Conversely, the specification required a film thickness of 60 mils on steel. The samples that were obtained from the skirt plate were in the range of 78-to-100 mils thick, which is 30–to-60 percent higher than specified.

Examination of the cross-sections of samples from below the operating level revealed that the discoloration present on the surface of the sample chips penetrated the coating depth by a few mils (Fig. 1, p. 21). The cross-section of a sample obtained above the operating level showed a consistent appearance in color and gloss throughout with the pale yellow discoloration appearing only on the surface (Fig. 2, p. 24).

Fourier transform infrared spectroscopy was performed to determine if the samples collected in the field were chemically consistent with the laboratory-prepared control sample of the material selected from the listing in the specification. Considering the exposure to digester sludge, and the fact that the coating material was exhibiting a cohesive break (within itself), both the top and bottom surfaces of the delaminated sample chips from below the operating level on the concrete shell were analyzed.

The spectra of the bottom surfaces of the sample coating chips were chemically consistent with a urethane material, and more specifically were consistent with the laboratory-prepared control sample that had been selected from the list of products in the specification for the project. These results confirmed that a different coating was not substituted for the specified material.

However, the analysis did reveal that there were wide variations in composition within the same sample, depending on the depth at which the coating was sampled for analysis. The infrared spectra obtained from the top surface of the coating appeared to have stronger bands associated with pigment materials than those associated with the resin. This was particularly noticeable when compared with the spectra obtained of the bottom surface of the sample chip, where the bands associated with resin were much stronger than those associated with pigment. When changes in band strength like this occur, it frequently indicates a breakdown of the chemical composition of the coating.

The samples of blister liquid obtained from the blistered coating on the skirt plate were collected using syringes and deposited in sealed septum vials during the on-site investigation. If any solvents were present in the blister liquid, they could be identified using gas chromatography-mass spectroscopy (GC-MS). The analysis revealed the presence of solvents in the blister fluid, which were consistent with solvents listed on the safety data sheet (SDS) for the coating material used.

SUMMARY OF THE SITE INVESTIGATION AND FORENSIC EVIDENCE

The coating failure observed in the wastewater digester manifested itself primarily as intra-coat delamination on the concrete shell, along with delamination due to blistering on the steel skirt plate. The failures were occurring at or below the operating level and the coating present above the operating level was intact and showed no signs of deterioration.

Microscopic examination of disbonded coating indicated that the thickness was slightly below the appropriate range in the concrete shell area of the digester; however, it was 20-to-40 mils thicker on the steel skirt plate than was recommended by the manufacturer. Blistering was predominant

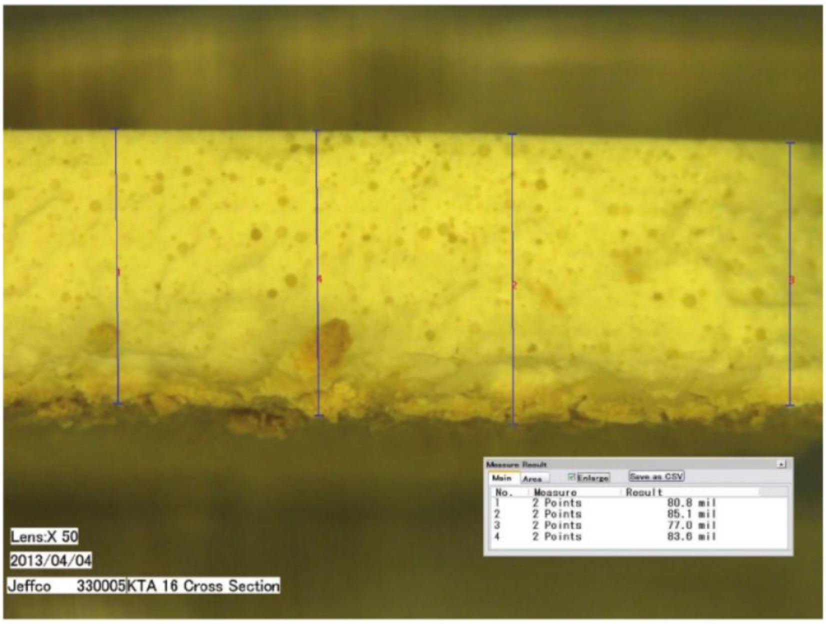


Fig. 2: Cross-section of sample removed above operating level.

in this area at or below the operating level. The actual operating temperature range of the digester (122-to-126 F) was a few degrees above the immersion service temperature limitations listed on the PDS (120 F). The brown discoloration on the top surface penetrated a few mils through the cross-section of the coating, indicating that it was not simply surface staining.

Infrared spectroscopic analysis revealed a difference in the composition of the coating based upon the depth at which it was sampled. The lower portion of the coating cross-section (portion protected from direct contact with the sludge) maintained its composition and exhibited the characteristics of the control material more so than the portion of the coating in direct contact with the digester contents.

The solvents detected in the blister liquid were consistent with those listed on the SDS for the coating applied. The excessive coating thickness noted in the areas with the most severe blistering likely led to solvent entrapment and blistering of the coating.

CONCLUSION

The specification indicated a digester operating temperature of 95-to-131 F and listed a product as "acceptable for use" even though the coating manufacturer indicated it was only able to maintain its properties to 120 F in immersion, a full 11 degrees lower than the maximum operating temperature listed in the same specification.

Though the thickness may have been excessive and led to blistering of the coating in the skirt plate area, the thickness of the coating was only slightly below the recommended range in the concrete shell area, yet delamination, discoloration, loss of gloss and other changes in performance characteristics were observed. The poor performance of the coating in this area indicated that the failure was primarily related to inadequate material properties for this service environment. Due to the severity of the deterioration, complete removal and replacement of the coating was recommended. Laboratory testing (one-sided cell, per ASTM D6943 or NACE TM0174) using actual samples of sludge from the digester and maintained at the maximum operating temperature would help to screen potential coating system candidates prior to full-scale installations.

ABOUT THE AUTHOR

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COATING EVALUATION PROCESS FOR MUNICIPAL MANHOLES

BY BOB MURPHY, SHERWIN-WILLIAMS PROTECTIVE & MARINE COATINGS

Images courtesy of The Sherwin-Williams Company.

From its origin, the word "manhole" had nothing to do with sewers. The original use came from the days of sailing ships to denote access points between a ship's decks. Later the term was used to describe sewer access points due to the similarity of providing access for a human to move from one level to another — in this case from street level to the

Fig. 1 (Left): For manholes facing more aggressive service environments, it is advisable to apply a protective lining material as a topcoat to mitigate the effects of corrosion on the restored surfaces.

Fig. 2 (Below): Corrosive gases and liquids inside manhole structures cause concrete to break down and steel to corrode, potentially creating leaks and subjecting sanitary collection systems to unwanted water infiltration that further taxes the systems.

sewers underneath for maintenance. In the United States alone, an estimated 20 million of these access points dot roadways, sidewalks, fields and other areas. Evaluating and estimating the service life of these structures has become of critical importance to the overall operation of sewer collection systems.

Manholes are subject to deterioration due to the presence of corrosive gases, liquids and soils, as well as soil movement, traffic loading and other factors. Hydrogen sulfide (H_2S), or sewer gas, builds up within the structure, turning into sulfuric acid (H_2SO_4) that eats away at concrete and brick mortar, corrodes steel and compromises the integrity of the structure. Manholes also face an additional problem that is often overlooked — the infiltration and inflow of ground and storm water. The influx of this added water greatly reduces the service life of these structures, subjecting them to higher amounts of corrosion and wear

Fig. 3: Spraying and hand-troweling a stand-alone calcium aluminate mortar has proven to be a sufficient long-term repair for manholes not subjected to significant corrosive attacks.

and tear. Much to the chagrin of municipalities, this water influx also increases the amount of water that needs to be treated, which often means increasing the size and cost of wastewater treatment plants.

Over the past decades, a wide array of coating technologies and manhole structure materials have been developed and brought to market to extend the life of manholes. This includes coatings ranging from cement mortars and epoxies to polyurethane and plastic technologies. Construction materials have ranged from brick and mortar to precast cement and rigid plastics as well. New coating technologies that can aid in the overall protection of manhole structures and collection systems are also emerging, giving municipalities hope for improving manhole service lives and reducing maintenance costs. Bringing these coatings to market can take an average of five years and cost in excess of millions of dollars to perform testing protocols that simulate the aggressive environment found in today's sanitary sewer systems.

Municipalities are doing their part to assist in the evaluation process by subjecting new manhole coating technologies to real-world applications in the field. These tests help to verify whether or not the coating can perform as expected outside a lab environment. Field-testing can also influence a city's maintenance protocols based on the performance of the coating technology. That's exactly what happened for a city in the southwestern United States when it evaluated the performance of a mortar and epoxy lining system compared to a stand-alone calcium aluminate mortar in two separate manholes. This article will outline the city's evaluation process and describe how the results influenced city officials to reduce requirements for relining all manholes with epoxy protective coatings.

EVALUATING MANHOLE MAINTENANCE SYSTEMS

The southwestern U.S. city had been using a simulated exposure test for its coating evaluations. Maintenance personnel would apply a proposed coating to a prepared eyebolt that was screwed into the wall of a representative manhole structure. Personnel would then monitor the eyebolt sample for one year. If the coating protected the eyebolt, it was approved for installation in the city's manholes. While the author applauds the effort to evaluate the coating in a "real-world" environment, a steel eyebolt is not the typical substrate found in a manhole structure, and the corrosive attack on the eyebolt could, in fact, be minimal.

To enhance testing procedures, the city received a proposal to prepare and coat two manholes that had different service environments and levels of wear. The first structure had significant attack of the concrete substrate, while the second manhole had just a slight degradation of the substrate. For the first manhole, crews would power-wash the structure down to a clean concrete substrate, apply a microsilica mortar to bring the surface back to an even plane, and then apply 80-to-100 mils of a 100-percent-epoxy coating to act as a barrier between the substrate and the environment. For the second manhole, they would power-wash the structure and apply a calcium aluminate mortar at a nominal thickness of ½-inch-to-1-inch, without applying a protective topcoat. Skipping the topcoat was a break from the city's existing specification protocol, which required the application of a protective topcoat when rehabilitating any manhole.

The goals of the separate protocols were twofold: first, to perform a real-world test of the epoxy coating in the first manhole; and second, to demonstrate that not all manholes need to be coated with a protective coating when restored. If the latter demonstration rang true, the city could reconsider its manhole maintenance specification protocol.

PERFORMING MANHOLE MAINTENANCE — DAY ONE

Commencing the two-day maintenance project in November 2012, the crew started the day with a safety meeting to discuss the project and the various hazards they may encounter. Though this was a relatively lightly travelled city street, the crew placed traffic barricades to provide an adequate area to complete the maintenance work.

Starting with the first manhole, personnel pressure-washed the surface to be repaired and coated using clean potable water at a pressure of 5,000-to-9,000 psi and a circular tip. This process cleaned the surface and removed any loose concrete. Due to the aggressive nature of corrosion on this particular structure, the crew removed and cleaned the degraded concrete to a depth of 2 inches. The resulting area was free from visible contamination and had an average surface pH of 9. The crew then mixed a microsilica cementitious mortar. It was spray-applied and then hand-troweled at a nominal depth of 2 inches to close up the mortar and create an even surface on which to apply the coatings on day two.

After the crew completed one process on the first manhole, they moved to the second manhole to perform similar actions there. This included surface cleaning and loose concrete removal, followed by spray-applying and hand-troweling mortar to an even plane. However, because the second manhole was not as badly degraded as the first, personnel did not apply any protective coatings. Instead, they used a stand-alone calcium aluminate mortar to make repairs. With no protective coatings to apply, the crew completed work on the second manhole on day one.

Fig. 4: Manhole structures tend to deteriorate over time due to exposure to a variety of corrosive materials.

PERFORMING MANHOLE MAINTENANCE — DAY TWO

The crew reopened the first manhole the following day to find that the applied microsilica mortar had sufficiently dried and cured. They then power-washed the surface and completed an abrasive sweep blast to remove any possible surface laitance prior to applying the protective lining system. Once this was completed and approved, a 100-percent-solids penetrating epoxy primer was applied to the prepared surface to reduce possible outgassing from the porous concrete.

The crew then applied a 100-percent-solids amine-cured epoxy lining as the topcoat while the primer was still tacky to enhance chemical bonding

UNDERSTANDING CHEMICAL EXPOSURE DURATIONS

It's important to recognize that the chemical resistance data for protective coatings and linings is generally reported according to chemical concentration, temperature and the duration of exposure. For example, chemical resistance may be reported as "no effect after exposure to 10-percent H_2SO_4 after seven days at 75 F (24 C)."

Among the chemical exposure variables, the duration of the exposure is particularly critical to the longevity of protective coatings or linings used in sewers and wastewater treatment facilities. Four major changes affect exposure conditions.

1. Stronger sulfuric concentrations related to higher hydrogen sulfide (H_2S) concentrations.
2. Greater rates of H_2S and other gas permeation of coatings/linings due to more constant and higher concentrations of trapped H_2S.
3. Greater sulfur-oxidizing bacteria (SOB) colonization resulting in thicker scum layers.
4. More constant formation of sulfuric acid (H_2SO_4) due to a higher and more constant H_2S presence.

Advanced protective coatings and linings help to account for these variable exposure conditions, providing sufficient protection to mitigate the effects of prolonged exposure to chemicals.

between the primer and the topcoat. For the topcoat, personnel used a rotary spray to apply a nominal thickness of 100 mils (2,540 microns). Once they applied the lining material, the crew removed all equipment from the job site and returned the roadway to its original condition.

VERIFYING RESULTS VIA FIELD INSPECTION

In November 2014, two years after completing the maintenance work, personnel reopened both manholes. Neither showed signs of apparent corrosion attack, cracking, delamination or degradation. The city engineer was pleased with the results and subsequently added the stand-alone calcium aluminate mortar system to the city's Approved Product List (APL). The manholes were reopened again in May of 2016 and again maintenance personnel observed no apparent degradation of the protective lining system in the first manhole or of the stand-alone calcium aluminate mortar system used on the second manhole.

Based on the success of the stand-alone calcium aluminate mortar system used on the slightly degraded manhole, the city began a systematic approach to evaluating its manhole structures and specifying maintenance procedures. The new policy states that only those manholes that were exposed to an aggressive environment were recommended to be lined with a protective lining. Counter to the city's original specification requiring an epoxy coating for all manholes, those that have been degraded but not aggressively attacked can now be repaired with only a stand-alone mortar lining. As a result, the city expects to maximize its return on maintenance investments by not overspecifying protective linings when a lower-cost material will suffice.

LINING IT ALL UP

Careful evaluation of a proposed coating/lining system is a key element in successful manhole rehabilitation programs to enhance overall system operation and long-term service. Using test platforms that mimic the real-world exposures found in a municipal collection system will enable users to evaluate how a particular coating/lining system will perform in that specific environment. Laboratory tests are just that; they attempt to achieve the same type of exposure in a controlled environment. Some laboratory testing protocols use higher temperatures or greater chemical exposure to accelerate testing, which can only give the end user a best guess as to how well the system will work in the field. Actual field-testing — like that performed by this southwestern U.S. city — provides the truest results and can even influence the cost and longevity of future repairs. For that particular municipality, the city was also able to adjust its maintenance protocols based on the performance of the coating technologies.

ABOUT THE AUTHOR

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THE DIFFERENCE BETWEEN WATERJETTING AND WET ABRASIVE BLASTING

BY DUANE T. HOUGH, CHAMPION PAINTING SPECIALTY SERVICES CORP.

Images courtesy of the author unless otherwise noted.

Photo: Jetstream

There is a wide gulf in the industry between the actual capabilities of waterjetting and wet abrasive blasting and also in the perception of their capabilities. Misinformation frequently leads to miscommunication between the various parties involved in projects where this type of equipment and associated standards are used. There is a wide range of equipment on the market that has vastly different abilities and is designed for different tasks, and it is important for all contracted participants to be able to clarify any relative ambiguities in specification and contract language.

MISCONCEPTIONS

The author himself has heard industry professionals express a wide range of expectations when discussing the use of waterjetting and wet abrasive blast equipment to perform surface preparation. The expectation at one extreme is that the equipment cannot perform as the contractor or manufacturer claims. At the other extreme is the perception that the equipment can perform more than it is actually capable of when it comes to achieving production rates, creating a profile, eliminating the necessity for containment and more.

These misconceptions can be the result of past experiences with early-generation equipment, misrepresented capabilities by manufacturers and contractors or misinterpreted understanding of the equipment and its capabilities.

WATERJETTING

Waterjetting is a method of surface preparation that uses pressurized water to remove surface contaminants, rust and coatings from a substrate. Waterjetting is used for a range of activities including removing oil, grease, soluble salts, rust and coatings. It is used throughout the coatings industry in commercial, industrial, marine, nuclear, oil and gas, and other sectors.

Pressure

Waterjetting is split into four categories dependent upon the pressure involved.

- Low Pressure Water Cleaning (LPWC) pressure is 5,000 psi or below.
- High Pressure Water Cleaning (HPWC) pressure is 5,000 to 10,000 psi.
- High Pressure Water Jetting (HPWJ) pressure is 10,000 to 30,000 psi.
- Ultra-High Pressure Water Jetting (UHPWJ) pressure is 30,000 psi and above.

CLEANLINESS LEVELS

The revised SSPC/NACE waterjetting standards — WJ 1 through 4 — define cleanliness levels achieved through waterjetting.

- Waterjet Cleaning of Metals: SSPC-SP WJ-1/NACE WJ-1, Clean to Bare Substrate.
- Waterjet Cleaning of Metals: SSPC-SP WJ-2/NACE WJ-2, Very Thorough Cleaning.
- Waterjet Cleaning of Metals: SSPC-SP WJ-3/NACE WJ-3, Thorough Cleaning.
- Waterjet Cleaning of Metals: SSPC-SP WJ-4/NACE WJ-4, Light Cleaning.

It is important to recognize that while waterjetting cleanliness levels can be specified to set a level of rust and coating removal, a surface profile is not included as an element of these standards due to the fact that waterjetting does not create a surface profile. Waterjetting can, however, uncover an existing profile.

FLASH RUST

Flash rust is an oxidation product that forms as a wetted carbon steel substrate dries and can occur on both water-jetted and water abrasive blasted surfaces. Flash rust is often confused with rust-back which occurs when freshly exposed, dry, bare steel is exposed to conditions of high humidity, moisture or a corrosive atmosphere. Rust-back is often dark in color and starts in the pits of the blasted surface. Flash rust is uniform, tightly adhered and brightly colored (with variations in coloring due to steel composition and condition). Flash rust and rust-back are not allowable per dry abrasive cleanliness standards, although some surface-tolerant coatings do allow for light flash rust.

There are four levels of flash rust: no flash rust, light (L), moderate (M) and heavy (H) flash-rusted surfaces. SSPC-SP WJ-1/NACE WJ-1, "Waterjet Cleaning of Metals — Clean To Bare Substrate," defines them accordingly.

3.1.1 No flash rust: A carbon steel surface that, when viewed without magnification, exhibits no visible flash rust.

3.1.2 Light (L) flash rusted surface: A carbon steel surface that, when viewed without magnification, exhibits small quantities of a rust layer through which the carbon steel substrate may be observed. The rust or discoloration may be evenly distributed or present in patches, but it is tightly adherent and not easily removed by lightly wiping with a cloth.

3.1.3 Moderate (M) flash rusted surface: A carbon steel surface that, when viewed without magnification, exhibits a layer of rust that obscures the original carbon steel surface. The rust layer may be evenly distributed or present in patches, but it is reasonably well adherent and leaves light marks on a cloth that is lightly wiped over the surface.

3.1.4 Heavy (H) flash rusted surface: A carbon steel surface that, when viewed without magnification, exhibits a layer of heavy rust that hides the original carbon steel surface completely. The rust may be evenly distributed or present in patches, but it is loosely adherent, easily comes off, and leaves significant marks on a cloth that is lightly wiped over the surface.

INSPECTING FOR FLASH RUST

There are several methods of testing for flash rust, including visual comparison to SSPC-VIS 4/NACE VIS 7 and SSPC-VIS 5/NACE VIS 9, the wipe method and the pressure-sensitive tape method. The latter test methods both involve using a material that rust will adhere to and quantifying the level of flash rust. The author recommends using "Inspection Manual for Flash Rust Supplement to Standard Photograph Guides Supplement to VIS-4," by Lydia M. Frenzel, Ph.D., as a guideline for establishing a project-specific standard. Visual standards are a useful tool when it comes to training one's eye to recognize levels of flash rust, but are limited in that the user will never be working with the same steel and conditions as those with which the standards were created. Setting project-specific acceptance criteria is always a good practice to alleviate future disagreements.

INHIBITING FLASH RUSTING

Dehumidification and additives are common methods used to inhibit flash rusting. Dehumidification stops corrosion by removing the electrolyte (humidity) from the anode/cathode/metallic pathway/electrolyte (ACME) corrosion formula which requires all four elements in order to produce corrosion. Although dehumidification is extremely effective it can be expensive, depending upon the volume of the space and the available power source. Dehumidification can also require complex containment systems that add an additional layer of cost. Dehumidification is, however, frequently specified in tank interior lining projects because the service allows absolutely no flash rusting.

Additives are available that that can be applied to the surface either during or after surface preparation to prevent flash rust. Some products are applied to the surface via manual spray pumps after waterjetting or wet abrasive blasting while some are added directly to the mix during operations. When adding product to the water-aggregate mixture, a dosimeter is necessary when there is a continuous running water source.

Additives work in a variety of ways and are often an alkaline treatment that forms a surface barrier layer on the steel. Various manufacturers offer products that inhibit flash rust and some also remove surface salts. It is important to know the capabilities of these products as rust inhibitors can also mask the presence of surface salts. Not all coating manufacturers will warranty their coating systems if these products are used on the surface, so it is important to check before using additives to ensure that the product has been approved for use with the coating system.

Fig. 2: Low Pressure Water Cleaning (LPWC) being done on a Florida Department of Transportation project to meet SSPC-SP WJ-4/NACE WJ-4, "Light Cleaning."

WET ABRASIVE BLASTING

SSPC-TR 2/NACE 6G198, "Wet Abrasive Blast Cleaning" was published in 1998 and revised in 2004. It covers several different types of wet blasting systems including radial water injectors, coaxial water injectors, slurry blasters and water blast with abrasive injection — all systems that either involve introducing water at some point with a pressurized air system, or an abrasive into a pressurized water system. Since the last revision of SSPC-TR 2/NACE 6G198 there have been innovations by several companies that have engineered new technologies.

In the past, slurry or wet blasting consisted of a dry blast setup with a water stream added at the nozzle. This method eliminated the dust but required a great amount of cleanup and used the same amount of abrasive as the dry method. New technology uses the water stream and abrasive at maximum productivity allowing for the best of both worlds — the generation of a dust-free surface profile.

Pressure

This new generation of wet abrasive blasting machinery pressurizes a mix of water and abrasive in a pot, enabling the operator to truly meter the abrasive on a job-by-job basis and achieve the water-to-abrasive ratio that is best suited for the specific task.

Hazardous materials and waste containing asbestos and lead can be removed safely with wet abrasive blasting, and simultaneous degreasing and blasting operations can be performed.

The presence of water creates a lubricating effect that protects both the abrasive and the surface from excessive damage, lowering the abrasive breakdown rates and preventing the impregnation of foreign materials into the substrate.

Cleanliness Levels

Wet abrasive blasting cleanliness levels are based off of the dry abrasive blasting cleanliness levels. The cleanliness levels have the same requirements regarding the removal of mill scale, rust and coatings. The percentages of remaining staining are also the same. The key difference between wet and dry abrasive blasting cleanliness levels is that the wet abrasive blasting standards include levels of flash rust (see sidebar, p. 36).

THE KEY DIFFERENCES

The most important difference between waterjetting and wet abrasive blasting is that waterjetting cannot create a profile onto a surface, and this difference dictates the types of jobs that each system is best suited for. Wet abrasive blasting is best suited for a substrate of new steel or one that requires a surface profile. It would also be called for when there is question as to whether or not the existing profile is adequate for the coating system being applied.

In an area where wet or dry abrasive blasting is forbidden, waterjetting could be used to remove a coating together with power tools to impart a profile. While labor and time intensive, this process is technically sound.

Waterjetting does not require abrasives, while wet abrasive blasting always does. When the surface profile has been previously tested and documented and a coating system with the safe profile requirements is being applied, then ultra-high pressure waterjetting can be the fastest and most economical approach. As an example, this system can effectively remove spent antifouling coatings from the hull of a ship, before reapplication of the same system. Occasionally, you will see UHPWJ used to cut off coatings that are difficult to remove with wet (or dry) abrasive blasting, such as heavy mills of coal tar epoxy.

CONCLUSION

The variety of both waterjetting and wet abrasive blasting equipment has a multitude of capabilities and restrictions. Having a clear understanding of the attributes and limitations of each is key to deploying the proper system for a specific project, ensuring a successful outcome and the most productive result.

ABOUT THE AUTHOR

Duane Hough is the vice president of southeast operations at Champion Painting Specialty Services Corp. in Fort Lauderdale, Fla. He has been involved in the protective coatings industry since 1999. Hough is an SSPC-certified Level-3 Protective Coatings Inspector (PCI), a Level-2 Bridge Coating Inspector (BCI), a Level-2 Concrete Coatings Inspector (CCI), a C 3 Supervisor/ Competent Person a Protective Coatings Specialist (PCS) and a Master Coatings Inspector (MCI). He is also a combat-decorated veteran of the U.S. Marine Corps.

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SHOP COAT VERSUS FIELD COAT

THE PROS AND CONS

Photo: Rudy Hudale, Avalotis Corporation

BY CHARLES S. BROWN, GREENMAN-PEDERSEN, INC.

Many bridge owners seem to believe that applying all three coats of paint in the shop is more cost-effective and will provide better coating performance on new steel.

This article will discuss the most widely used coating system coming out of the shop for bridge coatings, an inorganic zinc-rich primer, an epoxy intermediate coat and a polyurethane topcoat, and examine the cost differences through two case histories from the Maryland State Highway Administration where all three coats were applied in the shop.

CASE ONE

In March of 2014, the Maryland State Highway Administration advertised a bid for the replacement of a dual bridge on Interstate 70 over the Conococheague Creek. Among other things, the contract required the replacement of the existing structural steel for the bridge and called for all of the new steel to have all three coats of paint applied in the shop with inspection also performed at the shop.

Problems arose once the steel was shipped to the site as all the faying surfaces, including splice plates and diaphragm connections, were coated with all three layers of paint and once the plates were bolted to the faying surfaces, failures began to occur on all the connection faces. (Fig. 1, p. 44). Also, the faying surfaces did not meet slip critical requirements. In addition to these problems, many areas throughout the bridge had issues with damaged coatings that needed to be touched up. As this bridge was not a "road over road" configuration, the fascias were not repainted due to cost constraints (Fig. 2, p. 44).

The specification could have been written in a number of different ways to alleviate the problem with faying surfaces and reduce the cost to the State, but more importantly, the inspection in the shop did not detect this problem. The initial specification did not address faying surfaces and the issue was not questioned by the paint inspector or the fabrication shop.

The additional cost associated with removing the splice plates and connections, cleaning them down to bare metal, applying a zinc primer to make the connections slip-critical compliant, and then reattaching them, applying the intermediate and finish coats, as well as touch-up throughout the bridge, added approximately $150,000 to the cost of this project.

CASE TWO

In June of 2014, another project in Maryland was advertised for the replacement of a dual bridge on Interstate 70 over Maryland Route 63. This contract also required the replacement of the existing structural steel for the bridge and all of the new steel to have its three coats of paint applied in the shop with inspection performed there as well.

After the problems with the previous job, the State wanted to have the steel only primed in the shop. When the fabricator was contacted, all three coats had already been applied, but having been alerted to the previous problem beforehand, the shop had only applied the zinc primer to the faying surfaces.

This project also experienced problems with damaged coatings throughout the bridge. Bolt patterns and diaphragm connections had only been primed and the fascia surfaces required recoating due to damage during construction. In the end, the cost for this additional work was approximately $2.50-to-$3.00 per square foot and when the additional expenditure was added to the overall cost, the total was about the same as painting in the field. However, added traffic control was needed in order to fix the damaged coatings, extending the project by approximately two weeks, the same amount of time it would have taken to do all the field painting from the beginning.

SHOP AND FIELD PAINTING COMBINATIONS

There are three combinations of shop and field painting.

- Shop/Shop/Shop (with field touch-up).
- Shop/Shop/Field.
- Shop/Field/Field.

Shop/Shop/Shop

- All three coats of the specified system are applied in the shop.
- The only field work is the repair of any damaged coating.

Fig. 1: Once the bolts were tightened on the surfaces which had all three coats applied, failures occurred with the intermediate and topcoats fracturing down to the primer. Figures courtesy of the author unless otherwise noted.

Fig. 2: Fascia was only touched up and not repainted.

Fig. 3: Shop cleaning and painting allows for a controlled atmosphere.

Shop/Shop/Field

- The primer and intermediate coats are applied in the shop.
- The finish coat is applied in the field after the repair of any damaged coatings and the removal of surface contaminants.
- Additional surface preparation may be needed to ensure finish coat adhesion or if the recoat window has been exceeded.

Shop/Field/Field

- This is the most commonly used method.
- Only the primer coat is applied in the shop.
- The intermediate and finish coats are applied in the field after any damaged areas of the primer have been repaired and surface contaminants have been removed.
- Normally, the damaged inorganic zinc primer is touched up with an organic zinc primer.
- Additional surface preparation may be needed to ensure intermediate and finish coat adhesion if contaminants are found or if the recoat window has been exceeded on the intermediate coat.

TABLE 1: COMPARISON OF FIELD VS. SHOP COSTS

Application of Paint (Location)	Cost
Applying the primer coat in the shop (blast and prime)	$5.00 / sq. ft.
Applying two coats of paint in the field (clean steel and apply two coats)	$6.00 /sq. ft.
Applying three coats of paint in the shop (blast and paint all three coats)	$8.00 / sq. ft.
Apply the primer coat in the shop (blast and prime) and apply two coats of paint in the field (clean steel and apply two coats)	$11.00 / sq. ft.

SHOP CLEANING AND PAINTING

The Pros

- The atmosphere is more easily controlled.
- The environment is safer.
- There is less contamination of the blast-cleaned steel and painted surfaces (Fig. 3).
- There is less chance of interference from other trades at the job site.
- Work is usually more consistent so the labor is more consistent, generally leading to better quality and more reliable labor costs.
- Containment of blast media and paint overspray is easier.
- Access to perform cleaning, painting and inspection is easier as most work is done at ground level.
- Recycling of materials is easier at a shop facility.

THE CONS

- Coatings can be damaged in the shop during handling as well as in shipment and during construction (Figs. 4 and 5, p. 46).
- Environmental regulations are more stringent for fixed work sites than for construction sites.
- Storage of painted steel members is restricted due to space limitations.
- Special masking must be done on faying surfaces.
- Applying an additional coat of finish maybe be necessary on the fascia to give a uniform appearance after erection is complete (Fig. 6, p. 46).
- Most fabricators are not comfortable applying all three coats of paint and prefer to apply zinc-rich primers and then ship the members.

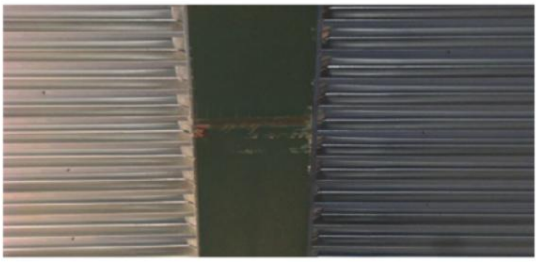

Fig. 4 (Top): This figure shows a shipping and erection defect.
Fig. 5 (Bottom): This gouge goes down to substrate and must be repaired to ensure that the coating has the longevity it was designed for.

Fig. 6: Applying an additional coat of finish may be necessary to give these fascia defects a uniform appearance after erection is complete.

FIELD CLEANING AND PAINTING

The Pros

- The coating is not normally damaged during shipment.
- No special handling or care techniques are necessary.
- Any damage to zinc-rich primer during construction is easily repaired using an epoxy zinc coating with some minimal preparation work.
- The finish coat is smooth and free of touch-up marks.
- Two continuous full-depth coats are being applied versus touch-up coats and feathering.

The Cons

- A controlled environment may be expensive on construction sites.
- There is less access.
- The possibility of contamination of cleaned surfaces and uncured coatings is greater.
- Conflicts with other trades may arise.
- Complex containment systems may be required.

THE COST OF PAINTING NEW STEEL IN THE FIELD

On average, the cost for applying two coats of paint in the field is approximately $5.00-to-$6.00 per square foot and consists of cleaning the zinc-primed steel, touching it up with an organic zinc primer and then applying a full coat of epoxy intermediate and a full coat of polyurethane finish. Also included in the cost are two stripe coats and access to the area, as well as all material costs. Work-zone traffic control is usually done by the general contractor but may be done by the painting contractor on certain occasions.

THE COST OF PAINTING NEW STEEL IN THE SHOP

On average, the cost of applying a primer coat in the shop is approximately $5.00 per square foot and consists of blast-cleaning the steel and applying a full coat of inorganic zinc primer.

The cost of applying all three coats of paint in the shop is approximately $7.00-to-$8.00 per square foot and consists of blast-cleaning the steel and applying a full coat of inorganic zinc, then a full coat of epoxy intermediate and a full coat of polyurethane finish.

Therefore, applying the intermediate and topcoats in the shop is approximately $3.00 per square foot less, based solely on square-footage estimates (Table 1, p. 44).

However, we must consider the areas that require field painting over shop-coated steel, and this is where the price for all three coats of paint increases. Painting the faying surfaces, bolt patterns and fascia surfaces must be factored in, as well as the touch-up of any areas damaged during construction. These issues increase the cost of shop-coated steel. How much the cost increases will depend on the amount of damage during erection, the number of bolt patterns and diaphragms, and the condition of fascias after construction. It has been this author's experience that on all new steel jobs, all fascia surfaces get damaged during construction and will need to be cleaned and coated.

On a typical job the cost for this work is approximately $2.50-to-$3.00 per square foot. When added to the overall cost it works out to be about the same as painting in the field or more. However, more traffic control is needed to repair damaged coatings which can extend the duration of the job to the same amount of time it would have taken to do all the painting in the field minus the primer.

CONCLUSION

Owners and specification writers using a three-coat system in the shop thinking it might save money should re-evaluate the proposed cost savings. As this author has seen, there are little cost savings, and in some cases more time and money required to perform the rework than it would have been to perform the painting in the field in the first place. Owners should evaluate the specific details of their projects to determine which type of coating application will provide the best quality and cost for their situation.

While applying all three coats of paint in the shop might be a current trend, owners must ensure that specifications and inspection procedures provide for a coating system that will deliver the best possible protection for their structures.

Owners must ensure that no matter which method of painting is employed, that they take the following into consideration.

- The appearance of the final product.
- The repair procedure for damaged coatings.
- Faying surfaces.
- Quality specification.
- Quality inspection.
- A quality contractor.

ABOUT THE AUTHOR

Charles Brown is a senior coatings consultant with Greenman-Pedersen, Inc. (GPI) providing services for the Maryland State Highway Administration as an area engineer for its Coatings Division. Before joining GPI, he worked for over 14 years as an operations manager for an industrial bridge painting contractor, overseeing all aspects of the company's operations. Brown is currently a member of AASHTO's Domestic Scan 15-03 Successful Preservation Practices for Steel Bridge Coatings, a member of the NBPP Coatings Group, the chairman of the Education Program Advisory Committee for the Society for Protective Coatings (SSPC) annual conference in 2017, a member of the SSPC-QP 2 revision committee and a past SSPC chairman for the Painting Contractor Certification Program (PCCP) Advisory Committee. He is an SSPC Protective Coatings Specialist and a NACE Level 3-Certified Coating Inspector with bridge certification. ***JPCL***

SSPC 2017 IN TAMPA: TECHNICAL PROGRAM

JAN 30 - FEB 2, 2017 • TAMPA, FL
SSPC 2017 featuring GREENCOAT

SSPC will hold its annual conference and exhibition, SSPC 2017 featuring GreenCOAT, at the Tampa Convention Center in Tampa, Fla., from January 30 to February 2, 2017.

The only conference dedicated 100-percent to protective, marine, industrial and commercial coatings, SSPC 2017 will comprise a full range of technical presentations, workshops, training courses, committee meetings, panel discussions, peer forums, exhibitors, networking opportunities and special events. The conference will also include SSPC's annual Business Meeting and Awards Luncheon, as well as the third-annual Poster Session highlighting research projects done by students and young professionals.

Previews of the SSPC 2017 conference and exhibition will be published in upcoming issues of *JPCL*. This month's preview outlines the presentations and workshops planned for the SSPC 2017 technical program. Information is current as of press time and is subject to change. For updates, visit the official SSPC 2017 conference website, www.sspc2017.com.

MONDAY, JAN. 30

MORNING, 8:30 TO 10:30 A.M.

SESSION 1: PROTECTING SHIPS AND MARINE STRUCTURES

- "An Investigation on the Effect of Surface Treatment and the Coating Performance at Welded Joint Lines for Ships and Offshore Structures," by Chung-Seo Park, Hyundai Heavy Industries Co. Ltd.
- "Thirty Years of Fouling Control Coatings Research, Development and Application," by Dr. Geoffrey Swain, Florida Institute of Technology
- "National Shipbuilding Research Program (NSRP) Surface Preparation and Coatings (SPC) Panel 2017 Update," by Arcino Quiero, Jr., Newport News Shipbuilding

SESSION 2: WORKSHOP

- "Composite Repair Systems — Design & Qualification, Installation, Testing and Inspection," by Davie Peguero, P.E., NRI

SESSION 3: HOT-DIP GALVANIZING

- "Common Causes of Premature Coating Failures on Hot-Dip Galvanizing," by Michael O'Brien, MARK 10 Resource Group, Inc.

• "Lessons Learned for Painting over Hot-Dip Galvanizing," by Kevin Irving, AZZ Galvanizing Services

AFTERNOON, 1:30 TO 4:30 P.M.

SESSION 1: WATERBORNE PROTECTIVE COATINGS, PART I

• "Waterborne Alkyds — Combining Oil and Water to Reduce VOC and Solve Coating Performance Challenges," by Jeffrey Arendt, Arkema, Inc.
• "Next Generation Near-to-Zero VOC High Build Waterborne Coatings," by Justin Rios, The Sherwin-Williams Company
• "The Challenge of Balancing Adhesion and Corrosion Resistance in Waterborne Styrenated Acrylic Direct to Metal (DTM) Resins," by Allen Bulick, Engineered Polymer Solutions
• "FEVE Fluoropolymer Coatings for High-Performance Waterbased Applications," by Kristen Blankenship, AGC Chemicals Americas
• "Introduction to Zero VOC, High-Performance Waterborne Epoxy Systems in Industrial Protective Coating Application," by Yong Zhang, Olin Corporation
• "Complex Inorganic Pigments and How They Can Make Your Waterborne Coatings Better," by David White, Heucotech Ltd.

SESSION 2: PROJECT PLANNING

• "Presenting Effective EH&S Training," by Christopher Lovelace, The Lovelace Group
• "The Right Paint Reduces Project Delays," by James McDonald, Hempel (USA) Inc.
• "Conceptual Flaws in Corrosion Mitigation Procurement — Optimal vs. Suitable," by Warren Brand, PCS, Chicago Coatings Group
• "Coating Process Tracking Matrix," by Peter Blattner, KTA-Tator, Inc.
• "Generating Leads with Social Media," by Richard Bueckert, RBX Marketing Insider's Circle
• "Contract Negotiation — A Cage Match," by James McDonald, Hempel (USA) Inc.; and Matt Stevenson, ALS Industrial Services

SESSION 3: WORKSHOP

• "Proper Use of Coatings Inspection Instruments and Visual Guides in the Digital Age," by Matt Fajt, KTA-Tator, Inc.

SESSION 4: OIL AND GAS

• "Testing and Acceptance of Coatings for Insulated Service," by Michael MeLampy, PPG Industries, Inc.
• "Composite Piping Repairs Onboard Offshore Platforms," by Thomas Fink, Technofink, LLC
• "Transmission Tower Painting," by Curtis Hickcox, PCS, Public Utilities Maintenance, Inc.; and Matthew McCane, PCS, Greenman-Pedersen, Inc.
• "Changes in Appearance and Corrosion Protection of Polyurethane Pipeline Coatings During Weathering Exposure," by Stuart Croll, North Dakota State University
• "Corrosion Control of CUI in a Refinery," by Arthur MacKinnon, PPG Industries, Inc.

TUESDAY, JAN. 31

MORNING, 8:30 TO 10:00 A.M.

SESSION 1: WORKSHOP

• "CSI: Coating System Investigations," by Chrissy Stewart, PCS, and Cynthia O'Malley, PCS, KTA-Tator, Inc.

SESSION 2: WASTEWATER COATING CHALLENGES AND SOLUTIONS

• "Penn Avenue Reconditioning: Tight Site & Telecom," by Daniel Zienty, PCS, Short Elliot Hendrickson, Inc.
• "Coating Selection for Wastewater Facilities Using Paint 44," by Robert Murphy, PCS, The Sherwin-Williams Company
• "Ceramic Coatings in Immersion," by Ben Rowland, PCS, Induron Protective Coatings

SESSION 3: WORKSHOP (SPONSORED BY DURABILITY + DESIGN)

• Coating and Water Repellents — Advantages and Disadvantages of Specific Brands by Kenneth A. Trimber, PCS, KTA-Tator, Inc.

SESSION 4: ENVIRONMENTAL, HEALTH, AND SAFETY REGULATIONS

• "OSHA's New Silica Standard," by Thomas Enger, MS, CSP, CHMM, Clemco Industries Corp.
• "Regulatory Update: New and Revised Regulations and Actions Effecting the Coatings Industry," by Alison Kaelin, CQA, ABKaelin, LLC
• "Ladder Safety: Protecting Workers from a Complex Hazard," by Stanford Liang, Golder Associates, Inc.

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MID-MORNING, 10:30 A.M. TO 12:30 P.M.

SESSION 1: DEFENDING AGAINST CORROSION IN THE MILITARY, PART I

- "Application of STEM Technology to Corrosion Engineering," by Daniel J. Dunmire, Office of Under Secretary of Defense Acquisition, Technology & Logistics
- "Data-Driven Decisions for Corrosion Prevention and Control in the U.S. Air Force," by Jeffrey Nusser, U.S. Air Force
- "Chemical Agent Resistant Coating (CARC) — How the U.S. Marine Corps Paints Their Tactical Equipment," by Andrew Sheetz, NSWCCD-SSES
- "The Effectiveness of Energy Efficient Coatings for Military Use," by Dr. Rebekah Wilson and Brooke Divan, M.Sc., U.S. Army Corps of Engineers

SESSION 2: BRIDGE PAINTING AND PROTECTION

- "Bedeviled Bridges: An Answer to a National Scandal," by Michael O'Donoghue, Ph.D., and Vijay Datta, MS, International Paint LLC
- "Report of Findings on AASHTO Domestic Scan 15-03 Successful Preservation Practices for Steel Bridge Coatings," by Charles Brown, PCS, Greenman-Pedersen, Inc.; and Paul Vinik, Florida DOT
- "Residual Dye (Lubricant) on Galvanized Fasteners — How Much is Too Much?" by Steve Duke, Florida DOT; Carly McGee, KTA-Tator, Inc.
- "Characterizing Bulk Porosity of CBPC Coatings on Aggressive Bridge Exposure," by Md Ahsan Sabbir, Florida International University

SESSION 3: WORKSHOP (SPONSORED BY DURABILITY + DESIGN)

- "Coating and Water Repellents — Advantages and Disadvantages of Specific Brands" by Kenneth A. Trimber, PCS, KTA-Tator, Inc.

SESSION 4: CONCRETE PROTECTION SOLUTIONS

- "How to Non-Destructively Measure Dry Film Thickness (DFT) on Concrete Substrates," by Joseph Walker and David Barnes, Elcometer Inc.
- "Considerations for Concrete Corrosion Control Alternatives," by Fred Goodwin, BASF Construction Chemicals
- "Case Study: A Polyaspartic Coating Made a Commercial Bakery Floor Look Really Sweet," by Steven Reinstadtler, Covestro LLC
- "Understanding Crack Repair Alternatives in Concrete," by Warren Brand, PCS, Chicago Coatings Group

AFTERNOON, 1:30 TO 4:30 P.M.

SESSION 1: SSPC 2017 COATING INSPECTORS' FORUM

- "SSPC 2017 Coating Inspectors' Forum," moderated by J. Peter Ault, P.E., PCS, Elzly Technology Corporation; and Christopher Farschon, PCS, Greenman-Pedersen, Inc.

SESSION 2: SURFACE PREPARATION: THE FOUNDATION OF EVERY COATING PROJECT

- "Effectiveness of Surface Preparation Methods in Regard to Chloride Remediation," by Bobby Meade, Greenman-Pedersen, Inc.
- "Soluble Salt Measurement — Are We Measuring it Correctly?" by Joseph Walker, Elcometer Inc.

• "The Benefits of Steel Grit Blasting and Recycling," by Mark Stewart, ARS Recycling Systems, LLC
• "Non-Abrasive Surface Preparation," by David Watson, Cold Jet, LLC
• "UHP Waterjetting and Surface Tolerant Coatings in New Building Applications," by Nuno Cipriano, Narus Consultoria; and Joaquim Quintela, Petroleo Brasileiro S.A.

SESSION 3: WORKSHOP (SPONSORED BY DURABILITY + DESIGN)

• "Coating and Water Repellents — Advantages and Disadvantages of Specific Brands" by Kenneth A. Trimber, PCS, KTA-Tator, Inc.

SESSION 4: WATERBORNE PROTECTIVE COATINGS, PART II

• "High Performance Water Based Coating Enhanced with Nano Vapor Corrosion Inhibitors," by Markus Bieber, Cortec Corporation
• "Liquid Applied Insulation Coatings: From the Lab to the Field," by Nicole Bowman, Tnemec Company, Inc.
• "Balancing Act: Principles of Design and Formulation for Waterborne Acrylic DTM Coatings," by Leo Procopio and Laura Vielhauer, The Dow Chemical Company
• "Newly Developed Waterborne Phenalkamine for Corrosion Resistant Primers," by Dr. Hong Xu, Cardolite Corporation
• "Case Study: High Performance Waterborne Floor Coating Has the Wright Stuff," by Steven Reinstadtler, Covestro LLC
• "Optimization of Non-Toxic Anti-Corrosives in Water Borne Coatings," by Andrew Thorn, Heucotech Ltd.

WEDNESDAY, FEB. 1

MORNING, 8:30 TO 9:30 A.M.

SESSION 1: MINI SESSION

• "Hubble Bubble Rising: A New Beginning, The Better Way," by Carl Reed, CCC&L Inc.; and Michael O'Donoghue, Ph.D., and Vijay Datta, MS, International Paint LLC

SESSION 2: MINI SESSION

• "Up Periscope: Hunting for the Scope of Work," by Troy Fraebel and Chuck Fite, The Sherwin-Williams Company

SESSION 3: MINI SESSION

• "Maintaining Aged Infrastructure with Difficult to Coat Features," by Allen Skaja, Ph.D., PCS, U.S. Bureau of Reclamation

SESSION 4: MINI SESSION

• "Environmentally Friendly Protective Coating Systems Using a Waterborne Fluoropolymer Top Coat," by Dr. Hiroyuki Tanabe, DAI Nippon Toryo Co., Ltd.
• "Novel Crosslinking Isocyanate-Free Coatings Technology," by Sunitha Grandhee, Ph.D. And Vincent Goldman, BASF Corporation

MID-MORNING, 10:00 A.M. TO 12:00 P.M.

SESSION 1: COATINGS OF THE FUTURE

• "Hydrophobic Spray Elastomers," by Aayush Shah, The Dow Chemical Company
• "Challenging the Performance Myth of Inorganic Zinc-Rich vs. Organic Zinc-Rich Primers," by Antoni Prieto, Hempel Coatings
• "Extent of Cathodic Disbondment of Nanoparticle Enriched Epoxy Primer in the Presence of a Defect," by Saiada Fuadi Fancy, Florida International University

• "Developing Selection Criteria for Field-Applied Pipeline Coatings," by Mike Quinn and David D'Ambrosio, Polyguard

SESSION 2: PANEL DISCUSSION

• "Exploring Differing Views on Causes of Coating Failures"

SESSION 3: DEFENDING AGAINST CORROSION IN THE MILITARY, PART II

• "Importance of Protective Coatings in Preventing Corrosion," by Terry Gabbert, Corrosion Prevention and Control Office
• "Test and Evaluation of Thermal Spray Nonslip Coatings for Marine Environments," by Patrick Cassidy, Elzly Technology Corporation
• "Development of Test Method for Evaluating Nonskid Performance for MV-22 Service Environment," by Cameron Miller, Excet, Inc.; and Colton Spicer, Vision Point Systems, Inc. (VPS)

SESSION 4: GREEN EVOLUTION

• "Green Solvents — Clean & Green," by Dave Pasin, TBF Environmental Technology, Inc.
• "A Green Approach to Surface Tolerant Coatings," by Richard Keeler and John Beighle, Chevron Phillips Chemical Company LP
• "Atmospheric Plasma Surface Preparation — 'Green' Surface Preparation and Coatings Removal Technology," by Peter Yancey, Advanced Plasma Solutions; and Cory Brown, Tnemec Company, Inc.
• "VOC Reduction in Epoxy Protective Coatings Using VOC-Exempt Solvents," by Eric Ripplinger

AFTERNOON, 3:00 TO 5:00 P.M.

SESSION 1: WOMEN'S PROGRAM

• "Women's Program: Cocktails & Conversation," moderated by Joyce Wright, Newport News Shipbuilding

SESSION 2: WORKSHOP

• "Protective Coatings 101," by Charles Brown, PCS, Tony Serdenes, PCS, and Christopher Farschon, PCS, Greenman-Pedersen, Inc.

SESSION 3: HOT TOPICS IN THE MARINE WORLD

• "Thermal Spray Coatings (TSCs)"
• "Cathodic Disbondment"
• "Measuring Surface Profile of a Waterjetted Surface"
• "Measuring Surface Profile on Pitted Steel"

SESSION 4: SURFACE PROFILES — HOW DEEP IS TOO DEEP?

• "Anchor Profile Issues for Maintenance Bridge Painting," by Bobby Meade, Greenman-Pedersen, Inc.; and Michael Baase, Kentucky Transportation Cabinet
• "Too Deep or Too Shallow - Can Surface Profiles be Changed by Additional Blast Cleaning?," by William Corbett, PCS, and Carly McGee, KTA-Tator, Inc.
• "Avoiding or Resolving Common Problems with Inspectors and Owners Related to Surface Profile on Blasted Steel," by Michael O'Brien, MARK 10 Resource Group, Inc.
• "Surface Profile Effects: What We Know/What We Don't Know/What We Should Know," by Carl Reed, CCC&L

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THURSDAY, FEB. 2

MORNING, 8:30 TO 9:30 A.M.

SESSION 1: MINI SESSION

- "Past vs. Present — Comparing Laboratory Performance of Vinyl Resin Coatings with Modern Epoxy-Polysiloxane Coating Systems," by David Tordonato, Ph.D., P.E., U.S. Bureau of Reclamation

SESSION 2: MINI SESSION

- "Blasting Jobsite Project Management Tips," by Brad Gooden, Blast-One International

SESSION 3: MINI SESSION

- "To Cycle or Not To Cycle: That is the Question," by Carl Reed, CCC&L; Kat Coronado, International Paint LLC

SESSION 4: MINI SESSION

- "NASA's Corrosion Technology Laboratory at the Kennedy Space Center: Anticipating, Managing, and Preventing Corrosion," by Luz M. Calle, Ph.D., NASA

MID-MORNING, 10:00 A.M. TO 12:00 P.M.

SESSION 1: FORMULATING COATINGS

- "Estimating Color Fade of PVDF-Based Topcoats for 'Bright Color' Architectural Restoration and Protective Coating Applications," by Kurt Wood, Arkema, Inc.
- "New Reactive Diluent to Reduce the VOC Content of Polyurethane Acrylic Coatings," by Christopher Letko, The Dow Chemical Company
- "Improving Waterborne Anti-Corrosive Coatings Properties with New Wetting & Dispersing Additives," by Ronald Brashear, BYK Additives & Instruments
- "Low VOC Autocatalytic Anti-Corrosion Primers," by William Heaner, The Dow Chemical Company

SESSION 2: WORKSHOP

- "Do You Really Know the Consistency of Your Coating Thickness?" by J. Peter Ault, P.E., PCS, Elzly Technology Corporation; and William Corbett, PCS, KTA-Tator, Inc.

SESSION 3: WORKSHOP

- "Rehabilitation and Strengthening of Concrete, Masonry and Metallic Infrastructure with Fiber Reinforced Polymers (FRP)," by Ehsan Mahmoudabadi, Ph.D., The University of Arizona; and Ramon Pelaez, PCS, MCI, Greenman-Pedersen, Inc.

New Orleans Welcomes Water Quality, Waterjetting Shows

WEFTEC SCHEDULED FOR SEPTEMBER

The 89th annual Water Environment Federation Technical Exhibition and Conference (WEFTEC) will be held September 24 to 28 at the Ernest N. Morial Convention Center in New Orleans, La. The largest water quality event in the world, according to the Water Environment Federation (WEF), WEFTEC 2016 will feature 29 workshops, 130 technical sessions, an exhibition hall with over 1,000 exhibitors, water and wastewater treatment facility tours and more.

The following technical sessions may be of interest to protective coatings professionals. For more information on WEFTEC 2016, visit www.weftec.org.

MONDAY, SEPT. 26

SESSION 207: ODOR AND CORROSION PROTECTION IN COLLECTION SYSTEMS

- "Protective Coatings & Lining Basics for Wastewater Treatment Plant & Collection System Assets," by Randy Nixon, Corrosion Probe Inc., 4:00 p.m.
- "Manhole Coating Evaluation Process For Municipal Manholes," by Bob Murphy, The Sherwin-Williams Company, 4:30 p.m.

SESSION 227: COLLECTION TUNNEL SYSTEMS

- "Corrosion Protection Linings for the Strategic Tunnel Enhancement Program, Abu Dhabi," by Terry Krause, CH2M, 3:30 p.m.

WEDNESDAY, SEPT. 28

SESSION 607: EMERGING COLLECTION SYSTEM TOPICS AND TECHNOLOGIES

- "Structural Coating of Sewers and Manholes Benefiting Sludge Recycle," by Mitsuhiro Kurozumi, Japanese Sewage Works Association, 2:30 p.m.

EXHIBITORS AT WEFTEC 2016

The following list of exhibitors at WEFTEC may be of interest to protective coatings professionals and is current as of press time. For a complete exhibitor list, visit the WEFTEC website.

3M
A.W. Chesterton Company
Arizona Instruments
Ashland
Atlas Copco Compressors LLC
AWWA
C.I.M. Industries Inc.
Carboline Company
CCI Pipeline Systems
Containment Solutions
Contech Engineered Solutions
Denso
Dow Water & Process Solutions
Draeger Safety, Inc.
Gardner Denver Inc.
Graco Inc.
Induron Coatings Inc.
Jack Doheny Supplies Inc.
KCH Engineered Systems
Kerneos Inc.
Lubrizol
MSA, The Safety Company
NACE International
NETZSCH Pumps NA, LLC
Nukote Coating Systems International, LLC
Pittsburg Tank & Tower Maintenance Co.
PPG Protective & Marine Coatings
Raven Lining Systems
ResinTech, Inc.
Sauereisen, Inc.
The Sherwin-Williams Co.
Solvay Chemicals, Inc.
Sprayroq Inc.
SSPC: The Society for Protective Coatings
StoneAge, Inc.
Sulzer Pumps Solutions Inc.
Sunbelt Rentals
Superior Tank Co., Inc.
Terre Hill Composites
Tnemec Company, Inc.
United Rentals
Vactor Manufacturing

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WJTA-IMCA EXPO RETURNS IN NOVEMBER

From November 2 to 3, the WaterJet Technology Association (WJTA) and the Industrial Municipal Cleaning Association (IMCA) will also hold its annual WJTA-IMCA Conference and Expo at the Morial Convention Center in New Orleans. This show is dedicated to the global hydroblasting, vacuum truck, industrial cleaning and waterjet markets, according to WJTA-IMCA.

The 2016 conference and expo will be composed of educational "Boot Camp" sessions, live outdoor equipment demonstrations, an industry appreciation reception and an exhibit hall. The application and development of mechanized and automated hydroblasting systems, safety in manual and robotic industrial cleaning and technical innovation in fluid jet applications are the major themes of this year's conference, according to WJTA-IMCA.

Preliminary topics for the "Boot Camp" sessions include the following.

- Personal protective equipment (PPE) requirements.
- New requirements for vacuum trucks.
- Waterjet recommended practices and training.
- Waterblast automation panel discussion.
- Safety devices for automated equipment.
- Waterblast pressure loss and pressure drop.
- Hydro-excavation.

For more information on the 2016 WJTA-IMCA Conference and Expo, visit www.wjtaimcaexpo.com.

EXHIBITORS AT WJTA-IMCA 2016

The following list of exhibitors at the 2016 WJTA-IMCA Expo may be of interest to protective coatings professionals and is current as of press time. A complete list is available at the conference website.

24 Hr. Safety
Advanced Pressure Systems
AquaFlow
BIC Alliance
The Blast Bag Company, Inc.
Blasters, Inc.
Cat Pumps
D&S Professional Services
DeBusk Services Group
Dragon Products, Ltd.
Easy-Kleen Pressure Systems, Ltd.
ENZ USA Inc.
Fruitland Manufacturing
FS Solutions
GapVax, Inc.
Gardner Denver Waterjetting Systems
General Pump
GHX Industrial, LLC
Giant Industries
Global Vacuum Systems
GMA Garnet (USA) Corporation
Guzzler Manufacturing
Hammelmann Corporation
High Pressure Equipment Co.
Hydra-Flex Inc.
HydroChem, LLC
Jack Doheny, Inc.
Jetstream of Houston, LLP
JGB Enterprises, Inc.
JPCL/PaintSquare
LaPlace Equipment Co.
National Vacuum Equipment
NLB Corp.
Northern Safety & Industrial
Parker Hannifin Corp.
Peinemann Equipment B.V.
Presvac Systems
PSC Industrial Outsourcing, LP
PSI Pressure Systems Corp.
Safety Lamp of Houston, Inc.
SPIR STAR
StoneAge, Inc.
Stutes Enterprise Systems
Terydon, Inc.
Under Pressure Systems, Inc.
Vac-Con, Inc.
Vactor Manufacturing
Vacuum Truck Rentals, LLC
Wilco Supply LLC
WOMA Kärcher Group