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Tank 12 Bulk Oxalic Acid Cleaning Flowsheet Strategy





SCDHEC Briefing
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Overview

- Tank closure sequence
- Tank 12 waste removal summary to date
- Bulk Oxalic Acid Chemical Cleaning (BOAC) flowsheet overview
- Chemical cleaning experience
- Implementation of Tank 12 chemical cleaning flowsheet

Closure Sequence

Bulk Waste Removal

Mechanical Heel Removal

Current Stage

Chemical Cleaning

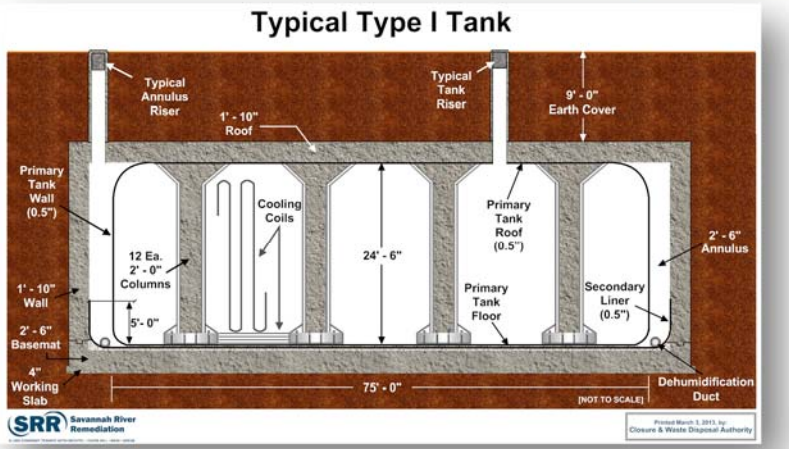
Low Temperature Aluminum Dissolution Complete

Cooling Coil Flushing

Annulus Cleaning

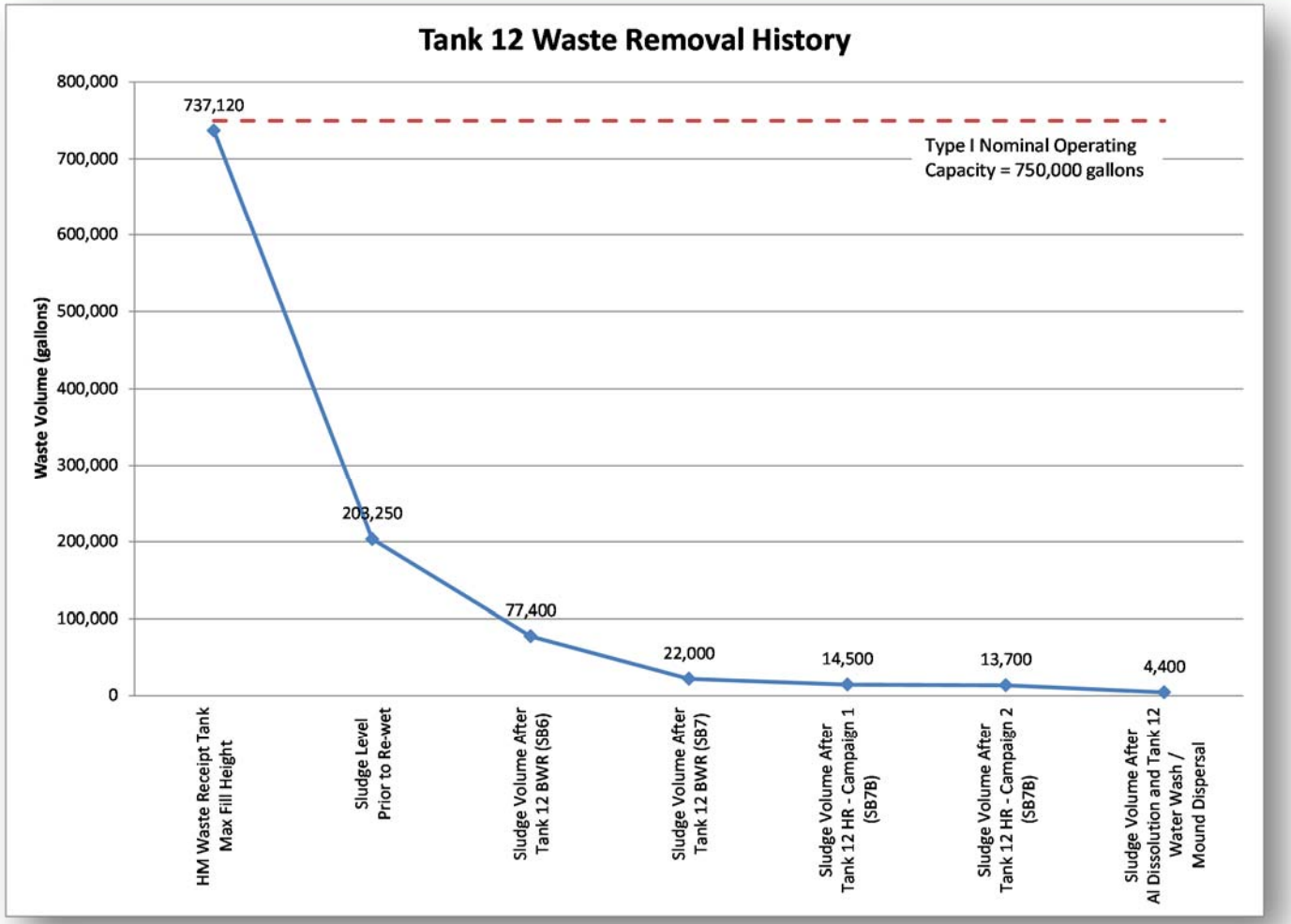
Final Sampling

Grout Tank



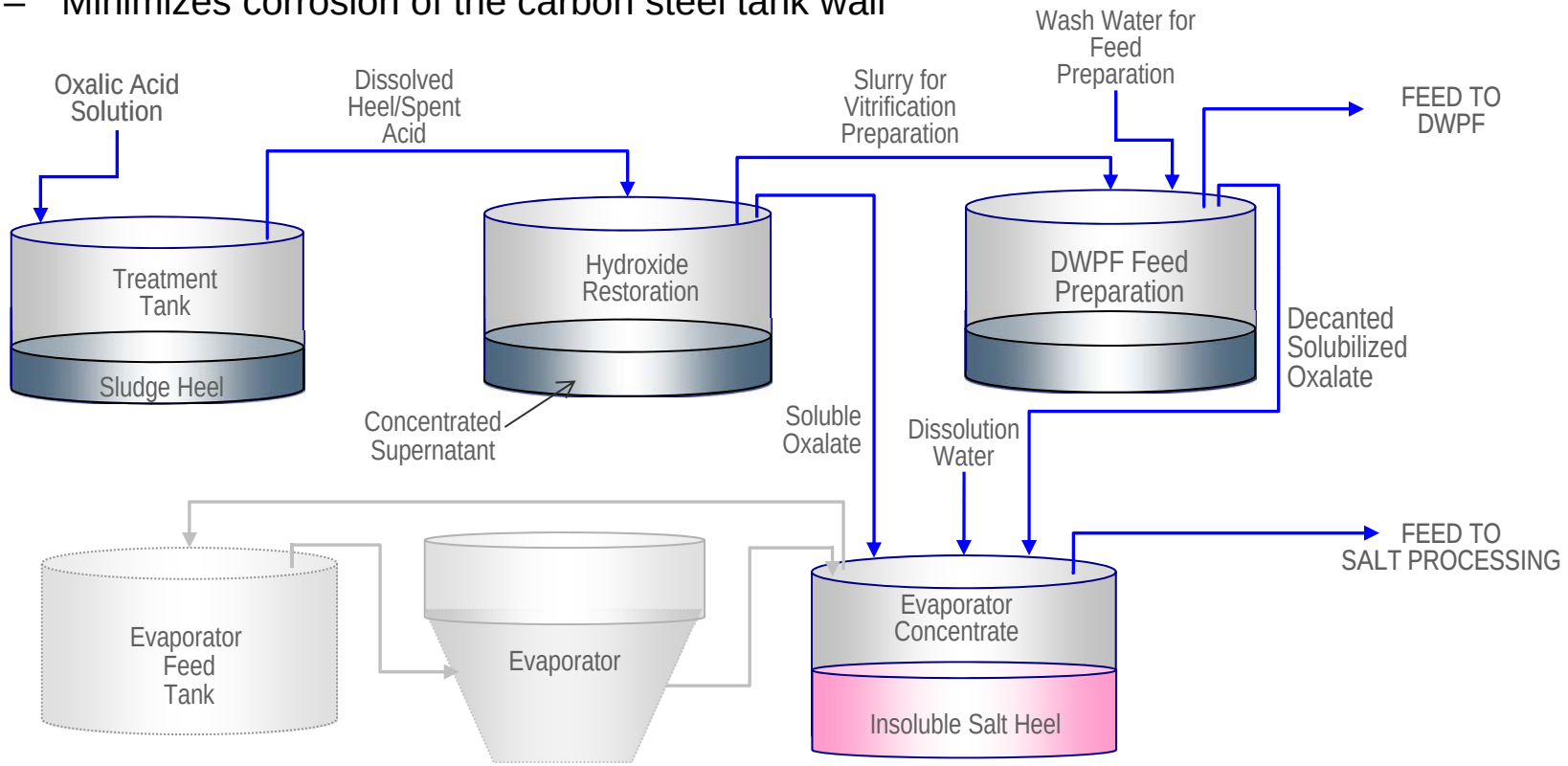
4 Tanks Closed

Tank 12 Waste Removal History



Bulk Oxalic Acid Chemical Cleaning

- Chemical cleaning intended to remove residual sludge following bulk waste removal and mechanical cleaning, when necessary
- Use oxalic acid to clean waste tanks and nominally remove residuals
  - Used multiple times since 1980's
  - Minimizes corrosion of the carbon steel tank wall



Tank 12 Flowsheet Development

- Developed based upon experience with chemical cleaning and detailed experimental program
  - Optimize sludge removal, minimize safety hazards, and minimize corrosion
- Experience from chemical cleaning of Tanks 5 & 6
  - Maximize contact of residuals with oxalic acid
    - Sludge depth and chemical constituents
    - Insoluble particulate mobilization
  - Provide adequate mixing
  - Control pH to prevent oxalate production
  - Pre-wash treatment tank to target sodium oxalate solubility

Tank 12 Flowsheet

BOA Baseline		Tank 12	
Attribute	Basis	Attribute	Implementation/Status
Pre-wash sludge heel	Pre-wash to a target based on solubility of sodium oxalate, i.e. [Na^+] = 0.5 M	Pre-wash heel to [Na^+] = 0.5 M	Complete
4 SLP's or 3 SMP's at maximum speed	Number of slurry pumps that supports coverage of the entire tank bottom to: • Maximize OA-sludge contact • Mobilize insoluble particles • Allow focused indexing on mounds	4 SLP's at maximum speed	4 slurry pumps running in indexing mode at maximum speed when tank levels allow
Disperse mounds during pre-wash	Distribution of the mounds maximizes OA-sludge contact	Disperse mounds during pre-wash	Significant mound reduction during low temperature aluminum dissolution (LTAD) Strike 2 to include focused indexing and longer pump runs focused on expected mounds
Planning basis of 3 OA strikes and OA spray wash	• Tank 16, 5, & 6 chemical cleaning experience • OA spray wash dissolves sludge material on the vertical surfaces of the tank, not submerged during the strikes	3 strikes	• 3 OA strikes
Maximum Volume ratio of 20:1 OA to Sludge	• Limits based on envelope of experimentation • Fill height determined by starting solids concentration • Tank level limitations may restrict volume of acid potentially affecting efficiency	Maximum Volume ratio of 20:1 OA to Sludge	• Tank level will restrict first strike to nominally 15:1 ratio of OA/sludge • Second and third strike will be at 20:1 ratios.

Tank 12 Flowsheet

BOA Baseline		Tank 12	
Attribute	Basis	Attribute	Implementation/Status
Maximum OA concentration of 8 wt% OA	• Limits based on envelope of experimentation • 2-4 wt% OA based on solubility limit of oxalate	8 wt% diluted to 4 wt%	To support mixing in the 2nd and 3rd strikes, the OA will be diluted to <4 wt%
• Processing temperature 75°C maximum • Normal operations ≤60°C	Experience indicates higher temperature results in more effective dissolution Maintain temperature within envelope of experimentation: • All PUREX testing has been completed at ≤ 75°C • HM testing completed at ≤ 75°C with no agitation and ≤ 60°C with agitation	Add OA at elevated temperature (55 - 65°C)	• Higher temperature will result in a treatment tank temperature of ~50 – 55°C • Slurry pump and transfer restrictions limit tank temperature to 60°C
Maintain pH<2	Experience indicates increased pH (>2) reduces the solubility of metals, therefore precipitating oxalates	Maintain pH <2	Minimize potential for oxalate precipitation also through timely transfers
Pump down between strikes to a minimum level	Reducing the heel volume: • Increases the fresh OA-sludge contact on subsequent strikes • Maintains a lower pH reducing precipitation of oxalates • Removes spent acid from the treatment tank	• Pump down to 11” between strikes • Pump down to 3” after Strike 2 & 3	• Optimizes reduction of heel volume between strikes accommodating current STP configuration while minimizing contamination and high radiation exposure risk • Dewatering pump will be used after Strikes 2 & 3

Tank 12 Flowsheet Protocol Three Acid Strikes

Strike	Purpose	Chemical Additions	Mixing	Transfer Protocol & Monitoring
1	• Target previously suspended, loose sludge on floor • Represents ~65% of sludge based upon inspections completed	• Add 65 kgal of 8 wt% OA to Tank 12 at 60°C • Dilute with 65 kgal of well water to a 4 wt% OA concentration	• Operate 4 SLPs in rotation mode for 2-3 days as dictated by monitored pH	• Temperature • Obtain periodic dip samples to confirm pH • Video inspection after transfer out
2	• Target acid/sludge contact with mounds under valve house	• Add 16 kgal of 8 wt% OA to Tank 12 at 60°C • Dilute with 50 kgal of well water to an OA concentration of 2 – 4 wt%	• Operate 4 SLPs 6-8 days as dictated by monitored pH	• Temperature • Obtain periodic dip samples to confirm pH • Video inspection after transfer out • Add IW/WW to neutralize solution
3	• Target remaining mounds/residual solids as identified in Strike 2 video inspection	• Add 14 kgal of 8 wt% OA added to Tk12 at 60°C • Dilute with 80 kgal of well water to OA concentration of 1.5 – 4 wt%	• Operate SLPs for 3 days • Mixing strategy will be tailored based on the Strike 2 video inspection	• Temperature • Obtain periodic dip samples to confirm pH • Video inspection after transfer out • Neutralize solution • Volumetric examination of tank wall

Summary

- Tank 12 is a Type I tank that has entered the chemical cleaning phase in the closure sequence
- Equipment modifications and new safety basis controls established to address potential hazards
- The Tank 12 chemical cleaning flowsheet developed based upon experience with chemical cleaning and a detailed experimental program
  - Three strikes with oxalic acid maximizing OA-sludge interactions, adequate mixing, and pH control
  - Sampling and monitoring program in place to ensure operational efficiency and safety envelope maintained