

## Case Study

# Whirlpool: Extremely Difficult Oily Wastewater



### Project Details

Location: Clyde, Ohio

Application: Oily Wastewater

Capacity: 3.5 million gallons per year

Engineering: Whirlpool Corporation

Commissioned: 2005

Product: KONSOLIDATOR™ Industrial Wastewater System featuring FEG PLUS™ Tubular UF Membranes

### Overview

Even the largest washing machine manufacturing plant in the world has its own cleaning challenges. Everyday thousands of washing machines—more than half of the units sold in North America—come off the line at the Whirlpool Corporation facility in Clyde, Ohio. The production process generates large amounts of oily wastewater composed of hundreds of different synthetic and petroleum-based lubricants.

This oily waste is segregated from the wastewater stream and separated into a concentrated oily phase and an aqueous phase. The concentrated oil is sold to oil recycling companies, and the aqueous phase is further treated by the plant's metal hydroxide precipitation process before it is discharged to a sanitary sewer. The plant as a whole produces a daily flow of more than 450,000 gallons of wastewater a day.

"We used to separate and concentrate the oily waste with a crude process of applying acid to break-up the oil molecules from the water," said Mark T. DelGarbino, senior environmental engineer at Whirlpool Corporation, Clyde Division. "However, this process was costly and labor-intensive, and it did not adequately concentrate the oily waste."

### The Challenge

To find a separation process able to handle the increasingly large volume from Whirlpool's manufacturing processes.

### The Solution

DelGarbino turned to Koch Membrane Systems (KMS) for a solution. "KMS has long been established as a supplier of membrane separation equipment, and has extensive experience with the membrane processes that are used in our electrocoat paint operation. With my significant involvement with the paint department and its processes and suppliers, I viewed KMS as a good resource when I began looking for an oil-water separation supplier."

After a competitive testing and bidding process, Whirlpool chose a KONSOLIDATOR system, a completely self-contained ultrafiltration (UF) unit using FEG PLUS tubular membranes.

The robust KONSOLIDATOR system is capable of processing suspended solids and oils in wastewater to an extremely high concentration, dramatically reducing the volume of waste. The system is designed with tubular UF membranes that have large flow channels to accommodate streams

with significantly high concentrations of solids. To maintain high permeate rates and to minimize the use of cleaning chemicals, the system features a mechanical cleaning process that uses spongeballs to wipe the membrane surface clean of accumulated debris.

“The KONSOLIDATOR™ system has performed very well,” says DelGarbino. “I attribute our success to the quality of the system and to the diligence of our technicians. We have only had to replace four of the tubes in the system since we commissioned the system eight years ago.”

### The Membrane System

The Clyde plant achieved its goal of reducing the volume and cost of the concentrated oil that is trucked off-site. The waste oil concentration is now at least 90%, which translates to a significant reduction in wastewater generated. In 2005, the UF system processed a total of 3.5 million gallons of oily wastewater, resulting in a total of 103,000 gallons of used oil. While the oil is shipped off-site, the permeate from the KONSOLIDATOR system is sent into the wastewater treatment process before it is discharged to the sewer.

Before the KONSOLIDATOR membrane system was installed, the old acid split process required chemical treatment of batches on a weekly basis. Now, acid is only required occasionally when there is a batch abnormality. The overall reduction in chemical consumption has resulted in significant cost savings for Whirlpool and resulted in a safer working environment for its employees.

Labor costs have also been reduced

significantly because the KONSOLIDATOR runs continuously with little need for intervention. Although the entire wastewater treatment operation at the Clyde plant is monitored 24/7, the whole process requires little maintenance.

From a financial standpoint, the return on investment for the KONSOLIDATOR system has exceeded expectations. “Originally, we expected the membrane system to pay for itself by lowering disposal costs with more concentrated sludge and reducing chemical consumption and labor costs,” says DelGarbino.

“We did not expect that, in addition to these cost-reductions, we would also create a new and growing revenue stream for Whirlpool. Now that the oil is more concentrated, it is more valuable to the companies that collect it for oil recycling. More concentrated material lowers transportation costs and the amount of processing required, so recycling companies pay us more. During each of the past two years, we sold our used oil for more than \$20,000, and we are on track to make even more this year.”

### Product Overview

The KONSOLIDATOR system with FEG PLUS™ membranes is the standard in treating wastewater and concentrating valued solids in industrial processing.

The KONSOLIDATOR System is specially designed for wastewater with high solids concentration or fibrous material. Whether the stream is 5,000 gallons or 500,000 gallons per day, there is a KONSOLIDATOR system that offers a complete solution to your challenging wastewater needs.

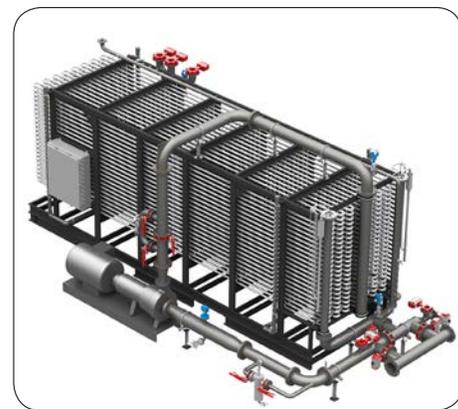
KONSOLIDATOR can be custom configured with FEG PLUS or ULTRA-COR™ membranes to provide a compact, all-inclusive automated wastewater handling system. Standard KONSOLIDATOR systems come in 48, 96, 160, 336, 544 and 736 membrane configurations.

Applications:

- Metal Fabrication and Finishing
- Food Processing
- Pulp and Paper
- Chemical Processing

Benefits:

- Heavy-duty industrial applications
- Mechanically cleaned, resists plugging
- Easily tolerates most system upsets
- Capacities of 5,000 to 500,000 GPD per system
- Corrosion resistant



KONSOLIDATOR System



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