# FLUID TECHNOLOGY SOLUTIONS INC.

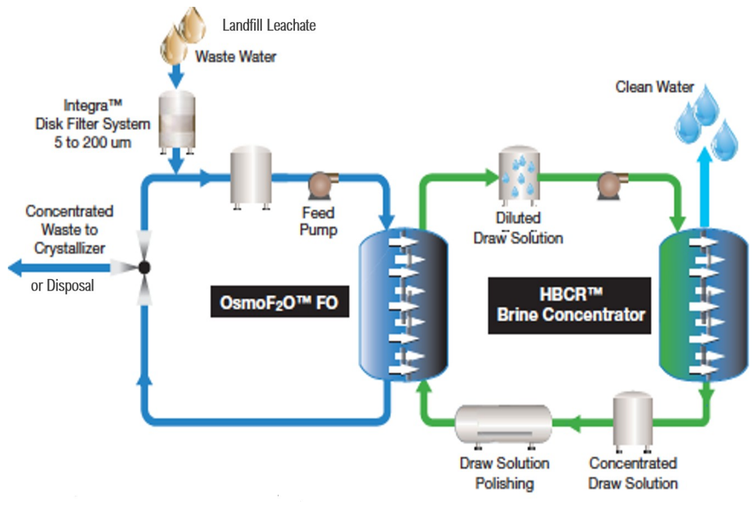
World Leader in Forward Osmosis and Wastewater Technologies

## Details of the Commercial Treatment System

Leachate Treatment Plant
Oregon, United States
Landfill Leachate
150 m3/day
Influent and effluent levels:

| Contaminant | Untreated Leachate mg/l | Permeate mg/l | % Rejection |
|---|---|---|---|
| N- Ammonia | 1110 | 1.6 | 99.86 |
| Arsenic | 0.039 | ND | |
| Calcium | 91.6 | 0.15 | 99.84 |
| Sulfate | 310 | 0.04 | 99.99 |
| BOD – 5 | 472 | 2 | 99.58 |
| COD | 3190 | ND | |
| TKN | 780 | ND | |
| TSS | 100 | ND | |

## Photo or Diagram of the Technology




| Pollutant | Max for 1 day (mg/l) | Monthly Avg, NTE (mg/l) |
|---|---|---|
| BOD | 220 | 56 |
| TSS | 88 | 27 |
| Ammonia | 10 | 4.9 |
| Arsenic (total) | 1.1 | 0.54 |
| Chromium (total) | 1.1 | 0.46 |

## What was the compelling value proposition?

The process combines Forward Osmosis with a High Brine Recovery process to re-concentrate the draw solution and produce high quality permeate. This pretreatment process only requires coarse pre-treatment (50 micron disk filters) and pH adjustment of 6.5 to operate.

The OsmoBC™ system has Capex from $ 450K to $900K for a 150m3/day system based on continuous operations. The capex range is mostly determined by the target percent recovery. In addition, the feed TDS, type and levels of inorganic scalants and organic constituents also affect the system size. The capex for the commercial system above was approximately $675,000. Smaller systems inherently are higher per m3/day due to fixed system costs. The FO process operates between 1-2 bars pressure, resulting in conventional MF style housings and PVC piping. The HBCR system produces plus 150,000 TDS brine and takes advantage of conventional SWRO equipment (316 or super duplex stainless steel) operating at 70 bar.

In addition, the unique Forward Osmosis membrane is very resistant to fouling, resulting run times of 4-6 weeks or more with simple osmotic backwash cleaning procedure. The HBCR system was cleaned weekly per standard SWRO cleaning procedures.

The key to the project was the ability to concentrate the leachate by over 93% prior to solidification. Competing technologies such as DTRO, extensive pretreatment (MBR, polymer addition DAF, MF, UF, followed by high pressure SWRO were limited to about 75% recovery. The OsmoBC™ process cut the solidification step by 66%.

Based on 3 year membrane life, standard cleaning chemicals, and kWhr cost of $0.08, the opex per m3 treated is in the range of $3.50 to $5.00.

## The Experience

Even with seasonal and variable water quality and operation of the process near capacity, the removal efficiency remained 99% or higher for removal of ions, metals, BOD, and COD.

The permeate continually met strict NPDES ammonia discharge levels for Final Concentration and Limitations for Hazardous Landfill Subcategory, Direct Discharges:

## What problem did this aim to solve?

Conventional treatment systems require much pre-treatment. The OsmoBC™ system eliminates the need for complex pre-treatment, even with variations in landfill leachate wastewater quality.

The FO membrane is extremely resistant to fouling in the presence of high TSS and TDS and hardness / organic levels. Flux remains stable through continuous operation.

The system produced a higher concentration and lower volume of retentate versus conventional treatment methods.

## What this means for the future?

Municipal and commercial landfill operations can utilize the advanced membrane and module design to enhance landfill effluent treatment to deliver high purity and clean water permeate that meets and exceeds NPDES discharge levels.

Pre-treatment is minimized, resulting in a streamlined process which is economical to install and operate.

The process is commercialized and can achieve over 93% clean water recovery. The result is the lowest volume of concentrate for return to the landfill or to be sent to evaporators / crystallizers.