

PREVENTING CONCRETE DEGRADATION IN WATER AND WASTEWATER ENVIRONMENTS

Water and wastewater infrastructure predominantly consists of concrete structures that are susceptible to degradation from environmental conditions and corrosive chemicals. The rehabilitation and protection of degraded concrete involves the use of protective coating systems to create a monolithic barrier between the corrosive environment and concrete substrate. In severe cases of deterioration involving the loss of 1/4-inch to 2 inches of concrete, the use of a heavy-duty repair mortar may be necessary prior to applying a protective coating system.

“Repairing and resurfacing severely deteriorated concrete substrates improves the quality of the protective coating by remediating surface irregularities and creating a level surface for topcoating,” explained Vaughn O’Dea, director of sales, Water and Wastewater Treatment. “The protective coating industry has long relied on cementitious repair and resurfacing mortars designed to specifically address the defects found in severely deteriorated concrete substrates.”

Severe deterioration was evident during the renovation of a 23,500 square foot water reservoir serving the Region of Halton in Oakville, Ontario, Canada, where chemicals used to treat the water were eating away at the concrete walls, columns, footings and floors. Prior to repairing the concrete substrates, all loose materials, deteriorated concrete and other bond-inhibiting materials were removed in accordance with SSPC-SP13/NACE No. 6 Surface Preparation of Concrete with a minimum profile of ICRI-CSP6. “A proper surface profile and a high degree of cleanliness are critical to ensuring adhesion of the repair material to concrete substrates,” O’Dea noted. “The adhesion of a protective coating system, including the repair material, should exceed the tensile strength of concrete, which is generally around 350 to 450 pounds per square inch.”



The existing coating system in the Halton reservoir was a urethane bitchum or coal tar, which is no longer approved by NSF International for contact with drinking water. Removal of the coating proved to be difficult, recalled Tnemec coating consultant David Walker of Avid Protective Products. “Normally, when you remove a coating it’s fairly rigid and will blast off in segments, but the bitchum would just reliquify,” Walker observed. “When the concrete was sandblasted to remove the coal tar, the walls ended up degraded as much as 2 inches deep in some places.”

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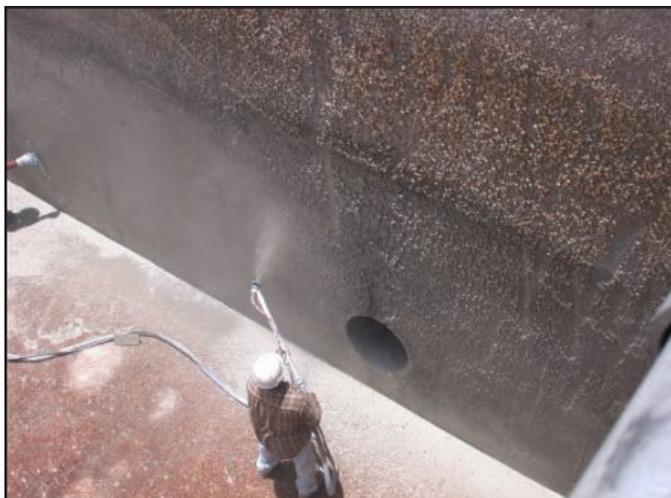


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Damage to two of the reservoir walls required the use of a single-component, cementitious repair mortar, Series 217 MortarCrete, to rebuild and level the surface for topcoating. Specifically designed for heavy-duty repair of concrete surfaces, the repair mortar was trowel-applied by hand, cured and then dry-abrasive blasted to achieve a SSPC-SP13/NACE No. 6 surface condition with a minimum profile of ICRI-CSP5. It was then coated with Series 218 MortarClad, an epoxy-modified cementitious mortar, which was spray transferred and trowel-applied at 1/16th of an inch DFT. Series 218 was also used on all of the reservoir's remaining walls, columns, footings and floors.

Although an ANSI/NSF Standard 61 approved protective lining is required in concrete water tanks to isolate potable water from the concrete substrate, O'Dea explained that the repair mortars are not required to be Std. 61 -certified as long as they are topcoated by an Std. 61 -approved protective coating. "Repair mortars are not intended to isolate the water from the concrete or provide barrier protection. The Standard considers repair mortars as a component of the substrate."



Specifications for the Halton reservoir required a Std. 61 compliant barrier system to protect the concrete from degrading any further and to prevent chlorine within the water from getting to the rebar and corroding it. In Canada, 11 of 13 provinces require accredited certification of protective coatings by NSF International in accordance with ANSI/NSF Standard 61 for use on tanks and reservoirs of 1,000 gallons capacity or greater.

The specified topcoat was an advanced generation, 100 percent solids modified polyamine epoxy, Series 22 Pota-Pox 100, which was spray- and trowel-applied at 30 to 40 mils DFT. "It was applied in two coats - a blue primer coat and then a white topcoat," Walker shared. "The exact same lining system is being used for several other reservoir projects in various stages of construction, totaling more than 200,000 square feet of concrete surface."

Wastewater treatment plants often require the heavy-duty repair of concrete damaged by biogenic sulfide corrosion (chemical attack). At a municipal wastewater treatment plant operated by Birmingham-based Integra Water in Alabama, a primary clarifier was heavily deteriorated after decades of immersion service. The previously uncoated concrete left the structure's sidewalls and floors vulnerable to erosion from chemicals and the environment, resulting in up to 2 inches of deterioration.

Integra Water contacted Robert Crumbaugh of SteelCon Coating Systems to help with coating specifications for restoring the damaged concrete. Following surface preparation and deep-patch repair with Series 217, a protective lining system was applied, which included a prime coat of Series N69 Hi-Build Epoxoline II, a polyamidoamine epoxy, followed by a topcoat of Series 406 Elasto-Shield, a two-component, aromatic polyurethane hybrid.

"Integra Water wanted a high-performance protective lining that would allow flexibility and movement of the substrate," Crumbaugh observed. "In addition to protecting concrete against corrosion, Elasto-Shield offers semi-flexible properties to resist minor hairline crack movement." "Integra Water and the contractor were so impressed with the results that they decided to use the same lining system on additional corroded splitter boxes," Crumbaugh added.

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