Editorial Emphasis

Capitalizing on Wastewater Treatment Process

By Randy Hill and Jenny Leverett

In the first months of operation, this wastewater ultrafiltration system reduced the amount of waste hauled off-site by 85%.

Becoming the best at something takes focus. For Dayton Progress Corporation, their focus has been on manufacturing metal punches, punch blanks and metal stamping tools. Part of the logistics behind running a global corporation includes the management of wastewater, a process that Dayton relies on *CROWN* Solutions, a water management firm.

CROWN manages all of the water treatment needs for the company's Dayton, Ohio plant, from water in, to process uses, and even water out. This relationship allows Dayton to concentrate on their metal-related business while trusting *CROWN* to concentrate on their wastewater-related issues, which primarily include reducing their wastewater stream in order to reduce haul-off fees.

Initially one of seven vendors involved with fluid and chemical treatment at the Dayton facility, *CROWN* provided a part-time environmental manager at the facility.

One of the responsibilities of this position was to schedule and supervise waste shipments. Being familiar with environmental issues and the proactive of having wastewater and waste oils hauled off, *CROWN* was able to recognize an opportunity of reducing the rate being charged per gallon to Dayton for the disposal of the wastewater.

New pricing was negotiated with a new waste hauler that resulted in an 80% reduction of disposal costs.

Sole source provider

Over the past two years, the services of seven vendors has been consolidated into one sole source provider for water treatment equipment service, cooling tower management ion exchange tank and electrical discharge machine (EDM) exchange tank services, material safety data sheet management, and environmental management.

CROWN now provides a full-time environmental and water management specialist at the facility and plans an important role in recognizing and implementing projects to save Dayton time and money.

Once such project was to condition the wastewater so that it would be acceptable for disposal to the local municipal wastewater treatment plant.

Jenny Leverett, left, is *CROWN's* full time environmental specialist at the Dayton facility. Leverett is responsible for conditioning the wastewater to make it acceptable for disposal to the local municipal wastewater treatment plant. At right is Randy Hill, service manager for *CROWN Solutions, Inc.*

This wastewater primarily consists of waste coolants, EDM wastewater, and used oils. The majority of the oils are water miscible synthetic and semisynthetic cutting fluids that are used in the metal machining of parts in concentrations of 3–10% volume, The wastewater also consists of slightly caustic soap that is used to clean the floors and wipe down machines, mixed at 17% by volume. Previously, the waste was hauled off-site for treatment and disposal at the rate of 200,000 gallons per year.

Deciding on the right process took considerable research along with several trial experiments. Several treatment options were explored, including traditional wastewater treatment, evaporation and ultrafiltration.

Traditional chemical wastewater treatment was the first strategy piloted. Jar tests were performed using pH adjustment and demulsifiers with only moderate success. With the high levels of surfactants in the combined wastewater, achieving complete oil separation was difficult.

Evaporation was considered as a wastewater treatment method to remove the water from the oil. Evaporation is a good option for smaller waste streams, but the energy requirements to evaporate the quantity of wastewater produced at Dayton's facility would have been large and economically unfeasible.

Finally, mechanical separation using ultrafiltration was pilot tested. A bench top unit was used to trial the wastewater stream. Membranes were chosen for the specific separation requirements of the wastewater stream at Dayton's facility.

Several samples were tested with varying solid and oil loads. In each sample tested, biological oxygen demand (BOD) and total suspended solids were minimized below the municipal discharge level of 300 ppm. The oil and grease in the wastewater started at a concentration o over 8,000 ppm and was minimized below the 100 ppm municipal discharge limit.

With conclusive results showing a high percentage reduction in wastewater having to be hauled off-site, this was the option that was chosen.

Randy Hill is part of an integral group that concentrates on their client's wastewater-related issues, which primarily include reducing their wastewater stream in order to reduce haul-off fees.

CROWN's objective was the successful implementation of a tubular wastewater ultrafiltration system, reducing the amount of waste hauled off-site by up to 95%.

Tubular system

CROWN's objective was the successful implementation of a tubular wastewater ultrafiltration (UF) system reducing the amount of waste hauled off-site by up to 95%. This UF process would separate the suspended solids, emulsified oils, and other relatively high molecular weight organics from the fluid. The wastewater would be pumped at low pressure across the surface of the membrane. Constituents larger then the membrane pore size such as most oils and suspended solids would be retained and concentrated, while water and low molecular weight constituents would pass through the membrane as filtrate. The filtrate water would be tested and then dumped to the sanitary drain.

The UF system chosen is designed with two banks of eight tubular membranes, with 30 gpm flowing to each bank. A duplex pump skid transfers waste from the wastewater collection tank to the process tank. Waste is circulated from the process tank to the ultrafiltration unit and back at 60 gpm producing 1 gpm of effluent.

An oil skimmer located on top of the holding tank skims tramp oils from the wastewater and transfers the oil directly to the waste tank. This helps keep the membranes clear and helps extend the time between cleanings.

The wastewater process in the tank is continually processed until the filtrate flow rate has diminished, at which time the tank is emptied to the waste tank.

The concentrate (<15%) from the ultrafiltration unit is collected in the waste tank awaiting transport to an off-site treatment and disposal facility. The waste is non-hazardous waste oil with about 30% oil content. Because of the cross-flow of the wastewater across the membrane, the flux rate through the membrane does not decline as rapidly as with traditional filtration technologies.

The membranes are cleaned chemically approximately once per week with a detergent solution and mechanically with sponge balls that are pushed through the membranes. The cleaning time varies with the severity of the membrane fouling, but generally takes between 2–4 hours to return to the normal operating flowrate.

Waste reduced

The wastewater unit runs 24 hours a day, seven days a week, as long as there is enough waste to be processed, and the unit is not in cleaning mode. It is semi-automatic, in that waste is automatically transferred from the holding tank to the process tank when the process tank drops to a specific level. The unit will automatically shut down if the flow rate drops below a set level, which indicates a cleaning is necessary, or if there is not enough waste to be processed. The wastewater generated is collected in totes and manually transferred into the unit using the two duplex pumps. While the unit is in normal operating mode, approximately one hour is spent daily recording the filtrate flow rate, total filtrate processed, inlet and outlet pressures, and transferring wastewater from totes to the wastewater holding tank.

In the first three months of operation, the wastewater UF system has reduced the amount of waste hauled off-site by 85%. This has resulted in a saving of $10,000 for the quarter and estimated annual savings of $40,000. The total dissolved solids have been reduced from 3,500 ppm to 7 ppm. The oil and grease has been reduced from 6,820 ppm to 42 ppm.

The next step in the wastewater project at Dayton is to find a reuse for the filtrate system that is now sent to the sanitary drain. The water could be used as cooling tower make-up water, or even as make-up water for the cooling sumps.

As regulatory requirements on facility discharge limits become increasingly more stringent, ultrafiltration will plan an important role in helping facilities small and large to meet the discharge and water re-use requirements.

Randy Hill is the service manager for TEAM Service, a division of CROWN Solutions Inc., an integrated water management, equipment designer/manufacturer, and water and wastewater management company. He has a combined 16 years of industrial, military, and high-purity water treatment experience.

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