AVANTech

Water Treatment Services

Radwaste Reverse Osmosis (RWRO™) System

AVANTech's patented Radwaste Reverse Osmosis (RWRO™) System revolutionizes liquid radwaste processing in Pressurized Water Reactors (PWRs). This system decontaminates even hard-to-process water (such as water from outage or from sluicing spent primary resin) to near minimum detectable amounts (MDA) in a single pass.

RWRO™ achieves high decontamination factors (DFs) by establishing a physical barrier between the plant and environmental outfall. Unlike the chemical barrier created by ion exchange resin, the RO membrane barrier remains constant, regardless of the quality and chemistry of the influent.

The key to the patented RWRO™ process is reordering the process configuration.

Conventional RO	RWRO™
Carbon Prefilter	Carbon Prefilter
▼	▼
Mechanical Filter	Mechanical Filter
▼	▼
Reverse Osmosis	Ion Exchange
▼	▼
Ion Exchange	**Reverse Osmosis**

In the Conventional RO configuration, ion exchangers are positioned downstream of the RO to polish the permeate. While this is effective for making high purity water, it is not optimal for Liquid Radwaste (LRW) processing, where the goal is to minimize the concentration of activity in the effluent.

The RWRO™ puts the ion exchangers upstream of the RO. In that position, ion exchange resin captures a high fraction of the radioactive contaminants from the process stream, leaving the RO membranes to make high quality water. Upstream ion exchange protects the RWRO™ from building up excessive dose, reduces the activity in the reject stream, and allows the reject to be returned to the plant's LRW system for reprocessing. The low activity concentration in the RWRO™ reject prevents a buildup of activity in the plant radwaste system and eliminates the need for secondary processing of the reject stream by drying or solidification.

AVANTech RWRO™ systems:

- ✓ Consistently produce high quality effluent in a single pass
- ✓ Eliminate the need for chemical pretreatment and hazardous chemicals
- ✓ Eliminate the need for reprocessing
- ✓ Reduce activity releases
- ✓ Reduce resin consumption and secondary waste volume
- ✓ Deliver superior results and high efficiency within a small equipment footprint

Radwaste Reverse Osmosis (RWRO™)

AVANTech's RWRO™ system reduces releases.

The RWRO™ System has set Life of Plant (LOP) records for activities releases and waste generation at EVERY plant where it has been installed.

Years of operating results show that the patented RWRO™ process consistently reduces annual LRW activity releases to low single digit mCi values.

Arkansas Nuclear One (ANO)

Since the RWRO™ system was installed at ANO Unit 2 in January 2014, average non-gaseous LRW effluent activity has been reduced from $3.73E^{-5}$ to $1.16E^{-7}$ mCi/ml, an improvement of over two decades. Process flow rate has been tripled and no waste has been generated in 18 months of operations, though the projected annual average waste volume is 30 to 40 cf/year of ion exchange media. During the first 1½ years of operation, all water has been decontaminated in a single pass without chemical treatment.

Nuclear Plant Users

Plant	Installed	LOP Record
Wolf Creek	1998	YES
Fort Calhoun	2006	YES
Seabrook	2006	YES
Vogtle	2006	YES
Farley	2009	YES
Diablo Canyon	2013	YES
ANO Unit 2	2014	YES

Fort Calhoun Station

The RWRO™ installed at Fort Calhoun, Nebraska, in 2006 elevated the plant from 4th to 1st Quartile, while maintaining or slightly reducing waste volume. The RWRO™ has performed well on a wide range of influent, including post steam generator changeout water and extensive river incursions during the "Great Nebraska Flood" of 2011.

Membranes last 3-5 years, which is typical of LRW installations. Because the RWRO™ is so reliable and eliminates the need for reprocessing, one technician can process all the plant's LRW water.

Stand-alone pedestal with Programmable Logic Control (PLC) touch screen controls permits easy, remote operation.

Side view of RWRO™ skid with integrated shielding and hinged shield doors for easy access to housings for membrane changeout.

AVANTech

▪ 803.407.7171 ▪ 2050 American Italian Way, Columbia, South Carolina 29209
▪ 865.539.9000 ▪ 2680 Westcott Boulevard, Knoxville, Tennessee 37931
▪ 509.943.6706 ▪ 2155 Robertson Drive, Richland, Washington 99354
▪ info@avantechllc.com ▪ **www.avantechllc.com**