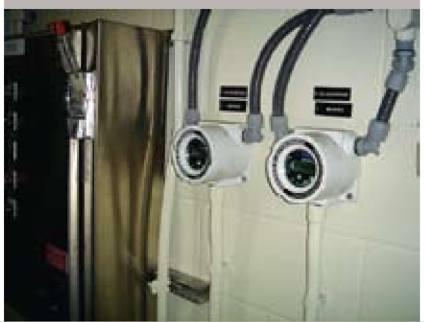
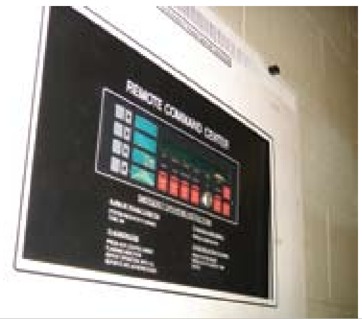
GAS DETECTOR bloodhounds

A score of electronic "bloodhounds" are monitoring dangerous levels of toxic, explosive and noisome gases at the Seneca Wastewater Treatment Plant (WWTP) in suburban Minneapolis. The bloodhounds are actually sensitive gas detectors from Sensor Electronics that keep a watchful eye out for hazardous methane, chlorine, hydrogen sulfide and sulfur dioxide throughout the plant.

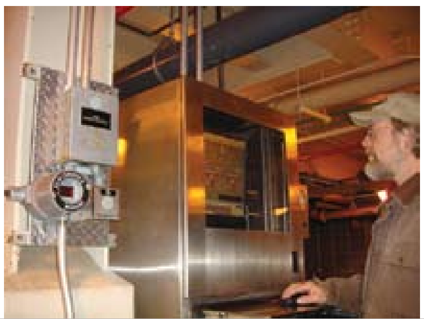
A tiny bucket scoops up a sample of water leaving the Seneca WWTP before it flushes into the nearby Minnesota River. Samples are tested for cleanliness and clarity, and discharge is purer than upstream river water.



Twin detectors monitor chlorine (Cl_2) and sulfur dioxide (SO_2) levels in the tank feed room. Because chlorine is heavier than air, sensing tubes go down to floor level. Besides watching for chlorine, detectors watch themselves, reporting problems on a digital readout panel, relaying an alarm to a remote command center.



Three remote command centers monitor the army of gas detectors and flash immediate warning of trouble conditions anywhere in the treatment facility. Systems also check every detector every 5 seconds, reporting any problems instantly.



Scattered throughout the plant, sensitive detectors show actual gas levels in ppm or LEL. A cubicle panel shows plant pumps/valves schematic.

Detectors in a long underground tunnel beneath the clarifier/aeration basins keep constant watch for toxic/explosive gas buildup. Digital readout panels show actual gas levels; LEDs glow green if levels are normal and change to amber then red if readings increase.

By Patrick G. Smith

Monitoring dangerous gases at a Minneapolis WWTP

Seneca gulps in some 28 million gal per day (mgd) of sewage from four communities in the Twin Cities' south suburban ring, plus the nearby Mall of America shopping center—"almost a small city in itself," according to Seneca Operations Chief Ted Stein.

Dating back a half century, Seneca is the fourth-largest treatment plant in the state. Regular expansions and updates have made it one of the top 10 in the nation in terms of efficiency, efficacy and operating economy.

"We recycle and reuse wherever we can," Stein said. "We recycle our bacteria. We send undigestible solids to a landfill. We wring excess water out of the remaining sludge and sell that to an eastern fertilizer plant. We treat the remaining water until it's clear and clean, then feed it into the nearby Minnesota River. And that water—18 mgd—is cleaner than the upstream river water. In fact, you can see the clarity difference at our discharge outlet in the river."

A Nickel a Day

By closely monitoring operations and operating costs, Seneca treats the 55 gal of daily sewage from each of its 300,000 customers for a nickel a day.

"We have held to that nickel-a-day rate for the past decade in spite of higher costs for almost everything," Stein said. "We have done it by streamlining our treatment methods, by automation, by using computers wherever possible and by cutting expenses in unusual ways."

"Take those gas detectors, for example. We are getting double the operating life compared to previous units," he continued. "This means that, depending on the location, we only change the sensing element every year or, more likely, every two years. And because these sensors are factory calibrated for each specific gas, we don't have to bother with onsite calibration. So we can change the sensor in a couple of minutes, in contrast to the half hour it used to take, what with fussy checking and calibration."

Another example is spraying water into the WWTP's incinerator chimney. According to Stein, keeping the stack temperature down to around 1,600°F cools the waste particles so that they do not clump into large chunks, making the slag easier to handle. It also keeps the incinerator cleaner.

"We used to shut down three [or] four times a year for chimney cleaning—an expensive proposition when you figure the downtime lasting days," Stein said. "Now we shut down just once a year, mainly to check the chimney. Cleaning is a thing of the past. And the lower temperatures mean the firebrick lasts longer."

Operations at a Glance

For the most part, Seneca operations parallel conventional waste treatment plants. Incoming effluent is screened to sieve out rocks, plastics and other indigestible materials. The heavy sludge is then pumped to twin clarifiers in which anaerobic bacteria begin digesting the sewage, creating toxic/explosive methane and hydrogen sulfide.

Indigestible solids go to a landfill; the remaining material goes to aeration basins, which together comprise the size of six football fields. Here oxygen bubbles up through the bacteria-laden liquid to speed the decomposition. Heavier materials sink to the bottom and are shunted to a centrifuge to wring out remaining water, then to the incinerator. Meanwhile, the bacteria-rich sludge is skimmed off and fed back to the clarifiers, where the bacteria go back to work.

"In effect, it is a self-selection process for the bacteria," Stein said. "They screen themselves out, with only the strongest and most vigorous going through the cycles. Hopefully we will wind up with bigger and better bacteria that will eat more and eat faster, meaning we can move sewage faster and thereby keep up with population growth without expanding our plant and our budget. So in a sense, we are genetically engineering better bacteria."

Depending on temperature—it can get to -30°F on a Minnesota winter day—it takes up to 16 hours for incoming sewage to move through the primary clarifiers and aeration basins. Increasing bacteria efficiencies could shave an hour or more from these times.

The liquid goes to six final clarifiers, is treated with chlorine, then cascades down a double-weir waterfall to aerate the water; oxygen-enriched air is also fed into the now-clear water. From there it flushes into the Minnesota River.

Bloodhouds in Action

The gas detector bloodhounds look for dangerous explosive/toxic gas levels at the initial separation stage, at the clarifiers and aeration basins, and at the chlorine feed units. In addition, detectors are at critical points in the four-block-long tunnel underneath the plant.

Digital readout panels on each detector show exact gas levels at that point. The detectors feature LEDs that change from green to amber to red as gas levels increase. At red, alarms go to a central control panel and warning signals alert personnel. The detectors even keep an eye on themselves, spelling out what is wrong and where in case of any troubles in the system.

Savings from these long-life gas detectors—from spraying water in the incinerator chimney, recycling better bacteria, automating and using computers—have helped Stein cut his operating budget by 30% compared to what it would have been with inflation and booming population growth.

"We are running lean and clean—just like our wastewater," Stein said. WWD

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