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No More Green Acres?

After Kern County wins an appeal, Los Angeles-area agencies petition the U.S. Supreme Court to decide the fate of its land-applied biosolids

After a district court found its antibiosolids voter initiative to be unconstitutional, Kern County, Calif., fired back against Los Angeles agencies in an appeal to the 9th U.S. Circuit Court of Appeals — and won. The agencies, in turn, have appealed yet again, petitioning the U.S. Supreme Court in March to review the case.

Measure E was passed overwhelmingly by a majority of voters in June 2006 in rural Kern County, which lies about 100 mi (160 km) north of Los Angeles. The ballot question read, "Shall the ordinance prohibiting the land application of biosolids in the unincorporated area of Kern County be adopted?"

The ban was never enacted, having been stopped by a preliminary injunction by a judge in the U.S. District Court in November 2006 (see "Battle Over Biosolids: Kern County, Calif., Ban on Los Angeles Biosolids Delayed," *Biosolids Technical Bulletin,* January/February 2007).

Kern County filed an appeal. Last September, the 9th Circuit Court found that the City of Los Angeles failed to make its case on two important points: that the biosolids ban violated the "Dormant Commerce Clause" of the U.S. Constitution and that Measure E would allow Kern County to overstep its authority by conflicting with California recycling mandates, which, by nature of being state law, "pre-empts" local laws.

(For more explanation on these laws and legal precedents, including the Dormant Commerce Clause and federal pre-emption of state and local laws, see "Legal Challenges to Land Application," *Biosolids Technical Bulletin*, January/February 2009).

In their opinion statement, the three judges who heard the appeals case said the summary judgment for plaintiffs is reversed, stating that the recyclers' injury was "not even marginally related" to the interests that the Commerce Clause seeks to safeguard.

High Stakes for Both Sides

The City of Los Angeles sends 90% of its biosolids, treated to Class A standards, to the 1900-ha (4700-ac) Green Acres farm in unincorporated Kern County. The city purchased the farm in 2000 for $28 million and land-applies biosolids to grow cattle feed. In total, the farm handles one-third of all California's biosolids.

In March, the City of Los Angeles, Orange County Sanitation District, County Sanitation District No. 2 of Los

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Removing Nitrogen in One Step

The first U.S. installation of SHARON technology reduces energy and BOD demands, saving money and space

Making its U.S. debut, Stable High Ammonia Removal Over Nitrite (SHARON) technology began startup in November 2009 at Wards Island Wastewater Treatment Plant (WWTP) in New York City.

At a cost of $71.5 million, the new technology, developed in the Netherlands, will remove nitrogen from 7000 m^3/d (1.85 mgd) or at peak flows of more than 8700 m^3/d (2.3 mgd). Currently, the process is treating 3800 m^3/d (1 mgd) of centrate.

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As a result, the plant's nitrogen discharges to Long Island Sound will be reduced by more than 4500 kg/d (10,000 lb/d; 95% of total nitrogen). SHARON also saves 25% of energy requirements, reducing Wards Island's carbon footprint, according to city documents. It also fits in the tight footprint of a confined urban utility.

Small, Efficient, Sustainable

The SHARON process, which treats the centrate sidestream, takes place in a single mixed reactor with two stages. The tanks are 29 m × 26 m × 7 m (95 ft × 86 ft × 23 ft) and 29 m × 13 m × 7 m (95 ft × 44 ft × 23 ft), respectively. According to Alphonse Warakomski, Wards Island project manager, partner, product manager of sidestream biological treatment processes, and southwest region manager for Mixing and Mass Transfer (M2T) Technologies LLC (Kansas City, Mo.), SHARON's installed cost at Wards Island is about $2.36 per kilogram ($1.07 per pound) of nitrogen removed.

In the SHARON reactor, nitrite is converted to nitrogen gas with zero sludge retention, which reduces the plant's overall sludge production by 30% to 50%.

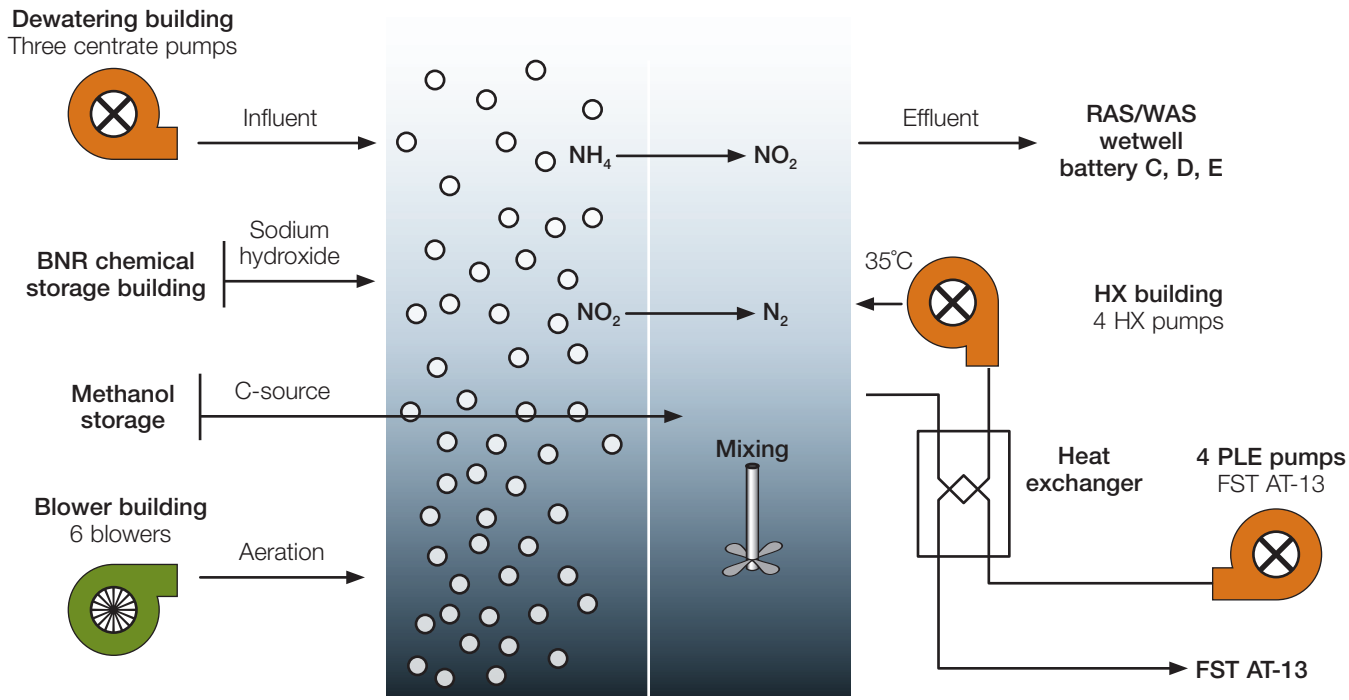
Unlike traditional processes that convert ammonia to nitrate, with SHARON, bacteria convert ammonia to nitrite, which is then converted to nitrogen gas. By essentially speeding through both nitrification and denitrification in a single step, SHARON reduces biochemical oxygen demand (and methanol additions) over conventional denitrification by 40% and oxygen energy transfer for nitrification by 25%, according to Warakomski and Grontmij (De Bilt, Netherlands), SHARON's developer and owner.

The ammonia oxidizers are an advantage. Due to differences in growth rates, nitrite oxidizers are washed out "more rapidly than they can proliferate" while ammonia oxidizers are maintained, Warakomski said. "This allows a different metabolic pathway to be used to convert ammonia to nitrogen gas."

"The key thing they discovered in the Netherlands with total nitrogen removal was a difference in growth rates of nitrogen groups" — the nitroso- and nitrobacteria, Warakomski said.

In the first tank, fine-bubble diffusers add oxygen, and ammonia is converted directly to nitrite under temperatures from 30ºC to 40ºC, at which ammonia-oxidizing bacteria thrive. In the second tank, methanol added under anoxic conditions converts the nitrite to nitrogen gas. Heterotrophs convert nitrite to nitrogen gas, reducing carbon (methanol) feed.

Figure 1. Wards Island SHARON® System



BNR = biological nutrient removal.
FST = final settling tank.
HX = heat exchanger.
PLE = pressure low effluent.
RAS = return activated sludge.
WAS = waste activated sludge.

"You can take advantage of [the bacterial] growth rate, and no one's ever seen it before," Warakomski said, noting that the smaller footprint is due to a shorter 1.5-day sludge retention time. Either a reactor with a single stage with sequencing oxic–anoxic time periods or a reactor with two stages (one oxic, one anoxic) can be used, he said.

Energy Savings, Better Water Quality

In terms of energy, the technology's reduced aeration requirements will save 20% to 35%, and perhaps up to 40%, in electricity costs, compared to traditional denitrification technologies that require aeration blowers, when SHARON is fully up and running at Wards Island.

"You talk about carbon footprints, Wards Island has a big nitrogen footprint," said Vincent Sapienza, deputy commissioner of the Bureau of Wastewater Treatment in the City of New York Department of Environmental Protection (DEP).

Wards Island, which began operating in 1937 and is the city's second largest WWTP, dewaters the anaerobically treated sludge of five of New York City's WWTPs, creating much more ammonia than other plants of comparable size.

According to Sapienza, New York will meet its commitment under the Long Island Sound Plan, which calls for reducing nitrogen discharges by 58.5% over 15 years, by 2017.

DEP had been investigating potential nitrogen solutions since 1998, but since the facility is landlocked in an urban environment, "that got us to scratch our heads a little bit," Sapienza said.

After a successful demonstration project by the city and Grontmij in 2006, the city chose SHARON because it not only provides denitrification in a small footprint but also supports citywide sustainability goals.

Energy-efficiency projects at WWTPs are a key goal of New York City Mayor Michael Bloomberg's official plans for a sustainable New York by 2030. According to Grontmij, SHARON produces 20% less carbon dioxide than conventional technologies.

At the Wards Island biosolids processing complex, centrate from the centrifuge building (upper left) is sent to the SHARON building (light-blue-walled building on right). There, ammonia is converted to nitrogen gas after caustic soda and methanol are added.

In addition to improvements at Wards Island, sidestream treatment processes to reduce ammonia and nitrogen are under construction at two of the city's other WWTPs that discharge to Jamaica Bay, and the city is investigating ThermoEnergy (Little Rock, Ark.) recovery systems at another plant that discharges to the bay.

As a result of the U.S. Environmental Protection Agency's 2000 *Long Island Sound Study*, Connecticut and New York are subject to a total maximum daily load for nitrogen, and the City of New York entered into consent order in 2006 to address nitrogen releases to Jamaica Bay and the East River. Other capital projects, such as $5 billion upgrades to the city's New Town Creek Plant in Brooklyn, are contributing to improved water quality. Recent monitoring has shown improvements to the overall region, according to Sapienza.

Temperature Challenges

Incorporating the process required some retrofitting of the main plant and, at press time, new alkalinity facilities were not yet on-line but were expected to be completed by May or June.

A Grontmij-designed heat exchanger was added to offset SHARON's heat by transferring it to the main plant, where temperatures are lower. According to Warakomski, the new reactor must be kept below 40ºC, and this could be a challenge in summer.

Bohdan Bodniewicz, project manager for design at AECOM (Los Angeles), explained that because of the kinetics of SHARON, temperature is a key variable when converting from ammonia to nitrite.

The key to the SHARON process is not letting ammonia get to nitrate, Bodniewicz explained. And because nitrification is exothermic and creates heat, increased temperatures could accelerate the reaction and effectively "go too far," creating nitrate, he said.

Recycled-cooling-water pumps "were sized fairly large to dissipate that heat in the summer," said Bodniewicz. "We're going to find out very shortly, but I don't think it's really going to be an issue unless we hit some really high variables" in terms of temperature. If that happens, adding more methanol is an option the city can use to correct it, he said.

The overall project, including construction, installation, and startup, will last about 18 months, according to city documents.

—Andrea Fox, *BTB*