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Sewer Doer: keeping good money from going down the drain

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By **Kurt Eckert, The Hillsboro Argus**

In a day and age where citizens are concerned about government waste, Washington County's government has figured out a way to turn waste into profit.

Through a partnership with British Columbia-based Ostara, the county's sewage treatment agency, Clean Water Services, has developed a way to extract by-product nutrients from the sewage and turn it into high-quality fertilizer. They've been successfully producing the slow-release fertilizer under the name Crystal Green at the CWS advanced wastewater treatment facility in Durham since June 2009.

Marketed under the name Crystal Green, the fertilizer owes much of its content to human waste. About 80 percent of the phosphorus and ammonia in sewage is urine, said CWS Senior Operations Analyst Rod Baur.

Clean Water Services serves about 527,000 residents in the county's urban areas, treating about 64 million gallons a day of wastewater.

With all that waste comes a load of phosphorus. As is common in all advanced wastewater facilities, phosphorus and ammonia become heavily concentrated during the sludge-handling process. Combined during the treatment process with naturally occurring magnesium, it becomes a sticky, pipe-coating compound called struvite. Struvite has a consistency similar to concrete, causing blockages, plant inefficiency and risk of process failures, says Clean Water Services Director Bill Gaffi.

"Struvite is a bit like kidney stones, or arteriosclerosis," Gaffi said.

Always considered a problem by sewage agencies, it's long been theorized that struvite could be used as a chief fertilizer ingredient if only it could be efficiently removed. Phosphorus from mined phosphate rock is on the decline worldwide, and many analysts believe new solutions will need to be found to replace its role in modern agriculture. While it won't make much of dent, phosphorus recovery from sewage could at least be a drop in the bucket, Gaffi said.

Many treatment facilities have been trying to perfect this solution for years, but CWS and Ostara think they've come up with the best one by far.

Through a patented process, the partners have found a way to extract much of the struvite without interrupting the treatment process. The Pearl nutrient recovery system is based on adding magnesium during the sludge dewatering process under a controlled chemical reaction.

Using unique geometry and up-flow velocity, Ostara's reactors produce prills, or fertilizer pellets of varying diameter for several different agricultural applications, said Rob Baur, the CWS Senior Operations Analyst who helped develop the process that unstuck the struvite from the reactor parts.

In one year of operations at the Durham treatment plant, 300 tons of struvite have been generated, representing 76,000 pounds of phosphorus and 34,000 pounds of ammonia recovered from the raw sewage.

By recovering phosphorus and other essential nutrients, Ostara improves the financial and operational efficiency, and the environmental sustainability, of Washington County's wastewater treatment facilities, Gaffi said.

Previously, all but a fraction of the phosphorus at Durham was trucked out of the plant and applied as fertilizer in spray form.

With the Ostara process removing 20 percent of the phosphorus load to the plant, the removal process became more stable and efficient. CWS is able to use less chemical solutions for struvite reduction, and decrease disposal costs, Baur said.

The resulting fertilizer is optimal for Washington County's nursery industry, he adds.

The Board of County Commissioners voted Tuesday to spend up to $4.7 million to expand the pilot Durham program to the larger Rock Creek treatment facility in Hillsboro. Construction is slated to begin in July.

Board Chairman Andy Duyck said a program with the potential to provide benefits to the county and the environment while also creating a revenue-generating product was a breath of fresh air.

"This is the kind of innovation we'd like to expand on and foster," Duyck said.

After flushing, the efficiency of the sewer system is the last thing on most people's minds.

Michal Thompson

Clean Water Services operations analyst Rob Baur watches as streams of struvite-containing effluent enter dryers at the Durham Advanced Wastewater Treatment facility. Clean Water Services has partnered with Ostara to turn the byproducts phosphorus and ammonia from sewage into a high-quality fertilizer.

Lucky for the folks at Clean Water Services, Senior Operations Analyst Rob Baur is always looking for way to turn Washington County's wastewater into a revenue stream.

In 2007, Baur attended a conference in Florida, bringing with him better ideas for reducing struvite — the cholesterol-like buildup of magnesium, ammonia and phosphorus that coats the pipes and valves of all advanced wastewater treatment facilities — like Clean Water Services' plants in Hillsboro and Durham.

Struvite has a consistency similar to concrete, and removing it is costly. Through trial and error, Baur came across the polyethylene compound Kynar. Struvite didn't appear to stick to it at all.

By happy accident, scientists from the University of British Columbia were also attending the conference. They had hit upon a process to turn the phosphorus-rich struvite into a high-powered fertilizer, but were having trouble getting the product to move from the pipes to the production line.

"Their pilot product was plugging up every day," Baur said.

With Baur's non-stick contribution, it suddenly looked like the Canadian contingent was sitting on a gold mine. The chance meeting led to an innovative public-private partnership. Clean Water Services now owns and operates the technology, developed by Vancouver, B.C., based Ostara.

The new fertilizer has been produced since May 2009 under the name Crystal Green at the Durham Advanced Wastewater Treatment Plant. The entire system was installed in an unused building. Instead of building the needed reactor vessels above ground, holes were drilled through the building's existing three floors to supply gravity. A 7-horsepower motor is all it takes to dry about a ton of product a day.

When the process expands to Hillsboro's Rock Creek facility, it will be the first use of Ostara's new, larger Pearl 2000 reactor vessels. Though the reactors are five times as large, Baur says there will be more pennies pinched. For instance, they'll use a by-product gas from sewer treatment to create heat to dry the product.

Based on the success at Durham, Baur expects revenues from the sale of Crystal Green and operational savings to pay for the system in seven years.

"That's my job," Baur said.