

SUSTAINABILITY IS KEY TO OUR INDUSTRY'S SUCCESS

FORECASTING FROM EUROPE

The January JPCL featured a coatings industry forecast from a number of notable figures across the U.S. protective coatings landscape, and the February issue followed up with some perspective from JPCL Editorial Advisory Board member, Edye Fox Abrams, on the current state of the American coatings chemicals market. This month, leaders from AkzoNobel/International Paint LLC shared with JPCL some thoughts on the company's outlook for the coatings market from a European point of view.

Assessments from marketing and manufacturing consulting firms, such as Orr & Boss, indicate that the paint and coatings markets will continue to improve and grow as the impact of COVID-19 vaccination programs and various fiscal measures help with global economic recovery.

This past year was challenging for the whole industry, due to limited raw material supply and its rapidly rising cost—although some market segments were more impacted than others. Despite borders reopening and demand increasing, we expect that raw material cost inflation and supply constraints will gradually ease by mid-2022. Any improvement in this area, however, is dependent upon the continued improvement of global supply chains in general.

We see asset investments in the global energy transition as a tailwind for our business. The U.K. continues to be a global leader in the manufacture and installation of offshore wind farms. Our company has built an extensive operational track record in this area—which covers blades, towers and foundations—stretching back to the very first offshore pilot projects, like the Beatrice Wind Farm. So, for a considerable amount of time, we have been dedicated to supporting customers with coating systems that provide both long-term performance offshore as well as solutions that serve manufacturing objectives.

We are actively working with customers to help achieve health, safety and environment (HSE) initiatives and to contribute towards project planning and, importantly, sustainability planning. In this context, we see having strong sustainability credentials and being equipped to support these customer objectives as keys to our current effectiveness and future success.

In 2021, our company took an important step by becoming the first coatings supplier to have our carbon reduction targets approved by the Science Based Targets initiative, which cemented our commitment to delivering not only our own targets but those of our customers and the industry.

Recognizing that trends differ based on region and segment, we will continue to work in an agile way, partnering with our customers to proactively manage the current supply chain environment. We believe that, together, continuing to pursue innovation that makes our offerings more sustainable is critical to our longevity and to the industry as a whole. JPCL

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COVER FEATURE

16 Lining Versatility for Rail Tank Cars to Enhance Operations

BY MATT SOKOL, ADVANCED POLYMER COATINGS INC.

This article presents a general guide to the rail car industry and how to best select linings to protect tank cars and the commodities they carry from corrosion and chemical attack. It outlines the different railcar types and cargo carried, discusses the importance of lining versatility and presents a case study of how one chemical producer was able to solve its corrosion problems with the proper coating selection.

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FEATURES

10 Investigating Failure: Blistering of Intumescent Fireproofing

BY JAYSON L. HELSEL, P.E., PCS, KTA-TATOR, INC.

An architectural firm designed an addition to a medical facility that included exposed steel members with an intumescent fireproofing coating. Over the ensuing summer, coating failure in the form of blisters in the topcoat and intumescent system were observed. A coatings consultant was hired to investigate the problems, and the findings are discussed in this article.

24 Honoring Notable People, Projects and Products from 2021

The JPCL Prestige Awards (formerly PaintSquare Prestige Awards) is an annual program dedicated to recognizing influential individuals, impactful products on the market and noteworthy projects completed over the last year in the protective and marine coatings industry. This article shares details about the 2021 honorees—and marks the first time the awards have been published in JPCL.

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COVERAGE

CURRENT EVENTS, CONVERSATION, CALENDAR UPDATES AND MORE FROM THE PEOPLE AT PAINTSQUARE.COM



SOURCE: TWITTER.COM / @GOVERNORTOMWOLF

NTSB Investigates January Bridge Collapse in Pittsburgh

Early in the morning on Jan. 28, a bridge in Pittsburgh collapsed, injuring 10 people just hours before President Joe Biden was scheduled to visit the city to discuss infrastructure. No fatalities as a result of the collapse were reported.

At 6:39 a.m., the Allegheny County Police Department was notified about a partial bridge collapse. Emergency crews arrived at Forbes Avenue Bridge, also referred to as the Fern Hollow Bridge, around Forbes and Braddock avenues. Five vehicles, including an articulated Port Authority bus, were on the bridge at the time of the collapse. First responder crews rappelled 100 to 150 feet to reach victims, while others formed a "human chain" to rescue people from the bus.

Authorities reported 10 "minor injuries," with four people – at least one a first responder – transported to a University of Pittsburgh Medical Center hospital. None of the injuries were deemed life-threatening, said Pittsburgh Fire Department Chief Darryl Jones. At the time, UPMC reported that admitted patients were in fair condition. Attorneys for two of the injured have since announced an intent to sue the city of Pittsburgh, the Pennsylvania Department of Transportation and the Port Authority of Allegheny County.

"We were fortunate" that no one was killed, Pittsburgh Mayor Ed Gainey said Friday morning from the scene of the collapse, where he was joined by Pennsylvania officials, including Gov. Tom Wolf, U.S. Sen. Bob Casey, U.S. Rep. Conor Lamb, Lt. Gov. John Fetterman and Allegheny County Executive Rich Fitzgerald.

Initial reports from witnesses described a loud noise and a hissing sound, along with a strong smell of natural gas in the area. Responders confirmed that the collapse also caused a gas line to break, prompting an evacuation of homes in the surrounding area. Authorities turned off the gas line, but a few hours later service was restored and families were permitted to return to their homes, according to Jones.

The final board report on the cause of the collapse is not expected to be issued for 12 to 18 months from the date of the collapse.

President Biden was briefed on the collapse and spoke with state and local officials prior to his arrival in the city. Biden visited the bridge site around 1:30 p.m. on Jan. 28 ahead of his previously scheduled trip to Carnegie Mellon University's Mill 19 research and development center to talk about infrastructure, the economy and supply chain issues.

Urban search-and-rescue crews planned to drill holes into the bridge deck later on Jan. 28, utilizing search cameras "just to make sure everyone is accounted for." Search dogs were also on the scene. There were no additional accident victims reported.



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The National Transportation Safety Board arrived Friday afternoon after announcing it was sending a "go-team" of about 10 people to investigate, with Chair Jennifer Homendy already on the scene. The cause of the collapse is currently under investigation. Video footage from the bus, which had nine cameras on board, is being used in that investigation.

> "The Fern Hollow Bridge collapse is a painful reminder of the condition of our bridges and a call to action..." — *Mayor Gainey*

BRIDGE HISTORY, INSPECTIONS

The 447-foot, rigid steel frame bridge with three spans was built in 1970 and owned by the city. According to reports, the posted weight limit of the bridge is 26 tons and sees an average of more than 14,000 vehicles a day. The bridge goes across Frick Park, one of the city's largest parks, over the Hot Dog Dam Dog Park and a public walking trail. The park was closed for safety reasons; Pittsburgh Public Safety will advise when it is to reopen.

Gainey told reporters the bridge was last inspected in September 2021, with the report from the Pennsylvania Department of Transportation stating that the bridge received an overall "poor" rating and has been consistently found to be in this condition in since 2011. The deck condition and superstructure condition received poor scores, while the substructure condition gained a "satisfactory" rating.

According to PennDOT, Pennsylvania has the third-largest number of bridges in the nation and the average age of bridges in the state system is over 50 years old. PennDOT conducts approximately 18,000 inspections annually on state-owned bridges, with inspection intervals based on each bridge's condition ratings and several other criteria. Inspection intervals reportedly range from six months up to a maximum of 48 months.

The "Bridge Conditions" page on the PennDOT site shows 175 bridges in Allegheny County rated as poor. $1.6 billion of funding from the infrastructure bill is expected to go towards the state's bridge maintenance.

"We do have people go out and inspect the bridges. As you know, Pittsburgh is the city of bridges. We have a lot of them, and they're routinely inspected," Jones said. "So, this one caught everyone by surprise this morning."

INVESTIGATION, NEXT STEPS

The final board report on the cause of the collapse is not expected to be issued for 12 to 18 months from the date of the collapse, but the NTSB said it hopes this will take less time. An interim report was released Feb. 7 by the NTSB, but it only includes factual details and not a determination of the cause.

Dennis Collins, NTSB Investigator-in-Charge, said team members will look at all components of the bridge, including supports, truss work, joints and the road. They will also be looking at bridge records and past inspections of the bridge.

"That's the most methodical way for us to narrow in on the key issues," he added.

In addition to video from the bus, data – such as the frequency and quality of bridge inspections, traffic counts and road treatments that may have been applied, as well as how bridge loads may have changed over time – is being analyzed.

While it's still too early to have a cause of the collapse, some engineering experts who reviewed prior inspections and saw photos of the wreckage have theories as to what went wrong, according to interviews conducted by the *Pittsburgh Post-Gazette*.

Hota GangaRao, an engineering professor and Director of the Constructed Facilities Center at West Virginia University, said cracks and spalling could have lead to corrosion. Since the middle section of the bridge collapsed downward, where the deck is attached to the abutment, the movement could indicate a problem with the expansion joints at the end and in the middle of the structure, GangaRao said.

"The way it is looking, I think the Achilles heel, the last straw, is the joints," he said. "The way it collapsed makes it look like the bridge came loose from the abutment."

"This is something in the maintenance component," said Kevin Heaslip, a professor in the Department of Civil and Environmental Engineering at Virginia Tech. "If I had to guess, something happened between that September inspection and the collapse."

Roberto Leon, the Burrows Professor of Construction Engineering at Virginia Tech, said the repeated poor ratings show "the bridge was never well taken care of." He called it "unusual" that cables were used to buttress a bridge support.

Wolf signed a proclamation of disaster emergency for the county following the collapse, authorizing state agencies to use all available resources and personnel, as necessary, to manage this emergency situation. According to the release, time-consuming bidding and contract procedures, as well as other formalities normally prescribed by law, are also waived through the proclamation.

A similar declaration was signed by Gainey on Jan. 30. The declaration will increase the availability of federal funds, facilitate closer coordination between PennDOT and Department of Mobility and Infrastructure (DOMI) and speed up cleanup and reconstruction of the Fern Hollow Bridge.

The release also stated that the City of Pittsburgh has become a party to the NTSB's investigation to share information in support of the investigation and improve safety.

"The Fern Hollow Bridge collapse is a painful reminder of the condition of our bridges and a call to action to address our aging infrastructure," said Mayor Gainey. "As the City of Bridges, we know how critical our infrastructure is to working families. They are the connectors to jobs, to schools, to childcare, and more.

"As Mayor, I want the people of Pittsburgh to know that I will be working tirelessly to secure additional funding for our infrastructure needs. With the support of our county, state, and federal partners, we will build back better."

Get updates on the investigation and bridge project in *PaintSquare Daily News*: paintsquare.com/register

PAINTSQUARE READER COMMENTS

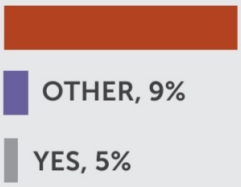
IN RESPONSE TO THE *PAINTSQUARE DAILY NEWS* REPORT, FEB. 1, 2022

Thomas Van Hooser:
"Looks like a combination of factors. The final investigation should be very interesting."

Stephen Dobrosielski:
"I am very interested in what the NTSB ultimately says what caused the collapse. Photos that I have viewed show corrosion on the inclined rigid frame legs, which surprises me. I do not think that there would be roadway deck joints anywhere but at the ends of this bridge. There was definitely a roadway drain pipe attached to the inclined leg. [Was it a] leaking drain pipe? I suspect that because one of the rigid frame leg supports had a K-brace that corroded through immediately above the bearing, [and] the bottom K-braces were replaced by wire rope bracing attached near the top of the leg and bottom of the leg. The original design's K-bracing did provide some lateral support to the inclined leg. This loss of lateral stability is critical."

POLL

The Bridge Replacement, Rehabilitation, Preservation, Protection and Construction Program (Bridge Formula Program) is expected to help repair approximately 15,000 highway bridges in the United States. However, the National Bridge Inventory shows that more than 43,000 bridges in the country are in poor condition. Do you think enough is being done to address the nation's bridge repairs?



Michael Beitzel:
"Not hardly enough is being done. Of the 43,000 bridges in poor shape, we should already have a prioritized data base, and I think we do, indicating the traffic usage of each of these bridges and the nearest detour in total mileage and time with the cause for the poor condition rating taken into account. Those with structural deficiencies that could cause failure or result in death or injury should be prioritized. Why have we not started dispensing the currently legislated funds dedicated in part for this task? I fear politics is playing too large a role and suspect that those responsible for directing and releasing these funds, which has not yet started, may be using other criteria in awarding these grants. Let's hope that this is not the case and that the work we desperately need to address this infrastructure need will begin sooner rather than later. I would be less suspicious if engineers were responsible for making these determinations rather than career politicians currently in charge."

COVERAGE

KTA-Tator Appoints New CEO, President

KTA-Tator, Inc., a Pittsburgh-based, 100% employee-owned nationwide consulting engineering firm specializing in infrastructure and asset protection, announced the next phase of their transition in executive leadership. Bill Worms has decided to step down as President and CEO effective July 1, 2022, passing executive responsibilities on to Dave McFayden as CEO, and Pete Ault as President. Worms will remain on staff in a consulting capacity until at least Sept. 30, 2022. Both McFayden and Ault have been with KTA since 2019, and both were brought on board with the specific intention of assuming these top leadership roles.



Dave McFayden

McFayden is currently Vice President and Business Unit Manager of the Coatings and Facilities Group. He received his Chemical Engineering degree from McMaster University in Hamilton, Ontario, and has been in the engineering consulting field his entire 34-year career spanning program management, client services management, strategic planning, business development and operations management across multiple disciplines in environmental, transportation, homeland security and international engineering consulting.



Pete Ault

Ault is currently President of KTA's Elzly Technology subsidiary and manager of their Professional Services Business Unit. He is a registered professional engineer in Pennsylvania, New York and New Jersey. He received a B.S. degree in Mechanical Engineering from Drexel University and an MBA from Drexel University's Lebow College of Business. Through his 35-year career, he has studied coatings and corrosion phenomena on a wide variety of applications; some of which include ships, bridges, pipelines, offshore platforms, storage tanks and historic structures. He holds coatings specialist certifications from AMPP, and is actively involved in AMPP, ASTM and several research programs.

KTA says that its employee owners embrace the thoughtful succession planning necessary to support continued growth and sustainability of their company and world class service to KTA's clients in transportation, defense, oil and gas, energy and commercial property markets.

CALENDAR

APRIL 2022

2022 AMERICAN COATINGS SHOW

April 5–7
Indianapolis
american-coatings-show.com

Hosted by the American Coatings Association, this biennial trade show and exhibition is dedicated to serving as a global business and educational forum for the paint and coatings industry, offering a complete spectrum of current and future trends and technologies.

COATING SOCIETY OF THE HOUSTON AREA TRADE SHOW 2022 AND DEMO FAIR

April 22
Pasadena, Texas
coatingsocietyofhouston.org/tradeshow

This annual event gives attendees a chance to discover the latest coating industry technologies and get to see the products, services and equipment in action. It is composed of a technical program, an exhibition, networking opportunities and live demonstrations of the latest corrosion control products and services.

SAVE THE DATE

Contractor Connect 2022
Oct. 25–28
Hammock Beach, Florida
paintsquare.com/contractor_connect

Technology Publishing Company has recently announced the location and dates for its fifth annual Contractor Connect for industrial coating professionals. The hosted buyer event will bring together qualified buyers (contractors) and sellers (suppliers) through a variety of networking activities and prescheduled one-on-one meetings. Over the course of the event, major industrial coating contractors and suppliers will have substantial opportunities to further develop personal and professional relationships, and these enhanced contacts will lead to new business and the growth of existing customer accounts.

If you are a supplier to the protective and marine coatings industry, visit the Contractor Connect website to find out more about our sponsor levels as well as additional sponsorship opportunities. If you are a qualified industrial painting contractor, you may inquire about participating as an invited contractor.

PHOTOS: COURTESY OF KTA-TATOR, INC.

DEADLINE
APRIL 1, 2022

Voting Period Extended for JPCL Readers' Choice Awards

Readers of the *Journal of Protective Coatings & Linings* will have extra time to cast their ballots for their favorite JPCL articles from the past year, as the voting deadline for 2021 JPCL Readers' Choice Awards has been extended to Friday, April 1.

"We owe recognition to our outstanding contributors for providing the articles that make JPCL the trusted industry resource that it has been for the better part of the past four decades," said Charlie Lange, JPCL Editor-in-Chief. "The JPCL Readers' Choice Awards give our readers the chance to applaud the authors that keep them informed and, ultimately, help them do their jobs better."

Voting for the program's fifth consecutive year opened earlier this year and will now officially close at the end of the day on April 1. JPCL readers are encouraged to vote for their favorite articles published between January 2021 and December 2021. The articles from the year are classified into four categories: **1) Coatings and materials, 2) Process technology, 3) Best practices** and **4) Projects.**

"As we are now an independent publication, our readers and contributors are more important to us than ever," added Lange. "By involving our readers in the process, we get to truly realize which articles from the past year had the greatest impact on the industry, and properly commend those authors."

The winning articles and authors will be announced in the April issue of JPCL. To cast your vote, visit: surveymonkey.com/r/2021jpclawards



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PHOTO: ANUSORN ABTHAISONG / GETTY IMAGES

BLISTERING OF INTUMESCENT FIREPROOFING

BY JAYSON L. HELSEL, P.E., PCS, KTA-TATOR, INC.

An architectural firm designed an addition to a medical facility in the northeastern United States that included exposed steel members with an intumescent fireproofing coating. The coating was required to have a two-hour rating meeting the requirements of UL 263 for Fire Tests of Building Construction and Material. A urethane finish coat was specified to complete the coating system.

Various steel column and tubular members were fabricated at a shop in the eastern U.S. The steel was prepared according to SSPC-SP 6, "Commercial Blast Cleaning," and shop primed with an alkyd primer. The steel was shipped to the project site and the building addition was erected from the summer through the fall.

Application of a thin-film, solvent-based intumescent coating began in early winter and continued into January of the following year. To achieve the specified fire rating, a total thickness of 200 to 300 mils was required depending on the size of the steel member. The intumescent coating could be applied up to a thickness of 40 mils dry film thickness per coat. The product information listed a recoat time of 4 hours at 70 F, however, additional recoat times at other temperatures were not listed. The minimum ambient temperatures allowed for applications were 40 F. An enclosure was installed around the work to maintain the temperature above the minimum. After multiple coats of the intumescent were applied, the urethane finish was applied one to two weeks later. The new space was not conditioned until the following winter.

Over the ensuing summer, coating failure in the form of blisters in the topcoat and intumescent system were observed. A coatings consultant was hired to investigate the problems.







FIG. 1: Widespread blisters in topcoat on tubular steel member.

FIG. 2: Blister of topcoat removed revealing intumescent coating.

FIG. 3: Delaminated topcoat at blister showing underlying intumescent coating.

FIG. 4: Pop-out failure on column.

FIG. 5: Pop-out failure removed.





PHOTOS: COURTESY OF KTA-TATOR, INC.

Field Investigation

After discussing details of the work, all parties involved performed a walk-through of the building addition where the intumescent coating system was installed. Once the walk-through was completed, the consultant performed a visual assessment of the coating condition, assessed adhesion and measured the coating thickness and Shore D hardness. Samples were also collected for anticipated laboratory analysis.

VISUAL OBSERVATIONS

The building addition consisted of two levels and the coated steel members included wide flange and tubular steel columns along each side. Generally, tall windows lined the sides of the addition on both levels. The columns ran from floor level to the top of each level and were the focus of the investigation. The primary coating failure observed on both levels were blisters in the gray topcoat of the system. The size of the blisters typically ranged from 0.5 to 1 inch in diameter, with some larger blisters. When blisters were removed, the underlying white colored intumescent coating was visible. The frequency of blisters was greater on the lower level where blisters were present on all tubular columns. Generally, there were few blisters on the wide flange columns on both levels.

Another type of failure was blisters of "pop-outs" that occurred within the intumescent layers. When the pop outs were removed, the thick intumescent coating layer broke cohesively (or between intumescent layers) such that a relatively thick layer of intumescent coating was removed, and a relatively thick layer of intumescent coating remained on the steel. The frequency of pop outs was much less overall than for the occurrence of topcoat blisters. Also present to some degree in all locations were coating defects that appeared to be the result of mechanical damage. The damage was most often on column surfaces near floor level.

Present to some degree in all locations were coating defects that appeared to be the result of mechanical damage ... most often on column surfaces near floor level.

COATING THICKNESS

Coating thickness measurements were obtained over various column surfaces. The thickness on wide flange columns was generally less than for the tubular columns (which was as specified due to the larger steel size). Thickness typically ranged from 175 to 225 mils for the wide flange columns, and from 250 to 300 mils for tubular columns. Where pop outs occurred, the thickness remaining on the steel ranged from 125 to 200 mils.

SHORE D HARDNESS

Shore D hardness measurements were obtained on numerous steel members over both levels. Typically, readings of 20 or less were measured on tubular column surfaces. The lowest overall readings were from the lower level where values below 20 were found on every tubular column. The hardness values on wide flange columns were generally greater with some measurements 25 or greater. However, some values below 25 were also found.

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COATING ADHESION

The coating adhesion of the topcoat (where intact) and entire system was good as assessed by probing with a utility knife. The coating system was relatively soft when cut into with the knife. When larger coating pieces were forcibly removed, the material had a putty-like consistency and strong solvent odor. Various coating samples were obtained, including samples of the entire intumescent thickness that were removed from intact (i.e. undisturbed) areas – these samples were immediately placed into a sealed vial.

PROJECT MEETING

Another meeting was held after the field investigation was completed. The findings were summarized including the relatively low Shore D hardness values, which were less than 40 as required for topcoat application. The coating manufacturer agreed that the low hardness values indicated that the intumescent coating layers were not sufficiently cured prior to application of the topcoat. Their general opinion was that the system would be able to cure properly if the topcoat was removed.

The manufacturer proposed removing the topcoat by scraping and sanding in all areas to allow trapped solvent to escape, which would allow the intumescent coating to harden. Topcoat could again be applied after minimum Shore D hardness readings of 40 were achieved.

It was agreed that repairs would be performed following the procedure in a "test area" on the lower floor of the building addition. The topcoat would be removed on members in the area and initial hardness readings obtained. The area would be well ventilated and heated to promote curing of the system. Hardness readings were intended to be obtained periodically to monitor the hardness and confirm it is increasing. The coating thickness would also be measured to confirm that the required thickness for particular members is maintained.

The coating manufacturer agreed that the low hardness values indicated that the intumescent coating layers were not sufficiently cured prior to application of the topcoat system.

Laboratory Analysis

Laboratory testing to determine various coating characteristics and potential solvent retention in the coating system was performed. Of most significance, testing of samples using gas chromatograph-mass spectroscopy identified solvent consistent with solvent contained in the intumescent coating. The finding confirmed that the coating layers had not fully cured and retained solvent.

This testing was performed using a vial containing the core sample of the intumescent coating, which was immersed in a heated mineral oil bath. After waiting a period of time, a sample of the air within the vial (the headspace) was obtained using a gas-tight syringe and injected directly into the chromatography system. A mass spectrum was generated, and individual components were identified via a library match using a mass spectral database.

PHOTO: TOTOJANG / GETTY IMAGES

Conclusion

The field investigation documented that blisters in the topcoat of the intumescent coating system were present to some degree in all locations, and pop outs within the intumescent coating were present to a lesser degree. Shore D hardness measurements showed that the intumescent coating system was less than the required level of 40 in all areas. The low hardness and strong solvent odor observed when removing samples indicated that the intumescent coating did not sufficiently cure, as further confirmed by the laboratory analysis.

A common problem when applying several coats of an intumescent coating is inadequate curing of the multiple coats. When this occurs, solvents from underlying coats do not completely evaporate from the coating film, which can create blisters in the coating layers if solvents still present are driven out. This would have occurred over time as the intumescent coated members would be heated to some degree by conditioning of the spaces and sunlight exposure. The solvent evaporation resulted in blisters in the topcoat, since the topcoat restricted further evaporation, as well as the pop-outs that occurred within the intumescent layers.

Coating repairs moved forward as intended following the field investigation. The topcoat was removed and the Shore D hardness readings gradually increased over several weeks. A new urethane finish coat was eventually reapplied. JPCL

ABOUT THE AUTHOR



Jay Helsel is a senior consultant with KTA-Tator, Inc. He holds an Master of Science degree in chemical engineering from the University of Michigan, is a licensed professional engineer in multiple states, a NACE-certified Coating Inspector, and an SSPC-certified Protective Coatings Specialist (PCS) and Concrete Coatings Inspector (CCI). At KTA, Helsel manages coating projects, performs failure investigations and coating surveys, writes coating specifications and is a regular instructor for KTA coating inspection courses. Helsel previously served as a lieutenant commander in the U.S. Coast Guard with experience in marine vessel inspection.

PHOTO, LEFT: COURTESY OF KTA-TATOR, INC.

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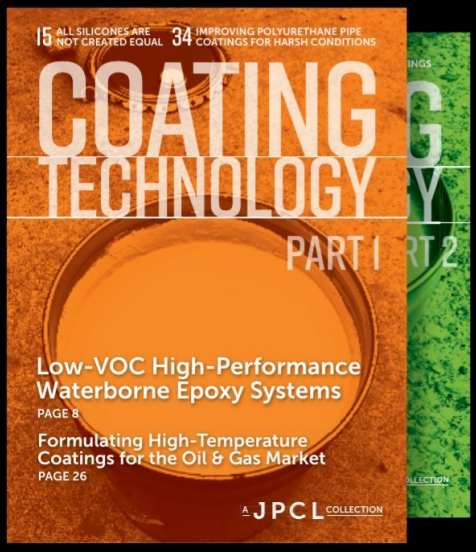

COATING TECHNOLOGY PARTS 1 & 2

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LINING VERSATILITY

FOR RAIL TANK CARS TO ENHANCE OPERATIONS

BY MATT SOKOL, ADVANCED POLYMER COATINGS INC.

The rail tank car has been hauling liquids since oil was first discovered in the 1860s. Their characteristics, with their different commodities being transported, make them unique. The longevity of assets is a crucial factor in the profit margins for tank container operators and lessors. Those of us in the protective coatings industry understand the need for impermeable barriers in tank cars, to protect both the steel substrate and the product from contamination, and particularly for those carrying aggressive cargos, a high-performance lining system is critical to extend the car's lifetime.

This article presents a general guide to the rail car industry and how to best select linings to protect tank cars and the commodities they carry from corrosion and chemical attack. It outlines the different railcar types and cargo carried, discusses the importance of lining versatility and presents a case study of how one chemical producer was able to solve its corrosion problems with the proper coating selection. In light of recent market uncertainty, it also offers a brief outlook on the future of the rail transportation market – and the subsequent need for coating solutions.

Tank cars are lined not only to protect the car from corrosion and chemical attack, but to protect the cargo from contamination, as well.

PHOTO: JOEY INGELHART / GETTY IMAGES



Rail Car History Timeline

Railroads and their associated mechanisms are always evolving in an effort to provide customers a competitive edge in the global economy. The following is a general timeline of the evolution of the rail transport industry, starting in the mid-1800s. It's particularly interesting to note the changes in the tank car (specifically regarding safety) from the past to today.[1]

1865

Charles P. Hatch of the Empire Transportation Company invents the railroad tank car. Flatcars with banded wooden planks or decking mounted on top are used for the first time to transport crude oil from Pennsylvania during the Pennsylvanian oil rush.

1869

Wrought iron tanks, with an approximate capacity of 3,500 U.S. gallons per car, replace wooden containers.

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Tank Cars & Other Rail Cars

All rail tank cars are built to standards and requirements of the U.S. Department of Transportation (DOT) and the Association of American Railroads (AAR). Railway Supply Institute cites:

"A railcar with a tank for its body consists of a shell and heads together with connections welded directly to it and used to transport liquids, solids, and liquefied gases. By AAR specifications, 'tank' means 'tank car tank.' The head of a tank is one of the end closures. Tank cars may be pressure or non-pressure and are often equipped with special equipment to enhance their usefulness for handling specific commodities. For pressure class tank cars, the tank includes the manway nozzle as well."

There are generally two basic categories of tank cars:

1. General-Purpose Cars: These are non-pressurized cars that can be used to carry any kind of material. They can be referred to as general-service or low-pressure tank cars.

2. Pressure Tank Cars: These are used to transport compressed liquefied gases under pressure, as well as some low-pressure, high-hazard materials. They are built with thicker tanks to withstand higher internal pressures.

A number of different car types comprise the U.S. and global rail car inventory.



ILLUSTRATION: DROGATNEV / GETTY IMAGES. PHOTO: WESVANDINTER / GETTY IMAGES



Flat Flatcar Covered Hopper Box Car

In 2014, the Railway Supply Institute Committee on Tank Cars (RSICTC) recommended that DOTs adopt tank car standards for newly built tank cars assigned to crude oil and ethanol service. Efforts were made to revise the tank car standards for insulation (to maintain the appropriate temperature), thermal blanket (for fire protection) and top fittings (with relief valves). For the protective coatings industry, the thousands of new tank containers entering the North American fleet each year present a consistent demand for high-performance lining systems and an opportunity for innovation and improvement within the industry.

In addition to tank cars, other rail car types commonly used to transport goods in today's economy include:

Hoppers: This type of railroad freight car or container is used to transport loose, bulk commodities such as grain or coal. These containers are typically tapered downward and can discharge their contents at the bottom.

Gondolas: These are open-topped rail vehicles that are also used for transporting loose bulk materials. According to the AAR, "Because of their low side walls, gondolas are also suitable for the carriage of such high-density cargoes as steel plates or coils, or of bulky items such as prefabricated sections of rail track."

Flats: These are a piece of railroad rolling stock that consist of an open, flat deck mounted on a pair of trucks, one at each end containing four or six wheels.

Flatcars: These are used for loads that are too large or clumsy to load in enclosed cars, such as boxcars.

Covered Hoppers: These hoppers are equipped with a roof to protects the loads from the weather.

Box Cars: These railroad cars are enclosed and generally used to carry freight. The boxcar is probably the most versatile since it can carry most loads.

While some of these types of rail cars traditionally have not required protective coatings, hoppers are one type that can be coated or lined to protect the substrate and the commodity from corrosion, chemical attack and contamination.

Choosing the Right Lining

There are many different types of linings and liner materials on the market today. Each one has vital attributes that make it worthwhile. Lining choices can include rubber, neoprene, Teflon, high-bake phenolics, epoxy amines, epoxy polyamides, novolac epoxies and high-performance, polymer-based linings. However, most of these linings can only handle limited cargo types, as they are not engineered for a broader range of chemical services.

According to industry studies, the most frequently carried cargoes in rail tank cars are (from most to least):

- Petroleum/crude;
- Ethyl alcohol;
- Sodium compounds;
- Petroleum byproducts;
- LPG; and
- Sulfuric acid (93-100%).

RAIL CAR HISTORY TIMELINE

1888

Tank car manufacturers sell units directly to the oil companies, with sizes ranging from 6,000 to 10,000 U.S. gallons.

1903

Tank car companies develop construction safety standards. More than 10,000 tank cars are in operation.

1915

A classification system is produced by the tank car industry to ensure the correct match of car type to the shipped product. Approximately 50,000 tank cars are in use.

1930

140,000 tank cars transport 103 commodities.

1940s

Virtually every tank car is engaged in oil transport in support of the war effort.

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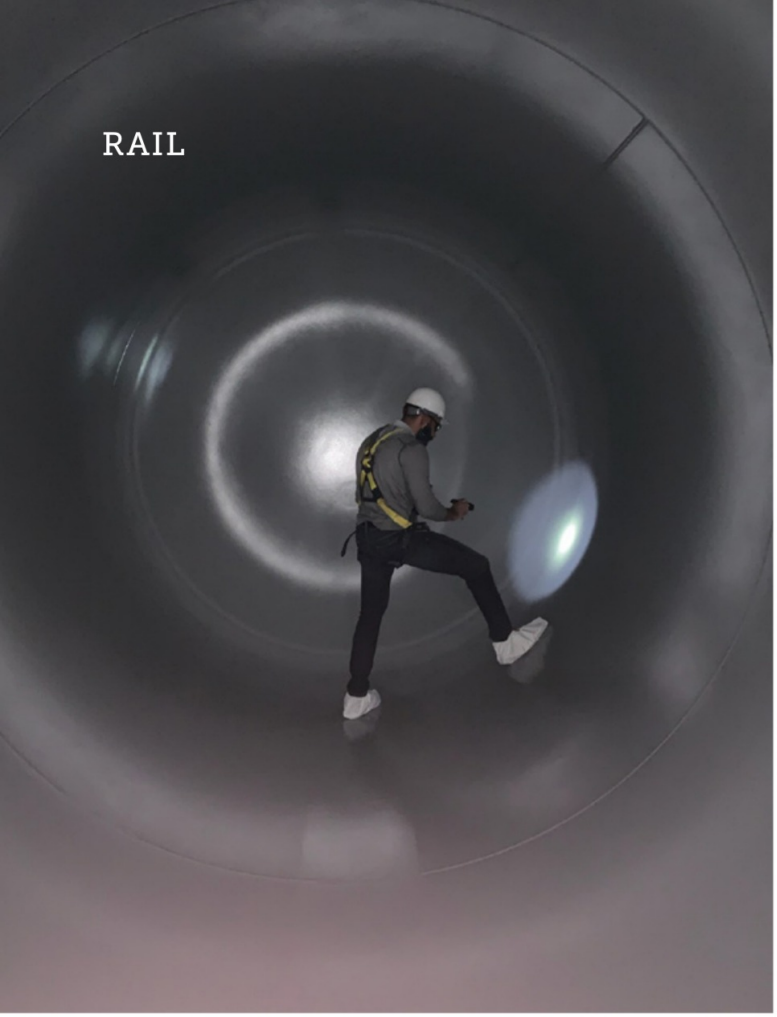



Inspectors ensure that linings have properly cured inside of these tank cars before the cars are returned to service.

Other products carried can include:

- High-fructose corn syrup (HFCS);
- Superphosphate;
- Sulfur liquid/molten;
- Soybean oil;
- Petroleum lubricating;
- Nitrogen fertilizer;
- Organic acids or salts;
- Benzene/toluene/other cyclic;
- Chemical products;
- Hydrochloric acid;
- Industrial inorganic acids; and
- Fatty acids.

Of the aforementioned lining systems, each one is often specially selected to provide suitable service for a specific cargo type, but that particular lining can limit the broader use of the transportation unit. For example, a rail car lined with a coating resistant to crude oil may not work for other commodities.

To handle multiple cargo types, rail tank car owners, operators and lessors should consider versatility in lining selection. How can lining versatility be best explained?

In essence, a versatile lining can internally protect the tank asset against corrosion and degradation from the broadest range of chemicals, including aggressive acids, alkalis, solvents, CPPs and edible oils, and to easily switch between these cargoes after cleaning and decontamination. A tank lining is applied to a tank to protect the substrate material from a chemical attack, as well as to protect the commodity carried from contamination.

A highly impermeable lining that can carry different cargoes allows for easy cleaning of the transportation unit and the flexibility to change shipments of varying types as market conditions change, maximizing asset utilization and revenue streams. The system should handle the broadest range of chemicals used in transport and has superior chemical resistance and product purity. It needs to clean quickly and is a proven performer in the transport market.

PHOTOS: COURTESY OF THE AUTHOR

Top Considerations

Various factors influence the lining selection for transportation equipment – whether it's a truck tanker trailer, rail car, barge or product tank container – and, as outlined, the most important factor is knowing all the different types of cargo carried.

In addition, several performance features help determine the versatility of a lining and consideration into the selection of any rail tank car lining.

Chemical Resistance to Exposures and Temperatures: Can this tank lining truly handle a wide range of cargoes – and not just in one class or one type of chemical? The lining must handle the entire range of chemical exposures and temperatures that the tank car may carry during its service life.

Food-Grade Approval for Safety (GRAS): Can the lining handle food-grade cargoes?

Product Purity to Reduce Cargo Contamination: Can the lining resist permeation (absorption) from its cargoes – as well as withstand corrosion and not leech into the commodity – to ensure outstanding product purity? Again, for specific linings that specialize in carrying particular cargoes, this is possible; however, versatility is sacrificed if the goal is also to carry a broader range of cargoes.

Easy Cleaning for Faster Return to Service: Does the lining clean easily and quickly?

Proper Application to Deliver Abrasion-Resistant Solution: When benchmarking what a versatile coating needs to be, check into the application and curing recommendations, environmental considerations, lining performance and toughness.

Proven Field Performance for Best Results: How do the linings being considered perform in different conditions and environments? Ask your coatings provider for case histories in myriad services. See how the linings have performed in a range of transport equipment – from rail tank and hopper cars to tanker trucks, barges and interbulk tank containers. Ask what chemicals they have carried and at what temperatures.

Case Study: Versatility at Work

One U.S. producer of essential chemicals observed a corrosion problem – hydrogen grooving – inside two of the company's rail tank cars carrying 99+% sulfuric acid and spent alkylation sulfuric acid. As readers will know, corrosion occurs when sulfuric acid produces hydrogen gas, and as the gas moves upward in the rail car, it erodes the steel surface, causing a grooving pattern. In fact, unlined tank rail cars are not usually retired from service due to uniform corrosion, but deep hydrogen grooving.

The two tank cars were brought to a railcar repair contractor's yard, where an inspection showed some pitting and other problems in addition to the hydrogen grooving. It was determined that a full blast and recoat needed to be performed, and a coating system was selected for its versatility based on the properties described previously.

The selected coating's formulation was based on a chemical matrix that crosslinks an organic polymer and an inorganic polymer with high multi-functional capability. The result of this linkage is a three-dimensional ladder-like

RAIL CAR HISTORY TIMELINE

1945–1950

Welding replaces riveting in car construction (both underframes and tanks) for the major manufacturers, including American Car & Foundry and General American.

1950

Pipelines and tank trucks begin to compete for the liquid transport business.

1955

Intermodal freight—the movement of containers and highway trailers by rail — is reported as a separate category of cargo for the first time. In that year, railroads moved 168,000 carloads of trailers and containers.

1963

The Union Tank Car Company introduces the "Whale Belly" tank car.

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RAIL CAR HISTORY TIMELINE

1980

Congress passes the Staggers Rail Act, reducing the Interstate Commerce Commission's regulatory authority over railroads and sparking competition that stimulates advances in technology and a restructuring of the industry. This includes the creation of hundreds of new shortline and regional railroads.

2017

U.S. railroads originate 13.7 million intermodal containers and trailers, setting a new annual record. In 1990, containers accounted for 44% of intermodal traffic. By 2000, the share was 69%. In 2017, it was 91%. Containers are generally more efficient than trailers, in part because they can be "double-stacked."

2018

Freight was steady in 2018, with carloads up 3.9% for the year.[2]

80,298 tank cars were used to transport flammable liquids.[3]



While the number of rail cars in the fleet has increased in recent years, the market currently faces uncertainty.

structure where the high degree of crosslinking is achieved by the formation of ether groups carbon oxygen-carbon (C-O-C), one of the strongest linkage bonds in chemistry. This technology eliminates the high concentrations of hydroxyl groups (found in phenol epoxies) and precludes the formulation of ester groups subject to hydrolysis and acid attack.

The coating can offer resistance to more than 5,000 chemicals and thermal shock resistance from -40 F to 350 F (-40 C to 176 C) with virtually no absorption of the cargo and with resistance to 98% of all corrosive acids, alkalis, solvents, gases and materials at various temperatures.

This high-volume-solids content (85%) lining with low VOC content is reported to be durable, yet flexible enough to be crack resistant. The lining can be applied in a single coat using plural-component spray equipment to achieve high-film-build dry-film thickness from 10 to 12 mils. The lining is then low-temperature forced-air-cured to enhance the crosslinking, which delivers high chemical and corrosion resistance.

Its enhanced crosslinking capability (number of crosslinks per unit of volume) creates a hard, smooth surface with low surface energy to withstand the rigors of transport, cleanings and mechanical damage and allow tanks to be cleaned more quickly than with conventional tank coatings. The lining is steam cleanable, making it relatively easy to remove any residue and to decontaminate the tank surface so cargoes can be easily switched, and the tank asset can return to service faster.

The contractor prepared the internal surface through grit blasting to clean out contaminants and pitting, grinding the sharp edges caused by grooving, and repairing areas as needed. After preparation, it was determined that the tank cars were structurally suitable for the coating application.

A red basecoat of the lining was applied, followed by a gray topcoat. The tanks were then forced hot air-cured, per the coating manufacturer's specifications. Within a few days, the rail tank cars were put back into service.

One year after the initial application, the two tank railcars were brought in for their one-year service inspection, for which representatives from both the

PHOTO: BENJAMIN DENOLF / GETTY IMAGE

chemical company and the coating manufacturer were on hand. The inspection showed that the overall condition of both rail tank cars was good, with the lining intact with no corrosion or grooving observed. Dry film thickness (DFT) readings were also recorded in both railcars, and these were shown to be consistent with DFT averages from the initial application.

Several areas in the tank where repair work was performed the previous year during the coating work were beginning to peel; however, the lining underneath was intact with no degradation. The original gloss of the coating had been lost and some staining occurred, however this did not affect any performance of the lining. Minor repair touch-up work was carried out, and the tank cars were again put back into service.

Future Market Outlook

According to reports from *FreightWaves*, "There are three broad railroad tank car markets – chemicals, crude oil, and selected agricultural commodities. Across North America, the number of tank cars in the fleet increased from ~300,000 in 2009 to ~432,000 in 2019."[4]

The chemical tank car market comprised roughly 13% of the carloads of rail traffic moved during 2019. Shipments of heavy crude oil into the U.S. was the largest crude oil market segment with approximately 54,000 monthly carload total. Railroad tank cars are used to move grain-based energy (ethanol). Railroads move more than 60% of the U.S. ethanol traffic.

All of these figures seemingly indicate a growing market, but obviously, markets were upended in 2020 due to the COVID-19 pandemic, and while recovery progresses, at this time the future of the rail market remain uncertain. Rail freight will probably continue to remain flat for the foreseeable future, but time will tell. There is, however, hope for market improvement after an overall economic recovery.

The current "go green" initiative and effort to reduce carbon footprint, along with continued challenges with staffing freight-truck drivers in the U.S., is causing the rail industry to become more popular over "OTR" transportation. As U.S. and global supply-chain solutions are sought, rail transport will likely play a crucial role in the years and decades to come.

Conclusion

Versatility in a coating or lining system can potentially offer a number of potential benefits. Today, expediency is crucial; owners are looking for the total lining process to take one or two days, not three to four or potentially more, and they look for versatility in a coating system so that they can pare down coating lines, as well. Painting contractors desire ease of application – a one- or two-coat system, with low heat curing and fast application, allowing them to push out more cars and earn more revenue. Also, cleaning procedures are very important to take into consideration when choosing the correct lining.

As the rail market stabilizes and demand for rail transport picks up, operators should be aware of their options for protecting their rail tank cars and the different factors that impact lining system selection. JPCL

PHOTO: COURTESY OF THE AUTHOR

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ABOUT THE AUTHOR



Matt Sokol is the Global Industrial Sales Manager for Advanced Polymer Coatings Inc., an Avon, Ohio-based coatings manufacturer of protective coatings to aid in the transportation of aggressive commodities in both the industrial and maritime sector, where he manages the company's ChemLine brand. He is a graduate of John Carroll University and has been with the company since 2018.

2021 PRESTIGE AWARDS

PLUS: Submission Information for 2022 Award Nominations

The JPCL Prestige Awards is an annual program dedicated to recognizing influential individuals, impactful products on the market and noteworthy projects completed during the past year in the protective and marine coatings industry.

Previously promoted in JPCL's former sister publication, *PaintSquare Press* (whose content was merged with JPCL in 2021), the Prestige Award nominees and winners will be publicized in JPCL going forward, presenting an exciting opportunity for recognition in the industry's most established journal.

"Not only does this make the potential audience for Prestige Awards coverage bigger, but I expect that JPCL print coverage will expand the future pool of nominations," said Charlie Lange, Editor-in-Chief of JPCL. "While the pandemic had an impact on the number of entries received for 2020-21, we and our panel of industry-leading judges look forward to reviewing a deep field of nominations from many different sectors of the industry in 2022."

Following are the winners of the 2021 Prestige Awards. Nominations for next year's Prestige Awards will open later this spring. Stay tuned for more information!

EDITOR'S NOTE: While some nominees ran unopposed in 2021, all were deemed worthy of their respective honors by JPCL editors. It is the journal's policy to present an award only if the entry meets our established standards. Thank you to those who submitted an exceptional group of nominees.

PROJECTS











PHOTOS, FACING PAGE & ABOVE: COURTESY OF INDURON PROTECTIVE COATINGS

The Top Project category recognizes the players involved in a notable industrial protective coatings project completed in 2020. This project may employ some of the nominated Top Products and Innovations, or involve some of the Top People chosen by the industry.

A CONE-TOP CANVAS

Esteemed Artist's Design Transferred to Water Tower

PROJECT LOCATION: DEEP ELLUM, TEXAS

CLIENT/OWNER: WESTDALE MANAGEMENT (DALLAS)

CONTRACTOR: TANKSPEK, CORP. (BERRYVILLE, ARKANSAS)

COATINGS SUPPLIER: INDURON PROTECTIVE COATINGS (BIRMINGHAM, ALABAMA)

Built in 1914 in Deep Ellum, Texas, the Continental Gin Company includes a cone-top water tower that has since become a landmark to the community. After more than a hundred years in service, the cone-top tower was in need of restoration.

Property owner Westdale Management enlisted Goldman Global Arts (GGA) and TankSpek, Corp. to initiate the tank restoration project. Goldman Global Arts commissioned a design by well-known American street artist Shepard Fairey that would transform the water tower into a piece of art for the Deep Ellum community. Fairey painted a mural titled "Cultivate Harmony" to span the 150-foot-tall water tower.

The news of Fairey being brought onsite was where, logistically, TankSpek's planning became almost surgical in their approach both to safety and general process. The team only had three days to install an incredibly complex rigging system, apply a two-tone backdrop of paint and have the safety team evaluate all installations and safety mechanisms before Shepard and his team arrived. TankSpek involved their safety team in every aspect of the rigging.

One of TankSpek's primary challenges for this project was the avoidance of property damage. Upon Westdale's request, due to the proximity of the surrounding properties and public spaces, it was necessary to use a coating system that would allow application methods that would mitigate any potential damage. The entire tank was pressure washed and hand-tool cleaned per SSPC SP-3 standards to remove any dirt, contaminants and old paint. TankSpek determined that the optimal coating system would need to be brush and roller applied. Induron recommended a three-coat system designed for these specific application requirements. TankSpek first applied a primer coat of Induron's E-bond 100 Epoxy Sealer to penetrate and seal the prepared surface. This was followed with a coat of Induramastic 85 Epoxy as an intermediate coat to provide a substantial corrosion barrier. For the finish coat, Induron recommended Indurlux 7600 Acrylic Polysiloxane. This single-component, isocyanate-free product can provide outstanding gloss and UV protection.

Induron worked with both the TankSpek and GGA teams to provide coatings that would meet the artist's specifications. Fairey's team requested eight to 10 colors in aerosol form to apply the mural in the method to which they were accustomed. This is when Induron's Paul Powers reached out to Jason Shaw of MyPerfectColor to package Induron's finish coat for aerosol application. Not too long after, Indurlux 7600 was delivered onsite in the form of hundreds of rattle cans. The whole project was full of creative people bringing ideas to the table to make something happen that would've been largely written off as impossible.

PROTECTING THE PROVIDENCE

Coating Triples Maintenance Intervals for Floating Dry Dock

PROJECT LOCATION: MORGAN CITY, LOUISIANA

CLIENT/OWNER: BIBLIA MARINE TOWING AND TRANSPORTATION (SAVANNAH, GEORGIA)

CONTRACTOR: CONRAD SHIPYARD (MORGAN CITY, LOUISIANA); JMS NAVAL ARCHITECTS (MYSTIC, CONNECTICUT)

COATING SUPPLIER: SHERWIN-WILLIAMS PROTECTIVE & MARINE



PHOTO: COURTESY OF SHERWIN-WILLIAMS PROTECTIVE & MARINE

The Providence is a 120-foot-long, 60-foot-wide floating dry dock in Savannah, Georgia, that Biblia Marine Towing and Transportation will primarily use for hauling tugboats, including its own fleet and other vessels navigating local waters. It will replace Biblia's existing dry dock and serve as a primary means for pulling vessels out of the water for repairs. With the dry dock being a critical part of the company's repair and maintenance services for its own tugboats, as well as a money maker when transporting other vessels for similar service, Biblia wanted to maximize uptime for The Providence.

Looking for some added insurance to protect this lifeblood of its operations, Biblia specified an edge-retentive, ultra-high solids epoxy amine coating system – FastClad ER – which has been a Navy staple since 2004. Yet, it had not yet been used before in the commercial marine industry as many shipyards and vessel owners considered the technology to be overspecified. These parties are used to the five- to seven-year maintenance intervals realized with traditional coatings. However, FastClad ER reportedly offers a 15- to 20-year service life – triple to quadruple that of traditional coatings. With the coating meeting Biblia's longevity goals, the vessel owner specified the coating system to protect its new investment inside and out.

JMS Naval Architects from Mystic, Connecticut, developed a complete engineering and design package for the vessel. Conrad Shipyard constructed The Providence at the company's Morgan City, Louisiana, yard.

Stationed near the company's Savannah River facilities, The Providence will primarily haul tug boats. To do so, crewmembers on the floating dry dock fill its interior 6-foot-deep pontoon ballast tanks with river water to submerge the deck below the vessel that's going to be hauled. After getting that vessel into place between the 14-foot-tall wing walls of The Providence and over its submerged deck, operators pump water from the ballast tanks to raise both vessels out of the water. Maintenance crews can then repair the dry-docked vessel right from the deck of The Providence or transport it to a shipyard.

EXTENDING MAINTENANCE

Because the vessel's ballast tanks would be frequently immersed with brackish water from the Savannah River, the design team specified the application of a coating system to prevent corrosion and damage that could otherwise lead to expensive steel repairs and longer downtime during maintenance activities. Traditional systems used are two-component, high-solids, polyamine-cured epoxies that offer roughly five to seven years of life before requiring maintenance. With Biblia requesting a more robust system that could offer longer maintenance intervals, Sherwin-Williams suggested the FastClad ER system.

Sherwin-Williams noted that all parties involved would realize significant benefits with the proposed FastClad ER specification compared to using traditional coatings. First, applicators would save two coating application steps, several hours of curing time and all of the associated labor costs with the FastClad ER material. Second, the owner would realize far longer service lives. The FastClad ER system only requires one coat – and no stripe coating. It is also applied at a higher total film build of 20 to 30 mils DFT, providing additional protection.

Comparing the coating application steps, as well as the service lives, of the coating options proved a better overall cost and life expectancy for the FastClad ER system. The project team then specified the coating for nearly all parts of the vessel, providing the inside and outside of The Providence with a thicker, more robust system with a long service life.

DIALING IN APPLICATION

For Conrad Shipyard, the 100%-solids coating specification triggered a





PHOTO: (LEFT) COURTESY OF BIBLIA MARINE TOWING & TRANSPORTATION; (RIGHT) COURTESY OF SHERWIN-WILLIAMS PROTECTIVE & MARINE

training opportunity for its crew. Because the shipyard's applicators were unfamiliar with spraying this type of coating, Sherwin-Williams and Graco provided hands-on training at a Mobile, Alabama, Sherwin-Williams store. Company reps helped pump operators understand how to dial in settings to enable good flow and atomization of the thick, ultra-high solids material. Sprayed in one coat at a higher thickness than traditional epoxies, the material requires more care to ensure proper mixing and that lines and gun tips don't get clogged.

Pump operators and applicators easily picked up the nuances of working with the 100% solids epoxy, noting how quickly they were able to apply high film builds in a single coat. There was no difference at the gun for applicators in spraying this material other than slowing their passes down to enable the thicker builds compared to when spraying traditional systems. They were also able to touch up coatings quickly due to the product's one-hour recoat window. Inspection timing could also be streamlined, as the coating can handle foot traffic in three hours, which is much faster than the six- to eight-hour wait with traditional systems. These factors all contributed to fast shipyard throughput for Conrad Shipyard.

Inside the vessel's ballast tanks, applicators spray-applied a single coat of FastClad ER featuring Opti-Check optically activated pigment (OAP) technology for better quality control. This formulation features an optional additive that provides visual feedback for applicators and inspectors. OAPs embedded in the coating will fluoresce under eye-safe ultraviolet (UV) lighting, allowing applicators to shine a light on the single-coat lining while it's still wet and easily spot coating deficiencies so they can touch them up. After coatings have cured, inspectors can do the same, easily spotting any non-fluorescing areas that indicate a pinhole, coating discontinuity or thin area. The technology helps increase the likelihood of having holiday-free film builds, while also accelerating the inspection process.

EXTERIOR PROTECTION

For the exterior of The Providence's freeboard and pontoons, Conrad Shipyard applied a single coat of FastClad ER topped by a high-gloss finish using Sher-Loxane 800, a versatile, high-performance epoxy siloxane hybrid that combines the properties of both a high-performance epoxy and a polyurethane. This high-performance finish will reportedly retain the high gloss and radiant color of the vessel's Biblia Blue and Biblia Gray colors, as well as its white logo and lettering.

For the underwater hull, applicators again sprayed the FastClad ER system in a single coat at 20 to 30 mils DFT to provide the same additional protective insurance the coating offers on the rest of The Providence. Because the hull will be constantly submerged, the use of an antifoulant coating was also warranted. In the spirit of ensuring long-term maintenance intervals, Sherwin-Williams recommended using an epoxy tie coat to provide even stronger adhesion of the antifoulant coating. Applied at 4 to 6 mils DFT, the SeaGuard Tie Coat gave Conrad Shipyard an extended overcoat window of four days, which meant applicators would not have to retack the coatings prior to applying the antifoulant coating if weather delays postponed applications. Traditional

systems would need to be coated with antifoulants within a couple of hours.

For the antifoulant coating, applicators sprayed two layers of SeaGuard Copper Bottom Antifouling Paint #45 at 3 to 5 mils DFT each. This single-component formulation is designed for use on shallow draft vessels that sit for extended periods of time with insufficient movement and friction for an ablative antifoulant coating to be effective. Instead, the coating forms a very hard barrier that prevents marine biofouling from sticking to and growing on vessels. The coating has a moderately high concentration loading of cuprous oxide and a chemically modified binder that only slightly dissolves upon immersion service.

NEW DOCK BUILT TO LAST

Biblia's new floating dry dock, along with other upgrades and expansions for the marine services company, were made possible by a $1.3 million grant from the U.S. Department of Transportation that supported improvements at 28 small shipyards across the U.S. The company is protecting the investment of that grant money with the added insurance of the long-lasting FastClad ER coating covering nearly the entire square footage of The Providence. With its high film-build and holiday-free application, the robust, 100%-solids epoxy will help Biblia achieve its goal of extending maintenance intervals and reducing overall operational costs compared to if the operator had specified traditional coating systems. Biblia can expect The Providence to operate at least 15 to 20 years before requiring dry dock coatings service.

PEOPLE

Top People honors were assessed based on a number of qualities: protective and marine coatings industry impact, personal achievement, positive professional influence and extracurricular contributions to the community.

TEX ENOCH

Water Tank Market Manager, Induron Protective Coatings

Tex Enoch has been in the protective coatings industry for 50 years. He is well-known for his commitment to the industry, specifically the potable water storage tank industry, through participation on standards committees and industry-supporting organizations. Most notably, throughout his career, Enoch has earned the respect of his peers, including customers, coworkers and even competitors.

Enoch became Induron Protective Coatings' first dedicated "out-of-state" sales representative in 2008. Through his intimate knowledge of the water tank market and invaluable leadership, Induron successfully expanded its network of dedicated out-of-state sales representatives. Enoch's personal success and influence within the water tank painting community has directly contributed to Induron's growth and success.

Enoch values relationships over all and believes deeply in the concept of relationship selling. With every project, he invests in the success, satisfaction and reputation of his customers. He strives to make their lives easier by lending his expertise to the various elements that lead to a successful project. As evidenced by his many friends in the industry, Enoch has served as a valuable resource and partner to many for years. Over his career, Enoch has been a part of quite a few notable projects.





Tex Enoch is a 50-year industry veteran with Induron Protective Coatings. At right, he is pictured with his wife, Peggy.

More recently, Enoch specified the interior and exterior coatings systems for an iconic 7.5 million-gallon standpipe in Lancaster, Pennsylvania, with which Enoch has had a long-standing history. More than 40 years ago, he supplied Chicago Bridge & Iron the paint for the original paint job, and 20 years later, he specified the paint required to maintain the tank. So, when the tank's exterior began to show signs of corrosion in 2018, he was the expert to call!

In addition to offering coatings expertise, Enoch is involved with his community. Annually, Enoch participates in the Richie Ashburn Golf Classic Cradle of Liberty Council, which is a Boy Scouts of America annual charity golf tournament.

CARL BURRELL

Global Product Director – Fire, Sherwin-Williams Protective & Marine

Carl Burrell is responsible for leading the development, testing and market strategy for the company's full line of Firetex FX intumescent coatings. He has worked in the protective coatings industry out of Manchester, United Kingdom, for 24 years, beginning as a chemist at Leighs Paints in Bolton, U.K., in 1998 and rapidly advancing to roles of increasing responsibility within Leighs Paints and Sherwin-Williams (Sherwin-Williams having acquired Leighs Paints in 2011).

TECHNICAL SERVICE

Burrell is a global authority on fire protection, specifically the safety enhancements made possible with intumescent coatings. As such, he is a frequent presenter and sought-after consultant. Notably, he was involved with other experts across the globe at the very start of two key industry initiatives to develop codified standards for coatings that protect steel assets from hydrocarbon fires and cryogenic spill: ICC-ES (ICC Evaluation Service) AC523 – Intumescent Fire-Resistant Coatings and Mastic Fire-Resistant Coatings Used to Protect Structural Steel Members from Rapid Temperature Rise Fires and ISO 20088 – Determination of the Resistance to Cryogenic Spillage of Insulation Materials standard, respectively.

At the time of developing the ICC-ES AC523 standard, the International Code Council had not yet created standards for hydrocarbon fires – just cellulosic ones. Noting the importance of helping the hydrocarbon industry better protect assets, Burrell was part of the team that identified proper protection criteria to develop this new international standard, filling important gaps in the fire safety industry.

A similar approach occurred for the development of the ISO 20088 standard, as no standards existed at the time to address cryogenic spillage, which can cause steel structures to become brittle and crack, presenting significant potential safety issues. Asked to be part of the ISO Technical Committee 67 team, Burrell was instrumental in helping bring that overarching standard to market, culminating in a series of specialized standards designed to contribute to safety improvements in the field of cryogenic spill protection.

Burrell also worked on various Underwriter Laboratories activities, NORSOK standards reviews, and other fire and cryogenic industry-wide initiatives and committees, including the British Standards Industry (BSI) FSH 22/12 and FSH 22/14 fire resistance tests and UL Standards Technical Panels (STP) 263, 1709 and 2431.

PHOTOS, FACING PAGE: COURTESY OF INDURON PROTECTIVE COATINGS



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Acknowledging that he has "a passion for life safety coatings and services that protect the world around us" since the start of his career, Burrell advocates for improved safety, urging his peers, "when we think of fireproofing, we have to adjust our mindset from corrosion protection to human safety."



Carl Burrell

LEADING BY EXAMPLE

Burrell views his professional contributions as team efforts. That includes being part of two Sherwin-Williams teams recognized with the coveted Queen's Award for Innovation. The first Queen's Award was for Dura-Plate 301W, a product invention that extended coating seasons, enhanced efficiencies and reduced overall project costs for asset owners and applicators. The second Queen's Award credited the Sherwin-Williams team for a new fire protection coating — FIRETEX FX6002 — with drying, weather and damage resistance, as well as aesthetic appeal, that's designed to protect assets in the harshest of environments.

Notably, Burrell also has collaborated with his colleagues at Sherwin-Williams to conduct detailed life cycle analyses (LCAs) of the company's coating materials to determine the resources required to manufacture, distribute, apply, remove and dispose of them. These LCAs are based on exhaustive Environmental Product Disclosures that are used to inform sustainability inputs. These inputs are incorporated into the independently accredited FIRETEX Fire Design Estimator software developed by the Sherwin-Williams Fire Engineering and Estimation Team (FEET), including Burrell, to enable architects and designers to understand how their design decisions affect the sustainability of a building. Team members are able to alter steel member sizes and appropriate coating thicknesses for specific fire ratings to determine the most sustainable building design approach.

As a leader, Burrell is passionate about driving best practices and developing standards for the industry, as well as mentoring entry-level, mid-management and rising leaders within and outside Sherwin-Williams. In addition to his knowledge and experience, he is known for his strong work ethic, integrity and grace. Mentoring, for Burrell, is about "encouraging people to look at the bigger picture and not be consumed in what you are doing in the immediate here and now. How can what you are doing now be modified to have the biggest, widest impact? I think this applies to people at all levels of their career and stages of life."

As a father to three, Burrell has had to set priorities and limitations to his volunteer work up to this point in his career. Still, he has made time to serve his community in numerous ways. Burrell is a sports and exercise enthusiast, particularly enjoying weight training, cycling, football and rugby, and not surprisingly, he has found ways to give back to the community in these areas. For example, he coached rugby for children under six years old ("Not the easiest thing I've ever done!" he noted) and assists members of Arnie's Inclusive Powerlifting & Weight Training Club, a local club for disabled people to learn and enjoy the art of powerlifting.

With coaching, Burrell "wanted to make sure the kids had a great time every Sunday morning, but I also wanted to introduce the values of teamwork and respect." He worked with a team of other dads to accomplish this. With the Arnie's Club, Burrell helps physically challenged individuals navigate the equipment, spots them on their lifts and provides motivation, "shouting when needed," to make sure they get the most out of their time in the gym. "Exercise is so powerful for overall wellbeing, not just physical," Burrell says. "To help people achieve their goals is incredibly rewarding."

Burrell also contributes to several charities, with Shelter (a homeless charity in the U.K.) and Stockport food banks being "closest to his heart." He also has been part of the Sherwin-Williams activities with the University of Manchester.

The Nominating Process for 2022

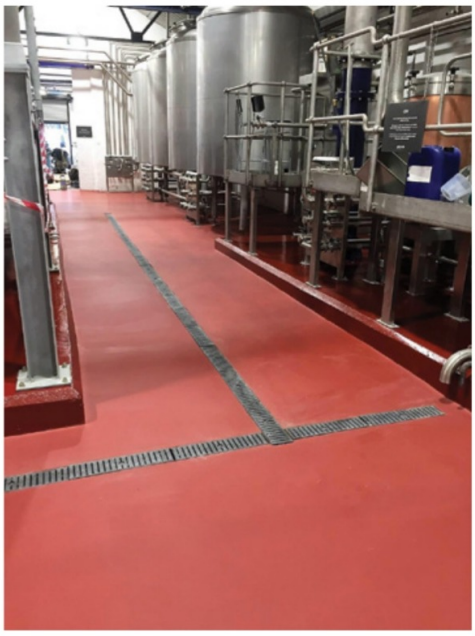
The start of the 2022 JPCL Prestige Awards nominations period is just around the corner! Beginning **June 1**, all nominations will be accepted online at **paintsquare.com/prestige**.

Now in its sixth year honoring protective and marine coatings industry achievements, the 2022 awards program will include updated categories, an enhanced online nominations form and a new judging panel. Completion of projects or product launches must be **between Jan 1, 2021 and May 31, 2022**.

Watch for additional details and deadline reminders in upcoming issues of JPCL and *PaintSquare Daily News*.

PHOTO: COURTESY OF SHERWIN-WILLIAMS PROTECTIVE & MARINE





FasTop Multi Systems were recently applied to protect the floors at two new brewery facilities located in Ohio.

PRODUCTS

INNOVATION: FASTOP MULTI SYSTEMS

Sherwin-Williams High Performance Flooring

FasTop Multi Systems are ideal resinous flooring systems for demanding, heavily used spaces like commercial kitchens – where the floor might be exposed to hot cooking oils and steam – along with food and beverage plants, breweries, dairies, manufacturing plants, garages, warehouses and chemical processing plants. These tough, long-lasting polyurethane flooring solutions hold up against repeated wear. They are hygienic, meaning they can be easily cleaned and disinfected to promote sanitary, healthy environments. In addition, the coating systems are resistant to chemicals, abrasions, slips, heat, steam and moisture.

Enhancing installation ease and aesthetics for the flooring market, the FasTop Multi Systems portfolio of polyurethane flooring solutions consists of new, finer aggregate blends that improve flow and leveling during application. With a finer aggregate than other systems, installers are better able to ensure a complete mix of the aggregate and binder. That well-blended material then flows and levels easily when poured over a concrete substrate with reduced pinholes in the coatings surface, minimizing rework for installers for faster returns to service. Further promoting fast project turnarounds, the product cures at lower temperatures. FasTop Multi Systems are packaged as four-component systems featuring a universal base and hardener, with the aggregate filler and color added separately. A truly unique feature of the products, all of the aggregate components for the systems are neutral in color, which reduces the number and quantity of materials installers need to keep in stock. In addition, liquid color packs take up less space on shelves and allow for more efficient storage.

The FasTop Multi System portfolio is comprised of six systems: two self-leveling solutions (FasTop SL23 and FasTop SL45), two screed flooring solutions (FasTop TG69 and FasTop RS69), a cove base system (FasTop Multi Cove Base System) and a topcoat (FasTop Multi T100).

PHOTOS: COURTESY OF SHERWIN-WILLIAMS HIGH PERFORMANCE FLOORING

FasTop Multi Systems were installed in two new Ohio breweries: Cartridge Brewing in Maineville and Loose Ends Brewing in Centerville. Both businesses hired Hardig Industrial Services from Cleves, Ohio, to select the material and lay the floor. Hardig chose FasTop Multi Systems for their ease of application, durability, hygienic qualities and chemical and slip resistance. The floor at Cartridge Brewing was installed in June 2020 in a historical building that was once an ammunition factory during World War I and World War II. Hardig used FasTop SL45 due to the product's self-leveling feature and its resistance to thermal shock, abrasion and chemical attack. FasTop SL45 was spread over an 1,800-square-foot production area, and Hardig applied Elladur 4850, a two-component, high-solids resin, as a topcoat. Because FasTop dried so quickly, workers were able to perform detail work the same day and walk on the floor within two hours of application. At Loose Ends Brewing, a brand new plant built from the ground up, Hardig applied FasTop SL45 in the production area and FasTop SL23 in the kitchen in June 2020, after the Cartridge job. Hardig had planned to use a different flooring system at Loose Ends, but after seeing the results at Cartridge, the company switched course. Again, Elladur 4850 was used as a topcoat. Color and aesthetics were important in both the Cartridge and Loose Ends projects. Both businesses had asked for standard polyurethane cement gray and red colors. A wide choice of colors is another reason why Hardig likes the FasTop line of products. Appearance is important at breweries because these businesses like to show customers their beer-making processes.

Another project involving FasTop Multi Systems took place at Pikes Peak Research Lab in the Rocky Mountains of Colorado. A building called the High Altitude Research Lab was constructed for the U.S. Army. The laboratory, 14,000 feet above sea level, is designed to study the effects of altitude on soldiers. The weather there continually changes, and officials were concerned how moisture vapor might affect the floor. Builders chose FasTop Multi Systems because it can withstand the harsh climate. They liked FasTop's quick turnaround, ease of application and, of course, the end results. Additionally, FasTop allowed them to repair cracks in the concrete slab.

INSPECTION EQUIPMENT: NEW POSITECTOR GAGE BODY

DeFelsko Corporation





For nearly 40 years and five generations, the PosiTector platform has been a pioneer in the coatings inspection industry. The new PosiTector gage body builds on this legacy with many industry leading features including a larger 2.8-inch impact resistant color touchscreen with a redesigned keypad for quick menu navigation with or without gloves, new ergonomic design with a durable rubberized grip for comfortable all-day inspection, an updated modern user-interface and on-gage help to explain menu items at the touch of a button. The new weatherproof, dustproof and water-resistant IP65-rated enclosure and shock-absorbing rubber holster are ideal for the toughest environmental conditions, including an unexpected rainstorm. Featuring the award-winning probe interchangeability that set the previous model apart, the new gage body is backwards compatible with nearly every PosiTector probe manufactured since 2012.

The PosiTector gage body accepts all coating thickness (6000/200), surface profile (SPG/RTR), environmental (DPM), salt contamination (SST), hardness (SHD/BHI) and ultrasonic wall thickness (UTG) probes. This innovation allows quick conversion

PHOTOS: COURTESY OF DEFELSKO CORP.

from a coating thickness gage to a surface profile gage, dew point meter, soluble salt meter, hardness tester or ultrasonic wall thickness gage with a simple probe change. Each probe retains its own unique calibration information allowing for full probe interchangeability. Long form certificates of calibration are included with each probe.

NEW GAGE FEATURES

Other new features of the new PosiTector gage body include:

- A touchscreen keyboard for quickly renaming batches, adding notes and more (Advanced only);
- On-gage help explains menu items at the touch of a button;
- Instant-on feature, which powers up the gage in a fraction of a second if recently powered down;
- Updated, stylized user interface retaining the same familiar menu structure for easy one-handed menu navigation with or without gloves;
- Up to 30% longer battery life;
- Universal ¼-inch-20 mounting point for securing gage to optional belt clip and other accessories;
- The PosiTector 6000 SSPC-PA2, ISO 19840 and IMO PSPC 90/10 modes help users comply with standard by prompting for max/min specifications, displaying the necessary readings and automatically calculating statistics with a pass/fail result (PosiTector 6000 only); and
- Backwards compatibility with nearly every probe manufactured since 2012 including coating thickness (6000/200), surface profile (SPG/RTR), environmental (DPM), salt contamination (SST), hardness (SHD/BHI) and ultrasonic wall thickness (UTG) probes.

Submitting Your Work

2022 JPCL Prestige Award nominations should include detailed information about the impact that the product, project or person has made on the protective coatings industry, as well as high-resolution photographs to accompany the written nominations. Send questions about the awards to Charlie Lange, Editor-in-Chief, JPCL, at **clange@technologypub.com**.



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COATINGS FOR STEEL FLUOROKEM HS 100

Sherwin-Williams Protective & Marine

Fluorokem HS 100 is a two-component fluoropolymer urethane coating, an upgrade of the original Fluorokem HS formulation. The high-solids, low-VOC product is ultradurable, meaning it extends maintenance and repainting life cycles, thus providing long-term cost benefits and enhanced uptime over the life of an asset. Formulated with fluoropolymer urethane chemistry using light stabilizing pigments, Fluorokem HS 100 provides exceptional color and gloss retention that significantly outperforms conventional urethanes, even under severe environmental exposures and/or extreme weather conditions. It also has low dirt pickup. The coating is attractive and ideal for use on highly visible steel and concrete surfaces, including storage tank exteriors, water tanks and towers, bridges, marine vessels, municipal buildings, museums, schools, stadiums, fascias, iconic structures and logos. Fluorokem HS 100 is also high-performance with improved flow and leveling during application due to the coating's longer working times. That lengthier time also provides a longer window to tie the coating into previously coated areas. In addition, Fluorokem HS 100 is low in volatile organic compounds (VOCs), measuring at less than 100g/L.

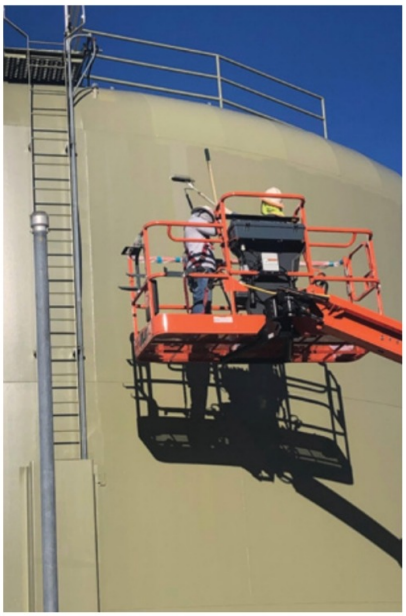
Fluorokem HS 100, in an improvement over the original Fluorokem HS, contains light-stabilizing pigments that lessen the impact of ultraviolet (UV) rays, thus lengthening the life of the coating and preserving its color and gloss, more so than conventional urethanes. The color fade resistance for Fluorokem HS 100 exceeds that of Fluorokem HS. Even the original Fluorokem HS, during accelerated weather testing, outperformed high-performance urethanes in gloss retention. Fluorokem maintained nearly 100% gloss retention – compared to 20% to 30% from competitive high-performance urethanes and 10% to 20% from traditional urethanes – over a 13,000-hour period. That translates into longer intervals between recoatings, less downtime and lower costs.



Sherwin-Williams' FluoroKem HS 100 can be applied to both steel and concrete surfaces, such as water tank exteriors.

PHOTO: COURTESY OF SHERWIN-WILLIAMS PROTECTIVE & MARINE

Color and gloss retention are key on assets like municipal water towers, which a local government wants to keep attractive for the town's image. A city may decide to repaint a water tower if the color and gloss have faded, even though the coating's corrosion protection is still strong. The city can save money if the color and gloss last as long as the corrosion protection, allowing it to delay repainting for a few years. Fluorokem HS 100 performed well in QUV Accelerated Weathering Tester studies, which in a few days or weeks reproduce damage normally caused by sunlight, rain and dew over months or years. The coating is exposed to UV lamps in the UVA, UVB and UVC portions of the spectrum, thus simulating natural sunlight and artificial lighting. Dew and rain are simulated with condensing humidity and/or water spray. Sherwin-Williams can expedite color matches for Fluorokem HS 100 in five days, through its Rapid Response Program, for small quantities between one and 250 gallons.



The new FluoroKem coating reportedly allows for longer recoat times.

PHOTOS: (BOTTOM) COURTESY OF SHERWIN-WILLIAMS PROTECTIVE & MARINE; (TOP) COURTESY OF INDURON PROTECTIVE COATINGS



COATINGS FOR CONCRETE: MORTARCHEM

Induron Protective Coatings

Cementitious epoxy mortars are a vital step in most concrete lining projects, but the existing products available to contractors have been fraught with problems and difficult applications. Induron's Mortarchem represents the next generation of this technology.

Mortarchem is a high-performance epoxy modified cementitious surface and repair mortar used to restore deteriorated masonry substrates prior to application of chemical resistant topcoats. When applied as a parge coat over properly prepared new concrete, Mortarchem fills bug holes, seals pores and mitigates outgassing.

According to Induron, Mortarchem was designed to simplify the application process while delivering better performance and improved applicator production. Mortarchem, packaged in a single container, simplifies the application process right from the start. With all three components conveniently contained within the same package, there is no confusion or time lost searching for misplaced or mismatched components. The viscosity of the mixed product has a significant application advantage versus the competition, in part, because the ceramic microspheres, which make up a portion of the pigment package, aid viscosity by both their weight and shape. A simplified application yields better production.

Oftentimes, mortar resurfacing projects will require a significant amount of material. Mortarchem, weighing approximately half that of competitive products, makes moving the product around the job site easier and safer. Once applied, small imperfections, such as fins, are easier to sand or stone off in order to achieve the desired smoothness for a successful coating installation.

Long-term performance is often the result of better application. Induron developed Mortarchem to spray, trowel and finish, smoother and more efficiently than other products. JPCL

NEWS FROM THE TRACKER

OR Rail Bridge Rehab Project Bidding

Awards: PA Vehicle Facility, VA WWTP

BY KONSTANTINE FEKOS, PAINT BIDTRACKER



PROJECT PREVIEWS

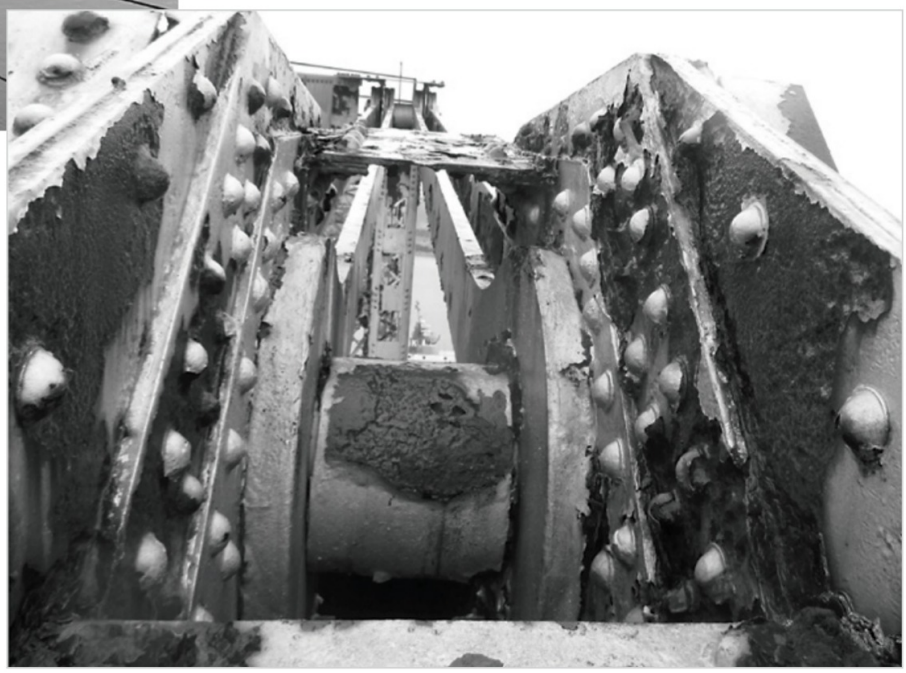
The **Port of Coos Bay** is seeking contractors to perform rehabilitation of steel members on three swing span rail bridges and approach spans located in Coos Bay, Oregon.

The contract involves replacement and rehabilitation of multiple steel members, as well as the associated track work to three swing span rail bridges and their related approach spans, including substantial temporary shoring and temporary bridge supports. The project includes cleaning existing surfaces to Hand and Power Tool Cleaning standards (SSPC-SP 2, SP 3). No abrasive blast-cleaning will be allowed on the bridges.

Work will include application of a three-coat zinc-rich system to all new structural steel members and existing structural steel surfaces damaged by contracting operations. The primer must have the capability of penetrating and adhering to poorly prepared surfaces. All micaceous iron oxide utilized in the intermediate coats and topcoats will conform to ASTM D 5532-94 Standard Type I. Residual lead paint may still remain on the bridge. Containment and disposal are required.

The owner-approved coating manufacturer is Wasser or an approved equivalent. The primer and intermediate coats will be equivalent to Wasser High Tech Coating MC-MioZinc (a urethane resin with zinc and micaceous iron oxide pigment system) and MC-MioMastic (a urethane resin with micaceous iron oxide system), respectively. The top coat will be equivalent to Wasser High Tech Coating Ferrox A.

Bids are due March 29.



PHOTOS: COURTESY OF THE PORT OF COOS BAY

PAINTBIDTRACKER
To try the project lead service, visit paintbidtracker.com/free-trial.

Sierraville Public Utility District is soliciting bids for the construction and painting of a 590-square-foot pump station. This project involves applying a three-coat system of latex on interior walls and ceilings; a single-coat system of latex on interior concrete slabs and exterior landings; a three-coat system of alkyd on exposed iron pipe fittings; a three-coat system of epoxy on interior and exterior ventilation ducts; a three-coat system of urethane on exposed structural and miscellaneous steel surfaces; and a two-coat system of siloxane on exterior concrete masonry units. Surfaces must be cleaned and prepared in accordance with standards for Solvent Cleaning (SSPC-SP 1), Hand Tool Cleaning (SSPC-SP 2), and Power Tool Cleaning (SSPC-SP 3). The manufacturer for this project is Sherwin-Williams or an approved equal. Bids are due April 14. JPCL

PROJECT AWARDS



The Pennsylvania Department of Transportation has awarded a $1,478,000 contract to Penn State Construction (Lewistown, Pennsylvania) for the construction of a vehicle wash building in Bridgewater Township. The project involves application of a three-coat system of epoxy on interior wood and concrete surfaces, and a three-coat system of alkyd on interior and exterior gas piping. Surfaces require cleaning and preparation in accordance with standards for Solvent Cleaning (SSPC-SP 1), Hand Tool Cleaning (SSPC-SP 2), Commercial Blast Cleaning (SSPC-SP 6/NACE No. 3) and Near-White Metal Blast Cleaning (SSPC-SP 10/NACE No. 2). Approved manufacturers for this project include PPG, Pratt & Lambert, Sherwin-Williams, Valspar or an approved equal.

The Virginia Department of Transportation has awarded a contract in the amount of $3,960,000 to J.S. Haren Company (North Athens, Tennessee) for the rehabilitation of a wastewater treatment plant at the Charlottesville Safety Rest Area, Interstate 64 westbound. This project involves coating all doors and frames with one coat primer and one finish coat of enamel paint, coating concrete floors with a heavy-duty polyurethane floor finish, touch-up coating of hangers and supports, and galvanized repair of welds and bolted connections.

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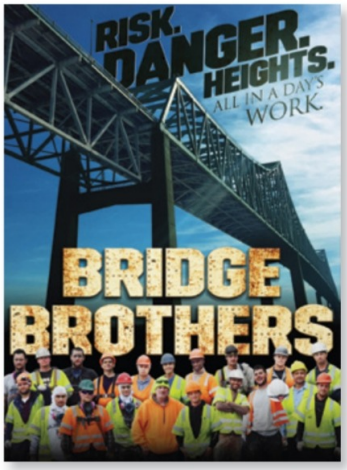

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PAINT BY NUMBERS

43,000+

The estimated number of bridges in the U.S. that are rated to be in poor condition according to the most recent National Bridge Inventory. P7

Oct. 25–28

The recently announced dates for the fifth annual Contractor Connect hosted buyer event in Hammock Beach, Florida. P8

40

The minimum Shore D hardness measurement level that a newly applied intumescent coating system failed to reach, resulting in premature blistering. P10

3

The number of rail swing bridges involved in a steel rehab contract currently out for bid at the Port of Coos Bay, Oregon. P36

8

The number of awards bestowed as part of the 2021 JPCL Prestige Awards program, which honors the top people, products and projects in industrial coatings. P24

1865

The year that Charles P. Hatch of the Empire Transportation Company invented the first rail car. P16

PHOTO: ARTISHOKCS / GETTY IMAGES