

Pulling the Plug on Corrosion

By Todd Hart

A deteriorating infrastructure is one of the biggest concerns for municipal wastewater systems. According to the EPA's 1992 Needs Survey Report to Congress, \$46.8 billion is needed over the next two decades to rehabilitate and upgrade aging equipment at treatment plants, many of which were built or expanded in the late '70s and early '80s with the aid of federal grants. Particularly hard hit are smaller wastewater authorities. Of the nation's 28,582 treatment facilities, 19,150 serve fewer than 10,000 residents and often have limited resources to make large capital investments or repairs. Traditional federal funding sources under the 1972 federal Clean Water Act have long since dried up, and new ones are not expected from Washington lawmakers any time soon.

How are small municipal utilities keeping their heads above water? For some, privatization has been the answer. Strapped-for-cash municipalities have turned over operation, leases and even full ownership of treatment plants to the private sector. Proponents of such

arrangements envision significant operational savings. However, critics believe such deals are risky experiments, and worry that privatizers will drain all the profit out of a facility, fail to reinvest and leave a shell. While outsourcing grows in popularity, it currently represents only 10 percent of the \$40 billion U.S. water and wastewater market.

The vast majority of the nation's wastewater systems have rejected privatization, and are instead exploring ways to reduce operating costs in order to keep sewer rates in check. Some of the more promising options include installing energy efficient equipment, employing computer automation controls and adopting comprehensive preventive and predictive maintenance programs. Since treatment plants are susceptible to damage from corrosion, well-executed maintenance programs are particularly effective at stretching operating dollars and preventing costly service interruptions. As officials at the Village of Speculator Wastewater Treatment Plant recently discovered, successfully implemented maintenance

programs, together with the use of advanced coating materials, provide the weapons to battle back against corrosion and save money.

Soaking in the View

Surrounded by rugged mountain ranges that rise above untouched forests and gleaming lakes, the Village of Specu-



Steel in non-immersed areas was commercially blasted to SSPC SP-6 standards to obtain the proper surface profile.

lator, New York, is a beautiful place to live and recreate. It is nestled in the heart of Adirondack Park's six million acres of land constitutionally protected by the State of New York. The park is home to all kinds of wildlife, 130,000 permanent and 200,000 seasonal residents, and several million tourists annually. It is considered a great asset to the state. Thus, ensuring that the area remains unspoiled for future generations is a major priority.

Vital to the park's economy is the existence of private holdings. Speculator is among 105 towns and villages in the park composed of homes, stores and resorts that sit on privately held land. While people are drawn to the Adirondack area for its primitive beauty, most still expect modern accommodations. As a result, the Village of Speculator offers its residents and businesses both water and sewer service. Along with having to meet New York State effluent requirements, its treatment plant must com-



Sulfuric acid and hydrogen sulfide generated by the sewage treatment process caused extensive corrosion, including damage to the concrete walls evident in calcium staining on the exterior of the clarifiers.



Course bubble diffusers were replaced with PVC piping and fine bubble diffusers to enhance aerator biological decomposition efficiency.

ply with guidelines established by the Adirondack Park Agency that governs land use and the park's natural resources.

Built in 1971, Speculator's wastewater treatment plant was designed to handle variations in flow created by summer tourism. It consists of two primary package treatment units, each with 0.15 million gallon per day (MGD) capacity. During the off season (when the village population drops below 400), only one unit is kept in operation. The second unit is activated from June to September to service 3,000 additional summer and fall customers. The tanks have identical configurations.

The method of treatment at the Speculator plant is fairly typical of older domestic wastewater facilities. After passing through a prelim-

inary screen, influent is first treated in an aeration tank for oxidation and biological decomposition. The circular clarifier is quiescent, allowing the sludge and remaining solids to settle to the bottom. Controlled lift pumps transport the sludge either to the aeration tank for further treatment or to an aerobic digester, where it is conveyed to drying beds. Clarified effluent is discharged after passing through a chlorine contact tank.

For more than two decades, Lake Pleasant was the source for Speculator's water distribution system. While the water contained very low levels of microbiological pollutants, it was highly acidic. It was not uncommon for the alkalinity to be as low as 5 milligrams per liter. This created problems for the wastewater treatment plant that required a higher alkalinity for efficient biological oxygen demand (BOD) reduction. The addition of hydrated lime to produce the sufficient alkalinity for nitrification of the influent temporarily alleviated the problem. However, by switching from lake water to rock wells, the alkalinity of influent entering the treatment plant was raised to 45 milligrams per liter, and the

"You mean I could have gotten Square D off-the-shelf water/wastewater control systems?"

"That's right, Square D prepackaged pump control systems and remote terminal units from Schneider Automation."

Introducing Square D Pump-PAK® and RTU-PAK® from Schneider Automation. These pre-engineered, prepackaged control systems save design and installation time and help deliver water/wastewater projects faster than custom designed control systems. Available in rugged NEMA rated enclosures, Pump-PAK and RTU-PAK feature quality Square D, Modicon and Telemecanique automation and control components. For more information, contact the Schneider Automation Industrial Applications Group at 1-800-894-7259.



GROUPESCHNEIDER

■ Modicon ■ Square D ■ Telemecanique

hydrated lime was no longer needed. Unfortunately, the years of processing acidic water had already taken their toll on the plant's infrastructure.

Concrete that formed the outer basin of the two treatment units was badly pitted and spalled. Structural steel for the catwalks, railings, roof supports and the clarifier was also corroded. The deterioration was particularly severe at and above the waterline, where the coating had blistered and peeled. In addition, on large portions of the concrete and steel surface areas, the coating was completely absent. This was caused by sulfuric acid and hydrogen sulfide generated by the sewage treatment process. On the tank exteriors, calcium staining was prevalent, indicating water penetration through the concrete walls. Without corrective action, the integrity of the tanks would be severely impaired, leading to leaks, service interruptions and ultimately, complete structural failure.

Filtering the Options

No one was more aware of the corrosion occurring on the treatment tanks than Chuck Smith, superintendent of Speculator's water and sewer department. Speculator, like many municipalities across the country, struggled to meet the challenge of providing cost-effective service within the restrictive limits of its wastewater operating permit, and Smith wanted to find the most economical way of rehabilitating the tanks without disrupting service. Smith sought technical assistance from Lamont, VanDeValk Engineers, P.C., a firm with experience in designing, upgrading and refurbishing water and wastewater facilities.

After conducting a comprehensive site assessment, Mike Harrington, P.E., from Lamont, VanDeValk presented Smith with the recommendations. At the top of the priority list was the need to make concrete repairs. Loose concrete at spalled and delaminated areas had to be removed and filled with a cementitious repair compound. For long-term corrosion protection, new coatings would have to be applied to all steel and concrete surfaces in both plants. However, what remained of the original coal tar coating would have to be first removed, and both substrates properly prepared. Harrington also discovered a red lead coating on structural steel in

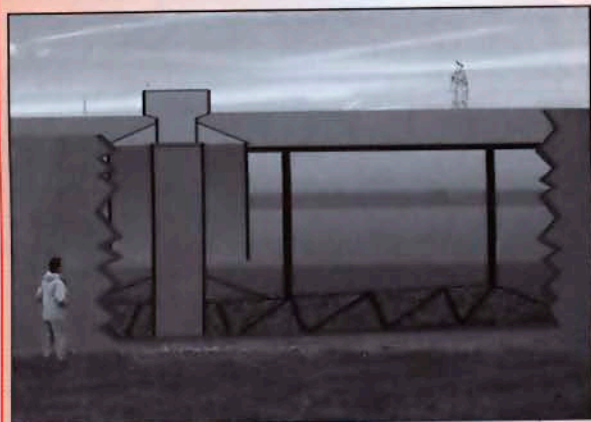
the second treatment unit, that would require special attention.

Not all of the suggestions made by Harrington involved maintenance issues. With tougher regulations on effluent quality expected, it made sense for Speculator to implement certain process upgrades during the rehabilitation project. Harrington focused his attention on the antiquated aeration basin. By removing coarse bubble diffusers and replacing them with PVC piping and fine bubble diffusers from Aerco Corporation, aeration biological decomposition efficiency could be enhanced. In addition to

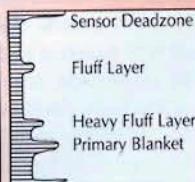
the aeration modification, he recommended that a new power generator be purchased. The existing generator had been in service for more than two decades. Miles away from any contractor that could make emergency repairs, it was vital that the plant's generator be in good working order.

Smith and the plant operator, Florence Braunius, agreed with Harrington's assessment and recommendations, and after obtaining financial assistance from New York State's Environmental Facilities Corporation, a final design was authorized. Upon completion of the final design, the vil-

WHERE IS YOUR SLUDGE BLANKET?



Typical
Profile On
Analyzer Face



A ROYCE Interface Level Analyzer

- ◆ Provides a continuous graphical display of all interfaces.
- ◆ Works in any tank up to 100 feet deep.
- ◆ Control setpoints are not preprogrammed, you make the decisions.
- ◆ Track and control the interface of your choice.

THOUSANDS INSTALLED WORLDWIDE - IN EVERY TYPE OF CLARIFIER

For More Information:

In the U.S. and Canada: **1-800-347-3505**

Immediate FAXBACK information: 504-254-3756

Internet: <http://www.royceinst.com>

E-mail: info@royceinst.com

Circle 752



13555 Gentilly Road
New Orleans, LA 70129
504/254-8888
FAX: 504/254-8855

ISO 9001
CERTIFIED

World Class Designs - From a World Class Company

CE

CONFORMANCE

lage was ready to request bids from contractors to perform the work. Service interruption to village residents could be avoided by scheduling the work in the off-season. One treatment unit would be repaired in the spring, while the other unit would be done in the late fall.

Washing Away the Signs of Aging

Efforts to restore the aging plant began in the spring of 1996. The primary treatment unit, that was enclosed and protected from the elements, was the first to receive a makeover. After patching the concrete and completing other structural repairs, interior surfaces were prepared according to the coating manufacturer's specifications. Corrosion Specification Specialist Gary O'Connor of the Sherwin-Williams Company helped develop the coating specifications. He knew proper surface preparation was the key to ensuring maximum coating performance. "Coatings applied to wastewater equipment have a multitude of enemies," said O'Connor. "To survive in such a hostile environment, they must form a strong mechanical bond to the substrate."

All steel below the waterline was abrasively blasted to SSPC SP-10 near white standards, leaving a 2 mil profile. Care was used when blasting to avoid "peaks" in the profile that could protrude through the coating. The concrete in the same area was brush blasted to remove all oil, grease, dirt, dust and loose particles. Small bug holes, voids, cracks and air pockets were filled with an epoxy resin. In non-immersed areas, SSPC SP-6 commercial blast was utilized. To comply with EPA and OSHA mandates, areas with lead paint were sectioned off and all blast material was reclaimed for proper disposal.

Coatings were applied once all surfaces were cleaned and had time to dry sufficiently. For areas above the waterline, a three-coat system was specified. The base coat was a rust-inhibitive catalyzed epoxy that featured a variable recoat window. This provided the painters extra flexibility in scheduling the application of the second coat. For enhanced chemical resistance, a high build, high solids epoxy was applied as an intermediate coat. The topcoat, Corothane II, an aliphatic two-component acrylic polyurethane, offered abrasion and impact strength and



Improvements made to the treatment plant allowed Speculator to achieve 97-99 percent BOD reduction.

color and gloss retention. The complete system had a dry film thickness of between 11.5 and 14.0 mils.

For the splash zone and all immersed areas of the tank where the wastewater created a strong electrolyte for easy ion transfer, a catalyzed amine cure epoxy from Sherwin-Williams was employed. Formulated with a high molecular weight polymer, the coating had increased crosslink density for greater dielectric strength and better moisture and chemical resistance than traditional epoxies. Two coats of the unique epoxy were applied to a 13 mil dft.

In order to prevent blistering caused by pinholes and voids, the finish was thoroughly inspected for flaws and conformity to the desired film thickness. The tests were conducted by Bob Wissinger, the Sherwin-Williams Industrial and Marine Coatings Representative overseeing the project. Like O'Connor, Wissinger knew that poor surface preparation and application were extremely detrimental to coatings specified for wastewater treatment equipment, so he wanted to make sure everything was done right. Wissinger made several trips to Speculator to ensure key point inspections met blast and coating inspection standards.

Despite less than favorable conditions, the tank was completed in time for the start of the tourist season. Painters from Quality Painters of Amsterdam, New York, were plagued by persistent rain, high humidity and wide temperature variations. In June alone, precipitation

was recorded for 18 out of 30 days. The second tank, which was uncovered, was taken out of service in September and was completed within two months.

A Drop in the Bucket

While the repairs and upgrades made at the treatment plant required a significant investment for the Village of Speculator, the total cost of the rehabilitation project was still considerably less than that of replacement. The protection provided by the advanced coating system will help extend the design life of the concrete/steel treatment units. In addition, the fine bubble diffusers that were installed have already allowed Speculator to achieve 97 to 99 percent BOD reduction. Chuck Smith believes the rehabilitation has better prepared Speculator for the challenges that lie ahead.

"Ten years ago the decisions I needed to make to ensure the plant remained viable were crystal clear," said Smith. "Now with an avalanche of new regulation and all kinds of sophisticated equipment on the market, all of which carry big price tags, it's hard to know where to make capital outlays. However, I think the upgrades we made put us in a much better position to tackle the hurdles that are coming down the pike."

About the Author:

Todd Hart is product manager at Sherwin-Williams, Industrial Marine Coatings Div., Cleveland, Ohio.

For more information on this subject, circle 872 on the reader service card.