

Reverse Osmosis (RO) is a technology that has many applications in water processing at nuclear power facilities.

How RO Works

In RO, pressure is applied to contaminated water on one side of a semi-permeable membrane.

The water and selected molecules, for example boric acid, pass through the membrane. Contaminants such as minerals, salts, and colloidal solids cannot pass through the membrane, and are “rejected.”

RO Applications

- RO is a proven cost-saving method of removing TDS and TOC from liquid radwaste (LRW) streams.
- RO is an ideal waste concentrator. Used upstream of an evaporator, it can reduce the evaporator’s workload by up to 99%.
- RO selectively removes radioactive and dissolved contaminants from plant systems — especially PWR LRW streams — while passing bulk materials such as boric acid.
- RO can be used at BWRs to process LRW for recycle by removing TDS and activity; the product is recycled as high-purity water (<1 µmho).
- RO units can be configured for single- or double-pass processing: double-pass units consistently yield reactor grade water.

Membrane Selection

The basic building block of an RO system is the membrane module. DTS uses several types of membranes in its systems; each selected to achieve the rejection/passage characteristics that you need for your project.



**50 gpm RO System
(Boric Acid Recovery System)**



**4 gpm RO System
(Boric Acid Recovery System)**

DTS RO Systems

DTS designs, fabricates, installs and operates stand-alone and skid-mounted RO systems in many sizes and configurations

Our turnkey systems handle flows from a few gpm to more than 100 gpm. Programmable Logic Control (PLC) systems and Man-Machine Interface (MMI) touch screens allow automatic remote operation, data logging, and fine-tuning of process parameters.

Spiral Reverse Osmosis

For years, plants have been limited in their use of RO in LRW applications due to the susceptibility of Spiral Reverse Osmosis (SRO) membranes to particulate fouling. This fouling plugs the membranes and creates high dose fields.

Use of a Tubular UltraFiltration (TUF™) system upstream of SRO units makes it possible to process high TSS water without membrane fouling. Combining TUF™ and SRO technologies extends SRO membrane life beyond five years, and decreases accumulated dose to a few mR.

The combination of TUF™ and SRO removes all TSS and TDS, to produce reactor grade water. The use of polishing ion exchange beds downstream of the SRO makes it possible to routinely produce 0.07 µmho water.

The SRO system can handle influent from 1 to 3,000 µmhos, consistently producing effluent that is from 0.1 to 1 µmho. Each pass of a double-pass SRO rejects more than 99% of almost all isotopes and dissolved solids (except tritium and noble gasses).

Summary of RO Results

Combining RO with advances in equipment design and membrane technology yields superior operational results. DTS routinely integrates filtration, membrane, and drying technologies to optimize processing performance, maximize water quality, and minimize waste volume.

Our systems:

- Reduce activity levels, with DFs from 100 to as high as 100,000 for most isotopes.
- Produce 100% water recovery with evaporation of reject to dry solids.
- Remove silica from borated water, with 85-98% recovery of boric acid.
- Produce high-purity product:
BWR <0.1 µmho, PWR <10 µmhos
- Reduce waste disposal volumes by a factor of more than 10 (compared to evaporation or ion exchange) when processing LRW.