



Pulp & Paper Project

MBBR technology helps mill meet effluent discharge limits

By Todd Schwingle

■ nland Empire Paper Co. (IEP) in Spokane, Wash., is a manufacturer of newsprint and specialty paper products. The mill, which has been in operation since 1911, supplies paper to more than 160 customers throughout the U.S. It produces an average of 530 tons of pulp and finished paper products every day.

An organization that describes its “first and foremost concern” as the “protection of our environment,” IEP also manages 116,000 acres of company-owned timberland in northeastern Washington state and northern Idaho. These forest lands are managed to enhance the long-term stability of IEP and the local forest products industry, and for sustainable resource preservation.

Wastewater Treatment Criteria

IEP uses two separate processes to produce pulp for use in its finished paper products: thermo-mechanical pulping (TMP) and recycling of old newsprint (ONP). The resultant wastewater from these processes is treated via an onsite system designed to comply with limits on biochemical oxygen demand (BOD), total suspended

solids (TSS), total phosphorus and pH range as specified in IEP’s National Pollutant Discharge Elimination System permit.

Until recently, the water had been treated using a primary clarifier, a Siemens Orbal three-channel oxidation system, and a secondary clarifier. But when mill production approached the existing system’s capacity at the same time that some of the most stringent BOD limits in the country were put into effect, IEP knew the mill’s wastewater treatment plant required upgrading.

In its project bid, IEP outlined several design, construction and equipment criteria that any upgrades to the facility would have to meet. An increase in the production of specialty paper products, including marketable newsprint and Hi-Brite paper, resulted in a subsequent increase in BOD loading to the treatment plant, which would push the existing wastewater treatment system to its limit. In addition to addressing this issue, a new system had to accommodate flow and BOD surges from the TMP and ONP processes being used at the mill, while also improving operations of the downstream



Left: Surface of MBBR at or near design organic loading rate.

Top right: Mechanical aeration discs in mixed liquor.

Bottom right: Three disc aerators over three channels.

processes. Lastly, space limitations on company property presented a significant logistical challenge in terms of what realistically could be added to the system and to what degree the existing equipment could be modified.

Turnaround time for the entire project was tight. IEP was in the process of replacing the mill's old pulping equipment, which dated from the 1960s, with a new TMP system. The new system's heat-recovery process would reduce IEP's dependence on natural gas to dry its paper products; subsequently, associated air emissions would decrease by more than 75%. In order to accommodate the TMP's startup date, upgrades at the wastewater treatment plant had to be online and operational within five months.

Choosing the Right System

Project leaders at IEP researched and pilot-tested several secondary-type treatment systems for enhanced removal of BOD that also could expand the capacity of the existing system and improve overall operability. After completing this due diligence, they determined that a moving-bed biological reactor (MBBR) would provide the

best overall performance, particularly because it could work in conjunction with and enhance the performance of the existing three-channel oxidation system.

"We went through a fairly extensive period of researching and testing to make sure the final decision we made was the right one," said Doug Krapas, environmental manager for IEP. "Siemens' MBBR technology provided the best overall performance with the most operational reliability and the least amount of capital and O&M [operation and maintenance] cost."

The MBBR is a once-through system that incorporates a biofilm process in a completely stirred reactor; no sludge recirculation is required. Biofilm develops on the inside of plastic carriers moving freely in suspension in the reactor tank, oxidizing ammonia nitrogen in the wastewater. Oxygen is delivered to the carriers through coarse-bubble aeration, which also keeps the carriers mixed and in suspension. Media is retained in the tank via stainless steel cylindrical retention screens.

For the IEP plant upgrade, the MBBR split into two parallel trains, each with a capacity of 262,500 gal—a

■ PULP & PAPER WASTEWATER TREATMENT

quarter of the volume of the Orbal system that was already in place. This modification allowed the MBBR to leave a smaller footprint fitting the confines of the company property.

Each MBBR contains four 14-in. wedge-wire retention screens sized for peak hydraulic flows with minimal head-loss. The screens are kept free of debris by aeration headers located directly underneath them and by continuous contact with the plastic carriers. Solids or sludge produced from the MBBR flow through to the three-channel oxidation system and become sludge inventory.

Immediate Results

In keeping with IEP's project time frame, the contract was finalized in April 2009; the first shipment of media and aeration was delivered in July; and the new system was operational in October.

Installation of the MBBRs significantly improved the performance of IEP's wastewater treatment system, allowing increased facility production shortly after going into operation. Before installation, the plant had difficulty maintaining a consistent solids retention time (SRT) due to a poor sludge volume index (SVI). This created a problem in maintaining the appropriate mixed liquor suspended

solids measurement necessary for the SRT for efficient BOD removal in the plant's particular waste stream.

Within three months of commissioning the new MBBRs, the SVI greatly improved, giving the operators tremendous flexibility in terms of the Orbal system's SRT. This also improved settling in the clarifier, greatly enhancing the removal efficiencies for BOD and TSS.

"The installation of Siemens' MBBR technology has virtually eliminated concerns of wastewater treatment system overload and sludge bulking," Krapas said. "The MBBR systems now allow us to operate over a wide range of varying process conditions with nearly hands-off operation. The Siemens group worked closely with IEP personnel through all phases of the project to assure that we had a complete and operational system within a very aggressive schedule."

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