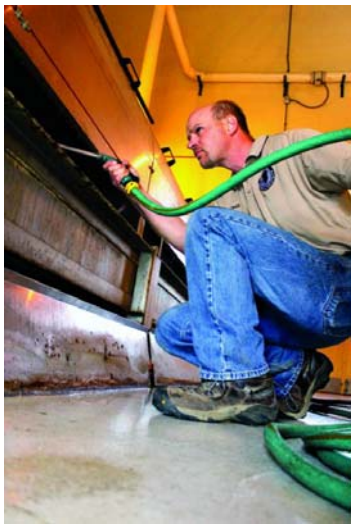
Right At Home



- By Ted J. Rulseh
- Top Performer - Plant
- TPO - September 2014

The Stevens Point treatment plant lives up to its community's environmental ethic while helping to create a climate friendly to business expansion and economic strength.

EDITOR'S NOTE: Jeremy Cramer, who was superintendent of the Stevens Point Wastewater Treatment Plant at the time this article was researched and written, has since left to become superintendent of the Fond du Lac (Wis.) Regional Wastewater Treatment Facility. His successor is Chris Lefebvre, formerly chief wastewater operator at Stevens Point.

The Stevens Point Wastewater Treatment Plant could hardly be a better fit for its central Wisconsin community of 27,000.

Walkers and bicyclists passing just outside the fence on the 26-mile Green Circle Trail experience little or no odor. The University of Wisconsin - Stevens Point and its College of Natural Resources provide a steady pipeline of interns for the plant, and three of its full-time operators are graduates.

The plant's multiple green features — biogas-fueled cogeneration that produces nearly all of its energy, biological phosphorus removal, use of effluent for heating and cooling, and a host of energy-saving innovations — match the community's strong environmental ethic. Even the building architecture is harmonious: The handsome sandstone exteriors match those of the structures at Jules Iverson Memorial Park.

Most important, Jeremy Cramer and his operations team make sure the plant sends high-quality effluent to the Wisconsin River, with an eye toward keeping rates down and helping local businesses prosper and grow.

“It’s a well-run facility, and that doesn’t start and end with me,” says Cramer, wastewater superintendent. “My predecessors Eric Niffenegger, Don Ceplina and Henry Tork left a great legacy to build on, and I’m blessed to be part of a strong team. We have a great boss [Joel Lemke, director of utilities] and excellent operators.”

Fuel for innovation

The solids side powers this 4.6 mgd design/3.0 mgd secondary facility. High-BOD wastewater from dairies and the fast-growing Stevens Point Brewery supports high biosolids and biogas production. The plant’s three mesophilic anaerobic digesters, also fed directly with brewery, dairy, food processing and distillery wastes, yield some 91,000 cubic feet of gas per day, enough to make the plant actually energy positive at times. (As a bonus, tipping fees from the wastes generate about $115,000 in annual revenue.)

The gas feeds a 180 kW engine-generator (MAN) by way of a fuel treatment skid (Unison) that removes hydrogen sulfide, water and siloxanes. The electricity powers essentially all plant processes, while heat recovered from exhaust gas and jacket water heat recovery keeps three buildings comfortable in cold weather and maintains the digesters at 96 degrees F. Two boilers that once burned natural gas to heat the digesters now function as heat exchangers.

“We still flare some gas because we bring in so much additional material and we don’t have gas storage,” says Cramer. “We could have installed a bigger engine, but we sized it for the amount of gas we would produce if we lost all our sources of high-strength waste. If we had upsized the generator, you wouldn’t see that flare.”

The digesters take in a mix of waste products and primary sludge, plus waste activated sludge thickened from 0.5 to 3.5 percent solids in an Envirex dissolved air flotation (DAF) system (Evoqua).

Biosolids leave the digesters at about 2 percent solids. Polymer is added, and a Hycor rotary drum thickener (Parkson Corp.) boosts the solids content to 4.5 to 5 percent. That material is delivered to two 1.6-million-gallon storage tanks, where decanting raises the solids content to as high as 6 percent. The finished Class B material (about 3 million gallons per year) is applied to grain corn ground in spring and fall and on alfalfa fields in summer after cuttings.

Doing it biologically

The overall treatment process makes use of most structures and tankage from the original facility, built in 1940. The highlight of the liquid side is the bio-P process. “In about five years, there will be a total maximum daily load on the Wisconsin River, and at that time our effluent phosphorus limit will be substantially lower — about 0.1 mg/L versus the current 0.93.”

Stevens Point wastewater is higher in organic waste than is typical. “While the average for a municipal plant is about 250 mg/L BOD, we see about 350,” Cramer says. “The Point Brewery nearby contributes to the higher organic loading.”

Two 78-inch-diameter screw pumps (Evoqua) lift influent 32 feet, after which it flows through the plant by gravity. The headworks includes a 3 mm stair screen (Vulcan Industries), a PISTA Grit vortex grit removal system (Smith & Loveless), and a grit washing and dewatering system (Huber Technology).

Primary clarifiers remove about 60 percent of incoming organic solids, accounting for 25 to 30 percent of BOD removal. Primary effluent enters an anaerobic zone where phosphorus-accumulating organisms first release phosphorus. When the water passes out of that zone (after about one hour) and enters the aeration basins, they take more phosphorus than they released.

“We do bio-P removal 100 percent of the time,” says Cramer. “We don’t use any metal salt for chemical precipitation. The high organic content of our wastewater drives the bio-P

process — the brewery wastewater definitely helps. If ever we were to struggle with our bio-P, we could use one of our high-strength waste substrates as a carbon source.

“Bio-P is not necessarily easy. It takes some operational changes through the seasons. In cold temperatures and warm temperatures we have to make some adjustments. But it’s definitely a huge savings. For a facility our size to get our influent down to our permit level of 0.93 mg/L using ferric chloride, that would cost about $128,000 per year. We spend essentially zero. In addition, if you add a metal salt, the precipitate increases your biosolids somewhat, so we avoid the extra expense of handling that material.”

The plant’s three aeration basins run in parallel. Air is driven through membrane fine-bubble diffusers (Sanitaire) by three 150 hp rotary-lobe positive displacement blowers from a 1993 plant upgrade, and a 3-year-old rotary screw blower (Atlas Copco) that is about 20 percent more efficient. “We try to run only one blower at a time to limit electric utility demand charges,” Cramer says.

Wastewater leaving the aeration basins enters two Envirex center-feed final clarifiers (Evoqua). Clarified effluent is disinfected (summer only) in a TrojanUV3000Plus system (TrojanUV) before discharge to the river through a concrete outfall structure.

Out with energy waste

Apart from consistent effluent quality, a point of pride for Cramer and his team is steady progress on saving energy, even as plant loads have increased. The biggest energy project was the cogeneration system, installed in 2012, but other projects, large and small, have contributed to energy self-sufficiency.

The team reduced power consumption significantly by ratcheting down the aeration basins’ dissolved oxygen setpoint from 2.5 mg/L to 0.9 mg/L. “If you give the bacteria more oxygen than necessary, you’re just wasting energy,” Cramer says. “Through years of profiling, experimentation and testing, we found that we can treat effectively at 0.9 mg/L of DO.” The DO setpoint is maintained in a feedback loop with LDO probes (Hach) that signal a programmable logic controller (PLC) to ramp blower output up or down. Other energy innovations include:

- Installing heat pumps using plant effluent to heat and cool the lab and office building and a new garage.

- Downsizing the compressor that supplies air to the plant's DAF system, diaphragm pumps and non-potable water reuse system from 50 hp to 10 hp.
- Installing an energy efficient linear motion mixer (Ovivo) on a digester.
- Programming PLCs to prevent high-horsepower motors from running at the same time, limiting demand charges.
- Downsizing three mixers in the bio-P basin from 8.3 hp to 2.5 hp.
- Shutting off pole lights for yard lighting and converting building exterior lamps to LEDs.

"This was a well-run and very efficient plant since before my time," says Cramer. "Before we put in the biogas cogeneration, we were in upper 90s percentile in the country for energy usage. We've continued to make progress because we focus on energy — we consider energy in every decision we make."

An exciting field

Energy is just one of many aspects of the profession that keep Cramer enthused about going to work: "Most people wouldn't think of wastewater as an exciting field, but it is. It's inspiring when leading tours to see people start to appreciate all that goes on here and start asking questions and get involved. The wastewater field is ever-changing. I'm proud to be part of it."

The staff at the Stevens Point Wastewater Treatment Plant, from left, Frank Suchon, operator; Adam Clark, operator; Jeremy Cramer, former superintendent; Joel Lemke, public utilities director; Michael Vassar, operator; and Chris Lefebvre, plant superintendent. Not pictured: Dan Ryskoski, operator.