

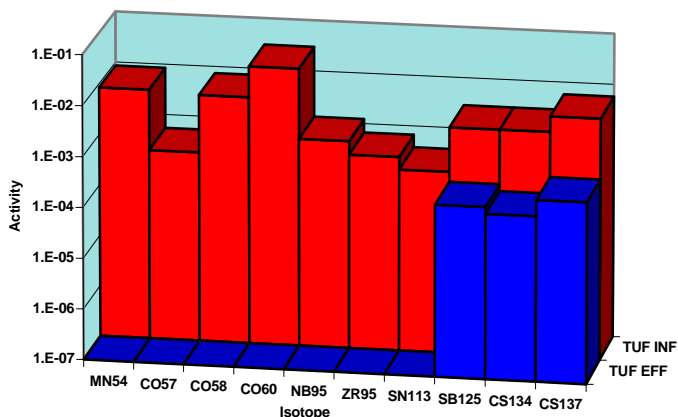
Materials separation has long been a challenge in liquid radwaste (LRW) processing. Many of the solutions tried over the years have fallen short of expectations. For example:

- Cuno-type filters are expensive, dose-intensive, and effective only to a low micron level.
- Mechanical filtration has been ineffectual, since most insoluble activity (primarily Co) is sub-micron: 0.5 to 0.05 microns.
- Chemical pretreatment is a fragile technology that can worsen filtration problems if not properly applied.

Ultimately, our industry needs a separation technology that targets the necessary micron range, generates little or no secondary waste, and is simple to apply and reasonably priced.

The TUF™ System

The Tubular UltraFiltration (TUF™) System meets the needs of a nuclear power plant's LRW operation. Filtering the process stream to 0.05 micron, the TUF™ removes virtually 100% of suspended solids, oils and greases, metal complexes, and most colloidal material from the LRW by passing it through a series of cross-flow membranes.



Typical TUF™ Performance Processing PWR Sluice Water



DTS TUF™ System

Reduced Curies

Because it's so effective at removing the Co that constitutes a majority of activity releases, ultrafiltration helps reduce curie discharges. Removal percentages of 50 to 100 have been achieved for Co, Fe, and Cr.

Minimum Waste Volume

Unlike conventional filters that generate waste volumes many times greater than the contaminants they remove, TUF™ removes only the volume of dirt, and generates no secondary waste. And the cross-filtration TUF™ needs no messy, dose-intensive element changes.

TUF™ and Demineralization

Used upstream of a demin system, the TUF™ removes non ion-exchangeable materials and fouling agents. Co, Cr, Fe, Mg, Mn, and Nb are all greatly reduced before reaching the demins. Eliminating fouling materials from the waste stream improves DFs and total throughput of downstream resin beds.

Innocuous ionic materials like Na, Ca, Cl, SO₄, and B pass through the TUF™ for discharge to the environment.

TUF™ and Reverse Osmosis

Used in front of an Reverse Osmosis (RO) system, the TUF™ prevents membranes from fouling, and removes many of the challenges to RO processing.

With the TUF™ there's:

- Little or no RO cleaning required
- No secondary waste
- TOC removal/destruction available
- Direct feed to RO - no intermediate tanks
- Constant feed - no filter backwashes or element changes
- Extension of RO membrane life by 3-5 years

System Operation

Plant feed enters a **pretreatment tank** where, if required, biological growth and organics are converted to CO₂ and water. Solids are concentrated and settle to the tank's conical bottom for removal to a High Integrity Container (HIC), Spent Resin Storage Tank, or other disposal container.

A **feed pump** sends wastewater from the pretreatment Tank to the TUF™.

The heart of the TUF™ consists of stainless steel **pressure vessels** arranged in series. Flow through each vessel is divided into parallel tubular channels. Inside the tubes, membranes reject waste stream contaminants, while clarified water is permitted to pass through to collect on the shell side of the vessel.

The process flow (less the permeate), circulates continually back to the pretreatment tank for re-processing. A booster pump pressurizes the permeate stream to drive this water through a demineralizer or RO unit, without intermediate tanks.

EXCLUSIVE Technology

DTS is the exclusive U.S. representative for the tubular ultrafiltration technology of PCI Membrane Systems Ltd., a leading manufacturer of membranes for industrial processes in the United Kingdom.

This technology, which is widely used in Europe, has provided the U.S. nuclear industry with the answer to its LRW materials separation challenges.

TUF™ Membranes

TUF™ membranes are selected for their ability to tolerate insults from dirt, organics, biological growth and complexed materials. The high flow rate of the TUF™ sweeps away fouling agents that accumulate on the membrane surface, and helps to extend run times and membrane life.

System Flexibility

Because the TUF™ is modular, you can add capacity as needed. This unit can be integrated to downstream demin or RO systems for LRW cleanup for discharge or recycle.

Process Control

The TUF™ includes a Programmable Logic Controller (PLC) that automatically adjusts operating parameters, optimizing system flow rates and pressures. The PLC provides system alarms and automatic shut down if parameters fall outside the norm.

