It Pays to **Conserve** and **Reuse Water**

WHETHER DUE TO COST, AVAILABILITY, or environmental concerns, water conservation is becoming a major focal point, both in the public and private sectors.

RALPH WAGNER

The reduction of wastewater discharges in a paper mill begins with the identification of ways to reduce fresh water use. Reducing the amount of fresh water make up also decreases the amount of fiber and raw materials going down the drain to the wastewater treatment plant, and the biosolids being disposed of. Ultimately, the operating costs or discharge fees are trimmed, too. But the most significant cost savings comes from energy reduction. Each 1,000 gallons of fresh water make up requires more than 79,000 BTUs to heat the water to process temperature.

For example, at a 50,000 tpy fine paper or tissue mill with minimal water recycle, the cost savings are estimated in excess of US$100 per ton if 100 percent efficiency is achieved. In addition to these savings, there are production quality gains to be made by maintaining increased consistency in feed from the machine chest. More consistent feed to the paper machine means more reliable operation and higher runnability.

MATCH NEEDS WITH WASTE SOURCES

Development of a fresh water minimization strategy begins with identifying the uses and quantity of fresh water makeup, but also identifies the sources of wastewater throughout the mill. Each wastewater source needs to be characterized by flow rate as well as the contaminant concentration and variability. Understanding these variables is key in understanding the treatment required to recycle/reuse the wastewater, and the total cost of reuse.

Based on the fresh water make up reduction goals, the various sources of wastewater can be matched with the water needs in the mill to develop an economic model for wastewater recycle and reuse. If the goal is 10 percent, 30 percent or even 50 percent recycle/reuse of wastewater generated in the mill, it may be relatively easy to identify specific wastewater streams that have relatively low concentrations of pollutants, or pollutants that are more economical to remove versus attempting to treat the centralized wastewater.

Water uses in a facility do not require the same water quality. Attempting to match a wastewater stream to a specific water need can result in a very inexpensive way to recycle/reuse wastewater.

While there is a significant amount of interest in the reuse of water from pulp and paper mills, the number of facilities at the present time actually reusing wastewater from centralized wastewater treatment plants is somewhat limited. Presented below are two examples of internal reuse of wastewater as a solution to wastewater discharge needs.

Category	Range (gal/Ton)	Avg. Representing Performance (gal/Ton)
PULP MANUFACTURE		
Unbleached kraft	15,000-40,000	20,000
Kraft bleaching	15,000-35,000	20,000
Unbleached sulfite	15,000-50,000	25,000
Sulfite bleaching	30,000-50,000	40,000
Semi-chemical	8,000-40,000	10,000
Deinked	20,000-35,000	25,000
Groundwood	3,000-48,000	4,000
Soda pulp	60,000-80,000	65,000
PAPER MANUFACTURE		
Fine paper	8,000-40,000	10,000
Book or publication grades	10,000-35,000	12,000
Tissue	7,000-45,000	15,000
Kraft papers	2,000-10,000	5,000
Paperboard	2,000-15,000	8,000

Effluent volumes from the manufacture of pulp and paper.

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Zero liquid discharge isn't a new concept. However, it is more expensive than the alternative approach of regulated discharge to a water body. The McKinley Paper Co. (MPC) is an industry benchmark for this concept.

A subsidiary of Group Industrial Durango Corporation of Mexico, MPC is a 100 percent recycled linerboard mill commissioned in 1994. It originally produced 130,000 to 135,000 tpy of 100 percent recycled linerboard using old corrugated containers (OCC) but later expanded to 190,000 tpy. The mill is located in the high desert of northwestern New Mexico to take advantage of reasonable land costs, low electricity costs from an adjacent power plant, and a good labor force.

The Water Reclamation Plant (WRP) treats wastewater from stock preparation and various waste streams. At the time of its installation, MPC was the only mill in North America and one of only three in the world that truly had zero liquid effluent. The WRP is a completely closed process that reclaims all available water for reuse. The mill consumes 150,000 to 180,000 gal of water per day in the linerboard produced through evaporation. A plant of similar size would typically use 2.5 million gallons of water per day.

LEFT:
The McKinley Paper Co.

RIGHT:
Köhler Pappen

There are five stages of treatment within the water reclamation plant:

- Dissolved Air Flotation (DAF)
- Biological treatment using a Cycling Activated Sludge System (CASS)
- Microfiltration to remove both biological and suspended solids
- Reverse Osmosis (RO) for removing dissolved solids
- Crystallization for converting RO concentrate into solid crystals for disposal in a landfill

Using a treatment process from Siemens Water Technologies, the Water Reclamation Plant has met all requirements for COD, conductivity, chloride, availability, and reliability.

KÖHLER PAPER COMPANY

Any expansion in production can bring with it extensive upgrade work in the wastewater treatment plant to assure that the plant continues to meet effluent limit guidelines. Köhler Pappen in Germany used membrane bioreactor technology to upgrade its plant, achieve significant water use reduction, and successfully meet effluent quality standards.

Albert Köhler GmbH & Co. KG, based in Gengenbach in the Black Forest, uses a fourdrinier machine and two wet machines to produce roughly 40,000 tonnes of high-quality board each year. Environmental protection and sustainability are an integral part of Köhler's work. For example, the company exclusively uses recovered paper.

Köhler Pappen is a recycle mill producing various varieties of cardboard. Because of the variety of materials and heavily colored boards, demands on the water cycle and water treatment are high. Process water is taken from wells and until recently wastewater was discharged to the municipal sewer. The necessity for on-site wastewater treatment and recycle/reuse resulted from the local government raising wastewater surcharges by a factor of seven. The driver for the project was mainly economics. But, the mill took it one step further by closing the water loop, sending ~600 m^3/d of treated water back to production. This has reduced well water usage from the original 1000 m^3/d to 250 m^3/d, while also reducing energy for heating the water for the papermaking process.

The total solution provided by Siemens Water Technologiesincluded an integrated system of MBR and RO processes to significantly reduce the COD and BOD concentrations while greatly reducing the amount of brine discharged to the local sewage treatment plant. The recovered water from the MBR and the RO provides two levels of water quality for reuse in the recycled paper mill. The plant is meeting its environmental and regulatory requirements, while reducing its overall water usage.

CONCLUSIONS

The first step in developing a water reuse/recycle strategy should be to identify sources of fresh water make up which can be eliminated or minimized. The benefits will include:

- **Energy savings:** Each 1,000 gallons of fresh water make up requires more than 79,000 BTUs
- **Fiber and raw material savings:** 100 percent Raw Material utilization means lower waste plant costs and less sludge disposal
- **Higher runnability:** Increased consistency in the Machine Chest means more consistent Paper Machine operation
- **Environmental management:** Cost and efficiency of wastewater treatment improves through increased water management
- **Higher productivity:** Tons of Paper per Total Cost of Operation increases as costs are reduced and downtime is decreased.

REFERENCES

Bentley, David J., Jr., "McKinley Paper Goes from Zero to Success in Less Than Four Years," *TAPPI Journal* 82, no. 1 (January 1999).

Layson, Andrew, "Impact of Emerging Technologies on Pulp and Paper Plant Water Reclamation," 57th APPITA Annual Conference, Melbourne, May 5-7, 2003.

Norris, P. J., "Water Reclamation Operations in a Zero Effluent Mill," TAPPI 1998 Environmental Conference Proceedings. Atlanta: TAPPI Press, p. 1045.

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