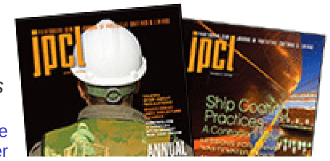
PAINTSQUARE

The First Word in Protective & Marine Coatings



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The Buzz

From *JPCL*, September 2012 | Free Product Information

Anita Socci
JPCL

OSHA's UK counterpart is adapting a "loser pays" system, in which companies that break health and safety laws would have to help pay for investigation and enforcement. What do you think of this idea?

Nice idea, but it won't be consistently enforceable 49%

Brilliant. All countries should do likewise 32%

Lousy idea. This is a government function 19%

Karen Fischer: "First, I am in favor of REASONABLE regulation regarding the health & safety of workers, as I am sure most people are. However, setting that aside for a moment, it seems to me that a "loser pays" system would be quite an incentive to accelerate inspections, increase citations and push hard for increased dollar amounts for fines since the agency will directly benefit by doing so.

If an agency (OSHA) is also the one to decide which citations stick and which ones do not, it would seem to me the deck is stacked against any company faced with not only the eventual fine, but also, the legal fees from their own attorneys as well as (now) the addition costs passed on by OSHA relative to this "loser pays" system. Not especially conducive to the business environment in my opinion. Our current system is not perfect, but if the US were to adopt such a system, the only beneficiaries would be China and third world countries that have no such requirements.

Mark Schilling: Reasonable regulation is fine but it so easily becomes a revenue stream. We often have a similar issue with paint inspectors. They can be like Chief Inspector Clouseau (from the Pink Panther movies). They know that something is wrong. No job is perfect. An inspector has to find some fault to prove his own worth. If there is nothing wrong, the inspector wasn't needed.

The same holds true for OSHA regulations. There is a do-gooder mentality. The vast majority of OSHA citations are for paper-work problems. No one was injured. It's arguable that anyone was made more safe. But someone found fault and they did good. I only mean to say that it can so easily go that way. Fault finding can become a revenue stream. The original purpose gets lost and the focus gets narrowed to revenue (and do-gooder self-esteem).

PSN TOP 10

DuPont Coatings Unit Sold for $4.9B
Cracks May Be Death Knell for $112M Hub
Truck Flips 3,700 Gallons of Road Paint
3rd Truck in 10 Days Dumps Paint Load
Trapped by Suit, Corroded Ship Sinks
Paint Firm: Personal Task Led to Blast
Coatings Muscle in on Dam Mussels
Painting Contractor Settles Lead Case
Navy Takes 3rd Strike on Storage Tanks
Pipe Corrosion Eyed in Refinery Fire

Most Popular Quiz Results
(As of Sept. 10)

True or false: Painting over weld spatter on steel is an accepted practice.

Michael Beitzel 20/21
Archie LeBourgeois 20/21
Robin Hasak 20/21
Mike Winter 20/21
Richard McLaughlin 20/21

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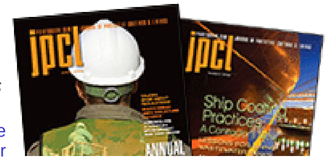
DURABILITY + DESIGN



News

From *JPCL*, September 2012 | Free Product Information

WEFTEC 2012, the Water Environment Federation's Annual Technical Exhibition and Conference, will be held at the New Orleans Morial Convention Center in New Orleans, LA, on Sept. 29–Oct. 3, 2012. Now in its 85th year, WEFTEC is the largest annual water quality event in the world, and this year will feature 24 workshops, 130 technical sessions, a large exhibit hall, and more, according to the Water Environment Federation (WEF).

The focus areas for workshop and technical sessions include: Collection Systems; Disinfection and Public Health; Facility Operations and Maintenance; Future Insights, Global Issues, and Sustainability; Government Affairs; Industrial Issues and Treatment Technologies; Research and Innovation; Municipal Wastewater Treatment Process and Design; Residuals and Biosolids Management; Stormwater Management; Utility Management; Water Reclamation and Reuse; and Watershed Resources Management and Sustainability.

Several facility tours are scheduled, including St. Bernard Parish's Munster Wastewater Treatment Plant, the U.S. Army Corps of Engineers' Gulf Intracoastal Waterway West Closure Complex, Nalco Company industrial wastewater treatment, Sewerage & Water Board of New Orleans' East Bank Wastewater Treatment Plant and Dwyer Drainage Pump Station, and the City of Mandeville's Chinchuba Swamp and East Tchefuncte Marsh Wetland Assimilation Project.

For more information on WEFTEC, visit www.weftec.org.

Exhibitors

The following is a list of exhibitors known to *JPCL* that might be of interest to protective coatings professionals. The list is current as of press time.

- 3M 2051, Hall C
- A.W. Chesterton Company 6319, Hall H
- Air Products & Chemicals 1628, Hall C
- American Water Works Association 3007, Hall D
- AP/M Permaform/ConShield Technologies 4939, Hall F
- Arizona Instrument, LLC 3021, Hall D
- BASF Corporation 1157, Hall B
- C.I.M. Industries, Inc. 2229, Hall D
- Carboline Company 3045, Hall D
- Containment Solutions, Inc 3337, Hall E
- Denso 830, Hall B
- Enviro-Tech Systems 3456, Hall E

- EP Minerals 1706, Hall C
- Farwest Corrosion Control Company 1640, Hall C
- Flex-A-Seal, Inc 2106, Hall C
- Gardner Denver Inc. 5813, Hall G
- Induron Coatings Inc. 6938, Hall H
- Insituform Technologies Inc 6213, Hall H
- International Paint 4371, Hall F
- Kerneos, Inc. 1944, Hall C
- LaMotte Co. 5449, Hall G
- NACE International 7242, Hall I
- Nelson Environmental Inc. 8047, Hall I
- PPG Protective & Marine Coatings 4266, Hall F
- Prime Resins, Inc. 1240, Hall B
- Raven Lining Systems 1227, Hall B
- ResinTech, Inc. 2958, Hall D
- Russell Corrosion Consultants, Inc. 4104, Hall F
- Sauereisen, Inc 2219, Hall D
- The Sherwin-Williams Co 6650, Hall H
- Spectrashield Liner Systems 1645, Hall C
- Sprayroq, Inc 2226, Hall D
- SSPC: The Society for Protective Coatings 2744, Hall D
- Sunbelt Rentals, Inc. 8531, Hall J
- Superior Tank Co., Inc. 4753, Hall F
- Thermo Scientific… 1804, Hall C
- Tnemec Company, Inc 6129, Hall H
- U.S. Environmental Protection Agency 8351, Hall J
- VersaFlex Incorporated 7414, Hall I
- Vulcan Industries, Inc 4343, Hall F

Call for 2013 Abstracts

Starting Sept. 7, 2012, abstracts can be submitted for WEFTEC 2013. The deadline to submit an abstract is Dec. 3, 2012. Information can be found on weftec.org, or by contacting Mary Ann Linder at mlinder@wef.org or 703-684-2442.

Products: Blasting, Coating Units Fit Tight Places

Portable, light-weight, low-abrasion cleaning systems for areas on structures with difficult access have been introduced to the North American market by IBIX Noth America, a partner of IBIX SRL, which manufactures the surface prep equipment. Also now available in North America through the partnership is flame spray application equipment for its polyethylene or polypropylene coatings for difficult access areas in the shop or the field.

The surface preparation equipment, application equipment, and Thermo-Coat systems have already been available and used in protective and marine coating work in 23 countries, according to IBIX North America.

The IBIX low-pressure blasting systems are small but powerful systems, the company says. With blast pots made primarily from aluminum, the lightweight units come in a variety of sizes and weights, with the smallest unit being less than 25 lbs when empty. The units were designed to be lifted easily on scaffolding or used for on-site maintenance and restoration in tight, small places where conventional equipment is not effective. Such areas can be found on vessels and bridges, as well as in industries such as onshore and offshore oil and gas, water, and mining.

The main benefits of the blasting system are the ease of pressure adjustment and its ability to use sodium bicarbonate, garnet, and other abrasives for a range of substrates, from steel that requires hard abrasives to sensitive substrates such as stone or marble on monuments. Operators can adjust media flow as well as pressure from a valve on the pistol grip, with pressures ranging from 3 to 130 psi, the company says. Other key features of the blasting systems are their versatility, ease of operation, and ability to allow wet or dry blasting with media with a low environmental impact.

The IBIX Flame Spray coating unit and Thermo Coating systems were designed for shop and field work on areas such as pipe field joints for the onshore and offshore pipeline industry (oil, gas, and water). The coatings are said to adhere well to factory-coated items such as pipe bends and variations of shapes that can be otherwise difficult to protect in the field, and they can be applied in the shop on items that do not fit in ovens used for factory coating. The coatings are VOC-free, the company says, and taken together, the surface preparation and coating equipment offer low emissions, low waste, and ease of use.

More info: MLaRocco@ibixne.com

Nu Flow Offers Hi-Heat Lining

Nu Flow, a San Diego-based supplier of small-diameter pipe lining technology, has introduced a high-temperature, highly chemical-resistant epoxy for pipe lining.

Nu Flow's new High-Temp Chemical Resistant epoxy (RN750NP) can reach a maximum temperature of 210 F. The company says the product is 50% stronger, cures twice as fast, and offers greater chemical resistance than standard epoxies. It was not designed for potable drinking lines or European pipe systems.

The company said it developed the epoxy with American Pipe Lining to meet growing demand for a higher-temperature-rated epoxy.

More info: nuflowtech.com

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The case of…failure in a filter house

From *JPCL*, September 2012 | Free Product Information

Rick Huntley
KTA-Tator, Inc.
Rick Huntley is the technical manager of consulting services and a senior coatings consultant for KTA-Tator, Inc. He is a NACE-Certified Coatings Inspector Level 3 (Peer Review) and an SSPC Certified Protective Coatings Specialist. He is a primary instructor for various KTA training courses and holds a B.S. in chemical engineering from Washington State University.

Richard Burgess
Series Editor, KTA-Tator, Inc.

Rick Huntley, KTA-Tator, Inc.

How long does it take for a premature coating failure to occur? The likelihood of failure is high shortly after application: from days to perhaps a year. In this month's Case from the F-Files, a coating delaminated shortly after installation of the coated assemblies. Repairs were made, and the units went into service. Can failure after six years be considered premature?

A company was contracted to supply to large inlet filter assemblies for installation at a natural gas-fired power plant in the Midwest. The assemblies were constructed mostly of carbon steel. The coating system specified for application to the filter assemblies consisted of abrasive blast cleaning to SSPC-SP 6, "Commercial Blast Cleaning," and application of one coat of a three-part epoxy zinc-rich primer and a polysiloxane top-coat. The product data sheet for the epoxy zinc-rich product stated that it had a recommended typical dry film thickness of three mils but also that the material could be applied in one coat up to five mils. The product data sheet warned that at thicknesses above five mils, the product was prone to mechanical damage.

The epoxy-modified polysiloxane topcoat was in two components and had volume solids of 90%. It had a recommended dry film thickness per coat of 3–7 mils. The epoxy zinc-rich primer was a recommended primer for the topcoat, although the product data sheet warned that a mist coat might be necessary before application of the full coat when using the epoxy zinc-rich primer.

Shortly after installation of the filter assemblies, a few instances of coating delamination were noted on the floor of one of the assemblies. The coating delamination was repaired by applying an additional coat of the topcoat over the areas of delamination. No additional coating failures were noted until nearly 6 years later. The failures were found in the spring after a particularly cold winter. At that time, a large quantity of paint chips was caught in the one of the assembly's trash screens. Subsequently, large sheets of coating were found delaminating in that unit's plenum. Similar failures were found on the exterior of two of the other assembly units.

Field Investigation

The field visit was made to the site of the natural gas-fired power plants shortly after the failures were discovered. The filter assemblies were first visually examined. Both the interior and the exterior of the filter assemblies were coated with a gray glossy paint. The paint in the majority of the areas was in good condition.

There were various areas of coating delamination on two of the filter assemblies. The most severe area of delamination was the plenum area of one of the units. In that area, there were various spots of coating delamination on the floor, on the walls, and on the I-beams supporting the ceiling (Fig. 1). Although the coating delamination was widespread, the total percentage of coating delamination in the plenum was no greater than 5 percent. Additionally, there was some coating delamination on the floor on the interior right-hand side of another unit. A close examination of the coating failure in these areas revealed that there had been previous delaminations that had apparently been repaired. The repair coating was a slightly different color and gloss than the rest of the paint, and a relatively distinct edge could be seen between the area where the coating had delaminated and the surrounding areas that had remained intact.

Fig. 1: Exterior surfaces experienced delamination especially on horizontal surfaces. Photos courtesy of KTA-Tator, Inc.

There was also some coating delamination on the exterior surfaces of both units that had coating delamination on the interior. On one unit, the coating delamination occurred both on the plenum section and the right-hand side of the unit. On the other unit, the coating delamination was limited to the right-hand section.

In all cases, when the coatings delaminated, the plane of failure occurred as a cohesive break within the zinc-rich primer. There appeared to be a thin film of zinc-rich primer on the back of the delaminated paint chips and a relatively thick coat of zinc-rich primer on the surface of the steel. The remaining zinc-rich primer was adequately protecting the surface; no rust was visible in any area.

In one area on the floor of a plenum, the coating was delaminating in an unusual blister pattern. In this area, there was a pattern of raised blisters with a diameter up to ½ inch. In some cases, the blister caps were broken, exposing the underlying zinc-rich primer. When the blister caps were forcibly removed with a utility knife, a white spot of what appeared to be zinc corrosion product was visible on the uncovered zinc-rich primer. This pattern of delamination was unique to this particular area.

In several areas in the plenum, the top-coat was detached from the surface yet still attached to the surrounding topcoat, creating large, irregularly shaped blisters. When the surface of the topcoat in those areas was probed with a utility knife, coating could be removed easily. In most cases, when the surrounding intact coating was probed with a utility knife, the surrounding coating was also found to have poor adhesion. In all cases, the plane of delamination was within the zinc-rich coating, leaving zinc on the back of the delaminated coating chips and on the surface of the steel.

The areas of delamination on the floor on the interior right-hand side of the unit that had obvious coating repair areas were probed with a utility knife. Where coating had previously delaminated and been recoated, the new repair coating adhered well to the originally applied zinc-rich primer. In the surrounding areas where the originally applied topcoat was left intact, it had extremely poor adhesion to the zinc-rich primer and could be removed easily with a utility knife.

The adhesion of the coating was assessed in accordance with ASTM D3359, Method A, Measuring Adhesion by Tape Test (Fig. 2). The adhesion of the coating system varied considerably. Near areas of delamination, adhesion was often found to be poor (1A-0A). In other areas, adhesion varied between 1A (poor) and 4A (good).

Fig. 2: The adhesion of the coating was variable, even adjacent to large sections of coating delamination

The dry film thickness of the coating system was measured in several areas in both units. In areas where the topcoat delaminated, exposing the primer, the primer that remained ranged in thickness between 1.7 and 5.2 mils and averaged approximately 4 mils. The thickness of the total system ranged from between 8.3 and 13.5 mils. There was no noticeable correlation between dry film thickness and delamination.

Laboratory Investigation

The laboratory investigation consisted of visual and microscopic examination, solvent resistance testing, and infrared spectroscopy analysis.

Visual and Microscopic Examination

A visual and microscopic examination of the samples was conducted using a digital microscope with magnification to 200X. The samples consisted of two to three layers of gray coating. The topcoat generally ranged from four to seven mils thick. The underlying coat(s) generally ranged from 0.3 to 0.8 mils thick.

Solvent Resistance

Solvent resistance testing was performed using a modification of ASTM D5402, Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs. The method was modified to accommodate the small sample size. A cotton tip swab was used in place of a piece of cheesecloth. The swab was saturated with methyl ethyl ketone (MEK). The samples were tested by rubbing the tested area with the swab for a total of 50 double rubs. The test was performed in duplicate on the backside of the sample chips where a thin layer of the epoxy zinc-rich primer was present. All samples of the epoxy zinc-rich primer were found to have extremely poor solvent resistance as the coating could be totally removed with 50 double rubs, and softening and color transfer were noticeable after as few as 13 double rubs.

Infrared Spectroscopy

Infrared spectroscopic analysis was performed on two of the samples and a control sample of an epoxy zinc-rich primer that had been drawn down and allowed to cure thoroughly. The samples were found to match the control sample of the polyamide epoxy zinc-rich primer except for a noticeable difference in an intense polyamide and silicate band relative to other epoxy bands. The polyamide and silicate bands in conjunction with large bound water bands suggested an excess of non-reacted polyamine.

Discussion

The field investigation and the laboratory analysis revealed that the cause of the delamination of the coating system from both the interior and the exterior surfaces of the filter assemblies at the power plant was the presence of a relatively weak polyamine-rich surface layer on the shop-applied, zinc-rich primer (Fig. 3). The weak layer fractured when the polysiloxane topcoat developed stresses during cold weather.

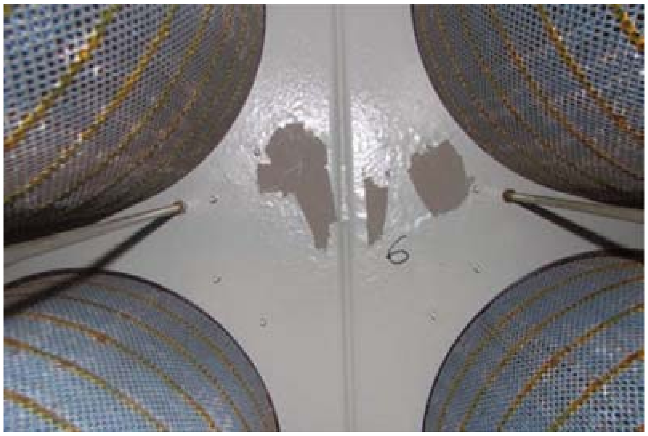


Fig. 3: Delamination of the topcoat often occurred between the filters

The plane of failure of the coating system was consistent in all areas and was within the zinc-rich primer. The split in the zinc-rich primer occurred very near to the top surface. Laboratory microscopic examination revealed that the zinc-rich primer that remained on the back surface of the delaminated coating chips ranged in thickness from 0.3 to 0.9 mils. There was no indication that the zinc-rich primer was applied in multiple coats, and, therefore, it was thought that the separation was cohesive within the zinc-rich primer, not adhesive between two coats of zinc-rich primer.

The zinc-rich primer on the back of the coating chips had extremely poor solvent resistance. In the laboratory, rubbing the back of the coating with a Q-tip soaked with methyl ethyl ketone completely removed the zinc-rich primer from the back of the delaminated coating chips. A Q-tip soaked with water had no effect on the zinc-rich primer. The affected coat was an epoxy zinc-rich primer. Properly cured epoxy coatings have good to excellent solvent resistance. A Q-tip soaked in methyl ethyl ketone should have had little effect on the primer if it had cured properly.

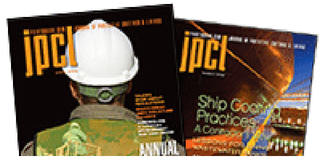
Additional evidence of the improper cure of the zinc-rich primer was found in the infrared analysis of the coating on the back of the delaminated coating chips. The infrared spectra were compared to a properly mixed sample of primer, and the samples removed from the filter units were found to have an excess of polyamine at the surface. This excess was an indication that either the coating was improperly mixed with an excess of the polyamine-containing components, or that unreacted polyamine exuded to the surface during the curing process. Either problem could have caused a poorly cured, weak layer to form on the surface.

There are several ways that mixing problems can cause the formation of uncured polyamine. The primer was a three-component coating, with two liquid components and one zinc powder component. The two liquid components must be thoroughly mixed together before the addition of the zinc powder. If the zinc powder is added to one of the liquid components, and the second liquid component is added later, the cure of the coating is hindered, because the intermixing of the liquid components is reduced. This could cause the polyamine components to come to the surface during the curing process, creating a weak layer on the top surface. Additionally, the polyamine-rich layer could be created simply by adding too much of the polyamine-containing component.

In most cases, the coating was thicker than the specified three mils. The actual thickness of the primer was estimated by taking the average thickness of the zinc-rich primer found on the back of the removed coating chips of 0.5 mils and adding that to the thickness of the zinc-rich primer that remained on the surface of the steel. It is thought that the actual dry film thickness of the zinc-rich primer varied from a little greater than 2 mils up to approximately 6 mils. Regardless, poor adhesion was found within the entire range of dry film thickness, including in areas where the thickness was only a little greater than 2 mils, so it is unlikely that excess dry film thickness of the zinc-rich primer was a significant contributing factor to the coating problems.

The coating delamination problem became evident after the coating had been in service for several years. It is likely that the coating delamination problem was aggravated by recent winter cold weather. The particular polysiloxane coating was relatively brittle and developed significant tension in cold weather. In this case, it is thought that the tension developed by the polysiloxane topcoat eventually became greater than the cohesive strength of the primer, causing the zinc-rich primer to split and the coating system to delaminate.

In this instance, the early delamination problem was repaired by reapplication of the topcoat. The underlying cause was not determined at that time, and the repair was considered sufficient. Yet the foundation for future failure was present at the time of installation but was unknown. There is no way of knowing how long it would have remained hidden if not for the cold weather. The local weather was considerably colder than had been experienced in the previous six years, but was not necessarily atypical for that area. Since the cold weather that precipitated the delamination could reasonably been expected sometime during the lifespan of the coating, and the expected life of the coating was far greater than six years, the coating failure was certainly considered to be premature.



How CAS Training Fits into Shop Painting in the Future

From *JPCL*, September 2012 | Free Product Information

David Boyd
Vulcan Painters Inc., Bessemer, AL
David Boyd is currently the Chairman of the Board of Vulcan Painters, Inc., a southeastern U.S. painting contractor that specializes in industrial and commercial painting projects, blasting and coating of structural steel and sewer pipe, electrodeposition, and powder coating of parts.
He is co-chair of the Alabama-Georgia Training Fund, where he developed a training program for painters that formed the basis of the one used today by District Council 77 of the International Union of Painters and Allied Trades (IUPAT). David was a founding member of the committee that established SSPC's Painting Contractor Certification Program in 1986.
David is a recipient of a JPCL Top Thinker Awards, and he has received awards from SSPC and other organizations.

David Boyd

The great thing about writing any article that has the words "in the future" in the title is that people will remember the few things you get right but will usually forget the 90% you get wrong. I was asked to write about how the new SSPC Coating Application Specialist (CAS) training will fit into shop painting in the future. I took the liberty of changing the topic a little—to how CAS training is the final stage in our industry's long quest for modern solutions to a coatings technology that completely outran the painter's training. If I am correct in my assumptions, then we have finally arrived at systems that can deliver the needed content for applicator training in the painting industry. In the future, painting contractors, industry facility operators, applicators, and paint manufacturers will be only tweaking the processes we use rather than continually reinventing the wheel on proper paint application methods.

Background

Let's put all of this in some historical context. The August 1970 issue of *Spotlights* (the official magazine of the Painting and Decorating Contractors of America at that time) asked this question on its cover: "Can our industry be wrecked by rising costs and degrading qualifications?" Through the 1970s, contractors in the industry were fixed on the need for recruiting and training the workforce of the future, i.e., apprentices. Radical changes in paint formulation meant that there were more and more formulations on the market but no comprehensive training on the use of the new coatings for the young employees entering the trade.

It helps to illustrate the problem with an example—a large project my company started in the 1970s that taught me a lesson I never forgot. We had four journeymen blasters cleaning steel to a commercial grade. Each person was getting different production rates and had a different consumption of abrasive. After the first day, the owner's inspector turned down most of the blasted steel because we were not meeting the SSPC-SP 6 standard. When we questioned the painters, we found out that each had been trained at a different contractor's shop and each had been told different criteria for meeting the standard. Some were told not to remove any tight rust; others said paint in the pits was all right; and others thought that as long as the topcoat was removed, the primer could stay. It was obvious that as long as different criteria were being taught on the various job sites by people who had a monetary interest in the outcome (the painting contractor), we were fighting an uphill battle to get any uniform results. This was especially true in the realm of blasting and covering up the cleaned surface with a primer. The contractor who tried to follow standards was penalized by his competition, which either did not know what the standard was or did not care.

The 1980s brought about the awareness that the process of applicator training might be too big for the individual contractor to change. Let the union or the NCCER take this on—painting contractors decided it was easier just to figure out how we could differentiate ourselves, both in the marketplace and to the customers. Rather than worry about comprehensive training for painters, contractors tried marketing our competence, selling our multi-year maintenance programs with guarantees, and outselling our competition. (The decision to stop trying to fix training may have been a wise one because it took decades for industry pillars SSPC and NACE to develop joint standards on the qualifications for an industrial coatings and linings applicator.)

After months of planning, the first CAS test in the Southeast took place April 13–14, 2012, at Vulcan Painters' Minor facility. Eight of the industrial painters who successfully passed the test were from Vulcan Painters. Front row (l-r): Trent McNutt (Proctor), Chuck Hill (D.C. 77), Glenn Wilson (Instructor/Coordinator), Bob Porto (Lead Auditor), David Biggs (Proctor) Back row (l-r): John Burcaw (Lead Proctor), Anthony Kippen (Lead Proctor), John Hamilton (Proctor), Brad Shafer (Auditor), Roger White (Auditor)

In the 1990s, there was an "anything goes" attitude from the contractors' marketing blitz, while facility owners started to put the brakes on painting costs and used third-party inspection as a form of protection. Other factors came into play, such as price pressures from non-union shops that increased the popularity of open shop businesses. There were mergers and acquisitions of painting contractors nationwide. Third-party quality inspection maintenance programs were developed, and the NACE Level I, II, and III inspection certification programs started graduating more and more inspectors. Everyone was struggling to answer the question, "How can facility owners be sure they are getting what they pay for with their maintenance dollars?" If you came up with the correct answer, you were a hero and earned all the respect and money that this billion-dollar industry could give.

SSPC-QP Programs

Most of the people in the industry knew that fixing the problems at the end of the job was not the answer. There is a saying in the quality industry that goes, "You can't inspect quality into a job." Finally, SSPC called a group of interested people together, and, over several years, developed a program to objectively certify and audit contractors. Based on industry standards, the SSPC-QP program was born.

We now find that we have a needed standard in the SSPC-QP 1 Certification (Field Application to Complex Industrial and Marine Structures). QP 1 is a nationally recognized program that evaluates the practices of industrial painting contractors in key areas of business. These standards are considered to be the *minimum* level of service and quality for today's coatings industry. The complex nature of coating systems and the specific surface preparations required for these systems have made the QP 1 guidelines vital to the longevity of applied protective coatings. The program was designed to provide facility owners and specification writers with a means to determine whether the painting contractor has the capability to perform surface preparations and coating application in the field on complex industrial and marine structures. These structures would include bridges, food and beverage facilities, offshore drilling, power generation facilities, petro/chemical plants, storage tanks, ship maintenance, and wastewater treatment facilities.

To be certified to QP 1, industrial contractors must demonstrate competence in several key areas:

- management procedures;
- quality control; and
- safety, health, and environmental compliance.

The QP 2 certification program covers Field Removal of Hazardous Coatings. This nationally recognized program evaluates the capabilities of industrial painting contractors for their ability to safely remove and properly manage hazardous coating material in the field. These standards are considered to be the *minimum* level of service and quality. QP 2 builds on the standards and guidelines of QP 1 to further qualify the industrial contracting company in hazardous paint removal operations. QP 1 certification is a prerequisite for QP 2, and QP 2 certification requires demonstrated competence in four key areas:

- management of hazardous paint removal projects;
- technical capabilities related to hazardous paint removal;
- personnel qualifications and training; and
- safety and environmental compliance programs.

The QP 3 certification program covers shop painting. The requirements for SSPC-QP 3 are similar to those for SSPC-QP 1, except that they are specifically focused on shop coating operations. SSPC-QP 3 is a nationally recognized program that evaluates the practices of shop painting facilities in key areas of business. These standards are considered to be the *minimum* level of service and quality for today's coatings industry. The complex nature of coating systems and the specific conditions and surface preparation required by these systems have made the QP 3 guidelines vital to the longevity of protective coatings applied in the shop.

QP 3 is segmented according to the type of shop.

- Enclosed Shop–A permanent facility, enclosure, or building (four walls to grade and a roof) where surface preparation and coating activities are normally conducted in an environment not subject to outdoor weather conditions and/or blowing dust.
- Covered Shop–A permanent facility, enclosure, or building having a roof beneath which surface preparation and coating activities are normally conducted out of direct exposure to outdoor weather.
- Open Shop–A permanent area or facility with no roof or walls where surface preparation and coating activities are normally conducted. The area or facility is exposed to outdoor weather conditions and blowing dust.

To be certified by SSPC, industrial contractors must demonstrate competence in several key areas:

- management procedures;
- technical capabilities;
- quality control; and
- health, safety, and environmental compliance.

Contracting firms are evaluated through a series of submittals to SSPC that describe business operations. Then an impartial, on-site audit is performed at the contractor's headquarters and shop locations to verify the information provided in the application submittals.

These three certifications will cover the topic we are currently interested in, but I do want to bring out the other certifications that have been put forth by SSPC for the contractor's third-party verifiable standard.

- SSPC-QP 6, Contractor Metallizing Certification Program
- SSPC-QP 7, Painting Contractor Introductory Program
- SSPC-QP 8, Installation of Polymer Coatings and Surfacings on Concrete and Other Cementitious Surfaces
- SSPC-QP 9, Standard for Evaluating Qualifications of Painting Contractors Who Apply Architectural Paints and Coatings
- SSPC-QS 1, Standard Procedure for Evaluating a Contractor's Advanced (ISO 9001 Compliant) Quality Management System

Achieving ISO Compliance

My own firm, Vulcan Painters, became ISO compliant before we ever went after QP certification, although we now have QP 1, QP 2, QP 3, QP 8, QP 9, and QS 1 certifications. The reason to become ISO compliant was simple: we had a shop operation that specialized in electrodeposition coatings and the application of powder coatings, mainly for the automotive industry. Our customer base required our ISO certification. On the other hand, QP certification was first embraced by public sector specifiers. We made the management decision to have all our processes—field, shop, and corporate—fall under the ISO umbrella.

With that decision came the ISO requirement to have a formal training program for everyone in the company. We were required to spell out the training required for each job. Every six months, our independent auditor would check our training records and go to the shops and field and talk to apprentices, journeymen, and even new hires and ask what their jobs were, what their goals were, and what Vulcan's goals were. (How many new hires know what a company's vision and mission are? Our new hires learned it in their orientation on day one.)

The certifier would check to see how complete the individuals' training records were. When deficiencies were found, Vulcan was written up and, depending on the severity, corrective actions were issued and then reviewed at the next audit. The responsibility for proper training for shop and field painters moved from others (e.g., the union, SSPC, NACE, material manufacturers) directly to Vulcan's management. I think we realized for the first time that if a painter could not use a wet or dry film gauge properly, the blame must be on our management, not on the painter. ISO opened up our eyes to the fact that we could not just be interested in apprentice training, but we also had to be intent on upgrading our journeymen's skills training as well. (Safety upgrades were always a given for journeymen, but programs on the use of inspection equipment were another thing entirely.)

With contractor certification in hand, and, recognition of the need for comprehensive craft worker training and certification of industrial painters, our industry finally developed a consensus standard for applicators, SSPC ACS-1/NACE 13. Now we have the program that spells out the types and amounts of classroom and hands-on practical experience an industrial applicator must have to use all the tools of our profession and apply coatings in a manner that will justify their cost. By having a clear path specified for the necessary knowledge needed by industrial painters, the contractors, specifiers, manufacturers, and facility owners will know exactly what training is required for a painter to apply more sophisticated coatings to meet strict environmental and performance (durability) requirements.

The CAS test covers the "body of knowledge" set forth in the joint standard, SSPC ACS-1/NACE No. 13. Painters are tested on their knowledge of the following areas.

- Surface preparation
- Coating materials and application techniques
- Equipment/troubleshooting
- Environmental and safety and health requirements

Some of the topics covered by the CAS test include the following.

–Basics of corrosion; substrates; surface preparation standards; equipment set up and operation for abrasive blasting; identification of specified surface cleanliness; acceptable surface profile and variables affecting it; acceptable abrasive blasting conditions

–Coatings materials; coatings application equipment; mixing, drying, and curing conditions; in-process measurement and monitoring; wet film thickness; film deficiencies; dry film thickness; requirements for maintenance painting; concrete and masonry coating

–Process control (including quality assurance & quality control)

–Specifications, codes, and standards; fluid and gas dynamics; basic electricity, chemistry, and physics; physical properties related to paint and protective coatings; procedures and work instructions; work planning and sequencing; procedures for receipt and storage; product data sheets and MSDS; thinning, application, and in-process measuring and monitoring; documentation; test equipment; ambient conditions; surface conditions; verification inspection

–Applicable safety codes, practices, standards, and regulations, including rigging, scaffolding, and ladders; fall protection; confined space; lock out/tag out; aerial lifts; hazard communication; first aid/CPR; electrical grounding requirements; fire protection; safety harnesses; safety related to abrasive and water blasting; ventilation; lead abatement and hydrocarbon solvent exposure, use, and disposal; ventilation; waste minimization and handling and disposal of hazardous materials; chemical and dust exposure; personal protective gear

The Coating Application Specialist Program

The SSPC Coating Application Specialist (CAS) program defines the criteria for the education, training, experience, knowledge, and skills required for the professional industrial painter.

The list is long. Painters are tested on their knowledge of various criteria, as shown in the box below.

While organizations such as the IUPAT and NCCER have provided craft training over the years, CAS is the first across-the-board certification standard for industrial painters applicable to the entire industry. That means a CAS-certified applicator knows the application trade and has a card certifying that he or she has spent two days proving his or her knowledge to an independent third-party test proctor. Eventually there will be four levels of recognition:

1. Trainee;
2. Certification as to the core area body of knowledge and grasp of fundamental blasting and painting skills;
3. Level 2 plus supplemental programs; and
4. Level 2 plus supervisory skills.

The CAS trainee is similar to an apprentice craftsperson. Level 2 Interim Status is designed for craft workers currently in the workforce. They must pass the written and hands-on tests and have 150 approved hours of training and 2,000 hours (equivalent to two years) of verifiable work experience, or 3,000 hours (equivalent to three years) of verifiable work experience if they do not have the 150 hours of formal approved training classes. CAS provides the opportunity to achieve professional certification in the near term.

For owners who want to specify a ratio of certified craftworkers to trainees on a job, CAS also provides a ready pool of qualified, certified painters. Level 2 defines requirements for the experienced industrial painter able to work independently. The individual may need occasional supervision but can prepare, start, stop, and clean up without direction (i.e., he or she knows the fundamentals of the trade without second thought). SSPC expects to give credit for the SSPC/NACE Applicator Certification Standard (ACS) hands-on exam for C12 (Airless Spray Basics) certification. Painters still must meet the experience requirements and pass the Level 2 CAS written exam.

With the CAS requirement added to the QP certification, the circle should be complete. Career paths are open to apprentices, skills training to journeymen, and management requirements to the company—all under the watchful eyes of third-party auditors.

How Shop Painting Fits In

So far I have written about only industrial painting as a whole, with an emphasis on field painting. How does this affect shop painting in particular? Our company has a saying that we paint bridges only on the ground; once they go over water, we are not involved. By this we mean that we apply the prime and finish coats to structural steel in our shops; we have not trained our employees to paint while suspended over water. Shop painting in the past was usually started by with the need to blast and apply the same type of material over and over again. Shops were part of the steel fabricating or manufacturing process. Whether it was the application of inorganic zinc coatings, coal or hot tar on pipe, or other coatings, the shop had a base customer list and set the shop or plant up around the individual characteristics of the coatings.

If one accepts the premise that more and more structures are being modulized in shops and shipped directly to the job site as a finished product, then the shop painter and management must be trained in all the characteristics of different coatings.

Pipe racks, towers, and even ductwork for power plants are all being built in the module method. Given this practice, environmental regulations, OSHA requirements, quality inspection, and paint usage all must be handled by trained applicators following certified management requirements. The automobile industry has largely solved the corrosion problems on cars and trucks. This would not have happened if standards for pretreatment, priming, and various topcoats were not specified worldwide and training of the applicators was not intensive. We learned with our electrodeposition shop that in order to be a vendor to automotive manufacturers, all of our quality systems had to be in place and audited two to three years before we could paint the first part.

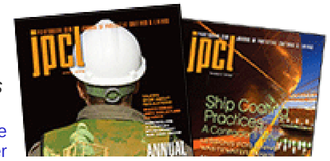
Conclusion

My father used to tell me that a typical commercial building's cost was 10–15% of the total construction dollar. At that time, all doors, windows, ceilings, walls, and other parts of a building had to be painted in the field. Wallcovering and fancy silk would raise the price even more. Today, our typical new construction job has less than ½% in painter's trade.

The industrial painting industry has developed into a mature, sophisticated industry that can protect and beautify our infrastructure at a reasonable cost. Our employees are expected to understand that the tolerance of even half of a human hair can affect the performance of paint that may cost $350 per gallon. The job is still risky—this paint is being applied with machines that can shoot the material hard enough to injure humans. The chemicals, if used improperly, can harm the environment and the public. But by adopting the standards we now have to certify our contractors and our certified applicators, we will earn the respect of the industry and the rewards that a successful painting program deserves.

Editor's Note: This article, by David Boyd, is part of the series of Top Thinker articles appearing in *JPCL* throughout 2012. Mr. Boyd is one of 24 recipients of *JPCL*'s 2012 Top

Thinkers: The Clive Hare Honors, given for significant contributions to the protective coatings industry over the past decade. The award is named for Clive Hare, a 20-year contributor to *JPCL* who shared his encyclopedic knowledge of coatings in many forums. Professional profiles of all of the award winners, as well as an article by Clive Hare, were published in a supplement to the August 2012 *JPCL*.



Technical Program Ranges Widely at SSPC 2013

From *JPCL*, September 2012 | Free Product Information

Bridge under the Convention Center. Photo courtesy of the San Antonio Convention & Visitors Bureau

SSPC will hold its annual conference and exhibition, SSPC 2013 featuring GreenCOAT, in San Antonio, TX, on January 14-17, 2013, at the Henry B. Gonzalez Convention Center. SSPC 2013 is the only conference and exhibition dedicated 100% to protective, marine, industrial, and commercial coatings. The conference will offer a full schedule of training courses, workshops, technical presentations, exhibitors, special events, award ceremonies, and networking opportunities.

The following is a list of technical presentations, organized by date and session, and the presenter and company affiliation, current as of press time. For updates, visit sspc2013.com. A future issue of *JPCL* will provide abbreviated abstracts, times, and any updates for the presentations.

Monday, January 14

Surface Preparation—The Foundation of Every Coating Project

- "Steps to a More Effective Blasting Operation," by Kumar Balan, Wheelabrator Group
- "Cool, Dry, or Both: When is Cooling Equipment Appropriate as a Dehumidifier?" by Don Schnell, Dryco, LLC
- "Surface Profile—A Comparison Analysis of Measurement Methods," by David Beamish, DeFelsko Corporation
- "New Developments in Surface Profile Measurement for Blast Cleaned Surfaces," by John Fletcher, Elcometer Limited-UK

Working in the Coatings Industry—What You Need to Know!

- "Creating a Culture of Safety: Are You Compliant or Committed?" by Greg Jochims and Doug Sams, Allen Blasting and Coating
- "Using Virtual Reality to Help Teach Application Techniques," by Matthew Wallace, VRSim, Inc.
- "History of Corrosion Resistance," by Joe Larson, ACT Test Panels LLC
- "Corporate and Professional Online Reputation Management (ORM)," by Nicole Eisenhauer, Eisenhauer Creative Group
- "How to Buy a Coatings Company with Limited Resources," by Robert J. Ziegler, BBZ Consulting
- "SSPC Education Committee Update," by William Corbett, PCS, KTA-Tator

Tuesday, January 15

Coatings That Beat the Heat

- "When Undercover Agents Are Tested to the Limit: Coatings In Action (CIA) and Corrosion Under Insulation (CUI)," by Mike O'Donoghue, Ph.D., International Paint, LLC
- "Waterborne Thermal Insulation Coatings," by Sudhir Achar, Dow Chemical Company
- "Introduction to Insulative Coatings," by David Hunter, Mascoat
- "Selection of Coatings for CUI Service," by Michael MeLampy, Hi-Temp Coatings Technology, Inc.

Concrete Protection Solutions

- "Polyurea 'Loose' Liners: A Band-Aid for Excessively Cracked Concrete," by Kristin Leonard, Bechtel Corp.
- "Preparing and Lining Concrete for Immersion Service: Steps and Procedures to Avoid Failures," by Robert Maley, Corrosion Probe, Inc.
- "What's New About Repairing Cracks in Concrete," by Rick Yelton, Hanley Wood Business Media
- "Old Coat, New Threads," by Todd Gomez, PC, John Winfrey, and Dudley Primeaux, VersaFlex Incorporated

Defending Against Corrosion in the Military

- "Operation: Combined Effort," by Dr. Roger D. Hamerlinck, Office of the Assistant Secretary of the Army: Acquisition, Logistics, and Technology—Office of the Army Corrosion Control and Prevention Executive
- "Marine Corps Corrosion Prevention and Control (CPAC)," by Matthew Koch, Marine Corps
- "U.S. Navy Surface Fleet Maintenance Painting," by Sarah Faber and Tom Valentine, U.S. Navy—SURFMEPP
- "Corrosion Control Knowledge Sharing Network: Fighting the War on Corrosion from Multiple Fronts," by Steve Melsom and Linda Stiles, NAVSEA
- "Partnering with SSPC in the Pacific Rim," by Dan Dunmire, Office of Under Secretary of Defense Acquisition, Technology, and Logistics
- "The Air Force Enterprise for Corrosion Prevention and Control," by David Robertson, Ph.D., Air Force
- "Paint and Coatings—Protecting the Assets of the U.S. Army Corps of Engineers," by Susan A. Drozdz, U.S. Army Construction Engineering and Research Lab
- "Single-Component Polysiloxane Coating for Navy Topsides," by Erick B. Iezzi, Ph.D., Naval Research Laboratory

Coatings Issues and Solutions— Commercial Structures, Sponsored by Durability + Design

- “Key Specification and Application Issues for Coatings in Steel Construction Projects,” by Walter Scarborough, HKS Architects
- “No Place for Hipsters When the Substance Behind a Pretty Façade is Required,” by Cynthia O’Malley, KTA-Tator
- “Elastomeric Acrylic Coatings for Use on Commercial Structures,” by Leo Procopio, Dow Chemical Company
- “The Quest for Success in Accelerated Weather Testing for High-Performance Architectural Coatings,” by Allen Zielnik, Atlas Material Testing Technology, LLC
- “Laboratory and Field Testing of Thin-Film Air Barrier Coatings Applied to CMU,” by Kevin Knight, Retro Specs, Ltd.
- “Department of Energy’s Landmark Study of the Impact of Air Barriers on Energy and Moisture Control,” by Andre Desjarlais, Oak Ridge National Laboratory
- “Moisture in Historic Commercial Building Walls—Approaches to Assessment and Restoration,” by John Harry, John Harry Restoration Services
- “A Novel Approach for Extending the Life of Factory Applied Coatings,” by Jim Deardorff, Superior Coatings
- “Painted Aluminum—Concerns with Fabrication Details and Exposure,” by Kirk Shields, GPI/Greenman-Pedersen
- “Moisture Issues and Mitigation Strategies for Concrete Surfaces,” by Fred Goodwin and Frank Apicella, BASF Construction Chemicals, Inc.

True Stories of Coatings in Action

- “Performance or Preference? Anoka Tank Reconditioning Revisited,” by Dan Zienty, PCS, Short Elliot Hendrickson, Inc.
- “San Antonio Power Plant Asset Corrosion Protection Program,” by Mario SanJuan, P.E., CPS Energy, and Kirk Wissmar, P.E., KTA-Tator
- “Rehabilitation and Lead Abatement of Water Tanks in a Residential Area,” by Travis C. Tatum, P.E., and Jimmy Dunham, P.E., Dunham Engineering, Inc.
- “Quagga Mussel Coatings Project,” by Randall Witowski, Metropolitan Water District of Southern California
- “The Good, Bad, and Ugly After 35 Years Involved with Coatings,” by Bryant (Web) Chandler, PCS, GPI/Greenman-Pedersen

Green Evolution

- “Corrosion Control Without the Use of Toxic Heavy Metals,” by David Tarjan, HALOX—A Division of ICL Performance Products LP
- “Newest Additives for Green Coatings,” John Du, BYK USA Inc.
- “How Can Companies Go Greener? (…Psst: Without Losing Performance),” by Anders Braekke, Jotun A/S (HQ)
- “Are You Restricted By Your Total Solar Reflectance Performance?” by Ian Goodwin, Huntsman

Looking Down at Concrete Floor Protection

- “QP 8 Certification,” by John Russo, Blendex Industrial Corporation
- “Understanding ASTM Test Standards and What They Mean in Evaluating Polymeric Flooring Materials,” by Anthony Gaffney, Floor and Deck Solutions T2
- “The Choices and Consideration Challenge of Resinous Flooring,” by Steven John Lipman, Guardian Industrial Products of Mass.
- “Adhesion Studies of Floorings and Coatings to Concrete with Various Preparation Methods,” Mike Houx, West Coast Industrial Flooring, and Steve Schroeder, Dex-O-Tex
- “Polymeric Flooring Advisory Committee Town Hall Meeting,” by Steve Schroeder, Dex-O-Tex, and John Russo, Blendex Industrial Corporation

Bridge Painting and Protection

- “Keeping the Schedule for the Charles De Gaulle Bridge,” by David Simkins, Polygon US Corporation
- “Successful Bridge Painting in the Northeast During the Winter Months: Pros and Cons from Owner and Contractor,” by Matthew McCane, GPI/Greenman-Pedersen
- “Brooklyn Bridge—Repainting the Most Iconic Structure in the World,” by Guerman Vainblat, GPI/Greenman-Pedersen
- “Bridge Coating in Japan: Doing it Right the First Time,” by Winn Darden, AGC Chemicals Americas
- “The Use of Coatings with Optically Activated Pigments (OAPs) on KYTC Bridges,” by Bobby Meade, GPI/Greenman-Pedersen, Ted Hopwood, and Sudhir Palle, Kentucky Transportation Center
- “How Chemistry Can Affect the Life of Reinforced Concrete Bridges,” by S.L. (Sindee) Gillespie, G.O.A. Enterprises

Wednesday, January 16

Protecting Ships and Marine Structures

- “NSRP Surface Preparation and Coating 2013 Update,” by Stephen Cogswell, BAE Systems Southeast Shipyards
- “Tralopyril Metal Free Marine Anti-Foulant Update,” by Dave Helmer, Janssen PMP
- “Electrochemical Impedance Spectroscopy (EIS) Analysis of Freshwater Foul-Release Coatings,” by Bobbi Jo Merten, Ph.D., U.S. Bureau of Reclamation
- “Anomalies, Ambiguities, and the Certain Uncertainties of Ballast Tank Corrosion Protection Systems and Regulations,” by Skip Vernon, Coating and Lining Technologies, Inc.
- “Evaluation of ‘Spot-and-Sweep’ Blasting as a Cost Effective Method of Underwater and Outer Hull Surface Preparation,” by Gordon Kuljian, CCAT
- “Polymeric Interior and Exterior Marine Decking Systems,” by Jing Zeng, ITW Polymer Technologies
- “Severe Erosion in Pump Casings,” by Allen Skaja, Ph.D.; David Tordonato, Ph.D., P.E.; and Bobbi Jo Merten, Ph.D., U.S. Bureau of Reclamation
- “Modernizing Shipbuilding with Blast and Paint Facility,” by Katie Urbas, NASSCO

Coating Technology for the Aerospace Industry

- “The Critical Truth Regarding Aerospace Coatings and Flight in the 21st Century,” by Matthew Thomas, Standard Aero
- “Chemical Reactivation of Exterior Decorative Aerospace Livery Coatings,” by Douglas Berry, The Boeing Company
- “New Harvard Coating Gives Ice the SLIPS,” by Philseok Kim, Harvard University
- “Development of Self-Stratifying Systems as Sustainable Coatings,” by J. Baghdachi, Coatings Research Institute, Eastern Michigan University

Wastewater Coating Challenges and Solutions

- “Martin ‘B-C’ Zone Reservoir Liner Replacement—An Owner’s Perspective,” by Dorothy Dolan, Tucson Water
- “Martin ‘B-C’ Zone Reservoir Liner Replacement: Doing Our Part for the Tucson Water Department Construction/Inspection Team,” by Eric Brackman, RFI Consultants
- “Plural Material Application Does Not Have to be Difficult,” by Mike Ivkovich, Graco, Inc.
- “Working Together—20 Million Gallon Concrete Relining Project Done On Time and On Budget,” by Robert Murphy, PCS, The Sherwin-Williams Company; Dorothy Dolan, Tucson Water; Eric Brackman, RFI Consultants; and Mike Ivkovich, Graco, Inc. o “Lessons Learned in Coating Water and Wastewater Treatment System Structures,” Manuel Najar, P.E., V and A Consulting Engineers, Inc.

Green Evolution II

- “Selection and Specifications for Architectural and Industrial Maintenance Coatings for Commercial Architecture,” by John C. Williams, FCSI, CCS, HOK
- “The Next Generation, Heavy-Duty, Anti-Corrosion Coatings Enduring 13,000+ Hours of Salt Fog Without Using Any Traditional Heavy-Metal Pigments,” by Sue Wang and Jianguo Wang, AnCatt, Inc.
- “Ice Phobic Coatings for Wind Tower Blades and Structures,” by Rob Thomaier and Danielle Peak, NuSil Technology, LLC
- “Novel Waterborne One-Pack (1K) Epoxy Technology for Corrosion Protection,” by Dr. Florian Lunzer, Cytec Industries

Thursday, January 17

Protective Coatings*—Past *and Future

- “The History of Paint,” by Charles Harvilicz, Newport News Shipbuilding
- “A Novel Alternative Surface Preparation for Duplex Coating of Galvanized Steel,” by Richard Schertzer, Madison Chemical Industries, Inc.
- “Titans of the Abyss: Polyurethane, Polyurea, and Hybrid Lining Technology,” by Mike O’Donoghue, Ph.D., International Paint, LLC
- “In-Situ Coating Method for Cleaning and Coating of Internally Corroded Pipelines in the Field,” by Baker Hammad, BSH Engineering Consultant Office

Environmental, Health, Safety, and Regulations

- “TCEQ Coating Hot Topics and Regulatory Resources,” by Glenda Swierc, MS, CHMM, Texas Corrosion on Environmental Quality
- “REACH and Its Grasp on the Protective Coatings Industry,” by Heather Stiner, PCS, SSPC, and Heather Ramsey, Sauereisen
- “Regulatory Update: Current and Emerging Trends in Occupational and Environmental Health,” by Alison B. Kaelin, KTA-Tator
- “A Walk Through the River of OSHA Regulations Relating to Abrasive Blasting,” by Tom Enger, Clemco Industries, Corp.

Inspection*—Assuring *Performance and Quality

- “Third Party Inspection: The Good, the Bad, and the Ugly,” by Tom Schwerdt and Johnnie Miller, TxDOT
- “Practical Coating Thickness Measurement Overview,” by Paul Lomax, Fischer Technology Inc.
- “‘Standard of Care’ for Coatings Inspection,” by Peter Ault, Elzly Technology Corporation
- “Optical Safety and Visual Ergonomics for Fluorescent (OAP) Coatings Inspection,” by Paul D. Gossen, Paul D. Gossen, LLC

High Performance Coatings

- “Spray-On Ceramic Insulation Up To 450 C and Encapsulating Existing Corrosion Without Sandblast,” by Joseph Pritchett, Superior Product International II, Inc.
- “Viscous Elastic Coating and Sealants: How They Are Unique and Different From Conventional Corrosion Prevention Coatings,” by John Glass, Amcorr Products and Services, Inc.
- “How Design Features Unique to AP1 000 Power Plants Affect Coating System Design Requirements,” by Mike Durbin and Pat Ward, The Sherwin-Williams Company
- “New Anti-Fouling Technology Applied to Prevent the Growth of Invasive Species on the Southern Delivery Project in Pueblo, CO,” by Steve Davis, Coblaco Inc.

Field and Laboratory Testing

- “Comparing Multiple Weathering Techniques Among Various Coatings Chemistries,” by Veronica Coleman, The Sherwin-Williams Company
- “A Study of the Effect of Film Thickness and Blast Profile on Accelerated Under Film

Corrosion Creep," by Carl Reed, International Paint, LLC

- "Adhesion Tests and Failure Modes Study on Structural Steel Coatings," by Dr. John J. Myers, Missouri Univ. of Science Technology
- "Laboratory Evaluation of Metalized Coatings," by David Tordonato, Ph.D., M.E., and Allen Skaja, Ph.D., U.S. Bureau of Reclamation

SSPC 2013 Exhibitors

The following is a current list of companies planning on exhibiting at SSPC 2013 featuring GreenCOAT, accurate as of press time. For information on exhibiting, contact Kate Jurik, SSPC Event Manager & Exhibit Sales Specialist, at jurik@sspc.org or 877-281-7772.

- Abrasives Inc.
- Advanced Recycling Systems, Inc.
- Aggreko
- AIR Systems International
- ARID-DRY
- Arma Kleen Company
- Barton International
- Binks
- BlastProMfg
- Bullard Co.
- Carboline Company
- CESCO/Aqua Miser
- Chlor*Rid International Inc.
- Cleaner Blast Solutions
- Clemco Industries Corp.
- *CoatingsPro* Magazine
- CSI Services, Inc.
- Custom Abrasives, LLC
- Cytec Industries
- Dampney Co. Inc.
- DeFelsko Corporation
- Dehumidification Technologies
- Denso NA
- DESCO Manufacturing Co., Inc.
- Detroit Tarp Inc.
- Diamond Vogel/Pinnacle Protective Coatings
- Doosan Portable Power
- DRYCO, LLC
- DUSTNET by EMI
- Eagle Industries
- Elcometer
- LVH Industries Inc.
- Marco
- Mascoat
- Midwest Rake
- Mohawk Garnet, Inc.
- Moisture Control Company
- Monarflex by Siplast
- Montipower, Inc.
- NACE
- National Equipment
- NexTec, Inc./PreTox
- Novatek Corp.
- Novetas Solutions
- Olimag Sand
- OPTA Minerals, Inc.
- Painters & Allied Trades LMCI
- Park Derochie
- Pinovo AS
- Polygon
- PPG Protective & Marine Coatings
- Praxair Surface Technologies
- Pro-Tect Plastic and Supply
- PTQ Safety
- Rhino Linings Corporation
- Ring Power Corporation
- SAFE Systems
- Safety Lamp of Houston
- SAFWAY Services
- Sand Express
- Sauereisen
- Schmidt Engineered Abrasive Systems

- EnTech
- Fischer Technology Inc.
- FS Solutions Group
- Fujian Duoleng Steel Group Co., Ltd.
- Geoblaster Equipment
- GMA Garnet (USA) Corp.
- Graco Inc.
- Granite Mountain Quarries
- Green Diamond Sand Products
- Greenman-Pedersen, Inc.
- Hanes Supply Inc.
- Harsco Minerals
- Hempel Coatings
- HippWrap Containment
- HoldTight Solutions Inc.
- HRV Conformance Verification Associates
- IBIX USA
- Indian Valley Industries
- Industrial Painting Limited, Inc.
- Industrial Vacuum Equipment Corp.
- International Paint LLC
- JAD Equipment Co.
- KTA-Tator, Inc.
- The Sherwin-Williams Company
- Spider
- Sponge-Jet Inc.
- Sulzer Mixpac USA, Inc.
- Sunbelt Rentals
- Tank Industry Consultants
- Tarps Mfg, Inc.
- The TDJ Group
- Technology Publishing/PaintSquare
- TFT-Pneumatic, LLC
- The Warehouse Rentals & Supply (TWRS)
- Tnemec Company
- Tractel Inc., Griphoist Division
- Timaco LLC
- Van Air Systems
- VersaFlex
- Wasser High-Tech Coatings, Inc.
- Western Technology
- WIWA LP
- Wooster Brush
- Zebron Corporation

Preparing Surfaces at Wastewater Plants: An Overview of Substrates, Practices, and Standards

From *JPCL*, September 2012 | Free Product Information

Vaughn O'Dea
Tnemec Company, Inc., Kansas City, MO
Vaughn O'Dea is director of sales—water & wastewater treatment for Tnemec Company, Inc., where he is responsible for strategic sales, marketing, and technical initiatives. He has written numerous technical reports and articles for various waste-water industry journals. He is active in the technical committees of NACE, SSPC, and ASTM and is a member of AWWA, WEF, ACI, ICRI, NASSCO, and NAPF. He is a contributing editor for JPCL, was awarded the JPCL Editors' Award in 2008 and 2010, and received a JPCL Top Thinker award this year.

Vaughn O'Dea

Our valued wastewater infrastructure has been underfunded, under maintained, and under attack for many decades. Corrosion and deterioration are winning the battle. Wastewater infrastructure in the United States is clearly aging, and the required investment is not able to keep up with the need. The 2009 *Report Card for America's Infrastructure* issued by the American Society of Civil Engineers (ASCE) assigned wastewater infrastructure a "D minus."[1] In accompanying comments, the ASCE indicated that as much as 900 billion gallons of combined sewer overflows are released yearly because of the poor state of our sewerage infrastructure. To complicate matters, a 2011 ASCE report titled *Failure to Act* determined that the investment gap has significantly increased because of our failure as a nation to respond.[2]

According to the ASCE report, the Environmental Protection Agency (EPA) estimated the cost of the capital investment required to maintain and upgrade waste-water treatment systems across the U.S. in 2011 was $58.3 billion. However, only $16.1 billion was funded, leaving a capital funding gap of nearly $42.2 billion. By 2020, the predicted deficit for sustaining waste-water treatment infrastructure will be $60 billion, a staggering 42 percent increase in less than 10 years. The funding gap is expected to widen by 2040.

These statistics are nothing short of alarming. Perhaps we can look to Adam Smith and his "diamond-water paradox" to explain why our wastewater infrastructure has deteriorated to such perilous conditions. In his epic book, *The Wealth of Nations,* Smith notes that although water is essential for life while the value of diamonds is mostly aesthetic, the price of water has always been far lower than that of diamonds. Consequently, our tendency to place little economic value on water has arguably resulted in the neglect on our water and wastewater infrastructure. What's more, it is said that the sustainability of a community is directly related to its waterworks system. Overburdened or failing wastewater infrastructure not only has a negative economic impact, but, worse, conditions caused by the result in unsanitary conditions increase the likelihood of public health problems.

Recognizing that investments made now have a profound impact in the long-term, the EPA issued the *Clean Water and Drinking Water Infrastructure Sustainability Policy* as part of its effort to ensure robust and sustainable waterworks systems moving forward.[3] The overarching goal of this *Policy* is to encourage the adoption of sustainable practices, such as embracing the philosophy of capital asset management. Simply put, sustainability is effectively maintaining a desired level of service life at the lowest life-cycle cost. This forward-thinking management of our infrastructure assets minimizes the total cost of owning and operating them while delivering the desired service levels. Asset management is the framework to achieve effective wastewater management.

The use of high-performance protective linings contributes to the sustainability of wastewater infrastructure. Let's take a look at how the protective coatings industry can support the sustainability concept beginning with surface preparation. This article discusses the prevailing views and current practices—from the author's perspective—for the surface preparation required for the common substrates found within severe wastewater environments: concrete, carbon steel, ductile iron, and stainless steel.

Background

The term severe wastewater environment is used colloquially in this article to describe any confined-space wastewater environment, whether a sewer pipe or enclosed structure, containing a headspace (or vapor area above the flow of sewage).

The Useful Lives of Wastewater System Components

Component	Useful Life (Years)
Collections	*80–100*
Treatment plants—concrete structures	*50*
Force mains	*25*
Pumping stations—concrete structures	*50*
Interceptors	*90–100*
Source: EPA (2002, Table 2-1, adapted)	

Wastewater headspaces are areas susceptible to corrosion from biogenic sulfide attack.[4] These areas are typified by elevated concentrations of hydrogen sulfide and other sewer gases. Despite a useful design life in excess of 25, 50, or even 80–100 years,[5] many of these structures commonly experience significant corrosion that ultimately requires replacement in dramatically less time. One such example is that of a lift station in Florida where the concrete, ductile iron, and stainless steel material were all severely corroding in less than five years of service (Fig. 1). The lift station is scheduled for complete replacement (a far cry from the 50-year design life).

Not surprisingly, the coal tar epoxy on the concrete and ductile iron in Fig. 1 is clearly unable to withstand the elevated headspace exposure and therefore certainly not able to provide the requisite corrosion protection. The wastewater industry is now recognizing that high-performance lining systems with low-permeation properties to sewer gases and acids are paramount to achieving the service life expected of these structures.[6] Equally important, and often overlooked, is the proper surface preparation of the construction materials to maximize the service life of the lining system. Although sound in principle, surface preparation is fraught with challenges and met with resistance because of the variety of surface preparation techniques offered in the wastewater marketplace.

Fig. 1: A wastewater lift station experiencing significant corrosion of concrete, ductile iron, and stainless steel materials. Note the failing coal-tar epoxy that was applied to the concrete and ductile iron materials. Photos courtesy of Tnemec.

Concrete

Concrete is inherently durable and is used extensively in wastewater construction. The alkaline nature of concrete, however, makes it—relative to other substrates discussed in this article—most susceptible to the effects of biogenic sulfide corrosion. Sewer pipes, manholes, lift stations, screening structures, grit chambers, equalizations basins, junction boxes, and many additional headspace-containing structures are commonly constructed of concrete and require corrosion protection by high-performance protective linings to achieve the anticipated service life of the structures.

Preparing concrete surfaces appropriately to maximize the performance offered by high-performance protective linings is, in this author's view, the most commonly overlooked aspect of coating concrete. Unfortunately, the wastewater industry sees a myriad of preparation recommendations, including the proverbial "pressure wash" or "sand blasting" techniques. With no standard of quality, the outcome often leads to premature failures—most commonly resulting in disbondment because of improper removal of the laitance layer (Fig. 2) or insufficient substrate rugosity—or profile (Fig. 3).

Fig. 2: Delamination failure due to inadequate removal of laitance layer

Fig. 3: Delamination failure due to insufficient substrate anchor profile

So how do you ensure consistent preparation on what is unquestionably considered an inconsistent substrate? First, follow industry consensus standards and practices such as the SSPC-SP 13/NACE No. 6, Surface Preparation of Concrete[7] and NACE (Standard Practice) SP0892, Coatings and Linings over Concrete for Chemical Immersion and Containment Service.[8] Both documents detail standardized and reproducible methods for inspection, surface preparation, and sample acceptance criteria to ensure that current preparation methods and coating system design requirements are achieved. Specifically, SSPC-SP 13/NACE No. 6 defines a standard degree of cleanliness, strength, profile, and dryness of prepared concrete surfaces while NACE SP0892 sets forth guidelines for the selection and installation for concrete surfaces that will be exposed to immersion conditions or chemical splash and spillages.

Second, it is important to specify the appropriate anchor profile to ensure a satisfactory mechanical profile is created for the lining specified. A tactile method for determining a substrate's profile is by using the ICRI Technical Guideline 310.1R[9] concrete surface profile (CSP) comparators. It is the author's experience that for severe waste-water exposures, the substrate profile should be equal to an ICRI-CSP5; a lesser profile may not provide sufficient mechanical interlocking of the system to the substrate to resist the lifting forces exerted on the film from exposure to the severe sewer environment.

Third, it is important that all voids, gouges, bugholes, and other surface anomalies on the substrate be repaired with the appropriate patching materials before applying a coating system.[10] Repairing new and existing concrete levels the substrate and creates a paintable surface (Fig. 4). Concrete substrates—including new, cast-in-place and pre-cast structures—should be repaired to allow the topcoat to achieve a continuous, monolithic film.

Fig. 4: Properly prepared concrete (above) and concrete repair via a cementitious resurfacing material (below)

Ferrous Metals

Ferrous metals, such as carbon steel and ductile iron, are also commonly used in wastewater construction for a variety of components including tanks, pipes, fittings, valves, and structural members. Ferrous metals are subject to microbiologically-influenced corrosion and direct molecular attack from hydrogen sulfide gas, so they require barrier protection in severe wastewater environments.

Carbon Steel

It is well understood that the surface preparation of carbon steel is the key foundation to achieving long-term performance of heavy-duty, high-performance protective liners. Carbon steel members are typically abrasive blasted to achieve a prescribed degree of substrate cleanliness and to achieve a suitable anchor profile (waterjetting is occasionally used for rehabilitation where a satisfactory profile exists). Similar to concrete, proper surface preparation is consistently achieved by following industry consensus surface preparation standards. SSPC-SP 5/NACE No. 1, White Metal Blast Cleaning,[11] with a minimum 3.0-mils (76.2-microns), angular anchor profile ensures optimum surface cleanliness and adhesion of the protective coating system in severe sewer environments.

Ductile Iron Pipe

Ductile iron (DI) is also a common material for many appurtenances, including pipe and fittings found in severe sewer exposures. Although inherently more corrosion resistant than concrete and carbon steel, ductile iron nonetheless requires a high-performance protective lining to achieve the useful design life when exposed to sewer environments. Similar to carbon steel, ductile iron surfaces require attention to surface preparation to make the substrate suitable for topcoating. While ductile iron and carbon steel are both ferrous metals, there are inherent metallurgical and manufacturing differences between the two metals that preclude ductile from meeting certain parts of the SSPC/NACE surface preparation standards. But there is an industry consensus standard to provide consistency in surface preparation: the National Association of Pipe Fabricators developed NAPF 500-03, Surface Preparation for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings.[12] The NAPF 500-03 contains several standards that can be selected based on whether the piece is a pipe or fitting, what surface—interior or exterior—is to be prepared, and what exposure conditions are expected (See box). For example, the method in 500-03-04, Abrasive Blast Cleaning–External Pipe Surface, is selected if a ductile iron pipe exterior is scheduled to receive a high-performance protective coating for heavy-duty exposures (Fig. 5). This standard is written specifically for exterior DI pipe because unlike carbon steel surfaces, it is possible to "overblast" the external surfaces of DI pipe, causing slivering of the substrate.

NAPF 500-03 Standards
NAPF 500-03-01 Solvent Cleaning
NAPF 500-03-02 Hand Tool Cleaning
NAPF 500-03-03 Power Tool Cleaning
NAPF 500-03-04 Abrasive Blast Cleaning of Ductile Iron Pipe
NAPF 500-03-05 Abrasive Blast Cleaning of Cast Ductile Iron Fittings

Fig. 5: Ductile iron pipe exterior prepared in accordance with NAPF 500-03-04 External Pipe Surface

High-Velocity Jet Sewer Cleaning: No Flushing Matter

Sanitary sewer overflows caused by blocked or corroded pipes result in the release of as much as 10 billion gallons of raw sewage yearly, according to the ASCE.1 Interruptions in sewer service are thought to be avoided by strict enforcement of sewer ordinances and timely cleaning and inspection of sewer systems. This is commonly accomplished using what the sewer cleaning industry refers to as high-velocity jet cleaning techniques (aka jetting or hydrocleaning) with pressures commonly 2,500–3,000 psi (172–207 bar; Fig. 9).[14] Jetting is a hydraulic cleaning method that removes grease buildup and solids debris by directing high velocities of water against the interior pipe walls at various angles.[15, 16] As the procedure connotes, hydrocleaning is extremely aggressive on high-performance linings applied to sewer interceptors. For context, visualize a 2,500 psi pressure washer with the 0-degree tip (jet) operating at a distance of 2 in. (51 mm) from the lined surface. The hydrodynamic forces (stresses) produced by high-velocity jet cleaning are considered extreme by any measure.

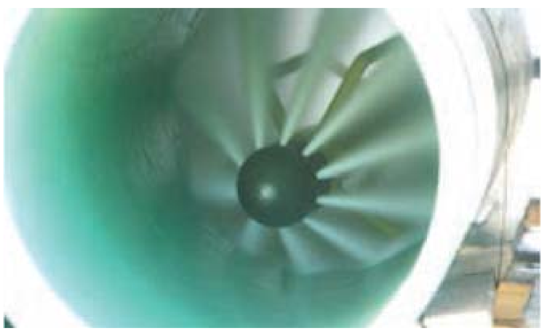


Fig. 9: High-velocity jet cleaning a ceramic epoxy-lined ductile iron pipe

An extremely durable, low pigment-volume-concentration (PVC) coating formulation with excellent adhesion is certainly a requisite to withstand hydrocleaning. In the author's experience, certain specialty, ceramic-modified amine epoxies have demonstrated their ability to withstand high-velocity jet cleaning.

Additionally, it may be said that the foundation for success— the surface preparation— plays a significant role. Assuming that the coating achieves certain physical properties, what exactly allows this lining to withstand the hydrodynamic stresses? An objective observer cannot rule out superior adhesion to the substrate. Further, it is well understood that a uniform, angular anchor profile directly contributes to maximum adhesion. Therefore, the author submits that, in addition to a high-quality coating film, the ability to withstand high-velocity jet cleaning is a function of the quality of surface preparation—in this case, thorough rotary blasting of carbon steel or ductile iron sewer pipe.

Conversely, the interior surface preparation of DI pipe is defined by the method in NAPF 500-03-04, Abrasive Blast Cleaning-Internal Pipe Surface. The standard requires that the entire surface to be lined shall be uniformly struck by the blast media. And like carbon steel pipe diameters of less than 42–48 inches, the interior preparation can only be accomplished adequately by employing rotary blasting equipment. Rotary blasting establishes a 90-degree angle of impact of the abrasive media to the interior surface to ensure removal of the annealing oxide layer on DI pipe as well as to properly profile the surface for optimum adhesion (Fig. 6). Otherwise, the annealing layer and other foreign contaminants may not be satisfactorily removed from the center section of the pipe, causing potential delamination or undercutting of the coating film. Damage from overblasting to the interior DI pipe normally does not occur.

Fig. 6: Rotary abrasive blasting the interior surfaces of ductile iron pipe

Ductile (Cast) Iron Fittings

NAPF 500-03-05, Surface Preparations Standard for Abrasive Blast Cleaning of Cast Ductile Iron Fitting, details four degrees of abrasive blast cleaning. The selection depends on the type of service for which the DI fitting is intended and on the type of coating/lining specified. (Typical abrasive blasting of DI fittings is shown in Fig. 7.) Briefly described, the four degrees of blast cleaning are

Fig. 7: Uniformly abrasive blasting the interior surfaces of cast iron fittings using an angular abrasive

- Blast Clean #1: no staining;
- Blast Clean #2: no more than 5% staining;
- Blast Clean #3: no more than 33% of staining; and
- Blast Clean #4: no limit on staining that may remain on the surface, provided it is tightly adherent.

The Blast Clean #1 condition is the recommended degree of cleanliness, with a minimum 3.0-mil (76.2-micron), angular anchor profile for high-performance linings for severe wastewater environments (Fig. 8).

Fig. 8: Internally lining a ductile iron fitting following a Blast Clean#1 condition, 3.0 mils anchor profile

Stainless Steel

Stainless steel, a non-ferrous metal, is often selected as a construction material for sewer exposures because of its general corrosion resistance to these environments. This corrosion resistance is primarily attributed to a thin, inert, chromium-rich, transparent oxide film on the surface—the result of a process called passivation. However, some types/grades of stainless steel succumb to the aggressive nature of severe sewer environments and eventually corrode. A high-quality, high-performance lining system with low permeation properties to sewer gases can significantly extend the service life of stainless steel in these environments.

As with ferrous metals, surface preparation is the key to achieving optimum adhesion—and ultimately protection—on stainless steels. Stainless steels should be uniformly abrasive blasted in accordance with SSPC-SP 16, Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals, again with a minimum 3.0-mil (76.2-micron),[13] angular anchor profile (Fig. 10). (Some manufacturers may require greater anchor profile.) Exercise care when selecting an abrasive material to ensure that it will not embed into the substrate, potentially causing bi-metallic corrosion. Generally, it is preferable to use only extremely hard mineral abrasives, such as garnet, aluminum oxide, and stainless steel grit, of suitable particle size. Also, given the reactive nature of stainless steels, this author suggests top-coating as quickly as possible after surface preparation, generally within 2 to 4 hours.

Fig. 10: Stainless steel surface following uniform abrasive blasting

Summary

Capital spending has not been keeping pace with the needs for wastewater infrastructure. While today's sewerage systems have become more severe, municipal owners and engineers are expecting increasing performance—it is imperative these structures meet their anticipated design expectancy. This tenet also applies to the protection offered by high-performance lining systems. To maximize the service life of quality lining products it is critical that all substrates in the sewerage systems be prepared in the very best manner. The use of industry consensus standards and prevailing industry practices are paramount to achieving optimum protection of our critical wastewater assets with high-performance protective lining systems.

Editor's Note: This article, by Vaughn O'Dea, is part of the series of Top Thinker articles appearing in *JPCL* throughout 2012. Mr. O'Dea is one of 24 recipients of *JPCL*'s 2012 Top Thinkers: The Clive Hare Honors, given for significant contributions to the protective coatings industry over the past decade. The award is named for Clive Hare, a 20-year contributor to *JPCL* who shared his encyclopedic knowledge of coatings in many forums. Professional profiles of all of the award winners, as well as an article by Clive Hare, were published in a supplement to the August 2012 *JPCL*.

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Comment from Joe Cesarek, (10/4/2012, 3:57 PM)

Groovy stuff here ...... every wastewater engineer specifier should read! Joe at SEH Engineering, Inc.

Comment from Tom Schwerdt, (10/8/2012, 8:45 AM)