

Case Study

Graywater Re-Use, 2008

Part way through construction at Green Plains Renewable Energy in Shenandoah, Iowa, it was determined that city wells could not deliver the freshwater volume that the plant would need for operation. The plant faced two options – cease construction or find a secondary water source that would enable the facility to meet their water needs. The city of Shenandoah offered a solution by providing the ethanol plant enough municipal graywater to account for the difference between the freshwater supply and the total amount of water the plant would require to run its process. Graywater is water that has been treated in a municipal sewage plant, which would normally be discharged to a river. It is usually a combination of municipal waste, industrial discharge and storm water. As a result, the water quality varies not only from town to town, but from day to day at each town.

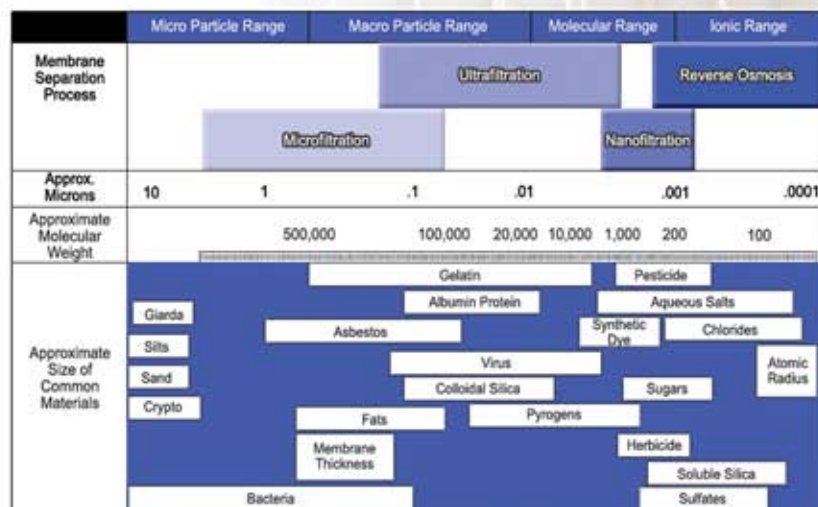
Graywater re-use is being considered more often, as demand on freshwater resources increases. However, graywater is not without challenges. A sophisticated water treatment system would have to be designed in order to make the water usable. US Water Services was asked to design a treatment system to convert the graywater into water suitable for use in the plant’s cooling tower. The solution was a two step water treatment system utilizing microfiltration and reverse osmosis technologies

The first step to this treatment process is microfiltration. The microfilter used in this plant has a pore size of 0.1 microns, absolute, filtering out suspended matter and bacteria. There are other filtration systems that can achieve this level of solids removal, but most can’t stand up to repeated cleaning required when processing graywater.

In This Case Study:

- Ethanol
- Freshwater
- Graywater
- Microfiltration
- Municipal
- Process Water
- Reverse Osmosis
- Wastewater

Figure 1: Filtration Spectrum



The second treatment step is reverse osmosis. During this process, pressure forces water through a series of semi-permeable membranes. As water passes through the membrane, most dissolved solids are filtered out and the clean water, known as the permeate stream, drains into the center of the membrane. The permeate water is used as the process water for the plant, while the concentrate stream, containing the rejected minerals, is sent back to the city without ever touching the facility's processes.

Using graywater in the plant decreases the stress on freshwater supplies by recycling wastewater. As demands for freshwater increase, the use of graywater

will become more common. However, using untreated graywater can lead to equipment fouling, loss of cooling capacity, and potential problems with the fermentation process critical to ethanol production. When using graywater to meet make-up water demand, a thorough analysis of the source and careful design of the system is critical to trouble-free operation.

Green Plains Renewable Energy in Shenandoah, Iowa, started in 2007, and has been operating successfully since. This facility was the first of its kind to use the technologies of microfiltration and reverse osmosis together for graywater reuse, but other US Water Services designed systems are currently under construction.

Figure 2: Water Treatment Building
Drawing provided by Fagen Engineering

