Contract No:

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Disclaimer:

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Tank 51 Sludge Batch 10 Low Temperature Aluminum Dissolution (LTAD)

Savannah River Remediation
AECOM | BECHTEL | CH2M | BWXT

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Overview

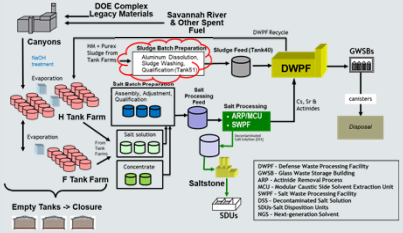
Background:

High Level Waste:

- Stored in 5,000,000 liter underground tanks in the form of insoluble sludge solids and soluble salts

Sludge Waste:

- Metal oxides and hydroxides from uranium and plutonium chemical separations
- Activity ~ 115 MCi (46% of total waste activity)
- Makes up over 11 million liters (8% of total waste inventory)
- Aluminum is > 12% of sludge



Waste Vitrification:

- Salt and sludge waste blended with frit to form borosilicate glass poured into canisters
- Each can contains between 620-750 kg sludge solids as oxides
- >4,000 canisters produced to date (sludge waste + ARP/MCU Low Activity Salt Waste)

Thick and Thin – Best to Blend when Possible

H-Area Sludge
(Includes THOREX material)

HM Sludge
- Thick – Harder to Pump
- High Aluminum / Low Iron
- Contains Mercury
- Slow Settling Solids
- Aluminum Removal Candidate

versus

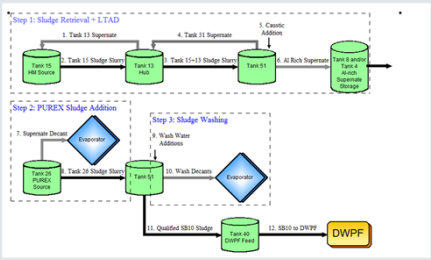
PUREX Sludge
- Thinner – Easier to Pump
- Low Aluminum / High Iron
- Little Mercury
- Fast Settling Solids

PUREX Sludge (F Area)

Sludge Batch Feed Preparation and Qualification

- **Waste removal operations performed to assemble sludge in Tank 51**
- **Low Temperature Aluminum Dissolution (LTAD)**
  - Performed on discrete sludge batch component with high Al concentration prior to final batch assembly and sludge washing evolution
  - Typically conducted in Tank 51
  - System Plan specified aluminum dissolution for Sludge Batch 10; LTAD was previously performed for Sludge Batch 5 and Sludge Batch 6
- **Sludge Washing**
  - Reduces soluble sodium salts in waste feed
  - Consists of repetitive dilution with water, gravity settling, and decanting
  - Gravity settling periods major contributor to schedule
  - Washing schedule requires maintaining enough tank space to support evaporator operations to receive and evaporate decants from sludge washing in a timely manner
- **Sludge Batch Qualification**
  - Ensure acceptability for DWPF
  - Performed in parallel with sludge washing evolution
- **After Sludge batch is assembled, washed, and qualified in Tank 51 it is transferred to Tank 40 for feed to DWPF**

Sludge Batch 10 Preparation Sequence



Sludge Batch Preparation – Recent Challenges

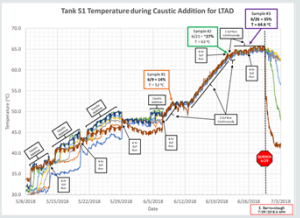
- Hydrogen produced by radiolysis builds up in the sludge matrix and must be released by periodic agitation of the sludge
- Slurried sludge retains a higher percentage of hydrogen than settled sludge, so slurried sludge requires more frequent agitation to meet nuclear safety requirements
- Quiescent time (Q-time) is the calculated amount of time that can elapse before sludge has to be agitated/mixed to release the hydrogen that is retained in the sludge over time
- Q-time program did not apply to source tanks for previous sludge batches since the entire tank sludge volume was not considered slurried
- Safety Basis changes now require application of Q-time program to tanks that contain any volume of slurried sludge – applies to source tanks as well as receipt tanks
- Sludge Batch 10 is the first sludge batch being prepared with these new Q-time requirements

Sludge Batch 10 LTAD Objectives

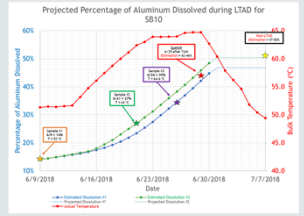
- Improve settling behavior to accomplish sludge washing
- Improve rheology for waste transfer and Chemical Process Cell (CPC) processing
- Improve projected canister waste loadings
- Effectively reduce the sludge mass from Sludge Batch 10, thereby reducing the amount of HLW canisters produced

Sludge Batch 10 Al Dissolution Operating Conditions

- Performed dissolution in Tank 51 for Sludge Batch 10
- Approximately 160 kgal of 50 wt.% caustic was added intermittently
- The target temperature for LTAD was 55-65 °C



Summary/Conclusions



Activity		Planned	Executed
Caustic Addition	Time	3 – 4 weeks	4 weeks
	Volume	160 kgal	164 kgal
Temperature Range		55 °C – 65 °C	55 °C – 65 °C
Bearing Water Addition from SLPs		60 kgal (conservative)	20 kgal
Dissolution Time		3 – 4 weeks	~3 weeks
Dissolution Projections	Sample #1	15 – 20%	14%
	Sample #2	25 – 30%	27%
	Sample #3	35 – 45%	35%
	Estimated Final	40%	47 - 50%[1]
Total Time		7 – 8 weeks	7 weeks

[1]Although the percentage of aluminum dissolved is higher than the goal of 40%, the total aluminum removed from the system is expected to be closer to 40%.