AWWA Conference Set for San Diego

The American Water Works Association's (AWWA) Annual Conference and Exposition, ACE09, is set for June 14–18 in San Diego, CA, at the Convention Center.

According to AWWA, there will be 17 workshops, 100 sessions in the professional program, and 6 tours of local facilities. At least 500 companies are expected to take part in the exhibition, which opens on June 15. This year's attendees can earn CEUs at the Exhibition Hall Education Sessions, which will cover corrosion control and more. AWWA plans to have a career fair and career coaching sessions. The Sixteenth Water Industry Luncheon will be held on June 16, where Frank Caliendo will entertain attendees.

For full details and registration information, visit www.awwa.org.

Courtesy of the San Diego Convention Center (www.sdccc.org)
Photographer: Timothy Hursley

Construction Outlook: Only Public Works Up

McGraw-Hill Construction, a provider of project information and industry news, has predicted that U.S. public works construction will rise in 2009, but overall, new construction starts will fall by 15% (to $463.1 billion).

Public works construction starts are estimated to climb 10%, including a 15% rise in highways and bridges. The increase is the most immediate benefit to be seen from the stimulus funding in the American Recovery and Reinvestment Act (ARRA). McGraw-Hill estimates that without the ARRA money, public works would fall by 10%. The 2009 outlook also anticipates that institutional building will decrease by 6%; commercial building by 27%; and residential building by 31%.

"The construction industry is facing divergent forces in 2009," said Robert Murray, vice president of economic affairs and the author of the outlook. "There's yet to be any sign that lending conditions for construction have improved. On the plus side, the federal stimulus bill is now in place, which will provide quick support to public works this year."

NIST to Fund Infrastructure, Mfg. Research

The U.S. National Institute of Standards and Technology (NIST) announced its 2009 competition for multiyear research funding under its Technology Innovation Program (TIP) in two areas of national interest—civil infrastructure and manufacturing. The competition is open to projects that develop new technologies for practical application of advanced materials and the monitoring of major public infrastructure systems. Small- and medium-sized businesses, higher education institutions, nonprofit research companies, and national laboratories are eligible, with some restrictions.

TIP plans on giving $10 million in first-year funding for civil infrastructure in two areas. The first is for cost-effective sensors and technologies for non-destructive testing and monitoring of major infrastructures, with emphasis on detecting corrosion, cracking, and delamination. The second focus is on new technologies that will help facilitate repairing and upgrading existing structures.

TIP expects to provide funding for approximately 25 new projects. Single companies are eligible for up to $3 million over 3 years and joint ventures for no more than $9 million over 5 years.

The due date for proposal submission is 3 p.m. EST, June 23, 2009. Proposals can be submitted electronically at www.grants.gov, or on paper to National Institute of Standards and Technology, Technology Innovation Program, 100 Bureau Dr., Stop 4701, Gaithersburg, MD 20899-4701. For details, visit www.nist.gov/tip.

Asia Pacific Show Cancelled

The Asia Pacific Coatings Show 2009, originally scheduled for June 3–5 in Bangkok, Thailand, has been cancelled. The Coatings Group cites ongoing economic uncertainty and recent domestic issues in Thailand as the reasons for the cancellation.

The next Asia Pacific Coatings Show will take place in 2010 in Jakarta, Indonesia, for the first time. Visit www.coatings-group.com for more information.

Demand to Rise for Antimicrobials in Paint

The Freedonia Group, Inc., an industry research firm based in Cleveland, OH, released "Disinfectant & Antimicrobial Chemicals," a study that predicts demand for the chemicals, including products for antifoulant coatings, will increase 3.6% to $1.2 billion in 2013.

The study predicts that organosulfurs will be the fastest-growing product category due to developments in the paint and coatings industry. The firm states that organosulfurs will likely be the leading replacement for tributyl tin (TBT) in the marine antifoulant segment.

Demand for disinfectant chemicals in industrial, commercial, and consumer markets is expected to grow in general, despite scientific disagreement on the necessity of using them in some current applications. However, the use of chemicals in antimicrobial additive applications, such as paints, plastics, or textile products, is less controversial.

To purchase a copy of the study, visit www.freedoniagroup.com.

Ex-Asbestos Training Head on EPA Wanted List

The Environmental Protection Agency (EPA) has added the former president of the largest asbestos removal training school in Massachusetts to its fugitives web site. Albania Deleon failed to appear for her sentencing on March 23 at the Federal District Court, District of Massachusetts, and a warrant has been issued for her arrest for violating post-trial release conditions, according to EPA.

Deleon was convicted in federal court last November on 28 felony charges related to her role as president of Environmental Compliance Training (ECT), a certified asbestos training provider. Counts included selling certificates from ECT to hundreds of undocumented immigrants who had not taken the course. She sent hundreds of the untrained persons to asbestos demolition sites to perform removal work and paid them under the table. Deleon's company was shut down in May 2007.

EPA's Criminal Investigations Division launched its fugitives web site in December 2008 as a tool to help enlist other law enforcement agencies and the public in tracking down fugitives accused of violating environmental laws and evading arrest. For a complete list of the persons on the EPA's fugitive list, go to http://www.epa.gov/compliance/criminal/fugitives/index.html.

EPA cautions the public not to try to apprehend any of the individuals on the list. Instead, any sightings should be reported through the EPA web site, www.epa.gov/fugitives, or the Criminal Investigation Division office in Boston, MA, at 617-918-2300.

Simon Parlis and Kabeer Khader

Euroblast Acquires LCL

Euroblast Middle East (Dubai, UAE) has acquired Liquid Control Limited (LCL) in Wellingborough, UK, from Graco, Inc., headquartered in Minneapolis, MN. Simon Paulis, the vice president of Graco N.V., Europe, and Kabeer Khader, managing director of Euroblast Middle East, signed the sale agreement at the end of February.

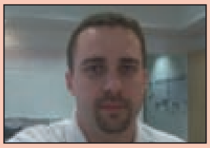
Euroblast provides surface preparation solutions to the coatings industry. LCL designs, manufactures, and installs dispensing solutions and is an authorized distributor of Graco products.

On Lining a Demineralized Water Tank

A high-quality epoxy phenolic lining failed after only five years inside a demineralized water tank. The 560,000-gallon tank is made out of carbon steel. The design pressure and temperature of the tank are atmospheric and 100 F (38 C). What advice can you provide for this application to avoid another premature failure?

Travis LeFever,
Crossway Protective Coatings

Whatever coating you end up selecting (and I would say there are many that would be appropriate), keep in mind that the contractor selected, the contractor's QA/QC procedures, and independent third-party inspection (during pre-cleaning, surface prep, and application and curing) may be the difference in any coating's ability to endure the anticipated life cycle, regardless of coating technology.



Travis LeFever is the president of Crossway Protective Coatings (Greensboro, NC). With 11 years of experience in the industrial painting business, he is a SSPC Certified Coating Inspector as well as a NACE Coating Inspector Level 3 and NACE Coating Inspector Program Instructor.

Jeff Longmore,
Thin Film Technology Inc.

I assume that the epoxy phenolic coating failed by osmotic blistering, which is the usual mode of failure in demineralized and distilled water tanks. I would recommend staying with a high-quality epoxy, but I would strongly recommend taking extra special care to thoroughly decontaminate the surface before coating by using one of the proven decontamination systems after SSPC-SP 5 White-Metal abrasive blasting.

Jeff Longmore joined International Paints Ltd. in 1965 and left as technical director of the Western U.S. states in 1983 to join Hempel Coatings as technical director of the Eastern Provinces of Saudi Arabia. He eventually became technical director and plant manager of Hempel Coatings USA. He started Thin Film Technology in 1990 in Houston, TX, where he is presently technical director.

Julian Hay, ACS Industrial Painting

Contrary to general opinion, demineralized, or deionized (DI), water is very nasty stuff, precisely because it is deionized and would like to become re-ionized in a hurry. To do so, it will go right through your coating if it possibly can.

A good quality immersion-grade epoxy should do the job, but the surface prep and surface cleanliness are absolutely critical. Based on observation and personal experience, I think surface cleanliness is the most important factor of all, and one that is frequently overlooked, to the great chagrin of many. Never omit rigorous substrate testing for low level "salts" contamination. The industry in general is just beginning to wake up to this factor, but, fortunately, there are some who recognize the magnitude and pervasive nature of this problem. Just because you cannot see the contamination does not mean it is not present. Regardless of where the steel came from, who made it, and how many times it has been blasted or water blasted, or how completely impossible it is that "your steel" is contaminated, it is still likely contaminated. Sorry about that, it's just the nature of the beast. (There is quite a bit of extant data on this. We have all been waiting for an industry consensus document on the topic.)

Here's what I would suggest: Blast to a real, proven SSPC-SP 5 White-Metal, with a suitable profile, then test for chloride contamination. In my opinion, you want less than 10 ppm of chlorides, but I would rather see 0 ppm—and it can be achieved. If chlorides are nil right off the bat (which is very unlikely—either you do not know how to test, cannot read, or are looking for the wrong salt) and you have extensive osmotic blistering (which I bet you do!), then test for sulphates and nitrates. Actually, you could just cut to the chase and insist upon a mandatory post-blast washdown with a proprietary salt-removal product, followed by yet more substrate testing, until levels of 10 ppm or less are achieved. Then pay attention to the cure (temperature and time), and insist upon a full pinhole test.

Now, let's talk about inspection! Some people consider it an unnecessary expense. But it is cheap insurance and you absolutely need it, full-time, for the duration of the job, by a fully qualified,

Continued

certified coating inspector. Your company produces a product, does it not? Presumably it is inspected and qualified every step of the way, correct? So why would you even think of doing an expensive and technically demanding job without inspecting it every step of the way?

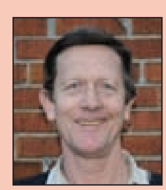
Full disclosure: I'm an independent, third-party inspector and I also own and operate a specialty coatings company, but I am writing here as a wise old dog (well, not that old) who has seen more than 25 years of coating work. Inspected jobs are always done better than non-inspected jobs.

While it is true that a really good, honest, competent contractor will have his own QC, who is QCing the QC? The contractor's QC has a vested interest, and the owner ain't necessarily it when the chips are down and money or time is scarce. Your coating failed in five years, so it was probably pooched (that's a technical term, meaning "gone to the dogs") or going that way by three years, I would imagine. With proper inspection (based on good specs and a good inspection and testing procedure), you would likely still be admiring your intact lining! My favorite quote is "You don't get what you expect, you get what you inspect."

Involve the most experienced person in the technical department of the coating manufacturer, and get the person's input, especially regarding quirks and foibles of the proposed coating (and yes, they all have some). And it would be smart to get all that in writing!

Pay careful attention to ventilation criteria and issues, and make sure the cure schedule is properly followed and done right.

Last but not least, face east and bow to the rising sun while crossing your fingers and holding garlic. DI water is nasty stuff and can be sneaky. It may still come back to haunt you.



Julian Hay has 25 years of experience in the specialty coatings/industrial painting business. He began as a sprayman and sand blaster in his own company, Toronto, ON-based Associated Coating Services (aka ACS Industrial Painting). A NACE Certified Coating Inspector, he also acts as a coating consultant to major engineering firms and local municipal governments and performs third-party NACE inspections, particularly for the nuclear and petrochemical industry. Mr. Hay is fluent in English, French, Spanish, and Swahili.

The Case of the Perplexing Paint Shop:

Accelerated Corrosion of Interior Corrugated Roof Surfaces

By E. Bud Senkowski, PE, KTA-Tator, Inc.
Richard Burgess, KTA-Tator, Inc., Series Editor

Coating specifiers, contractors, or manufacturers are often blamed when installed coatings fail to meet service life expectations. However, in the following situation, the failure of an installed coating system was the result of conditions created by an unsuspecting building tenant and a little-known chemical reaction.

Fig. 1: General appearance of roof interior
All photos courtesy of KTA-Tator, Inc.

Facility Description

A building owner leased out approximately 50,000 sq ft of a 150,000 sq ft building to a tenant who operated an auto painting and refinishing shop. Automotive painting facilities use a variety of solvents for paint thinning, metal cleaning, and stripping operations. In addition, most of the paint systems used in automotive shops contain evaporating solvents in the 40–50% (by volume) range. The contained solvents are released as the coatings are baked to facilitate their cure. Solvents present or released during all automotive paint shop operations include toluene, xylene, butyl acetate, mineral spirits, methyl amyl ketone, and methylene chloride. Well-designed shops typically use mechanical exhaust systems to remove nearly all of the released evaporating solvents; however, some solvents find their way into the workspace.

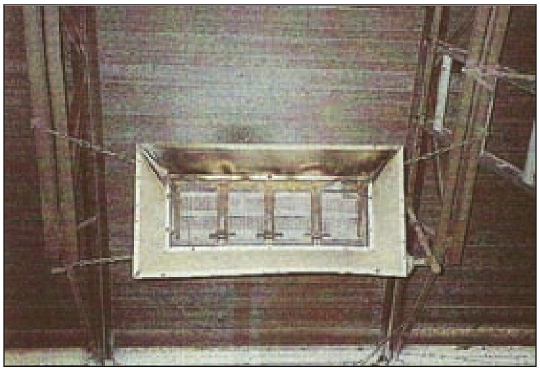


Fig. 2: Infrared heater unit

The building was of masonry block construction with a truss-supported, galvanized, and corrugated steel roof. The interior roof in the paint shop area was finished in a white acrylic coating (Fig. 1). The steel truss system was painted with an alkyd primer and finish coat. The paint shop area was heated with eight natural gas-fired, un-vented, infrared space heaters. Each one had a thermal output of 40,000 BTU/hr and was suspended from the open truss system (Fig. 2).

The First Signs of Failure

After approximately one year of operation, the building owner began to observe deterioration of the coatings applied to the interior of the corrugated steel roof and its supporting truss system. The deterioration took the form of rust stains and coating delamination. Both the steel truss system and galvanized roof displayed corrosion attack. The corrosion of the galvanized roof panels was particularly severe. In addition to loss of the acrylic topcoat, the underlying galvanized layer had corroded in localized areas to expose the steel core of the roof panels.

Investigating the Failure

An examination of the interior surfaces of the auto shop roof and supporting truss system revealed that the metal surfaces were covered with a combination of rust, paint particles, and unidentified whitish deposits. Physical probing of the roof surface in the immediate vicinity of a suspended infrared heater revealed that the metal substrate contained no visible adherent paint. Instead, there was a layer of corrosion

Continued

product approximately 5 to 10 mils thick that could be easily removed by scraping it with a putty knife. Once cleaned of corrosion products, the metal substrate revealed a random pattern of corrosion pits throughout.

The degree of corrosion and the thickness of adherent corrosion products appeared to vary somewhat throughout the auto shop, depending on the location of the infrared heaters and the nature of the body shop operations conducted in the affected area. In general, the corrosion appeared more severe in the vicinity of the heaters in areas where solvents were used in support of painting operations (Fig. 3). The areas included those where paint stripping, paint mixing, and spray equipment cleaning took place. In general, surface corrosion was distributed throughout the interior ceiling of the auto shop. The percentage of surface corrosion was estimated at 60% to 70%, with little adherent paint. The applied coatings had ceased to function as an effective corrosion barrier in all areas of the shop.

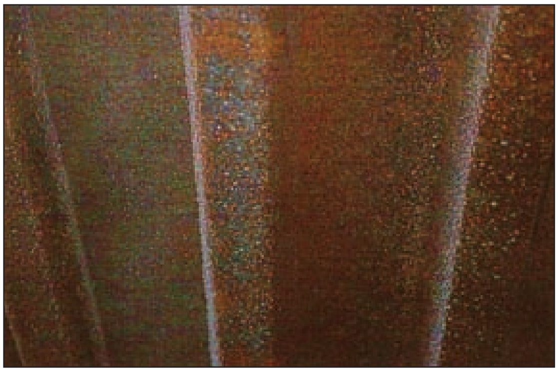


Fig. 3: Corroded roof panel in vicinity of heater unit

Field tests for soluble chlorides were conducted at various locations in the auto shop. Surfaces were swabbed with deionized water, and the wash liquid was tested for soluble chloride content using a chemical indicator (Fig. 4, p. 14). In all cases, the chloride level exceeded 800 ppm.[1]

Laboratory Analysis

In addition to the field tests, scrapings of ceiling surface deposits were removed from the vicinity of the heaters in the paint shop area. The laboratory investigation consisted of the analysis of two corrosion products for chloride ion by an ion-selective electrode. The tests revealed that the corrosion deposits contained between 19% and 42% chloride.

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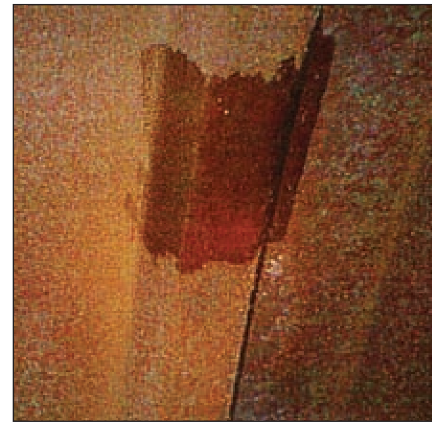


Fig. 4: Chloride extraction test on roof panel

What Went Wrong?

When the surface contamination analysis tests revealed a high concentration of soluble chloride ion (Cl^-), the material safety data sheets (MSDS) for solvents and paints used within the shop were reviewed. The review revealed that one product used as a paint-stripping solvent in the shop contained approximately 60% methylene chloride. The MSDS for the paint stripper, Section 5, entitled, "Physical Hazards (Reactivity Data)," also cautioned that the stripping material should not be used in the vicinity of hot surfaces because it would undergo thermal degradation, producing hydrogen chloride.

Methylene chloride, a chlorinated hydrocarbon, is non-flammable but will decompose into hydrogen chloride (HCl) and carbon dioxide (CO_2) when heated to temperatures above 250 F. The reaction for this chemical decomposition is shown on p. 16.

Both hydrogen chloride and carbon dioxide are gases and will disperse throughout the auto shop. Hydrogen chloride quickly reacts with environmental moisture to form hydrochloric acid ($HCl + H_2O$) droplets.

Investigators found that the unvented, gas-fired heaters situated throughout the auto shop provided the heat source for the thermal decomposition of the methylene chloride. The heaters were fed a pressurized flow of natural gas, principally methane (CH_4). The methane mixed with air and ignited to burn within a porous ceramic panel that formed the radiant panel of the infrared heater. Because the flame front was within the ceramic panel, most of the heat transfer was in the infrared frequency range. However, the combustion of the natural gas in the unit produced temperatures of approximately 1,800 F. This temperature was high enough to cause the thermal decomposition of methylene chloride. The heaters also produced water as a product of combustion. The equation for the combustion of methane (natural gas) is shown in the box on p.16.

In the reaction, two pound-mols of water were produced for every pound-mol of methane (natural gas) burned by the infrared heaters. At a heat output of 40,000 BTU/hr for an infrared panel heater, approximately three pounds of water per hour were created in the products of combustion. The water was released into the shop area, and provided a water source for the hydrolysis of hydrogen chloride to hydrochloric acid.

The droplets of hydrochloric acid eventually condensed on cooler surfaces in the building, such as the underside of the painted, galvanized steel roof. The hydrochloric acid droplets are highly aggressive to carbon steel and many paint systems. Both carbon steel and zinc corrode rapidly when exposed to hydrochloric acid at a pH of 5 or below, often developing corrosion pits due to the formation of ferric chloride and, in the case of galvanizing, zinc chloride.

The hydrochloric acid aggressively attached to the carbon steel surfaces in

Continued

Thermal decomposition products of methylene chloride (CH_2Cl_2):

$CH_2Cl_2 + O_2 + Heat \rightarrow 2\ HCl\uparrow + CO_2\uparrow$

Methylene Chloride + Oxygen > 250 F → Hydrogen Chloride + Carbon Dioxide

Combustion by-products of natural gas (Methane, CH_4):

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + Heat$

Methane + Oxygen → Carbon Dioxide + Water + Heat

the shop. The corrosion rate of carbon steel in dilute hydrochloric acid has been estimated at up to 50 mils/year. The zinc metal applied by the galvanizing process was even more aggressively attacked by hydrochloric acid, forming zinc chloride and hydrogen gas in the process. The thickness of the steel roof panels measured at only 40 mils (0.040 in.), with an additional 4-5 mils of zinc. The presence of hydrochloric acid on the roof interior and its potential for continued corrosion would result in the eventual perforation of the steel roof panels through localized pitting.

These factors, together with the observation that pitting corrosion had already been established on 60-70% of the inner roof surface, made it imperative that remedial action be undertaken without delay.

Fixing the Problem

A recommendation was made that the use of halogenated solvents, such as methylene chloride, be discontinued to prevent further roof corrosion. At a minimum, the solvents should not be used when the space heaters are in operation. The addition of ventilating fans and fume collection hoods would also be effective in removing corrosive vapors. The immediate remediation of the problem involved having the existing interior roof surfaces cleaned by wet blasting to remove all residual hydrochloric acid, adherent corrosion products, and paint. The interior roof was then coated with a surface-tolerant and chemical-resistant epoxy mastic coating.

A subsequent visit to the shop revealed that the roof area corrosion was substantially reduced. The paint shop, however, was unwilling to change solvents. The building owner was looking for a new tenant.

Footnote

1. No specific threshold for chloride in a dry, interior environment has been established. However, for comparison purposes, a limit of 10µg/cm², mea-

sured using the Bresle patch technique, an extraction volume of 2 milliliters of water, and effective area of 12.25 cm^2 will back calculate to 61.25 ppm, lower by more than a factor of 10.

E. Bud Senkowski, P.E., is a senior coatings consultant with KTA-Tator, Inc. He has over 30 years of combined engineering experience in a variety of coating engineering positions involving nuclear, fossil, fuel gas, and hydroelectric facilities.

Mr. Senkowski is a registered professional engineer, a certified nuclear coatings engineer, a SSPC Protective Coatings Specialist, and a NACE Certified Coatings Inspector Level 3. He received a BS in engineering from Pennsylvania State University and an MBA from Drexel University.

Mr. Senkowski has taught courses for the Electric Power Research Institute (EPRI) on protective coatings. He is a member of ASTM Committee D33 on Coatings for Power Generation Facilities and has served as chairman of ASTM Subcommittee D3.06 (Pipeline Coating and Linings) and vice-chairman of ASTM Committee G3 (Durability of Non-Metallic Materials). He has also served on the Steering Committee of the Nuclear Utilities Coating Council (NUCC). Mr. Senkowski is a contributing editor for *JPCL*.

Next Month in *Cases from the F-Files*

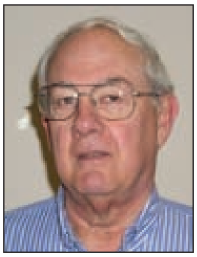
After only eight years in service, a pedestrian bridge had to be closed due to corrosion. The bridge spanned saltwater and was subjected to high humidity and marine conditions—so what could have caused the coating to fail prematurely? Was the bridge's environment not properly considered or were other circumstances to blame? Stay tuned to find out.

Training Managers and Workers Benefits All

By Lori Huffman

Worker training can be a means of accomplishing diverse goals: complying with customers' requirements, performing high-quality work, and developing future company leaders. As Main Industries' president Mike Challoner says, the cost of training individual workers can equal the price of a semester's tuition at a state-owned college. However, trained workers perform higher quality work, resulting in satisfied customers and more jobs, he says.

This article shares the experiences of three companies—F.D. Thomas, Inc.; Vulcan Painters, Inc.; and Main Industries Inc.—with training programs for their employees.


Mike Challoner

Attitudes about Training Mirror Companies' Visions

According to Dan Thomas, president of Medford, OR-based F.D. Thomas, letting people know that their work is respected and appreciated is an important aspect of running a successful company. Providing training and advancement is one way to accomplish this goal.

By providing training to his workers, Thomas increases their abilities and ameliorates the "transferrable value" of the company. A greater transferrable value facilitates the company's future sale or assumption of control by key employees, Thomas says. "A small specialty contractor expands based on the people they have," he notes. According to his company's strategic plan, the training program would take 10 years to implement fully. Three years ago, the company began to see the first results of the training program, he says.

In accordance with its ISO 9001 certification, training is an integral part of Vulcan's quality management system, says Jeff Theo, vice president of field operations for the Bessemer, AL-based company. Vulcan recognizes management's responsibility to educate its workforce and to continually evaluate workers to determine the need for additional training. "The company's organizational structure has an entire flow chart for training," says Theo.


Jeff Theo

For Main Industries, headquartered in Hampton, VA, training for its workers is as necessary as it is desirable. As a contractor that performs shipyard coating work for the U.S. Navy, the company is required to ensure that its workers are trained and certified to meet government mandates.

Sources for Education

All three companies take advantage of training opportunities from a variety of sources. While each company has developed in-house training programs, third-party courses, such those offered by SSPC and NACE as well as union-sponsored training, are valuable resources. "We rely heavily on the LMCI [Painters and Allied Trades Labor Management Cooperation Initiative] and FTI [Finishing Trades Institute] as training partners. We don't consider the [union organizations] to be third-party providers. They're part of Vulcan and we're part of them," says Theo. Thomas notes that union courses provide content that his company can then reinforce on a daily basis with its employees. *[Editor's Note: LMCI and FTI sponsor training in partnership with the International Union of Painters and Allied Trades and the Finishing Contractors Association.]*

SSPC instructors are brought into Challoner's facility to conduct training courses and test the participants. In fact, Main Industries has set up a testing area in its yard for painters and blasters, says Challoner.

Training Workers in the Basics and Beyond

Training gives workers the opportunity for growth in lateral and vertical steps, Thomas says. For those not interested in project management, Thomas encourages training in different skill sets to allow employees to explore positions of equal, yet different, responsibilities.


Dan Thomas

According to Theo, Vulcan offers in-house, train-the-trainer programs for quality control as well as basic quality control for entry-level employees. The company trains all employees on the quality processes and procedures used in its facilities. Skills training is also provided in the company's various departments, he says.

Main Industries developed its training program 20 years ago. The company conducts a three-hour training session that covers safety training as well as instruction in company-specific procedures and processes, says Challoner. The company also encourages experienced workers to train newer personnel. He emphasizes that experienced employees don't have to fear their job security. "[We're] not trying to replace them but rather perpetuate the company," he says.

Educating Future Managers

F.D. Thomas' training program lasts between three and five years, depending on the interests of each employee. The trainees learn estimation, contract administration, and field management. During the first year of the project management program, employees learn estimation. "While an estimator may benefit from having project management abilities, he may not want to deal with the other side," he says. In this case, training can be tailored to suit the employee's strengths and interests.

When the college-aged sons of Main Industries' founders began to consider joining the company, the Challoner brothers devised a management training program that would allow each candidate to experience every aspect of the business. Participants spend two months working in each trade area, and two years total to cover all departments, says Challoner. In addition, the company takes advantage of the Virginia Department of Labor's Training Assistance Program, which offers training in business-related activities, customer relations, and communication.

Interns Offer Insights

Four years ago, Vulcan began recruiting interns from the University of Alabama's Business School to undertake specific projects, such as cost analysis for a particular program. The company has also sponsored training projects for graduate classes, in which students analyze Vulcan's business practices as part of its strategic management initiative. The benefit of this program is getting the students' fresh perspective on the company's business; in addition, the program acts as a recruiting tool for future management positions, says Theo.

Two of the students' early projects led to the development of a new inventory management program as well as the selection and implementation of an equipment maintenance management system.

Investment in Training Reaps Rewards

Challoner sums up the contractor's perspective on training, noting that educating workers is worth the cost. "We all recognize that employees are valuable assets. They need to be trained, be able to do their jobs, and be supported by us. Training translates into higher quality and hopefully more work. And the more technical the work becomes, the more training you have to do," he says.

Coating Concrete: Double-Check Your Specs

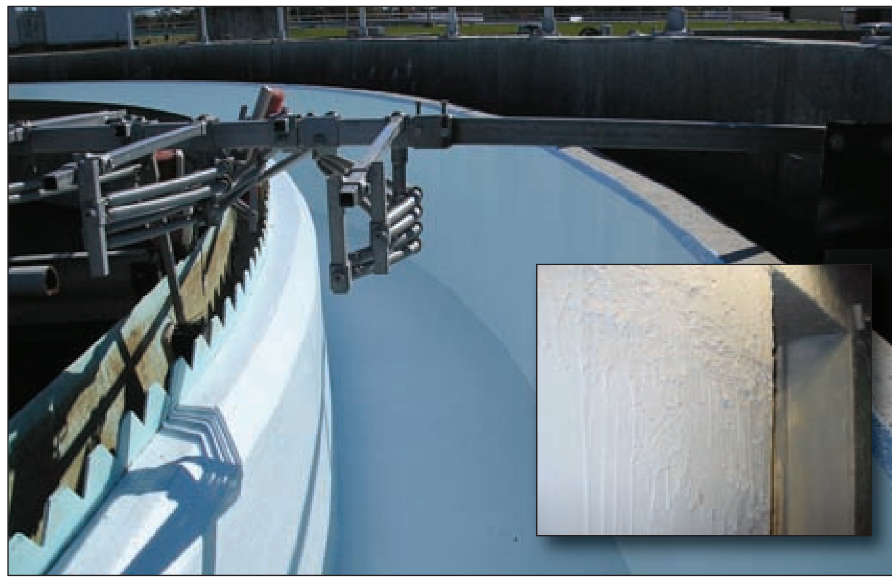
By Kevin Morris, Market Development Director, Water and Wastewater, The Sherwin-Williams Company

Editor's Note: This article is a condensed version of a paper the author presented at PACE 2009, the joint conference of SSPC and PDCA, held February 15–18, 2009, in New Orleans, LA. The full paper appears in the conference Proceedings *(www.sspc.org).*

There's more to coating work than meets the eye. The words behind the work have a lot to say about a project's outcome. A poorly written specification increases the risk of a poorly prepared surface and an incorrectly or poorly applied coating. Ambiguous or missing language in a specification can delay a project, wasting time and financial resources.

An effective specification for coating or lining a concrete structure should be written only after careful consideration of the substrate and structure itself, the purpose of the lining, the anticipated ambient and environmental service conditions, the method and timing of application, and the economic factors. A well-developed specification normally includes many sections, beginning with Scope of Work, Terms and Definitions, Related Work in Other Sections, Reference Standards and Codes, Safety Issues, Submittals, Quality Assurance, Job & Pre-Job Conference Planning, Surface Preparation Requirements, Coating Materials, Coating Schedules, Workman-ship and Application Instructions, Work Schedules, Testing & Inspection Criteria, and Repair Procedures.

This article reviews commonly overlooked items in sections of specifications that address everything from surface preparation to repair procedures for coating or lining concrete tanks, industrial floors, secondary containment, or similar concrete structures.



A clarifier trough that has been correctly rehabilitated and lined. Inset: Runs, sags, and voids in an epoxy laminate lining system. All photos courtesy of The Sherwin-Williams Company.

Surface Preparation

Concrete is made of materials that vary in size, consistency, shape, and physical characteristics. The range of formulations, mix ratios, performance admixtures, and placement or finishing techniques add to the complexity. Every mix of concrete is unique, so a master or boilerplate specification is not useful.

While the substrate and the methods of surface preparation differ from project to project, the goals of preparing concrete surfaces remain the same: to provide a clean, sound, and properly cured surface to coat, as well as one that is saturated surface dry (SSD), i.e., moisture is in the pores of the concrete but not standing on the surface. The surface should be free of honeycombs, bugholes, voids, fins, or inclusions, which can lead to pinholes or voids in the film. The surface after preparation should also demonstrate an adequate surface profile to anchor the designed system at the specified film thickness.

Surface Profile

The initial steps in surface preparation are to clean the surface and insure that the profile is adequate. These steps are described in SSPC-SP 13/NACE No. 6, Surface Preparation of Concrete, the joint standard for the preparation of concrete. In addition to spelling out acceptable levels of moisture content, surface cleanliness, tensile strength, and related factors, this standard makes important reference to the ICRI (International Concrete Repair Institute) Technical Guideline No. 03732.

The ICRI Guideline helps quantify surface profile by establishing degrees of surface roughness. The degree of profile is compared visually to one of nine rubber replica templates that define the Concrete Surface Profile (CSP) (Fig.1). Too often, specifications state the requirement of surface preparation of concrete to meet the joint standard, but do not specify a desired CSP number.

An example of correctly referencing a

Continued

surface preparation method and a surface profile in a specification is: "Prepare all areas to receive a corrosion protection system in accordance with SSPC-SP 13/NACE No. 6, including achieving a concrete surface profile of CSP 3–5, per ICRI Technical Guideline No. 03732."

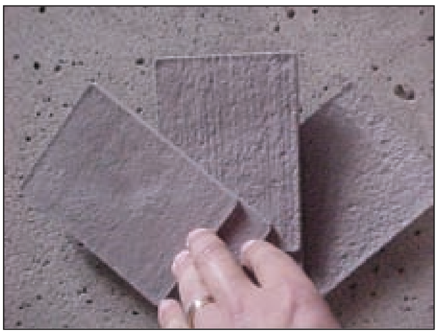


Fig. 1: ICRI No. 03732 Visual CSP Templates against abrasive blasted concrete surface

Treatments/Fillers & Surfacers

A specification should clearly state the required degree of filling bugholes, honeycombs, and voids before coating application (Fig. 2), and it should specify the resurfacing materials—traditionally, epoxy-based fillers or mortars ranging from polymer-based cementitious materials to 100% volume solids epoxy materials. Further abrasive preparation may be required.

Coating Materials

To select a suitable coating material, the specifier must consider factors related to proper performance and life cycle, such as moisture vapor emission (MVE); chemical types, concentrations, and exposures; temperature of the stored commodities; traffic anticipated on the surface; point loads of heavy equipment or weight from traffic loads; abrasion factors; movement or vibrations; environmental conditions; and substrate conditions.

Suitable coatings for concrete tanks, floors, and secondary containment are typically epoxies, epoxy novolacs, vinyl esters, polyesters, polyurethanes, or polyureas. These may contain fillers like silica sand blends, fumed silica, glass flake, mica flake, micaceous iron oxide, fiberglass mats or veils, or broadcast media. Variations in resin type and fillers dictate physical characteristics and may affect life cycle in a certain environment. Specifications should require that contractors follow the manufacturer's recommendations.

Coating Schedules

The schedule reflects the chronological order in which the specified materials and sequence of application steps are named. Recoat windows (minimum and maximum) need to be reviewed to pre-

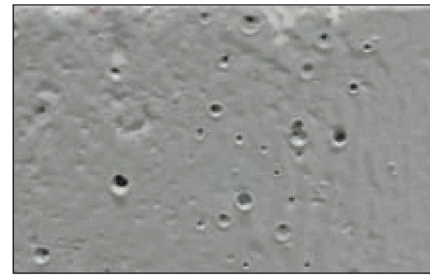


Fig. 2: Outgassing from bugholes that were not properly filled before lining application

vent potential issues in a multiple-coat application. Total system dry film thickness (DFT) must be included.

Primers

Concrete is porous, so air and moisture can move through the substrate. This movement increases when temperatures rise, and decreases as temperatures fall. Specifications should require primers to be applied while the temperature of the substrate is falling, reducing the potential for air and moisture movement to cause defects such as pinholes in the coating.

Construction Details

Construction details include items like cove bases, control joints, construction joints, and transitions from floor-to-wall intersections that, if improperly specified or treated, could reduce the long-term performance of a coating system. Material suppliers should provide the necessary drawings for details that they recommend. This does not include treatment of moving joints.

Laminates

Some coatings for concrete include laminates (e.g., glass fiber mat). Installed incorrectly, the laminates could have hollow spots or stray fiberglass strands that are potential wick points for moisture if not fully covered with resin (Fig. 3). The specification should address application of a basecoat resin, hand lay-up of the fiberglass, imbedding the fiberglass into the resin with ribbed rollers, and the use of additional resins as needed to completely wet the fiberglass. Properly installed fiberglass should change from a white appearance when dry to a translucent/clear appearance when properly wet out.

Fig. 3: Improperly "wet out" chopped strand fiberglass mat in an epoxy laminate lining

Topcoats

Topcoats will vary in resin chemistry, film thickness, and number of coats based on the required chemical resistance, type of system being installed, and the desired finished texture. Specifications that call for aggregate should include the amount of aggregate by weight that is to be mixed with the resin before application or broadcast into the applied resin. With slip-resistant finishes, there is a fine line between roughness and cleanability. Owners' expectations always seem to be different from any discussion or small samples that are agreed upon. Acceptance of the finished appearance and texture should be

Continued

addressed through a specification that calls for an approved jobsite mock-up.

Expansion and Isolations Joints
Concrete expands and contracts naturally, but such movements can damage the concrete. Expansion and isolation joints are designed to prevent detrimental effects on the substrate from movement. The joints are intended to be honored (i.e., not filled or coated over, but left so that the joint will remain flexible without fracturing the liner) through a coating or lining system and treated after coating application with appropriate joint filler. The filler provides sufficient expansion/contraction to handle the designed joint movement. Fillers are typically polyurethane, polysulfide, or fluoroelastomers. Preformed joints, primarily used in decks and roadways, are also available.

Workmanship

This section of the specification is too often addressed with a comment similar to "Work is to be performed in conjunction with good painting practices as detailed in SSPC Painting Manual, Volume 1 Good Painting Practice." This statement may not be sufficient for the application of coatings and linings to concrete. Due to the technical difficulty in properly installing some of today's high-performance coating systems, the specification should require applicators to complete specialized training or verify their skills.

If aesthetics are important to the owner, the specification should detail what constitutes an aesthetically acceptable finish. (Approved jobsite mock-up samples would be the best way to eliminate disagreements or rejection of work during project close out).

Application

Specifications should spell out the equipment and methods for application, such as airless, conventional, or plural-component spray; brush; or roller. A specification may require a particular piece of application equipment.

The section should also provide conditions for applying the specified coatings and necessary equipment to provide an acceptable environment. At minimum, the conditions that should be covered are ambient temperature, substrate temperature, humidity, dew point restrictions, pot life, sweat-in times, recoat times, cure to service, approved solvents and percentages for thinning, and range of application per coat.

Work Schedule

This portion of the specification should clearly define limitations on working hours, such as the acceptability of extended daytime and weekend work holidays, and scheduling conflicts. The work schedule portion of the specification should require the contractor to submit a defined work plan before project startup.

Testing and Inspection

Testing and inspection procedures give owners ways to ensure that their assets are being protected as specified. The specification should describe all testing to be performed and the testing methods, including when, where, and how many times. Specifications should also detail all acceptable limits for pass/fail criteria of the required tests.

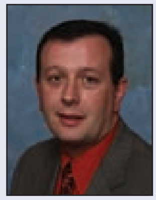
For inspection, the specification should include the required credentials for the inspector (e.g., SSPC, NACE). It is critical to establish the authority of the inspector on the project site and the flow of inspection and non-conformance reports to the necessary person(s). Specifications should describe the instruments for testing, the party who provides the instruments, and the calibration requirements.

Repairs

The specifier should try to include repair procedures for common defects (e.g., holidays/pinholes), uncured materials, blisters, inadequate thickness, and hollow spots in laminate systems. The specification should also direct the contractor and inspector to the specification writer or material manufacturer for repair procedures not listed.

Conclusion

A properly written specification requires a working knowledge or understanding of the substrate, system being installed, and inspection criteria. Seeking clarifications over missing or ambiguous language—or worse, doing the job wrong because of a poorly written specification—may cost the specifier, the contractor, and the owner considerable money and production time.



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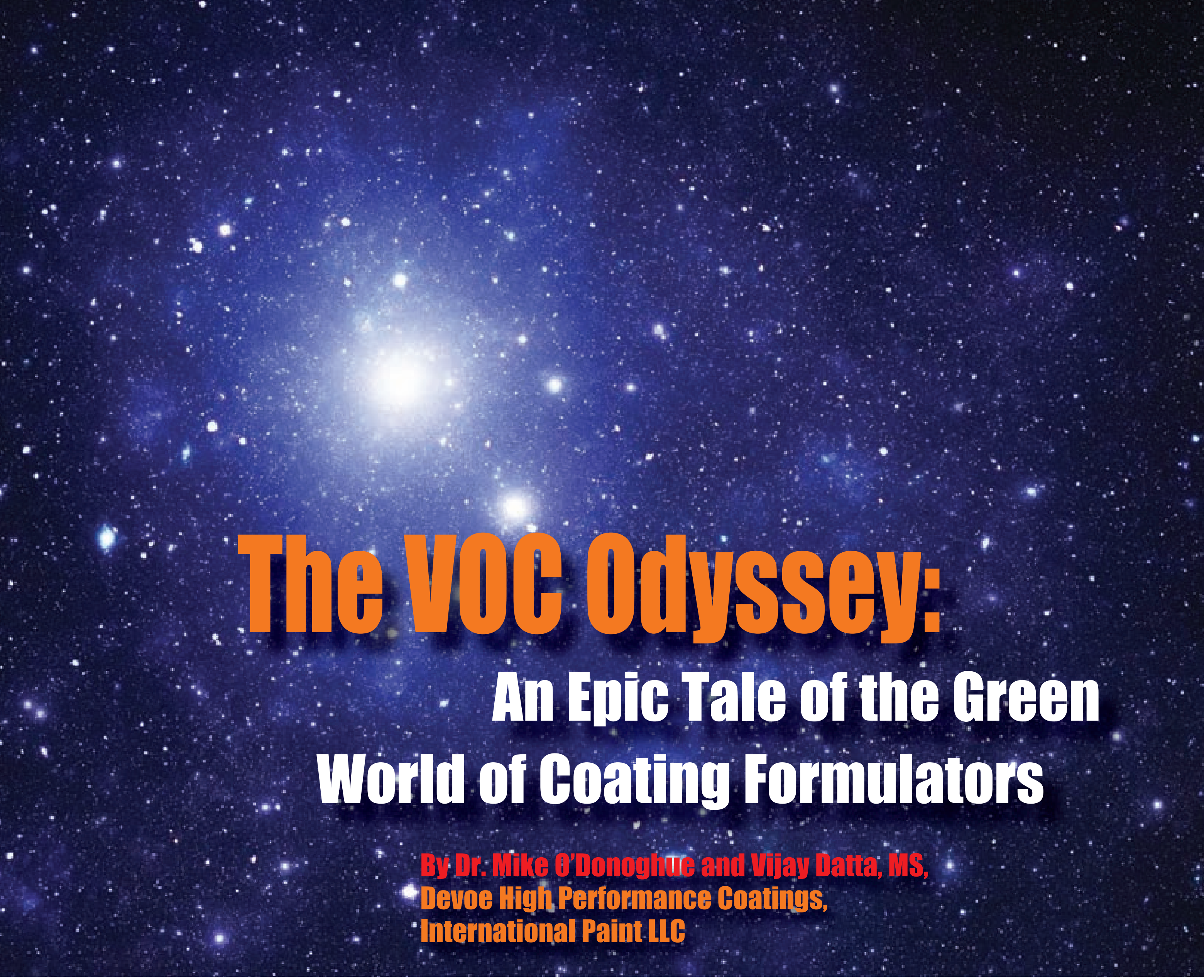

The VOC Odyssey:

An Epic Tale of the Green World of Coating Formulators

By Dr. Mike O'Donoghue and Vijay Datta, MS,
Devoe High Performance Coatings,
International Paint LLC

So there you are in the laboratory, a coatings formulator in the modern age, pondering an exciting challenge in the realm of protective coatings, where a real sense of scientific wonder often prevails. The crucial task at hand? One that's been around in one form or another since the late 1980s to the present. You must address head-on the sometimes perplexing regulatory position of volatile organic compounds (VOCs); produce high-performance coatings that are easy and safe to apply; keep the costs down without detracting from in-service performance; do your stint for the environment in particular and the planet at large by complying with VOC regulations without inadvertently introducing something worse; strengthen your company; and delight your customers. No mean feat in creative problem solving. After all, what innovative design goals could be more stimulating or rewarding? Headline stuff in molecular engineering: Get a Green "A" Grade.

At the heart of the matter are VOCs, which are hydrophobic or hydrophilic compounds, either of a man-made or natural source, that participate in atmospheric photochemical reactions and thus contribute to atmospheric pollution. Most of them are considered to be hazardous air pollutants (HAPS). VOCs emitted from activities in the paint and coatings industries accounts for a significant amount of the total VOCs emitted by man-made activities. For instance, in the U.S. in 2007, solvent utilization (of which the manufacture and use of VOC-emitting paints and coatings are a substantial subset) accounted for 23% of all VOC emissions from man-made sources.[1]

Air quality issues are front and center in society nowadays. In the presence of sunlight, VOCs have the ability to react with nitrogen oxides; form ground level ozone; contribute to smog formation; and thus have a deleterious effect on both our health and the environment. Small wonder that, even without the hot topic of climate change in North America and the European Union (EU), solvent emission regulations are always subject to new proposals, change, and ever-increasing stringency. In July 2006, for instance, the

South Coast Air Quality Management District (SCAQMD) in California lowered VOC limits for industrial maintenance coatings to 100g/L. A decade earlier, the SCAQMD levels were 340 g/L.[2] Meanwhile, in 1998, the U.S. Environmental Protection Agency had set a national limit of 420 g/L. (See sidebar on this page.) So coating formulators have their work cut out.

Trauma Here; Transcendence There...

Sure, you are aware that an adversarial relationship between regulators and the coatings industry has surfaced from time to time. But while it might be objected that tackling VOC emissions through coercive policies has been a blessing for coatings manufacturers, few would dispute that those policies have been anything short of revolutionary or have generated a new paradigm in the coatings industry. Admittedly, compliance with VOC regulations has brought a measure of travail. Smaller coatings manufacturers have been subject to attrition: many have succumbed or vanished, or have been swallowed up by larger fish in the coatings sea. Resin restrictions have led to certain coating types having all but disappeared. Coating application, aesthetics, and performance have at times been negatively impacted in one way or another. Add to this the reality that capital costs increase considerably due to VOC compliance in the coatings manufacturing process.

Notwithstanding the above, with enforced VOC regulatory compliance holding court, there is, in fact, a transcendent bright side in the way coatings are now formulated. There has been a litany of substantial developments and occasional breakthroughs with respect to the creation of new and customized resin technologies, exempt solvents, reactive diluents, additives, and corrosion inhibitors.[3-9] The resulting cost effectiveness of new, improved, and innovative coatings has often led to notable life cycle increases for facility owners. All good.

Advances and adaptations in waterborne, solvent-free, powder, and radiation-cured coatings are mainstream nowadays. While solvent-borne coatings are often considered superior to waterborne technologies, this is not always the case and has been described as myth in the case of waterborne epoxy technology.[10,11] Table 1 (p. 28) shows the merits and shortcomings of some new approaches to VOC reduction.

Application technologies have undergone diversification and streamlining. Such changes are exemplified in the development of HVLP, air-assisted airless, and new generation, heated plural-component equipment that facilitate application of one-coat, thick-film coatings and short-pot life, solvent-free coatings.[12] Moreover, working in concert, progressive coatings and equipment manufacturers have made welcome progress in the indirectly VOC-prescribed requirement to optimize coating performance, optimize application technologies, innovate, and minimize or even eliminate solvent usage.

A snapshot of advances in the tactical approach to VOC reduction in the world of industrial coatings is the primary thrust of this paper. An overview of four formulation strategies is provided: waterborne technology (single-component and two-component coatings); solvent-free and high-solids coatings; those coatings formulated with exempt solvents; and additional miscellaneous strategies. While powerful strides have recently been made on many more fronts than the above three, formulators' contributions to VOC compliance from their work on pigments, additives, tint systems, thermal spray, powder coatings, and radiation-cured coatings will be discussed in a future paper.

Follow the Numbers

Long before the U.S. Environmental Protection Agency (EPA) established limits for industrial maintenance (IM) coatings, state and regional regulators had already set VOC limits on IM coatings. As of 1991, the South Coast Air Quality Management District (SCAQMD) in California had been regulating most IM coatings at 420 g/L. By 1993, the SQAQMD had reduced VOC limits in IM coatings to 340 g/L. In 1998, the U.S. EPA set a limit of 450 g/L for IM coatings. But where stricter state or regional restrictions existed, the stricter limits applied, as is the case with the SCAQMD. In 2002, the SCAQMD reduced the limit to 250 g/L and in 2006, the SCAQMD further reduced the limit to 100 g/L. For details, see the articles cited in Reference 2.

Karen Kapsanis, Editor, JPCL

Formulation Strategy 1

Waterborne Single Component

Popular wisdom has shown that it is not an insuperable problem for the coating formulator to ramp up the performance of any coating system while simultaneously being eco-effective by lowering the coating's VOC levels. But it is technically challenging for the formulator from the chemistry vantage point. Nowhere is this more true than in the pursuit of matching solvent-borne coating performance with that of waterborne technologies. That said, some outstanding innovation from waterborne latex raw suppliers is notable. Ordinarily, single-component waterborne latexes with VOCs in the 100 to 200 g/L range possess inferior performance profiles in medium- to heavy-duty industrial service (chemical and salt-laden) environments. But now, novel technology has come to the fore from different waterborne resin manufacturers. The result? Proprietary direct-to-metal (DTM) acrylic latexes not only have <100 g/L of VOCs but also possess increased gloss, barrier properties, corrosion resistance, and

Table 1: Merits and Shortcomings of New and Traditional Coating Technologies

Technology	Merits	Shortcomings
Waterborne	Low VOC Easy color change Easy cleaning with water Versatile for application over complex surfaces Application versatility (multiple techniques) Suitable for shop and field application Low flammability	Slow drying Humidity-dependent drying Reduced performance Fair to moderate gloss and distinctness of image High surface energy (low tolerance for oily and dirty substrates) Flash rusting
High-solids	Ambient or thermal cure Low solvent costs Easy color change Full range of gloss Application versatility (multiple techniques) Versatile for application over complex surfaces Reasonably easy touch-up High film build capability	Reduced flow and leveling Reduced distinctness of image Two-pack or thermal cure (no lacquer) High cost/wet gallon Flammability concerns
Traditional solvent-borne	Wide range of suitable application techniques Easy touch-up and repair Applicable to ambient, thermal and lacquer cure Extremely fast cure Suitable for application over complex surfaces Suitable for high-speed continuous production lines Excellent control of evaporation rate Good tolerance for marginal surface quality Low capitalization costs Suitable for shop and field application Full range of gloss and color High aesthetics	Low to moderate film build capacity Relatively high cost ($/dry mil) High VOC emissions (unless using exempt solvents) Clean up is easy but expensive Flammability concerns

(Courtesy of C.H. Hare)

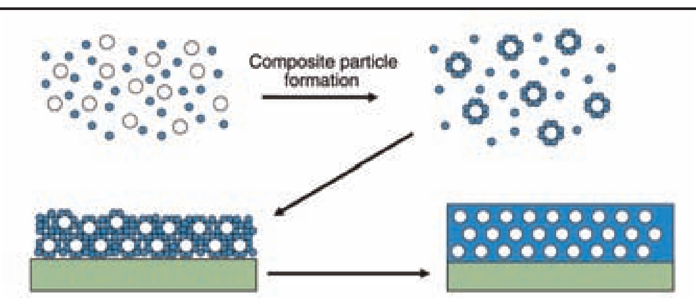

Fig. 1: Formation of latex polymer-pigment composites and their effect on the film formation mechanism of latex paints.[13] Courtesy of Dow Coating Materials (formerly Rohm and Haas Company)

hardness, as well as the ability to withstand freeze-thaw cycles.[13-16]

How have these advances been achieved? In one case, through the formation of "composite particles," where a controlled adsorption of latex particles onto a pigment has been engineered to take place.[13] Novel chemistry causes latex particles to associate with pigment surfaces in the wet applied coating and give rise to a dry film where the pigments are uniformly encapsulated by latex particles; the film then cures by a self-crosslinking oxidative cure mechanism (Fig. 1). Elegant and creative chemistry from the formulator yields micro- to nano-sized "composite particles" that afford substantial film property enhancements compared to conventional single-component acrylic latexes in which the latex or pigment particles may be over-aggregated (Fig. 2). Essentially, as water begins to evaporate from the applied film, the latex binder appears to cocoon each pigment particle and act as a spacer between pigment particles in the drying film.[16] In a conventional single-component waterborne coating, the pigments often agglomerate. In contrast, in a new technology single-component analogue that forms composite particles, the result is a dry coating film in which the pigment is more optimally dispersed and capable of far higher in-service industrial performance.

Accelerated laboratory tests using electrochemical impedance spectroscopy (EIS) show that single-component waterborne coatings that contain composite particles have improved barrier performance. Such coatings have been placed in aggressive ISO 12944 C4 industrial environments

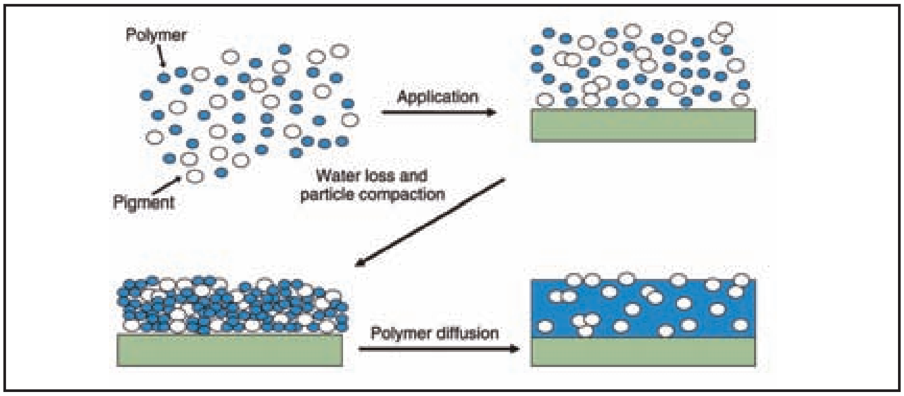

Fig. 2: Film Formation for a Typical Latex Paint.[13] Courtesy of Dow Coating Materials (formerly Rohm and Haas Company)

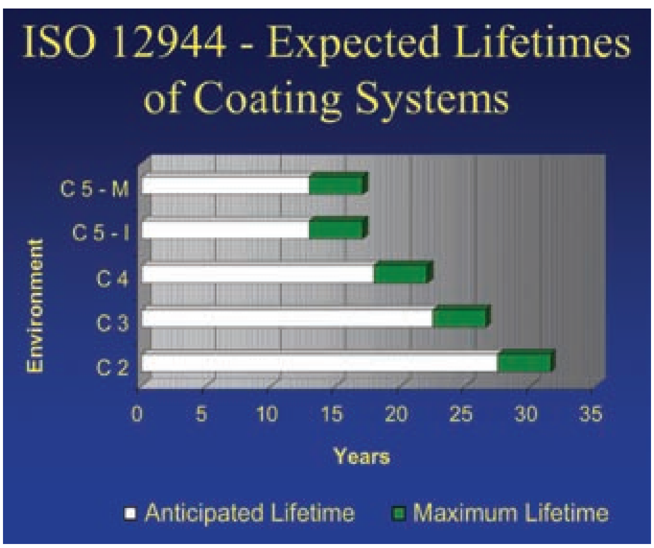

Fig. 3: ISO 12944 - a comprehensive corrosion protection standard. Examples: C3: Urban and industrial atmospheres; moderate sulphur dioxide levels; production areas with high humidity. C4: Industrial and coastal; chemical processing plants. C5-I: Industrial areas with high humidities and aggressive atmospheres. C5-M: Marine, offshore, coastal areas with high salinity.

Fig. 4a (above): A tank coated with a single-component new generation waterborne latex containing "composite particles." 4b (below): The tank before overcoating. Courtesy of Dow Coating Materials (formerly Rohm & Haas Company)

(Fig. 3). As expected, the superior durability of this technology is also aided by the polymer's high molecular weight.

With VOC levels below 100 g/L, a new generation class of styrene acrylic waterborne coatings possesses good adhesion, early humidity resistance, and corrosion protection and durability comparable to the same properties in high-quality solvent-borne alkyds and polyurethane coatings.[15] Although used as DTM primers, more commonly, the new generation waterbornes are primarily used as high-quality finishes (Figs. 4a and 4b).

Granted, the familiar waterborne styrene acrylic coatings have been around for more than a decade and have performed well in harsh conditions (Fig. 5a and 5b, p. 30). In recent times, however, they have undergone such rapid advances using nanoparticle technology and creativity in resin formulation that coatings incorporating such technology have performance profiles now suited to more aggressive service environments. A key criterion for enhanced coating performance is the subtle effect of particle size. The latter dramatically affects coating durability.

Novel approaches in styrenated acrylic latex polymer design include the following.[15]

- Formulating to ensure that the monomers used produce nano-sized emulsion particles with dialed-in heterogeneity that combines both hard and soft polymer chains in the very same particle. Monomers typically include styrene, butyl acrylate, butyl methacrylate, methyl methacrylate, and 2-ethyl hexyl acrylate.
- Self-cross linking between additives and the polymer.

Unlike alkyds and two-component polyurethanes—with their inherent technology limitations to achieve VOCs below 100 g/L without compromising performance characteristics—new generation styrenated acrylics offer far fewer limitations.

Waterborne Two-Component Epoxies

Epoxy resin technology has come a long way since its development in the 1940s by a chemist working at Devoe & Raynolds.[17] Today, epoxy coatings formulated from a wide spectrum of curing agents frequently provide unri-

Fig. 5a (above): Thermal generation plant (fueled by natural gas). Steel overated with an acrylic latex. 5b (below): The coating 15 years later, maintenance free, at same location: the structure is open to a seacoast environment. Courtesy of Frank Bird, Glidden Paints and Peter Roberts, Devoe Coatings

Table 2: Epoxy to Amine Ratio Affects on Performance

Increasing the epoxy relative to curing agent gives improved:	Increasing the curing agent relative to epoxy gives improved:
• Pot life • Acid resistance • Water resistance • Humidity resistance • Corrosion resistance	• Cure rate • Gloss • Adhesion • Solvent resistance • Stain resistance

(Courtesy of M.J. Watkins)

Table 3: Factors Affecting Pot Life

As the variable below increases...	Pot life...
Epoxy/curing agent ratio	Increases
Acid addition to curing agent	Increases
Temperature	Decreases
Catalyst level	Decreases
Initial viscosity	Decreases
Solids	Decreases

(Courtesy of M.J. Watkins)

valled anticorrosive performance and the lowest life cycle costs. This is especially true with respect to tank and vessel linings.

Most high-performance, ambient-cure epoxy coatings are primarily solvent-borne, and to a lesser extent, solvent-free. Given that certain solvents have been known to pose potential health, safety, and environmental hazards, two-component, waterborne coatings are steadily gaining acceptance as formulators innovate in the realm of waterborne binders.

Historically, although they were introduced in the late 1960s, waterborne epoxy coatings have suffered from limited acceptance due to largely inferior performance compared to their solvent-borne counterparts. Challenges arise because epoxy resins are hydrophobic and require water-sensitive surfactants to facilitate dispersion in the most ubiquitous solvent on earth—water; moreover, curing agents are invariably water-soluble amines and are often salted with an acid to enhance water solubility.

Overcoming these deficiencies, certain resin formulators developed a waterborne epoxy dispersion and amine curing agent that uses proprietary non-anionic surfactants pre-reacted to the epoxy backbone.[10] While obtaining VOC levels below 100 g/L, this novel technique yields faster dry time, faster hardness development, and better corrosion resistance than the solvent-borne benchmark.

Although by no means exhaustive, the preferred approach to formulating waterborne epoxies involves the following three primary aspects.

• Stoichiometry: basically this aspect is the ratio of amine hydrogen to epoxy in a formulation. Generally, two-component waterborne epoxy coatings are formulated at a stoichiometric ratio of 1:1 to achieve the best balance of performance attributes. Table 2 illustrates, however, the effect on coating properties with a deliberate excess of either epoxy resin or curing agent.

• Pot Life: new generation waterborne epoxy coatings do not suffer from shortcomings of earlier waterborne epoxies in which the end of the pot life cannot be determined. (See Table 3 for influences on the pot life.) New generation waterborne epoxy coatings require no induction period and, labeled as a Type 5 System in Fig. 6a, use liquid emulsions and hydrophobic amine adduct curing agents to give fast dry, DTM, low-VOC properties.[18]

• Coalescence: complete coalescence is the distinctive characteristic in the new generation coatings versus earlier types. Formulators have been able to fully coalesce epoxy resin particles plus curing agent particles in a continuous aqueous phase (Fig. 6a, p. 32). In marked contrast, incomplete coalescence typifies earlier two-component waterborne epoxies (Fig. 6b, p. 32).

The chemistry of two-component waterborne epoxies is far more complex than the snapshot presented here. Hence, the reader is encouraged to plumb the depths of Watkins et al. for a complete treatise.[11]

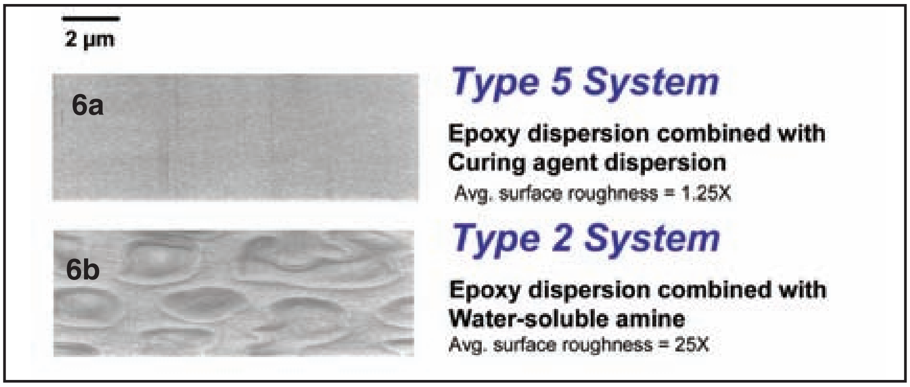

Fig. 6a and b: Coalescence Comparison of Waterborne epoxy Type 5 and 2 Systems. Courtesy of Michael J. Watkins et al, Hexion Specialty Chemicals[11]

Waterborne Two-Component Urethanes

Not to be outdone, formulators have forged ahead in the realm of waterborne polyurethanes. For the past 40 years, two-component polyurethanes have largely been the de facto long-lasting finish coats of choice and one of the largest polymer classes used in the coating industry.[19] A polyol cross-linked with an aliphatic isocyanate provides highly durable, gloss- and color-retentive finish coats that, since the mid 1960s, have mushroomed in growth not only in the world of coatings but in other areas such as foams, sealants, adhesives, and flooring materials. Until recently, these coatings have been available in solvent-borne formulations only.

Due to the well-known sensitivity of the isocyanate group (NCO) to the OH moiety in water (and moisture), for years, little effort was spent developing a waterborne, two-component aliphatic urethane. The formulation landscape has altered dramatically. Now, extensive research has culminated in the advent of waterborne aliphatic urethane coatings based on polyester or polyacrylic as the polyol and HDI trimer as the curing agent.[20] Early formulation attempts required vigorous agitation in a controlled aqueous medium for full compatibility of isocyanate and OH groups, but recent developments of more hydrophilic resin components have made it easier to use this technology and overcome the natural shenanigan tendencies of some active little molecules! As opposed to their solvent-borne counter parts, stochiometeric ratios of NCO: OH are kept quite high to compensate for the side reaction with water. Normally, these new waterborne aliphatic urethane coatings are used as thin films because overbuilding them causes gas formation (that pesky CO_2 molecule) to unleash poor aesthetic finishes.

On a practical note, it is noteworthy that advances in two-component waterborne epoxy and polyurethane systems are forging ahead and such coatings have been used for many years on rail cars.[21] This technology also finds very promising use in flooring and OEM applications. Coatings made from the new generation of waterborne polyurethane resins are typically below 50 g/L.

A helpful suggestion would be to ensure sufficient training is provided for applicators and facility owners on the proper use of two-component waterborne coatings. For example, inclement weather conditions (rain and relative humidity) invariably have a greater deleterious effect on the application of waterborne coating than on solvent-bornes. Furthermore, spray equipment cleaning also has challenges given that only water-miscible solvents should be used to clean spray gear for waterborne coatings.

Formulation Strategy 2: VOC Exempt Solvents[7]

Coatings are often formulated with solvents that are VOC exempt. The EPA defines exempt compounds as "organic compounds that are not considered volatile organic compounds due to negligible photochemical reactivity" (40 CFR Part 59.401; a list of exempt solvents is found in 40 CFR 51.100). The selection of these solvents is rather limited. Of particular interest to the formulator are parachlorobenzotrifluoride (PCBTF), acetone, tert-Butyl Acetate (TBAc), and more recently, tarksone (some examples are included in Table 4; Fig. 7). On the one hand, these solvents can allow the continued use of traditional coating systems without unduly exceeding VOC limits. On the other hand, they have drawbacks that may not offer the same useful properties as non-exempt solvents.

Solvent System Design and Release

The use of the exempt solvents acetone, PCBTF, or tert-Butyl Acetate (TBAc) with non-exempt solvent tails that contribute flow and leveling characteristics is a strategy that delivers fast dry systems at low VOC with little or no effect on the pot life. Solvent release from a traditional coating film is typically 60–80% evaporational and 20–40% diffusional. In contrast, solvent release from a solvent-borne, low-VOC coating film is 0–30% evaporational and 70–100% diffusional.

Acetone

A strong and polar solvent, acetone is a low boiler that possesses little photochemical reactivity, has excellent solvency, and is inexpensive.

Unfortunately, acetone is hydrophilic and water miscible, and, as a result, can cause all sorts of maladies, from cooling the surface of coatings and promoting blushing, to causing poor application and leveling of a coating due to the latter drying too fast. Indeed, it is widely recognized that the major weaknesses of acetone are its fast evaporation rate, low flash point, and fire hazard.

In the case of epoxy coatings, acetone

Table 4: Currently Exempt Solvents

	Solvency	Evaporation	Cost
Acetone	Excellent	Fast	Low
Methyl Acetate	Very Good	Fast	Moderate
Parachlorobenzotrifluoride	Good	Moderate	High
Volatile Methyl Cyclosiloxane	Very Poor	Slow	Very High

Courtesy of C.H. Hare

can associate with amine curing agents to form ketimines, upset the cure reaction, and increase dry times. For this reason, acetone would be employed in the epoxy base component as opposed to the curing agent. So to lower the VOC of high-performance coatings, a satisfactory solvent system design strategy for binder systems will often consist of acetone blended with parachlorobenzotrifluoride (PCBTF) or tarksone, with or without a high-boiling VOC solvent.

Parachlorobenzotrifluoride (PCBTF)

This relatively non-polar chlorinated hydrocarbon solvent is a medium boiler and one of the "best friends" of the coating formulator.[22] It is hydrophobic, VOC exempt, and neither an ozone-depleting substance (ODS) nor a hazardous air pollutant (HAP). With a broad-spectrum solvency, PCBTF possesses a compact and planar shape and diffuses more readily from coating films and certainly not as fast as acetone. Unlike acetone, PCBTF is not reactive with any amines in two-component epoxies, and is invariably unreactive in most coating systems.

With zincs, high-molecular-weight epoxies, moisture-cured urethanes, and polyurethane finishes, the use of PCBTF affords the coating formulator the means to reduce VOCs to less than 250 g/L without fear of reactivity with other coating constituents or decomposing in a dehydrochlorination reaction.

In the field, the coating applicator benefits by being able to thin coatings with this non-exempt solvent and thus achieve usable film viscosity and excellent spray characteristics, and in doing so, maintain full compliance with VOC regulations.

On the negative side, PCBTF can impart odor/taste-related problems to potable water coatings. Additionally, in an age in which cost reduction is deemed a priority, the cost of PCBTF is high and can severely impact the attractiveness of coatings that use high levels of PCBTF to yield VOC levels that approach 100 g/L.

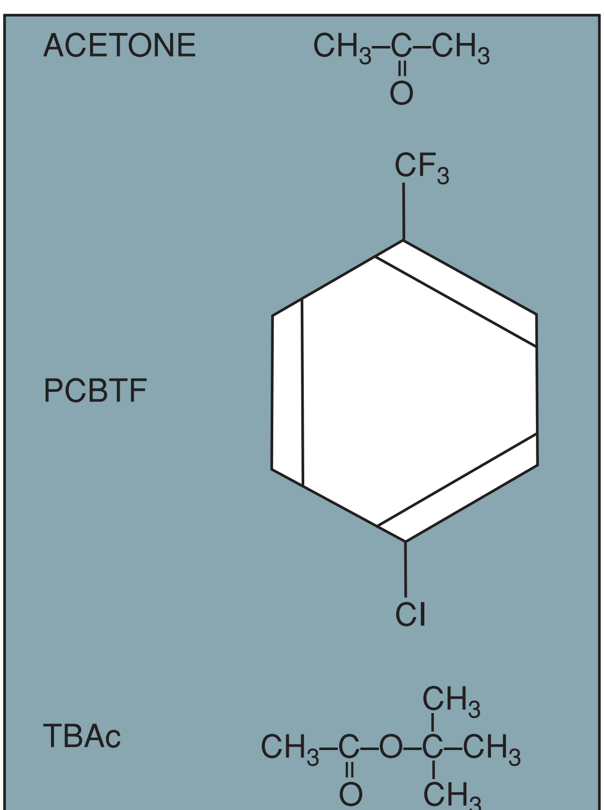

Fig. 7: Structural formulas for VOC-exempt solvents

Tertiary Butyl Acetate (TBAc)

With an evaporation rate similar to toluene, TBAc is a VOC-exempt solvent due to its limited reaction to form smog and its low environmental and health impact. A versatile solvent for the coatings formulator, TBAc resists aminolysis, hydrolysis, and acidolysis and is used in a variety of generic coating types, including polyurethane finishes and two-component epoxies.[23] Interestingly, TBAc may be successfully used to replace xylene in new-generation epoxy coatings. Limitations for TBAc are that it is not a particularly strong solvent for high-molecular-weight epoxy resins and it has a rather low flash point.

Tarksone (A Blend of Solvents)

Synonymous with outstanding performance in water immersion, solution-polymerized vinyl-based coating systems (VYHH and VMCH) may well be set to return to the protective coatings scene, having largely disappeared from the map in the past two decades because of stringent VOC regulations.[24] The coating formulator blends an environmentally friendly biomass alcohol that is both non-HAPS and non-VOC (from wood-related products) with acetone in the vinyl formulation. Acetone is considered to be an ideal, non-polluting solvent for vinyl coating systems. The resulting vinyl film has a VOC content less than 100 g/L.

A potential downside is the cost associated with the blended biomass solvent, because a relatively large amount must be employed in the vinyl formulation to both achieve the desired VOC levels of the coating and raise its flash point to about 120 F. That said, PCBTF and TBAc are somewhat more expensive solvents.

In a nutshell, exempt solvents afford an improved VOC air quality strategy

- by replacing solvents with high atmospheric reactivity,

• with minimal effect upon coating performance or ease of application, and
• by assisting application in the field without running afoul of VOC regulations.

Formulating Strategy 3: Solvent-Free Coatings (100% Solids by Volume)

For decades, solvent-free epoxies and urethanes have been a particularly effective means to produce zero- or low-VOC, high-performance chemically curing coatings. The basic approach in formulating them is to use low molecular weight and low viscosity liquid resins, being mindful to create a careful balance between mono- and di-functional materials. This approach strikes a balance among flexibility, impact resistance, and abrasion resistance in contrast to hardness and chemical resistance. Additionally, both monofunctional and difunctional epoxy diluents may be employed in epoxy systems to further reduce viscosity for low VOC.[4]

Why are modern solvent-free coatings becoming even more popular? Aside from their low VOC attributes, they can have a number of advantages, some of which were outlined by Dromgool in a well-balanced review of the plusses and minuses of solvent free epoxies. The advantages that Dromgool identified for solvent-free epoxies when used as tank linings included: "They are usually a one-coat lining system; they can be applied at high film builds; there is no risk of solvent entrapment; some will tolerate early immersion; they can save much time and labor; and they combine the generally excellent adhesion of epoxies to prepared steel substrates with a hard, tile-like finish. In addition, they have minimal occupational health and safety (OH&S) issues, including no worker exposure to solvents (no lower explosive limit, or LEL), and no release of solvent when changing from liquid to solid."[25, 26]

Fig. 8: One-coat solvent-free advanced hybrid epoxy in crude oil storage tank. Courtesy of Darryl Corbin, Enviroline, High Performance Coatings and Linings

While no one disputes the key advantages of solvent-free epoxy coatings, the approach of using low molecular weight resins has resin toxicity implications not as prevalent with higher molecular weight resins. Furthermore, there are performance disadvantages, too, because the judicious use of solid epoxy novolac resins in a multi-coat solvented coating can usually produce better chemical resistance (due to a more tightly cross-linked polymer structure) and hence better chemical resistance than a solvent-free system.

For many solvent-free epoxy coatings, one negative is the extended dry times, but having said that, there have been significant advances that largely overcome this dry time deficiency. Some proactive coating manufacturers have long since formulated ultrahigh-build solvent-free epoxies that can be applied in one-coat applications from 15–150 mils DFT that are cured in hours for fast turnarounds[27] (Fig. 8). The key to success most often lies in the domain of the curing agent. For example, phenalkamines—curing agents derived from cashew nut shells—afford the formulator very fast, low-temperature, and all-season curing coatings along with substantial VOC reductions as low as zero VOC.[28] Benefits include the following.

• Low viscosity (<1,000 cps)
• 100% solids
• Non-brittle
• Compatible with all resins
• All-season cure
• Non-blushing
• Workable pot life

The phenalkamines are also considered "green in terms of CO_2 consumption," as the shell-derived CNSL (cashew nut shell liquid) is obtained from a renewable natural source.[28]

In the relentless pursuit of excellence, it cannot be overemphasized that the use of solvent-free coatings of any generic type has been one of the major contributions of coating formulators in addressing VOC regulations.

Formulating Strategy 4: Miscellaneous

Additional strategies to meet low-VOC regulations involve gaining traction with new coating technologies per se. Among them, two new approaches merit serious consideration.

Polysiloxanes

In polysiloxane technology, inorganic silicon-epoxy hybrid or silicon-acrylic hybrid polymers have been developed to combine the excellent properties of both organic and inorganic moieties in a new class of polymers.[29] The low viscosity siloxane polymers can be formulated to achieve durable and very low-VOC, two-component coatings systems.

Polyaspartics

More recently, a second approach is the development of polyaspartic ester technology. Giving rise to rapid curing and rapid return to service capabilities, polyaspartic coatings possess performance comparable to conventional aliphatic polyurethanes and do not employ the polyols of urethane finishes. A new dimension in high-solids and low-VOC, rapid-cure finish coats has been spearheaded by the formulator where polyaspartic coatings can be applied in thick films, in a single coat, without sacrificing quality and cure times.[19]

All in all, looking back at the excellent strategies described to address VOC compliance, coating formulators have turned out to be eco-contributors in a world of eco-centricity. Without a doubt, they have earned their bread and butter!

Conclusions

Coating formulators have demonstrated ingenuity in complying with stringent VOC regulations while keeping the same standard of high performance.

Significant research and development in recent years has shown that two-component waterborne epoxies can deliver comparable performance to solvent-borne epoxies, and that novel single-component waterborne coatings possess outstanding corrosion resistance and aesthetic properties.

VOC regulations should not be deemed adversarial. The overarching brighter side of VOC regulations has brought out the best from coating formulators in providing owners with life cycle extension benefits; applicators with a lower number of applied coats; and all parties a quicker return to service, sometimes in a single coat.

Special Acknowledgement

The work of Dr. O'Donoghue's personal friend Clive H. Hare has been used extensively herein. The protective coatings industry will forever be indebted to Clive for his exemplary contribution. For those of us who have walked with Clive through the mysterious fields of protective coatings, who could ask for a better guide?

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JPCL

An Overview of Preparing Concrete for Coatings:

What to Ask, What to Do, and Where to Find Help

By Fred Goodwin, Fellow Scientist, BASF Construction Chemicals, Beachwood, OH

"I want you to apply a coating, sealer, topping, overlay, membrane, or some kind of protective or decorative material to this concrete." It's deer in the headlights time for contractors. Quickly you think, "I'm trapped amid the project cost (*and my profit*), the condition of the concrete substrate, the expectations of the owner, the surface preparation required, the material properties, the application conditions, and the service environment. What do I need to ask, know, do, and find out myself? Where do I go to get help?" This article intends to help with some of these questions for one of the most basic and important parts of the work: concrete surface preparation. Included in the discussion are lessons learned from industry standards and guidance documents.

Editor's Note: This article is a condensed version of a paper the author presented at PACE 2009, the joint conference of SSPC: The Society for Protective Coatings and PDCA, the Painting and Decorating Contractors of America, held February 15–18, 2009, in New Orleans, LA. The full presentation, "Concrete Surface Preparation," appears in the conference proceedings (www.sspc.org).

The Big Picture

First, determine the project objectives. Define with the owner and other interested parties what success means on this project. Mockups can help all parties decide what can be done and can serve as a test bed for different techniques, materials, and cost vs. performance results. Decide what happens if the results are less than expected. Who pays? What are the penalties? Who can arbitrate disputes?

Agree on the project "tolerables": how to mitigate the side effects of the construction process (e.g., noise, dust, vibration, fumes); what to do with debris; whether utilities (e.g., power, ventilation, water) are available for the needed procedures; what kind of protection for the project area is possible (e.g., from weather and traffic); and what kind of protection (from the construction activity) is needed for the environment around the project.

When it comes to thinking broadly about what surface preparation method to use, follow the steps outlined in the guideline, ICRI No. 310.2 (formerly 03732) from the International Concrete Repair Institute (ICRI). The document notes, for instance, that to determine the correct surface preparation, you must analyze the project and develop a preparation strategy by answering a number of questions, including those about the substrate conditions, coating requirements, owner requirements, application conditions, project objectives, the performance criteria and their price, and methods that will meet the performance criteria.[1]

It is also helpful to think in detail about what surface preparation *is* before determining how it is best achieved on a particular project. For concrete, SSPC-SP

13/ NACE No. 6, Surface Preparation of Concrete, defines surface preparation as "[t]he method or combination of methods used to clean a concrete surface, remove loose and weak materials and contaminants from the surface, repair the surface, and roughen the surface to promote adhesion of a protective coating or lining system." SP 13 further requires that an "acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems."[2]

Questions and issues to address on a specific project form the remainder of this article.

Learn the Substrate's Condition

What kind of concrete is involved? What can you learn about its properties, such as its orientation, its age, its exposure, its finish, and its quality? Surface preparation provides options for improving those properties of the host concrete that facilitate accepting the specified material.

What orientation is the substrate? Horizontal concrete can be on-grade or suspended slabs with different types of traffic. Slabs suspended above the ground can usually dry from two directions. Vertical concrete is not subject to traffic but can be exposed to wind-driven rain on elevated surfaces and hydrostatic pressure on below-surface walls. Overhead concrete may require water drainage through the slab and light-reflective coatings. Vertical and overhead concrete are subject to defects such as fins, bugholes, and formwork pattern transfer.

For slabs on grade, check for a vapor barrier. If one is present, is it over or under the subbase fill? If granular fill has been applied over the vapor barrier, the fill can act as a reservoir for water that can escape only through the slab. If no vapor barrier is present, the chances of success decrease as the moisture sensitivity of the material to be applied increases and the amount of moisture underneath the slab increases . Vapor barriers can also let water through—both from punctures (which create localized high vapor emission regions) and from the use of substandard material (out of sight, out of mind, until it becomes your problem). Some success has been reported with moisture vapor mitigation systems, but before considering them, you must first test the substrate to see if it is uniformly moist, where the moisture is coming from, and whether the changes in the substrate's environment will affect the moisture vapor permeability. (For example, starting an HVAC system can change the dew point; covering the slab with a moisture impermeable material changes the escape path of the moisture; and changes in drainage provide external sources of water). Testing for moisture vapor emissions and internal relative humidity only capture the situation during the time of the test; the conditions may be different after the material application. Consult ACI 302.2 R-06 if you will be using moisture-sensitive coatings.[3]

How old is the concrete and what does its age mean? Concrete yet to be placed can be modified to reduce moisture issues, be textured for coating acceptance, or even become a decorative surface not requiring further preparation. Recently placed concrete has a relatively high rate of shrinkage (developing cracking and curling) and contains more moisture than older concrete. Applying cementitious toppings and overlays to freshly placed concrete can allow both materials to shrink at the same time.

Old concrete can be rehabilitated for change of use, restored by recoating, or repaired (thereby creating the issues of both old and new concrete on the same installation). But beware: old concrete can also be contaminated with oil, chlorides, carbonation, or other unknown materials absorbed during previous service. Coating suppliers usually recommend removing existing curing compounds, form release agents, coatings, and membranes (as well as contamination) because compatibility between different coating and concrete products is generally not known and difficult to ensure, especially when long-term service life is expected.

All concrete can be subject to contamination from carbonation—a reaction between carbon dioxide in the atmosphere and hydrated components of Portland cement paste in the concrete. Carbonation occurs in two forms: early carbonation, which forms during cement hydration and produces a dusty chalky surface; and longer-term carbonation, which lowers the pH of the exposed concrete surface. Early carbonation must be removed before applying any material to the surface. Treatment of later carbonation depends on the properties of the protective systems applied. Laitance (a weak layer on the concrete surface) from bleeding and settlement during the concrete's hardening must also be removed.

And remember: new or old concrete may have residual form release agents and curing compounds that must be removed before applying any protective material.

What exposure does the concrete have? Most deterioration mechanisms of concrete require moisture, whether from internal mechanisms (e.g., alkali aggregate reactions, sulfate attack, and freezing and thawing damage) or from the migration of deleterious influences, such as chlorides and carbonation, that lead to reinforcement corrosion, staining (except from oil), leaching, and efflorescence. Keeping water out of hardened concrete is a major reason for applying a protective system to concrete. Concrete exposed to differential temperatures (such as through an exterior wall or at the periphery of a cold storage unit) will develop a moisture profile, depending on the amount of moisture present and the temperature difference. When used for secondary containment, concrete will be subject to chemical exposures and will need chemical-resistant coatings. (See

Table 1: Typical Surface Properties of Finished Concrete

Method	Profile	Porosity(A)	Strength(A)	Problems
Formed concrete	Smooth to medium	Low to medium	Medium	Voids, protrusions, release agents
Wood float	Medium	Medium	Medium	
Metal trowel	Smooth	Low	High	
Power trowel	Smooth	Very low	High	Very dense
Broom finish	Coarse to very coarse	Medium	Medium	
Sacking	Smooth	Low to medium	Low to high(B)	Weak layer if not properly cured
Stoning	Smooth to medium	Low to medium	Low to high(B)	Weak layer if not properly cured
Concrete block	Coarse to very coarse	Very high	Medium	Pinholes
Shotcrete(C)	Very coarse	Medium	Medium	Too rough for thin coatings

(A) These surface properties are based on similiar concrete mix, placement, and vibration and are prior to surface preparation.
(B) Strength depends on application and cure.
(C) Shotcrete may be refinished after placement, which would change the surface properties shown in this table.

SSPC-TU 2/NACE 6G197.[4])

What kind of finish does the concrete have? Table 1 from SSPC-SP 13 describes typical concrete surfaces with respect to different types of concrete finishes.[2]

Is the concrete sound? SSPC-SP 13 also describes several simple qualitative tests to determine soundness of the concrete, including lightly scratching a concrete surface with a screwdriver, file, or pocket knife; lightly striking the concrete with the edge of a hammer head; and dragging a chain across horizontal concrete.[2]

ICRI No. 210.3 (formerly 03739) and ASTM C 1583 quantify the soundness of the concrete substrate using near-surface tensile strength measurements and should be used to supplement the simple tests above.[5,6] The same tensile tests can also be used to perform adhesion for coating compatibility during application mockup and quality control for the applied system. SSPC-SP 3 includes a table that provides guidance on acceptable concrete surfaces for many coating applications following surface preparation; while the tests are helpful, the recommendations of the coating manufacturer and good trade practice for the specific situation should always be followed.[2]

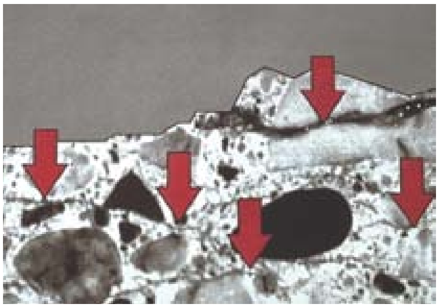

Fig. 1: Microcracking ("bruising") of concrete from impact type surface preparation

Surface Profile Requirements

What are the requirements of the surface profile for the applied coating? The required profile will depend on the thickness of the material to be applied. ICRI No. 310.2 (formerly 03732) describes three thicknesses of material:

- sealers (0–3 mils) [0–75 µ];
- thin film coatings (4–10 mils) [100–250 µ]; and
- high build coatings, self leveling coatings, and polymer overlays (10 mils–1/4 inch) [250 µ–6mm].[1]

ACI defines a sealer as a liquid applied to the surface of hardened concrete to either prevent or decrease the penetration of liquid or gaseous media. A sealer is absorbed by the concrete, is colorless, and leaves little or nothing visible on the surface.[7] Sealers require surface preparation mainly to promote penetration into the concrete; any visible defects or profile will be unaffected. Depending on the chemical makeup of the sealer, different amounts of breathability (moisture vapor emission), darkening, and protection are provided.

Generally, breathable sealers such as silanes and siloxanes will prevent the absorption of liquid water while allowing moisture vapor to escape without noticeably changing the appearance of the concrete. Some sealers, such as silicates and fluorosilicates, change the pH of the concrete and are reported to also densify and improve abrasion resistance of the concrete surface. Stains and dyes for concrete may also fall into the sealer category, depending on their drying film formation, unless the only purpose of the stain is to change the color of the concrete. Surface polishing has also recently gained popularity as an enhancement for concrete surfaces. Frequently, the polished concrete is stained and then sealed.

Thin-film coatings may be formulated to mask very minor defects and surface discolorations. Suitable surface preparation techniques for thin-film coatings depend on several factors. Patterns from surface preparation and any but the smallest defects will likely become visible through the coating. If the amplitude of the surface profile is greater than the dry film thickness, a smooth coating surface is not possible. Some thin-film coatings on smooth horizontal surfaces can become very slippery when wet and generally require periodic recoating if subjected to wear from traffic. Thin-film coatings that are impermeable or otherwise sensitive to moisture tend to be problematic unless the concrete substrate is very dry.

Thicker coatings, such as self leveling

materials, polymer overlays, toppings, and high-build coatings, have much in common with thin-film coatings regarding the relationship between surface profile and dry film thickness, moisture sensitivity, and wear; however, thicker coating layers can fill larger defects, create surface texture to yield slip-resistant surfaces; and provide longer service life than thin-film coatings.

Characterizing Surface Preparation

One way of describing surface preparation is by comparing the substrate's surface roughness with various other surfaces, such as the ICRI CSP specimens or sandpaper, or by using semi-quantifiable methods such as ASTM E 965 (commonly called the "sand patch test").[8] More sophisticated methods are being developed, including ASTM E 2157 and laser profilimetry, which are compared with ASTM E965 in the VTRC reference.[9,10] Other techniques occasionally referenced are ASTM standard WK16987 (in development), which takes measurements from a cast replica of the roughened concrete surface (ASTM D 4417 Method C/NACE RP0287-95).[11,12,13]

The most common guidance for the

Table 2: Surface Preparation Methods for Concrete (Ref. 1)

Method	Equipment	Mechanism	Surface Texture Achieved	CSP Ranking
Detergent Scrubbing	Mop and Pail, Floor Scrubber	Emulsification	No change	0-1
Low Pressure Water Rinse	Pressure Washer	Emulsification (if soap in water), Erosion (of loose particles)	Removal of loose debris	0-1
Acid Etching	Acid, Mixing Container, Neutralizing Agent	Reaction	Light profile, removal of concrete paste, discoloration	1-3
Dry Grinding	Dry Grinder	Erosion	Smooth surface, dust, debris to remove, pattern	1-3
Wet Grinding	Wet Grinder	Erosion	Wet, smooth surface, slurry, debris to remove, pattern	1-3
Dry Abrasive Blasting	Dry Sand Blast	Pulverization, Erosion, Expansive Pressure	Dusty substrate, light profile (depending on media, size, pressure, time) debris to remove	2-4
Recuperative Abrasive Blasting	Vacuum Recovery Sand Blasting	Pulverization, Erosion, Expansive Pressure	Light profile (depending on media, size, pressure, time)	2-4
Wet Abrasive Blasting	Wet Sand Blast	Pulverization, Erosion, Expansive Pressure	Wet substrate, light profile (depending on media, size, pressure, time) debris and slurry to remove	2-4
Shot Blasting	Shot Blast Unit	Pulverization, Impact Erosion	Dust free substrate, some pattern, depth dependent on shot size, sustrate hardness, equipment	2-8
Scarifying	Scarifier	Impact	Dusty substrate with striated pattern, bruising likely, debris to remove	4-9
Needle Scaling	Needle Scaler	Impact	Similar to shot blasting, striated pattern, debris to remove	5-8
Scabbling	Scabbler	Impact	Dusty substrate, irregular pattern, fractured aggregate, bruising likely, debris to remove	7-9
Hydrodemolition, Hydroblasting, Water Jetting	High- and Ultra-High-Pressure Water Blast	Erosion, Expansive Pressure	Saturated substrate, debris to remove, profile dependent on substrate hardness, equipment, pressure, time	6-9
Flame Blasting	Special Oxy-acetylene Torch, Saturated Substrate Helpful	Expansive Pressure, Reaction	Irregular chipped surface, hot, charred debris to remove, bruising possible	8-9
Rotomilling	Rotomiller	Impact	Dusty substrate (unless water used to suppress dust), grooving, tool marks, fractured aggregate, bruising likely	9
Liquid Surface Etchant	Specialty Chemical, Fresh Concrete	Reaction	Exposed aggregate, green wet concrete with debris to remove using pressure wash, curing still required, no bruising, depth dependent on retarder chemistry, curing rate, length of exposure	3-9

required profile for each coating thickness is also found in ICRI No. 310.2 (formerly 03732), which assigns a concrete surface profile (CSP) number based on the coating to be applied; the document further defines profile with physical replica specimens prepared with different surface preparation techniques.[1] The higher the CSP number, the more aggressive the profile.

Another method of describing surface preparation techniques is by the mechanism of concrete removal or treatment. Mechanisms include cleaning, erosion, impact, pulverization, chemical reaction, and expansive pressure. Table 2, which is based on information in ICRI No. 310.2 (formerly 03732), compares different surface preparation techniques, which are also briefly described below.[1]

Cleaning with low-pressure water (pressure washing <5000 psi) and scrubbing with detergent do not remove sound concrete or change the concrete surface profile. Removal of surface contaminants from scrubbing, use of surfactants, and water velocity followed by vacuum removal of the cleaning solution produces a wet substrate and removes minor amounts of dirt, oil, grease, dust, friable, materials, debris, or other water-soluble contaminants. ASTM D 4258, ASTM D 4259, and a guidance document from the Water Jet Technology Association are useful resources.[14,15,16]

Erosion methods (i.e., grinding) uniformly wear away the concrete surface with abrasive force from grinding media such as abrasive discs. This method leaves a dry dusty surface with very little profile. See ASTM D4259 for guidance on good practice of this technique.[15]

Chemical reaction methods include acid etching and the use of surface retarders for fresh concrete. Acid etching dissolves the cement paste (and limestone aggregate, if present), producing a very light profile on the concrete surface that has a relatively low pH unless neutralized. Acid etching does not work well on vertical surfaces or on concrete that has had a curing compound or sealer applied. ASTM D 4260 provides guidance for acid etching and D4262 for surface neutralization following acid etching.[17,18]

Surface retarders are used only for freshly placed concrete. The cement hydration adjacent to the layer of surface retarder is delayed, while the remaining concrete continues to harden normally. After sufficient strength has developed in the underlying concrete, the layer affected by the retarder is removed by pressure washing and scrubbing, leaving an exposed aggregate wet surface suitable for placement of cementitious overlays and toppings. Guidance on surface retarders is usually supplied by the material producer.

Some methods of surface preparation can cause "bruising" (Fig. 1, p. 42). Bruising occurs when a surface layer is weakened by interconnected microcracks in concrete substrates; the microcracks are caused by use of impact, pulverization, and other mechanical methods for surface preparation. Be careful of bruising when using bush hammers, scabblers, scarifiers, and rotomilling machines for surface preparation. Scarifiers and rotomilling (also known as surface planers or milling machines) use the chipping action of multi-tipped cutting wheels that rotate at high speeds to chip away at the concrete surface. Bush hammers and scabblers use serrated hammers with rows of pyramidal points and remove concrete by pounding the surface with piston-driven cutting heads placed at a right angle to the surface. The bruised layer typically extends to a depth of $\frac{1}{8}$ to $\frac{3}{8}$ in. (3 to 10 mm) and frequently results in lower bond strengths as compared to surfaces prepared with nonimpact methods.

Abrasive blasting, shotblasting, and hydrodemolition are methods not only for surface preparation, but can also be used to remediate bruised concrete. Shot blasting, used to strip, clean and profile surfaces, produces a roughened texture that is dry and relatively dust free. Depending on the size of the steel shot, its speed, and machine design, the method can selectively remove softer and more brittle portions of the substrate. Hydrodemolition uses very-high-pressure water jets to prepare the surface, producing a saturated deeply profiled substrate. ICRI No. 310.3 (formerly 03737) discusses hydrodemolition in great detail.[19] The hardness of the concrete, speed of hydrodemolition jet travel, impingement angle, and pressure of the water jet control the amount of removal.

Primers are sometimes used as a form of surface conditioning following surface preparation. Primers are used to improve the bond between the prepared surface and the subsequent coating material or to improve the surface for coating.

Conclusions

Unless the concrete surface is properly prepared, even the best sealer, coating, topping, overlay, or membrane will not perform satisfactorily. Trial applications that follow the manufacturer's instructions and good trade practices referenced in this article are the best means of achieving good system performance; they also provide acceptance criteria for proceeding with an installation. On any trial areas, bond testing, substrate cleanliness, substrate surface hardness, porosity, and moisture condition evaluation should be performed to assure integrity of the substrate preparation effectiveness, coating adhesion, and finished appearance.

Notes

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Overlay Materials by Direct Tension (Pull-off Method), 2004, ASTM International, West Conshohocken, PA.

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9. ASTM E2157-01 (2005), Standard Test Method for Measuring Pavement Macrotexture Properties Using the Circular Track Meter (2005), ASTM International, West Conshohocken, PA.
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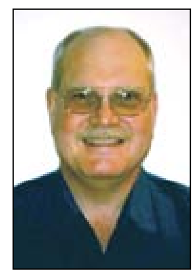
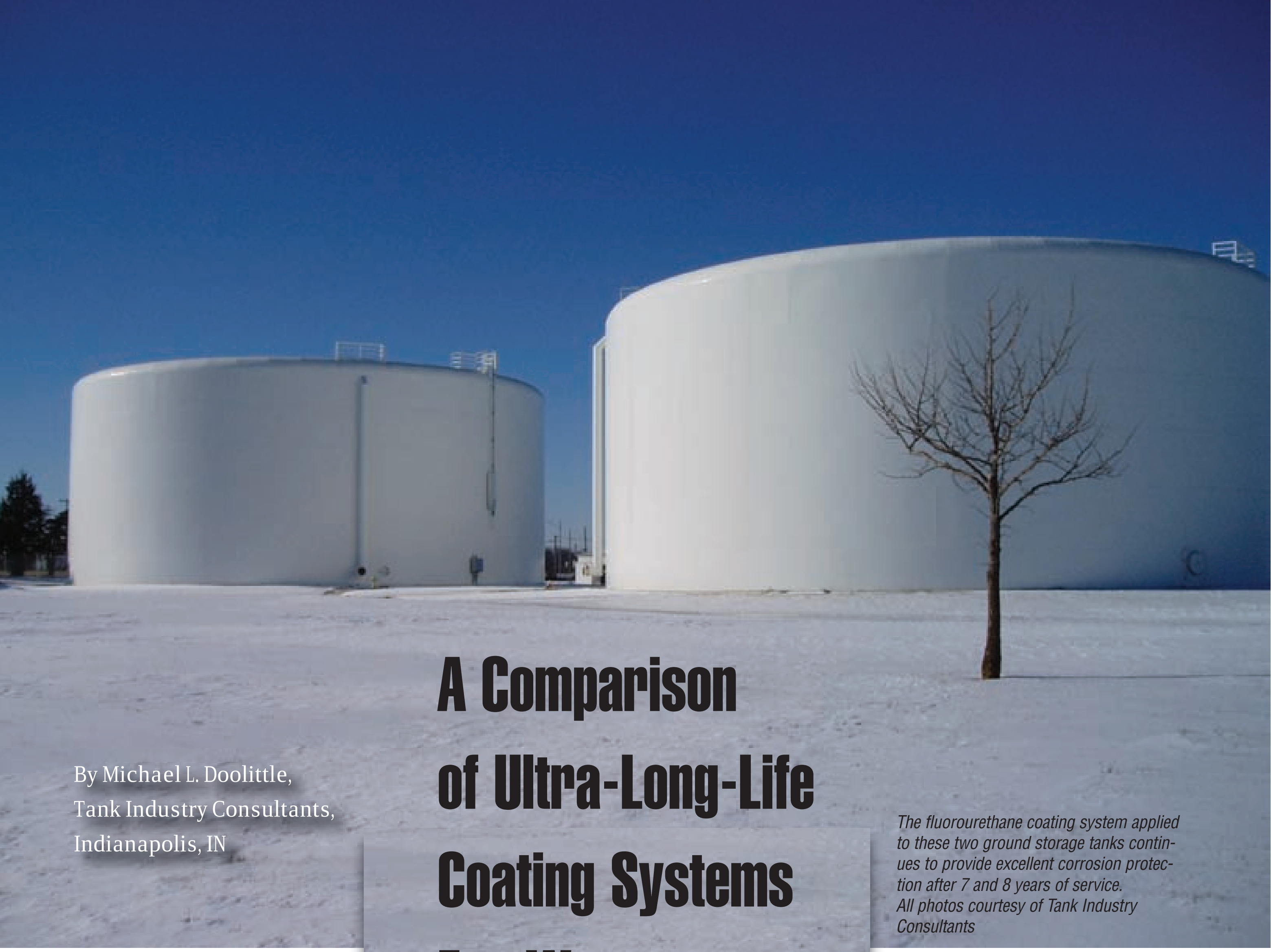
13. NACE RP0287-2002, Standard Recommended Practice–Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape (2002), National Association of Corrosion Engineers, Houston, TX.
14. ASTM D4258-05, Standard Practice for Surface Cleaning Concrete for Coating (2005), ASTM International, West Conshohocken, PA.
15. ASTM D4259-88 (2006), Standard Practice for Abrading Concrete (2006), ASTM International, West Conshohocken, PA.
16. Waterjet Equipment Recommended Practices Manual, WaterJet Technology Association (WJTA) St. Louis, MO.
17. ASTM D4260-05, Standard Practice for Liquid and Gelled Acid Etching of Concrete (2005), ASTM International, West Conshohocken, PA.
18. ASTM D4262-05, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces (2005), ASTM International, West Conshohocken, PA.
19. ICRI G03737, Guideline for the Preparation of Concrete Surfaces for Repair Using Hydrodemolition Methods (2004), International Concrete Repair Institute, Des Plaines, IL.



Fred Goodwin is a fellow scientist in research and development at BASF Construction Chemicals LLC (Cleveland, OH). He has 30 years of experience in the construction chemicals industry and is an active member of SSPC, ICRI, ASTM, ACI, SDC, NACE, and ISO. Goodwin is a chair on the ICRI Materials and Methods, the ACI 364 Rehabilitation, and the ASTM C09.68 Volume Change Committees. Goodwin and co-author Gail Winterbottom won a *JPCL's* Editor's Award for their January 2005 *JPCL* article, "Concrete Cracks: Causes, Correcting, and Coatings." **JPCL**



The fluorourethane coating system applied to these two ground storage tanks continues to provide excellent corrosion protection after 7 and 8 years of service.
All photos courtesy of Tank Industry Consultants

A Comparison of Ultra-Long-Life Coating Systems For Water Storage Tanks

By Michael L. Doolittle,
Tank Industry Consultants,
Indianapolis, IN

For water storage tank applications, alkyds, the much-trusted coatings of the past, were summarily replaced by superior performing polyurethane coatings in the late 1970s and early 1980s. Polyurethanes were then, in the early 1990s, supplanted by polyurethanes with clear coats and polyurethanes with UV protectors—coatings that promised resistance to fading and a twenty-year service life. These later polyurethanes are now being challenged by fluorourethane and polysiloxane coatings—coatings that, although developed in the 1980s, are only recently being used for water storage tank applications. Fluorourethanes and polysiloxanes are ultra-high-performance coatings that are said to have a service life of up to thirty years.

This article gives an overview of long-life coating systems for water tank exteriors and interiors, including a relative comparison of salient application and performance properties.

Coating Systems for Water Storage Tank Exteriors

Fluorourethane and siloxane coatings are rapidly gaining popularity with tank owners. The advertised thirty-year service life of these coatings is a big plus as regulations placed on coating removal and application procedures become stricter and the costs of materials and labor rise. The product cost, however, makes most tank owners think twice and re-evaluate the benefit of the increased service life.

Siloxane coatings, newer to the industry than fluorourethanes, are promoted as having very good color and gloss retention, and they are less expensive than the fluorourethane coatings. Siloxanes have a wider recommended application thickness range and are relatively easy to apply, with pot life exceeding the fluorourethane coatings.

Life Expectancy

What defines the end of an exterior coating's service life? When the first rust spot appears? When a certain percentage of primer is showing? When a certain percentage of rust is visible? Or when the finish coat is not aesthetically pleasing? For this article, the definition of the service life of a coating is the amount of time before repainting becomes necessary due to coating failure and corrosion. Future touch-up may be required on isolated coating failures. If aesthetics are a concern, the owner may have to topcoat the repainted tank before the end of the expected service life. However, future topcoating would be less expensive than complete cleaning and recoating and could postpone the need for complete cleaning and repainting for many years.

Color Availability

Most exterior tank coatings are available in practically all colors. Many times, color and aesthetic concerns drive the selection of the coating.

Ease of Application

Generally, single-component materials dry on surfaces via the evaporation of the solvent, while multiple-component materials generally cure by a chemical reaction of the materials. Some coating types are more sensitive to atmospheric conditions than others, and this should be taken into account during coating selection.

Single-component materials, such as alkyds, acrylics, moisture-cured urethanes, and silicone alkyds, are easier to mix and apply than the two- and three-component, higher-performance coating materials.

During both application and cure, moisture-cured coatings are prone to blushing when exposed to humidity or dew. Good painting practices must be followed for a coating to perform as intended. For example, to perform properly, all components of a moisture-cured urethane must be mixed using the correct component ratios and power mixers; clean thinner in clean containers should be used as well. In addition, most coating manufacturers recommend using shorter roller nap, high-quality roller covers for application. The shorter roller nap is somewhat more difficult to use—it requires the applicator to reapply the coating to the roller more frequently because the shorter nap does not hold as much paint as the longer nap. Care needs to be taken to apply and roll the material to achieve the required dry film thickness.

Because of its sensitivity to coating thickness, a polyurethane clear coat is much more difficult to apply evenly and consistently. It is critical that the material be applied at the specified thickness—normally about 1 mil. A polyurethane application can look great when it is completed, but once a year or two has passed, any areas where the clear coat is too thick can yellow, and undercoats that are too thin can begin to very noticeably fade.

This tank in Lombard, IL, "The Lilac Village," is still a community landmark three years after the tank was recoated with a fluorourethane coating system.

Resistance to Abrasion

In reality, the sources of abrasion on a water tank surface are limited: vandals throwing rocks or shooting at tanks, or, possibly, ice and snow build-up in cold weather. When vandals throw rocks and chip the coating, spot rusting may result. Our company's experience shows that all of the finish coatings are going to react similarly. If a tank has been damaged previously by vandalism, consider using a zinc prime coat in which the zinc may help reduce the rusting caused by a breach in the finish coat. The best strategy to reduce abrasion from ice and snow is to make sure the material is applied with a smooth finish so the ice and snow will slide off, with no lifted edges where moisture can get in and lift the coating.

Resistance to Graffiti

If the solvent in an anti-graffiti paint softens the underlying coating, graffiti will bond readily to the underlying coating and will be difficult to remove. Ultra-high-performance coatings may reduce the damage from graffiti because they provide a smoother finish, have lower surface energy, and are more solvent resistant, thus giving the graffiti less "bite" into the surface. With high-performance polyurethanes and ultra-high-performance fluorourethanes and polysiloxanes, graffiti can be removed, but it takes a lot of elbow grease using the appropriate thinner.

Removing graffiti can remove part of the finish coat, and often residual graffiti is visible. The only way to "remove" graffiti from acrylics and alkyds is to apply coating over the graffiti, but matching the color of the original coating is often difficult.

Resistance to Fading (Color and Gloss Retention)

Although alkyds and acrylics can be obtained in many colors, the poor color retention and gloss retention of these coatings should limit the color selection to light blues, light greens, light tans, and white. As these coatings fade and chalk, they will tend to look white anyway.

The higher performance polyurethanes in bright colors will begin to fade during the first three to five years. If a tank is to be painted white, it might be adequate to use a standard polyurethane because, while the gloss is likely to fade, the color will remain the same.

Water tank applications of solvent-borne fluorourethanes have not been in service long enough to know how much they will fade. However, tanks that our company observed being coated with a fluorourethane three to five years ago do not appear to have faded nearly as much as we would have expected had they been painted with a standard polyurethane. Longer in-service results for water tank applications of siloxane coatings are not yet available

A recent and common application of note is the use of fluorourethanes for bright colored logos on lighter colored tanks because fluorourethanes hold color well.

Also of note: in our company's experience with exterior tank coatings, acrylics seem to hold their color significantly better than the alkyds.

Resistance to Chalking

Chalking is a white powdery substance that forms on the surface of a coating as it is degraded by UV radiation and as the coating pigments and binders break down. Chalking is usually an aesthetic consideration, except in extreme situations in which the thickness of the coating decreases and reduces the coating's protective properties. Alkyds and polyurethane coatings seem to be most apt to chalk.

Equipment used in the application of metalized coating

Ease of Topcoating

Coatings that have good resistance to graffiti (having a very hard or smooth surface) are typically not easy to topcoat for the same reasons. Although water tank applications of fluorourethanes and siloxanes have a short history, given their short recoat windows, abrading is normally required before topcoating or touch-up; polyurethanes with clear coats also require abrading prior to topcoating or touch-up.

Polyurethanes, acrylics, and alkyds typically have an extended recoat window. By the time they are ready for topcoating, the surface has degraded and chalked sufficiently that a good power wash, using a detergent and usually some scrubbing, is required to prepare the surface. By nature, chalking normally causes the surface to become abraded. To provide good adhesion for the topcoating, it is important to remove chalk, dirt, and debris.

Dry Fallout

Coatings that dry or cure quickly and fall to the ground in a relatively dry condition have good "dry fallout" characteristics. Because most water tank abrasive blasting projects are done inside containment due to lead paint or nuisance dust restrictions, dry fall coatings are not as critical as they once were—the tarps or containment can easily be left in place during coating application. In addition, more and more exterior tank painting projects are using brush and roller application instead of spray application. Application by brush and roller will reduce the amount of overspray because the coating droplets will be larger and not travel as far.

Polyurethane, fluorourethane, and polysiloxane coatings do not have good dry fall characteristics. In addition, some of the dry fall acrylics cannot be applied by brush and roller and achieve good results.

Corrosion Resistance

Corrosion resistance can be documented by many testing procedures that compare different coating types under similar conditions. Because lead-based primers are no longer available, many coatings, such as alkyds, silicone alkyds, and acrylics, will not have the same corrosion resistance as previously manufactured coatings of the same generic type that contain lead or chromates.

Coating Systems for Water Storage Tank Interiors

Two- or three-coat tank interior epoxy coating systems have been a standard in the industry for the past 25 years. Recent additions to the coatings specifer's arsenal are zinc-primed epoxy and polyurethane interior coating systems. Metalized coatings, also available for 25 years or so, are also gaining popularity for the interiors of potable water storage tanks.

Life Expectancy

Is interior coating failure defined as when the first rust spot appears or when a certain percentage of rust is visible? The service life of an interior coating is defined in this article as the typical expected number of years before repainting becomes necessary due to excessive coating failure and corrosion. The owner can extend the service life of the interior coating by installing and properly maintaining and operating a cathodic protection system to help protect the interior submerged steel surfaces that have experienced coating failure. Cathodic protection is not commonly used with zinc/aluminum spray-applied coatings.

Epoxy or zinc-epoxy interior coatings are expected to last 15–25 years. Polyurethanes and metalized coatings have a significantly longer service life.

NSF 61 Certified Products

The National Sanitation Foundation (NSF) has established testing criteria for coatings in contact with potable water. These criteria include protocol for bacteria growth, VOC contamination, and limits on other impurities in the cured coating system. Most states have adopted the NSF/ANSI 61 listing procedure for tank interior coating systems; the participation status of all 50 U.S. states is provided in the NSF report, "Survey of ASDWA Members Use of NSF Standards and ETV Reports: May 2008," available at http://www.nsf.org/business/water_distribution/pdf/ASDWA_Survey.pdf.

Ease of Application

Epoxy and zinc-epoxy coating systems are relatively easy to apply and have a relatively short material pot life. The higher performance interior coatings, such as polyurethanes and polyureas, are one-application, multi-pass systems. These materials have a very short recoat window, and, once applied and set, require significant additional surface preparation for topcoating and touch-up. They are more difficult than the standard epoxy systems to apply because they require special plural-component spray guns, heaters, and other equipment, as well as a deep anchor pattern. Specialized training and certification is also required for the applicator, and training is recommended for the equipment operator. For the coating to perform well, the operator must make sure the coating temperature is correct and the material is "on ratio."

A metalized coating system is also more difficult to apply because special contractors and equipment are needed to apply them, and a higher degree of surface preparation is required.

One advantage to metalizing, however, is that it can be applied in the colder winter months if proper dehumidification equipment is used. The SSPC-CS 23.00/AWS C2.23/NACE No. 12 joint standard is an excellent guide to use for specifying and evaluating metalizing systems.

Resistance to Abrasion

Applied correctly, polyurethane coatings for tank interiors are very resistant to ice damage, which is the only abrasion to which they are really subjected. Metalized coatings also have excellent resistance to corrosion and abrasion.

Ease of Topcoating

It is not normally cost effective to topcoat standard epoxy interior tank coatings. However, when ultra-high-performance coatings are applied correctly, they may be very difficult to remove, and topcoating may therefore be an option. With the long expected service life of ultra-high-performance systems, the need to topcoat has not come up yet. Based on experience so far, it is expected that spot repair will extend the life of these coatings in water tank service. However, the surface will need to be well abraded before any spot touch-up.

Corrosion Resistance

Metalizing and a zinc primer under an epoxy or polyurethane topcoat are the only tank interior coating systems that offer corrosion resistance. Epoxy and polyurethane coatings offer a barrier, and polyurethanes have especially good resistance to coating "undercut," should a coating break occur. (Undercut occurs where corrosion works its way under a coating and enables a coating failure spot to develop.) A metalized system has excellent resistance to corrosion.

Specialized Test Equipment

High voltage holiday testing is required for polyurethane tank interior coating systems that are applied at more than 20 mils of dry film thickness. This test is more involved and more difficult to use than the standard low-voltage test.

Cost of Materials

Metalizing is very expensive but has one of the longest life expectancies of any of the coatings discussed. A sealer or finish coat is often recommended.

Conclusion

It is important to take into consideration many criteria when designing a coating system for each tank coating specification. Items to consider include the following.

- In what environment is the tank located?
- What are the constraints of the tank site?
- What is the design of this tank?
- What is the present condition of the coating?
- What are the types of coating failures observed on this tank, why did they occur, and what can be done to correct them?
- Where are the existing corrosion problems on this tank?
- What time of year and for how long can the tank be taken out of service for painting?
- What are the owner's short- and long-term plans for this tank?

What is the right coating system for your water storage tank? Now, more than ever, tank owners and operators need expert, unbiased, third-party input to make this complex decision.

Michael Doolittle has worked for Tank Industry Consultants (TIC) for 25 years.

Formerly TIC's field services manager, he continues to be one of the primary liaisons between owners and contractors. He conducts failure analyses, is involved in dispute resolution, attends pre-construction meetings on behalf of tank owners and TIC, and is responsible for project administration duties. Mr. Doolittle is a Level III NACE Certified Coating Inspector, an SSPC Protective Coating Specialist, and an American Welding Society Welding Inspector. He has written several articles for *JPCL*.

JPCL

SSPC Announces New Protective Coatings Show

SSPC has announced the re-launching of its own protective coatings show and technical conference in 2011.

The event, set for January 31–February 3, 2011, at the Mandalay Bay Hotel in Las Vegas, will focus exclusively on protective, marine, industrial, and architectural coatings technology, products, and services. According to SSPC, this effort is a reflection of the interests and desires of SSPC's core members and supporters and returns the organization to its roots of providing a dynamic venue for protective coatings professionals to network and discover the latest developments in the industry.

As in the past, SSPC will hold its Annual Meeting, standards development committee meetings, coatings training programs, and a robust technical conference in conjunction with the show. SSPC also hopes to incorporate newer technologies within the framework of the show to allow greater participation by its membership, such as live web casting, an interactive exhibit hall, and digital video proceedings.

"This new show represents the future of SSPC and our commitment to meeting the needs of our members," said SSPC President Bruce Henley. "They've enjoyed the PACE experience since 2005, and that has really opened their eyes to the power of a well produced trade show. At the same time, our members are really interested in 'next steps' and how we can reach our potential as a technically driven society. This new show represents a logical progression in moving toward that goal."

According to Bill Shoup, Executive Director of SSPC, "Both SSPC and PDCA are fully committed to having a successful PACE show in Phoenix in 2010. Our efforts are completely focused on making the last PACE show the best one we've had. After a great experience in New Orleans, we're as excited for the show in Phoenix as we've ever been."

After going to Las Vegas in 2011, SSPC plans to take the show back to Tampa, FL, in 2012. A new name for the revamped SSPC show will be announced in the near future.

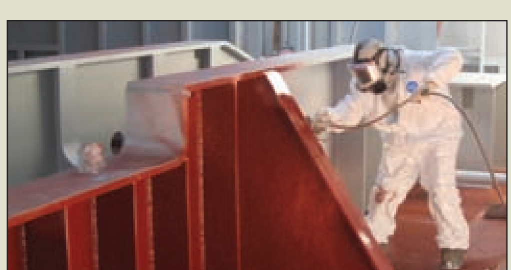
SSPC Training: From Shanghai to South Carolina

SSPC training and certification courses, designed to enhance coatings professionals' skills and marketability, were held recently in China and South Carolina.

The SSPC China Chapter, in association with Moody International, sponsored the first Protective Coatings Inspector (PCI) course to be held in China. The class took place in Shanghai, December 8–13, 2008, and was led by veteran SSPC instructor Tom Jones. There were 8 students in attendance. SSPC continues to enjoy strong support for the PCI Program overseas, particularly in Asia, the Society says.

An Airless Spray Basics (C-12) class was held on January 21–22 in Charleston, SC. The training was hosted by US Coatings, Inc. (SSPC-QP 1-certified). There were 17 students in attendance, with Joe Williams as the instructor.

Students of the Protective Coatings Inspector course, held in Shanghai, China, in association with Moody International



Student participating in Airless Spray Basics (C-12) class, held in Charleston, SC, and hosted by US Coatings, Inc.

PACE 2010: Call for Presentations

SSPC and PDCA have announced that they are currently accepting abstracts for presentations for their joint conference, PACE 2010, to be held February 7–10, 2009, in Phoenix, AZ. The PACE Education Advisory Committee welcomes proposals of any level for the technical, business, and special emphasis sections. For information on topics covered in the sessions, important deadlines, and speaker responsibilities, visit www.pace2010.com

Abstracts for the technical sessions should be sent to Jennifer Miller, miller@sspc.org, and those for the business sections should be sent to Adam Potts at apotts@pdca.org. All abstracts are due June 6, 2009.

Continued

SSPC Individual Member Update

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

- Oscar Aguilar, San Diego, CA
- Merrick Alpert, Mystic, CT
- James Anderson, Escanaba, MI
- Leonard Antonelli, Blackwood, NJ
- Terrence Awai, St. Joseph, Trinidad and Tobago
- Diane Ballard ,San Diego, CA
- Harold Barras, Jr., Abbeville, LA
- Megan Beyer, Washington, DC
- Ganapathy Bhaskaran, Riyadh, Saudi Arabia
- Mike Bignell, Calgary, AB, Canada
- Alex Bills, Hampton Bays, NY
- Connie Brown, Birmingham, AL
- Robert Burns, Jackson, TN
- Scott Buttes, Placnetia, CA
- Pradeep Chawla, Wanchai, Hong Kong
- Wei Chiu, Delta, BC, Canada
- Robert P. Cook, Hampton, VA
- James Corbin, Dacono, CO
- Bud Crolley, Lawrenceburg, KY
- Tony Cunningham, Guildford, Surrey, UK
- Jim DeLong, Connellsville, PA
- Gary J. DeShaw, Puyallup, WA
- Bary Dickson, Plant City, FL
- William Donaldson, Sparks, NV
- Geoffrey Durant, South Boston, MA
- Lorne Edmonds, Limoges, ON, Canada
- Dick Eglinton, Saegertown, PA
- David E. Engle, Kansas City, MO
- Adam Eusepi, Lively, ON, Canada
- Marshall Fayard, Buford, GA
- Salvo Fichera, Città, Giardino-Melilli-SR, Italy
- Martín Flores, Chetumal, QROO Mexico
- Marty D. Fransted, Rosebush, MI
- Garrick Gay, Lawrenceburg, KY
- Manuel Gialousis, Tarpon Springs, FL
- Nagesh K. Goel, Yorktown Heights, NY
- Robert F Guise, New Orleans, LA
- Thomas Hannah, Turlock, CA
- David Harris, Porter, IN
- Arthur Hiers, North Charleston, SC
- Ted R. Hobin, Arcade, NY
- Amy Hoke, Houston, TX
- John Hubbard, Hemlock, MI
- Jeffery Hunter, Jacksonville, FL
- Howard Jess, Greenock, Renfrewshire, UK
- Yoon Jo, Chanwon-si, Gyeongsangnam-do, Republic of Korea
- Stephen Joest, Prospect, KY
- Clarence A. Jones, Oakley, CA
- George Kanellopulos, Perry Hall, MD
- Isa Kartal, Kocaeli, Turkey
- Murota Kazutoshi, FPO, AP
- Anne Kozak, Edmonton, AB, Canada
- Kymarie Kuster, Pleasant Prairie, WI
- Thomas J. Langill, Centennial, CO
- Danny LeBlanc, Alpharetta, GA
- Erik Llewellyn, Sandy, UT
- Benigno Lopez, Ferrol Coruña, Spain
- Paul D. Lovett, Rehoboth Beach, DE
- Bill Lynn, Summerville, SC
- Joseph Marshall, Belle Chasse, LA
- Michael Martin, Grand Bay, AL
- Steven J. Martin, Magnolia, TX
- David Matlock, Thicket, TX
- Kenneth M. Mavica, Waterford, NY
- Darel McCormick, Seattle, WA
- Tom Merrill, Salisbury, MO
- Chaundra C. Mitchan, Temple, TX
- Smarajit Mitra, Saint Paul, MN
- Junki Miyashita, Yokohama, Japan
- Embry Murphy, St. John's, NL, Canada
- Tony Nguyen, Houston, TX
- Kevin Niles, Buffalo, NY
- Joseph Olvey, Haleiwa, HI
- Len Padgham, Nisku, AB, Canada
- Robert J. Parker, Exton, PA
- Arturo Perez, Miami Beach, FL
- John Pittman, Lawrenceburg, KY
- Lorenzia Pitts, Colorado Springs, CO
- David Plunkett, Schaumburg, IL
- John Repetto, Concord, CA
- Edith Robbins, Cotati, CA
- Joseph S. Robertaccio, Marcy, NY
- Larry Rollins, Friendswood, TX
- David Rozene, Wyckoff, NJ
- Robert Ruff, Romeoville, IL
- William Russell, Borger, TX
- Thomas Santos, Providence, RI
- Doug Sawyer, Charlestown, IN
- David Schexnaydre, Amelia, LA
- Irene Scordos, Independence, OH
- Chris Seale, Hubbard, OR
- Jeff Seison, Portsmouth, OH
- Joseph M. Serpico, Shelby, NC
- Zulfiquar Sheermohamed, Cooper City, FL
- Robert Simon, Springfield, MO
- James Spruill, Elizabeth City, NC
- Steve Taggar, Walnut Creek, CA
- Mark Thomas, Oshkosh, WI
- Mario Torres, Utuado, Puerto Rico
- Rick Traughber, Kingwood, TX
- Tim Traughber, Chino, CA
- Fernando A. Turegano, Kingwood, TX
- William Volkman, McFarland, WI
- Karen Walker, Gainesville, GA
- Kevin P. Weaver, Hanover, PA
- Nancy Wellhausen, Santa Barbara, CA
- James Wenberg, Joliet, IL
- Joey Weninegar, Mobile, AL
- Gerald Wilson, Champaign, IL
- Ron Wolfe, Council Bluffs, IA
- Harmodio Yuen, Panama City, Panama
- Lee K. Zacharczuk, Gadshill, ON, Canada

An Update on Regulatory Action Affecting Maintenance Painting Work

By Alison B. Kaelin, CQA, KTA-Tator, Inc.

So far in 2009, there has been little significant new regulatory action for industrial maintenance painting operations, but some regulatory activities that the industry should follow are reported.

EPA Reduces Ambient Lead Level

As described in the January 2009 *JPCL* (Kaelin, pp. 9–13), effective January 2009, the Environmental Protection Agency (EPA) reduced the allowable limits for ambient lead from 1.5 micrograms per cubic meter of air ($\mu g/m^3$) to 0.15 $\mu g/m^3$. The tenfold reduction in the National Ambient Air Quality Standard (NAAQS) for lead was not directly intended to address maintenance painting work at this time, but depending on how it is interpreted and implemented by EPA and the States, it could impact monitoring and control of lead emissions from coating removal projects.

As a result of meetings held by SSPC's Regulatory Affairs and Containment committees in February 2009 to discuss the potential impacts of the NAAQS revisions, SSPC issued letters to its membership and to EPA on March 13, 2009, regarding the revision.

In its letter to the EPA, SSPC requested clarification on several points: whether typical industrial field painting projects are considered "sources" under the requirements of the standard and whether EPA affirms that the NAAQS would not apply if higher levels of containment are used equivalent to Reasonably Available Control Technology (RACT). The clarifications SSPC seeks would in turn establish how the EPA may apply the NAAQS-lead standard to field painting projects and/or confirm that any monitoring done to evaluate containment effectiveness falls outside strict compliance with the NAAQS-lead standard.

The EPA replied to SSPC's letter in mid-April via email. According to Heather Bayne, protective coatings professional at SSPC, EPA stated that monitoring requirements would only be triggered if the actual emissions are estimated to exceed the threshold, which is currently 1 tpy (tons per year) for monitoring requirements. If emissions are less than 0.5 tpy, then the project is not subjected to the monitoring requirements. In response to questions about containment, Bayne reports that the EPA responded that the 0.5 tpy threshold for RACT analysis would only apply to geographical areas determined to be in non-attainment, which won't be established by the States until October 2009 and by EPA between October 2010 and 2011. It is at the state's discretion as part of

Table 1: Most Frequently Cited OSHA Standards, Oct. 2007–Sept. 2008*

Scaffolding, general requirements, construction	**29 CFR 1926.451**
Fall protection, construction	**29 CFR 1926.501**
Hazard communication standard, general industry	29 CFR 1910.1200
Control of hazardous energy (lockout/tag out), general industry	29 CFR 1910.147
Respiratory protection, general industry	29 CFR 1910.134
Electrical, wiring methods, components and equipment, general industry	29 CFR 1910.305
Powered industrial trucks, general industry	29 CFR 1910.178
Ladders, construction	**29 CFR 1926.1053**
Machines, general requirements, general industry	29 CFR 1910.212
Electrical systems design, general requirements, general industry	29 CFR 1910.303

* Construction industry standards are shown in bold type

Table 2: Top 10 OSHA Standards by Fines Levied, Oct. 2007–Sept. 2008*

Fall protection, construction	**29 CFR 1926.501**
Scaffolding, general requirements, construction	**29 CFR 1926.451**
Electrical, hazardous (classified) locations	29 CFR 1910.307
Control of hazardous energy (lockout/tag out), general industry	29 CFR 1910.147
Excavations, requirements for protective systems, construction	**29 CFR 1926.652**
Machines, general requirements, general industry	29 CFR 1910.212
General duty clause Section 5 a) 1) of the OSH Act	
Powered industrial trucks, general industry	29 CFR 1910.178
Walking-working surfaces, general requirements	29 CFR 1910.22
Process safety management of highly hazardous chemicals	29 CFR 1910.119

* Construction industry standards are shown in bold type

their state implementation plan to require controls on these sources in non-attainment.

Hexavalent Chromium: From OSHA to NIOSH

On February 28, 2006, OSHA published a final standard for occupational exposure to hexavalent chromium, or CrVI (29 CFR 1926.1126). CrVI is a component of anti-corrosion coatings as well as other industrial and consumer products. The standard was developed because workers with chronic exposures to CrVI compounds may be at an increased risk of developing lung cancer. Breathing high levels of CrVI can irritate or damage the nose, throat, eyes, skin, and lungs or cause asthma-like symptoms. In effect since May 30, 2006, the standard lowered the Permissible Exposure Level (PEL) to 5 $\mu g/m^3$ and established the Action Level (AL) of 2.5 $\mu g/m^3$. The U.S. Court of Appeals for the Third Circuit recently upheld a challenge to the PEL (The PEL refers to the maximum limit to which workers can be exposed to CrVI calculated as an 8-hour time-weighted average (TWA), and the AL refers to the exposure level that requires implementation of medical surveillance).

The National Institute for Occupational Safety and Health (NIOSH) recently performed a "Criteria Document Update: Occupational Exposure to Hexavalent Chromium." The draft NIOSH document reviews the available literature on CrVI exposures and updates NIOSH policies on occupational exposure to CrVI compounds. The document led NIOSH to recommend protective measures for workers exposed to CrVI that go beyond the OSHA standard and to issue a Recommended Exposure Limit (REL) for CrVI compounds of 0.2 $\mu g/m^3$, or 25 times lower than the recently upheld PEL of 5 $\mu g/m^3$. (NIOSH is a research agency, so its recommendation is not binding.)

OSHA Reports Enforcement Actions

OSHA published data on its most frequently cited standards and on the standards with the highest penalties levied for fiscal year 2008 (October 2007 through September 2008).

For the second year in a row, scaffolding and fall protection in construction rank at the top, both in terms of being cited and in highest penalties (Tables 1 and 2).

Expected OSHA Enforcement in 2009

OSHA's budget and planning agendas for 2009 indicate that a significant amount of the agency's funds and attention will be focused on enforcing

Continued

existing regulations and emphasis programs. Over $80 million in stimulus money is being designated for hiring additional OSHA personnel. OSHA planning documents and the OSHA advisory committee for construction indicate that targeted enforcement can be expected for fall protection and any current National Emphasis Programs (NEPs) for enforcing construction standards, including those involving silica exposures, lead exposures, and trenching and excavation projects.

New OSHA Documents

In April 2009, OSHA released the publication, *Assigned Protection Factors (APF) for the Revised Respiratory Protection Standard* (OSHA 3352-02 2009), a new guidance document that provides employers with supplemental information for selecting respirators for employees.

OSHA revised its existing Respiratory Protection Standard (29 CFR 1910.134) in 2006 to add Assigned Protection Factor (APF) and Maximum Use Concentration (MUC), which are mandatory respirator selection requirements that can be used only after respirators are properly selected and are used in compliance with the entire standard. The guide provides an expanded discussion on types of respirators and their corresponding APFs. The guide also re-emphasizes the requirements for respirator selection, medical evaluations, fit testing, training, and program evaluation.

In addition, the guide covers the mandatory fit testing procedures for respirators. Employers who previously implemented fit testing programs in response to Appendix D of OSHA's lead-in-construction standard, 29 CFR 1926.62, may need to review the requirements for fit testing in the revised Respiratory Protection Standard because they are more comprehensive than the fit testing requirements in the lead standard. For example, for fit testing by Irritant Smoke (the method most commonly used for fit testing of HEPA equipped mask respirators), the Respiratory Standard requires pre- and post-fit test sensitivity screening (i.e., can the employee detect the irritant smoke?), among other criteria.

Additionally, the standard requires that the fit test should be performed "while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use." This means that for a typical industrial painter, the fit test should be conducted while wearing protective clothing, hard hat, fall protection, and any other safety equipment.

OSHA Standard Interpretation

On January 14, 2009, OSHA issued a Standard Interpretation relative to whether a manufacturer-stipulated minimum anchor point elevation of 18-½ feet precludes the use of a shock-absorbing lanyard in an aerial lift. Employers who utilize standard 6-foot lanyards and/or aerial lifts may want to review OSHA's interpretation because it appears to imply that either a self-retracting lanyard, a body belt (while body belts are not permitted as fall protection they are allowed to be used under certain conditions), or a restraint system capable of preventing an employee from falling any distance from the lift may be required.

OSHA further elaborates that regardless of the type of fall protection that is used by an employee on an aerial lift, the vertical and lateral loads that may be placed on an aerial lift in the event of an arrested fall must be evaluated, and such loads must meet the Section 1926.502(d)(15) load requirements for anchorages.

For More Information

• Safety and Health Topics—Hexavalent Chromium
www.osha.gov/SLTC/index.html (Search "hexavalent chromium")

• NIOSH Criteria Document Update: Occupational Exposure to Hexavalent Chromium
www.cdc.gov/niosh/review/public/144

• Respiratory Protection Standard (29 CFR 1910.134)
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716

• Assigned Protection Factors (APF) for the Revised Respiratory Protection Standard
www.osha.gov/pls/publications/publication.html (Search "revised respiratory standard")

• Field Operations Manual (FOM)
www.osha.gov/OshDoc/Directive_pdf/CPL_02-00-148.pdf

associations

PDA Elects New Board Members

The Polyurea Development Association (PDA) has announced its 2009–2010 board members. Don Dancey, from Innovative Painting and Waterproofing (Brea, CA), was elected president. He will use his term to develop stronger relationships among PDA members by increasing networking and communication, says the Association. Dancey also plans to strengthen PDA's industry education.

Serving with Dancey are President-Elect John Turnour, Rebus, Inc. (Aston, PA); Secretary/Treasurer Christiane Hackl, BASF Corp. (Florham Park, NJ); and Immediate Past-President Lee Hanson, The Hanson Group (Duluth, GA).

For a full contact list of all directors and board members, visit www.pda-online.org.

companies

RPM Has 35 Years of Dividend Increases

RPM International Inc. (Medina, OH) has declared a regular quarterly cash dividend of $0.20 per share that was payable on April 30. This represented a 5.3% increase over the quarterly cash dividend paid at the same time last year.

The cash dividend increase in October 2008 marked the 35th consecutive year of increased dividends paid to stockholders. RPM is one of only 67 of the U.S.'s 19,000 publicly-traded companies (less than one half of 1%) that have consistently paid an increasing annual dividend for this amount of time, the company says.

RPM is a holding company that owns subsidiaries in industrial and consumer specialty coatings and sealants.

Continued

Sherwin-Williams Renames Marine Group

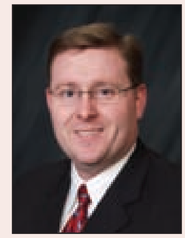
The group formerly known as Sherwin-Williams Industrial Marine Coatings will now be called the Protective Marine Coatings group. According to the company, the new name is meant to reflect Sherwin-William's commitment to protecting the assets of customers through coatings solutions.

The group will continue to serve the same markets as under the previous name.

Sherwin-Williams is headquartered in Cleveland, OH.

Matcor Names Sr. Corrosion Engineer

Matcor, Inc., headquartered in Doylestown, PA, has named Matt Matlas as the senior managing corrosion engineer for the Gulf Coast office in Houston, TX. He will oversee all of the engineering operations.



Matt Matlas

Matlas has 15 years of experience in engineering and cathodic protection design and is a NACE-Certified Cathodic Protection Specialist and Level 1 Coating Inspector. He has a bachelor's degree from Central Michigan University in engineering technology with a major in electrical engineering. Matlas co-authored "Advances in Pipeline Rehabilitation" for the 1995 Systems Integrity Rehabilitation Conference.

MSA Sales Increase in 2008

MSA, a manufacturer of safety products, announced that its net sales for 2008 were $144 million, or 15%, higher than 2007. Net income increased by $2.8 million, or 4%. Sales for the fourth quarter of 2008 increased by 8% over Q4 2007, with net income increasing 5%.

William M. Lambert, MSA president and CEO, stated that it was the highest full-year and fourth quarter sales in MSA's history.

MSA is headquartered in Pittsburgh, PA.

BlastPro Adds Distributor

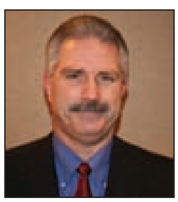
BlastPro Manufacturing, Inc. (Oklahoma City, OK) has named a new master distributor of its portable shotblasting equipment, replacement parts, and dust collectors. Niagara Machine, Inc. will be responsible for all sales, rentals, and service of

BlastPro equipment east of the Mississippi River, except in Illinois and Wisconsin.

Sales locations are in Erie, PA; Charlotte, NC; Memphis, TN; Rochester, NY; Pittsburgh, PA; and Detroit, MI. Service centers are in Erie, PA, and Charlotte, NC.

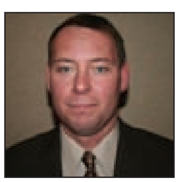
BlastPro manufactures a full line of electric-, gasoline-, and propane-powered portable shotblasting equipment for surface preparation of horizontal concrete and steel surfaces.

Spider Promotes Two District Sales Reps



Kevin Muldoon

Spider recently promoted Kevin Muldoon and Scott Ryder to district sales representatives. Both were previously operations managers.



Scott Ryder

Muldoon has been with Spider since 2005 in its Cleveland, OH, branch. He will be responsible for Ohio, western Pennsylvania, New York, West Virginia, and eastern Kentucky. Ryder started in the Boston, MA, branch of the company nine years ago and will handle the Boston area in his new position.

Spider, a division of Safeworks, LLC, is headquartered in Seattle, WA. It manufactures and distributes access and safety solutions in North America.

Two Companies Form Flame-Spray System

Evonik Industries (Essen, Germany) and IBEDA Sicherheitsgeräte und Gastechnik GmbH & Co. KG (Neusadt/Wied, Germany) have joined together to offer a complete solution for coatings applied by the flame-spray process. Using Evonik's Vestakeep® coatings, the IBEDA F311 FX-S plastic flame-spraying system can coat large work pieces without an oven, according to the companies. The process gives a

Continued

wear- and chemical-resistant surface with thermal stability of 260 C (500 F).

For details, visit www.evonik.com.

Bayer Will Build Plant in India

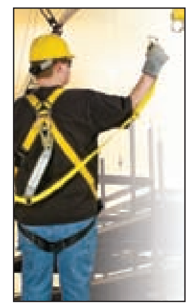
Bayer MaterialScience (Pittsburgh, PA) plans to invest EUR 20 million in a new aromatic and aliphatic polyisocyanate manufacturing facility in Ankleshwar, Gujurat, India. Opening the plant is part of the company's strategy to grow business in the country and strengthen its position as a supplier of polyurethane raw materials.

The new facility is scheduled to open in 2011 and will produce polyisocyanates, which are used in the formulation of a variety of polyurethane coatings, adhesives, and sealants.

products

MSA Offers Heavy Worker Lanyard

MSA (Pittsburgh, PA) now offers Heavy Worker Lanyards, which the company rates up to 400 pounds. The lanyards are available in polyester web and cable configurations with a choice of anchorage and harness connections. According to the company, the lanyards are shock absorbing and comply with applicable OSHA regulations. Visit www.msanorthamerica.com for details.



New Cold Pressure Washers from Jenny

Steam Jenny has introduced four new models of direct-drive cold pressure washers. The washers are available with pressure ratings between 3,000 and 4,000 psi.

The company says that a number of safety features are available, such as a high-pressure relief valve and automatic shutdown when low oil levels are detected.

Steam Jenny is located in Somerset, PA, and is a product division of Jenny Products, Inc. More information is available at www.steamjenny.com.

Dow Adds WB Stain Repellents

Dow Corning Corporation has added two new water-based products to its line of stain and water repellents. The Dow Corning® 6706W and 6707W Penetrating Stain Repellents are water-based fluorosilane post-treatments that provide oil and water repellency to porous materials such as concrete, natural stone, and grout, the company says. The 6706W is ready to use, and 6707W is a concentrate that can be diluted with soft water. According to the company, neither products will damage glass, metal, wear- and chemical-resistant surface with thermal stability of 260 C (500 F).

For details, visit www.evonik.com.

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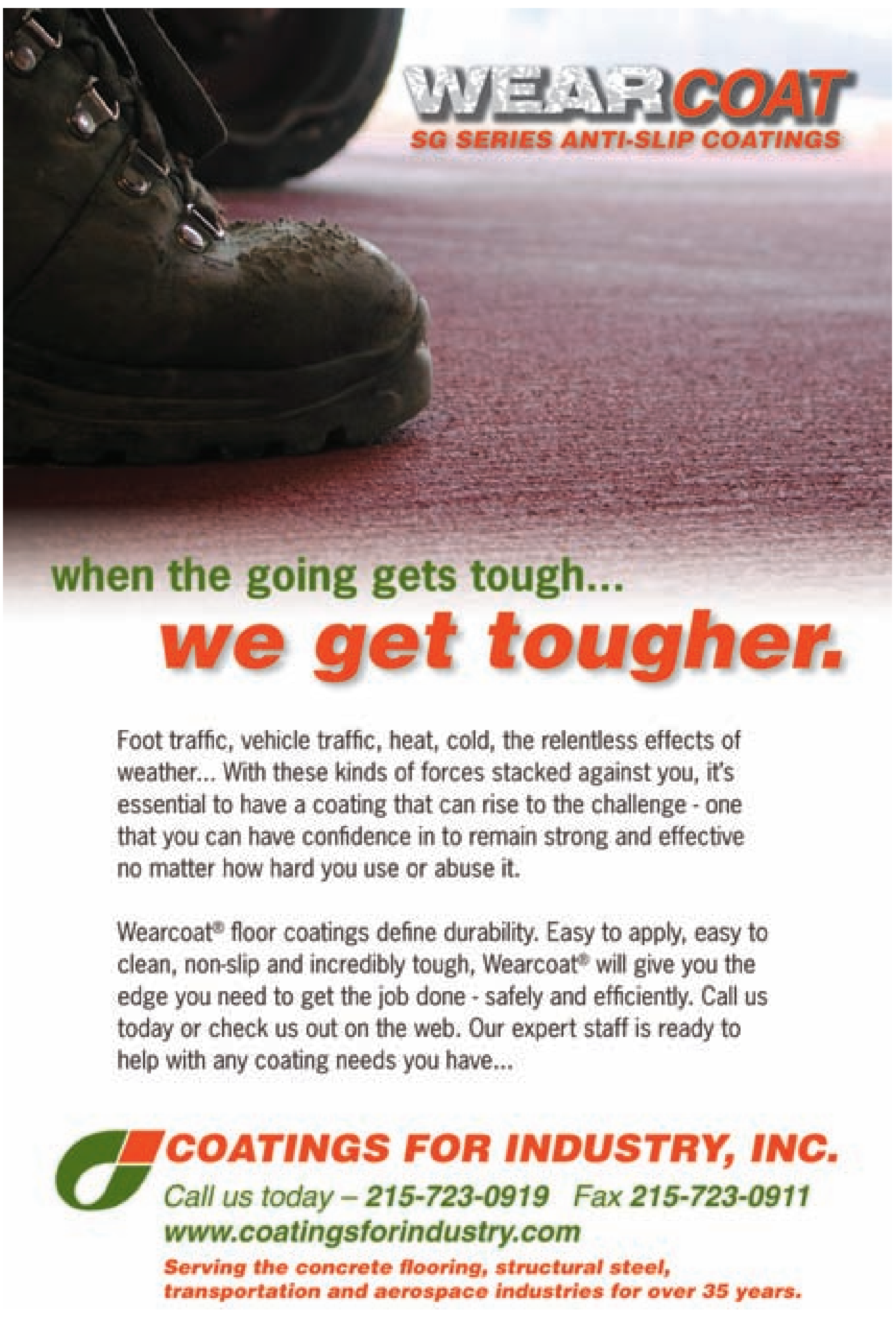

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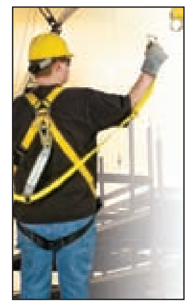

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Dow Corning (Midland, MI) is a joint venture equally owned by Dow Chemical Company and Corning, Incorporated. For more information, visit www.dowcorning.com.

Fischer Expands Thickness Gauge Line

Fischer Technology, Inc. (Windsor, CT) has added several new instruments to its product line for measuring film thickness. The FMP Series includes the Deltascope® and Isoscope® FMP10, Dualscope® FMP20, Deltascope® and Isoscope® FMP30, Dualscope® FMP40, and Dualscope® FMP100 coating thickness gauges. These instruments have large graphic displays; shock resistant casings; and can measure several coating types. The company says that the probes are designed for hard to reach areas.

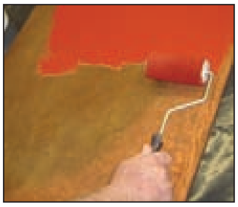
Dualscope® FMP100

The company also now offers the MP0R Series, which has an internal probe, two large displays, and automatic substrate recognition. The new Feritscope® FMP30 measures ferrite content in austentic and duplex steel.

For details, visit www.fischer-technology.com.

Int'l Coatings Releases 100% Solids DTM

International Coatings, Inc. (Franklin Park, IL) has released a 100% solids, direct-to-metal (DTM) coating, ICO-Rust Guard. According to the company, the epoxy coating protects metal in high humidity and damp conditions. It can be applied by roller, brush, or spray, and it adheres to rusted steel. A fast-cure version is available for applications down to 32 F.



Visit www.internationalcoatings.com for more information.

Krylon Reduces VOCs in IM Coating

Krylon Products Group (Cleveland, OH) has reformulated its Iron Guard® coating to meet the South Coast Air Quality Management District's VOC regulations of 100 g/L for industrial maintenance coatings.

According to the company, the direct-to-metal acrylic enamel coating is high-gloss, waterborne, and corrosion-resistant. Recommended substrates include steel, iron, aluminum, galvanizing, concrete, masonry, and wood.

Visit www.krylon.com for details.

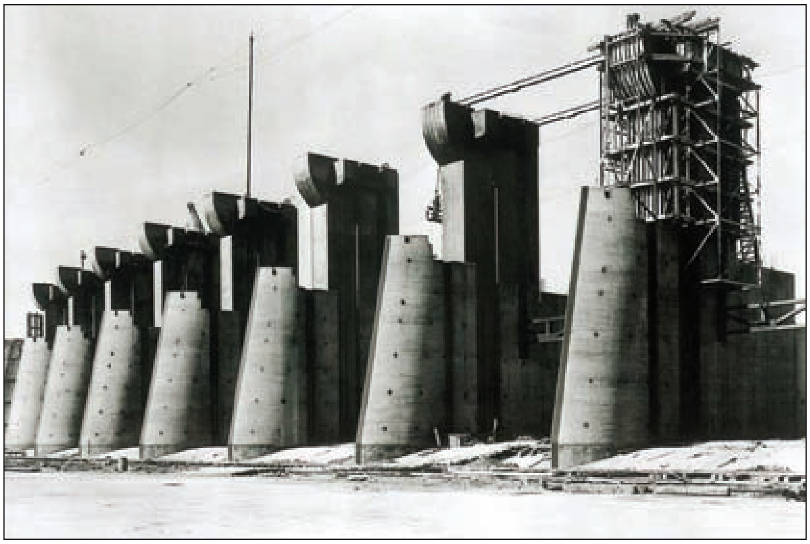
May Project Preview – Special Economic Stimulus Edition

By Brian Churray, PaintSquare

The $787-billion American Recovery and Reinvestment Act of 2009 (ARRA), which was signed into law by President Obama on February 17th, 2009, includes an estimated $130 billion for public works infrastructure spending. Public works facility owners have acted quickly to allocate this funding, and the initial response has provided hope for economic recovery driven by improvements to the nation's aging infrastructure. According to the President, "projects are being approved ahead of schedule, and they are coming in under budget." The Federal Highway Administration, which is responsible for the disbursement of $48.1 billion dollars of transportation funding, has reported intense competition to secure the stimulus-funded contracts, with average bids coming in at 15-20% below engineering estimates. Combined with recent reductions to steel, concrete, and oil costs, the lower-than-expected bid results will enable facility owners to stretch the economic recovery funds to pay for additional projects, which in turn will create more jobs and more infrastructure improvements.

The protective coatings industry plays a vital role in helping preserve the nation's transportation, drinking water supply, and waste treatment facilities. This article represents a small portion of this fund allocation, as reported by the Paint BidTracker project lead service during the month of April.

Army Corps of Engineers Bids Fort Peck Dam Coatings Work



The Fort Peck Dam during its New Deal-funded construction in the 1930's (photo courtesy of USACE, Omaha District).

The U.S. Army Corps of Engineers (USACE), Omaha District, is accepting sealed bids in early May for weld repairs and coatings application on sixteen 40-foot-long spillway stop logs and a lifting beam at Fort Peck Dam on the Missouri River in Montana. The dam was constructed during the 1930's as an effort of the New Deal, a series of federal stimulus programs that created jobs during the Great Depression. The project, which requires SSPC-QP 1 and QP 2 certification for the surface preparation and coatings application, includes containment of the existing lead-bearing coatings using a Class 3 containment system (SSPC-Guide 6). The steel stop logs and lifting beams will be abrasive blast-cleaned to a White Metal finish (SSPC-SP 5) and coated with a zinc-epoxy-polyurethane system.

Continued

Stimulus-Funded Tank Painting Awards

ARRA funding will also be used to upgrade the nation's aging water and wastewater infrastructure, including the repair of corroded steel on water storage tanks.

The Portland Water District (Portland, ME) awarded a stimulus-funded contract of $213,500 to Marcel A. Payeur, Inc. (Sanford, ME) to recoat the interior and exterior surfaces of an existing standpipe-style water storage tank.

The U.S. Air Force awarded a contract of $201,224.39 to JAMCO Ventures, LLC (San Antonio, TX) to perform lead-based paint abatement and coatings application on two existing elevated water storage tanks at Laughlin Air Force Base in Texas. The ARRA-funded contract was awarded through the 8(a) Program under an existing Simplified Acquisition of Base Engineering Requirements (SABER) agreement.

Project Preview

PennDOT Allocates Stimulus Funding to Bridge Painting Projects

The Pennsylvania Department of Transportation (PennDOT) has dedicated a significant portion of its stimulus funding for repairs on deteriorating bridges throughout the state, including multiple bridge painting projects. PennDOT recently awarded two bridge painting contracts, with both awards coming in below engineering estimates.

Hercules Painting Company (SSPC-QP 1- and QP 2-certified) in New Castle, PA, secured a contract of $4,389,810 to recoat 20 bridges in Bedford, Blair, Cambria, Fulton, Huntingdon, and Somerset Counties. The contract, which had an advertised estimate of $5–7.5 million, involves applying an organic zinc-rich coating system to the existing structural steel surfaces.

P.S. Bruckel, Inc. (SSPC-QP 1- and QP 2-certified) located in Avon, NY, was awarded a contract of $2,028,000 to recoat 10 bridges in Monroe and Schuylkill Counties. The contract has an estimated value of $2.5–5 million and involves applying an organic zinc-rich coating system to the steel bridge surfaces.

WisDOT Receives Below-Estimate Bids for Project

The Wisconsin Department of Transportation received four bids for a bridge painting contract that was administered during its April 28 letting. The project, which had an advertised estimate of $1.5 million, involves cleaning and recoating a total of 115,030 sq ft of steel on two sets of dual bridges in Lincoln County. The steel will be abrasive blast-cleaned to a Near-White finish (SSPC-SP 10) and coated with a zinc-epoxy-urethane system. The contract includes erection of negative pressure containment structures, which is a standard requirement for lead abatement work in the state. The low bid of $1,044,265.75 was submitted by C&L Contracting Inc. (Gillett, WI), followed by bids of $1,241,554 by Bridges 'R' Us Painting Company (SSPC-QP 1- and QP 2-certified) in Campbell, OH; $1,380,693.51 by Era Valdivia Contractors, Inc. (Chicago, IL); and $1,680,827.51 by Mill Coatings, Inc. (Suamico, WI).

Amtrak Seeking Bridge Painting Contractors

Amtrak requested statements of interest from contractors for an upcoming bridge painting project to be funded by its $1.3 billion allotment from the ARRA. Statements were due in late April. The project, with an estimated cost of $15–20 million, involves recoating four through truss spans with a combined length of 1,165 feet on the Thames River Railroad Bridge. The 1,353-foot-long bridge, which includes a new 188-foot-long vertical lift span that was completed earlier this year, connects New London and Groton, CT. The project includes erecting staged containment for the abrasive blast-cleaning and recoating of the steel through truss spans, which were built in 1919.

Gate Repairs and Painting at Lake Whitney Dam

U.S. Army Corps of Engineers Fort Worth District is currently advertising a bid for repairs and coatings application on existing tainter gates at Lake Whitney Dam and Powerhouse on the Brazos River. Photo courtesy of USACE, Fort Worth District.

Hawaii DOT Lets Bridge Painting Bid

The Hawaii Department of Transportation is accepting bids for bridge painting work on Hawaii Belt Road. The project, which will be bid in late May, involves recoating structural steel surfaces on the Ninole Bridge, Maulua Bridge, Kuwaikahi Bridge, and Kukaiau Bridge. The contract includes containment of the existing lead-bearing coatings and requires SSPC-QP 1 and QP 2 certification. The department of transportation estimates the work will cost between $5–10 million.

Icarus Wins Bridge Coating Contract

Icarus Industrial Painting & Contracting Company, Inc. (SSPC-QP 1- and QP 2-certified) located in Valparaiso, IN, was awarded a stimulus-funded contract of $447,413.80 by the Indiana Department of Transportation to perform coatings work on 7 bridges in the Crawfordsville District. The contract, which requires SSPC-QP 1 certification, includes recoating approximately 561 tons of existing structural steel with an inorganic zinc primer, an epoxy intermediate, and a polyurethane finish, as well as applying an epoxy penetrating sealer to abutment and pier surfaces.

Information Resource

Contractors, design professionals, and material suppliers can use the information resource, Paint BidTracker, to learn more about public works projects supported by ARRA funding. Visit www.PaintSquare.com/BidTracker/Stimulus or call (800) 837-8303 x157 to sign up for daily reports on painting projects that will be funded by the ARRA.