Waste Treatment Plant (WTP) Pretreatment Engineering Platform Testing Overview

Steve Barnes

December 4, 2007

U.S. Department of Energy

Office of River Protection

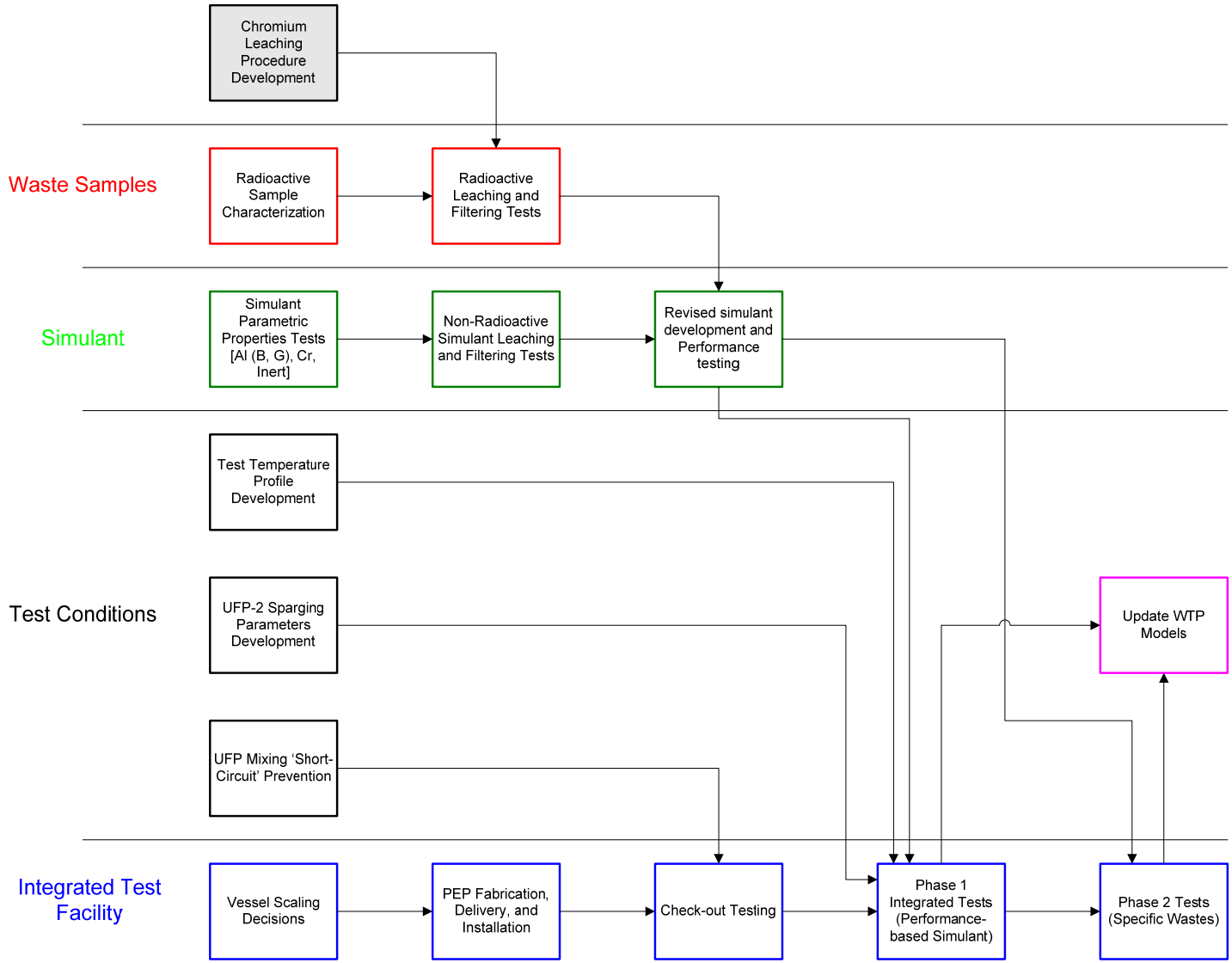
Bechtel National, Inc.

Washington Group International
Integrated Engineering, Construction, and Management Solutions

Testing Program Drivers

- Verify the Pretreatment Facility (PTF) flowsheet and reduce the process and modeling risks:
  - Demonstrate ultrafiltration system and leaching flowsheet scale-up
  - Improve projections for PTF impacts on campaign duration and canister production
  - Demonstrate Pretreatment Facility operating conditions and flowsheet alternatives
    - Solids concentration
    - Caustic leaching (to dissolve Al) at 100 ºC
    - Slurry washing
    - Oxidative leaching (to dissolve Cr)
    - Ultrafilter operation, control, and cleaning

Pretreatment Verification Integrated Test Logic



Radioactive Waste Characterization

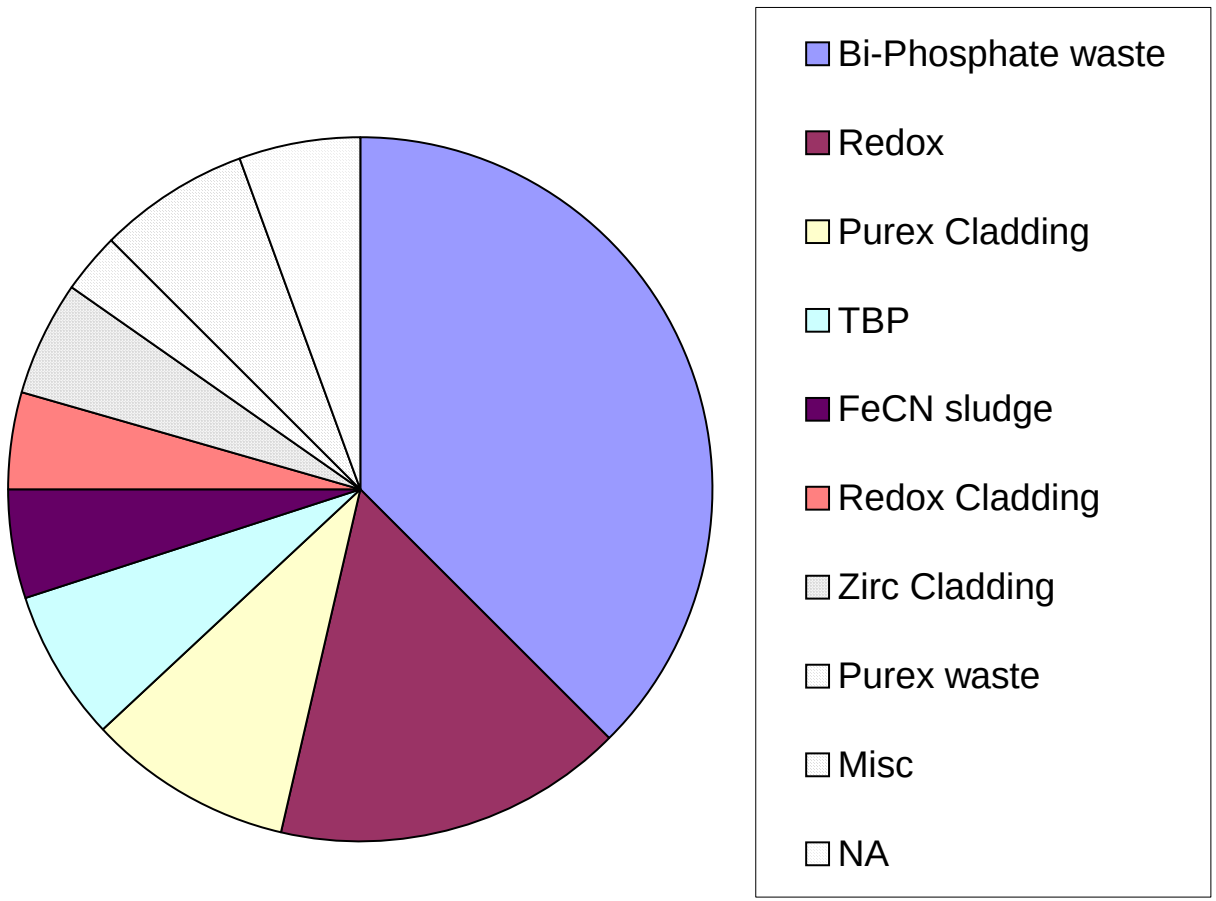
- WTP Waste Characterization to date limited to tanks specified in the statement of work.
- Goal: Characterize samples representing 75-80% of the Hanford Wastes (in addition to the PUREX waste previously characterized by the WTP).
  - Determine physical and chemical properties of these wastes for Phase 1 and 2 simulants
  - Subject the waste samples to the initial PTF chemical separations processes
  - Develop non-radioactive simulants representing these wastes for PEP testing

Total Al, Cr, and Phosphate Mass Source Breakdown

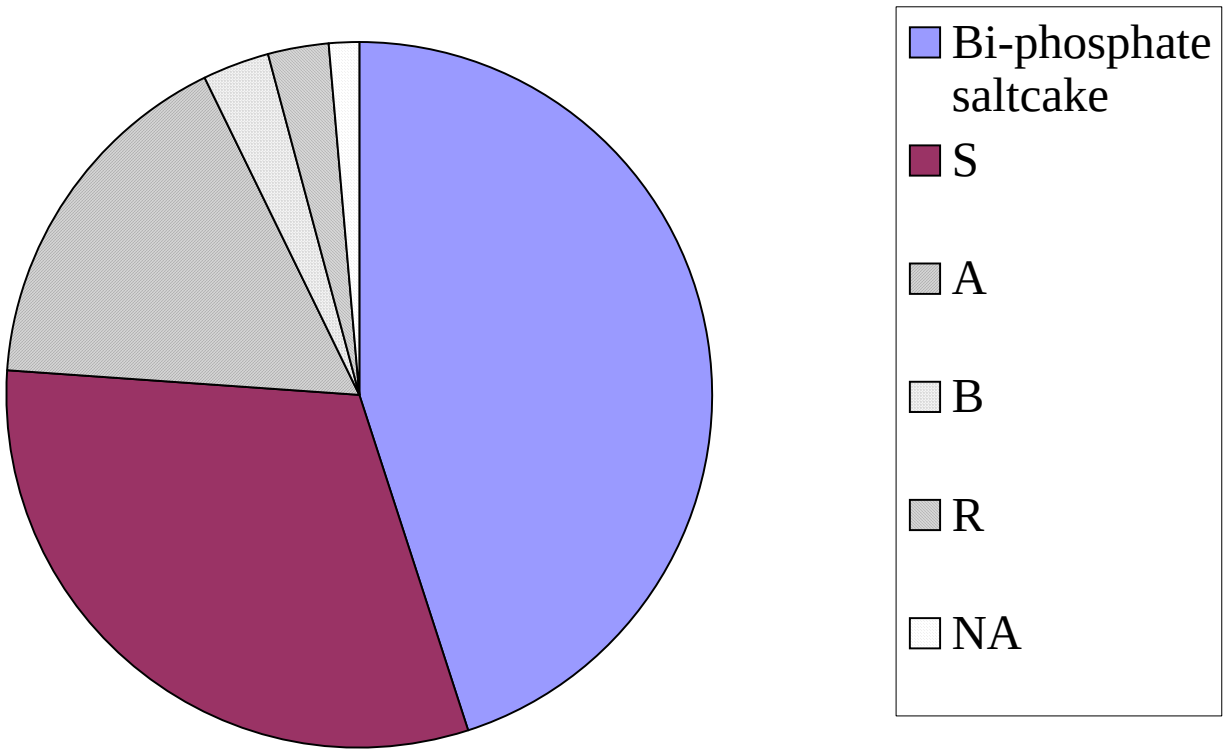
Fraction of Hanford Waste Inventory

Group ID	Fuel Processing Waste Source	Al	Cr	Phosphate
1	Bi Phosphate sludge	3%	3%	21%
2	Bi Phosphate saltcake (BY, T)	18%	25%	36%
3	PUREX Cladding Waste sludge	12%	1%	3%
4	REDOX Cladding Waste sludge	8%	1%	0%
5	REDOX sludge	26%	8%	1%
6	S - saltcake (S)	11%	38%	12%
7	TBP waste sludge	1%	1%	8%
8	FeCN wastes	2%	1%	4%
	Balance	19%	22%	14%

Hanford Waste Solids Mass by Source



Hanford Waste Saltcake Mass by Source



PEP Testing, Phase 1

- Single simulant based on existing waste data and IRP specified mass loss and processing time
  - Boehmite (Al)
  - Gibbsite (Al)
  - Chromium
  - Oxalate
  - Filtration (iron rich solids)
  - Supernatant containing aluminum, sodium, carbonate, hydroxide, nitrate, nitrite, sulphate, phosphate at concentrations found with the Hanford wastes

PEP Testing, Phase 1

- Demonstrate PTF design (filter draining, filter back-pulsing, dual pumps in series, washing efficiency, etc.)
- Provide the basis to estimate the Al and Cr leach factors in the Pretreatment Facility (prototypic mixing conditions, 100^{o}C, expected OH^{-} molarity, etc.)
- Examine washing efficiency

PEP Testing, Phase 1

Evaluate the ultrafilter system performance

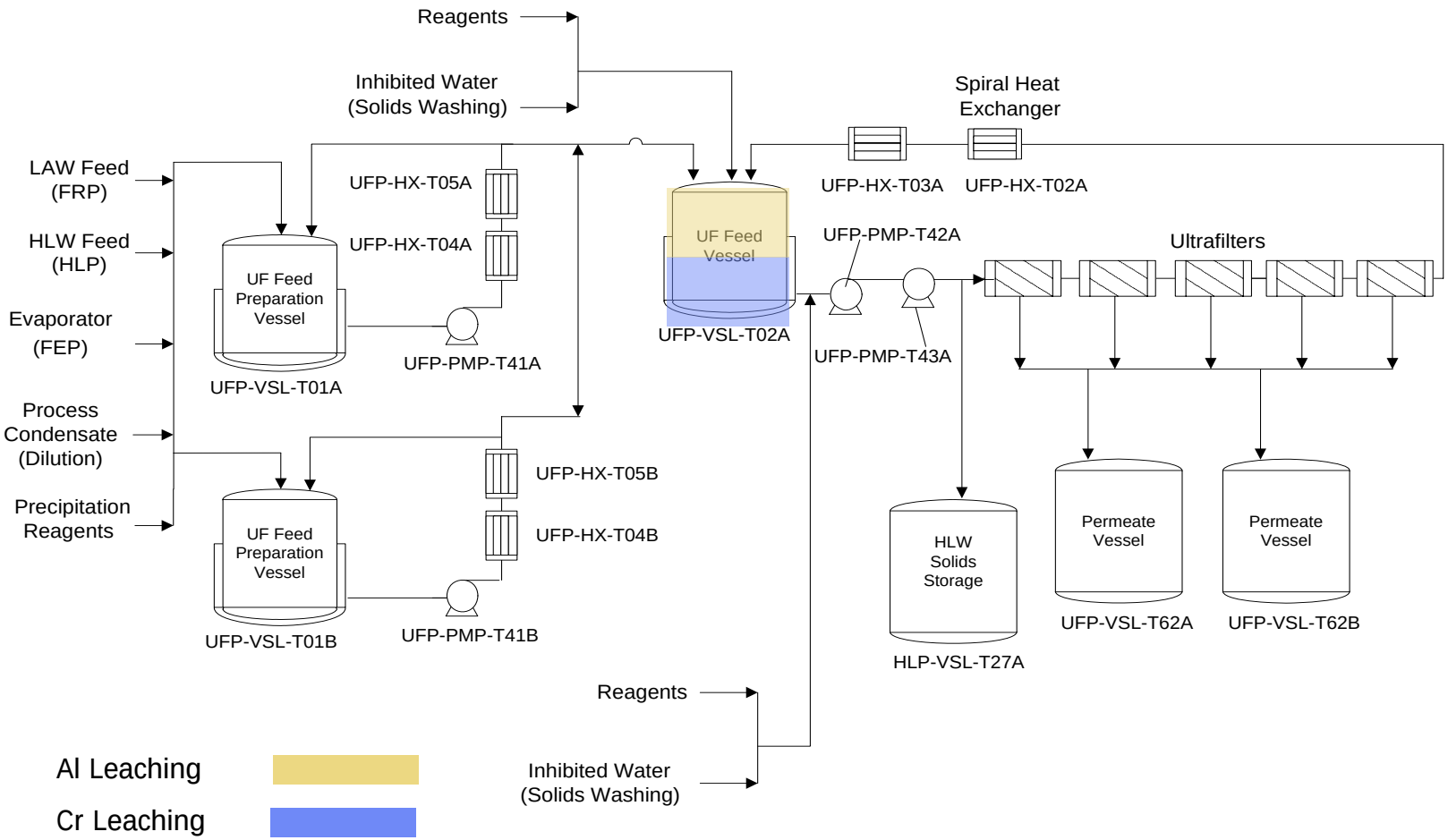
- Flux rate and viscosity models
- Control system operation (back pulsing, pulse pots, etc.)
- Filter cleaning performance

- Determine if aluminum phases form after initial dissolution and / or filtration:
  - Oxalates or sodium aluminates
  - Aluminosilicate formation when blended with recycle
  - Samples for extended precipitation studies

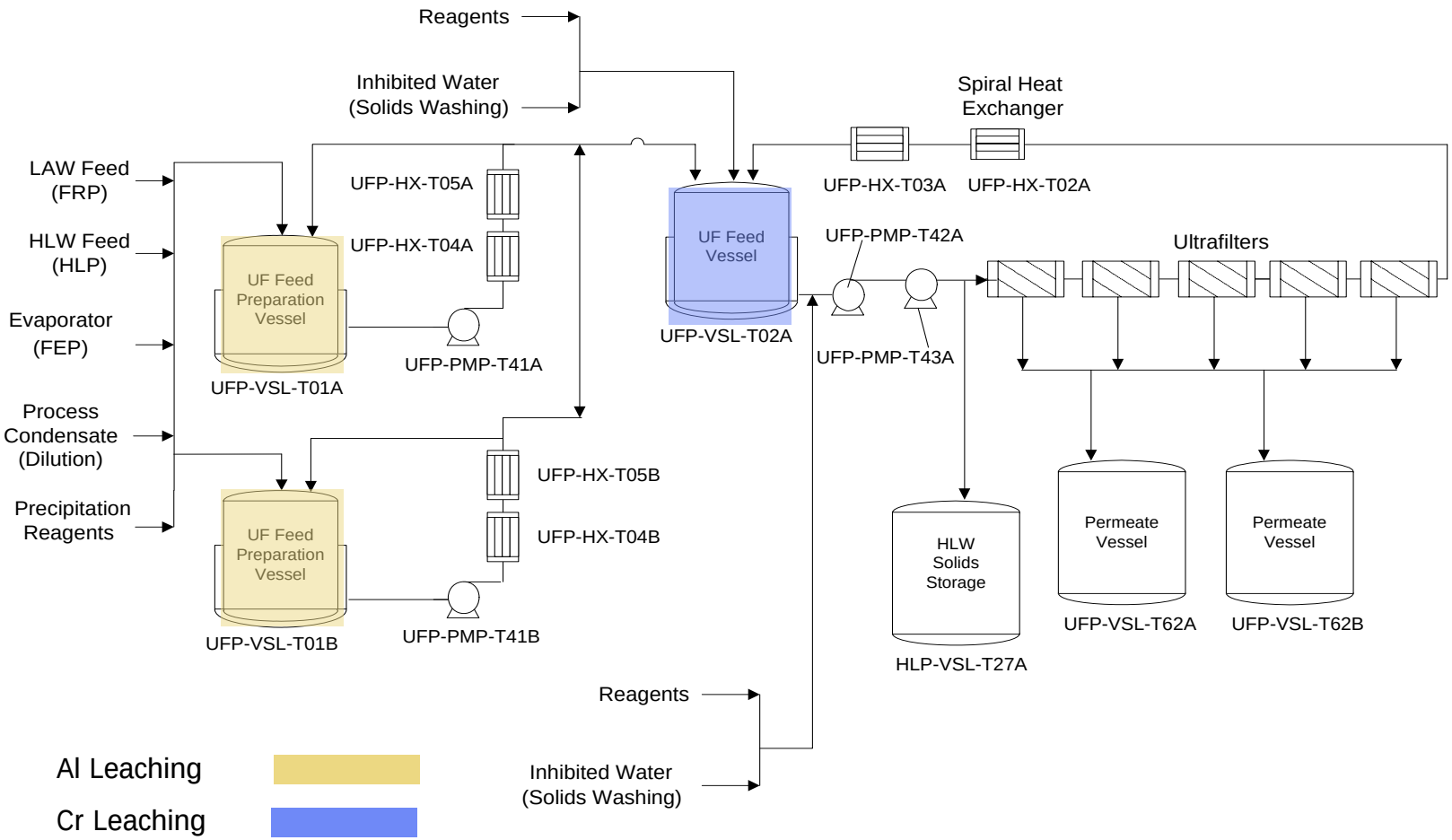
Phase One Test Overview

- Test Plan describes five, 24h/d tests
- Test crew is anticipated to be 6 people plus a dedicated, real time data analysis staff
- Tests 1, 2, and 3 are performed using the original flowsheet (all solids concentration, leaching, and washing operations occur in a single vessel)
  - Approximately 5-day duration
  - About 1000 gallons of simulant
- Test 4 and 5 employ the revised flowsheet where Al leaching is performed upstream, prior to concentration and Cr leaching
  - Approximately 9-day duration
  - About 3000 gallons of simulant

Simplified PEP Test System Equipment



Simplified PEP Test System Equipment



Key Analyses

- Mass balances for Al, Cr, Na, oxalate, etc.
- Filter permeate fluxes
- Solids distributions
- Post filtration precipitation
- Temperature distribution

Estimated Schedule

- Initial assembly of the PEP: ~6/30/08
- Check-out and training operations complete: ~8/31/08
- Phase 1 testing complete: ~10/15/08
- Data analyses and reporting follows