

Background

A drinking water plant in Texas is suffering from aging infrastructure and its 1 MGD capacity is limiting growth. The **Cuf** process successfully completed a 90 day pilot program for the implementation of a 3 MGD Plant. Water was pumped from the Rio Grande River to the reservoir shown in the background and then pumped directly to the **Cuf** Pilot system during the summer of 2016.



There is no pretreatment prior to the **Cuf** which eliminates the need for a clarifier and other pretreatment infrastructure. A small dosage of coagulant is added in-line where concentrated sweep floc occurs in the **Cuf** system. Coagulant dosage is less than the existing plant. No polymer or other process chemicals are added. The results of this pilot are consistent with other **Cuf** surface water pilot results.



Performance

During the 30-day 24/7 sustained portion of the test program the pilot operated at a flux of 230 GFD with TMP varying between 3-15 psi. The **Cuf** system operated for 200 hours between TMP maintenance rinses (longest run 230 hrs.). The concentrated solids waste stream was 7.5%.

Parameters	Raw Water (mg /L)	Filtrate (mg/L)
Total Organic Carbon (TOC)	4.49	2.98
Total Suspended Solids	30.6	<2.00 (ND)
Alkalinity (as CaCO ₃)	127	74.6
Total Hardness	290	280
Aluminum	0.9	0.029
Iron	0.56	0.013
Total Dissolved Solids (TDS)	720	812
pH	7.96	6.52
Turbidity (NTU)	5-35	0.02-0.04
THM		0.015





Turbidity / TMP Performance

Analysis of the **Cuf** data logs over the 90 days showed that the influent water quality changed day to day as well as month to month. A correlation between time of day and TMP performance was also found and is attributed to algae behavior in the reservoir feeding the pilot unit.

The filtrate turbidity was always maintained between 0.02 - 0.04 NTU throughout the entire pilot regardless of influent turbidity spikes and changes in water quality. This turbidity performance is better than the existing clarifier/ filter process which generally achieves 0.05 - 0.10 NTU.

In July the inlet turbidity rose from 4 to 30 NTU due to summer operating conditions and the **Cuf** system continued to produce the same filtrate turbidity without any process changes.

Complexity & Chemical Reduction & Primary Disinfection

The pilot demonstrated the ability to eliminate all conventional membrane pretreatment requirements. The need for permanganate to remove taste and odor compounds was eliminated by the **Cuf** as well. Free Chlorine was dozed at the inlet to the **Cuf** to achieve primary disinfection and the residual free Chlorine is 0.5 ppm with 015 ppb THM formation. This is a significant reduction due to the ability of the **Cuf** to lower DOC. Therefore, testing demonstrated the ability to eliminate chloramines and its associated ammonia addition. The Coagulant requirement was also reduced by 60% over the existing plant's baseline usage.

THM Comparison

Disinfection Method	TTHMs (ppb)
CUF with 1 ppm Chlorine, Primary	15
CUF with 4 ppm Chlorine for 2 ppm Residual	36
Existing Plant with Chloramines	46

Chlorine demand reduced from 12 ppm* to 5 ppm (reduced by 60%)

* Baseline chlorine demand estimate based on chlorine dose requirements to treat raw water with similar characteristics (Warton *et al.*, 2006)

Regulatory Approvals

TCEQ approved the Pilot Test Protocol and Pilot Test Report which is the approval for the full-scale design currently underway.

Cuf used a Particulate Marker Based Challenge Test and Direct Integrity Test (DIT) in compliance with the USEPA LT2ESTR Guidelines.

Other Benefits

- The **Cuf** process utilizes reduced chemicals (eliminates permanganate, ammonia, chlorine dioxide, and polymer) while providing enhanced TOC/DOC removal.
- The **Cuf** concentrated waste stream is less than the conventional plant process.
- **Cuf** can provide complete ZLD (Zero Liquid Discharge) through the Solids Recovery Unit (**SRU**) achieving 99.99% water efficiency.
- Fully automated process.
- For additional information reference documents “**Cuf** Continuous Ultra Filtration” & “**SRU** (Solids Recovery Unit)”

