RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamation

# Chlorine Resistant Polyamide Desalination Membranes

**New polyamide reverse osmosis membranes can reduce water treatment costs.**

## What Is The Problem?

Desalination and water treatment plants have been using reverse osmosis (RO) polyamide (PA) spiral-wound membranes since 1977 to purify and remove salt from seawater, wastewater, and surface water to produce new sources of water for drinking and other needs. PA membranes used in RO are preferred by industry because they operate at lower pressures relative to other RO membranes, with lower energy demand and hence lower operating costs.

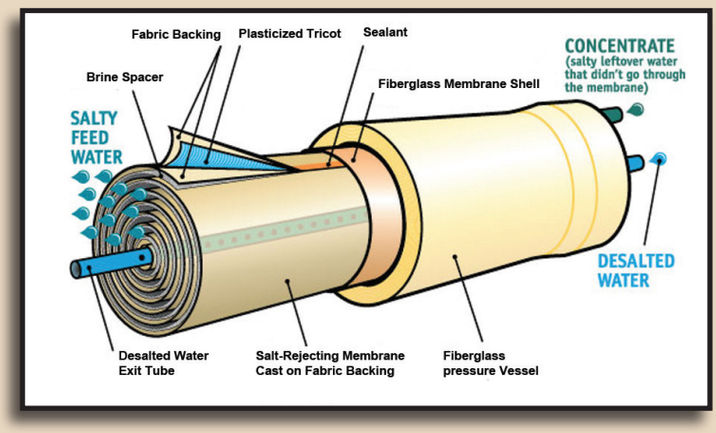
RO pretreatment and treatment processes typically use chlorine disinfection upstream of the desalination membrane in order to control microorganisms that biofoul and clog the membrane. In addition, chlorine is typically added to many source waters to prevent water-borne diseases. However, chlorine rapidly degrades PA membranes.

Therefore, to reduce chlorine levels immediately before filtering with standard PA membranes, RO plants use sulfur dioxide, bisulfite or sulfite. However, this requires additional equipment and chemicals and must be carefully balanced against the increased risk of biological growth on the membranes. The result is higher operating costs for the plants.

## What Is The Solution?

A high performance membrane that is resistant to chlorine degradation has been long-sought by the desalination industry to simplify and lower the cost of operating desalting plants.

Researchers from Reclamation, Separations Systems Technologies, and the University of Denver have collaboratively developed new PA membrane chemical formulations (U.S. Patent No. 7,806,275) that potentially can revolutionize the desalination membrane industry.




**Reverse Osmosis Membrane Element inside a Pressure Vessel**

Initial tests of the new PA membranes constructed on flat sheets were conducted at SST. Swatch size samples of the most successful membrane formulations tested at SST were transferred to Reclamation's Water Quality Improvement Center (WQIC) in Yuma, AZ to verify how these membranes would react in actual field test situations. Water production and salt rejection comparisons for a standard PA membrane and new PA membranes have been monitored since August 2005 at the WQIC. Currently, about 50% of the new PA membranes have completed long-term testing on swatch size samples. Several of the new PA membranes tested indicated a superior degree of chlorine resistance and with water production and salt rejection properties equal to or better than traditional PA membranes.

## Who Can Benefit?

Existing RO treatment facilities could replace damaged membranes with chlorine resistant PA membranes that would significantly lower operating costs. New facilities using chlorine resistant PA membranes would benefit from reduced capital and operation costs. All current users of RO treated water and other applications including microfiltration, ultrafiltration, and nanofiltration could benefit.


**Long term testing for chlorine resistant PA membrane at the WQIC**

## Future Development Plans

We currently have 2.5” by 40” spiral wound membrane elements made from our patented formulation. We will be testing these membranes at three different testing facilities with three different water types during 2011:

Seawater; Office of Naval Research testing facilities at Port Hueneme, CA

Inland Brackish Water; Bureau of Reclamation, Water Quality Improvement Center, Yuma, AZ

Synthetic Water; Bureau of Reclamation, Denver Laboratories, Denver CO

## Contact Information

Principal Investigator:
Yuliana Porras
Phone: 303-445-2265
Email: yporras@usbr.gov

Technology Transfer Coordinator:
Samantha Zhang
Phone: 303-445-2126
Email: szhang@usbr.gov

## Collaborators

Reclamation’s Science and Technology Program and Reclamation’s Yuma Area Office, Separation Systems Technologies, Denver University, U.S. Army, U.S. Navy, and State of California.