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Spray-applied polyurea coatings create a seamless, waterproof, durable protective liner that stops leaks and strengthens the integrity of the entire structure.

REHABBING AGING CONCRETE WASTEWATER INFRASTRUCTURE

ADVANCED POLYUREA COATINGS AND LINERS PROVIDE STRONG, FLEXIBLE WATERPROOFING TO BRIDGE CRACKS AND PROTECT AGAINST FUTURE CRACKING AND DETERIORATION.

By Del Williams

AS MUCH OF THE nation's wastewater and sewer infrastructure approaches the 50- to 100-year mark, it must be rehabilitated to remain in use for a growing population. Yet, municipal wastewater treatment facilities, sewers, and vaults endure some of the most severe and corrosive environments in the water industry and must pass increasing Environmental Protection Agency (EPA) scrutiny.

At industrial plants as well, EPA enforces requirements to ensure that industries pretreat pollutants in their wastes to protect local sanitary sewers and wastewater treatment plants. Such extreme wastewater handling environments operate under continual chemical exposure and heavy abrasion that deteriorate concrete and corrode steel in clarifiers, containment pits, anaerobic digesters, manholes, tanks, and other infrastructure assets.

A variety of factors can cause these structures to develop sizable cracks through which wastewater can escape (exfiltration) or groundwater can enter the wastewater system (infiltration). Leaks, cracks, and damage to existing coating systems not only top the list of challenges in facility maintenance and new construction, but can also trigger severe penalties if municipalities or industrial facilities are found in violation of EPA judicial consent decrees.

Fortunately, advanced polyurea coatings and liners are proving ideal for wastewater infrastructure rehabilitation by delivering strong, flexible, abrasion- and chemical-resistant waterproofing that not only bridges existing cracks, but can elongate as much as 400 percent without cracking. Because they set and cure rapidly and can be installed and used in a wide range of temperatures, they also minimize facility downtime.

Concrete cracking and deterioration

Cracks can develop in aging concrete wastewater infrastructure for a number of reasons, ranging from earth movement to daily or seasonal temperature changes that cause expansion and contraction including freeze-thaw. Additionally, harsh chemicals used to treat wastewater can deteriorate the concrete, as can exposure to hydrogen sulfide gas, a form of sulfuric acid created by anaerobic organisms and present in sewers.

Since the EPA regulates municipal wastewater and stormwater management, concrete cracks or leaks that lead to wastewater

exfiltration or groundwater infiltration can put the municipality in violation of a judicial consent decree, triggering significant penalties.

"If the EPA finds that a municipality has old leaking sewer systems, putting them on a consent decree can mean that they don't receive federal tax money until the problem is fixed," said Jim Osborn, president of Osborn Contract Services Inc., a South Carolina-based certified applicator of spray-applied coatings and rehabilitation products.

According to Osborn, a cementitious material is traditionally used to repair wastewater-related sewer leaks, but this has disadvantages, as do other coating materials.

"Hydrogen sulfide gas eats away at the cement in sewer concrete, so it may only have a lifespan of a few years," Osborn said. "Because epoxies are limited by much lower elongation properties, they crack and don't bridge cracks well. Polyurethanes have more elongation, but nothing like polyureas."

For concrete repairs in wastewater infrastructure from municipal manholes and lift stations to clarifiers, trenches, and sumps, Osborn has transitioned to an advanced polyurea system from VersaFlex, a manufacturer of spray-applied protective coatings and waterproof membranes for the U.S. wastewater and industrial markets.

The spray-applied coating creates a seamless, waterproof, durable protective liner that stops leaks and strengthens the integrity of the entire structure. It exhibits superior physical properties such as elongation up to 400 percent, crack bridging, hardness, and tensile strength to create a robust industrial liner that protects, strengthens, and waterproofs concrete wastewater infrastructure.

According to Osborn, a number of the polyurea's characteristics help to extend wastewater infrastructure longevity as well as prevent wastewater exfiltration and groundwater infiltration.

"Since the polyurea system provides superior elongation, it bridges cracks up to 1/8 inch, Osborn said. "With tensile strength higher than traditional materials, it has much lower permeability for better waterproofing. Its impact, abrasion, and chemical resistance are excellent so it resists hydrogen sulfide. Instead of years between the replacement of cementitious coatings, the polyurea coating can cost-effectively provide decades of protection."

With the proper crack repair and surface preparation, the polyurea coating can be a thick film applied directly to the concrete or similar substrate. An alternate application method that can sometimes mitigate the need for surface or crack repairs is to pre-spray the polyurea to geotextile fabric panels placed above the onsite substrate, fusing the panel edges together with more polyurea.

Because of the polyurea's ability to set and cure quickly, it also minimizes wastewater treatment plant or infrastructure downtime. This can translate into thousands of dollars per hour savings as well as avoiding days of service interruption.

When extensive cracks were found in a concrete clarifier shortly before a chemical plant's ribbon cutting ceremony, Osborn turned to the polyurea for superior protection and fast installation. After repairing all cracks greater than 1/8 inch wide in the clarifier with a concrete repair grout, Osborn prepared, then primed the floor and walls with VersaFlex VF 20 primer, and applied 80 to 100 mils of FSS 45DC polyurea.

"The polyurea allowed us to provide a warranty against potential future cracks opening in the concrete because of its crack-bridging ability," Osborn said. "We were able to spray the polyurea as thick as needed in one application. Since it sets and cures rapidly, structures can be put back in service very soon after spraying."

While traditional coatings such as cementitious, epoxies, and polyurethanes will prematurely fail if not installed under a relatively narrow range of temperatures, the polyurea is designed for installation and use from -40°F to +350°F. It will withstand decades of freeze-thaw cycling and wide variations of temperature and humidity.

"When you're above ground in the Midwest, you have freeze and thaw with concrete expansion, contraction, and cracking," said Jennifer Hoop, president of Conco Spray Solutions, an Indianapolis-based contractor specializing in rehabilitation and protection of municipal infrastructure including potable water, stormwater, and wastewater systems. "We needed a lining that would move with the structure through the different seasons and tank temperature differentials. For that, polyurea works very well."

To withstand extreme weather conditions at a northern Indiana wastewater treatment plant, Hoop selected the polyurea for a secondary containment area around ferric chloride tanks. "After filling in cracks with grout and restoring the concrete, we sprayed the polyurea on geotextile to provide a really nice containment area for the ferric chloride tanks," she said.

Hoop, whose company does a large amount of wastewater-related work on containment, clarifiers, tanks, and wet wells, said that the polyurea has an added benefit in reducing continual clarifier maintenance. "Typically, clarifier maintenance crews need to use high-pressure power washers for hours to clean solid waste from concrete surfaces," Hoop said. "Since the polyurea provides waterproofing and has a cleanable surface, crews can simply hose down the clarifier to clean it. This can cut required weekly clarifier cleaning by two-thirds."

"For wastewater-related rehabilitation, polyurea is a superior coating for any application that requires crack bridging, longevity, chemical and temperature resistance, as well as fast turnaround," Hoop said.

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