

Tests support admixture for all concrete assets

A nontoxic agent thwarts microbiologically induced corrosion in new head works, clarifiers, and treatment plant pipes as well as rehabilitation.

In 1996 Atlanta-based ConShield Technologies Inc. introduced a germicidal liquid that bonds molecularly with concrete, shotcrete, and repair mortars to keep single-celled organisms like *Thiobacillus* from growing and producing sulfuric acid. Nontoxic to humans and animals and EPA-registered as biocide #75174-2-

47000, Con^{mic}Shield additive kills the bacteria by rupturing its membrane.

Unlike a coating or liner, the liquid is evenly dispersed throughout the concrete mixture of a pipe or other asset. As a result, maintenance-related wear and tear doesn't compromise a structure by scraping off and giving *(continued)*

Miami-Dade engineers tested the anti-microbial additive on the first manhole out of a force main that was replaced two or three times a decade despite treatment with epoxy coatings and plastic liners. Satisfied with the precast concrete's performance after eight years, they specified the additive for clarifiers and other upgrades. Photos: Miami-Dade Water & Sewer Department

WEB EXTRA

For more information, including an excellent explanation of what causes microbiologically induced corrosion, look for the Web extra icon on www.pwmag.com.





Miami-Dade Water & Sewer Department added Con^{mic}Shield to specifications for new assets such as four 200-foot-diameter clarifiers.

bacteria a foothold. According to Sales and Marketing Manager Joe Cherry, on average Con^{mic}Shield adds \$3 to \$4/square foot for a new 48-inch manhole compared to \$12 to \$14/square foot for a coating and \$15 to \$20/square foot for plastic liners.

Intrigued by a low-cost rehabilitation option that doesn't require in-field welding and spark or adhesion testing, managers in Arizona, California, Florida, Michigan, Missouri, New York, South Carolina, Virginia, Washington, and Wisconsin use the product for new precast concrete pipe and structures and for manhole repair. If the structure's basically sound, the interior can be coated with special cementitious liners that includes Con^{mic}Shield additive. If beyond repair, a precast producer can be directed to include the product — typically at a rate of 1 gallon/cubic yard — in the design mix for a new manhole.

An early adopter, the Hampton Wastewater Division in Virginia opt-

ed to repair assets in-house through the "City Self-Install Program" offered by AP/M Permaform of Johnston, Iowa. A \$100,000 investment (which the manufacturer can finance) buys a bi-directional device called the SpinCaster that flings Con^{mic}Shield-infused mortar onto a structure in one direction, then the other, at 5,000 rpm. The operator uses a winch to repeatedly raise and lower the device through the manhole's center to apply an even layer of mixture ranging from 1/2 to 2 inches thick. ASTM International developed standard F-2551 for lining manholes and is developing a similar standard for lining pipe — WK 26451 — using this technique, called centrifugally cast concrete pipe (CCCP).

According to the company, a three-person crew can do four to eight sanitary or storm manholes and catch basins a day. Since 2000, Hampton's crews have done 3,200, which is almost 30% of the city's 11,000 manholes; and Collection System Manager Barry Dobbins

says the operation has "nothing but positive things to say about the product."

This is how Chicago's Department of Streets & Sanitation is fixing 20,000 manholes, the world's largest such rehabilitation, though the \$60 million project is being performed by two licensed applicators: Smith Maintenance Co. and Benchmark Construction Co. Inc., both of Chicago. Having specified an impermeable material that would provide a minimum of 3,000 psi compressive strength and 150,000 psi modulus of elasticity within 24 hours, engineers chose a 1- to 2-inch layer of AP/M Permaform's MS-10,000 Permacast cement with Con^{mic}Shield sealed and then coated with a layer of epoxy to protect against road salts in the storm sewer.

The City of Westlake, Ohio, will receive an achievement award from the North American Society for Trenchless Technology this month for one of the first horizontal rehabilitations.

Initially, managers considered cured-in-place pipe for a 40-year-old interceptor that had lost up to 1 1/2 inches
(continued)

GET A SECOND OPINION

In addition to Indianapolis, Fort Wayne and Zionsville, Ind., have asked manufacturers to submit products for independent technical analysis by **Indiana University-Purdue University Indianapolis (IUPUI)**.

Construction Engineering Management Technology Director Tom Iseley says the **New Product Review program** is slated to roll out nationally within several months. Manufacturers will be charged \$7,000 to participate; public agencies can subscribe to results for an annual fee of \$500.

For more information, contact New Product Review Manager Behnam Hashemi in Indianapolis at 317-274-7082 or shashemi@iupui.edu.

from 6-inch-thick walls. But most of the damage was within 25 feet of trunk lines. It wasn't cost-effective to tear apart extremely deep manholes to insert the lining when a SpinCaster could be inserted anywhere along the interceptor and adjusted to inside diameters ranging from 36 to 60 inches. In the end, 1/2-inch of Con^{mic}Shield-infused PL-8000 cement was applied to half of the 7,200-foot asset.

With ConShield Technologies right in its backyard, Atlanta's Department of Watershed Management used the additive in a major shotcrete pipe repair project in 1997. The city uses the same self-install program that Hampton, Va., does using Permacast with Con^{mic}Shield additive.

Use in new construction

"When cities saw how the agent performed in sanitary sewers they asked if they can use it in new construction," Cherry says.

After watching how a particularly problematic manhole replaced with additive-infused precast concrete performed over eight years, the Miami-Dade Water & Sewer Department added the product to both precast and poured-in-place mix specifications for 30,000 yards of pipe, manholes, clarifiers, and air entrainment tanks in a \$600 million plant upgrade.

Because the liquid is delivered to the ready-mix producer, construction managers controlled quality by reviewing the mix tickets of each incoming concrete truck. To see how the mixes perform, stainless steel screws were inserted to measure the distance from screwhead to the concrete surface.

Associate Director John Chor-

log, PE., told *Treatment Plant Operator* magazine in January that after six months "we found minimal concrete loss in some tanks below the liquid level, but we think that's just surface latents, like form oil, that are being washed off. Overall, the treated concrete above the liquid waste level where corrosion occurs looks good." The additive is designed to do just that: avert damage where the air-breathing bacteria produce sulfuric acid rather than submerged concrete.

Ever cautious, though, some specifiers require additional testing.

The Indianapolis Department of Public Works reviewed the product internally and asked ConShield Technologies to submit the additive to an independent technical analysis by Indiana University-Purdue University Indianapolis' Construction Engineering Management Technology program (see box on page 42).

After six months, the program verified that Con^{mic}Shield additive-infused mixes meet the department's ASTM-based sanitary sewer specifications for compressive strength, shrinkage, set time, hardened air properties, precast reinforced manhole sections, absorption, freeze/thaw, and scaling and protection against microbiologically induced corrosion. The research included the results of testing by Oldcastle Precast Inc. of Auburn, Wash., and Rinker Materials Corp. of Houston, which evaluated how the product affects curing and strength. Though the former reported longer set times, they still met department requirements.

In February 2009, the New Products Committee of the city's public works department notified ConShield Tech-

nologies the product "may be specified as an alternate as DPW deems best as on a case-by-case basis." The first project that allows for the product just received a notice to proceed.

About a decade ago, the Metropolitan St. Louis Sewer District used the product to repair a 50-foot drop shaft. Before repairs, one-third of the 18-inch-thick concrete walls had been eaten away. Ten years after lining with Permacast mortars with Con^{mic}Shield additive, the shaft remains in excellent condition. The utility has specified the additive repeatedly since then with similar results for new and rehabilitated manholes and new, precast pipe.

Some precast producers prefer dry-casting pipe because of its shorter mixing times. When a project requiring new pipe arose, Materials Engineer Ron Moore wanted to ensure the recommended formula of 1 gallon of additive per cubic yard of concrete performs equally well for both the dry- and wet-casting methods.

Two studies, one funded by the district and the other by ConShield Technologies, were conducted to ensure that the utility's specifications for sampling dry-cast pipe mixes don't affect the additive's performance or pipe strength.

Situ Biosciences LLC in Skokie, Ill., tested three samples: one without the additive, one with the additive mixed for the standard dry-cast mixing time of 90 seconds, and one with the additive mixed for seven minutes. The latter killed the bacteria and thoroughly incorporated the additive into the mix.

The Hauser Laboratories Division of Microbac Laboratories Inc. in Boulder, Colo., confirmed the utility's protocol for identifying the presence of bacteria is sound. ASTM D4783 modified for concrete uses *Serrita Marces* instead of *Thiobacillus*, which can take 28 days to cultivate. In addition to growing much more quickly, the presence of *Serrita Marces* is easily visible to the naked eye as a red stain.

The utility has specified the additive for new construction including projects with 42-inch through 96-inch pipe. **PW**

Con^{mic}Shield is a registered trademark of ConShield Technologies Inc., Atlanta.