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MARCH 2015

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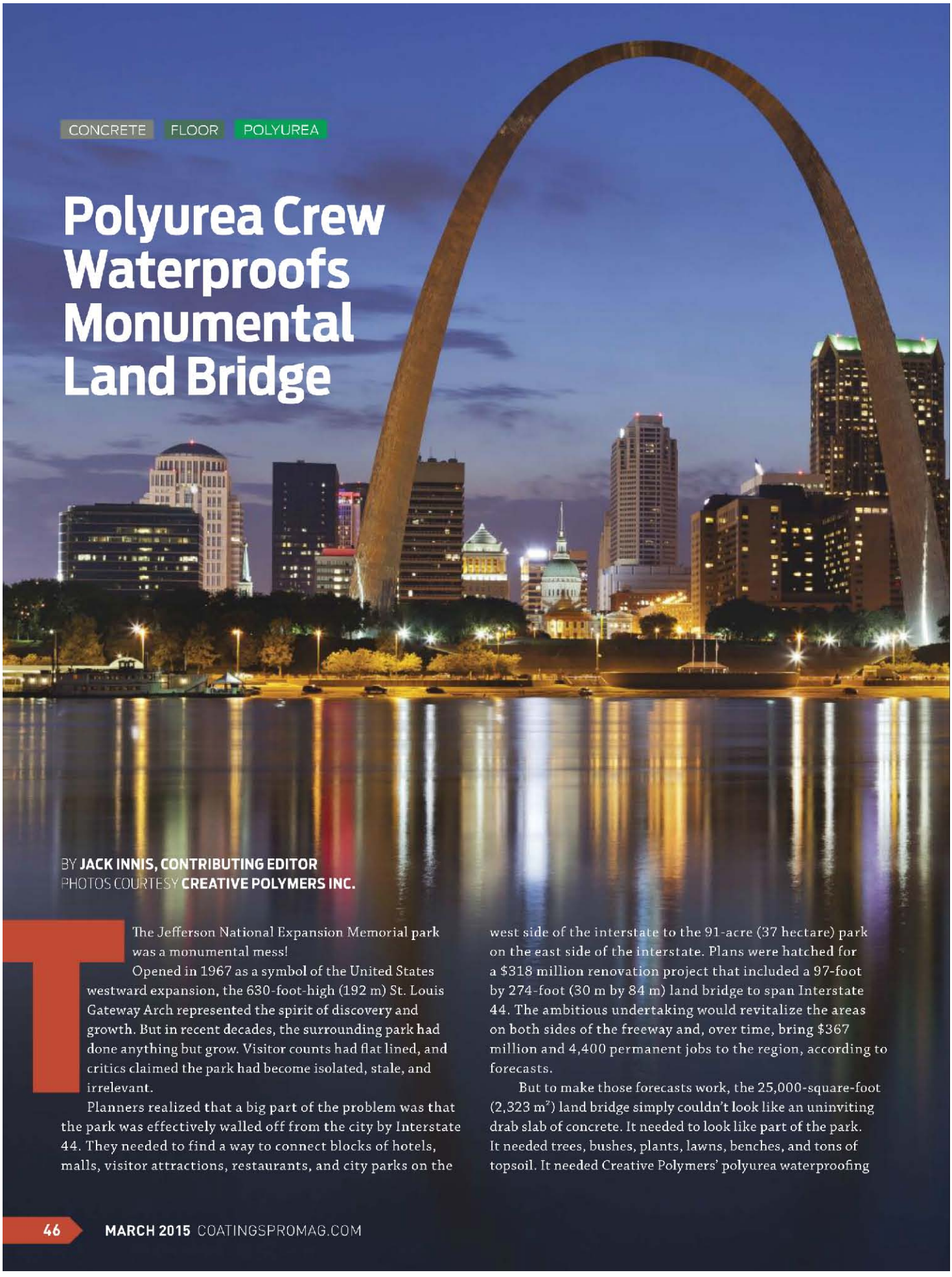
Polyurea Crew Waterproofs Monumental Land Bridge



BY **JACK INNIS, CONTRIBUTING EDITOR**
PHOTOS COURTESY **CREATIVE POLYMERS INC.**

The Jefferson National Expansion Memorial park was a monumental mess!

Opened in 1967 as a symbol of the United States westward expansion, the 630-foot-high (192 m) St. Louis Gateway Arch represented the spirit of discovery and growth. But in recent decades, the surrounding park had done anything but grow. Visitor counts had flat lined, and critics claimed the park had become isolated, stale, and irrelevant.

Planners realized that a big part of the problem was that the park was effectively walled off from the city by Interstate 44. They needed to find a way to connect blocks of hotels, malls, visitor attractions, restaurants, and city parks on the west side of the interstate to the 91-acre (37 hectare) park on the east side of the interstate. Plans were hatched for a $318 million renovation project that included a 97-foot by 274-foot (30 m by 84 m) land bridge to span Interstate 44. The ambitious undertaking would revitalize the areas on both sides of the freeway and, over time, bring $367 million and 4,400 permanent jobs to the region, according to forecasts.

But to make those forecasts work, the 25,000-square-foot (2,323 m^2) land bridge simply couldn't look like an uninviting drab slab of concrete. It needed to look like part of the park. It needed trees, bushes, plants, lawns, benches, and tons of topsoil. It needed Creative Polymers' polyurea waterproofing

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system to protect the concrete land bridge from tree root infiltration, water seepage, and premature deterioration.

Potential Colossal Failure

St. Louis-based Coatings Unlimited, Inc. (CUI) won the application bid, but company vice president Steven R. Philipp, Jr. and project foreman Larry Faltus quickly identified a potential colossal failure. As soon as CUI finished installing the waterproofing system, teams of landscapers were slated to bring in more than 20,000 cubic yards (15,291 m^3) of soil, materials for 944 linear feet (288 m) of bench seating, and more than 220 mature trees. To install these things, landscapers would have to drive earthmovers, bobcats, and other machinery directly on top of the waterproofing system. Hey, polyurea is tough, but would it stand up to intentional abuse? The project brain trust decided not to take the chance. If earthmoving equipment somehow compromised the polyurea, tree roots could infiltrate, water could seep into the slab and corrode the rebar, and in a few years, chunks of concrete could begin falling onto cars.

"Originally the idea was simply to prep, prime, and put 100 mils [2,540 microns] of fast-set polyurea over everything," said Philipp. "But when the owners became concerned about working on top of the polyurea, we wanted to come up with an option so they could protect the integrity of the waterproof membrane. We're not talking boots on the ground here; we're talking heavy equipment."

The National Park Service in St. Louis, Mo., decided to build a 97-foot by 274-foot (30 m by 84 m) land bridge over Interstate 44; it needed a coating system and topsoil to cover the concrete.

An eight-person crew from Coatings Unlimited, Inc. (CUI) was brought in to waterproof the new concrete land bridge over I-44 near the Jefferson National Expansion Memorial park, and, therefore, the St. Louis Arch.

Philipp turned to Creative Polymers president Rodney Jarboe, who drew upon more than three decades of experience as a polymer coatings chemist. He suggested topping the 100-mil (2,540 microns) polyurea system with a slower curing 50-mil (1,270 microns) polyurethane system into which the crew could embed a layer of 8-ounce (227 g) geotextile fabric.

"You have to have at least five to ten minutes of open time to install the fabric," said Jarboe. "Polyurea cures in seconds, and you really can't slow it down to more than a minute or two, so we went to slower-curing polyurethane to bond the geotextile into."

Thinking the additional polyurethane/fabric layer would act as insurance against a potential disaster of titanic proportions, the specs changed to 150 mils (3,810 microns) total dry film thickness (DFT) of primer, polyurea, polyurethane, and geotextile fabric.

The spec rewrite delay had Faltus and his eight-man crew chomping at the bit, but the time had finally come to get this two-week project started!

The crew got right to surface prep on this ~25,000-square-foot (2,323 m²) surface. They used a ride-on centrifugal shotblaster and angle grinders to achieve International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) 2–3.

JOB AT **A GLANCE**

PROJECT:

Install a 150-mil-thick (3,810 microns) waterproofing system atop a newly built concrete land bridge near the St. Louis Arch

COATINGS CONTRACTOR:

Coatings Unlimited, Inc.
4325 Bridgeton Industrial Dr.
St. Louis, MO 63044
(800) 628-4145
www.coatingsunltd.com

SIZE OF CONTRACTOR:

About 150–200 full-time employees

SIZE OF CREW:

8 crew members

PRIME CLIENT:

National Park Service
Jefferson National Expansion Memorial
11 North 4th St.
St. Louis, MO 63102
(314) 655-1700
www.nps.gov

SUBSTRATE:

Concrete

CONDITION OF SUBSTRATE:

New

SIZE OF JOB:

About 25,000 sq. ft. (2,323 m²)

DURATION:

2 weeks

UNUSUAL FACTORS/CHALLENGES:

- Tons of topsoil placed over waterproofing system to support trees, bushes, plants, lawns, and benches
- Fast-cure polyurea was followed almost immediately (30 to 45 minutes) by slower-cure polyurethane to allow installation of geotextile fabric and to prevent earthmoving equipment from damaging primary polyurea coating

MATERIALS/PROCESSES:

- Checked substrate using plastic sheet test, moisture meter, and sodium chloride test kit
- Prepped concrete surface with centrifugal shot blaster to International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) 2–3 specifications
- Used magnets to pick up spent steel shot and blowers to clean substrate
- Rolled in one pass 5 mils (127 microns) approximate dry film thickness (DFT) Creative Polymers UREPRIME 1305 primer
- Spray-applied in one pass 100 mils (2,540 microns) (approximate DFT) of fast-setting Creative Polymers GEO-TEK 4950
- Spray-applied in one pass 50 mils (1,270 microns) (approximate DFT) of slow-setting polyurethane, Creative Polymers PLIA-THANE 4975
- Rolled and embedded a layer of US Fabrics' 8-ounce (227 g) geotextile material with 6-inch (15 cm) overlaps

SAFETY CONSIDERATIONS:

- Wore boots, hard hats, Tyvek suits, chemical-resistant gloves, and 3M full-face respirators where warranted

The CUI crew rolled the primer on at 5 mils (127 microns) approximate dry film thickness (DFT). It had a 48-hour recoat window, so they had to get the next layer on quickly!

The crew used proper safety gear wherever necessary, including boots, hard hats, Tyvek suits, chemical-resistant gloves, and 3M full-face respirators, and a 20-foot (6 m) enclosed trailer on-site trailer carrying drums and rigs for mobilization.

Go West, Young Man!

Faltus might have had in mind Horace Greeley's advice, "Go west, young man," when he staged this project. Since the CUI spray squad works best walking backward (it keeps hoses out of the goo), and a perfect staging area existed just west of the land bridge, his crew would start in the east and work their way west.

"We began by bringing in our 20-foot [6 m] enclosed trailer with spray rigs inside," Faltus said. "We trucked in a 20-foot [6 m] heated storage container to hold the paint drums and other material. We also towed in our 120 kW Generac generator and 185 CFM [5 m^3/min.] Sullair air compressor."

The crew checked the concrete slab using a calcium chloride test kit, plastic sheet test, and Elcometer moisture tester. All systems go, they fired up their Blastrac 10-inch (25cm) propane-powered, ride-on centrifugal shotblaster loaded with 280-grit steel shot to achieve International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) 2–3. Seven-inch (18 cm) Metabo angle grinders handled edge work and other areas that the shotblaster couldn't reach. The CUI crew then ran magnets over the slab to pick up excess shot and blew down the surface with gas blowers. The crew quickly set up to roller-apply a 5-mil (127 micron) (approximate DFT in a single pass) coat of Creative Polymers' UREPRIME 1305 primer, a two-component polyurethane designed to adhere to fast-setting polyurethanes and polyureas.

"We had one guy at the mixing station, one runner, and three guys rolling," Faltus said. "We used nine-inch [23 cm] rollers with ½-inch [1 cm] nap covers. The primer applied easily and worked into the concrete very well. While two guys rolled the primer, a third guy with spiked shoes followed behind them about 15 to 20 minutes later with an 18-inch [46 cm] roller with ½-inch [1 cm] nap cover to lay down bubbles caused by outgassing. I initially wanted to flat squeegee and backroll the primer, but the Creative Polymers reps didn't want me to. I thought the application would have gone faster, but they thought we might leave a little too much material in places, which could affect the cure."

Monolithic Barrier

After letting the primer set up for 24 hours, Faltus huddled with his crew to express the importance of getting the 100-mil (2,540 microns) (approximate DFT) Creative Polymers GEO-TEK 4950 monolithic polyurea barrier sprayed down ahead of the primer's 48-hour recoat window. The fun was over! From here on out, they'd work anywhere from eight to sixteen hours a day, with days off staggered to keep everyone as fresh as possible. To add to the pressure, this was no handpicked crew; they had been selected from CUI's pool of 150 to 200 men, based on availability. Hey, most foremen prefer to work with their own teams, but sometimes it's simply not in the cards. This particular polyurea crew comprised two men who Faltus had worked with before, five he had not, and a rookie. Still, Faltus had faith.

"There was a lot of teaching going on, especially with a rookie on board," said Faltus. "This was a hard job, and we needed our rookie, Shane Petty, to come through. We were relying on him to pull lines, help out, act as a runner, learn, and watch. When a rookie doesn't perform well, things can go south real quick. You can lose time, money, and valuable spray

"[The project's] huge for the city," said company vice president Steven R. Philipp, Jr. "And we feel an immense sense of corporate pride in helping connect the arch and waterfront to the downtown business district."

equipment in a matter of seconds."

The team fired up their Graco Reactor plural component sprayer and began laying down the GEO-TEK 4950. The nozzle man worked in 20- by 30-foot (6 m by 9 m) grids and simply sprayed as much as he could in a single day.

"He worked in a cross hatch pattern fashion with roughly three-foot [0.9 m] sweeps: two horizontal and two vertical," Faltus said. "The goal was to keep the tip about two feet [0.6 m] from the concrete and aim the nozzle straight down (perpendicular to the substrate) as much as possible to let it build. If you try to build 100 mils [2,540 microns] in one sweep, you're not going to be as accurate as if you do it in four crosshatches. The polyurea sets quickly, so overspray was not an issue."

GEO-TEK 4950's fast-setting properties helped in another way. On this project, the CUI crew didn't have the luxury of waiting for the entire land bridge to be covered by polyurea prior to installation of Creative Polymers' PLIA-THANE 4975. So part of the crew splintered off and hooked up a Graco XP 70 plural component 2:1 pump to a ¾-inch (1 cm) "B" component line, a ¼-inch (0.6 cm) "A" line, mixing block, two static mixers, a 20-foot (6 m) whip, another static mixer, and an 8-foot (2 m) whip. The whip led to a Graco XP 7 gun armed with a 535 tip. The crew fired up the rig, and soon a second nozzle man was spraying polyurethane while the first sprayed polyurea. Little did they know, they had a hidden audience.

"I rode up the Gateway Arch and shot a video one afternoon," Jarboe said. "The neat thing about this combination is that as the polyurea is being laid down, sometimes within 30 to 45 minutes, they were putting down polyurethane. Usually you put down your basecoat and have to wait overnight. It was amazing to see both applications going down nearly simultaneously. This allows an entire section to be 100 percent completed on the same day in a coordinated fashion. That helps productivity."

To build the PLIA-THANE 4975 to 50 mils (1,270 microns) (approximate DFT), the nozzle man aimed the gun straight down and kept the tip less than a foot (0.3 m) from the substrate. This helped control overspray, too. As soon as the nozzle man achieved the specified mil thickness, other crewmen went behind and laid down five-foot-wide (1.5 m) swaths of US Fabrics' eight-ounce (227 g) geotextile fabric with six-inch (15 cm) overlaps. Other crewmen used nine- and eighteen-inch (23 cm and 46 cm) rollers with half-inch (1 cm) nap covers to press the fabric into the still-wet polyurethane.

"You have to make sure you get the fabric completely saturated," said Faltus. "It's pretty apparent if you don't because you're going to see bubbles. You have a bit of time so you can always roll again if needed. If you go back later and find that a bubbled area has set up, you just slice it up with a knife, load the section with more polyurethane, put a fabric patch on top of it, and wet it again."

The crew spray-applied a 100-mil (2,540 microns) pass (approximate DFT) of fast-setting polyurea. The applicator worked in 20- by 30-foot (6 m by 9 m) grids with quite the 630-foot-tall (192 m) backdrop!

The plan changed after Philipp realized that the equipment to install the park could cause serious long-term issues, especially for cars below. The solution: install fabric in polyurethane for protection over the polyurea.

Westward Expansion

As the project wrapped up, Faltus thought back over the past two weeks. His gang had lost two days due to rainy weather but had worked extra hours to meet the deadline. In the beginning, Faltus had worried about having a rookie on board, but his concerns turned out to be unfounded.

"Shane (Petty) did real well," Flatus said. "By the end of the job, I was teaching him the pumps. He's a fast learner, and I hope he sticks with us. The project went well, too. We had the complete support of our company, great field support from Creative Polymers, and aside from two rainy days, good weather. That 150-mil [3,810 microns] waterproofing system is going to last a very long time."

Jarboe firmly believes tree roots will never breach his Creative Polymers waterproofing system. Roots exist to search for water, he said. If there's no moisture, they won't expend energy trying to infiltrate anything solid. But more importantly, the polyurea/polyurethane barrier is too tough to penetrate.

The final step was to spray-apply a 50-mil (1,270 microns) pass (approximate DFT) of slow-setting polyurethane with a layer of geotextile material into the still-wet polyurethane. After two weeks, their westward expansion was done!

"If I handed you a 150-mil [3,810 microns] patch of this, you couldn't tear it if you tried," Jarboe said. "You might be able to stretch it a bit, but you couldn't puncture it. Nothing's going to penetrate that!"

Philipp is proud of the way Faltus and his squad tackled this high-profile project. There are quite a few monuments in this nation but only one St. Louis Arch.

"Economically, this project is very important to the city of St. Louis," Philipp said. "It's huge for the city, and we feel an immense sense of corporate pride in helping connect the arch and waterfront to the downtown business district."

Soon after the waterproofing was installed, the landscaping crew began turning a drab slab of concrete land bridge into an inviting, westward expansion of the park.

Now, the Jefferson National Expansion Memorial park — once a mess — is a monumental success! **CP**

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www.3m.com

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Equipment manufacturer
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Oklahoma City, OK 73114
(800) 256-3440
www.blastrac.com

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Coating manufacturer
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Hazelwood, MO 63042
(314) 524-2040
www.creativepolymersinc.com

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Rochester Hills, MI 48309
(248) 650-0500
www.elcometer.com

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Tuvek by DuPont
Safety equipment manufacturer
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www.tyvek.com

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Material manufacturer
3904 Virginia Ave.
Cincinnati, OH 45227
(800) 518-2290
www.usfabricsinc.com

Polyurethane and Polyurea Technologies: Working Together?

By ***Rodney D. Jarboe, President for Creative Polymers***

There has been an industry competition between polyurea and solventless/fast-set polyurethanes for the past two decades, and it is probably a little confusing to the average contractor. In reality, some of the application and performance differences between a polyurea and a polyurethane may be occasionally overhyped. In fact, the physical properties between the polyurea and polyurethane systems are really relatively close when compared to other coatings and elastomers. But despite the way these different systems are touted, the chemistry of each of these systems can influence what applications suit their attributes.

System Similarities

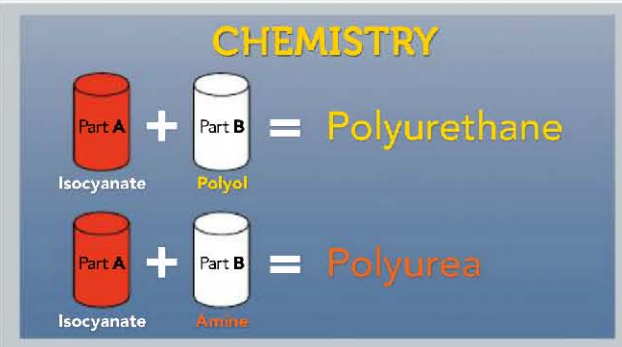
There are both differences and similarities between these two coatings systems, and each system has some advantages depending on the end-use application. One of the similarities is that the "A Component" used in both systems is an isocyanate polymer; the same product could be used as the A Component for both the polyurea and polyurethane systems. Another similarity is that both systems typically use a 1:1 ratio between the A and B sides. They can also both be sprayed with the same plural component spray proportioner and plural spray gun.

The key difference between the two systems is the B side, or resin. The polyurethane system is based on a blend of resins (a polyol) that require a catalyst system in order to cure quickly with the A side. The polyurea system, on the other hand, is based on a resin-blend system (polyetheramines) that is "auto-catalytic," meaning that it will cure quickly and automatically with the A side without a catalyst.

Chemistry in Action

Now let's look at how these chemistries influence application and physical properties. Both systems can be formulated to cure in less than 30 seconds, so a major advantage is their fast-cure properties. This property can allow a contractor to finish his or her projects in a portion of the time that traditional coating systems may offer. On top of that, polyurea systems can cure at a colder temperature than polyurethane systems, thus providing a longer application season; however, there are times when fast-cure is not an advantage.

For instance, there are some applications where a geotextile is required to be embedded into a membrane system, which means the system might cure too fast to allow the proper "wetting out" of the geotextile. In this type of application, which is what happened at the St. Louis bridge deck project, the polyurea systems are not a good candidate; however, a polyurethane system (with a 5- to 10-minute cure time) might be ideal for this type of application, since it allows the geotextile to be embedded into the polyurethane coating system prior to it curing.



Additionally, solventless polyurethane systems typically have slightly more abrasion resistance, chemical resistance, and elongation than polyurea. But polyurea systems typically have higher tensile and tear resistance than polyurethanes.

Working Together

In the case of the concrete land bridge deck project that required waterproofing in front of the St. Louis Arch grounds, the contractor used the advantages of both the polyurea and polyurethane waterproofing systems to accomplish the required end result. The specification for this project required 100 mils (2,540 microns) of a polyurea system followed by 50 mils (1,270 microns) of a polyurethane system with a geotextile embedded into the topcoat. The polyurea system provided the productivity of curing fast, the tolerance for cooler temperatures, and the tolerance for potential moisture in the concrete deck. The polyurethane system offered abrasion resistance and a slower cure time, so that it could be sprayed over the polyurea and have enough open time so that the geotextile could be rolled into the membrane prior to it curing. (The polyurethane system was slowed down by adjusting the catalyst type and amount to have an eight-minute cure time.)

Using both systems enabled the contractor to get the most of each of the two types of systems. Both polyurea and polyurethane systems have their pluses and minuses, but this project goes to show that using different systems together can sometimes have the best result. CP