The Dynatec Difference

Significant Savings
- Improved process reduces treatment costs
- Water reuse reduces overall consumption
- Material recovery saves on processing chemicals
- Easy maintenance

Technology Benefits
Membrane Separation Using (UF) Tubular Ultrafilters:
- Simple mechanical process
- Consistent high quality water
- Low operating costs
- Minimal operator attention
- Minimal disposal costs

Membrane Bioreactor System (MBR) allows for:
- Higher levels of MLSS
- Small footprint
- Long sludge age allows for significantly higher levels of COD removal

Contaminants Removed
- Heavy metals
- COD
- Phenols

Equipment Shown
The picture on the right shows the installed membrane portion of the MBR system with the clean-in-place tank behind the skid.

DYNATEC PROVIDES MBR SYSTEM FOR HAZARDOUS LANDFILL

The Challenge
A hazardous waste landfill needed to develop a treatment process to remove COD, high TDS, heavy metals, phenol, PCB’s, Ammonia, and Molybdenum from the landfill leachate. Current treatment consisting of chlorination and activated carbon treatment was costly.

Evaluation
The application was piloted using chemical/physical pretreatment and MBR to nitrify, reduce the high COD and phenol and overcome the potentially toxic conditions. Dynatec supplied a pilot treatment plant to be used as an investigative tool for the design of the full scale treatment process. The pilot operation phase of the project lasted almost 3 years.

Some unique challenges offered by this application were:
- Foaming
- Toxicity from the metals, phenol and other unidentified substances
- Biological temperature sensitivity
- Sensitive nitrification process
- Difficult chemical precipitation of metals
- Small footprint requirement

Dynatec was engaged to supply and install the full scale system because of Dynatec’s experience with the treatment technologies employed and Dynatec’s HiRate™ MBR’s ability to process the high MLSS requirement.

System Design
Dynatec provided and installed the system including a stainless steel insulated covered bioreactor with both heating and cooling capabilities. To solve the foaming problem, a combination of jet aeration, defoamer, DO control and concentrate return splash plates were employed along with an emergency potable water spray to prevent foam-over.

The membrane filtration equipment was designed to make efficient use of a small existing building that houses the membranes, controls, dewatering and other equipment. The process includes chemical/physical treatment of the leachate both before and after the MBR. The post MBR chemical precipitation is for Molybdenum. The MBR removes compounds that were found to interfere with the precipitation process. The treated water is discharged to sanitary sewer.

A sludge tank receives the solids from both clarifiers of the pre and post chemical treatment systems as well as the WAS (Waste Activated Sludge). Additional iron and lime is added and mixed in the sludge tank prior to feed to the filter press for dewatering. The solids are discharged within the landfill.
The Process
The process design consists of the following:

- The hazardous wastewater is pretreated for removal of CN, Cr, Cu, Pb, Ni and Zn.
- The hazardous wastewater is mixed with non-hazardous wastewater in a 500,000 gallon EQ tank to help make nitrification work. Approximately 65% of the wastewater discharged to the EQ tank is hazardous wastewater and 35% is non-hazardous.
- The wastewater in the EQ tank is sent to the MBR for treatment for reduction in phenol, ammonia, nitrogen and COD.
- The MBR permeate is post treated for removal of molybdenum. The molybdenum is organically bound and does not precipitate adequately in the pretreatment step.
- Sludge from the metals precipitation is mixed with WAS and dewatered in a filter press.

Operation
During system startup, a special bacterial culture was added to promote nitrification, which improved performance. After a period of acclimation, the COD removal efficiency increased to between 89% to 96%.

The system operator is able to adjust conditions as needed. The system is currently operating at high mixed liquor concentration, an average of 24,000 mg/l. The jet aeration system makes operation at this level possible. Temperature ranges from a low of 25°C in the winter to 36°C in the summer.

The continuous addition of defoamer is necessary. The concentrate return hits splash plates in the reactor to create a spray of sorts to help depress foam. There is also a fresh water spray available for use that rings the top inside of the reactor.

Phenol in the effluent is typically below 0.1 mg/L and metals removal is consistently below discharge requirements and below toxicity levels required to protect the biological process.

Conclusion
The complete and comprehensive system provided has consistently performed beyond expectations. The many years of experience Dynatec has in the application of membranes to wastewater has enabled it to design and provide systems that perform in even the most difficult applications.

<table>
<thead>
<tr>
<th>Influent Parameter</th>
<th>Influent, mg/L</th>
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</thead>
<tbody>
<tr>
<td>COD</td>
<td>3,000—6,000</td>
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<tr>
<td>Phenol</td>
<td>40—70</td>
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<tr>
<td>TDS</td>
<td>12,000—23,000</td>
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<tr>
<td>Hardness</td>
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