



Pretreatment Engineering Platform

Office of Waste Processing Technical Exchange

Session 5, Facility Readiness and Start-up

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DOE-ORP

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U.S. Department of Energy

**Pacific Northwest
National Laboratory**

Operated by Battelle for the
U.S. Department of Energy



Bechtel National, Inc.

URS

Washington Division

Pretreatment Engineering Platform (PEP)

The PEP is part of an integrated testing program to resolve issues raised by DOE and an External Flowsheet Review Team with the WTP ultrafiltration system and associated leaching processes.

Issue response required WTP to:

- Confirm ultrafiltration system and leaching process at appropriate scale
- Provide the basis for leaching effectiveness and throughput estimates over a range of wastes representing the majority of the WTP mission
- Verify the Pretreatment Facility ultrafiltration system design including key components and process control strategy

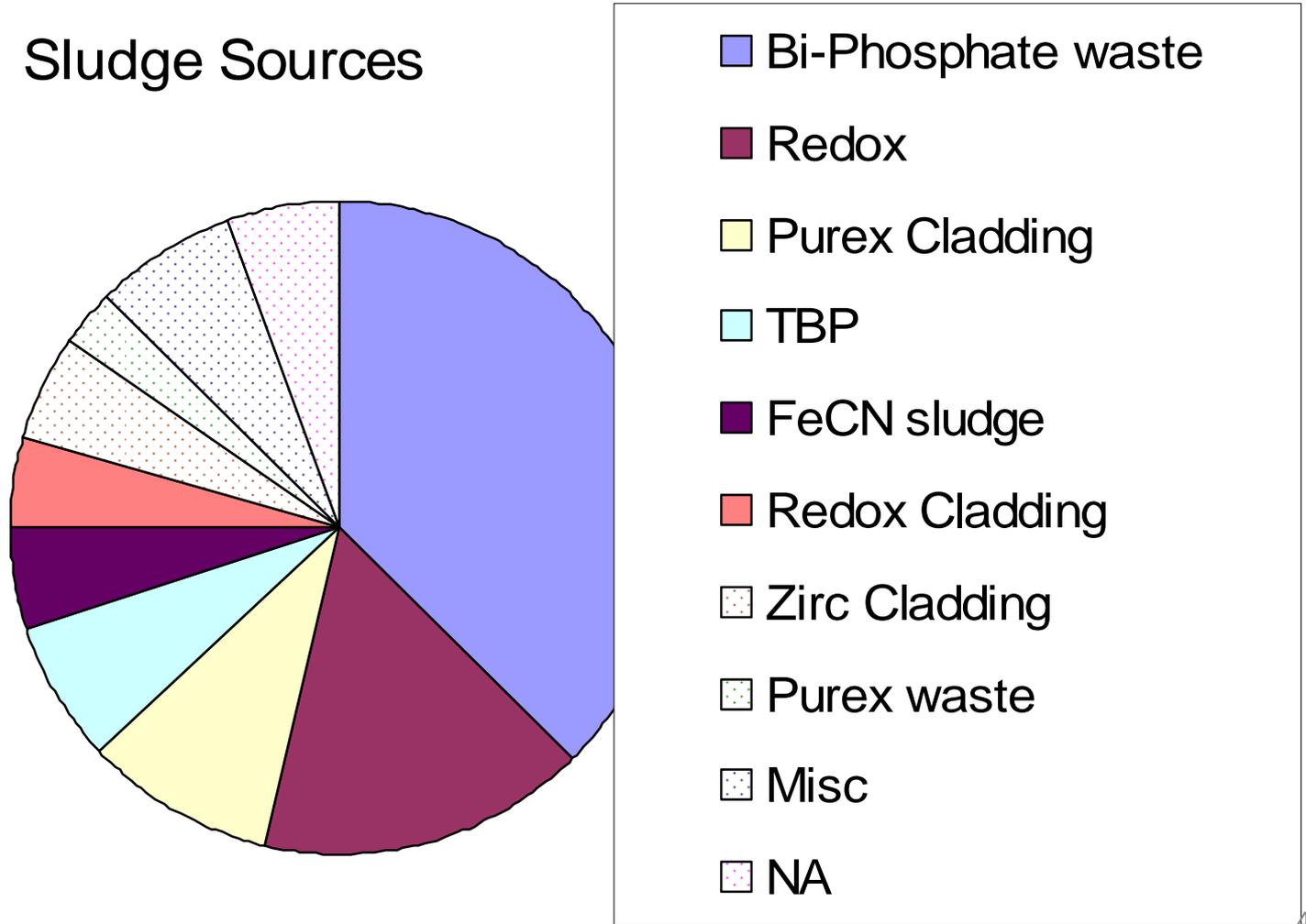
Issue Response Plan

ORP and WTP Prepared a Plan to Resolve the Issue Including:

- Modeling to Project System Performance and Identify Prudent Changes (Complete)
- Waste Characterization (Complete)
- Simulant Development and Testing (Complete)
- Engineering Scale Testing (Complete)
- Reconciled Modeling to Project System Performance (Ongoing)

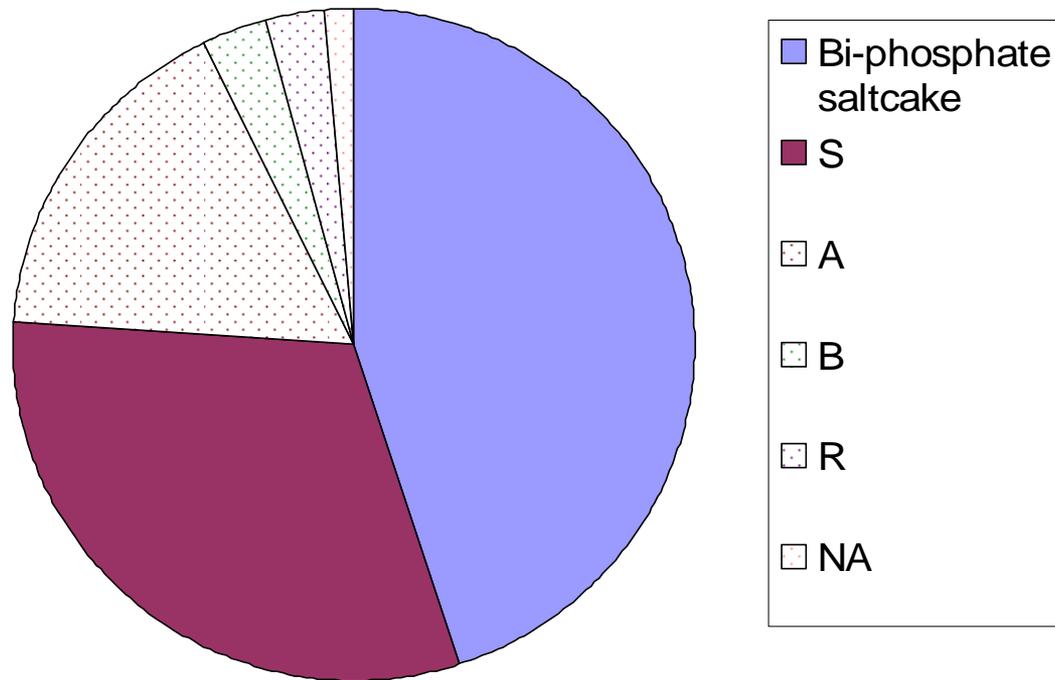
Hanford Waste Sludges

Sludge Sources

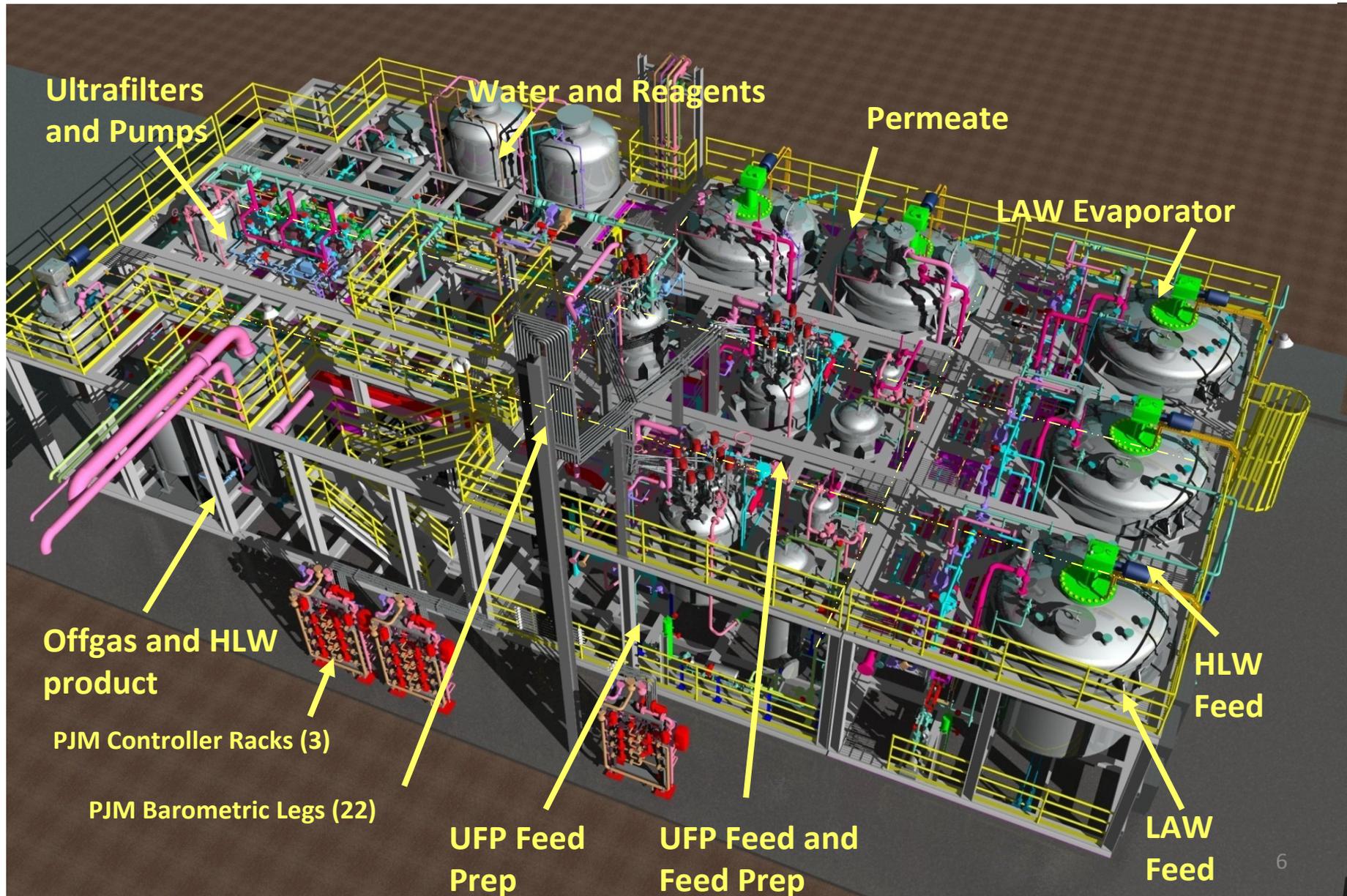


Hanford Salt Cake

Saltcake fractions



Pretreatment Engineering Platform









CRANE NO.
983

CLAYTON

3 TON
CAP

WATER TANK
NO. 10

FILTER VESSEL
NO. 102

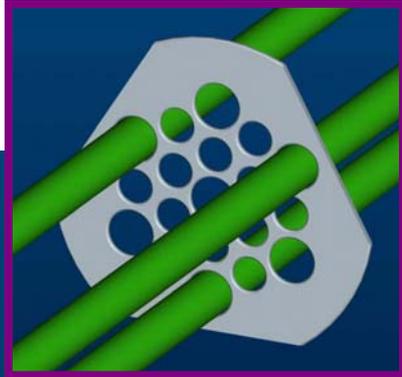
EXIT



PEP Description – Prototypic Components

- Prototypic feed prep vessels (UFP-1A & 1B) and feed vessel (UFP-2A)
- Prototypic mixing systems
 - In-line addition of reagents
 - PJMs
 - Ultrafiltration loop
 - Air spargers
- Prototypic cross-flow ultrafiltration loop
 - Dual pumps
 - 3x 10-ft and 2x 8-ft filter bundles
 - Spiral-plate chiller (for removing pump heat)
 - Pulse pots (for back-pulsing ultrafilters)
- Prototypic control strategies

Mott Ultrafilter Unit

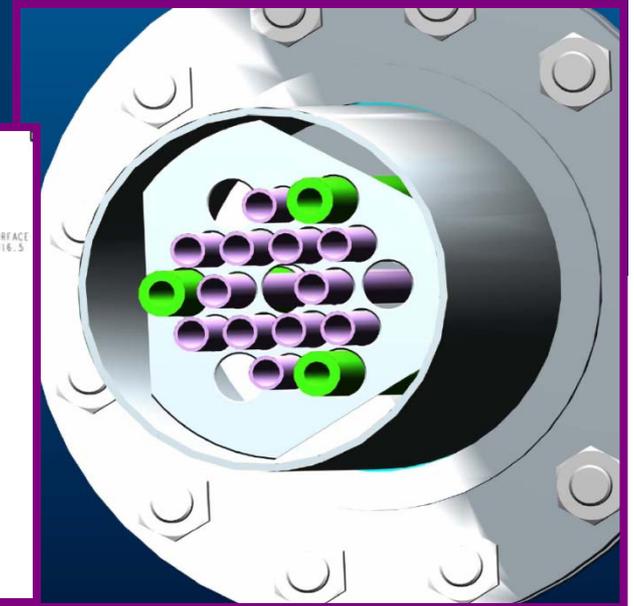
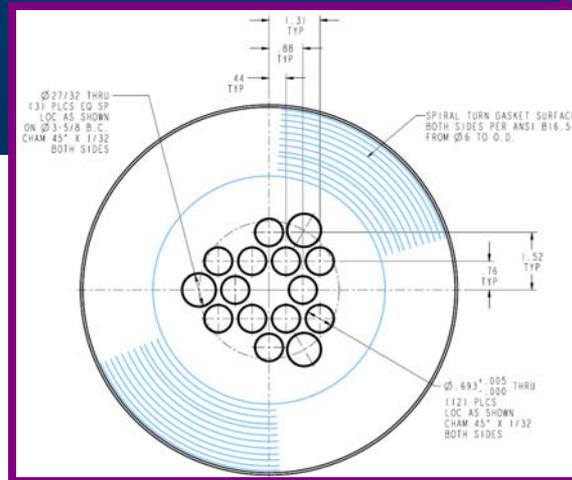


MEMBRANE TUBE
SUPPORT PLATE

FIXED TUBESHEET



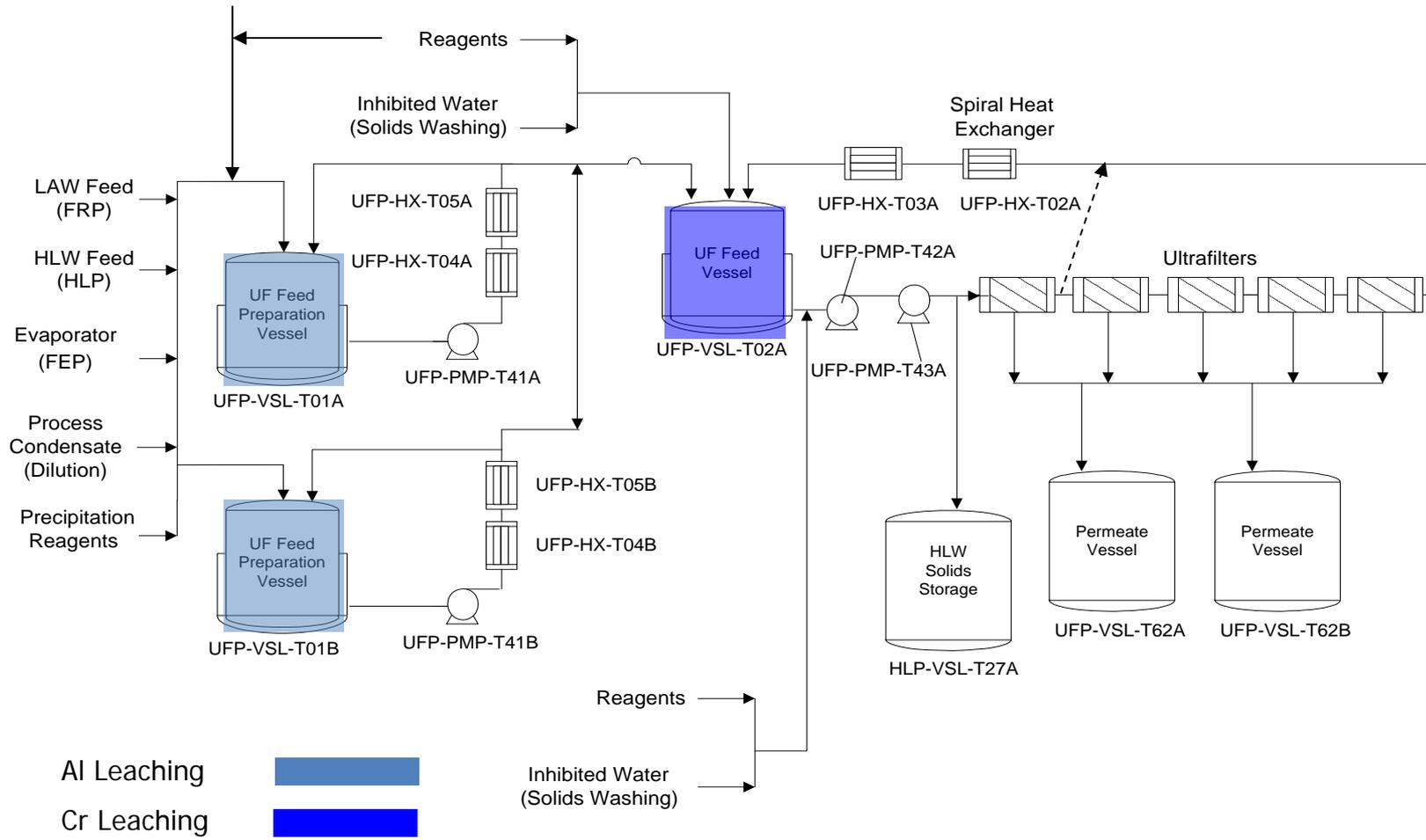
FLOATING TUBESHEET



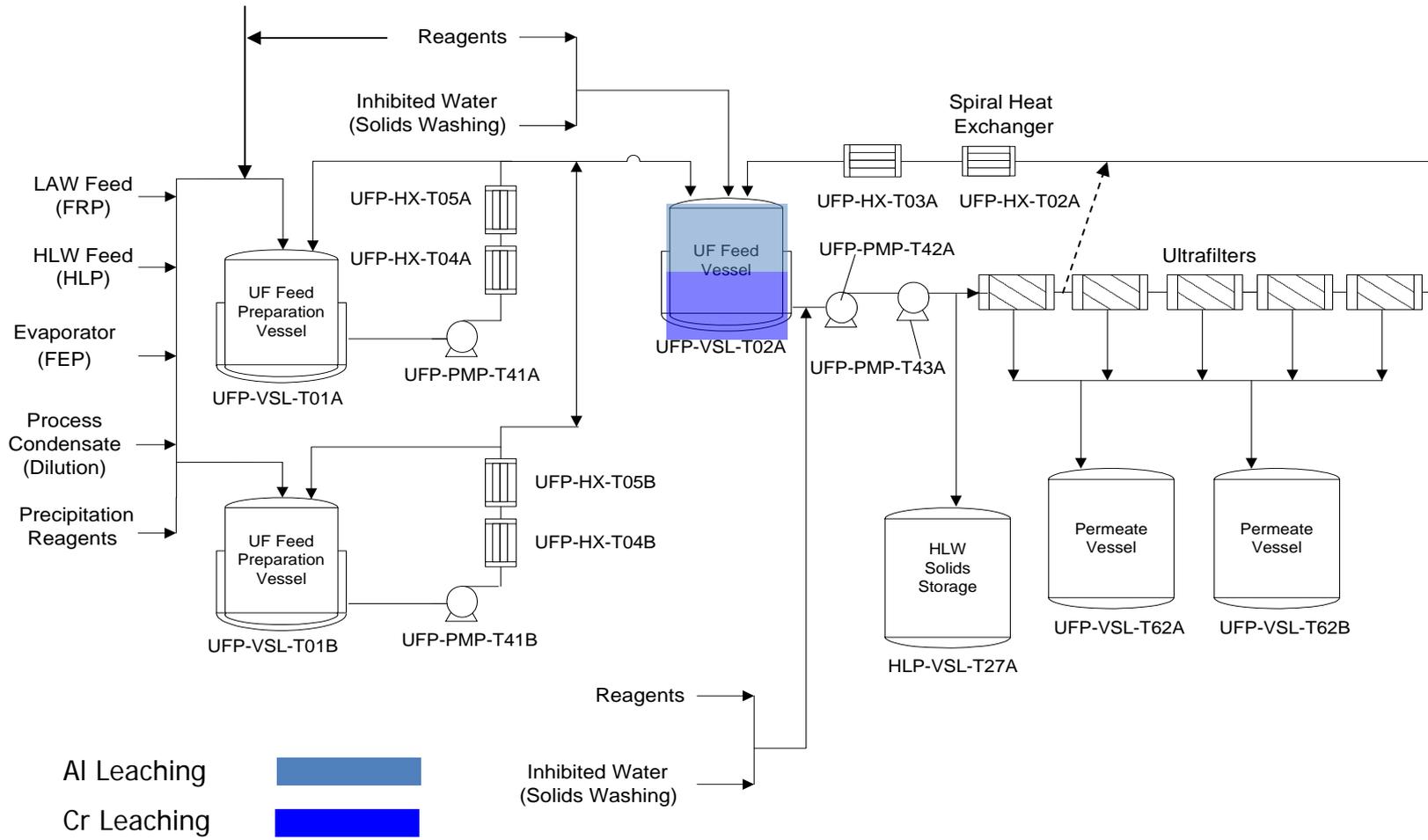
Test Description – Integrated Process Testing

- Demonstrate all leaching and ultrafiltration processes
 - Parameters maximize similarity of PEP and WTP results
- Test A
 - Caustic leaching in UFP-1A and 1B at 98 C
 - 6 caustic leach batches
- Test B
 - Caustic leaching in UFP-2A at 98 C
 - 2 caustic leach batches (non-prototypic)
- Test D
 - Caustic leaching in UFP-2A at 85 C
 - 2 caustic leach batches (non-prototypic)
 - Demonstrate WTP process control strategy for oxidant addition

Simplified PEP Process Flow Diagram, Test A



Simplified PEP Process Flow Diagram, Tests B and D



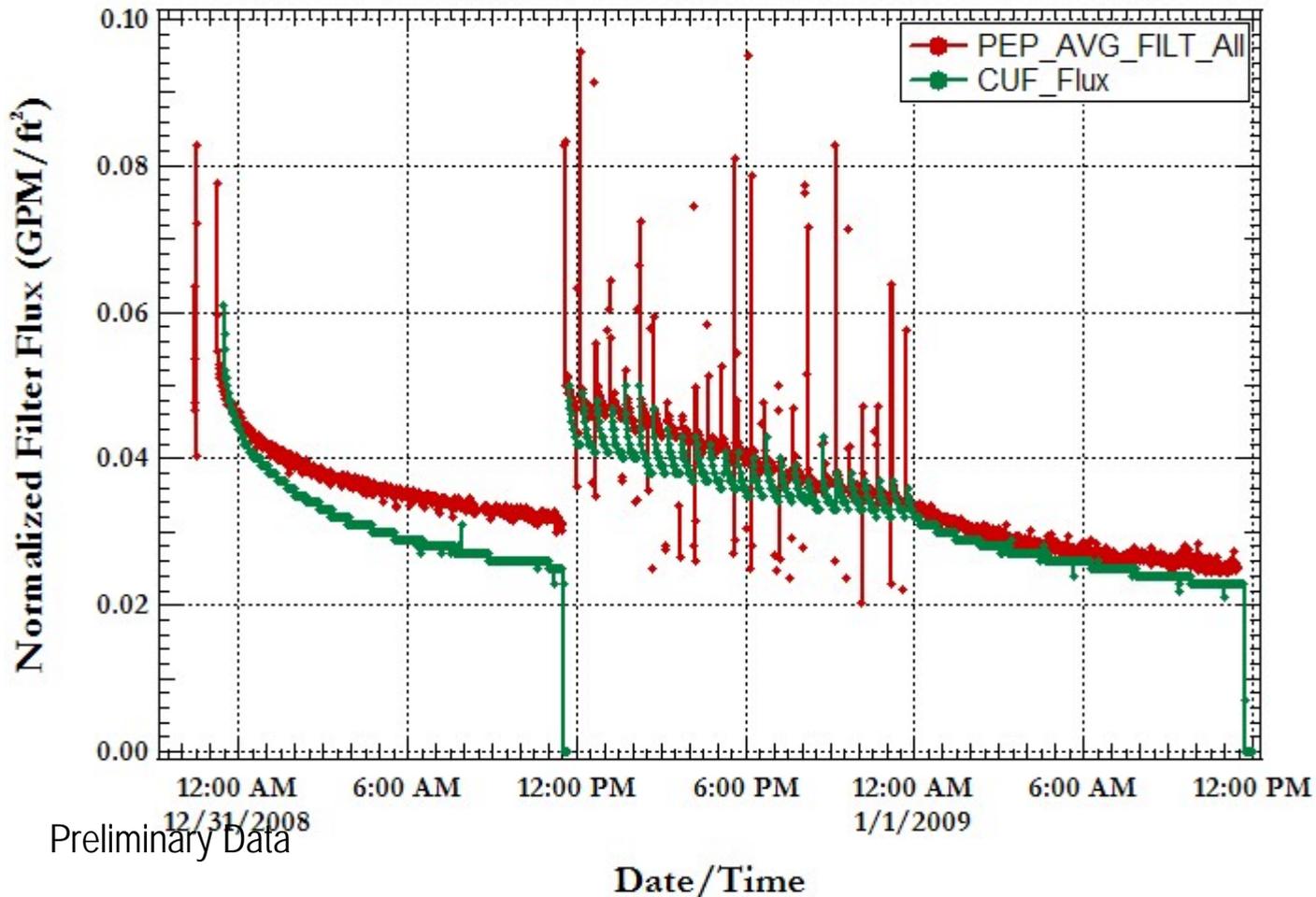
Test Description – Parallel Lab Testing

- Low- and high-solids filter flux testing
 - In cold Cell Unit Filter (CUF)
 - Run with sample collected from PEP
- Caustic leaching
 - In ~500 mL impeller-stirred reaction vessel
 - Run with sample collected from PEP
- Oxidative leaching
 - In ~500 mL impeller-stirred reaction vessel
 - Run with sample collected from PEP

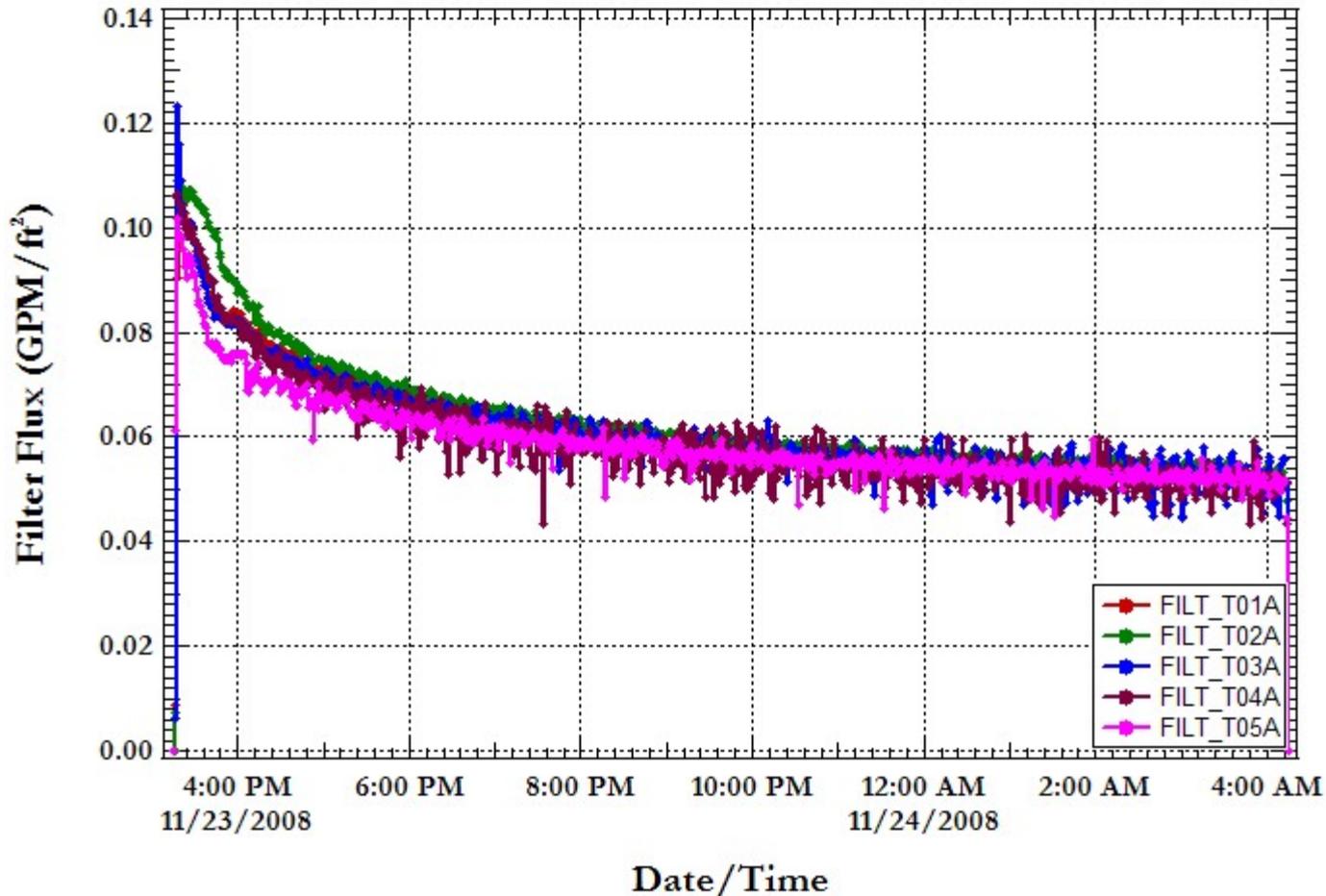
Preliminary PEP Filtration Test Results

- PEP filter performance:
 - ~5 wt% solids is equivalent or better than lab filter
 - Demonstrated solids concentration
 - All five filters performed well
 - Ten foot filters effective
 - No pressure drop issues with fifth filter
 - Control system is effective

PEP Average Flux and Lab Filter Comparison



Initial PEP Filter Flux Equivalent for All Five Filters



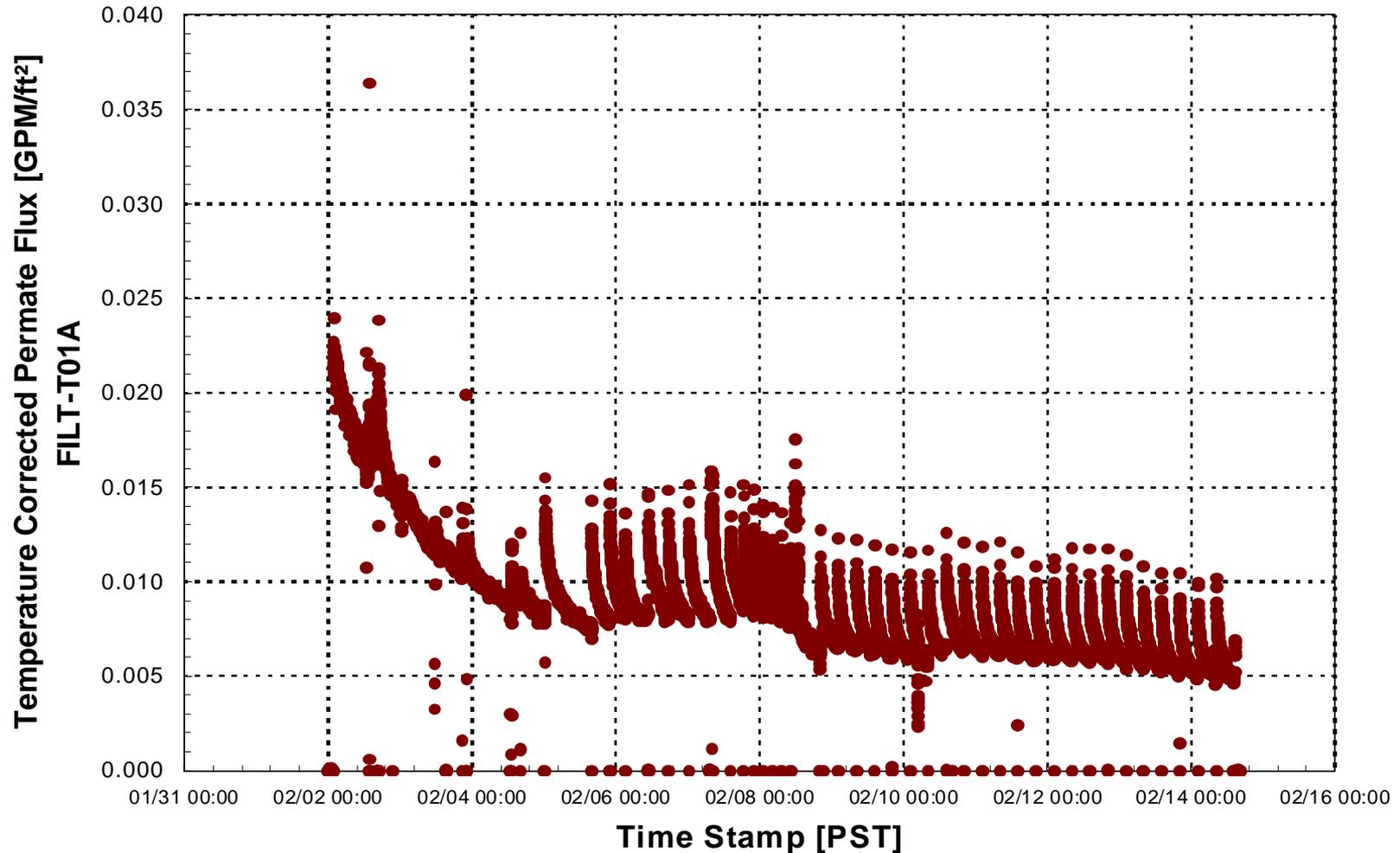
Preliminary Data

Preliminary PEP Filtration Test Results, cont.

- Filter back-pulsing:
 - Successfully cleared blocked filter
 - Maintained filter flux through Test A leached solids concentration at rates higher than the WTP process model
 - Increasing back-pulse pressure, back-flow volume, or number of back-pulses did not appear to change effectiveness

Integrated Test A Initial Dewatering- with backpulsing

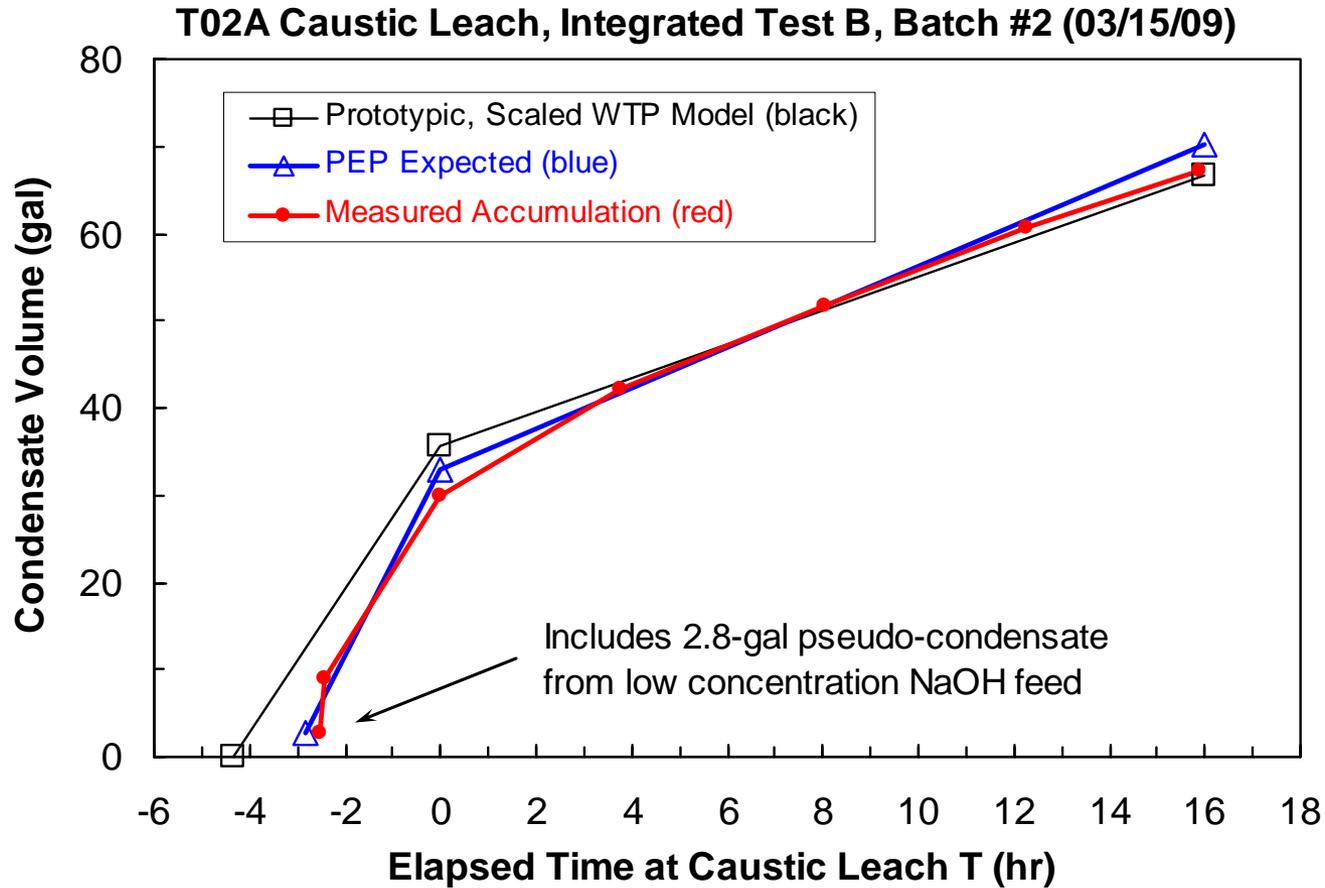
Preliminary unreviewed data



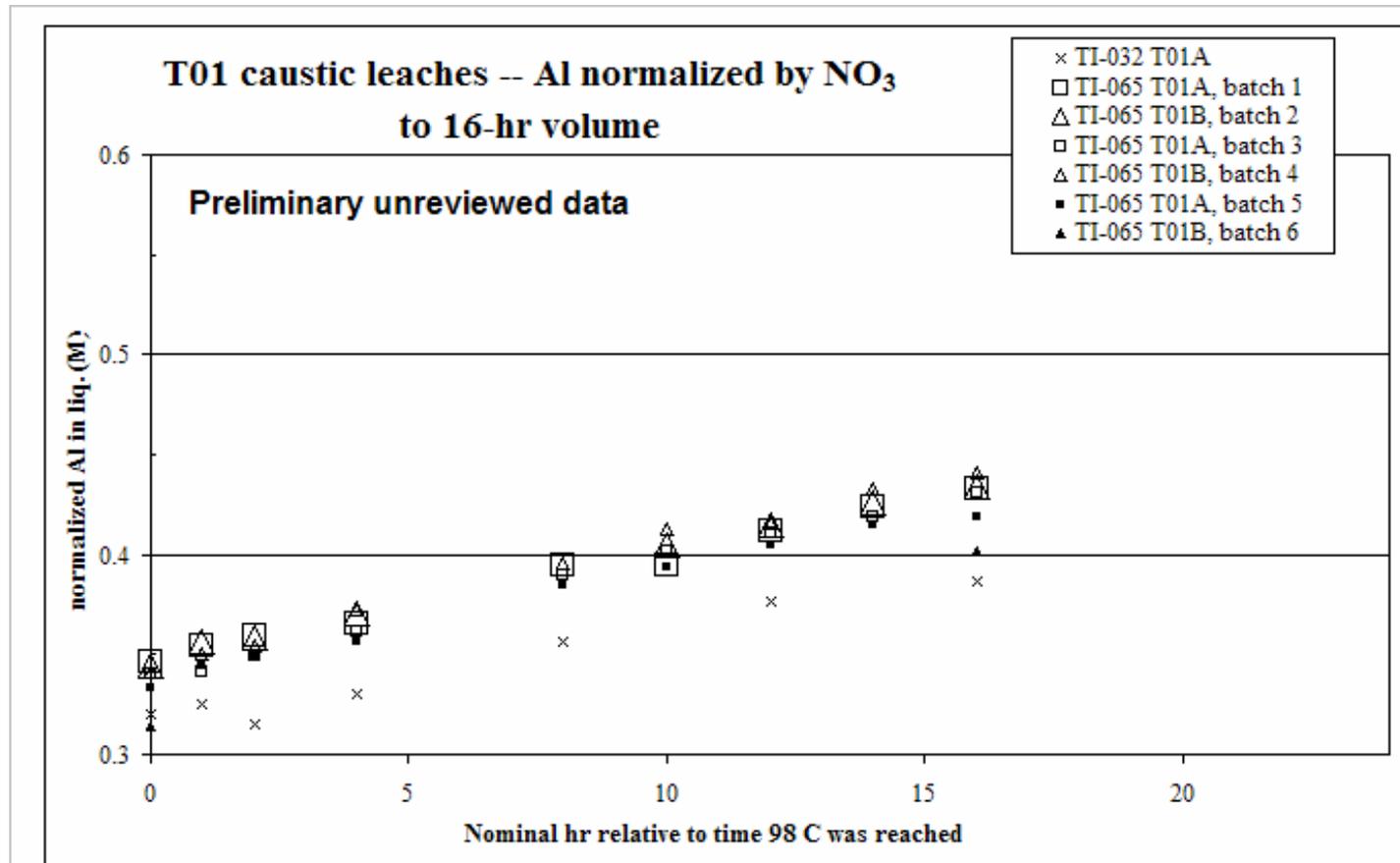
Preliminary PEP Leaching Test Results

- Leaching operations successful
 - Steam condensate estimates on target
 - Aluminum leaching is achieving targets and very repeatable
 - Chromium leaching is very rapid, as was observed during the waste studies

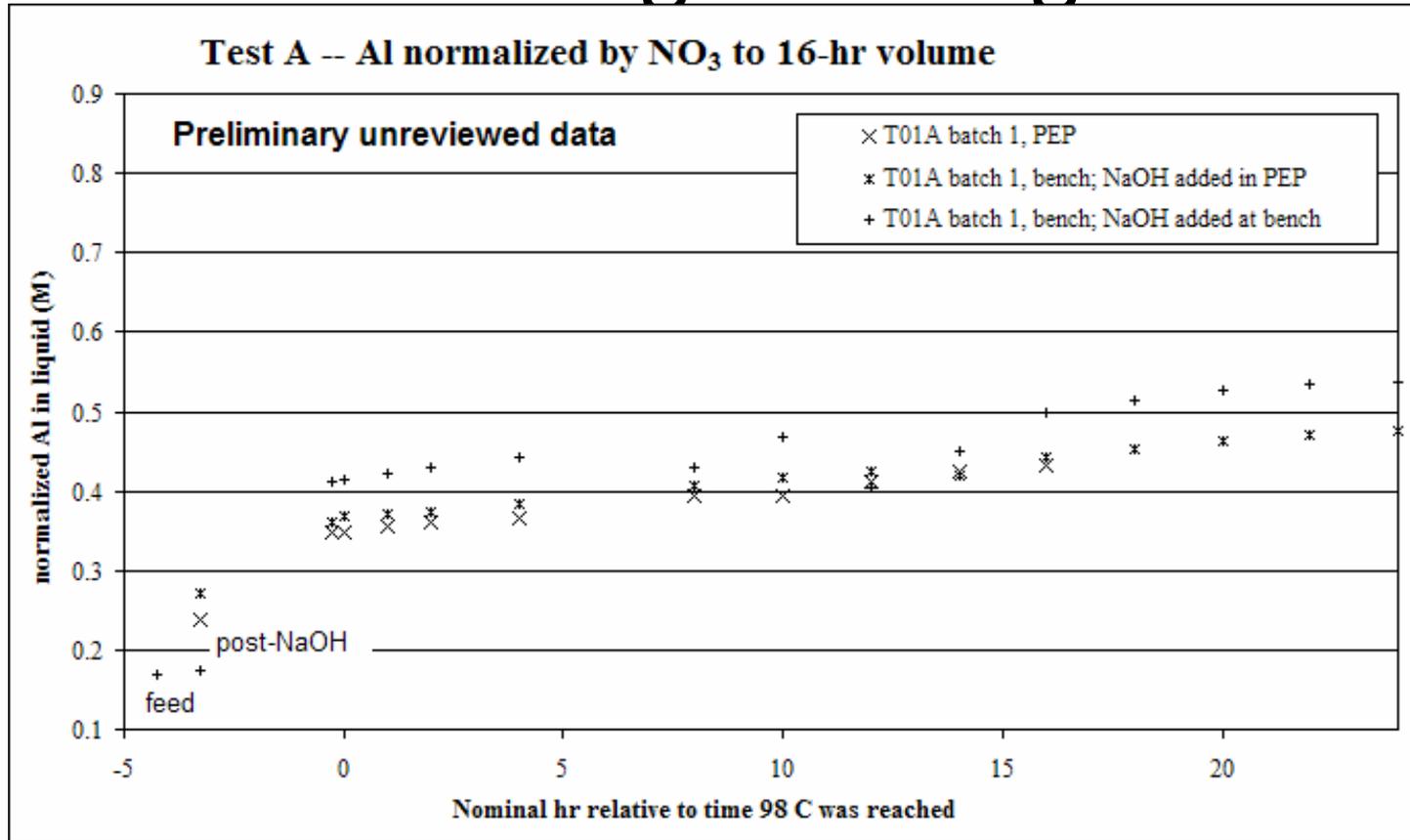
Integrated Test B Condensate Accumulation During Caustic Leaching



Excellent Reproducibility of Integrated Test A Caustic Leaching Results



Comparison of PEP to lab-scale Caustic Leaching for Integrated Test A



Preliminary unreviewed data

Preliminary PEP Test Results For Engineering

- Mechanical systems data
 - Dual, series pump operation control demonstrated
 - Spiral plate heat exchanger maintaining filter loop temperature
 - Direct steam addition effectively heated the leach vessels
 - Temperature distribution very uniform

In Conclusion ...

- Overall, the PEP data is meeting expectations and matching the laboratory predictions
- PEP filtration and leaching test results replicating lab results well
- Preliminary data shows EFRT concerns will be closed
- Initial data for Mechanical Systems has been collected and Engineering is evaluating to release procurements
- Phase 1 integrated testing completed March 31, 2009
- Filter cleaning test completed April 29, 2009
- Lessons learned being processed
- Final PEP Phase I reports December 31, 2009

Issues/Lessons with Follow-up

- Use of high velocity flush to clear filters
- Direct steam injection to heat for Al leaching
- Ultrafiltration feed vessel level measurement
- Air entrainment in leached waste simulant
- Filter cleaning
- Filter backpulse optimization
- Optimize process for feed variation over the mission (e.g. high phosphate waste)
- Others being captured in lessons learned

Pretreatment Engineering Platform

Question and Answers

Presenter:

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