COATINGS 101: WHY SURFACE PREP IS SO IMPORTANT P13 TEST LININGS FOR THE BIOFUEL ENERGY TRANSITION P28

SPONGE MEDIA, ROBOTICS SOLVE SURPRISING ISSUE P17



An Unexpected Challenge Leads to a HIGH-TECH SOLUTION

BY DREW JOHNSON, CORROSION CONTROL RESOURCES, INC.

FIG. 1: The contractor found that the pipe interior was lined with coal tar enamel, a much thicker and harder to remove coating than coal-tar epoxy. The coal-tar enamel coating varied in thickness throughout the pipe, averaging between 250 and 500 mils.

nexpected jobsite findings, especially when combined with an extremely tight deadline, can completely derail a project, costing both the client and the contractor time, resources and money.

This, however, was not the case when one coating contractor arrived on the scene at Arlington Water Utilities Pump Station in Arlington, Texas, expecting to find a raw water pipe lined with coal tar epoxy, but instead found coal tar enamel in the pipe's interior – which is a much thicker coating than coal tar epoxy.

With that discovery, the contractors knew that they had to pivot and come up with another solution for the lining removal. Ordinary hand-blasting with coal slag was no longer a viable option for the removal of the coating and the surface preparation of the water pipe.

This article will describe how, by working with a great team of experts, the crew was able to switch gears and remove the coating by robotic blasting with sponge media and get the interior surface of the pipe ready for a new coating system application.

Unexpected jobsite findings, especially when combined with an extremely tight project deadline, can completely derail a project, costing both the client and the contractor time, resources and money.

Project Background

The raw water pump station at the heart of this project sits on Lake Arlington and is owned by Arlington Water Utilities. The City of Arlington, as well as the Trinity River Authority (TRA), use Lake Arlington as a source for raw water. The lake was built in the late 1950s and spans 1,926 acres. Although the City of Arlington owns the lake, it is a part of a chain of reservoirs and lakes that provide water to North Central Texas.

The Arlington Water Utilities Pump Station was built in 1974 and, as with most infrastructure from this time period, various rehabilitations and repairs have been made over the years. Recently, however, it became apparent that a complete overhaul of the pump station and piping was needed. The \$21 million renovation project was a joint venture funded by Arlington Water Utilities and TRA.

The coating contractor was brought on by the project's general contractor to perform removal of the existing internal lining of a 60-inch (1.5 m) raw water line. Once the liner was removed, the crew was tasked with relining the pipe. Limits of the liner removal and relining were defined as inside the pump station to outside the pump station where the aerial (aboveground) pipe transitioned below grade.

The pump station and pipe are a crucial part of the water supply system, and the coating contractor crew felt the pressure of getting the pipe back into service as quickly as possible, with only 28 days allotted to remove the existing liner in the pipe, recoat, allow for cure time and get the pipe back into service. As a result, the crew would have to work around the clock to meet this deadline, and there was little – if any – room for error.

An Unwelcome Surprise

Prior to the five-man crew beginning the surface preparation and coating application, the old pumps and piping were removed from the pump station. These were to be replaced



FIG. 2: The crew had their work cut out for them as the coal-tar enamel had failed in areas, leaving behind corrosion in the 60-inch raw water pipe.

HOTO: COLIBTESY OF THE ALITHO



FIG. 3: Given the surface area, the total coal slag abrasive media (top) required for this job was estimated to be 21 to 22 semi-trucks filled with abrasive media. After test blasting determined that 100 lbs. of coal slag removed just under 1 square foot of coal-tar enamel, it was apparent that sponge media (bottom), along with robotic abrasive blasting, was the only viable option.

later on in the overall rehabilitation project with new pumps and piping. Inside the pump station, a butterfly valve was cut out of the water pipe to create an 8-linear-foot access opening for the crew.

When the contractor's project manager and team arrived and began disassembling the piping, they found the pump cans were lined with coal-tar epoxy lining, but the pipe was lined with coal tar enamel. The coal-tar enamel varied in thickness, but averaged between 250-500 mils (6,500-13,000 microns).

The discovery of coal-tar enamel coating was a huge roadblock for the crew. Coal-tar enamel is a very thick lining that has been phased out over the last couple decades.

To give readers an idea of the difference between epoxy and enamel: coal-tar epoxy is typically anywhere from 8–15 mils (200–400 microns) thick, while coal-tar enamel is 10 times that thickness.

Faced with having to remove a lot more material using hand blasting with coal slag abrasive, the project manager immediately knew that this method wasn't going to work and started to consider other approaches – namely, using sponge media through a robotic abrasive blasting unit to pull off this undertaking.

To prove that ordinary grit was not the right choice given the newly discovered coal-tar enamel lining, the crew performed a test blast using ordinary blasting equipment and coal slag abrasive on a section of the pipe. Results of the test blast showed that 100 lbs. (45 kgs) of media removed just under 1 ft 2 (0.1 m 2) of coal-tar enamel. Given the surface area of 3,500 ft 2 (325 m 2), the total media required with minimal waste would be 350,000 lbs. (160,000 kgs) – or about 21 or 22 semi-trucks filled with abrasive media.

In addition, the estimated timeframe to complete the removal with grit was 20 weeks, a schedule that was unacceptable to the project manager, not to mention the general contractor and the client. There was simply no way that the pipe could be out of commission for that long.

After the test blast, the engineers on the project determined that sponge media, along with robotic abrasive blasting equipment, would the most viable option to save the job and keep the contractor's schedule on track.

The speed of coal-tar enamel removal varied based on the thickness of the coal-tar enamel. The robot speed varied, but ran most of the time at 2.2 inches (6 cm) per minute.

In addition to saving time and money, the robotic system provided a safer way to remove the coaltar enamel lining from the interior of the pipe.

AUGUST 2022 / VOL. 39, NO. 8



FIG. 4: Robotic abrasive blasting was a safer option for the crew, allowing for reduced man hours spent in the confined space of the pipe.

With the 60-inch diameter pipe, that equates to $2.87~\rm{ft^2}$ ($.25m^2$) per minute. To compare, it took two minutes and 32 seconds to remove under 1 ft² ($.1m^2$) of liner when hand-blasting with coal slag. Even when accounting for the robot having two nozzles, it is still safe to say that using this method was approximately three-to-four times as fast as conventional hand blasting.

In addition to saving time and money, the robotic system provided a safer way to remove the coal-tar enamel lining from the interior of the pipe. If the contractors had attempted to use hand blasting with coal slag, the crew would not only have been blasting in a confined space, but they would have also had to carry the 350,000 lbs. (160,000 kgs) of abrasive media out of the pipe, bucket by bucket. With robotic abrasive blasting, the man-hours the crew spent in the confined space of the pipe was significantly reduced, making the jobsite much safer. The robot was operated from a pendant, which allowed operators to remotely adjust drive speed, direction and blast arm rotation. However, because of the hazardous nature of the existing lining, the team wore special protective suits, extra-heavy chemical gloves and utilized protective breathing gear when in any type of contact with the coal tar enamel. The same PPE was used later on in the project when they began the coating application process.

Ultimately, only one truckload of sponge media waste was hauled away from the jobsite – a great reduction from the more than 20 truckloads that could have been required if grit and hand blasting was used.

22 JPCL / JPCLMAG.COM

Coating the Pipe Interior

The coating contractor crew spent 11 days on the lining removal and surface preparation portion of the job, and a third-party inspector was brought onsite prior to the application of the lining system. The inspector measured pipe wall thickness, surface profile and surface cleanliness to make sure that proper adhesion of the new lining system could occur.

When it came to the lining system chosen for the interior of the raw water pipe, the contractor consulted with coating manufacturers to come up with the correct specifications for the lining system, ultimately choosing an 80%-solids epoxy coating specially designed for application in pipes and tanks containing potable water, wastewater and salt water. The chemical- and abrasion-resistant coating meets requirements of AWWA C210 for coating systems for the interior and exterior of steel water pipelines, and was formulated with cure times that ensure a rapid return to service.

Using heavy-duty pneumatic airless spray equipment, the crew applied three coats of the coating in contrasting colors (white, blue and white) at a DFT of 7 mils per layer. In between the first white coat and the blue coat, the crew applied a stripe coat to all edges, welds and transition areas. Special termination was made in some areas using a 100%-solids epoxy surfacing compound designed as a fairing compound for weld seams and riveted connections. The crew also sealed the areas where the pipe was mechanically joined together internally





FIG. 5: At top is the SSPC-SP5/NACE No. 1, "White Metal Blast Cleaning" finish achieved using robotic blasting. The bottom photo shows (from left to right) the surface before and after robotic blasting with sponge media.





FIG. 6: Using spray application equipment, the crew applied three coats of an 80%-solids epoxy coating specially designed for application in pipes and tanks containing potable water, wastewater and salt water, in contrasting colors (white, blue and white) at dry film thickness of 7 mils per layer. In between the first white coat and the blue coat, the crew applied a stripe coat to all edges, welds and transition areas.

with a high-performance, non-sag, NSF-approved chemical resistant elastomeric joint sealant.

After the coating application, the contractor performed QC testing that included visual inspection, dry film thickness measurements and holiday testing in accordance with NACE SP0188. A third-party inspection was also performed and, after any necessary repairs were made, the pipe lining underwent a final inspection and holiday test.

Controlling Environmental Conditions

Throughout the duration of the project, the contractor continuously monitored environmental conditions inside the pipe to ensure the success of each stage of the process.

Dealing with the humidity was a huge factor in the success of this job, both from the surface preparation and coating application standpoint. In Texas, relative humidity is always an issue, and in this case, the crew also had to deal with being only 15 feet from the lake, in some areas. To combat the humidity and keep the interior of the pipe dry, the crew built their own scaffolding system and built containment around the pipe opening using a high-mil poly.



FIG. 7: The crew performed QC testing that included visual inspection, wet film thickness testing, dry film thickness measurements and holiday testing in accordance with NACE SP0188.









FIG. 8: The contractor was able to complete the job in the extremely tight timeframe of 28 days; 11 days were spent on lining removal and surface preparation, and the remaining time was dedicated to the application of the new lining system.

ABRASIVE BLASTING

A 5,000 CFM desiccant wheel dehumidification unit was set up and ran the entire duration of the project. The dehumidification unit allowed for a constant flow of dry air to go through the pipe. The contractor was able to environmentally control the interior of the pipe to prevent flash rusting during the robotic abrasive blasting and create the proper conditions for the application of the new liner.

Conclusion

At first, finding the coal-tar enamel coating in the pipe seemed like an insurmountable challenge for the contractor, especially given the original plan to remove the existing liner using hand blasting and coal slag. However, with some outside-the-box thinking, a team of industry experts, a high-tech surface prep and coating removal method, and a carefully chosen coating system, a resounding success was achieved on all fronts.

Using robotic abrasive blasting saved time and money, created less waste and, most importantly, provided a much safer option for the contractor's crew. All of this, coupled with high-performance coating materials, allowed the team to turn the water pipe over to Arlington Water Utilities on schedule and with a new liner that will extend the service life of the pipe and keep water flowing to residents.



ABOUT THE AUTHOR

Drew Johnson is the General Manager of Corrosion Control Resources. He has more than 20 years of experience in the protective coatings industry, holding various technical service and project management positions over the course of his career. Johnson is a NACE-certified Coating Inspector (Level 3) and an SSPC-certified Protective Coatings Specialist and is currently working towards earning a degree in construction engineering from the University of Southern Mississippi.

26 JPCL / JPCLMAG.COM