

Testing of Full-Scale Rotary Microfilter



SRNLTM
SAVANNAH RIVER NATIONAL LABORATORY

We Put Science To Work

**Michael Poirier
David Herman
Samuel Fink**

April 17, 2006

SRNL-CST-2006-00019

Background

- Crossflow filtration used in many DOE site applications
- Looked for alternative technologies to improve process throughput
 - Identified rotary microfilter
- Initial testing showed significant increase in filtration rate (2 – 6X)
- SRNL received funding from DOE EM-21 to adapt technology for radioactive service and procure 2nd generation (full-scale) unit
- Two 25-disk units arrived at SRNL - one is being tested
 - SCIX prefilter or DDA filtration
 - Sludge washing
 - Simulate maintenance operations: flushing, filter stack removal/replacement
 - Feed will be sludge only, which previous testing showed filtered slower than sludge + MST

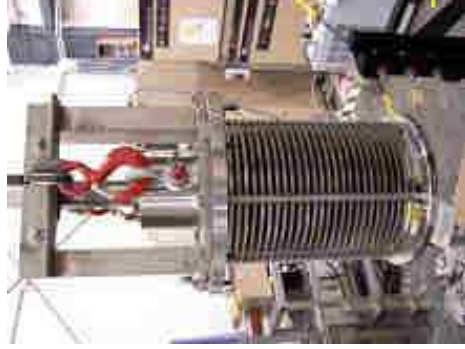
Program

- Install full-scale unit at ACTL
 - Install and remove filter with crane
- Conduct dye test to evaluate removal of soluble contaminants (i.e., Cs-137)
- SCIX prefilter test
 - 0.06 – 4.5 wt % sludge
 - Flushing/chemical cleaning to remove solid particles
- Sludge washing test
 - 12 – 18 wt % solids
 - Continuous wash

2nd Generation Rotary Filter @ ACTL



2nd Generation Rotary Filter Assembly

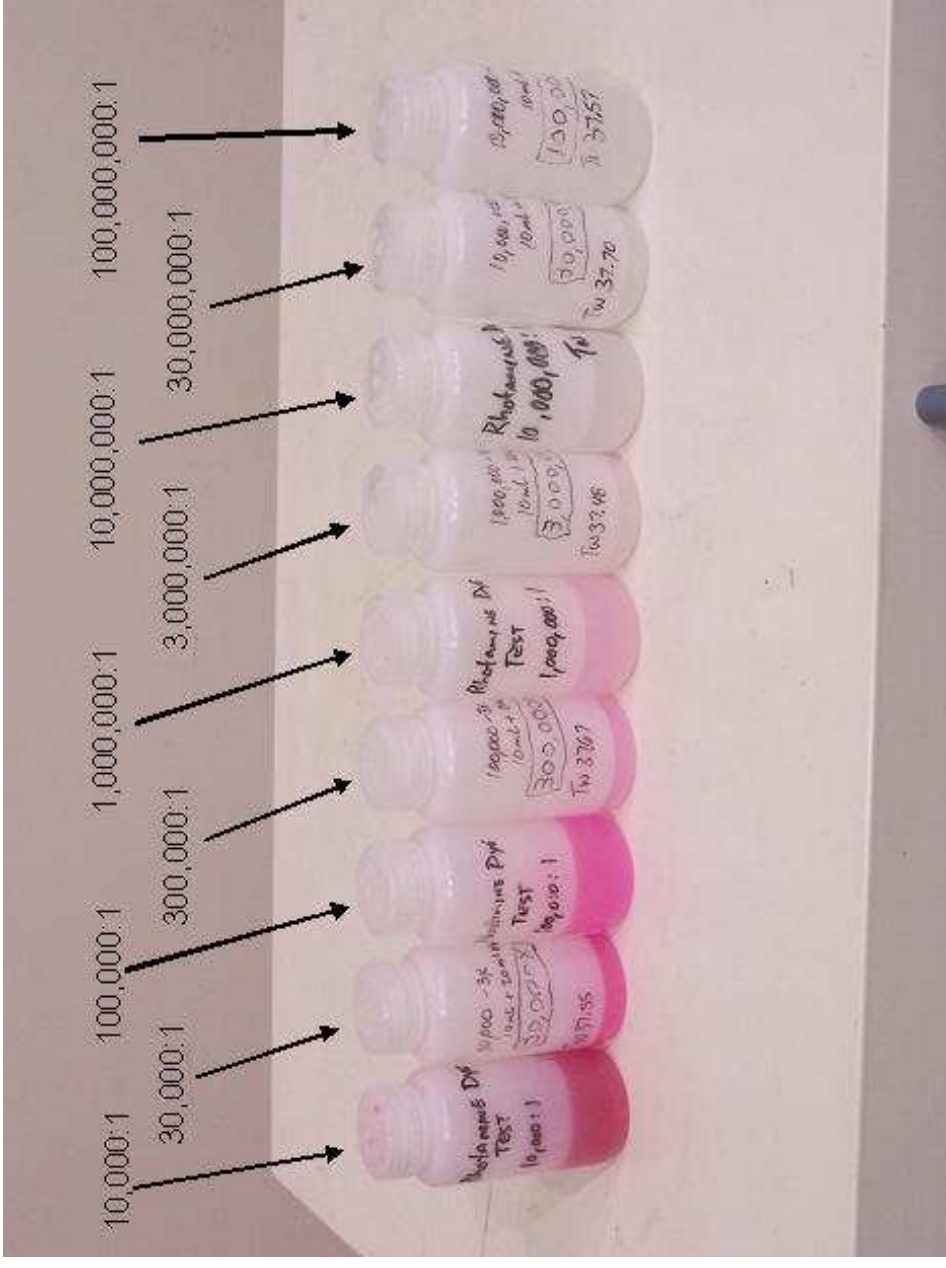


Filter stack can be installed using overhead crane
SRNL-CST-2006-00019

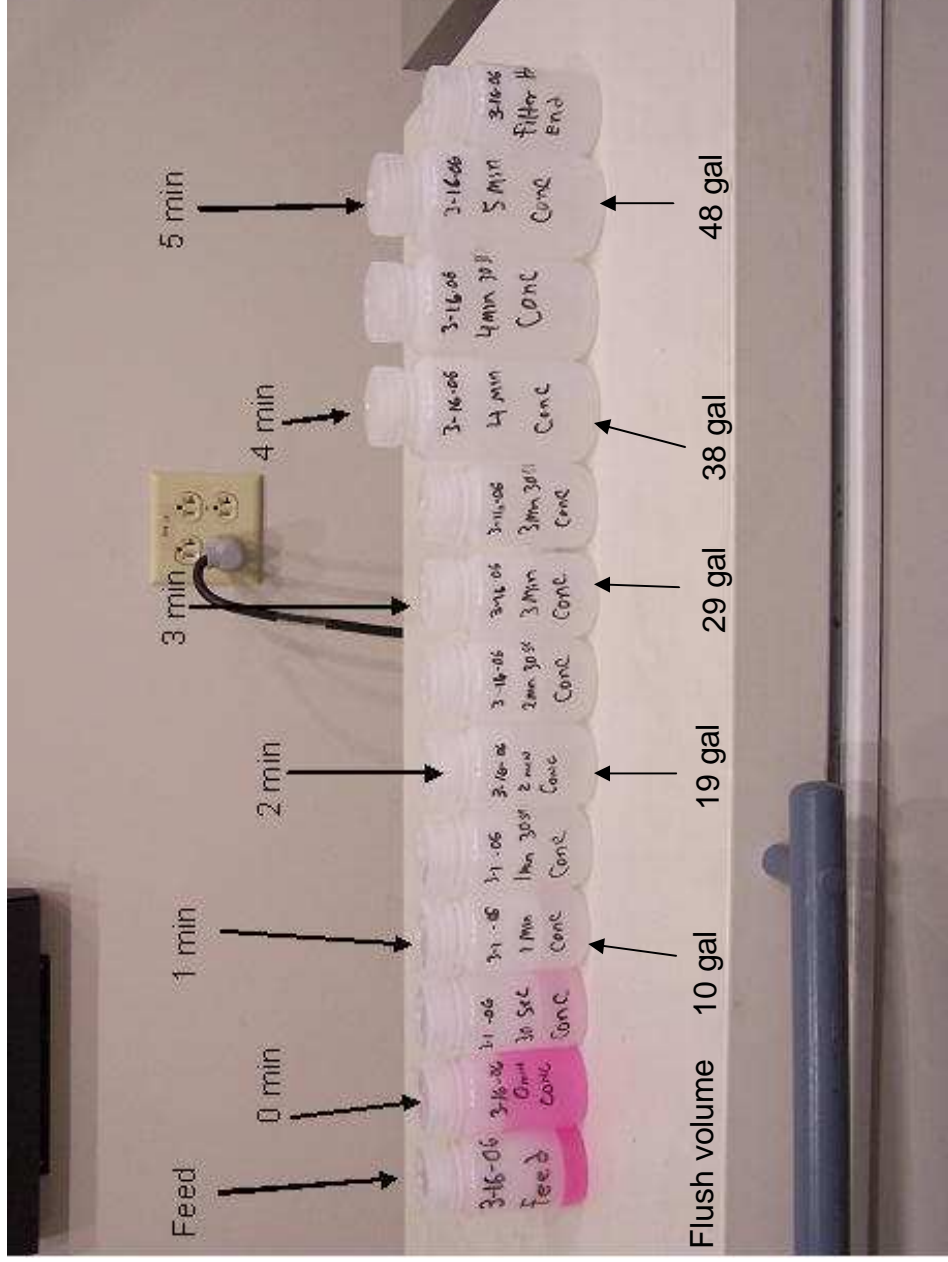
RMF Flushing Test with Rhodamine Dye

- Filled container with 45 Liters (11.9 gallons) of deionized water
- Added 0.9 mL of Rhodamine WT dye to the container (50,000:1 dilution)
- Mixed for 5 minutes
- Pumped the dye into rotary filter feed lines and housing
- Drained filter housing
- Filled drum with 50 gallons of deionized water
- Pumped deionized water through RMF at ~ 6 gpm.
- Collected concentrate and filtrate samples every 30 seconds
- Continued until concentrate and filtrate had no color
- Analyzed samples by spectrophotometer
- Drained system
 - Analyzed drained water
 - Inspected filter housing

Rhodamine Dye Test - Standards

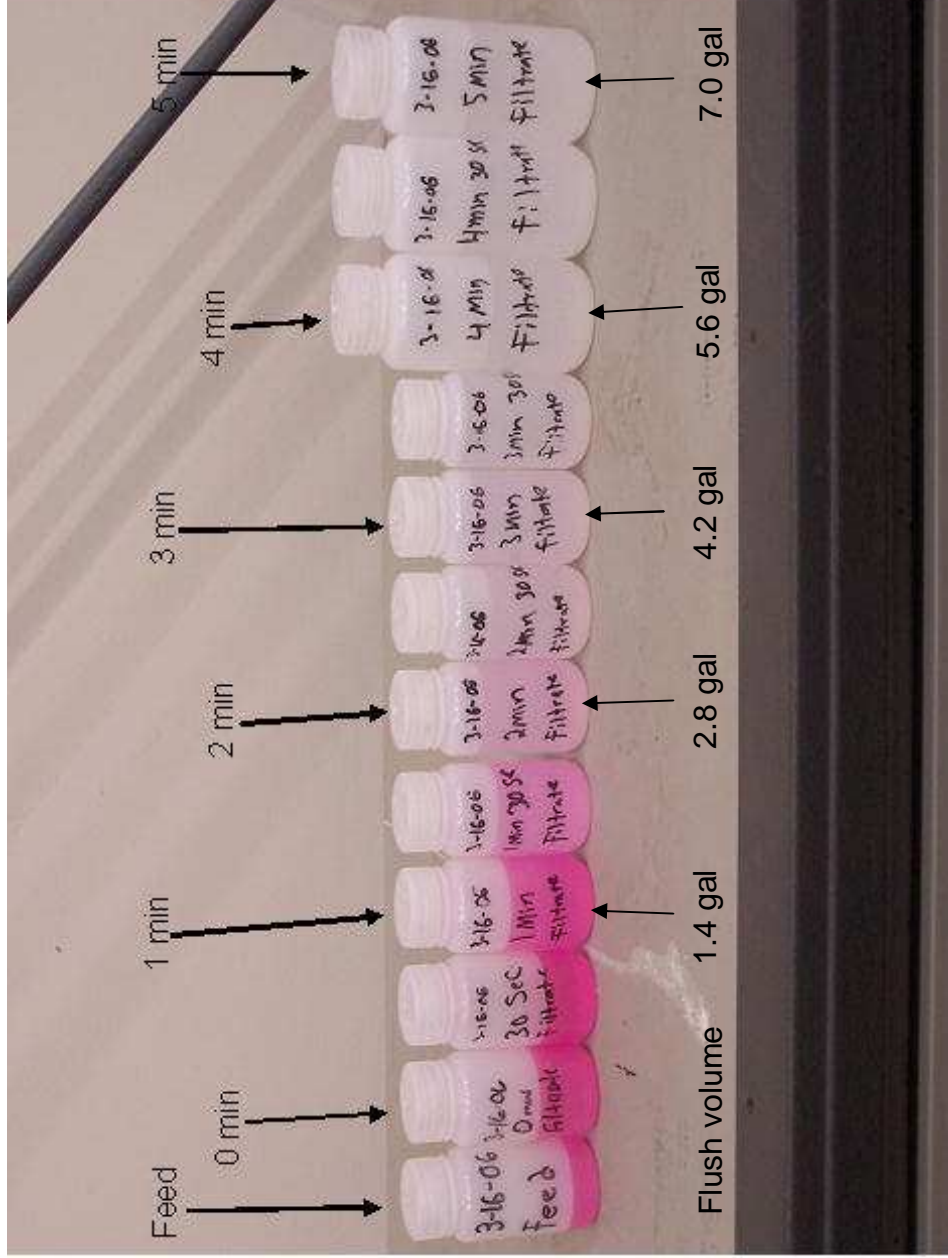


Concentrate Line



- Concentrate line clear within 1 minute
- Greater than 100X reduction

Filtrate Line



- Filtrate line clear within 4 minutes
- Greater than 100X reduction

Filter Housing Following Draining

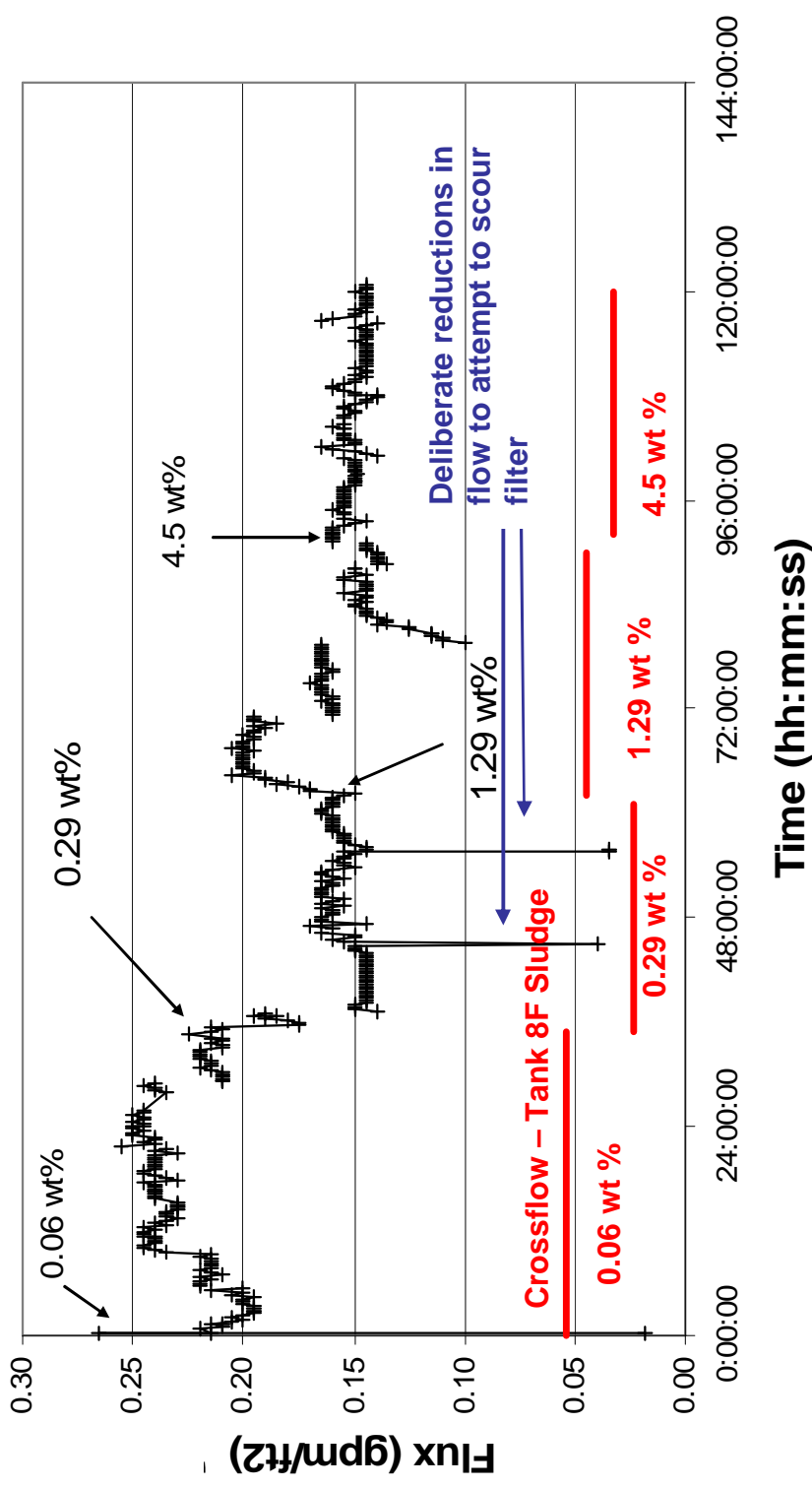


No significant liquid in filter housing after draining

SCIX Prefilter Test

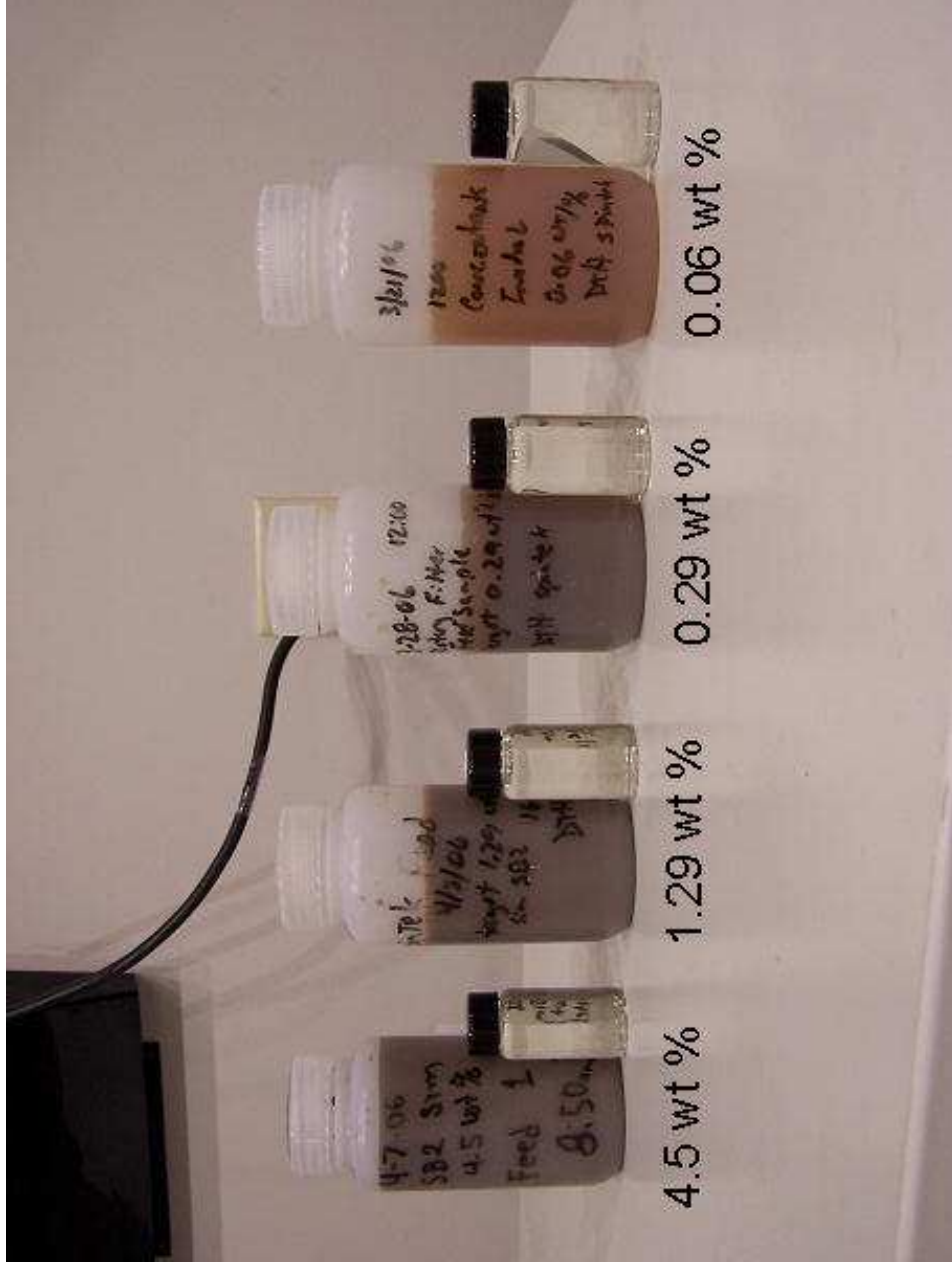
- Reused 5.6 M sodium salt from previous filter test
- Added Sludge Batch 2 sludge (target 0.06 – 4.5 wt % solids)
- Feed pressure 40 – 95 psi
- TMP 40 psi
- Temperature 30 – 40 °C
- Feed flow rate ~ 25 gpm

SCIX Prefilter Test Data



Flux significantly above crossflow filter (FRED)
 Flux > 0.2 gpm/ft² (10 gpm) with expected SCIX feed (0.06 wt % solids)

Filter Feed and Filtrate



No visible
solids in
filtrate

Path Forward

- **Complete SCIX testing**
 - Flushing/chemical cleaning
 - Post test inspections
- **Optima prepares simulated sludge**
- **Sludge washing**
- **Ship rotary filter to ORNL**
- **Document results**

Acknowledgements

- DOE EM-21
- Sammie McDuffie and Henry Bolton