HYDRAcap™ UF Testing at Kern River Water Treatment Plant

Introduction

Hydranautics was invited to pilot test its HYDRAcap® Capillary Ultrafiltration Membrane technology for a 10MGD Potable Water Treatment Plant at Bakersfiled, CA. The feed water was raw surface water from the Kern River.

The following is the typical raw water analysis:

Parameter	Unit	Kern River(Bakersfield)
pH		8
Temperature	Degrees F	70-79
Turbidity	NTU	2 to 4
Alkalinity	ppm as CaCO3	40
TOC	ppm	2 to 6
UV-254	cm-1	~0.07
HPC	CFU/mL	typ <2000 max 12000
Particles >2um	counts/mL	6000 to 12000

Summary

The study was divided into three run scenarios, each summarized below:

Run 1. Raw river water. Duration ~1 month.

Filtrate Flux:	32 GFD
Recirculation gpm	0
Recovery	~75%
Backwash frequency	Every 20 min
Chlorine Enhanced Backwash Frequency	6-60ppm Every 20 minutes
FeCl3 dose	none
TOC reduction	~10%
UV254 Reduction	~10%

Run 2. Introduce Coagulant for DBP precursor removal. Duration – 1 month.

Filtrate Flux:	37-42 GFD
Recirculation gpm	20 (closed loop)
Recovery	89%
Backwash frequency	Every 30 min
Chlorine Enhanced Backwash Frequency	6-8 ppm Every 30 minutes
FeCl3 dose	18-22ppm continuous in feed
Citric acid dose	pH 2.0-2.2 every 12-24 hours
TOC reduction	~60%
UV254 Reduction	~60%

Run 3. Coagulant optimization. Duration ~1 month

Filtrate Flux:	53-58 GFD
Recirculation gpm	20 (closed loop)
Recovery	92-93%
Backwash frequency	Every 30 min
Chlorine Enhanced Backwash Frequency	6-8ppm Every 60 minutes
FeCl3 dose	12ppm continuous in feed
TOC reduction	~50%
UV254 Reduction	~50%

Results

The HYDRAcap® membrane technology demonstrated the following attributes: that it is capable of reducing the following:

- Reducing turbidity levels from raw water of 1-4 to less than 0.1NTU
- Reducing TOC and UV254 up to 60% with FeCl3 coagulant

In addition, the following other observations are pertinent:

1. Due to large concentration of organic matter, and in order to achieve stable performance, it was necessary to adjust the process by increasing the CEB chlorine concentration to ~60ppm. This high concentration of chlorine was needed temporarily, and the level was successfully reduced to ~6ppm.

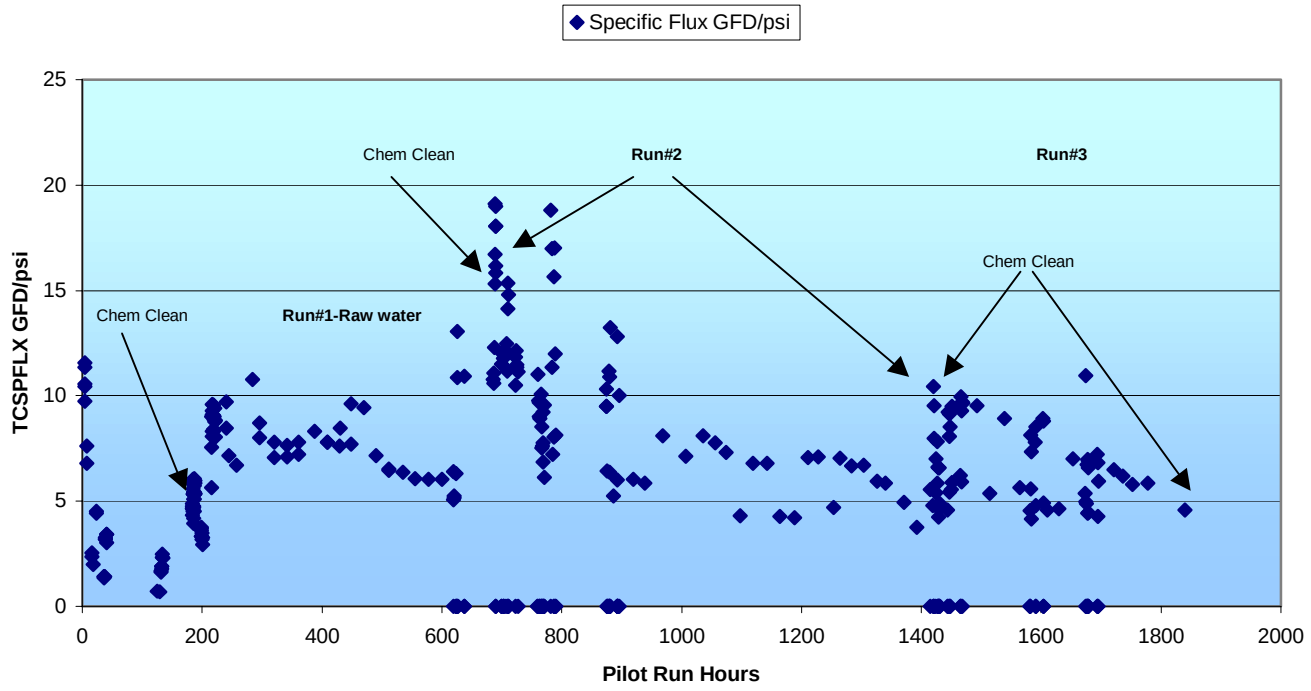
2. The addition of FeCl3 and 20 gpm recirculation flow provides the following advantages:
   A. Increase in stable operating flux up from 32 to 53-58 GFD
   B. Increase in system recovery from 75 to 93%
   C. Increase in TOC/DBP precursor removal from 10% to 62%
   D. Increase intervals between chemical cleanings

3. Due to the presence of iron as part of the $FeCl_3$ coagulated feed, it was necessary to adapt an enhanced cleaning regiment, which incorporated a specific iron cleaner. Specific information about this procedure is available by request.

4. Membrane Integrity was very stable throughout the pilot study.

[1] Taken from Membrane Pilot Study, California Water Service Company NE Bakersfield Water Treatment Plant by Carollo Engineers.

Kern River Temperature Corrected Specific Flux GFD/psi



Kern River Feed and Filtrate Turbidity