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SSPC The Society for Protective Coatings

FEATURES

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THE IMPORTANCE OF ROUTINE MAINTENANCE OF WATER STORAGE TANKS

By Gregory R. "Chip" Stein, Tank Industry Consultants

Welded steel tanks can provide effective service lives in excess of 100 years if properly maintained. Proper maintenance of steel tanks includes periodic cleaning and reapplication of a lining that provides a barrier between the underlying steel and its environment. In almost every case in the water tank industry, this involves abrasive-blasting the steel and applying a coating. The author describes the factors involved in water tank maintenance painting including coating condition, economics, aesthetics, civic pride and more.

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MEASURING VERTICAL CONCRETE SURFACE PH: TESTING FOR SEVERE EXPOSURES

By Vaughn O'Dea, Tnemec Company, Inc.

Concrete that has been distressed from chemically induced deterioration should be properly prepared to achieve a sound substrate prior to the application of protective linings for severe service environments. Concrete surface pH testing is one quality-control method of assessing the appropriate removal of chemical ingress. This article explores a more appropriate testing procedure for vertical concrete that has been developed.

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ABOVE THE FIELD: ELEVATED TANK PROJECTS SHOW LONGEVITY, SERVICE

By JPCL Staff

SSPC's annual Structure Awards recognize the work of teams of contractors, designers, end users and coating manufacturers for excellence on protective coatings projects. Two elevated water storage tank painting projects earned SSPC Structure Awards this year—one for coating longevity and one for service to the community. This article presents a profile of each project.

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DEPARTMENTS

ALSO THIS ISSUE

STAFF

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SSPC, NACE Leadership Discuss Unified Efforts

On March 18 of this year, SSPC: The Society for Protective Coatings, and NACE International announced that both organizations were discussing possible "synergistic opportunities" between the two. PaintSquare sat down with the leaders of each organization—Bill Worms of SSPC and Bob Chalker of NACE—to learn more.

Bill Worms, Executive Director, SSPC

Bob Chalker, Chief Executive Officer, NACE International

PaintSquare: Regarding a potential merger, what's in it for each organization?

Bob Chalker: First of all, our mission is to serve the industry, so what's in it for NACE isn't as important as: is this the right thing to do for the industry? I've been at NACE for nine years and the first couple of weeks I was there, I was approached by at least one NACE member, actually a couple that said, "You know, it makes sense that NACE and SSPC were one organization and not two, or at least were working together cooperatively." This has been a consistent theme over the years.

SSPC has a great relationship with the contractors and the applicators in the coatings industry. NACE has a very strong relationship with asset owners, with the engineers and the specifiers. And we believe that by bringing those two together we'd do a much better job making sure we are providing the highest quality services for our members.

Bill Worms: I'll reiterate what Bob said. It's really not about SSPC or NACE, it's about what's best for the industry. We're really here just to serve the members and it's going to be up to the members to decide what's in it for both organizations. But from my perspective, when you look at what NACE has been able to do over the years on an international basis, they've done a very good job of getting their message out internationally. I think they've done a great job promoting their inspector program, too—as you know, that's an area where we have overlapping programs, but when you look at the industry as a whole, CIP is in a lot of different places all over the world and to a much greater extent than PCI.

PS: Both of you brought up what's in it for the industry. How will the industry benefit if this happens?

BW: When you look at it from an industry perspective, there's an opportunity to start with standards. When we cooperate on standards and do a joint standard, it takes eight to 10 years on average. As one organization, you can potentially get that down to a much more reasonable level. When we work on our own, it's probably about three years and together you can maybe even benefit more from that, getting out standards at a faster rate.

The other aspect is international presence. You don't have duplication of efforts whether internationally or based on specific programs. If you're able to take the best of the programs where we overlap, and if you have two people working for each organization on that program, now you have four working on the same program, so you can have more reach and more relevance on a global basis.

I believe another thing that's an an advantage, and something that NACE does well, is their work in Washington, D.C. If you were to put two organizations together with as much influence and membership as NACE and SSPC, you'd have a much louder voice and a greater relevance as it relates to regulatory efforts or lobbying.

BC: The other thing is just making better use of the resources that we have. They come from the industry, either by members paying dues or by allowing their people to volunteer with our organization[s] or by purchasing our products. And right now, a lot of those resources end up going into duplicate efforts. We're both maintaining IT systems, we've got marketing programs that overlap and in the case of CIP and PCI and inspection, we're trying to maintain two programs that compete. I think the industry—and I believe this is why our members think this—the industry would be much better served if we were making the very best use of those resources as efficiently as possible. Get rid of that duplication and then repurpose those resources—whether it's volunteer time, money or staff time—to create new and better programs and continue to support the industry in new ways, or making the programs we have the best they can be as opposed to spending time and duplicating efforts.

We both have conferences. Our members have to attend both. Wouldn't it make a lot more sense if there was just one industry event?

BW: General, one-stop shopping, right? You have potentially one conference, one membership, one organization that you go to, from soup to nuts. You span the industry from the craft worker to the engineer and everywhere in between.

PS: You mentioned the standard work that you've collaborated on. How might a merger affect existing standards and then how might it affect future standards and standard development in general moving forward?

BC: We've worked hard to collaborate on standards when we think it's best for the industry. But

what happens now when we've had to cooperate or tried to cooperate, [we're] running the standards through two parallel systems. Interestingly, they are both ANSI-accredited systems—they're both good systems, but they're different systems. They don't match up well and they don't time well, and we have to get two committees' approval. We have to maintain this infrastructure. There's a cost to maintaining standards, so the big improvement will be how quickly we can respond and develop and bring standards forward to the industry [and] making the best use of our volunteers' time.

BW: The other thing you asked is what's going to change in the future. I think it's premature to go there, but I wouldn't foresee that the standards that are already existing would change much; as Bob mentioned, there isn't much overlap. In the standards industry, you're looking for gaps in standards or needs for standards. I believe that with the name recognition of a NACE and SSPC—those joint standards—they would remain as-is.

BC: As new technologies are coming down the road, new manufacturing processes, new methodology, there are going to be needs for new standards. I don't know what those are sitting here, but history says that there's always a need for new standards because there's always new technology and our ability to respond to that is critical. Particularly today, we, the industry, want to create [our] own standards; we want to control our own future and destiny. There's a lot of other groups out there who would like to create those standards in our industry. So, by working together and becoming as efficient and effective and quick to market as we can with standards, our members benefit because of that. They don't get something forced on them potentially from an entity that lacks coating- and corrosion-specific expertise; rather as an industry we have control over our future, and again, that energy and effort being used effectively is critical.

BW: I don't want to lose sight of something Bob mentioned earlier, that with standards or even training development, it's volunteer fatigue. If you look in the industry—not just our industry—everybody's volunteer work for nonprofits is going down. And like Bob said, in a lot of cases, we use the same volunteers. So they're volunteering for NACE, they're volunteering for SSPC, splitting their time. If we were joined, hopefully you would have a quicker turnaround and more people that are willing to participate.

BC: We believe at NACE the most valuable and rarest asset that we have available to us is our volunteers' time. And it's becoming rarer and rarer because they're becoming busier and busier with their lives, just like we all are. So anything that we can do that allows us to use that effectively is a smart thing for us to do.

PS: How do you foresee existing training and certification initiatives being handled? For example, the inspector programs that each organization has—do you foresee them being combined into

one? And how might certification holders among your memberships be impacted by this?

BC: I think it's too early to tell what that answer's going to be. Right now our members are talking at the highest levels of the organization as to what the board structure will look like. Eventually we'll get down to looking at each of the various aspects of what we do. We're just way too early in the conversations to be able to say this is what's going to happen with any specific product, service or program.

PS: So can you share any information about what the board structure will look like?

BC: We don't know. We have a team of five representatives from each board working together and they've had a couple of phone meetings and met face-to-face during the NACE conference, but it's really just getting started.

PS: Many in the industry believe that SSPC and NACE have vastly different cultures. Have you discussed or thought about how the cultures will blend? Also, we've heard from some SSPC members that there's a concern about the contractor's voice being lost and concern about adequate representation for the coatings industry itself. Can you speak about that?

BW: One of the basic tenets that Bob and I, our staffs and the board members who have been involved are all in agreement on is that NACE and SSPC will remain as brands. There's brand loyalty to both of them. Having said that, we also agree that it's going to be a merger of equals. Even though the organizations are different in size and revenue, the intent is to have equal representation from both organizations at a board level and to try to move forward with that so no one's voice is lost.

You have two organizations that have been around for 70 years or more. No one wants to lose that. No one wants to upset the industry or the members who have that brand loyalty. Again, we're here for the members. It's going to be up to them to say how they want it organized through their board representation.

BC: Bill and I have been through mergers before in the for-profit world. It's challenging to get through and culture is often one of the stumbling blocks. So we're very aware that the culture has to be done right. You can't just ignore it. It needs to be groomed or curated and invested in to make sure that it's a positive culture and there's no group that can be left behind.

The contractors have a very legitimate concern. On the other side of the house at NACE, we have people who have been in the corrosion industry but not on the coatings side of it and they have a concern that they might get left behind in this because all of a sudden we build this very large organization that has a heavy focus towards coatings. So we can't ignore any of our constituencies. We've got to listen to them all and make good decisions. And this is both staff and our member leaders, making good decisions that

will protect the interests of all of our organization. And ultimately in the end, this goes to a vote of the membership. So they will have a voice. Plus, the future will be designed by member volunteer leaders. So they'll have a strong voice, and, if there is a new organization, what that new organization will look like.

PS: Neither of you were in your positions during the previous merger talks, but can you lend any perspective as to why you think those previous previous efforts failed and why it may be different this time around?

BC: One of the things that we agreed to early on, at the very first meeting of member and staff leadership from both organizations, was we were not going to look backwards. Now that doesn't mean we're going to ignore what happened, but we're not going to focus on it. Honestly, neither one of us were there. We hear rumors, we hear stories, but that's all they are. We have looked back over some meeting minutes of course, but that is just reflective of the conversation. Our focus is, what are we going to do going forward to make it successful?

BW: There's nothing more I can add to that. We can learn from history, but we weren't here to experience the history and a lot of it is hearsay with a number of perspectives from different people. So, for me to comment on it would be out of place.

PS: What do you see as the biggest challenge or obstacle with these talks actually resulting in a merger?

BW: Well, the first thing that needs to happen is for both of the boards to agree that they want to move forward and both of the boards to agree that they can agree on a board and organizational structure that will work for both sides. I think Bob and I—knowing the members we have on each of our sides—are confident that we have people that know the industry, and know our organizations. If something is going to happen, I think we have the right teams in place to be able to do that.

BC: I think one of the other challenges with these types of organizations that we've already addressed, is a tremendous loyalty to the brand and to the programs, and as Bill said, one of the early decisions we made is both brands will be protected. We've done some homework and talked to other organizations that have been successful and that was one of the messages we received. Protect the brands. So we put that in place right from the beginning.

PS: Have either of you had any kind of responses from your memberships?

BC: One of the best metrics was a poll that you guys did, it showed 85 percent of the people that responded were positive. It wasn't a huge sample size, but it was still significant enough that it's a good indication of where the mind of the industry is. The other thing I'll say is, we went public with this the week before our annual conference. Our conference started on that Friday. We went public on the Monday before. We came in to that conference prepared for everything that we could be prepared for because we weren't sure how the members would respond. We thought it would be positive but you never know. We had talking points and prepared for challenging questions and we brainstormed [about] what could be concerns. And the truth is, the overwhelming response—whether it was somebody walking up to us in a hallway or it was actually in a meeting—the overwhelming response has been positive.

BW: I was at the NACE conference also and it was basically the same response that Bob just articulated. It was mostly positive. Again, some of the people were mentioning losing their voice and I think those are valid concerns which will be addressed, but overall it was more positive than negative by a pretty wide margin.

BC: There are legitimate concerns and there are probably some illegitimate concerns, but there are concerns out there. And as long as we're listening and addressing the concerns, the overall intent and direction is being supported by the industry. But there are smaller issues, like questions you've brought up that we're not ready to answer yet. What will happen to the education programs? What do these new standards look like? So those kinds of things are going to have to be answered as we go through this. But at the 30,000-foot level, to have one organization serving this industry—that was very, very strongly supported.

PS: Is there any kind of timeline? What are the next steps and when are the next steps?

BW: The next steps are being put together through these board teams. They've put a schedule together over the next couple of months, with calls every couple of weeks to discuss various aspects of what needs to occur or what we might want to do together. Again, it's very early in the process. I think everybody's just trying to get their legs under themselves to determine what are the key next steps and pieces of information we need to know, and what information do we want to go out to the membership with to see what their pulse is—are they in favor or are they not in favor of this?

One of the things we want to make sure we do is get out information as quickly as we can and to be as transparent as we can.

PS: When do you see an actual membership vote taking place?

BC: We'd like to see something in the next 18 months to two years. This is not a fast process. You've got to give the time for the teams to work together. They are volunteers, they've got full-time jobs and regular activities and a family life. So the amount of time that they're able to dedicate to it is limited as well. Plus, there are other volunteer responsibilities. They're still on our board of directors and officers and serving the organization in other ways. We're not trying to rush it, we're trying to get it done as well as we possibly can.

BW: I think the other thing is that all of the discussion in the industry and even in this interview has been merger-related. It might not even be a merger. If it goes to a merger, that time frame is probably in play, if it's just working together closer on standards and trying to pick a process that fits both organizations or if it's a common conference, those things might be a lot quicker.

PS: Are you saying that this whole thing may conceivably end up with just a shared conference

and two separate organizations or just a partnership in "this" but not in "that"? Is that a possibility?

BW: Everything's on the table right now.

BC: Everything.

We want to hear [the membership's] voice. So we've set up a website at NACE keeping our members and customers up-to-date with what's happening. Also on that is an email address—cooperation@nace.org—where people can send in their thoughts and ideas—and we're getting a lot of them—and we're using those thoughts and ideas in our planning and discussion. It's also a place where people can ask questions and if we're capable of answering the questions, we will. So it's really important that the industry or members or customers are giving us their feedback.

BW: We have the same thing set up on our website also.

To get more information, provide feedback or ask questions, visit www.sspc.org/sspc-nace-updates or www.nace.org/about/nace-sspc-news.

SSPC Structure Award Nominations Open

SSPC is now accepting nominations from its membership for the annual Structure Awards.

These prestigious awards, many of which are named after prominent members who had an impact on SSPC and the industry, are given to recognize the work of teams of contractors, designers, coating manufacturers and end users for excellence on protective coatings projects.

The 2019–2020 Structure Awards will be presented at the awards luncheon on the first day of SSPC Coatings + 2020, which will be held at the Long Beach Convention Center in Long Beach, California from February 3–6, 2020. The winning structures will also be featured in *JPCL* after the conference.

Nominations can be submitted for all types of structures, including but not limited to bridges, tanks, concrete structures, and industrial or commercial facilities. Award descriptions are as follows.

E. CRONE KNOY AWARD: This award, named in honor of the late E. Crone Knoy, founder and president of Tank Industry Consultants, recognizes outstanding achievement in industrial or commercial coatings work that demonstrates innovation, excellence in craftsmanship, or the use of state-of-the-art techniques or products to creatively solve problems or provide long-term service.

**Work on the structure must have been completed between July 1, 2018 and June 30, 2019.*

SSPC ON THE FRONT LINE

CHARLES G. MUNGER AWARD: Named after the late Charles Munger, who advanced the use of zinc-rich primers and wrote prolifically for the coatings industry, this award acknowledges an outstanding industrial or commercial coatings project demonstrating longevity of the original coating. The structure may have had spot repairs or overcoating with the original coating still intact.

WILLIAM JOHNSON AWARD: This award recognizes outstanding achievement demonstrating aesthetic merit in industrial or commercial coatings work and is named in honor of the late William Johnson, a former consultant with KTA-Tator whose work in coatings formulation, failure analysis and surface preparation was instrumental in advancing the industry. Qualities considered for aesthetic merit include color, gloss or texture, or the coating on the structure complementing the environment while enhancing the structure itself. The coating may represent a theme, an object or a specific graphic design.

**Work on the structure must have been completed between July 1, 2018 and June 30, 2019.*

GEORGE CAMPBELL AWARD: Named after the late George Campbell, founder of Campbell Painting Company in New York, this award honors outstanding achievement in the completion of a difficult or complex industrial or commercial coatings project. Qualities may include work occurring in extreme environmental conditions, work completed under strict time constraints, work done with limited access or in high-traffic areas, work on a structure with complex structural components, or a project that requires coordination with multiple trades or subcontractors.

**Work on the structure must have been completed between July 1, 2018 and June 30, 2019.*

ERIC S. KLINE AWARD: This award was named in honor of the late Eric S. Kline, former executive vice president with KTA-Tator and an SSPC Honorary Life Member, in recognition of his leadership and support of SSPC and the coatings industry. It honors outstanding achievement in industrial coatings work performed in a fixed shop facility. The project can be repair work or new construction, with qualities representing the use of state-of-the-art techniques or special coatings; work with complex structural components (such as large, very small, ornate or intricate); or exceptional color, gloss or texture of finish.

**Work on the structure must have been completed between July 1, 2018 and June 30, 2019.*

MILITARY COATINGS PROJECT AWARD OF EXCELLENCE: This award is given in recognition of exceptional coatings work performed on U.S. military ships, structures or facilities.

SSPC COATINGS INDUSTRY SPIRIT AWARD: This award is given in recognition of a coatings project that demonstrates extraordinary service benefitting a community or the industry.

Please note that a representative of the structure owner must be willing to attend the awards luncheon to accept the award and give permission for the information to appear in JPCL.

Nominations must be submitted by email to Diane McGuire, Organizational Membership Specialist mcguire@sspc.org by August 30, 2019. For questions or more information, call 412-288-6052.

JPCL En Español Coming Soon

The *Journal of Protective Coatings & Linings (JPCL)* is celebrating its 35th anniversary in 2019. Since its inception in 1984, *JPCL* has been the "Official Voice of SSPC."

Technology Publishing Company (TPC), parent company to *JPCL* and PaintSquare, has published and distributed content globally ... but all in English. That is about to change with the launch of *JPCL En Español*.

This month, *JPCL* will be launching a Spanish-language version of its publication. The magazine is to be issued six times a year and will encompass translated technical content from the *JPCL* English edition, as well as original content from Latin America.

The technical information, insights and best practices featured in the pages of *JPCL* have been relied on, applied and helped shape the industry for the past 35 years. This new educational resource will include four to five feature articles, SSPC Latin American chapter reports, relevant industry developments and news from the region—all in Spanish.

The number of industry professionals who use Spanish as their primary language is rapidly growing, and *JPCL En Español* will provide these industry professionals with a valuable, trusted, respected and credible professional resource in their native language. Currently, the Latin American region's coatings market is worth an estimated $1.4 billion. According to India-based market intelligence and advisory firm, Mordor Intelligence, the Latin American protective and marine coatings market is projected to have a compound annual growth rate of 4.76 percent through 2023.

Those at *JPCL* and SSPC feel that this ground-floor opportunity will help others reach a high-growth market, while further cultivating the workforce that will be consuming various products, techniques and equipment throughout the region.

SUBSCRIBE TODAY

Current SSPC members can elect to receive *JPCL En Español* instead of the traditional English version or purchase an additional Spanish subscription at a 50-percent discount off of the annual subscription rates, listed as follows:

- $45: 1-year subscription.
- $90: 2-year subscription.
- $125: 3-year subscription.

Those who are not already SSPC members can apply for a one- to three-year membership and receive *JPCL* as a member benefit. If you are not a member of SSPC and do not wish to sign up currently, subscriptions to the *JPCL En Español* print and digital versions are also available.

- $90: 1-year (six issues).
- $160: 2-year subscription.
- $225: 3-year subscription.

If you are interested in receiving only the digital version of *JPCL En Español*, prices are as follows.

- $75: 1-year (six issues).
- $130: 2-year subscription.
- $175: 3-year subscription.

And finally, if you wish to purchase single copies of *JPCL En Español*, you may do so for $25 each, which includes shipping and handling.

Orders may be made by going to es.paintsquare.com/suscribir or calling 800-837-8303 (U.S.) or +57-316-741-1528 (international).

Q1 MARKET REPORT

Sherwin-Williams' Sales Increase

The Sherwin-Williams Company released its 2019 first-quarter financial report on April 23, indicating a 1.9 percent—$75.9 million—consolidated sales increase, totaling $4.04 billion, for its first quarter. The company largely attributes the growth to a new customer program, as well as high paint sales volume in North American stores and selling price increases.

For the Americas Group, Sherwin-Williams reported a 3.6 percent increase in net sales, totaling $2.15 billion. The upswing was partially offset by currency translation rate changes decreasing sales by 1.5 percent. Compared to last year, net sales for stores in the U.S. and Canada that had been open for more than 12 months saw a 3.6 percent increase over this time last year. Segment profit saw a $6.3 million decrease to $331.1 million, partially due to an increase in the cost of raw materials and unfavorable currency translation. Sherwin-Williams also opened 15 new store locations in the group in this year's first quarter.


John G. Morikis

Net sales for the Consumer Brands Group decreased 0.3 percent to $654.5 million,

Getty Images / MicroStockHub

which was attributed to "soft non-domestic market conditions," the divestment of Guardsman furniture protection in 2018's third quarter, and unfavorable currency translation. Segment profit increased to $87.9 million from $74.2 million last year due to selling price increases and lesser impact in purchase accounting. The divestment of Guardsman had a 2.6 percent negative impact on Group net sales for the quarter. Currency translation rate changes also decreased Group net sales by 1.6 percent.

The Performance Coating Group's net sales increased 0.2 percent to $1.23 billion, an increase similarly attributed to selling price increases that were partially offset by soft sales outside North America, as well as unfavorable currency translation. These rate changes decreased Group net sales by 3.9 percent. Segment profit increased to $98.7 million from last year's $90.8 million, likewise due to selling price increases and reduced impacts associated with purchase accounting. Currency translation rate changes also put a $3.5 million dent in segment profit for the first quarter.

"We made good progress on our pricing initiatives across all segments during the quarter and effectively managed SG&A spending, but volumes fell short of expectations due to a slower start to the architectural painting season in North America and continued challenging conditions in many end markets outside North America," said John G. Morikis, Sherwin-Williams' chairman and CEO.

"For the second quarter, we anticipate our consolidated net sales will increase 2-to-5 percent compared to last year's second quarter," said Morikis, who went on to add that for the full year 2019, Sherwin-Williams expects consolidated net sales will increase 4-to-7 percent in comparison to 2018's results.

AkzoNobel Revenues Flat

Coatings manufacturer AkzoNobel published its first-quarter financial report on April 24, noting that the company numbers are holding steady in the beginning of this fiscal year.

For the company's first quarter, revenue was reported to be flat, changing slightly from 2.176 billion euros ($2.42 billion) to 2.185 billion euros ($2.43 billion), but up 1 percent in constant currencies, offsetting the positive price/mix which was 6 percent overall.

"We're encouraged by the underlying business performance during this seasonally low quarter. Our pricing initiatives and cost-saving programs resulted in 8 percent higher profit and return on sales up at 9.1 percent," said CEO Thierry Vanlancker.

Volumes were also reportedly 7 percent lower due to the company's value-over-volume strategy and lowered volumes in China, in addition to order patterns and a lower demand for Automotive and Specialty Coatings.


Thierry Vanlancker

In addition, the first-quarter results indicated that adjusted operating income was up 14 million euros over this quarter last year, from 149 million euros to 163 million euros. Meanwhile, operating income was up 5 million euros and net income from total operations was down 253 million (including 134 million from discontinued operations) to 65 million. However, the company believes the quarter shows progress toward its "Winning Together: 15 by 20" initiative, which was kicked off in July 2018, and aims for the company's ROS to hit 15 percent and its ROI to be greater than 25 percent by 2020.

ROS for the Performance Coatings segment was up 10.3 percent (10.0 percent in 2018) with pricing incentives contributing to a price/mix of 7 percent. Adjusted operating income was up 4 million euros—from 134 million to 138 million. Volumes continued to be down, with an 8-percent drop in this quarter. Revenue was up in one subsect of the segment: Powder Coatings, which witnessed a 2-percent increase. All other sects, however, saw a flat revenue or decrease including Industrial, Marine and Protective Coatings, and Automotive and Specialty Coatings (3 percent).

Akzo noted that the report showed a continued good momentum within a seasonally low quarter. Increases in revenue were also seen in EMEA, which was up 3 percent and up 5 percent in constant currencies due to successful pricing initiatives. However, decreases in revenue were reported in regional subsegments, including Latin America (6-percent drop) and Asia (4 percent).

Akzo foresees raw material inflation to continue in 2019, although at a lower rate than in 2018. The new robust pricing initiatives and cost-savings programs are working to address various current challenges.

"Our transformation plans for creating a more fit-for-purpose organization are on track and delivered savings of 38 million euros during the quarter. We're maintaining our focus as we continue to deliver toward our 'Winning Together: 15 by 20' strategy," said Vanlancker.

The company plans to continue executing its transformation to deliver 200 million euros in cost savings by 2020, incurring one-off costs in 2019 and 2020.

PPG Net Sales Decrease

Global coatings supplier PPG Industries reported a 4 percent decrease in net sales for its first quarter, while also reporting the completion of the acquisition of automotive coatings manufacturer Hemmelrath and low-friction coatings manufacturer Whitford Worldwide.

Net sales were reportedly $3.6 billion, down roughly 4 percent in comparison to last year's first quarter, and net sales in constant currencies were flat, which was aided by 2.6 percent higher selling prices. Volumes also saw a 3 percent decline. Half of the decline in sales volumes was attributed to previously announced architectural coatings customer-assortment changes in the national retail do-it-yourself segment.


Michael H. McGarry

The company's adjusted net income from continuing operations was $330 million. Michael H. McGarry, PPG chairman and chief executive officer, noted that first quarter operating margins were higher than last year.

PPG's Performance Coatings segment, which includes architectural, protective and marine, auto refinish and aerospace coatings, saw a 2 percent decrease in net sales in the first quarter, totaling $2.1 billion, down $52 million from last year. There was a 2 percent increase in sales in constant currencies, which was attributed to increased selling prices. Sales related to acquisitions totaled $15 million. Segment volumes were also down 2 percent, and unfavorable foreign currency translation lowered net sales by 4 percent, or roughly $85 million. Income in the segment was up 6 percent, $297 million, up $17 million from last year's first quarter, which includes a $10 million unfavorable foreign currency translation impact.

Sales for aerospace coatings increased over 10 percent for the fourth quarter in a row, driven by technology platform growth and outpacing industry demand, according to PPG. Protective and marine aggregate sales volumes also saw a 10 percent increase, with both segments bringing in positive contributions.

Industrial Coatings segment income was $218 million, down $21 million, or 9 percent from last year, which was attributed to $10 million in unfavorable foreign currency translations. Net sales were down 8 percent, totaling $1.5 billion, down $105 million from last year's first quarter. Numbers were driven by higher selling prices, though this was partially offset by 5 percent lower sales volumes. Unfavorable foreign currency translation put an $80 million dent in sales. Automotive OEM coatings volumes decreased by a high-single-digit percentage, which was in line with lower global automotive industry production rates.

"We continued to experience cost inflation in raw materials, logistics and wages, and have additional initiatives under way to offset the cumulative impacts from this inflationary cycle," said McGarry. He also noted that in looking ahead to the second quarter, PPG expects industry demand in a number of markets to "remain mixed."

"We are still targeting full-year sales growth of 3-to-5 percent and adjusted earnings-per-share growth of 7-to-10 percent, both excluding currency translation impacts," McGarry said.

PAINTSQUARE COMMENTS

In Response to "SSPC, NACE Explore Unified Efforts" *(PaintSquare News, March 20)*

On March 18, SSPC: The Society for Protective Coatings and NACE International announced the beginning of discussions regarding "synergistic opportunities" between the professional associations, and the coatings and corrosion control industries have sounded off with their reactions to the news as well as their thoughts and hopes on how these talks might proceed.

Getty Images / ismagilov

Lou Lyras:
"Before we jump into this merger, let's ask a few questions, and I certainly hope they are being asked by the powers that be. NACE is a 36,000-strong membership of primarily engineers, inspectors, technicians, scientists, business owners, executives, researchers, educators, students and others. What is the membership composition? How many contractors? What is the role of labor? SSPC [has] 11,500 members worldwide [and] approximately 960 corporate members. Industrial painting contractors are a primary beneficiary of SSPC's efforts. I am a union industrial steel painting contractor. Will my voice be drowned out in this merger?"

Gunnar Ackx:
"With the ultimate goal being to bring the best of both worlds together, this exercise should ultimately benefit the membership at large of both organizations. Of course, many things are still to be considered, so we are looking for as much feedback as possible that will help create a better and stronger new future for all of us. [It is] also important to keep in mind that this is not an acquisition scenario where one would absorb the other and one would have less voice than the other. The current scenarios being looked at are ranging from multiple levels of closer cooperation to a full merger, [becoming] one single organization with bigger impact in the industry. And knowing some (union and non-union) contractors, you guys will never be left out."

Larry Muzia:
"I believe it is an idea whose time has arrived. It appears there are many crossovers that can be properly combined to make the single entity much better. Having one annual conference is a prime example of a better overall experience, in my opinion."

Gabriel Herrera:
"What will happen with the training and certification programs? For example, NACE CIP and SSPC PCI ... Maybe the programs will merge and will create a kind of SSPC-NACE inspector program?"

Jon Cavalla:
"Folks, let us not forget what happened when a NACE/SSPC merger was discussed in the '80s. The merger talks fell apart and went hostile not because of technical problems but because of commercial disagreements. Who is going to be the 'big dog on the porch' in today's negotiations?"

William Pybus:
"Cooperation on standards, I understand. Maybe I am just too old and cynical, but every time I hear about merger discussions, my first thought is, don't these folks have something better to do with their time and our membership dues?"

PAINT POLL

paintsquare.com/poll

In response to the March 18 announcement that SSPC and NACE have opened discussions regarding potential collaboration between to the organizations, PaintSquare surveyed its readers to gauge their response to this news and the direction in which they wish to see these talks go.

When asked for their opinion on a potential merger between SSPC and NACE, the vast majority of respondents replied positively. 69 percent said they were for it, with only 11 percent opposing and 20 percent voting that they were undecided at this time.

While some have expressed concern that the coatings industry could lose its voice if a merger were to go through, survey respondents were for the most part unconcerned. 77 percent said that they feel that the coatings industry would be adequately represented in a merger. 68 percent said that they felt that painting contractors in particular would be adequately represented.

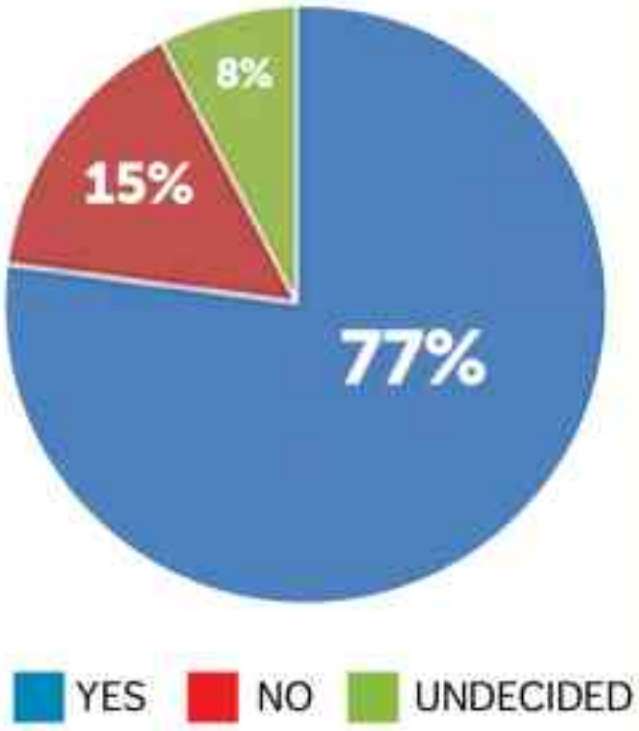
Other stats from the survey include the following.

Membership: 46 percent of respondents indicated that they were members of both SSPC and NACE. 23 percent were only SSPC members; 17 percent were only NACE members. 21 percent of respondents were not active members of either association.

Demographics: Of the respondents, 34 percent identified as engineers, while 26 percent were coating suppliers, 17 percent were painting contractors and 9 percent represented equipment suppliers. The remaining 14 percent selected "other."

Conference Attendance: 23 percent of respondents said that they generally attend both SSPC's and NACE's annual conferences. 25 percent said they attend the annual SSPC Coatings+ show, while 15 percent said that they attend NACE's annual CORROSION conference. The majority of respondents (37 percent) said that they did not typically attend either association's annual conference.

Do you feel that the coatings industry will be adequately represented in a merged organization?



Problem Solving Forum

paintsquare.com/psf

Is it sufficient to specify simply that paint should be applied "according to the manufacturer's instructions"? If not, what kind of detail should be included?

Warren Brand, Chicago Coatings Group:

"As a firm that writes specifications (among other things) for a living, I think you hit the nail on the head. It's sufficient—at least, one would hope. We only write site-specific, application-specific material and application specifications. I can tell you that we use manufacturer-provided specifications as a framework, but then take into consideration weather, time frame, logistics and other issues too numerous to list here. And, most importantly, we modify the specifications (with the approval of the manufacturer) to make the specification best for the owner, and not the material supplier. For example,

we often require a more severe blast, or deeper profile than required by the manufacturer, to provide a longer service life for the client. Or we will sometimes increase the thickness of the coating for the same reason. We often try to increase the DFT range. Just recently we were working on a failure at a local, very large facility where the topcoat was specified at a DFT of 2-to-2.5 mils. I argued that was physically impossible to achieve in the field. Had we been involved in development of the specification of materials and application protocols, we would have either specified a much wider range (say, 3-to-6 mils, if the material allowed it) or used a different material. Our industry wallows in what's suitable or acceptable, when our target needs to be what's optimal. And very, very few vendors are incentivized or know how to provide optimal."

Michael Halliwell, Thurber Engineering Ltd.:

"I agree with Warren on this one. Keep it simple and default to the folks who should know their product best: the manufacturer. The only time where you might consider other instructions is in unusual circumstances [or] off-spec applications, but if you're doing that, you're going to be specifying an awful lot of items—not just how to apply the paint—and you would need to know 100 percent what you're doing because you're assuming a far greater portion of the liability on it."

Joe Friedt, Proco:

"I have one for you to ponder. We had a project that required a 98-percent-solids sprayed at a heavy thickness. The paint manufacturer's data sheet said that at that thickness the coating will sag on vertical surfaces and to back roll as it sets up. The customer who chose the coating rejected the roller stipple. We referred to the data sheet to no avail. [The] owner wanted a glass finish, and said they got one with another contractor. After many conference calls to various owners, suppliers and contractors, it was revealed that the other contractor would apply the coating per spec, let it sag and dry, then grind it down and feather it, then apply a thin coat to get the mils back up without sags or stipple, which was the only way to get it approved. This process resulted in higher prices and losing the next project to [those] less experienced with the product. Sometimes, more information is needed."

Zenith Czora, Parex Davco:

"Specifying a coating system that is suitable for the application and its purpose is a complex task. Most often, the manufacturer's instructions are not sufficient and some product data sheets lack information. Limited knowledge and understanding of the technical requirements associated with coating selection and surface preparation will end up costly not only to the owner but to the reputation of the paint contractor and paint manufacturer. A specifier must be well-versed in all specifications and requirements relevant to a coating system. He must also know the limitation of a coating system to avoid overdoing its purpose. Thorough assessment and careful consideration of the requirements for areas of use, substrate/surface preparation, right application method and conditions, the right coating system can be selected for successful installation."

Erik Andreassen, CPS:

"This draws a multitude of answers for everyone in our trade. Having spent a number of years with a leading paint manufacturer, the data sheets provided are a guideline to protect against the misuse of the product supplied. The main problem concerning application is the operator, who can either lose you money or make it. Having conducted training all over Asia for companies claiming to be professional within our industry, I found 9 times out of 10 that the applicator had never seen a data sheet for the material in use. QC had never bothered to inform the applicator of such important issues as tip size, air pressure or mixing ratios.

Now we come to another critical area which I'm sure 99 percent of our people encounter: specifications written by people who have no clue regarding the coating range of products out there. Some use a tried-and-tested system from more than 10 years ago. Why? Because they are not up-to-date with the newly developed state-of-the-art coatings constantly being released by the manufacturers. Take into account that when things do go wrong and failures occur, the application company will blame the materials used and the coating supplier will in turn blame the application contractor.

Training is the answer. Why do projects state that all welders and insulators have to be tested and approved, [but] not applicators? Have certification for different products. Then clients can view that the company selected for the project has applicators who are trained and certified to use what has been specified."

PAINTSQUARE NEWS TOP 10

paintsquare.com/news, April 7–May 12

1. **'Leaning' NY High-Rise Sparks Lawsuit**
2. **Sherwin-Williams Reports Sales Increase**
3. **SSPC, NACE Leadership Discuss Unified Efforts**
4. **University Warns About Antimicrobial Paints**
5. **Lawmakers Reveal $2T Infrastructure Agreement**
6. **Fire Consumes Notre Dame Cathedral**
7. **AG Audit: PennDOT Diverted $4.2B from Repairs**
8. **FIU Bridge Cracks Reportedly Initially Dismissed**
9. **MO Pipeline Explosion Caused by Corrosion**
10. **$13.6B Solar Plant Grows in Dubai Desert**

THIS MONTH IN ...

CELEBRATING 1984 35 2019 YEARS

1986

Advantages and disadvantages of specific coating systems for water storage tanks and wastewater treatment structures were discussed in Thomas P. Delany's article, "Selection and Use of Protective Coatings for Water Storage and Waste Treatment Facilities," one of the first comprehensive looks at coating types for these structures published in JPCL.

1991

As industry professionals sought to differentiate heavy-duty industrial coatings from typical house paints, a Problem Solving Forum helped readers understand some of

the important differences between industrial and residential latex coatings. As coating technology has developed over the years, latex finishes have largely been replaced by newer, high-performance coating types for industrial applications.

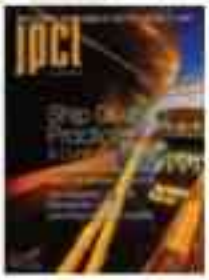
2000

In "Protecting Splash Zone of Offshore Platforms," several coating specialists from the offshore industry gave their thoughts about best practices for protecting steel

fixed-legged platforms and other vulnerable splash zone components of platforms in the major offshore oil- and gas-producing areas of the world.

2012

Consultant Randy Nixon, who was honored as a JPCL Top Thinker in 2012, used his 15-plus years of experience to write, "Issues That Do Not Meet the Eye," which focused on condition assessment and design considerations associated with using coatings to protect concrete sludge storage and mixing tanks at wastewater treatment plants.



PAINTING FOR ANTENNA INSTALLATIONS ON WATER STORAGE FACILITIES REVISITED

BY DAN ZIENTY, SHORT ELLIOTT HENDRICKSON INC.

For many communities, the expansion and advancement of wireless communications has meant double duty for water storage facilities, as they must meet both their intended use to supply safe drinking water, and also provide a macro site for wireless service equipment.

Since the publishing of this original article in 2002, numerous changes have occurred in cellular service offerings, which now include data and video streaming along with voice communications. The impact of this evolving technology has meant changes in the equipment and amount of equipment placed on these facilities. Simple installations involving a whip or omni antenna and a coaxial cable have been replaced by multiple-panel antennas, fiber cables and radio equipment to enhance speed and capacity. This change in equipment volume has had an effect on how we think about initial installation and future facility reconditioning.

Having a general understanding of fabrication and protective coatings can be beneficial in achieving a successful result for the owner and the stakeholders representing the telecommunication provider.

Different tank configurations, such as ground storage vessels, standpipes, pedestals, fluted-column and legged designs, each lend themselves to different approaches when installing telecommunications equipment. Depending on need from a technological standpoint, installations may take place on the shell face or roof handrail system (ground reservoirs); roof or riser (pedestal/fluted column); or roof, catwalk and support column (legged). For each situation, it is important that consideration is paid to maintaining structural integrity, functionality with respect to normal operations for both the provider and facility operator, and visual aesthetics combined with serviceability maintenance.

This article revisits these necessary considerations for placement of telecommunications equipment on water storage facilities from a protective coatings perspective. It will address changes in attachment methods, surface preparation and coating selection for the telecommunication components, repair areas on the tank, and material selection (hardware).

Editor's Note: This year marks the 35th anniversary of the publication of JPCL, the definitive source of technology and information about protective and marine coatings. To celebrate, JPCL will be highlighting archival content—updating previously published technical articles throughout the year and looking back on past practices and technologies.

This article initially ran in the September 2002 issue and has been updated by the author for publication in this issue.

ATTACHING THE TELECOMMUNICATIONS EQUIPMENT

New site development often requires making modifications to the structure to accommodate attachment and routing. Generally, there have been three methods used for attachment to support antennas and cables for these facilities: seal-welding, stud-welding and bolt connections. Magnets have also been utilized as a method for attachment on a case-by-case basis. Further, the cutting or drilling of holes and penetrations, and installing piping or couplings allowing for the pass-through of cables through surfaces is another modification consideration.

Each of these attachment methods has its advantages and disadvantages specific to application, which were discussed in a previous JPCL article by this author ("Antenna and Cable Attachment Methods for Water Tanks: A comparative Study," February 2010).

Of these methods, seal-welding can have the most adverse impact on the coating system, affecting both exterior and interior surfaces at and around the affected area due to heat transfer. It is important to understand that this can delay the project scheduling due to the added operational sequencing associated with repairs. Before seal-welding, existing coatings need to be removed to avoid weld contamination.

For tank immersion surfaces, the potential for damage is greater because corrosion can be accelerated above and below the waterline.

Fig. 1 (facing page): Elevated water storage tanks are commonly used for telecommunications equipment installation. Photos courtesy of the author.

Fig. 2 (above): Typical sector equipment installation on water tank roof handrail system with tape protecting attachment of galvanized components.

style. This type of connection, when properly installed, offers few drawbacks.

Due to concern for maintaining the tank's structural integrity, the owner often just does not want additional holes to be made in the tank; this would include penetrations associated with what are referred to as jumper cables for connecting antennas to remote radio heads. From a coating standpoint, these types of connections, if not designed and finished properly, create the potential for failures resulting in corrosion. Spot rusting can come from contact between dissimilar metals (the fastener), while paint pull-back results from sharp edges, both causing damage to the coating system.

For this reason, as this work is typically done while the facility is in service, seal-welds can be problematic. However, knowledge of the tank's history can allow for opportunities to tie-in this work with pre-planned maintenance.

As water tanks vary in design, so do the number of dry surfaces where damaged areas could be easily repaired, and efforts to coordinate repairs in these areas should be made prior to equipment installation. This will allow greater coating system continuity.

Depending on the type of stud being used (standard welded studs or discharge capacitor studs), stud-welding generally causes less damage to the existing finished surface based upon point of contact, but may not provide comparable structural integrity for the attached equipment. Studs of either type require coating removal in a much smaller area, limited to the contact point, when compared to seal-welding. Specific to standard stud application, the coating system on the backside of the base material can be damaged by heat transfer and require repair.

Bolted or screwed connections are normally associated with the placement of antennae and/or accessory equipment such as remote radio heads attached to the riser of pedestal or fluted column-style tanks. Connection devices involving screws (such as C-clamps) can be incorporated into design details for any tank

SURFACE PREPARATION

Surface preparation for the affected tank surfaces and attached components is essential to maintaining the overall integrity of the coating system. Experience has shown that shop preparation of to-be-painted components, including antennas and support frames, provides a better end result as compared to field preparation—even for components that will be field-welded—taking scheduling, access and environmental conditions into consideration. At the very least, it allows for options, as a surface profile has been established.

In any case, specific procedures that are in concert with the substrate being painted or the type of repair being undertaken should be followed by the engineer. Procedures should include the following, and as applicable to the substrate:

- Scarify non-ferrous material, if being painted;
- Clean surfaces in accordance with SSPC-SP 1, "Solvent Cleaning," to remove grease, oil or other surface contaminants before abrasive blasting or hand- or power-tool cleaning. When cleaning antennas, acetone is the recommended solvent for the fiberglass substrate following scarification; and
- Protect adjacent areas that might be affected by grinding, filing or welding to prevent heat damage, as hot metal grindings or filings can become imbedded into the existing finish coat, causing surface rust within a short period of exposure.

Other preparation measures include the following:

- Remove all surface imperfections such as sharp fins and weld spatter;
- Feather all edges to provide a smooth transition for paint application. This is important when making repairs adjacent to field welds;
- Sand painted surfaces to scarify and degloss the existing finish prior to an overcoat (touch-up) repair; and
- Apply all coatings in accordance with the manufacturer's recommendation.

As a note, the need for installation of telecommunications equipment is not subject to seasonal constraints as is coating application; therefore, timing and operational sequencing by each of the contracting parties must be considered in developing a project game plan. This can often be clarified at the pre-construction meeting.

Fig. 3: Use of manufactured colored cabling.

COATING SELECTION

Coating selection is based primarily on three factors: the existing system on the tank, the type of material being painted and the anticipated environmental conditions. This author would suggest a fourth factor: minimizing the need to repaint, which will be discussed later in the article.

Fig. 4: Completed surface preparation on fiberglass antennas.

Fig. 5: Galvanized compression plate assembly used for attachment of the antenna support pipe to the handrail system.

During field application and especially during summer months, cold water entering the tank can cause condensation on the surface, which can cause application problems depending on water tower design and location of operations. Seasonal conditions, including high humidity or low temperatures, may also result in application difficulties for the repair coating.

Alkyd-based systems may be found on older tanks; however, many, if not most, water tower exteriors today are painted with organic zinc or epoxy primers and top-coated with acrylic-polyurethanes or fluoropolymer finishes. It is essential that the repair paint is compatible with the existing system to ensure coating integrity. The size of the repair area and tank location, and the condition of the existing coating(s) can also factor into selection of the repair coating system.

Different generic coating types may be chosen for shop-painted components. Some telecommunications equipment requires a non-metallic paint system (i.e., on antenna covers) to prevent signal problems. Some equipment and components should not be painted at all depending on their location (visibility) on the tank, or their ability to be properly painted, such as support pipes and frames and remote radio heads, respectively. Should stealthing (camouflaging) be an owner requirement, painted covers are a consideration.

Much of the installed coaxial cabling is in the process of being replaced with flexible fiber with a black exterior casing. On an interior cable installation, painting would not normally be considered to satisfy a need for aesthetics by the owner. On many exterior-exposed installations, providers are often asked to match the cables in with the finish color of the tank.

Fig. 6: Painted welded water tank platform penetration.

The selection of this finish coating should be based on its ability to adhere to the plastic substrate (cable) and offer color and UV stability similar to the existing tank coating. As identified in the original article, waterborne acrylics appeared to offer improved adhesion and flexibility when applied to a properly prepared (scarified) surface. Typically, application is by brush and roller, but spray application may be an option if the coating offers dry-fall capabilities. However, all of the following should be weighed with other options or considerations:

- Planning, so that the cabling is routed on the inside face (legged-tank support column), which would be less obtrusive;
- Requiring manufactured color jacketed cabling;
- Requiring colored tape (shorter, jumper cables); and
- Requiring routing through electrical metal tubing (EMT) paint to match.

With regard to the use of manufactured color-jacketed cabling or EMT, it is important to understand issues related to availability and manufacturing constraints — from a supplier's perspective — that provide their own restrictions as the telecommunications industry moves into fiber.

Depending on the type, age and condition of the existing tank coating, an exact color match may be difficult. Contingent upon the degree of chalking, selecting colors one-to-two shades lighter than the original finish may offer an adequate solution regarding color match. It is recommended that final selection be made during a site walk with the equipment providers, the contractor and the owner or owner's representative. Masking (squaring up) the affected area to be finish-coated will provide a cleaner appearance.

The tank owner should provide information about the product manufacturer, the paint system series and product name(s), and the color of the finish coat (interior and exterior, as applicable) to the contractor or the equipment provider.

The contractor repairing the tank should be responsible for the following:

- Supplying the manufacturer's material safety data sheets (MSDS); and
- Providing, at the owner's request, certification (documentation) that the applicator is qualified, specific to the procedures for proper preparation, mixing and application of the coatings to be used.

MATERIAL SELECTION

Material selection refers to altering or changing the type of installation components or the installation method to be used on the tank. Introducing, or at the very least considering, alternative materials as part of planning an equipment installation can reduce the possibility for corrosion, expedite project scheduling and reduce project cost on the part of the telecommunication provider.

Time can be a friend, as can the ability to recognize what has and has not worked. Earlier, the author mentioned the routing of cables on the inside support column of a legged tank. Attachment methods have included the use of galvanized Z-brackets or cluster mounts. In the past, these components had been field-painted; however, once the cables were installed with metal snap-ins, the paint would inherently chip off, presenting, at the very least, an aesthetic issue. A design solution has been to weld painted extension brackets to the tank with a base-plate having holes to accommodate bolting either of the previously mentioned components eliminating the issue. The cables themselves provide cover for the galvanized component.

As discussed earlier, bolted attachments are an alternative to welding and can prove less damaging to the existing painted surface. However, care is necessary to provide proper film thickness around the edges of the drilled holes. Additionally, care must be given in selecting the type of fastener used. The introduction of dissimilar metals can cause or accelerate galvanic corrosion at the point of contact.

For smaller penetrations, such as those provided for 7/8-inch (2-centimeter) routing of jumper cables, drilled holes incorporating firewall grommets with metal edges prime-coated and silicon caulk applied around the grommet before installation. This can eliminate the need for welding a larger penetration.

Attaching Z-brackets, cluster mounts or other cable mounting components with C-clamps can damage the paint down to the substrate. This situation can also result when using stainless steel straps around support columns or interior piping. Damage can be reduced or eliminated by placement of neoprene strips along with metal wedges between the strap or screw and the painted surface.

Respective of antenna sector attachment frames, galvanized compression or universal ring mounts represent an alternative to

welding, and allow for easy temporary detachment for future tank reconditioning and operation of a full containment system.

HEALTH CONSIDERATIONS

It is important that applicators involved in on-site operations, including both surface preparation and painting application, are aware of the potential health hazards associated with radio frequency (RF) radiation exposure. Right-to-know training for persons that may be exposed to RF radiation is an OSHA requirement. Exposure limits are those as developed by the American National Standards Institute (ANSI) and adopted by the Federal Communications Commission (FCC).

Overexposure can occur as a result of working directly in front of in-service antennae for an extended period. This exposure can be avoided by providing notification to the communications provider in advance so that a particular antenna sector can be temporarily interrupted (i.e., taken out of service) until work in that area is completed.

SUMMARY

Time has not diminished the important role that water storage facilities play in the advancement of cellular communications. To the contrary, changes in technology to keep pace with the ever-growing services we require has only added to their footprint.

With that said, it is important that along with providing these telecommunications services, the facility's first and foremost function is to provide the community with safe drinking water. Therefore, careful consideration must be made during planning and project implementation for the routing of cabling, and the locating and attachment of antennas and accessory equipment to protect the integrity of the tank. Though it must take into account functionality in serving a dual purpose, it must also do so with a focus on long-term facility care and maintenance, with attention paid to surface preparation, coatings application and the selection of materials used for the installation of equipment that will interface with this water storage facility.

ABOUT THE AUTHOR

Dan Zienty is a principal at Short Elliott Hendrickson Inc., where he has been a manager for protective-coatings-related projects for more than 20 years. He has a Bachelor's degree in construction technology from Purdue University, is an SSPC Protective Coatings Specialist and a NACE-certified Coating Inspector. Zienty has received numerous Engineering Excellence Awards from the Consulting Engineers Council of Minnesota for his work on water tower restorations and has authored and presented related articles on protective coatings maintenance. He is an active member of SSPC and was recently appointed to the AWWA D102 Subcommittee for Steel Elevated Tanks, Standpipes/Reservoirs.

Successful Water-Tank Coating

BY WARREN BRAND, CHICAGO CORROSION GROUP

All coating projects can be broken down into phases which are, ideally, sequential. Broadly speaking, they look something like this: concept, material selection, document development and implementation.

While the specifics and tasks associated with each phase will vary, the process by which each is developed should be the same. Each phase should be viewed as a discrete process which has a beginning and an end, and can withstand objective scrutiny. And each phase should blend seamlessly into the next.

CONCEPT PHASE

In the late 1990s, I was asked to participate in the concept phase of one of the largest tank-lining projects in the world. Thirty minutes after I arrived at the headquarters of one of the world's largest architectural firms, I was in a conference room surrounded by half a dozen architects who were involved with the construction of the Burj Khalifa, a skyscraper in Dubai.

The building would house many large, concrete drinking-water tanks strewn throughout the more than 160 floors and would supply roughly a quarter-of-a-million gallons a day. They requested my input to determine which coating system would be optimal for lining the interior of the tanks and which would "last forever."

It was very early in the process and they had plenty of time to vet my input, as well as gather input from others. We discussed coating system types, thickness, odor, cure times, elasticity and so forth.

The concept phase is characterized by gathering as much information, opinions and hard data as possible from as many sources as is reasonable. As the data comes in and is compiled it must be reviewed, discussed and evaluated in an open and professional setting, where differing viewpoints are not only tolerated, but encouraged. Keep in mind that during the concept phase, one of the main sources of data will be vendors who are trying to sell the client something. Each vendor is advocating for the use of his or her product and selling its own truth. The incoming data, therefore, can be overwhelming and biased, but whoever is leading this phase must have a strong technical background, unwavering integrity and backbone. And for everyone participating, it's good advice to leave your ego at the door.

I would assert that the concept phase is the second most important phase. Ideally, this phase should be characterized as a free-flowing discussion about all issues pertaining to the overall project.

Fig. 1: Potable water tanks come in every conceivable shape and size possible. The author specified the coating system for all of the dozens of concrete water tanks spanning the length of the Burj Khalifa. Getty Images / dblight.

MATERIAL SELECTION PHASE

The primary difference between selecting a coating material for a potable water tank over a chemical tank, is that people use it. They cook with it, bathe in it, brush their teeth with it and wash their children in it. It goes into soup, mac n' cheese, brownies, tea and coffee and anything else you can think of. Whereas one might be able to choose from hundreds of coating systems for a chemical tank, from a potable-water context in the United States, the coating system must meet ANSI/NSF Standard 61. Coating systems are certified by both the temperature (for hot or cold potable water) and the size of vessel (by gallons) to be interior coated.

Because people will be drinking from water in contact with the material selected for installation, this phase is the most important.

I could write a small book about how to vet coating systems for potable water tanks, and there's a vast amount of bad information in the marketplace. For example, I was speaking once with the owner of a large engineering firm specializing in elevated water tank consulting.

I asked how they managed coating systems that were more than 15 or 20 years old. His response stunned me. "Oh, anything older than 15 years is shot. We tell our clients to completely remove the coating and install new."

I asked, "Do you inspect the coating first before recommending its removal? What if it's in good condition?"

"Nah. If it's that old, it needs to go."

He was wrong, of course, but nevertheless, that's the advice he provides to his clients—and that's the advice they most likely take. His attitude mirrors that of some segments of the industry: the engineered obsolescence of coating systems. The life expectancy of drinking water coating systems will vary depending on a number of variables, but designing for extended service life in excess of 20 years is not difficult.

The selection phase is characterized by technical evaluation of the various products or services that have been identified as being in alignment with the concept phase. Unlike the concept phase—where non-technical individuals and concepts are welcome—the selection phase is highly technical and entirely data-driven. And like the concept phase, vendors will be selling their products or solutions as optimal, requiring the owner or owner's rep to be vigilant.

In order to identify an optimal choice in the material selection phase, great care must be taken by highly competent, highly trained individuals of uncompromising integrity. In regard to paint and coating selection, the owner or owner's rep must have an excellent grasp of surface-preparation theory, as well as coating application characteristics and performance. Very often, product application bulletins will recommend a Near White blast (SSPC-SP 10/NACE No. 2) while a White Metal blast (SSPC-SP 5/NACE No. 1) will be slightly more costly, but, may in fact, provide a substantially longer service life. The same holds true with single-coat or multi-coat systems. Even when determining DFT, the difference between a 12-mil system and a 24-mil system might equal an additional fraction of a penny on the dollar during installation, but may provide double the service life.

The selection phase is exclusively characterized by technical evaluation of alternatives without bias for one technology over another. It must also take into account all aspects of the work, including installation, performance, service life and end-of-service life repair, replacement or refurbishment, among other considerations.

DOCUMENT DEVELOPMENT PHASE

As we move down the phases, you might notice that we are moving from less specific to more specific. That's how any vetting process works.

Fig. 2: Severe corrosion above the water line (the ullage) is a common mode of failure. Moisture-vapor molecules are smaller and more insidious than liquid water molecules, and are able to permeate the coating system faster than liquid water, thus leading to accelerated corrosion. Photos courtesy of the author unless otherwise noted.

Document development is where one seeks to quantify what has been determined in Phases 1 and 2. The primary document that will be used by coating applicators is, of course, the specification.

Discussing specifications is somewhat like talking about used cars. It's easy to make

Fig. 3: A riveted water tank lined by the author more than 25 years ago remains in pristine condition. This tank is well over 100 years old and had exhibited severe corrosion. Blasted to SSPC-SP 5/NACE No. 1, a thick-build coating system was applied. Twenty-five years later, there's is not a single holiday or any evidence of corrosion.

them look good at first glance. Formatting a specification into a document that looks good is just as easy as painting or detailing a used car. But unless you look under the hood—and understand what you're looking at—buyer beware.

Detailing the nuances and complexities of asset-specific, site-specific specifications for potable water is well beyond the scope of this article, but I'll point out two critical differences that make potable water specifications different from all others.

Consider the materials. Testing to ANSI/NSF Standard 61 is stringent. When an NSF certification is granted, it will indicate how thick the material can be installed and at what temperature and time it must be cured in order to obtain its NSF rating. And this time frame may be different than the manufacturer's time to full cure. For example, one might have a product data sheet that indicates a material is fully cured at 77 F after 18 hours, but an asterisk indicating that for NSF approval, it must cure for 48 hours.

Also, there is typically a cleaning or sterilization process required after the coating has fully cured, which is unique to potable water. When lining the interior of a clarifier, diesel or chemical tank, one may simply leave the job as-is. There's no requirement for cleaning the coating and tank before return-to-service (food, FDA and USDA notwithstanding). Often, the standard for cleaning used is AWWA C652.

IMPLEMENTATION PHASE

The implementation phase takes into account a wide variety of tasks from staging, to scaffolding (if required) material shipments, permits, confined space permits and more. It should also ideally involve third-party inspection services.

I advocate a tripod of three required steps in order to ensure that an optimal corrosion-mitigation solution has been achieved. If any one of these steps is missing, the project is at serious risk of failing, or more commonly, experiencing a substantial degradation of performance and durability. For example, instead of a system lasting for 30 years, it lasts for 10.

These three steps are identification of an optimal coating system, development of a site-specific, asset-specific specification and inspection services.

There's a saying that keeps popping up in our industry which I find is unfortunate, but true. You don't get what you expect. You only get what you inspect. Inspection services are a critical component of any sophisticated coating project, but vital when working on potable water tanks, for the aforementioned reasons.

SUMMARY

Most of the requirements for coating a potable water tank overlap nicely with any other type of coating application. However, there are some critical considerations that are unique to potable water and outside of a typical coating project that must be attended to in order to ensure a durable and safe outcome.

The Importance of Routine Maintenance of Water Storage Tanks

BY GREGORY R. "CHIP" STEIN, TANK INDUSTRY CONSULTANTS

Getty Images / Purestock

Welded steel tanks can provide effective service lives in excess of 100 years if properly maintained. Proper maintenance of steel tanks includes periodic cleaning and reapplication of a lining that provides a barrier between the underlying steel and its environment. In almost every case in the water tank industry, this involves abrasive-blasting the steel and applying a coating. Oftentimes, the steel surfaces that are on the interior (or water-bearing) side of the tank will receive supplemental corrosion protection by the use of a cathodic protection system (either galvanized/sacrificial or impressed current).

Protective barriers such as coatings and linings have finite service lives, and the degradation and failure of these coatings will expose the underlying steel to an environment that allows corrosion to occur. The typical life of a coating system for the interior surfaces of a water storage tank is 12-to-15 years. The typical life of a coating system for the exterior surfaces of a water storage tank is 15-to-20 years.

Metal loss occurs when corrosion is allowed to take place and can have a negative impact on the structural integrity of the steel (Fig. 1). The more severe the metal loss, the greater the impact it will have on the steel's ability to provide the necessary structural support. Metal loss can take the form of general cross-sectional reduction, pitting or vertical-groove pitting, which is the most structurally significant form of metal loss if occurring in the shell of a water tank.

One of the most aggressive environments in which corrosion occurs on a water tank is on the interior surfaces above the high-water line due to the presence of oxygen and a chlorine-rich atmosphere (Fig. 2). The hyper-aggressive corrosive atmosphere combined with roof-support-structure members with irregular shapes (angles and channels), construction methods (bolted connections), and often unsealed roof-plate seams, typically result in the highest rates of corrosion and metal loss. It is common for interior recoat cycles to be dictated by coating failure that is occurring above the high-water line. It should also be noted that cathodic-protection systems that may be used to provide supplemental corrosion protection on the submerged interior systems will not afford protection above the water level.

As metal loss occurs on roof-support members and their bolted connections, expensive repairs and/or member replacement will become necessary as the member's structural integrity becomes compromised (Fig. 3, p. 32). The area of metal loss most commonly seen on roof-support members is on the flanges of either angles or channels. The decision to replace or repair the member is one of economics, based on the extent of the metal loss.

Roof-support systems, connection methods and roof-plate seams that are more "maintenance-friendly" should be designed and required during tank fabrication. However, due to the fact that most *new* tanks are awarded based on the lowest bid, and the AWWA D100-11, "Welded Carbon Steel Tanks for Water Storage" standard does not provide "best-practices" design, roof-support systems are frequently an area of high concern over the life of the water tank.

Metal loss in the shell is most often in the form of isolated pitting. Isolated pits do not generally pose great risk to the structural integrity of the shell but if left unchecked, leaks will eventually develop. The repair of significantly deep pitting can be accomplished by either filling the pits with a solvent-free epoxy seam sealer or, if necessary from a structural aspect, the pit may need to be weld-filled. In some cases, however, the pits can align vertically. This significantly and negatively impacts the structural integrity of the shell by disturbing the necessary tangential or hoop-stress-resisting capacity of the shell, which could lead to tank rupture and failure. If vertical groove pitting occurs and is allowed to develop to significant depths and lengths, the repair welding or affected plate replacement becomes very expensive.

Fig. 1: Corrosion and metal loss on a roof rafter. Photos courtesy of the author unless otherwise noted.

Metal loss on the interior floor plates of ground supported tanks is oftentimes not of significant structural concern, as the floor plates primarily serve as a waterproof membrane and are not integral to the structural stability of the tank. The exception to this would be the outer perimeter of the floor plates, often called the "chime area." There are significant stresses in this area of the tank due to the shell-to-floor welded connection, and metal loss here is of high concern. However, if metal loss in the form of pitting is allowed to occur unchecked, holes and leaks will develop and if the leaks are bad enough, the escaping effluent could erode the underlying fill and compromise the soils supporting the tank.

ECONOMIC CONSEQUENCES OF COATING DETERIORATION AND CORROSION

AWWA recommends that water-storage tanks be inspected every three-to-five years. This inspection interval is recommended in order to monitor coating failure, document rates of corrosion and perform testing on the existing coatings to determine whether the system can be spot-cleaned and topcoated, or the entire coating system needs to be removed and replaced.

There are many factors that must be considered when deciding the viability of spot-cleaning and topcoating a coating system. The two primary factors are adhesion of the existing coating system and the extent (or percentage) of the existing system failure.

If a coating system is not routinely evaluated and monitored, the percentage of failure may become so excessive that spot-cleaning all areas of failure will approach the cost of complete system removal and will therefore no longer be an economically viable alternative.

Coatings adhere to a prepared surface profile imparted on the steel substrate (typically by abrasive blasting) and over time, the adhesion will deteriorate and/or weaken. As the coating's adhesion weakens, the ability of the coating to remain on the steel lessens. Also, adding more coating, which would be done during topcoating, becomes precarious and will likely result in premature coating failure.

There are many factors that affect the cost of complete coating removal and reapplication compared to spot-cleaning and topcoating. However, generally accepted industry consensus is that a spot-cleaning and topcoating operation will be 30-to-40 percent less expensive than complete recoating. The cost of complete coating removal and recoating a tank is approximately $23-to-25 per square foot and if there is a regulated heavy metal present in the coating system, the cost typically increases $2-to-3 per square foot. However, spot-cleaning and topcoating a tank typically costs between $14 and $16 per square foot. The anticipated service life of a properly spot-cleaned and topcoated system

Fig. 2: Left unchecked, coating failure can result in significant metal loss, as seen on this pipe in a tank interior.

Fig. 3: A roof rafter with metal loss exposed following interior cleaning.

is eight-to-12 years, depending on the condition of the underlying coating.

The longer corrosion is permitted to occur, the more extensive and expensive the repair of the metal loss. Metal loss on the interior surfaces of a water tank in the form of isolated pitting that is 1/16-inch deep or less can typically be adequately repaired by properly applying the specified coating system. Pitting that is between 1/16 and ⅛-inch deep can be filled with a solventless epoxy seam sealer, which would cost approximately $1,000 per gallon in a competitive bidding process. The author estimates that approximately 2,000 pits could be filled with that quantity; however, if the pitting is deep enough that Engineering determines that the pit needs to be repaired by welding, the cost is typically $15-to-18 per one square-inch pit. Once the pitting has progressed to a point where it exceeds approximately 50 percent of the original plate thickness or develops into a hole, a welded steel patch plate becomes necessary. The actual cost of the repair patch plate would be significantly more expensive than pit welding. The actual cost of repairing the pit or hole with a patch would depend on the size and depth of the pit or hole to be covered, as well as the size of the plate.

If the corrosion and metal loss has occurred along a weld seam, the corrective action is very similar to the repair options of pit

repair—seam sealing or welding. Anticipate bids of approximately $50 per foot to perform seam welding.

Corrosion that occurs above the high-water line in a column- and-rafter-supported tank roof will often progress to a point where the resulting metal loss dictates roof-structure-member repair or replacement. Rafter-member replacement costs are typically approximately $2,000 to $2,500 per rafter, depending on length and size.

TANK AESTHETICS

For many tanks, aesthetics are not something a tank owner or operator worries about. These tanks are in secluded areas and infrequently seen by the public. But in other more populated areas, the aesthetics of a tank become a problem when customers call to complain about "that ugly old water tank." There is no real way to attach economics to the aesthetic appeal of a tank, but a tank in need of exterior repainting can cause public outcry and customer-service nightmares.

Fig. 4: Corporate logos on water tanks are essentially giant billboards—a continuous reminder to water consumers about a company and its standing in the community.

Civic Pride

The town of Speedway, Indiana, known as the Motor Racing Capital of the World, takes great pride in its aesthetic appeal—from its downtown street surrounding the Indianapolis Motor Speedway, to the water tank in its public park. Built in 1959, this 500,000-gallon elevated single-pedestal tank has been a highly visible community landmark. The tank was repainted in 1987 and again in 2001 and completed in August of 2018. The town prides itself on regular maintenance and upgrade of this water storage tank.

Corporate Identity

Just like an "ugly old tank" in the Mayor's backyard would not be good for community relations, tanks are often also a symbol of corporate identity, and as such, the regular maintenance of a tank is good for public relations. These giant billboards are a continuous reminder to water consumers of a company and its standing in the community (Fig. 4).

Tank Condition "Barometer"

A more hidden aspect of water tank aesthetics is that if the outside of the tank looks rusted and the coating has peeled,

the inside—the more corrosive area—will be much worse. Thus, a tank's aesthetics can be a barometer of the total tank's condition.

NIMBY

And finally, there is the ever-present "NIMBY" ("not in MY back yard!") factor. Known by other names such as "NIMN" ("not in MY neighborhood!"), this aspect of tank maintenance cannot be overlooked when residents band together to protest the "ugly old water tank" in their neighborhood. Not only are residents not interested in seeing the local eyesore, they are concerned about how the tank will affect their property and resale values. Utility customers become very concerned about that "ugly old water tank" when it impacts their wallets.

Whatever the reason, the aesthetics of tanks in highly populated areas can be, and often are, a driving force in the tank-maintenance cycle.

On the popular real-estate website, Trulia, Jeff Paeltz, a real estate agent from Ohio, responded to a question about the impact of a water tower on the resale value of a home this way: "One of the aspects of a home's value is what is known as 'curb appeal.' That is, once you get out of the car and look around, are the other homes in nice condition and well landscaped? Water towers and electrical/cell towers would also be included. Home buyers look for what is aesthetically pleasing to the eye. Anything that would detract from a home's curb appeal will be an objection to a possible home buyer down the road and therefore affects its value."

Cost of Aesthetics

Aesthetics aren't typically a factor that cost can be assigned to, but obviously, aesthetics are still a significant factor when considering tank rehabilitation frequency.

EVALUATION FREQUENCY

In accordance with AWWA recommendations, washouts and coating, structural, sanitary, safety and corrosion evaluations should be conducted at lease every three-to-five years. Relatively new or recently rehabilitated tanks could go five years between evaluations, whereas tanks that are approaching the need to repair and repaint should be evaluated every three years to better monitor the progression of deterioration.

As a coating's condition worsens, the frequency of evaluation may need to be accelerated in order to develop a recoating schedule that addresses and arrests corrosion before it results in structural metal-loss requiring repairs.

ABOUT THE AUTHOR

Gregory R. "Chip" Stein, P.E., is managing principal of Tank Industry Consultants, headquartered in Indianapolis and specializing in the evaluation and design of steel-plate and concrete structures of all types. Stein is responsible for scheduling and overseeing all work conducted by TIC's staff of civil, mechanical, chemical and structural engineers, and specially trained field staff.

He is extensively involved in industry-related activities and has presented papers at several AWWA, SSPC and NACE regional and national conferences. Stein chairs the AWWA Standards Committee on Steel and Composite Water Storage Tanks, the D101 Standard Subcommittee for Inspection of Water Tanks and Related Facilities Revision Task Force, and the AWWA M42 Manual Revision Task Force. He previously served as a member of the Board of Directors for the Steel Tank Institute and Chair of the STI Field-Erected Steel Tank Committee. Stein holds a Bachelor of Science degree in mechanical engineering from the Rose-Hulman Institute of Technology with a concentration in structural and material analysis. *JPCL*

Measuring Vertical Concrete Surface pH:

Testing for Severe Exposures

BY VAUGHN O'DEA, TNEMEC COMPANY, INC.

Concrete is porous and is susceptible to cracking. If acids, chlorides or carbonation are able to reach the reinforcing steel through cracks or pores in the concrete, corrosion of the steel can result. When the alkalinity in the pore water near the steel reinforcement has decreased to less than a pH of 9, the protective passive oxide layer on the surface of the steel bars is broken and corrosion ensues if water and oxygen are available[1,2]. Corrosion of the steel produces iron oxides and hydroxides that have a volume much greater than the volume of the original metallic iron. This increase in volume will, in turn, cause cracking and spalling of the concrete. The corrosion of steel bars in reinforced concrete is a major issue for environmental engineering concrete structures[3]. The rate of attack on concrete is directly related to the activity of the exposure chemicals. There are many types of protective treatments used to guard concrete from aggressive solutions[4]. The focus of this article is the use of high-build (greater than 20 mils dry-film thickness), fluid-applied, protective linings used as barrier materials for chemical containment and immersion exposures. For these exposures, protective linings must achieve maximum bonding to the concrete substrate in order to attain long-term barrier protection. The adhesion of protective linings must be greater than the internal and external stresses and strains caused by the exposure conditions (i.e., thermal cycling, impact, abrasion, and absorption of water or chemicals). In order to achieve maximal bonding, it is imperative that the parent concrete surface be properly prepared to remove any weak, deteriorated or otherwise damaged concrete that could affect adhesion and performance.

Clive Hare stated that the purpose of surface preparation is to remove all anomalous substances and conditions and render the surface a better approximation to the theoretically "pure" substrate[5]. However, applying this tenet to concrete may not be practical or feasible because it would require achieving a surface pH of 12.5 to 13.5 for concrete exposed to aggressive chemical solutions. The concrete might be otherwise sufficiently sound to receive a protective lining despite the surface pH being slightly lower than these theoretical values. This certainly poses a technical dilemma that has to be balanced with practicable solutions. To balance theory

with practice, this article will review pH and conducting surface pH measurements of concrete.

Simply, pH stands for potential of hydrogen and is a measure of acidity or alkalinity defined as a negative logarithm of the hydrogen ion concentration. The pH scale ranges from 0 to 14. Neutral solutions, such as distilled water, have a pH of 7. Values above 7 indicate solutions of increasing alkalinity and values below 7 indicate solutions of increasing acidity. The pH scale is logarithmic, and as a result, each whole pH value below 7 is 10 times more acidic than the next higher value. For example, pH 3 is 10 times more acidic than pH 4 and 100 times more acidic than pH 5. The same is true for pH values above 7, with each value 10 times more alkaline than the next lower value. For example, pH 12 is ten times more alkaline than pH 11 and 100 times more alkaline than pH 10.

SURFACE PH MEASUREMENTS

Surface pH measurements can be used to quantify the neutralized (or chemically attacked) alkaline components in concrete. A surface pH greater than a 9 indicates that enough of the neutralized alkaline components have been removed to allow for passivation of the reinforcing steel. This pH is also generally considered sufficiently clean and sound enough to receive a high-performance protective lining. However, because pH is a measure of a solution, accurately measuring the pH of concrete is a challenging task. ASTM has two active standards covering the procedures for concrete surface pH measurements: ASTM D4262-05 (2018), "Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces," and ASTM F710-17, "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring."

ASTM D4262

ASTM D4262 is refereenced for surface pH testing following concrete preparation in a number of industry consensus standards, including SSPC-SP 13/NACE No. 6, "Surface Preparation of Concrete," NACE SP0892, "Coatings and Linings over Concrete for Chemical Immersion and Containment Service" and ICRI Guideline No. 310.2R-2013, "Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair."

According to the scope of ASTM D4262, this test method covers procedures for determining the acidity or alkalinity of concrete surfaces prepared by chemical cleaning or etching prior to coating. The significance and use statement further explains that this method is used to confirm removal of chemical cleaning and etching. Also known as "acid etching," this process is generally conducted on horizontal concrete slabs where the acid etching chemical can dwell on the surface to produce a slight anchor profile. ASTM D4262 details three apparatus by

Fig. 1: Existing cast-in-place concrete surface following surface preparation. Figures courtesy of the author.

which surface pH can be measured: pH test paper, the pH pencil and pH meter. The pH pencil is the only method that requires the user to actually measure the concrete surface. According to this method, the concrete surface is scratched with a sharp metallic object, moistened with distilled water, and marked over the scratch with the pH pencil. After 15 seconds, the color is compared to a color comparison chart supplied by the manufacturer. The other two methods require the pH measurement of the rinse water (used to remove the etchants) dwelling on the concrete surface.

A study by Pinelle et al. reportedly found that the pH increased over time when water was in contact with the concrete surface[6]. A separate study conducted by Grubb et al. concluded that placing a few drops of deionized water on a concrete surface is not enough to form a solution containing concrete particles and doesn't provide a true indication of the concrete pH[7]. Instead, these researchers found it was important to gather cement particles (powder) by hand-sanding and mix with water at a 1-to-2 dilution ratio. The dilution ratio and temperature of that solution were shown to have the most pronounced effect on measured pH values[8,9].

ASTM F710

ASTM F710-11 also details a procedure for surface pH measurement of horizontal concrete. This standard prescribes that several drops of distilled or deionized water be placed on a clean concrete surface to form a circle of approximately 25 mm in diameter. After 60 (plus or minus five) seconds, the surface pH is measured using pH test paper, a pH pencil or a pH meter. Fundamentally, this procedure differs from ASTM D4262 in that it prescribes the amount of water and a specified wetting (dwell) time, as opposed to measuring the rinse water after some unspecified time.

ASTM F710 may appear to be an improvement over the ASTM D4262 with respect to a prescribed quantity of water (i.e., dilution ratio) and dwell time on the surface prior to the surface pH testing. However, research by Kakade found that pH measurements obtained using the ASTM F710 method was hundreds of times less than the actual pH when the concrete powder was collected and measured as a solution[9]. Kakade concluded a more accurate pH test requires the measurement of a concrete solution made from powder collected from the surface using either pH paper or a pH meter. Based largely on the work of Grubb and Kakade, in 2018, the American Concrete Institute (ACI) published Tech Note: ACI 364.17T-18, "How to Measure pH of a Concrete Surface Prior to Installation of a Floor Covering" to establish a test method that measures the pH of a concrete surface more accurately[5]. According to ACI

Fig. 2: Removing approximately 1 mm of cement paste.

Fig. 3: Measurement of a solution using pH indicating paper.

364.17T-18, the ASTM F710 test method is inaccurate because it essentially measures the pH of water and readily-soluble materials on the concrete surface verses the true pH of the concrete itself.

MEASURING PH ON VERTICAL SURFACES

After reviewing the published literature, it does not appear that ASTM D4262 or ASTM F710 offer an accurate procedure for vertical surface pH measurement despite their widespread usage. There are many instances where modified versions of these methods have been attempted on vertical surfaces with varying results. This is likely due to an insufficient dilution ratio—either too much or too little water—effectively measuring the pH of the test water and not the concrete surface. The ACI 364.17T-16 test method appears to be more accurate than ASTM D4263 and F710, but the procedure detailing the use of 50-grit sandpaper may not remove a sufficient quantity of the cement surface paste on profiled concrete to meet the requirements for high-performance protective linings for chemical containment or immersion service environments[10]. This is especially challenging on existing concrete with exposed aggregate and very little cement paste (Fig. 1).

The research by Grubb et al. found that a more accurate technique for measuring the surface pH of concrete was to measure a solution of cement particles. In 2016, the author and Robert Maley proposed a pH-testing procedure for vertical surfaces measuring a solution of cement particles at a 1-to-2 cement-water dilution ratio and testing using pH paper or pH meters[11]. Specifically, the procedure uses a flat screwdriver to remove a 1-mm-deep layer of cement paste instead of sandpaper (Fig. 2). Also, the authors found a pH meter that could accurately measure a 1 ml slurry solution. If a particular pH meter requires a greater volume to operate, then the amount of concrete paste should be increased proportionally to maintain the 1-to-2 dilution ratio. If there is a concern with scratching the sensor, the slurry solution can be filtered using a coffee filter or filter paper. The vertical surface pH test procedure is as follows.

MATERIALS

- A digital scale capable of measuring up to 20 grams in 0.001-gram increments.
- A calibration weight, 1.0 grams, for calibrating digital scale.
- Calibration buffer solutions, pH 4.00, pH 7.00 and pH 10.00 for accuracy testing the pH test paper or calibrating pH meter.
- An infrared thermometer, industrial gun style with temperature accuracy of plus or minus 2 C (plus or minus 4 F) and point laser sight for measuring the temperature of the solution and concrete surface.
- A testing vial (2.0 ml) with sealed lid for measuring the cement solution.


Fig. 4: Weighing concrete paste using a digital gram scale.

Fig. 5: Measurement of a solution using a pH meter.

Fig. 6: Phenolphthalein solution testing on prepared concrete.

- Testing water, distilled or purified with a temperature of 24 plus or minus 3 C (75 plus or minus 5 F).
- PH test paper, with a minimum range of 1 to 14 pH units with a capability of measuring in increments of 0.5 pH units, or a flat electrode pH meter with a minimum range of 0 to 14 pH units with the capability of measuring 1 ml of water and in increments of 0.01 pH units.

THE TEST PROCEDURE USING PH PAPER

1. Calibrate pH paper using three calibration solutions: 4, 7 and 10 pH. Dip separate pH papers into each of the buffer solutions, compare to the provided pH scale and record. Discard any pH paper if readings vary by more than 0.5 pH units (Fig. 3, p. 43).
2. Identify a 0.3 square meter (1 square-foot) area on a vertical concrete surface.
3. Use an infrared thermometer to measure the surface temperature of the concrete surface to the nearest degree (Celsius or Fahrenheit).
4. Zero out the digital gram scale with the plastic vial.
5. Using a flat-blade screwdriver, lightly scrape and collect 0.5 gram of cement paste into the plastic vial with a lid and weigh it using the gram scale (Fig. 4, p. 43).
6. Add 1 ml of distilled or purified water (with a temperature of 24 plus or minus 3 C [75 plus or minus 5 F]) to the plastic vial, close the lid and shake for 30 seconds. Then let mixture stand for two minutes.
7. Insert the pH paper into the mixture and determine the pH by comparing it to the scale and record.

THE TEST PROCEDURE USING A PH METER

1. Calibrate the pH meter immediately before use. If a series of measurements are made, repeat the calibration procedure at 60-minute intervals using the calibration buffer solutions: 4, 7 and 10 pH. The temperature of these solutions should be 24 plus or minus 3 C (75 plus or minus 5 F) and should not differ from each other by more than 3 degrees C (5 degrees F). Judge the meter to be operating satisfactorily if the reading obtained agrees within (plus or minus) 0.1 unit of the assigned pH. Immerse the electrode into the known solutions and calibrate the meter in accordance with the manufacturer's instructions or as follows.
   a. Immerse the electrode into a small volume of the first known buffer standard. Adjust the pH meter to read this pH. Remove the electrode from the first solution, rinse with fresh distilled water and wipe it dry with a clean paper towel.
   b. Repeat the same procedure for the second known buffer standard and adjust the pH meter accordingly.
   c. Repeat the same procedure for the third known buffer standard and adjust the pH meter accordingly.
2. Identify a 0.3 square meter (1 square-foot) area on vertical concrete surface.
3. Use an infrared thermometer to measure the surface temperature of the concrete surface to nearest degree (Celsius or Fahrenheit).
4. Zero out the digital gram scale with the plastic vial.
5. Using a flat-blade screwdriver, lightly scrape and collect 0.5 gram of cement paste into the plastic vial with a lid and weigh it using the gram scale.
6. Add 1 ml of distilled or purified water (with a temperature of 24 plus or minus 3 C [75 plus or minus 5 F]) to the plastic vial, close the lid and shake for 30 seconds. Then let the mixture stand for two minutes.
7. Insert the pH meter into the mixture and record the stabilized pH (Fig. 5, p. 44).

PHENOLPHTHALEIN INDICATOR TESTING

Once the surface pH is quantitatively measured, testing can be augmented

with qualitative phenolphthalein solution ($C_{20}H_{14}O_4$) indicator testing. The phenolphthalein solution is applied adjacent to an area tested for surface pH. The known surface pH can then be associated with the degree of purple-red coloration from the phenolphthalein solution test and then used on other areas to confirm the desired surface pH requirement following surface preparation. A 1-percent-phenolphthalein solution is made by dissolving 1 gram of phenolphthalein in 50 ml of isopropanol and diluted to 100 ml with deionized or distilled water. The phenolphthalein solution remains colorless at pH values lower than about 8, but presents a characteristic purple or magenta when the values exceed 10.5 (Fig. 6, p. 44).

PUTTING THE PROCEDURE INTO PRACTICE

An experienced industrial coatings and restoration contractor was rehabilitating a headworks facility in a northern Florida wastewater treatment plant. The contract specifications required that the measured concrete surface be greater than a 9 pH following surface preparation. The contractor completed what seemingly appeared to be sufficient surface preparation and cleanliness of the concrete and then performed pH testing in accordance with ASTM D4263 using a pH pencil. However, the results were inconsistent and well below the required pH of 9. The contractor then used pH paper—also included within the ASTM method—only to yield similar results. The contractor continued with surface preparation to remove additional concrete several more times without improvements in surface pH measurements. After discussions with the author, the contractor followed the vertical surface pH-testing procedure and achieved pH readings of 12 and greater. By following the ASTM D4262 procedures, the contractor was essentially measuring the pH of the test water and readily-soluble materials on the surface of the concrete versus the true pH of the concrete surface and this caused unnecessary labor and excess removal of sound concrete substrate.

SUMMARY

Concrete that has been distressed from chemically induced deterioration should be properly prepared to achieve a sound substrate prior to the application of protective linings for severe service environments. Concrete surface pH testing is one quality-control method of assessing the appropriate removal of chemical ingress[11]. To that end, a more appropriate testing procedure for vertical concrete has been developed using pH paper or a pH meter.

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Above the Field: Elevated Tank Projects Show Longevity, Service

BY JPCL STAFF

Editor's Note
SSPC's annual Structure Awards recognize the work of teams of contractors, designers, and users and coating manufacturers for excellence on protective coatings projects. The 2019 Structure Awards were presented at SSPC Coatings+ 2019 in Orlando, Feb. 11, and each award-winning project will be profiled in this series.

The 2-million-gallon Luza Street elevated water storage tank was recently overcoated 18 years after going into service. Photo courtesy of Dunham Engineering, Inc.

Two elevated water storage tank painting projects earned SSPC Structure Awards this year—one for coating longevity and one for service to the community.

The Luza Street Elevated Tank project in Bryan, Texas, won the **Charles G. Munger Award**, which recognizes an outstanding industrial or commercial coatings project demonstrating longevity of the original coating. Munger Award-winning structures may have had spot repairs or overcoating with the original coating still intact.

Originally painted 18 years ago with a four-coat acrylic system, the exterior of the 2-million-gallon welded steel Luza Street tank was recently overcoated, allowing the owner to save the abrasive blasting and containment labor and expenses that would go into a total recoat. In addition, overcoating the existing system also prevented any nuisances to the nearby neighborhood that may have come with extensive surface-prep operations.

Because the original four-coat acrylic system showed excellent adhesion over its service life, the parties involved in the project—including the City of Bryan; the tank engineering and design firm, Dunham Engineering, Inc.; and the painting contractor, M.K. Painting, Inc.—selected a two-coat acrylic system for overcoating from Tnemec Company Inc., supplied by coating distributor Barry Group LLC.

In addition to the exterior overcoating,

LUZA STREET TANK PROJECT AT A GLANCE

Start Date: Dec. 7, 2016
Completion Date: April 28, 2017
Facility Owner: City of Bryan (Texas)
Engineer: Dunham Engineering, Inc.
Contractor: M.K. Painting, Inc.
Coating Manufacturer: Tnemec Company, Inc.
Coating Distributor: Barry Group, LLC

The city's logo and slogan were added to the overcoated tank. Photo courtesy of Dunham Engineering, Inc.

OAK GROVE TANK PROJECT AT A GLANCE

Start Date: Oct. 1, 2017
Completion Date: Nov. 7, 2017
Facility Owner: Oak Grove Water
Department Specifier: Wet or Dry Tank Inspection
Contractor: Sam Estes Painting
Coating Manufacturer: Rust-Oleum
Coating Distributor: HPP Industrial
Specifier: Wet or Dry Tank Inspection

The **Coatings Industry Spirit Award**, presented for a project demonstrating service benefitting a community or industry, went to the **Oak Grove Elevated Storage Tank** project in Oak Grove, Kentucky. Located at the entrance of the Fort Campbell Military Base, the 500,000-gallon legged steel tank serves a small community that is close-knit to the military stationed within.

The tank needed a full interior and exterior repaint, but the Oak Grove Water Department did not have enough funds in the project budget to construct containment and perform complete abrasive-blasting of the tank exterior. Instead, painting contractor Sam Estes Painting performed high-pressure

(Above): Garry Manous, president, SSPC; John Bathell, M.K. Painting Inc., Wesley Oatman, Dunham Engineering, Inc.; and Patrick Barry, Barry Group LLC. Photo courtesy of SSPC.

(Right): The Oak Grove elevated tank stands at the entrance to the Fort Campbell Military Base and supplies water for the base and surrounding community. Photo courtesy of City of Oak Grove.

the contractor performed minor touch-ups of the interior coating system and made miscellaneous structural steel repairs to the tank. The new overcoating is expected to extend the life of the original coating system for an additional 25 years and saved the city a considerable amount in maintenance costs.

The 5,000-gallon tank was pressure washed and topcoated, saving the owner the cost of a full blast and recoat. Photo courtesy of City of Oak Grove.

The tank's exterior received a military beige finish with a bald eagle design and U.S. military logos honoring servicemembers. Photo courtesy of City of Oak Grove.

Honors: Mark Sholtes, HPP Industrial Inc.; David O'Bryan, Rust-Oleum Corp.; Steve Birchmeier, Sam Estes Painting; and Jay Hoffman, Wet or Dry Tank Inspection. Photo courtesy of SSPC.

water-blasting with a degreasing additive from Rust-Oleum for exterior surface preparation before hand- and power-tool cleaning to SSPC-SP 2 and SP 3, respectively.

After surface preparation and spot-priming, two coats of an elastomeric acrylic coating were airless spray-applied over the existing system at a total DFT of 14 mils. Next, 3-to-5 mils of a urethane mastic finish were applied in a military beige color. The exterior was finished with an American bald eagle design and logos of each military branch to honor their service. Coatings from Rust-Oleum were provided by local distributor HPP Industrial Inc.

Interior surfaces were able to be abrasive blast-cleaned to an SSPC-SP 10, "Near White Metal," finish and recoated with a three-coat epoxy system. The project was completed in just over a month, and the tank serves as both an important utility as well as an honor to the service members and community who rely on it.

Index to Advertisers

CALENDAR

JUNE 2019

SSPC COURSES

Course information available at sspc.org

June 7–8	C12 Spray App, Chesapeake, Va.
June 10–11	C7 Abrasive Blast, Pittsburgh, Pa.; Portland, Ore.
June 11–12	C14 Marine Plural Comp App, Plymouth, Minn.
June 11–12	C12 Spray App, Pittsburgh, Pa.
June 12–13	C12 Spray App, Portland, Ore.
June 12–14	CAS Ctg App Spclst, Pittsburgh, Pa.
June 14–15	C6 Power Tool, Pittsburgh, Pa.
June 17–18	C7 Abrasive Blast, Ketchikan, Ala.
June 18–20	CAS Ctg App Spclst, Theodore, Ala.
June 19–20	C12 Spray App, Ketchikan, Ala.
June 19–21	CAS Ctg App Spclst, Chesapeake, Va.

CONFERENCES & MEETINGS

June 4–5	Cleveland Ctgs Society Sink or Swim 2019, Cleveland, Ohio, clevelandcoatingssociety.org
June 9–11	AWWA ACE 19, Denver, Colo., awwa.org
June 9–12	ESWP International Bridge Conf, National Harbor, Md., eswp.com/bridge
June 10–13	International Bridge Conf, National Harbor, Md., eswp.com/bridge
June 12–15	CSCE Annual Conf, Laval, Quebec, csce2019.ca
June 25–28	ABWMA ACE 2019, Quebec City, Quebec, awma.org

70+

The years that the SSPC and NACE organizations have been in existence.
See page 4.

2

Elevated water tank painting projects that received 2019 SSPC Structure Awards, including a 2-million-gallon tank in Bryan, Texas, and a 500,000-gallon tank at the Fort Campbell military base in Oak Grove, Kentucky.
See page 48.

3

The number of required steps recommended by the author to ensure that a quality corrosion-mitigation solution has been achieved: identification of an optimal coating system; development of site-specific, asset-specific specifications; and inspection services.
See page 28.

$23-to-25 per square foot

The approximate cost of complete coating removal and recoating of a water tank. If there is a regulated heavy metal present in the coating system, the cost typically increases by $2-to-3 per square foot.
See page 30.

9

The minimum surface pH following surface preparation to ensure concrete is sufficiently sound and passivation of the reinforcing steel is provided.
See page 38.

2002

The year that JPCL article, "Painting for Antenna Installations on Water Storage Facilities," by Dan Zienty of SEH Inc., was originally published; the author revisited and updated the article with new information for this issue.
See page 20.