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How We Do It: Antibacterial concrete
in Miami-Dade County, Fla.

PAGE 24

Ready Remedies

YUCAIPA VALLEY STAFF
TACKLES TOUGH REGS IN A
TOP-FLIGHT RECLAIM PLANT

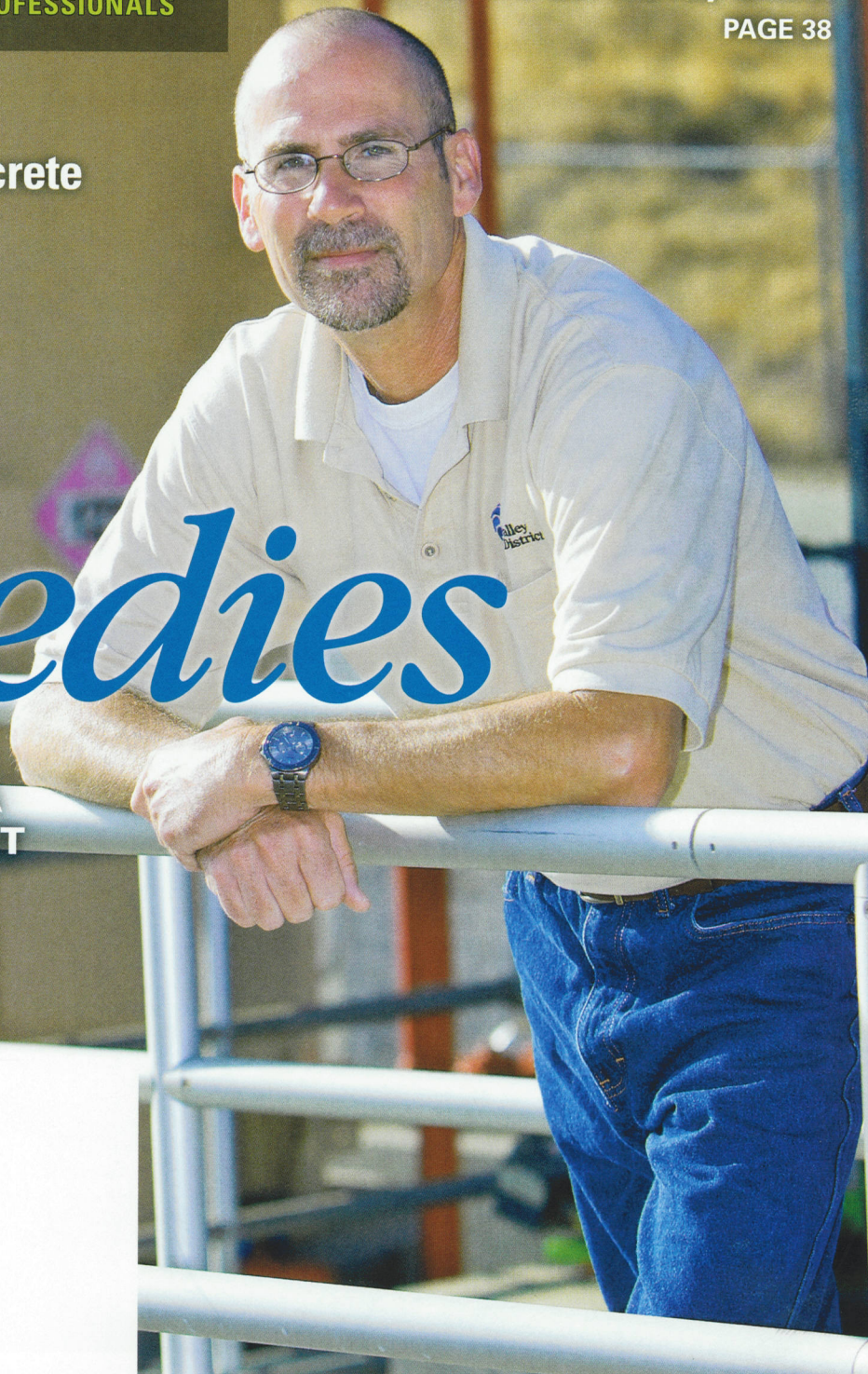
PAGE 14

In My Words: Dealing with
floods in Rhode Island

PAGE 33

PlantScapes:
A colorful scene in
Fairfield, Ohio

PAGE 38



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Right In the Mix

A FLORIDA DEPARTMENT USES AN ANTIBACTERIAL CONCRETE ADDITIVE IN AN EFFORT TO HEAD OFF MICROBIOLOGICAL CORROSION IN A MAJOR TREATMENT PLANT UPGRADE

By Angus W. Stocking, L.S.

Microbiologically induced corrosion (MIC) was a persistent maintenance issue for Miami-Dade (Fla.) Water and Sewer Department (MDWASD).

"We spend a lot of money repairing corrosion," says associate director John Chorlog, P.E. "Over the last 20 years, MIC has cost us hundreds of millions of dollars."

To fight MIC in the construction of an upgrade to its Black Point Wastewater Treatment Plant, the department deployed a U.S. EPA-registered antibacterial additive mixed with concrete at the batch plant. Department leaders hope the additive will prove as successful as when used over the past 10 years to protect manholes.

BIOLOGICAL ATTACK

MIC occurs when the warm temperatures, turbulence, organic waste, and oxygen levels common in sanitary sewers create hydrogen sulfide gas and breed *Thiobacillus* bacteria. The bacteria colo-

Clarifiers added in an upgrade to the Black Point Wastewater Treatment Plant were built using concrete containing an antibacterial additive to head off microbiologically induced corrosion.

PHOTOS COURTESY OF CONSHIELD TECHNOLOGIES

nize on concrete pipe and convert hydrogen sulfide to sulfuric acid which attacks the concrete matrix and turns it into crumbly gypsum. When conditions are optimal, MIC can destroy concrete integrity in a few months.

MIC is an especially serious problem in Florida. "We have flat topography and high groundwater which requires us to have lots of sewerage pumping stations," says Chorlog. "Coupled with our year-round warm temperatures, we have perfect breeding grounds for *Thiobacillus*."

Prevention in Miami-Dade traditionally involved epoxy coating or embedded plastic lining. But in 2001, the department tried ConShield antibacterial additive manufactured by ConShield Technologies.

"We were introduced to it by a vendor," says Wastewater Collection Division chief Rod J. Lovett. "I was interested because I'd read an article about antimicrobials that made them sound promising. So I asked if it was available separately, as an admixture."

When added to concrete, the product bonds molecularly with the material and prevents bacteria growth. It is nontoxic to humans and animals but permanently inhibits single-celled organisms like *Thiobacillus*.

PROBLEM MANHOLE

To test it, Lovett specified its use in August 2001 for a precast manhole being replaced. "This manhole in Key Biscayne has very aggressive MIC conditions," he says. "We'd been replacing the manhole, the first one out of a force main, two or three times every ten years."

For the test, Lovett directed the manhole base to be made of concrete with the additive and the manhole chimney to be made from normal material. "Eight years later, we've already replaced the corbel but the base still looked good," he says.

Based on that success, Lovett has begun to use more of the additive. "We've built more manholes with it, and we're specifying it in our standards for both new and rehab," he says. "We don't have to worry about it peeling off or getting chipped or damaged. Because the protection is in the concrete, it can't wear off."

PART OF AN UPGRADE

Now, the department has



The ConShield antibacterial additive is mixed with concrete at the batch plant. A clarifier at the Black Point plant is shown under construction using the treated material.

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specified the additive extensively in a \$600 million upgrade of the Black Point plant. Francisco Fuentes, P.E., who heads the department's structural design unit and is chief engineer on the upgrade, had monitored the manhole experiment and often visited sites to see the results for himself.

So the additive became part of several large portions of the plant upgrade. "We used it for concrete in the new oxygenation train, and for four new 200-foot-diameter clarifier tanks," says Chorlog. "We also used it for pipe up-gradient of the clarifiers. The amount used is in the thousands of cubic yards and may be up to 30,000 cubic yards."

"We've already taken parts of the oxygen train out of service after six months of use. We did find minimal concrete loss in some tanks below the liquid level, but we think that's just surface latents, like from oil, that are being washed off. The treated concrete above the liquid waste level where corrosion occurs looks really good."

JOHN CHORLOG

Fuentes says the additive has no effect on the structural and application aspects of a concrete mix. "We didn't change our design at all, except to avoid the expense and application of coatings," he says. "The two contractors who poured the tanks told me they couldn't tell the difference. So no specialists were needed."

STRAIGHTFORWARD PROCESS

Mixing the additive with concrete is straightforward. "Basically, it's introduced at the batch plant at one gallon per cubic yard," Chorlog says. "For quality control, we reviewed mix tickets, which give us a list of concrete components for each truck. There were no issues with the mix, for us or the plant."

Quality control also includes ongoing testing. In the tanks, for example, stainless steel screws were placed so that the distance from the screwheads to the concrete surface can be measured, allowing any losses to be quantified over time.

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The Black Point upgrade is important to the department, as it will

increase the plant's peak capacity from 225 mgd to 285 mgd. It will also improve effluent quality and bring the plant into line with new EPA standards.

"This is a conservative utility, and we want to see proof before we take the next steps," says Chorlog. "We waited almost ten years to see how the additive worked in a manhole, and we'll probably wait for a while to see how it works out in this application. If we can avoid or delay corrosion, or put off rehabilitation for even ten years, it more than pays for itself." *tpm*

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