ISTC **Fact Sheet** TN12- 101
December 2011

# Ultrafiltration: In-Line Recycling of Multi-Stage Parts Washer Process Fluids

***Preventing money from going down the drain***

**Abstract**
This fact sheet documents the waste reduction measures of a company located in central Illinois that manufactures metal components used in electrical and mechanical support systems. These include conduit, process piping, wiring race ways, and other electrical equipment. The company's goals were to improve its paint line's pretreatment cleaning performance and to reduce operating costs. To achieve this, they successfully implemented ultrafiltration membrane technology, which produced significant environmental reductions and savings.

**The Story**
This company has utilized ultrafiltration membrane technology since the mid-1990s to recover synthetic metalworking fluid. Though not new to membrane filtration, the company requested ISTC's assistance to investigate membrane filtration to reclaim its large paint line's pretreatment process fluids (degreaser, rinse waters and iron phosphate). The pretreatment process consists of a multi-stage wash system comprised of a series of 1,000-2,000 gallon process tanks. Historically, these tanks were dumped, cleaned and recharged on a routine basis, causing line downtime and increased operating costs. Through ultrafiltration, the expectation was to recycle the fluids *in situ*, thereby extending bath life, reducing labor costs, and chemical costs while improving the line's cleaning performance.

After several months of evaluating membrane compatibility and performance within the varying process chemistries and criteria, the company determined ultrafiltration to be a viable waste minimization solution. Previously disposed fluids could now be recovered.

**The Results**
The facility engineer installed ultrafiltration systems throughout the entire pretreatment line: degreaser, phosphate and three post-process rinses. Resultant annual reductions: 1,401,000 gallons water, 825 gallons of specialty chemicals and 1,108 gallons of paint. This resulted in a total annual savings of $45,275.

**Ultrafiltration Membrane Technology Primer**
Membranes are semi-permeable barriers capable of separating feed stream components that have a particle size relative to the pore size of the membrane. Feed stream components that have a particle size larger than the pore size of the membrane are retained while components that are smaller than the pore size of the membrane are allowed to pass through. A major difference between conventional filtration practice and membrane filtration is with respect to the mechanism of contaminant capture. Conventional filters operate by capturing particles within the filter matrix, a process termed depth filtration. The filters

cannot be regenerated after use because the particles accumulate within the filter matrix. Membrane filters are usually sized to have pores that are too small for particles to enter. Therefore, the bulk of the filtration occurs at the surface of the filter. Therefore, membrane filters can be reused by removing the particulate matter from the surface by flushing or cleaning. Figure 1 illustrates the common mode of operation employed in ultrafiltration. This mode, termed cross-flow filtration, describes the flow of the feed solution in a direction parallel to the membrane surface or filter. This facilitates the sweeping of the membrane surface and limits filter cake buildup and allows for longer periods of operation without having to clean the membrane. A small portion of the solution is forced through the membrane by the applied pressure and recovered as permeate.

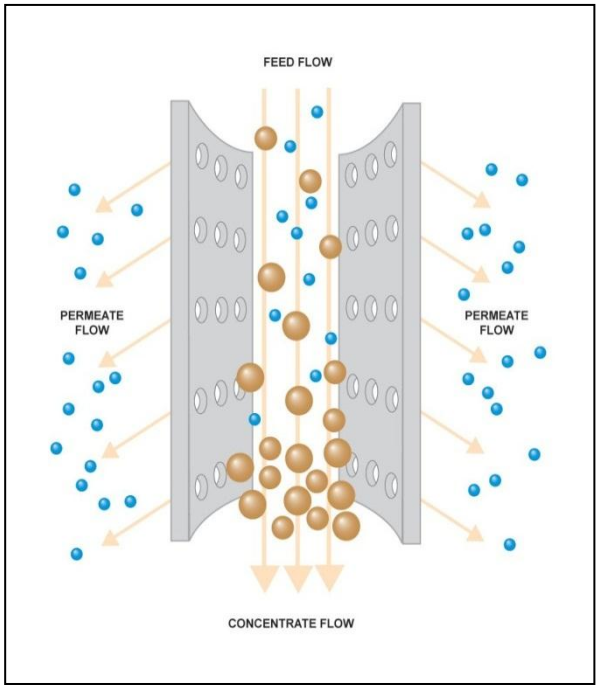


**Figure 1: Membrane cross-section**

The development of more durable membranes, such as polyvinylidene difluoride (PVDF), has expanded the application of membrane filtration beyond its origins in the food industry to successfully handle industrial process solutions with extreme pH's, high temperatures, and high oil concentrations. Because of its unique capabilities to concentrate oily wastewater and produce a clean permeate; ultrafiltration has emerged as the premier technology for extending the life of various process solutions. Most of the valuable chemicals (such as biocide, rust preventative and detergent) present in these solutions pass through the membrane in the permeate and are returned to the process operation.

The concentrated oily phase typically comprises a small fraction of the original wastewater volume, so the volume of waste disposal is reduced, as are waste disposal costs. Additional fact sheets about ultrafiltration are available at ISTC's web site, www.istc.illinois.edu

**For More Information**

Additional ISTC fact sheets covering energy efficiency, water conservation and pollution prevention are available at www.istc.illinois.edu. You may also contact:

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**This fact sheet was developed as part of the Illinois Conservation of Resources and Energy (ICORE) project, funded by a grant from the U.S. Environmental Protection Agency. ICORE helps Illinois businesses and communities make energy and water conservation improvements. Through the project, ISTC provides technical assistance to water and wastewater treatment facilities and businesses to improve efficiency in: 1) water consumption; 2) wastewater generation; 3) energy consumption; and 4) carbon emissions.**