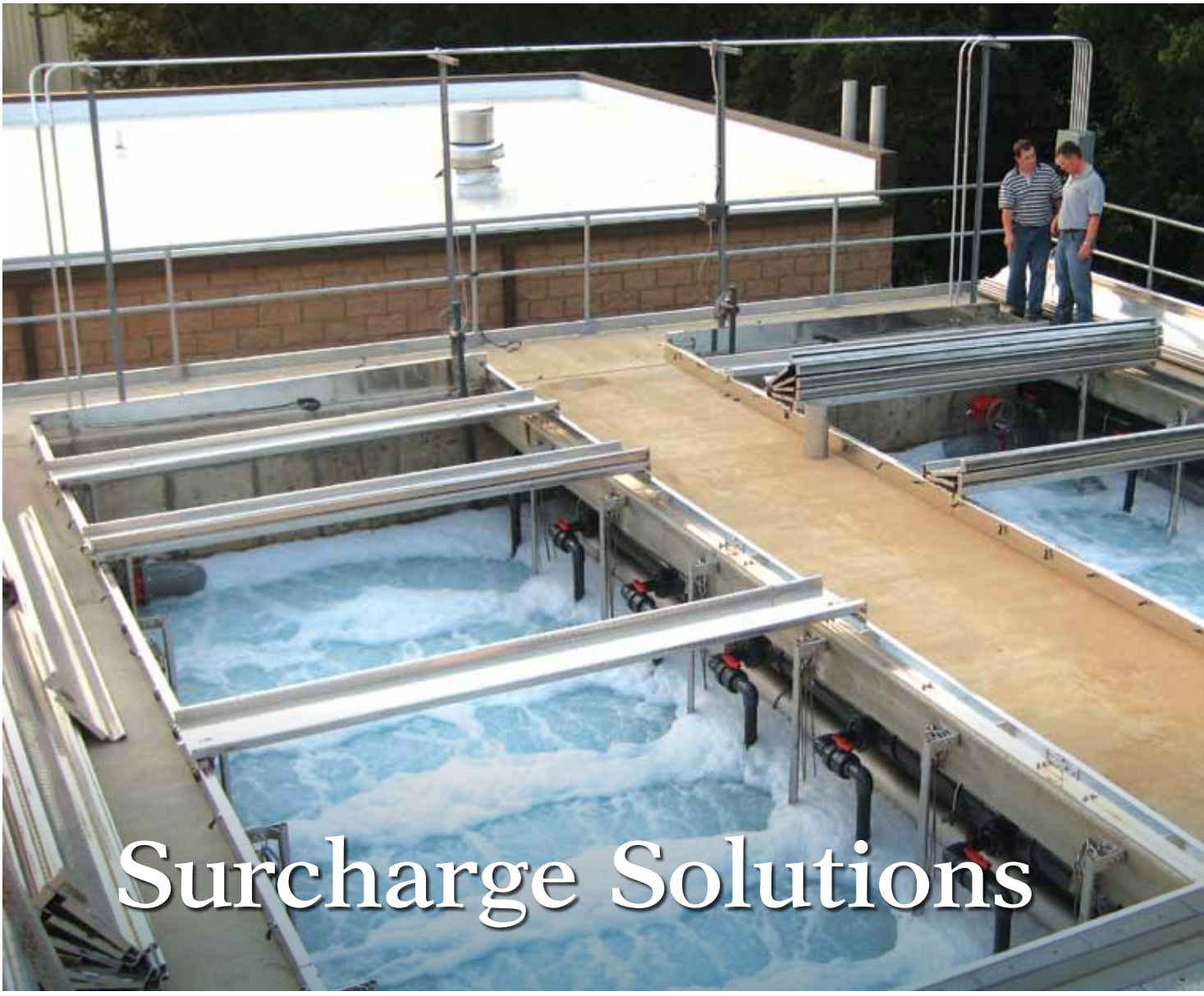

Surcharge Solutions

How mounting costs and higher standards forced one snack food plant to look at new options for wastewater.

BY JIM MCMAHON

IN 1998, Birmingham, Alabama's Golden Flake Snack Foods was paying US$800 to $1,000 per month to Jefferson County in surcharges for decanting its 100,000 to 350,000 gallons of wastewater into the county's municipal sewer system. By 2008, that figure had escalated to $100,000 per month in surcharges for the same daily discharged wastewater flow rate, with county projections that the rate would most likely raise to $250,000 per month within the next five years.

The plant was faced with a tough decision: either come up with a solution to stem the escalating municipal wastewater surcharges, or move its 300,000-square-foot building out of the county to stop costs from increasing any further.

Given the fact that 68 per cent of Golden Flake's 250-plus work force lives within a 20-kilometre radius of the plant, the company preferred to keep its 80-year-old headquarters and main manufacturing facility in Birmingham, and find a solution to reduce or eliminate the surcharges. In essence, this meant getting off of the county sewer system.

The Alabama Department of Environmental Management, which sets standards for wastewater regulations within the state, made it clear that if Golden Flake could reach prescribed total suspended solids (TSS), biochemical oxygen demand (BOD), ammonia-nitrogen (NH_3-N) and dissolved oxygen (DO) concentrations, it could receive a discharge permit to convey treated effluent directly into a creek that runs along the perimeter of its property

Credit: ADI Systems

Open membrane bioreactor tanks at Golden Flake's facilities in Alabama.

"The wastewater being decanted to the county sewer system had BOD and TSS concentration levels in the thousands, exceeding maximum surcharge levels," says David Jones, executive VP of operations for Golden Flake. "As our surcharges continued to escalate, we began looking for a treatment technology that could not only handle our high-volume peak flows of 350,000 gpd, but also produce an effluent that was below the Alabama Department of Environmental Management's maximum allowable discharge concentration limits for BOD, TSS, NH_3-N and DO."

and bypass the Jefferson County sewer system altogether.

Golden Flake's wastewater

The Golden Flake plant manufactures and distributes a full line of snack food items, including potato chips, tortilla chips, puffed corn, corn chips, cheese puffs, cheese curls, onion rings, and pork skins. Pork skins are its specialty, producing over a dozen varieties. In fact, it sells more pork skins in the southeastern United States than any other company. It is also well known for its extensive line of potato chips.

In 2009, Golden Flake's Birmingham facility processed more than 20 million pounds of snack foods totalling US$120 million in sales, 95 per cent of which was distributed within 12 southeastern states.

The plant's production mix of potato chips, corn chips, and pork skins can vary, causing the raw snack food wastewater to have varying strengths and consistencies, with flow rates ranging from 100,000 to 350,000 gallons per day (gpd).

All of the wastewater handled through the plant's on-site wastewater treatment facility comes from the production of snack foods—mainly from the processing of potatoes and corn. No sanitary sewage enters this system. From their arrival on site, the potatoes are carried in a water flume to be peeled and sliced. The slices are then washed and put through deep fryers before being packaged. The flume and wash water is drained daily and discharged for onsite wastewater treatment.

Credit: ADI Systems

Installing MBR piping at Golden Flake.

Raw corn, for the production of corn and tortilla chips, is cooked in kettles with water and lime to loosen and remove the husks, then soaked in vats to increase the moisture content of the kernels. The kernels are then washed to remove impurities, milled, sheeted to run through ovens, deep fried and packaged. The water from these processes is discharged after use for onsite wastewater treatment.

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Pork skins arrive at the plant in pellet form and go straight into deep frying, then seasoning and packaging. The plant has seven deep fryers that handle its various product types. The majority of the spent cooking oil is trapped in an oil pit and removed before entering wastewater treatment. But the fryers do need to be boiled out weekly, contributing to the wastewater stream.

Raw snack food wastewater is pumped through vibrating screens, which collect 15,000 to 20,000 pounds per week of large food particles. This organic matter is collected and transported upstate to be used as animal feed.

From the time the facility was originally built in the 1950s, the pre-screened wastewater leaving the plant was received at a primary clarifier for primary sludge settling with supernatant discharged to the county sewer system (Golden Flake is permitted to release up to 400,000 gallons of wastewater per day). The stagnant wastewater in the primary clarifier was not aerated or covered and would produce odours. The clarifier was located along the edge of a street, where a housing development had been built, and the odour was becoming an issue with residents.

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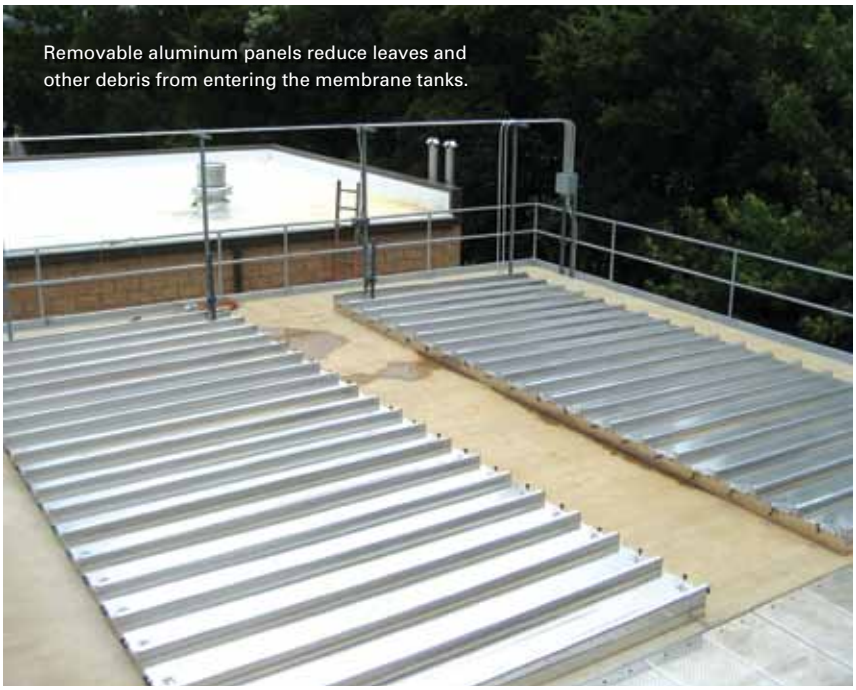
Engineering a solution

Golden Flake engaged Fredericton, New Brunswick's ADI Systems to engineer a solution. Located in Birmingham's inner city, the plant is landlocked, which complicated the matter. There was no room for site expansion, and little available room for a conventional activated-sludge facility with the footprint requirements for spray fields to process the plant's wastewater flow.


Removable aluminum panels reduce leaves and other debris from entering the membrane tanks.

Credit: ADI Systems

The solution? The implementation of a membrane bioreactor (MBR) system to treat the raw wastewater following the vibrating screens. The MBR process, based on technology developed by ADI Systems and Japan's Kubota Corporation, is a form of activated sludge technology that uses a submerged membrane barrier to perform the liquids/solids separation and reactor biomass retention functions, instead of gravity clarification, which eliminated problems associated with sludge settling and separation.

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Golden Flake liked the MBR approach. The treated effluent from the MBR system could be discharged into the Upper Valley Creek, adjacent to the property, eliminating the need and expense associated with discharging wastewater to the county sewer system.

For three months, ADI Systems operated a 350-gallon MBR pilot plant onsite at Golden Flake using a small stream of pre-screened wastewater. The study was a success and demonstrated that ADI-MBR technology was easy to operate, could consistently meet the effluent limits, and produce a direct discharge quality effluent.

"The system also fits in to a very compact and small footprint," says Jones. "This is what we needed for our site."

The system

The ADI-MBR system provides a near-absolute barrier to suspended solids and allows for operation at higher mixed liquor suspended solids (MLSS) concentrations (typically 10,000 to 18,000 mg/L, versus 2,000-5,000 mg/L found in conventional activated sludge systems) resulting in longer solids retention times, less waste sludge production, and a much smaller footprint.

The system at Golden Flake consists of a pre-aeration tank and two membrane basins, each equipped with double-decker submerged membrane units (SMU).

The system is also equipped with aeration blowers, a re-aeration chamber, pumps, instrumentation, and controls. The total package includes a control building with a dewatering press/conveyor system, automatic composite samples, laboratory, office, and PLC systems.

During operation, treated effluent is passed through the membranes via a slight suction, and then aerated to meet the DO limit prior to discharge to the adjacent stream. Waste activated sludge is dewatered onsite with a screw press and the sludge cake is removed for disposal.

The system at Golden Flake provides a design hydraulic retention time of approximately one day, and is designed for a daily influent flow rate of up to 400,000 gpd. The system treats pre-screened wastewater with BOD and TSS concentrations that range from 1000 to 10,000 mg/L and 200 to 12,000 mg/L, respectively.

Implementation

The system consistently produces effluent that is lower than effluent discharge limits set by the Alabama Department of Environmental Management: <2ppm TSS, (<30 ppm TSS limit); <5 ppm BOD, (<10ppm BOD limit); <1 ppm NH_3-N (<1.5 ppm NH_3-N limit); and >6 ppm DO (>6ppm DO limit).

Up to 250 gallons per minute of clean, high-quality effluent is released into Upper Valley Creek, and serves to enhance the downstream riparian environment by improving the oxygenation of the water flow within the small watercourse.

The final effluent is clean enough to reuse for certain applications, such as site irrigation. The waste activated sludge is pumped through an on-site dewatering press to reduce the overall sludge volume to 20,000 pounds per week, which is then trucked upstate for farm fertilization.

Golden Flake was able to stop discharging primary treated wastewater into the county sewer system, putting a stop to the escalating surcharges it was paying for its wastewater discharge. WC

Jim McMahon writes on water and wastewater systems.