**Ceramic Ultra Filtration with Zero Liquid Discharge**  
**Better Water, Safer Water, Lower Cost**

*Cuf* is a 5th Generation Ceramic Membrane Process with proven performance and represents a quantum leap forward in water purification; effectively rendering all other MF/UF membrane processes obsolete in terms of comparative performance. *Cuf* has no pre-treatment, no filtrate loss, absolute filtration at its rating over the 25 year design life of the system.

The *Cuf* process is a disruptive game changer and challenges conventional engineering, cost structures and performance criteria. *Cuf* does more than just filter.

*Cuf* systems have a much smaller footprint and significant complexity reduction over all other ceramic, hybrid-ceramic or polymeric membrane filtration processes. Low TMP (Trans Membrane Pressure) with unmatched flux and duty further contribute to comparable operating and capital cost structure reductions in the 50% range.

*Cuf* is comprised of patented ceramic membrane and process technology which has been developed and optimized with over 25 years of continuous application and operations experience.

### Purification Capability

Removes and/or Recovers Particulate, Color, DOC, Pathogens (> 4 log), TSS, VSS, Radium, Turbidity, Hardness, Oil, Cr⁶, Metals, H₂S, Organic & Inorganic Phosphorous, THM & HAA Precursors, Taste & Odor compounds and Silica. All this is performed in a single *Cuf* platform which eliminates conventional pre, auxiliary and post treatments. *Cuf* is a complete plant and capable of ZLD (Zero Liquid Discharge).

### Applications

- Drinking Water
- Wastewater
- Reuse IPR/DPR
- Remediation
- Solvent Filtration
- RO pre-treatment

### Process, Complexity & Cost Reduction

Pre-treatment and auxiliary processes such as coagulation basins, flocculation, clarifiers, microfiltration, precipitation reactors, chemical oxidation reactors, back wash, back pulse and CIP cleaning skids, sludge thickening and filter presses are eliminated with the *Cuf* process. The capital & operating costs and land for these redundant processes is also eliminated. As shown below, the *Cuf* platform is the entire plant.

### Expertise

Purifics has been deploying its proprietary Ceramic Membrane Systems since 1993. Our installed global base (60+) provides unmatched Experience and Leadership in ceramic membrane system technology for Municipal and Industrial applications to Filter, Destroy and Recover (FDR) contaminants in water and other fluids.

Purifics’ Experience and Leadership in ceramic membrane technology has led to unique innovations:

1. That Inhibit Fouling
2. Allow Sustained High Flux Rates
3. Continuous Online Duty
4. Marker Based DIT

### Carbon Capture

*Cuf* will capture and reduce your carbon footprint.
Platform Process Components

Unique Features

- No Fatigue & Abrasion Failure
- No Off Gassing / Leaching
- No Chemical Degradation
- No Backwashing or Back Pulse
- No Membrane Replacement
- No Temperature Constraints
- Sustained Flux with changes in Fluid Temperature
- No Chemical Limitations
- No pH Constraints
- No TMP Constraints
- No Filtrate Losses
- Self-Cleaning; Inhibits Fouling
- Hydrophilic (resists oil)
- Converts Plant from Chloramines to Free Chlorine
- Product Recovery
- 25+ Year Membrane Life
- Multi Membrane Modules
- Modular Growth & Capacity
- Reduced Trans-Membrane Pressure
- Reduced Cross Flow Pressure Drop
- No Temperature Constraints
- Sustained Flux with changes in Fluid Temperature
- No Chemical Limitations
- No pH Constraints
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Typical Cuf Plant

* NOT ALL APPLICATION SPECIFIC FEATURES REQUIRED OR IDENTIFIED
Process Description
Raw water is screened for “frogs and logs,” and in a cross flow arrangement, not dead end; TMP is modulated in the Cuf to maintain constant flux over the performance range to ensure that flow rate requirements are achieved. The membrane module is frequently subjected to a dynamic shock to self-clean the membranes which inhibits fouling, allowing continuous online duty (~99%). Over time the concentrate loop will have highly concentrated levels of filtered material that impacts the TMP.

This causes a concentrate blow down or optionally the concentrate is sent to a DeWRS (DeWatering Recovery System) where the concentrated material is dewatered to a wet solid to achieve Zero Liquid Discharge (ZLD).

Cuf is not Trans-Membrane Pressure (TMP) limited like conventional membrane processes. Cuf is unique and runs at a constant flux and the TMP is modulated to maintain that constant flux. This means that the flux in a Cuf process is independent of the fluid temperature and the plant is not de-rated as the fluid temperature drops. This means that a Cuf process can respond to changes in viscosity, load and demand and is only limited by the installed TMP pump’s capability.

Process Flow

Intermittent concentrate blowdown to head works or DeWRS for ZLD

In certain applications dissolved oxygen or a common coagulant is injected to oxidize or agglomerate dissolved contaminants such as metals or DOC. These reactions occur in the HSC Tank. No upstream coagulation basins or clarifiers pretreatment is required, just the Cuf platform.
Dynamic Shock
Purifics’ proprietary Dynamic Shock process self-cleans the Cuf membrane in a continuous online operation. The shock is generated and travels through the water, the membrane and the module to drive foulants off the membrane surface.

Remote Access & Control
Cuf utilizes a high speed internet connection with a static IP or VPN access to a client supplied network. This allows Remote Control, remote programming/SCADA updates and remote technical support. The connection allows the Cuf to automatically message pertinent plant personnel in the event of a fault. If no landline access is available, cellular alternatives are available.

Duplex & Redundancy System Options
For system design and regulatory requirement purposes to retain capacity in the event of a component failure, Cuf systems are available in a Duplex or Dual Module (DM) platforms. There are two complete and identical membrane module assemblies that operate together or independently in a single platform assembly. To achieve redundancy for pump or PLC related failures, two platforms are required.

Ratings & Certifications Available
- LT2ESWTR Compliant
- NSF/ANSI 61
- ASME B31.1 & 31.3
- Class I Div 2

Regulatory Compliance
Regulatory Compliance in Multiple Jurisdictions since 2015 with the largest installed base of ceramic drinking water plants in the USA.

TMP Maintenance

There is no Clean-In-Place (CIP) with the Cuf process. Over time or extended shut down or an upset event the Flux may not be fully recovered by Dynamic Shock alone. When this occurs an automated TMP Maintenance Rinse Cycle (chemical rinse) is activated and the concentrate recirculation loop (in blue) is isolated from the process, the TMP pump recirculates high cross-flow, the temperature may be raised, and the pH shift chemical is injected. Acid is used for inorganic and caustic is used for organic fouling. The combination of heat, cross-flow velocity and pH shift is used to scour and dissolve residual foulants from the membrane. The TMP maintenance fluid is discharged through the blowdown line. When this 20 minute cycle is complete, full TMP recovery is achieved and the system is brought back online.
LT2ESWTR Compliance for Membrane Integrity Verification

LT2ESWTR “Long Term 2 Enhanced Surface Water Treatment Rule” identifies the requirements for log removal of Cryptosporidium and the verification method to ensure the membrane integrity. This is achieved in the Cuf process by the following procedure.

Challenge Test & Direct Integrity Test (DIT)
A key benefit of the Cuf process is that the Direct Integrity Test (DIT) is the same test as the Challenge Test therefor no surrogate test (such as bubble decay) is required.

Challenge testing was conducted as per LT2ESWTR using a conservative marker at 1,175 GFD (2,000 LMH) and achieved 4 log removal. The integrity of the membrane is performed using a Conservative Marker which is enumerated by a particle counter. This method of membrane integrity testing is compliant with LT2ESWTR. The Conservative Marker, TiO₂ Nano-particulate (1 micron), is added at the required loading and operated at the rated Filtrate flux. A particle counter is used to verify >4 log removal of particles.

The membrane integrity testing process is simple, automated and only takes 15 minutes. Purifics has been using the TiO₂ (Titanium Dioxide) Marker test successfully for over 25 years. The TiO₂ marker is NSF/ANSI 61 compliant, as part of the Purifics Drinking Water Systems UL certification, and is very low cost.

Continuous Indirect Integrity Monitoring (CIIM)
Continuous indirect integrity monitoring is performed using Turbidity monitoring of the influent and effluent stream and is compliant with LT2ESWTR. This is performed using inline turbidity sensors and is monitored and logged by the Cuf systems PLC. The systems PLC will automatically take the required action if the turbidity limit is exceeded.
Modular Platform Capacity 0→1→2→4→16→32→64 MGD/MLD

*Cuf* is available in 11 different platforms with single “M” or double “DM” modules to meet your process and capacity requirements. Detailed Platform Specifications Sheets are available in the “Downloads” section at [www.Purifics.com](http://www.Purifics.com). A *Cuf* Sizing and Application document is also available upon request.

![Platform Process Components](image)

*Cuf* Membrane; Elegant But Tough

Purifics patented & patent pending SiC membrane is a unique 5th generation technology providing unmatched performance, efficiency, strength, durability, flux and anti-fouling properties. Once installed the membrane is **NEVER** removed or never sees the light of day again during its lifetime.

![Membrane](image)

Plant Tours

To fully appreciate the benefits of the *Cuf* process for your application, we highly recommend that you tour an existing installation that meets your requirements. Contact us to arrange a tour at your convenience.