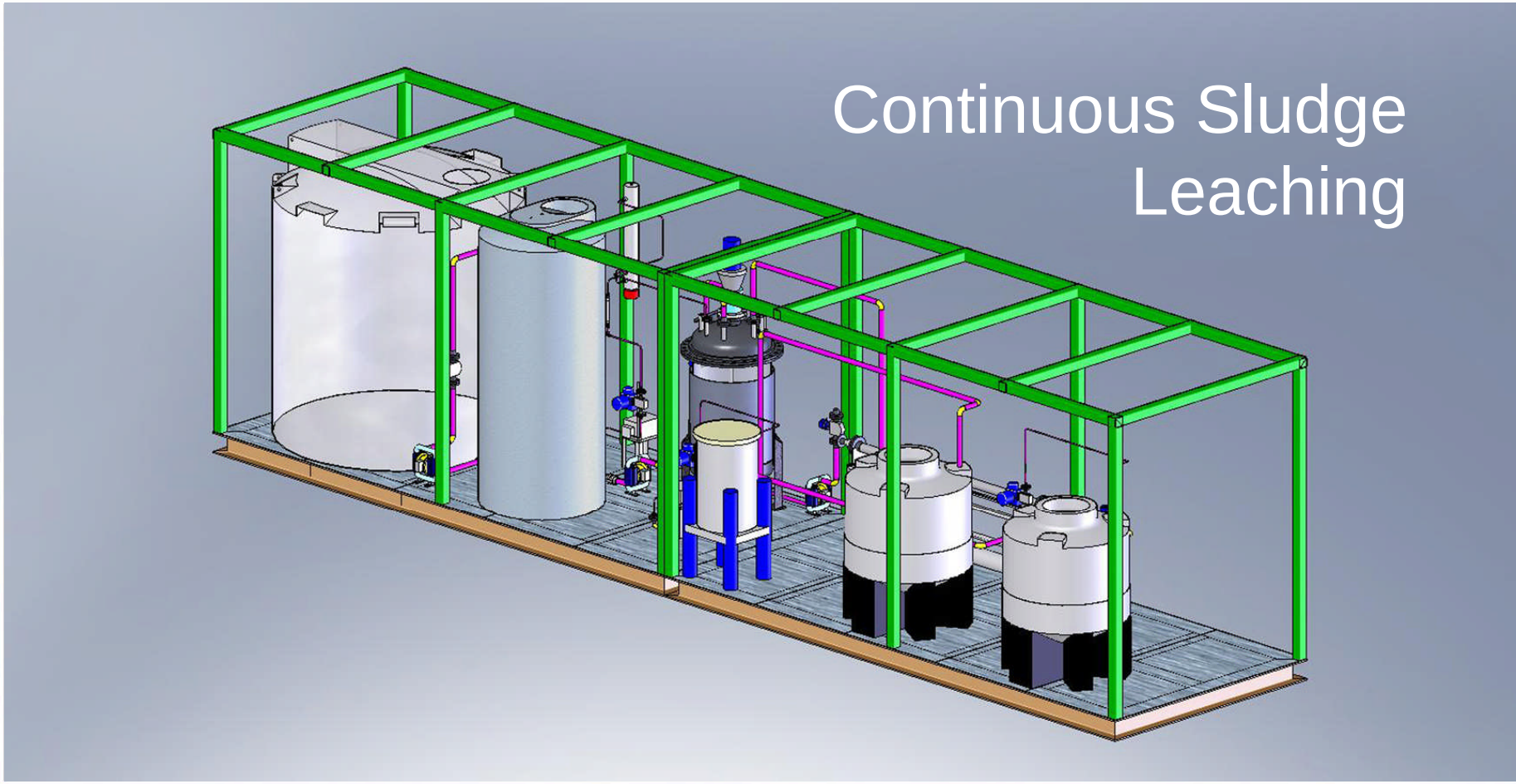
PARSONS

Parsons Infrastructure & Technology Group and

Battelle Memorial Institute

Advanced Remediation Technologies



Continuous Sludge Leaching

October 23, 2007

Agenda

- Introduction
- Phase I Activities
- Phase I Results
  - Pilot Scale Test Skid Design
- Phase II Planned Activities
- Phase II Expected Results
- Facility Interaction
- Technical Approach
- Key Personnel
- Summary and Conclusions

Key Personnel

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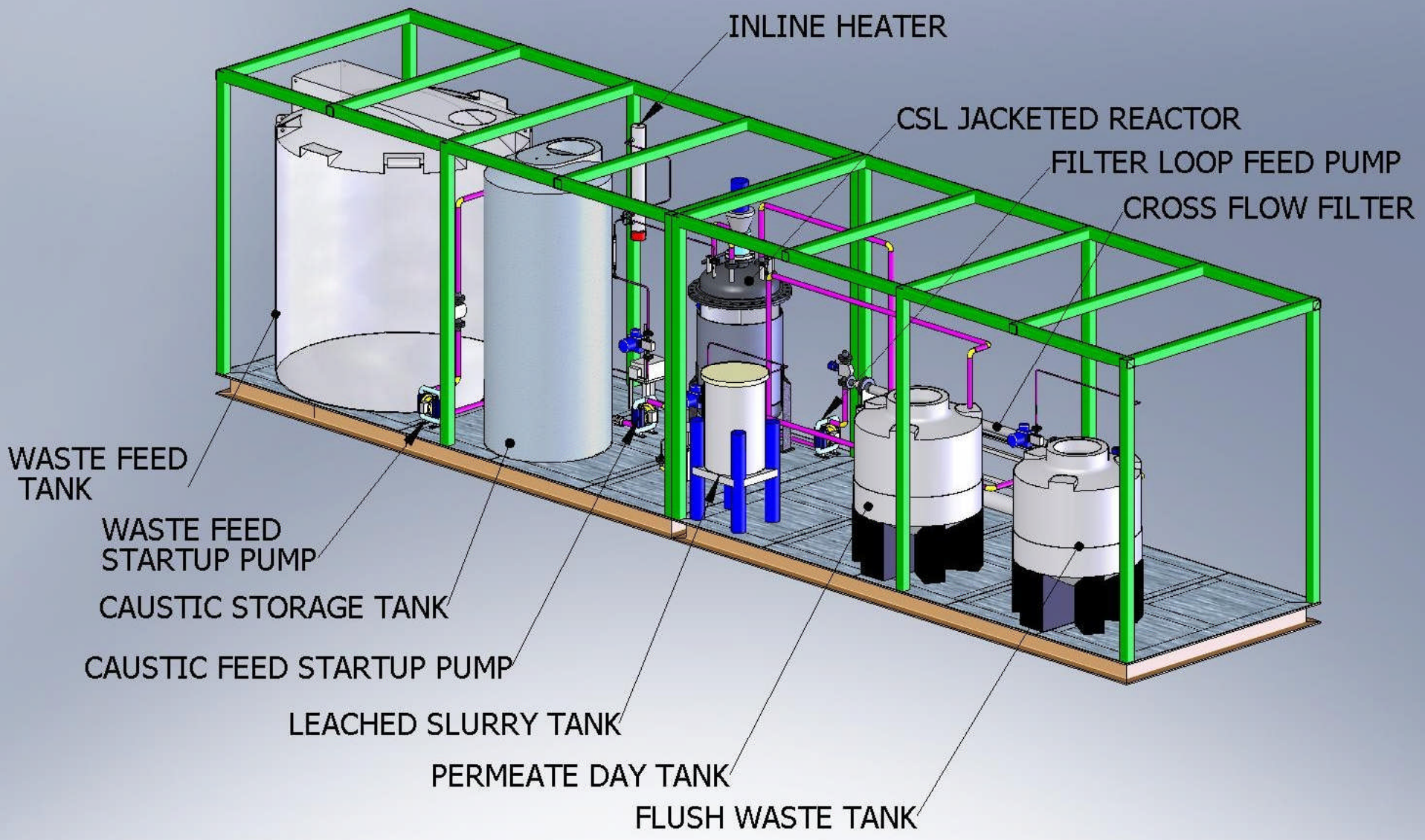
Introduction

- Deployment of the CSL process could result in about a one third to one half reduction in the quantity of HLW canisters produced at Hanford
- This reduction in canisters will result in up to $10B life cycle cost savings at Hanford (assuming $1M/canister) and allows early closure of tanks
- CSL is a highly efficient process that offers an order of magnitude improvement over originally planned facilities
- Leachate stream can be disposed as LAW with Cs removal where required using IX
- The CSL process is based on extensive actual waste testing and deployment of proven technologies

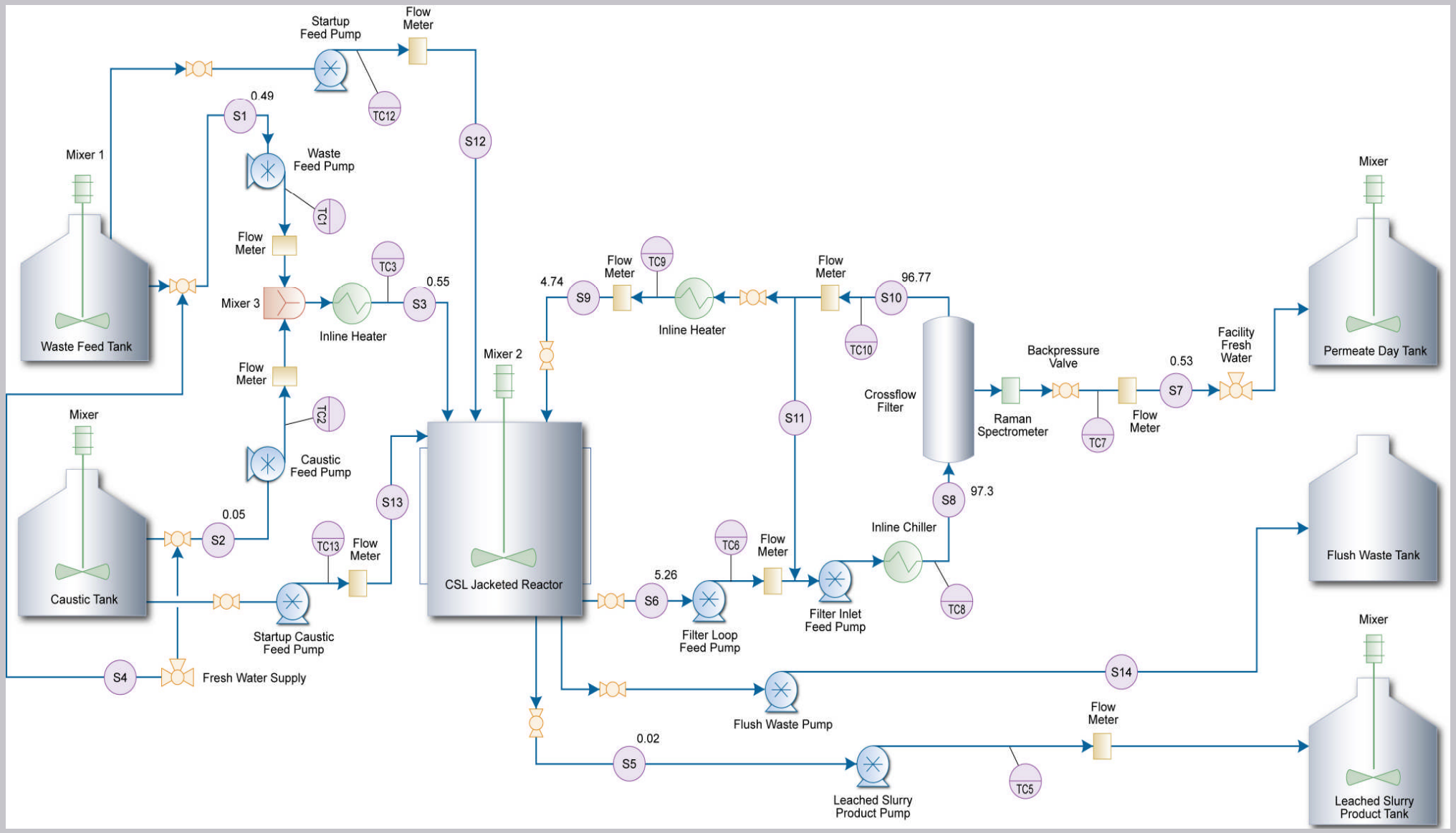
Phase I Activities

- Completed the system description for the Phase II demonstration unit
- Completed PFD, P&ID, GA and cost and schedule estimates for Phase II demonstration unit
- Completed risk review to identify testing needs for Phase II demonstration unit
- Completed topical report to summarize results of Phase I work

Pilot Scale CSL Test Skid

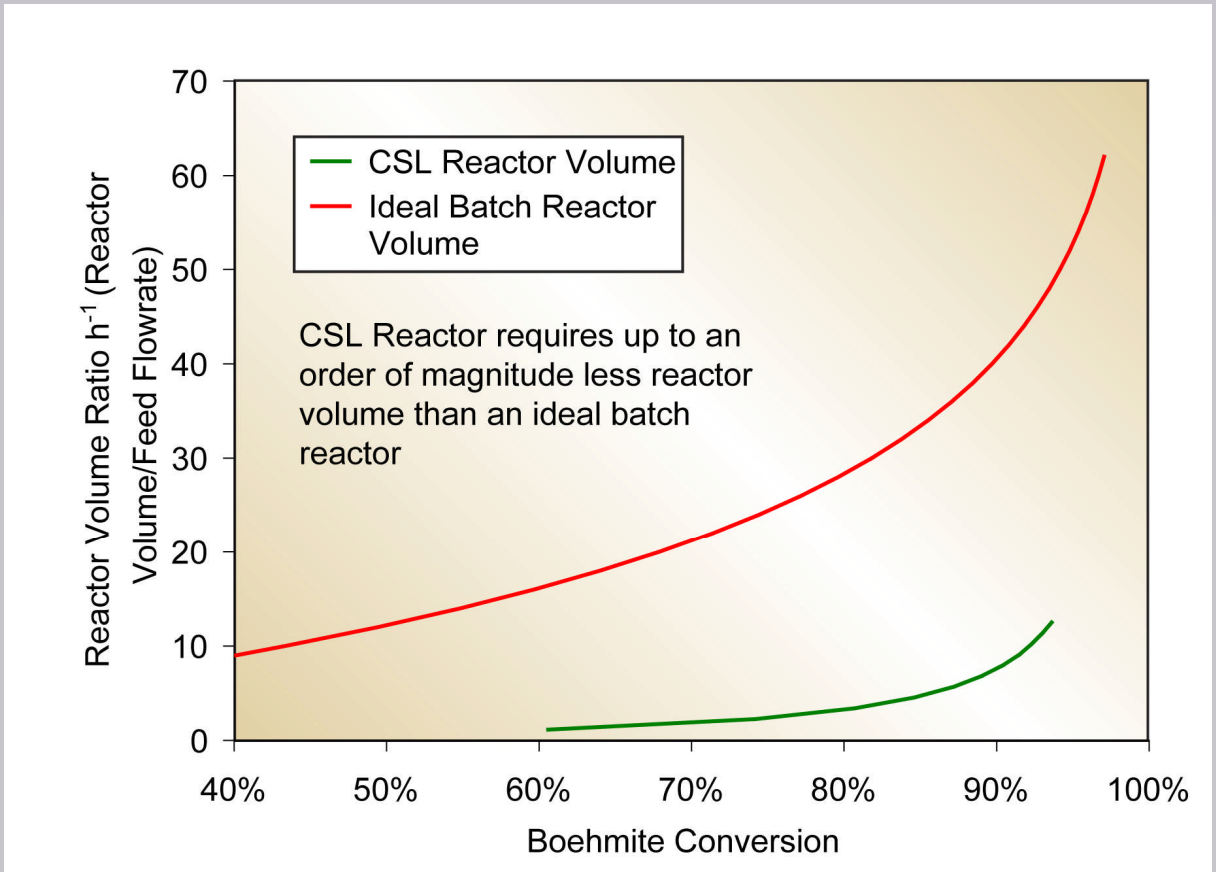


Pilot Scale CSL Test PFD



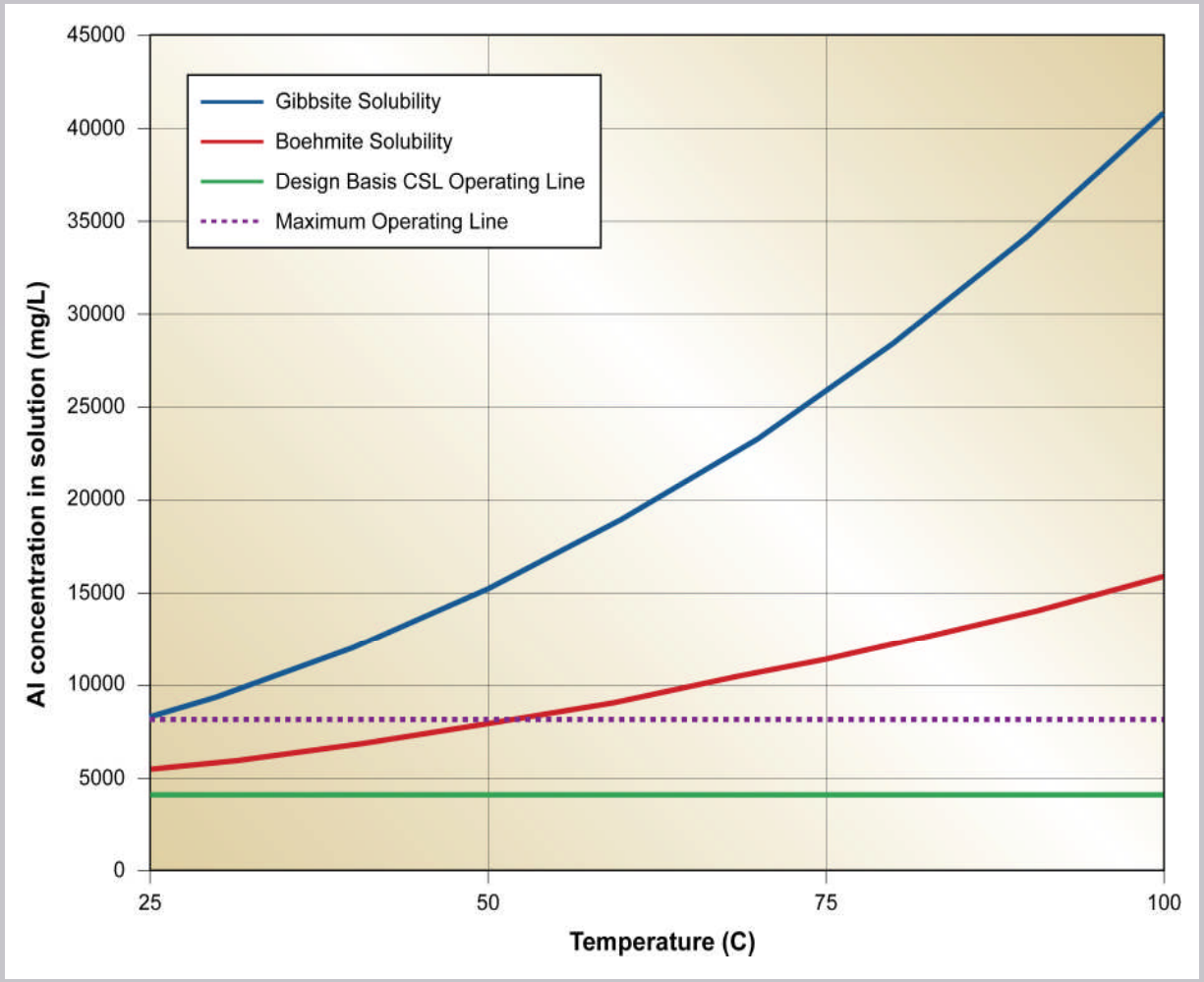
Phase I Results

- By employing reactive separations, CSL is able to achieve significantly higher boehmite dissolution than typical batch processes



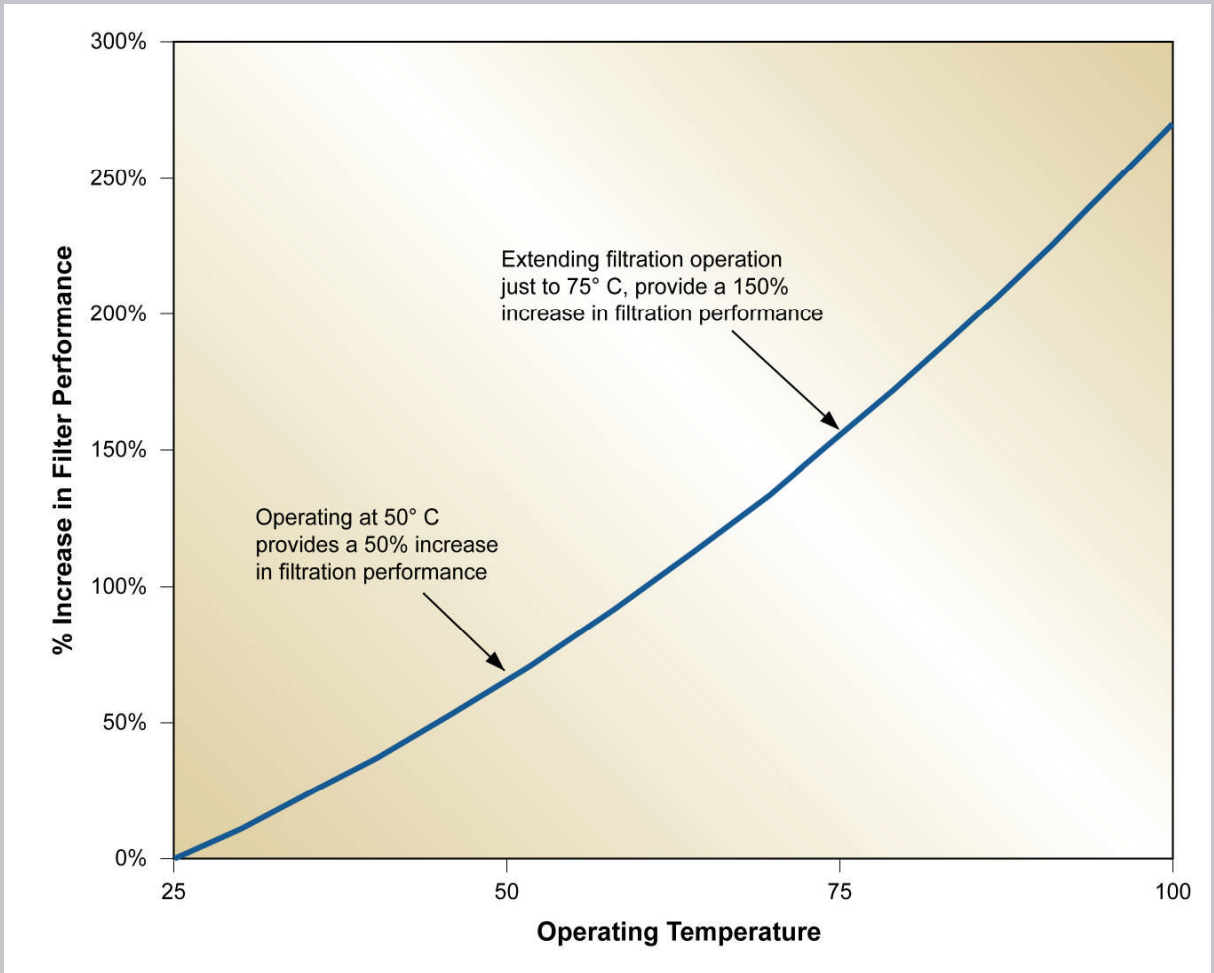
Phase I Results

- Real Time Laser Raman monitoring techniques to optimize the trade-off between reactor volume and caustic demand.



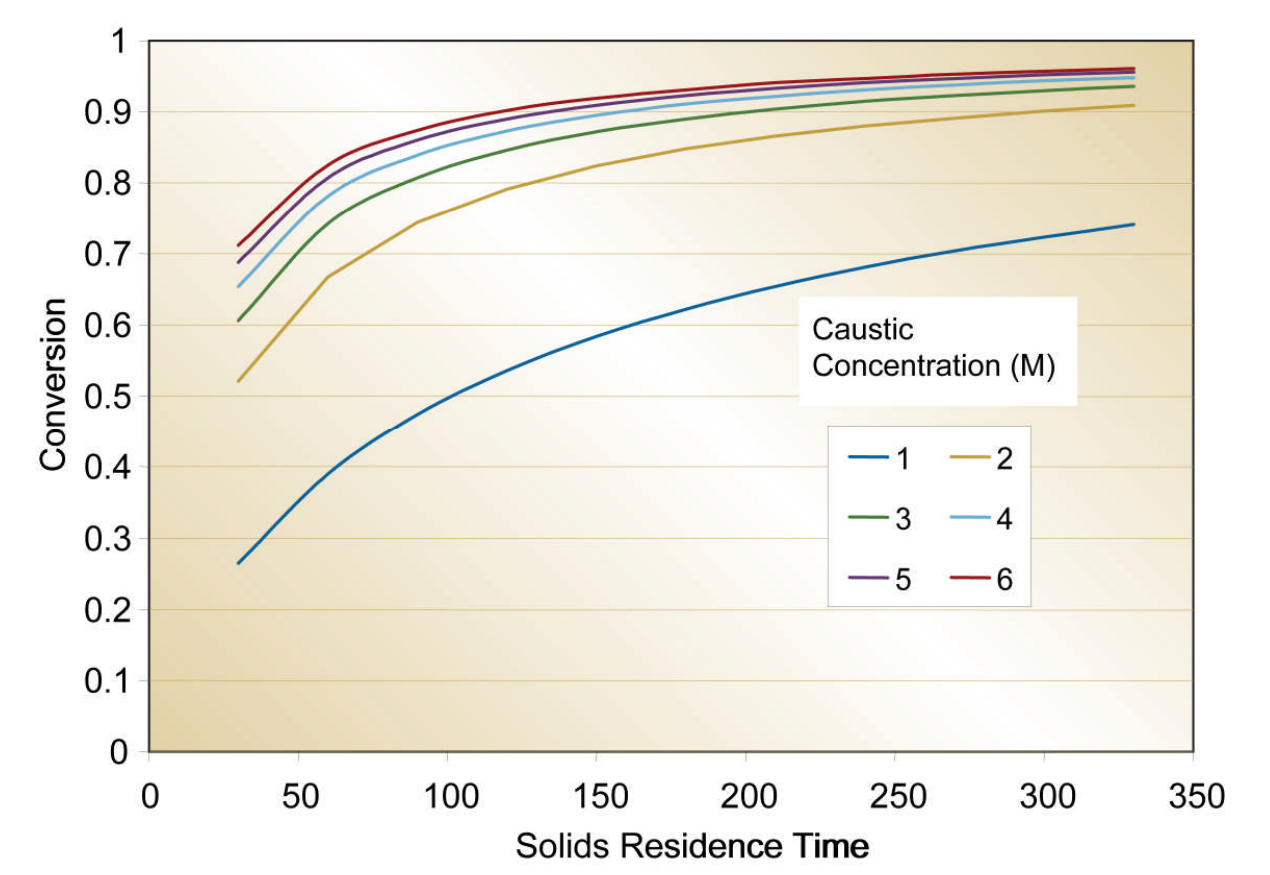
Phase I Results

- Dual pump configuration allows filtration at elevated temperatures
  - Results in 150% increase in filtration performance



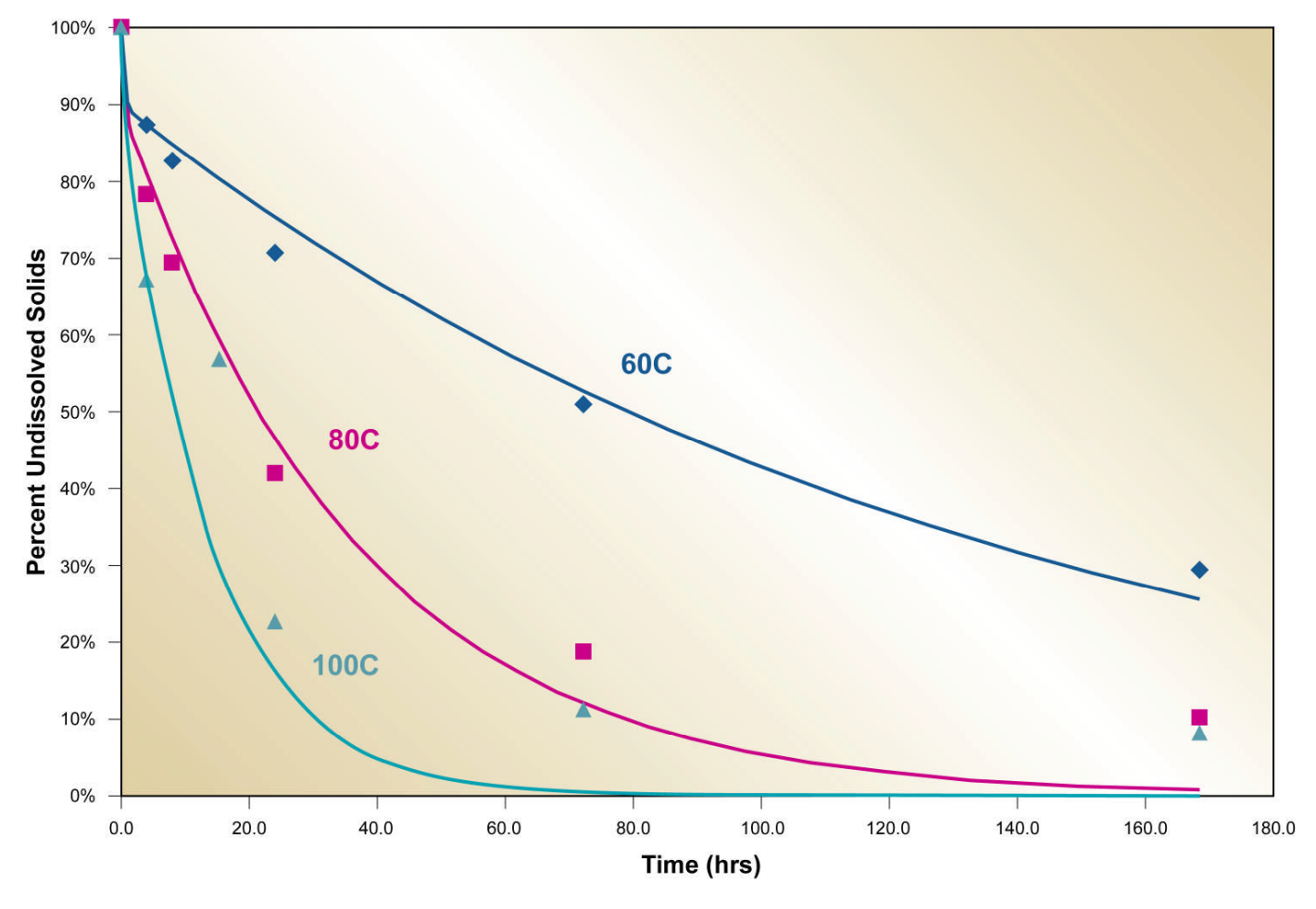
Phase I Results

- Process requires a 200-300 hr residence time for Al dissolution which can be readily achieved
- Design basis is to use 3 M NaOH (will be optimized in Phase II)



Phase I Results

- Process can remove Cr simultaneously with Al dissolution



Phase I Results

- Design basis for Phase II involves a 100 gallon reactor with a full length – 3 tube filter bundle
- Designed to produce full scale reaction residence time
- Full length tubes will give full scale filtration performance
- Results can be applied directly to full scale system

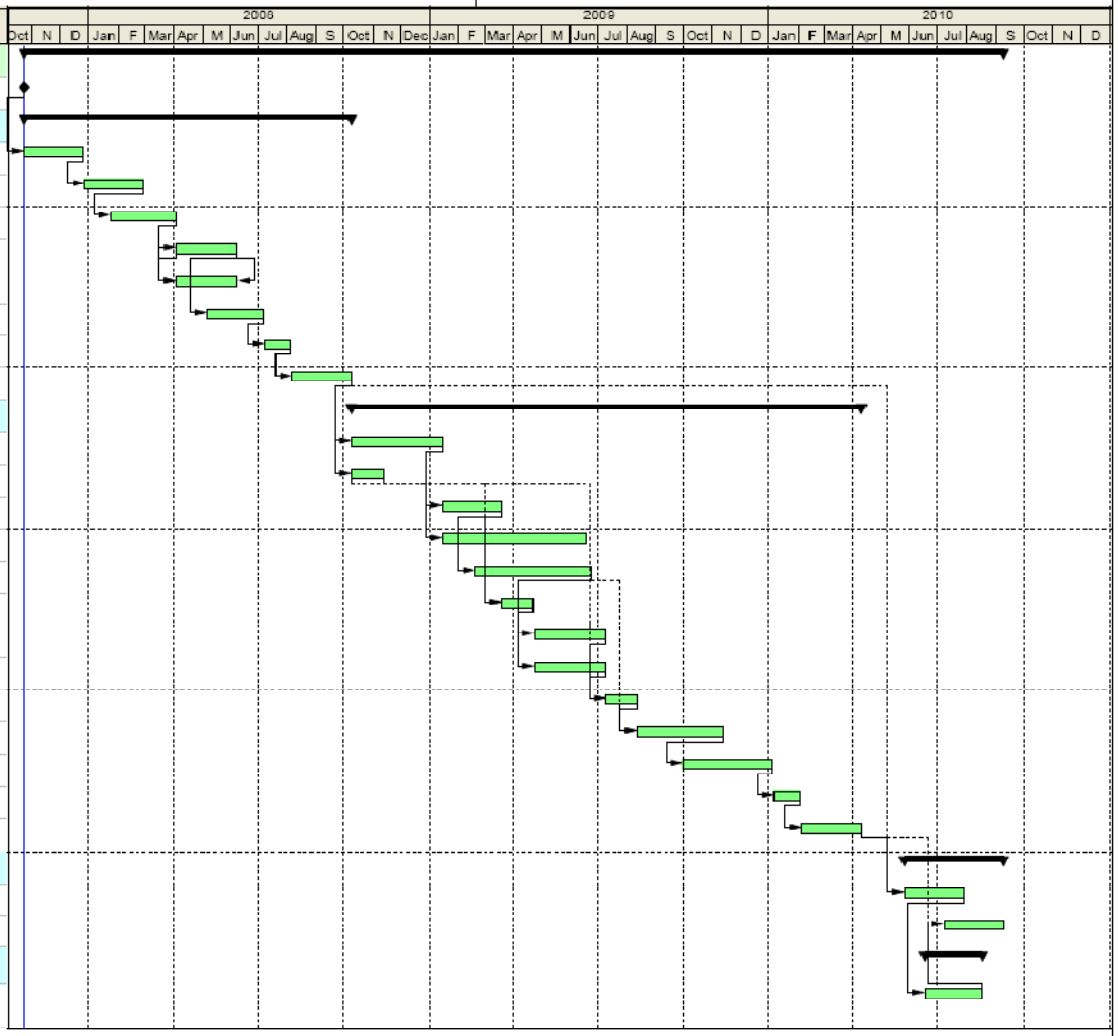
Phase II Planned Activities

- Perform bench scale studies to optimize process performance
  - Caustic residence time trade-off
  - Validate temperature impact on filtration performance
- Initiate procurement and construction of demonstration unit
- Using bench scale results, perform demonstration unit 300 hr continuous test
  - Al and Cr dissolution as a function of time
  - Temperature impact on filter flux
  - System response due to feed upsets
  - Develop and demonstrate process control strategy
- Conceptual design of Phase III deployment unit
- Cost and schedule estimate for field deployment

Phase II Planned Activities

Phase II Deployment | Classic WBS Layout | 16-Oct-07 16:57

Activity ID	Activity Name	Start	Finish
Phase II Deployment		23-Oct-07	09-Sep-10
A1040	Notice to Proceed	23-Oct-07	
Bench Scale Testing		23-Oct-07	08-Oct-08
A1000	Prepare Bench-Scale Test Plan	23-Oct-07	26-Dec-07
A1010	Procure Bench-scale Materials/Equipment	27-Dec-07	28-Feb-08
A1020	Fabricate/Assemble Bench-Scale Systems	24-Jan-08	03-Apr-08
A1050	Bench Scale Caustic Test	04-Apr-08	09-Jun-08
A1030	Bench Scale Filtration Test	04-Apr-08	09-Jun-08
A1060	Analyze Bench-Scale Sample Results	07-May-08	07-Jul-08
A1070	Evaluate Bench-Scale Test Data	08-Jul-08	05-Aug-08
A1080	Preapare Bench Scale Test Report	06-Aug-08	08-Oct-08
Pilot Demo Testing		09-Oct-08	09-Apr-10
A1100	Prepare Demo Test Plan	09-Oct-08	14-Jan-09
A1190	Revise Test Plan	09-Oct-08	12-Nov-08
A1110	Design Demo System	15-Jan-09	19-Mar-09
A1210	DOE Procure/Deliver Simulant	15-Jan-09	18-Jun-09
A1120	Procure Demo System Materials/Equipment	19-Feb-09	23-Jun-09
A1200	Revise Design	20-Mar-09	22-Apr-09
A1130	Fabricate/Assemble Demo System	23-Apr-09	09-Jul-09
A1250	Modify Demo System	23-Apr-09	09-Jul-09
A1140	Demo System Water Runs	10-Jul-09	11-Aug-09
A1150	Demo System Performance Tests	12-Aug-09	13-Nov-09
A1160	Analyze Sample Results	29-Sep-09	04-Jan-10
A1170	Evaluate Demo Test Data	05-Jan-10	04-Feb-10
A1180	Prepare Test Report	05-Feb-10	09-Apr-10
Phase III Deployment Conceptual Design & Cost & Schedule Estimate		25-May-10	09-Sep-10
A1220	Deployment System Conceptual Design	25-May-10	28-Jul-10
A1240	Prepare Phase II Project Completion Report	08-Jul-10	09-Sep-10
Phase III ROM Estimate		16-Jun-10	18-Aug-10
A1230	Prepare Phase III Deployment System Cost/Schedule ROM Estimate	16-Jun-10	18-Aug-10



Remaining Level of Effort | Actual Work
Actual Level of Effort | Remaining ...

Page 1 of 1

TASK filter: All Activities

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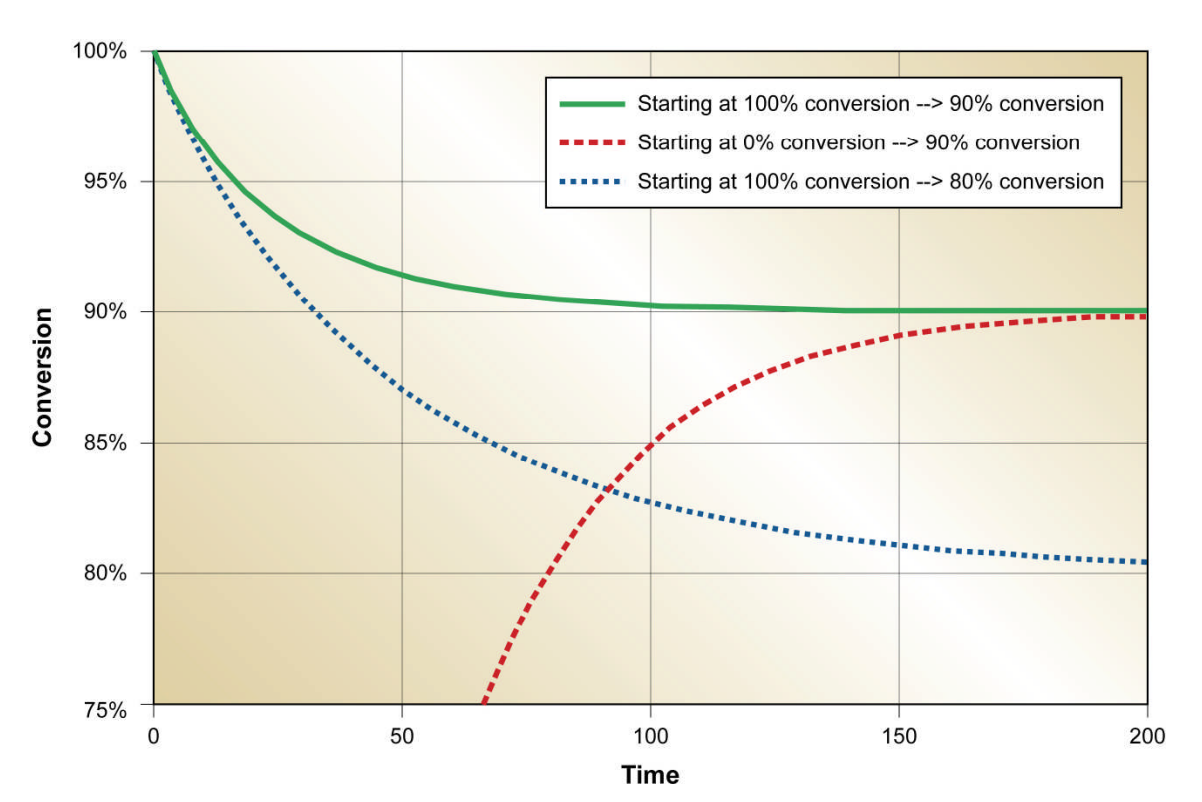
Phase II Planned Activities

Activity	***Start***
Bench-scale testing	October, 2007
Pilot Demonstration Unit Testing	October 2008
Deployment Engineering	May 2010
Deployment Cost Estimate and Schedule	June 2010

Phase II Expected Results

- Demonstration testing will evaluate the dissolution performance using boehmite simulant
  - Test will be at steady state within 200 hr



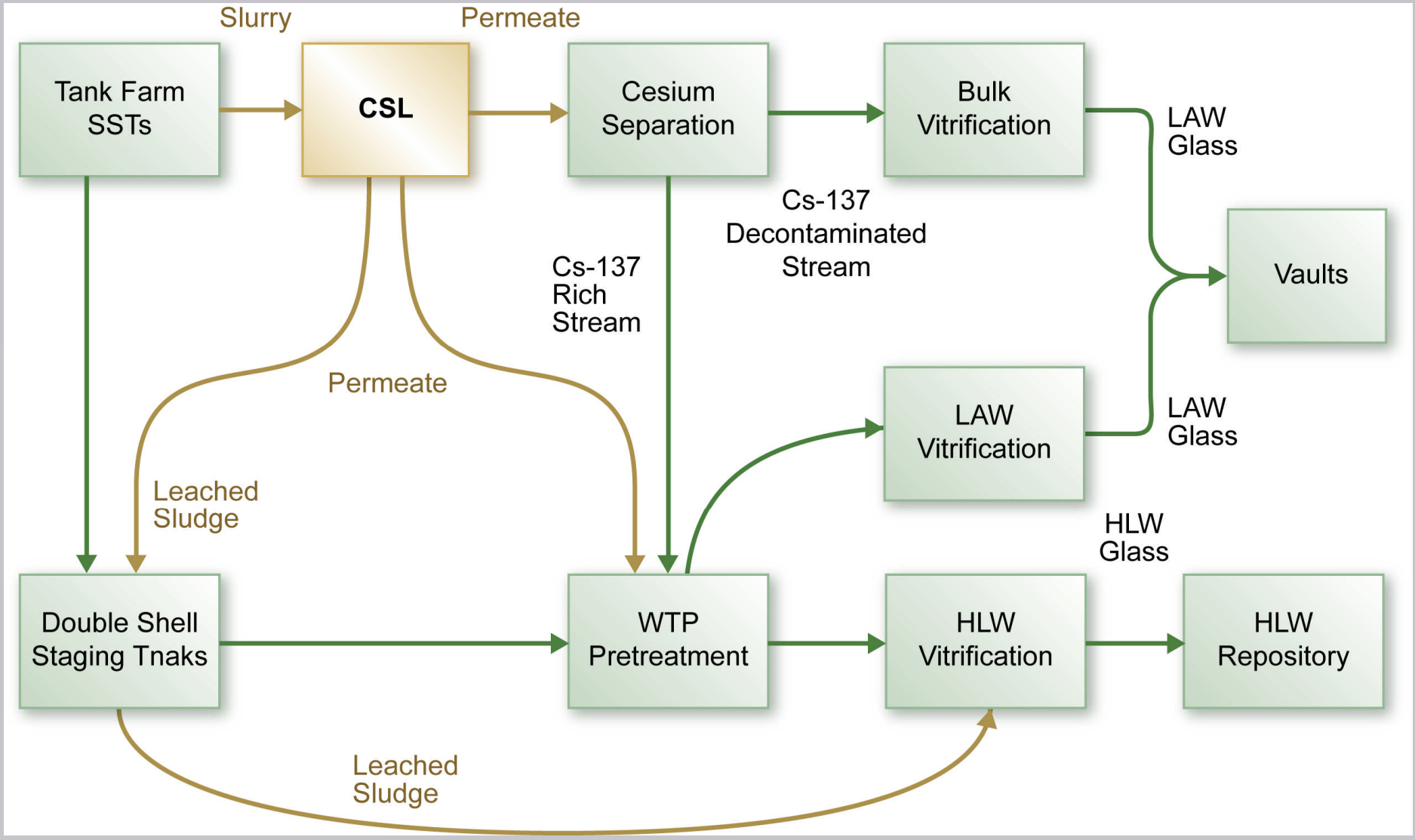
Full Field Deployment

- Current design basis is to produce 29 kg/hr of leached sludge
- CSL would target treatment of the REDOX sludges in the S and SX tank farms.
- Process produces 8.3 gpm of leachate
- Can readily add flexibility to include sludge washing with zero wash water production

Facility Interaction

- CSL will complement existing/planned facilities at Hanford by providing enhanced leaching capabilities
- The CSL concept is sufficiently mature such that upon completion of Phase II, sufficient detail will exist to support detailed design

CSL Integration With Hanford



Facility Interaction

- The CSL process does not introduce any new hazards to the site
  - Uses existing chemicals
  - Reduces quantity of material at risk relative to process baseline
  - Small size (10 ft diameter reactor) reduces potential doses to onsite workers
- The CSL process can be integrated into the existing waste retrieval/treatment plans at Hanford

Hazard Mitigation

Hazard Mitigation Table

Hazard	Unique CSL Hazard	Mitigation	Prior use of mitigation strategy
Radiological	Pumps, valves, agitators and filters may require replacement.	• Remote maintenance equipment • Process equipment installed inside shielded containment enclosure	Waste Transfer Enclosure designed and fabricated by Parsons for C-103/105 retrieval
Deflagration	Radiolytic production of gas will occur in the CSL process.	• Active mixing with an agitator system to ensure hydrogen gas release • Ability to provide nitrogen pad to vessel overhead in the event of extended loss of power	Used in WTP
Criticality – Liquid Phase	A small quantity of U and Pu may dissolve during leaching.	• The soluble U and Pu concentration in the CSL effluents are bounded by those found in current process streams	Rely upon current criticality analyses for liquid effluents.
Criticality – Solid Phase	Due to removal of Al from the solid phase, the concentrations of fissile nuclides would increase	• Establish waste feed minimum poison-to-fissile ratios	Standard practice at Hanford tank farms and vitrification facilities.

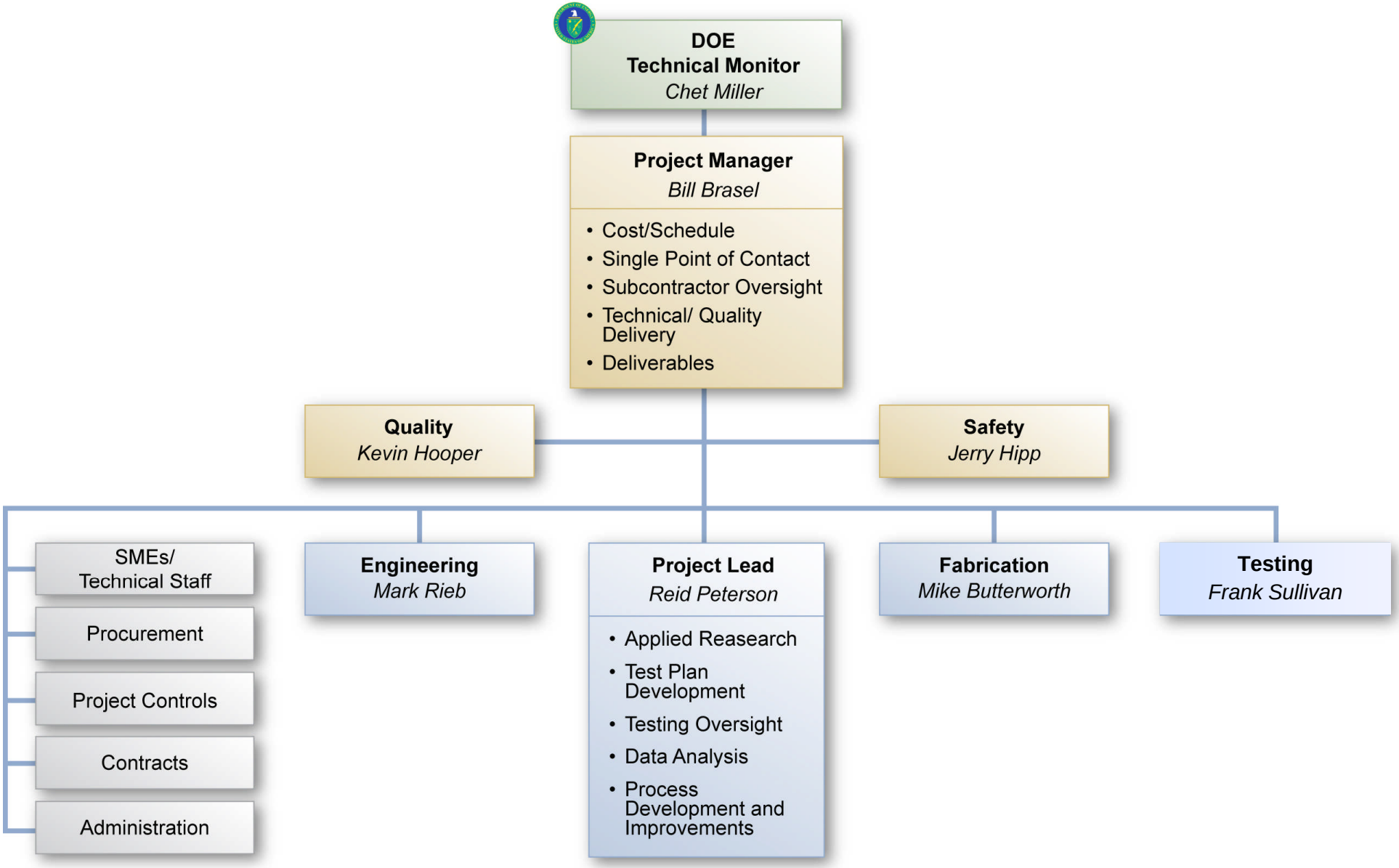
Benefits of CSL

- The CSL process allows the extended sludge residence time required to achieve boehmite dissolution – thus enabling dramatic reduction in HLW canister production
- The CSL process is based on extensive prior testing and proven technology
- The CSL process represents an order of magnitude improvement of originally planned batch processes

Team Experience

- The Parsons Team has extensive experience in working in the SRS/Hanford Tank Farms and working with the Management and Operating Contractors
- Parsons experience with SWPF and Chem Demil has demonstrated our ability to deploy technology for treatment of highly hazardous waste
- Battelle has extensive experience in planning and managing bench and pilot scale demonstration for HLW treatment technologies

Organization



Summary and Conclusions

- The CSL process could result in about a one third to one half reduction in the quantity of HLW canisters produced at Hanford
- The CSL process is based on extensive experimental data and the deployment of proven technologies

Backup Slides

Pilot Scale CSL Test Mass Transfer

Stream ID	Units	S1	S2	S3	S5	S6	S7	S8	S9	S10	S11
Description		**Tank Waste Feed**	**NaOH Feed**	**Feed to CSL Vessel**	**Leached Slurry Product**	**Filter Loop Feed**	**Permeate**	**Filter Inlet**	**Reactor Return**	**Filter Outlet**	**Recirc.**
Temperature	C	25	25	100	100	100	60	60	100	60	60
Flow Rate	L/min	0.49	0.06	0.55	0.02	5.26	0.53	97.30	4.74	96.77	92.04
Total Mass	kg/min	0.591	0.093	0.684	0.028	6.97	0.656	129.57	6.310	128.92	122.61
Total Solids Mass	kg/min	7.98E-03	0.00E+00	7.98E-03	2.78E-03	6.97E-01	0.00E+00	14.23	0.70	14.23	13.54
Boehmite Solids Mass	KG/min (undissolved Al)	5.58E-03	0.00E+00	5.58E-03	3.90E-04	9.78E-02	0.00E+00	2.00	0.10	2.00	1.90
Inert Solids Mass	kg/min (inert solids)	2.39E-03	0.00E+00	2.39E-03	2.39E-03	5.99E-01	0.00E+00	12.23	0.60	12.23	11.63
Total Liquid Mass	kg/min	5.83E-01	9.29E-02	6.76E-01	2.51E-02	6.27E+00	6.56E-01	115.34	5.61	114.69	109.07