



DOE Office of Waste Processing
Technical Exchange



Tanks 5 and 6 Chemical Cleaning

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**Washington Savannah River Company
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EM21-GDT **URS**

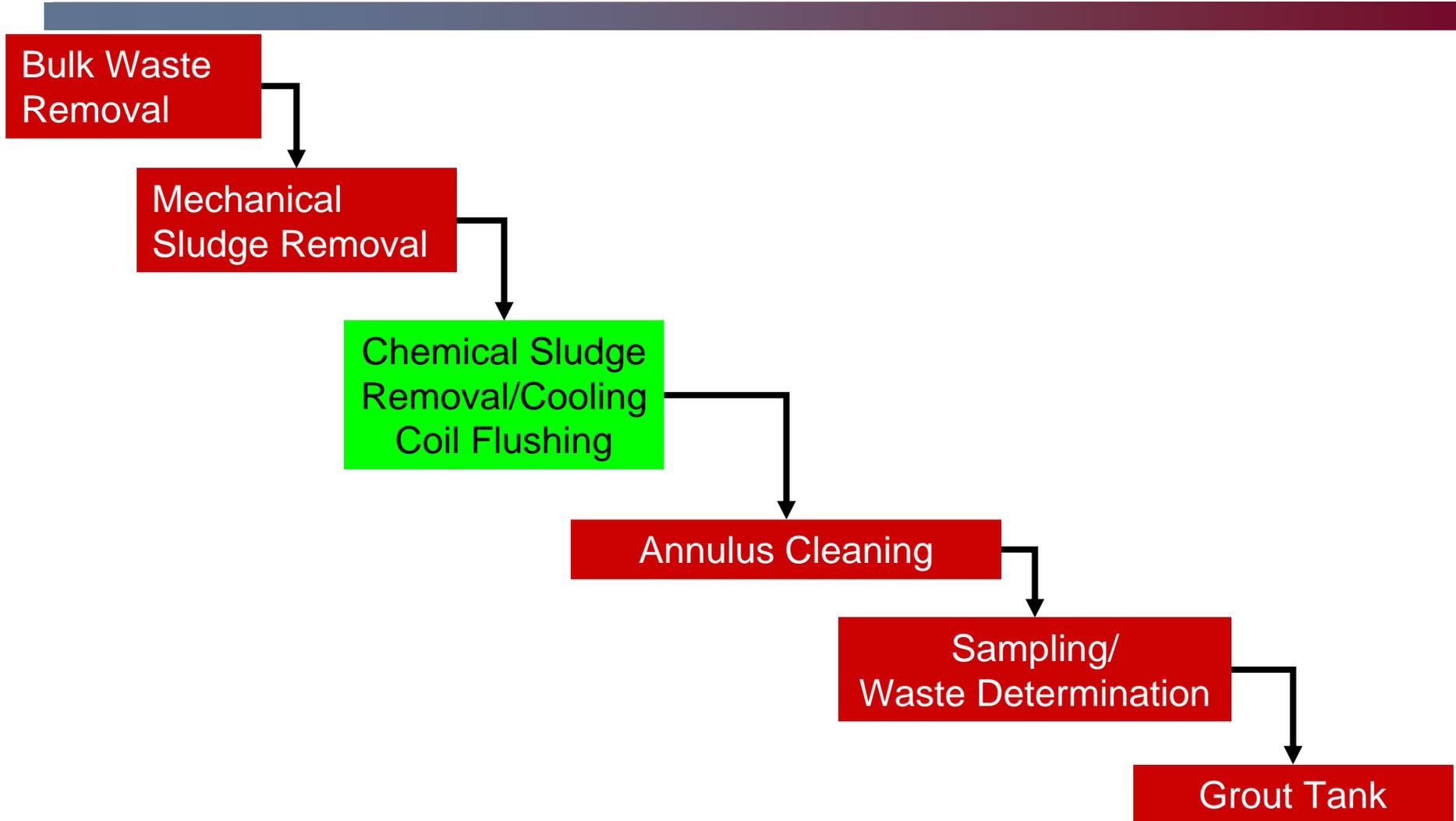
Introduction

- **Closure Process Overview**
- **Process Flowsheet**
- **Configuration**
- **Technical Issues & Resolution**
- **Cleaning Status and Results**

Tank Closure Driver

- **In the Federal Facilities Agreement with the State of South Carolina and the Environmental Protection Agency, SRS has agreed to close non compliant waste tanks by specific dates.**
- **Two of the first tanks selected for closure are Tanks 5 and 6 in F-Tank Farm.**

Tank Closure Process

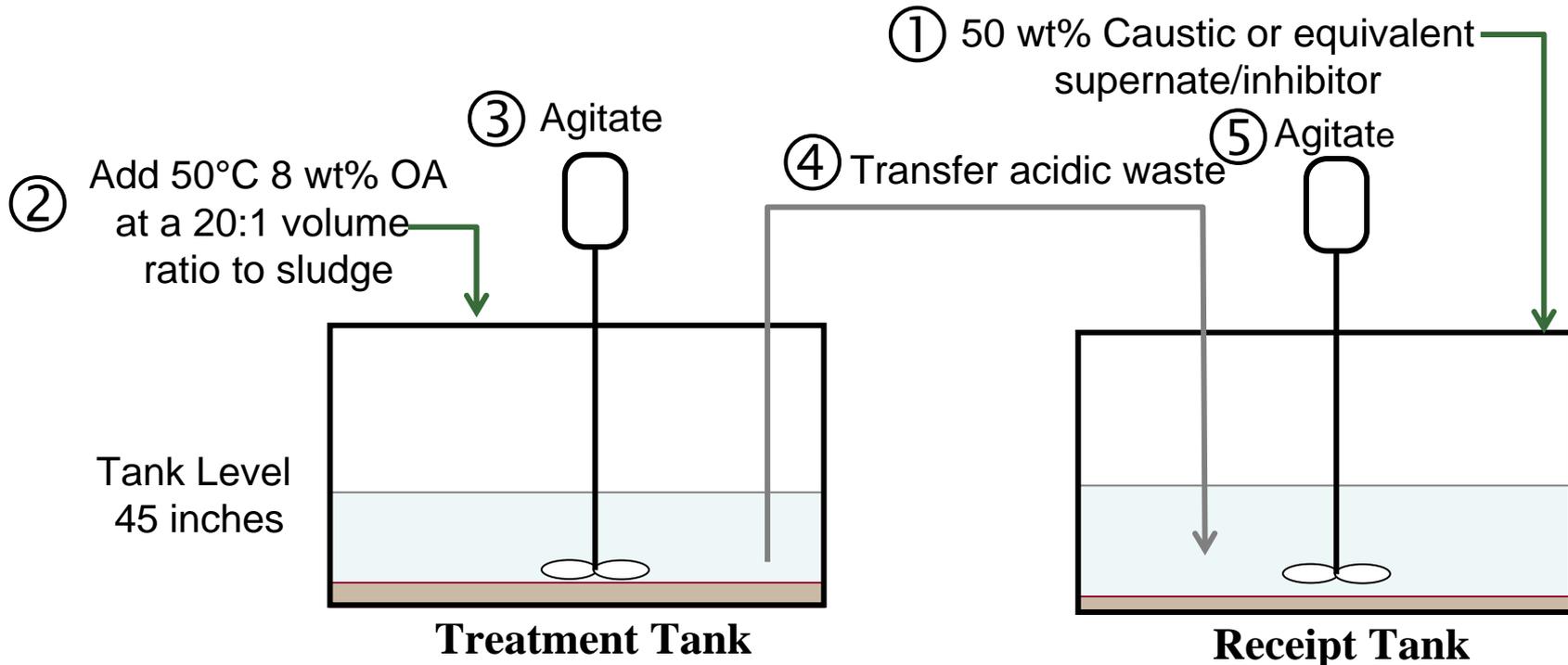


Tanks 5 & 6 Chemical Cleaning

Chemical Cleaning – Planned Flowsheet

- Dilute supernate heel in Treatment Tank
- Use 8 weight-percent oxalic acid at 50°C
- Three acid strikes planned
- Last acid strike is added via spray wash tool
- After acid cleaning, tank is spray washed using water and cooling coils are flushed
- Final well water wash is performed using Submersible Mixer Pumps (SMPs)

Process Steps – First Acid Strike



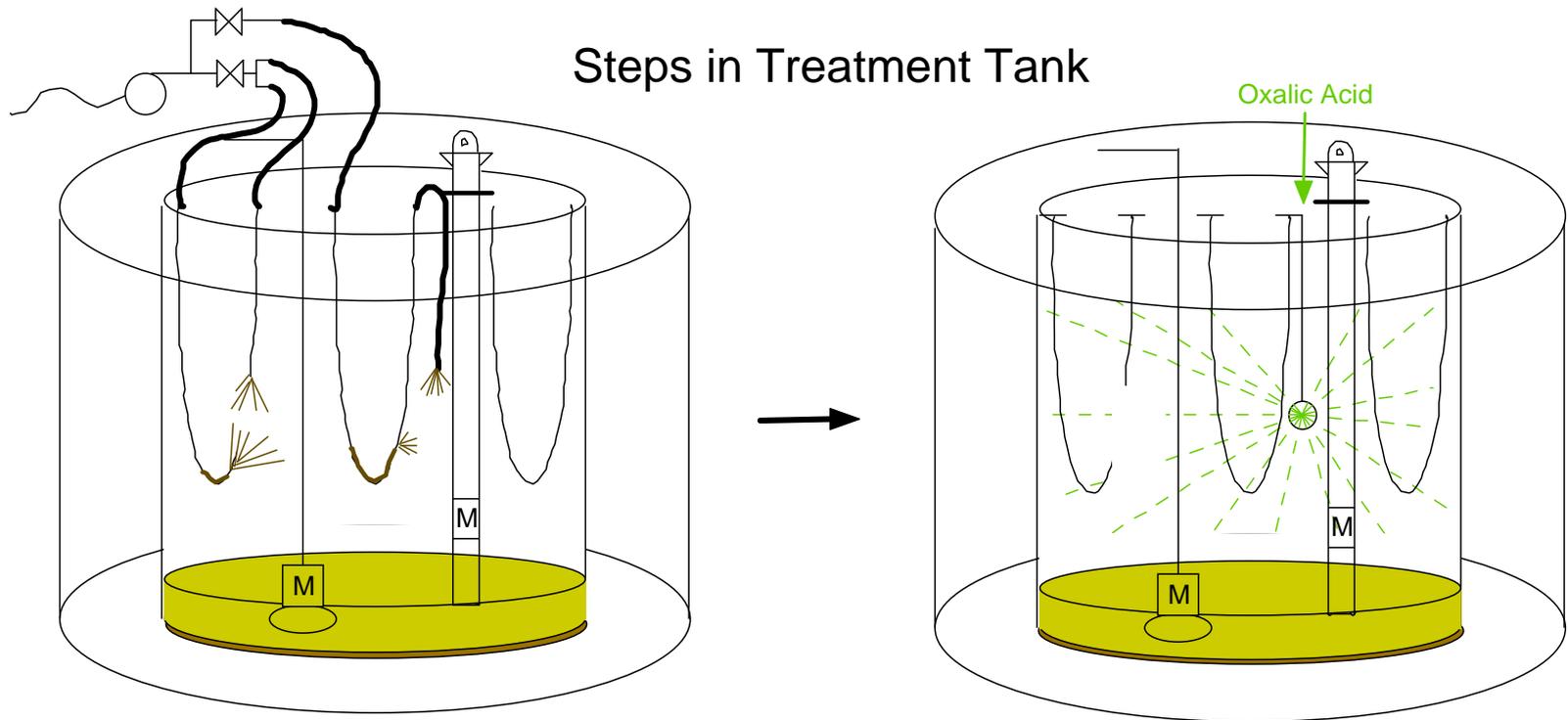
- Tk 34 supernate transferred to Receipt Tank for pH adjustment of acid waste stream
- Add OA at 20:1 volume ratio of acid to sludge from tankers at 50°C
- SMPs operated in Treatment Tank to aid dissolution and suspension
- Acid waste stream transferred to Receipt Tank
- Standard Slurry pumps operated in Receipt Tank to enhance pH adjustment

Tanks 5 & 6 Chemical Cleaning

Process Steps – Second Acid Strike

- Tank 34 supernate transferred to Receipt Tank for pH adjustment of acid waste stream
- OA at **13:1** volume ratio of acid to sludge unloaded to Treatment Tank from tankers at 50°C
- Time provided for acid soak
- Acid waste stream transferred to Receipt Tank
- Standard Slurry pumps operated in Receipt Tank to enhance pH adjustment

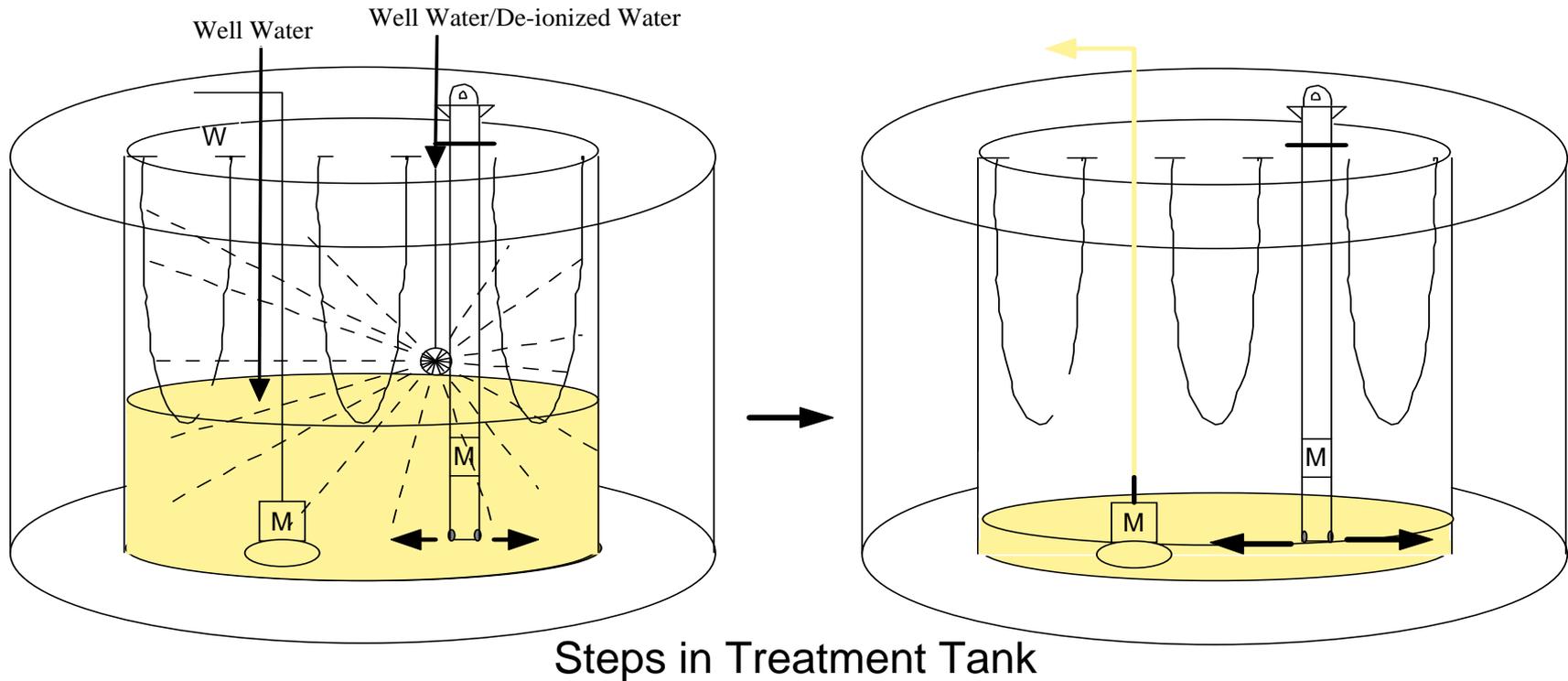
Process Steps – Coil Flush and Third Acid Strike (Acid Spray Wash)



- Flush failed cooling coils
- Tank 34 supernate transferred to Receipt Tank for pH adjustment of acid waste stream
- Add OA at 13:1 volume ratio of acid to sludge via spray wash and provide soak time
- Acid waste stream transferred to Receipt Tank with slurry pumps running

Tanks 5 & 6 Chemical Cleaning

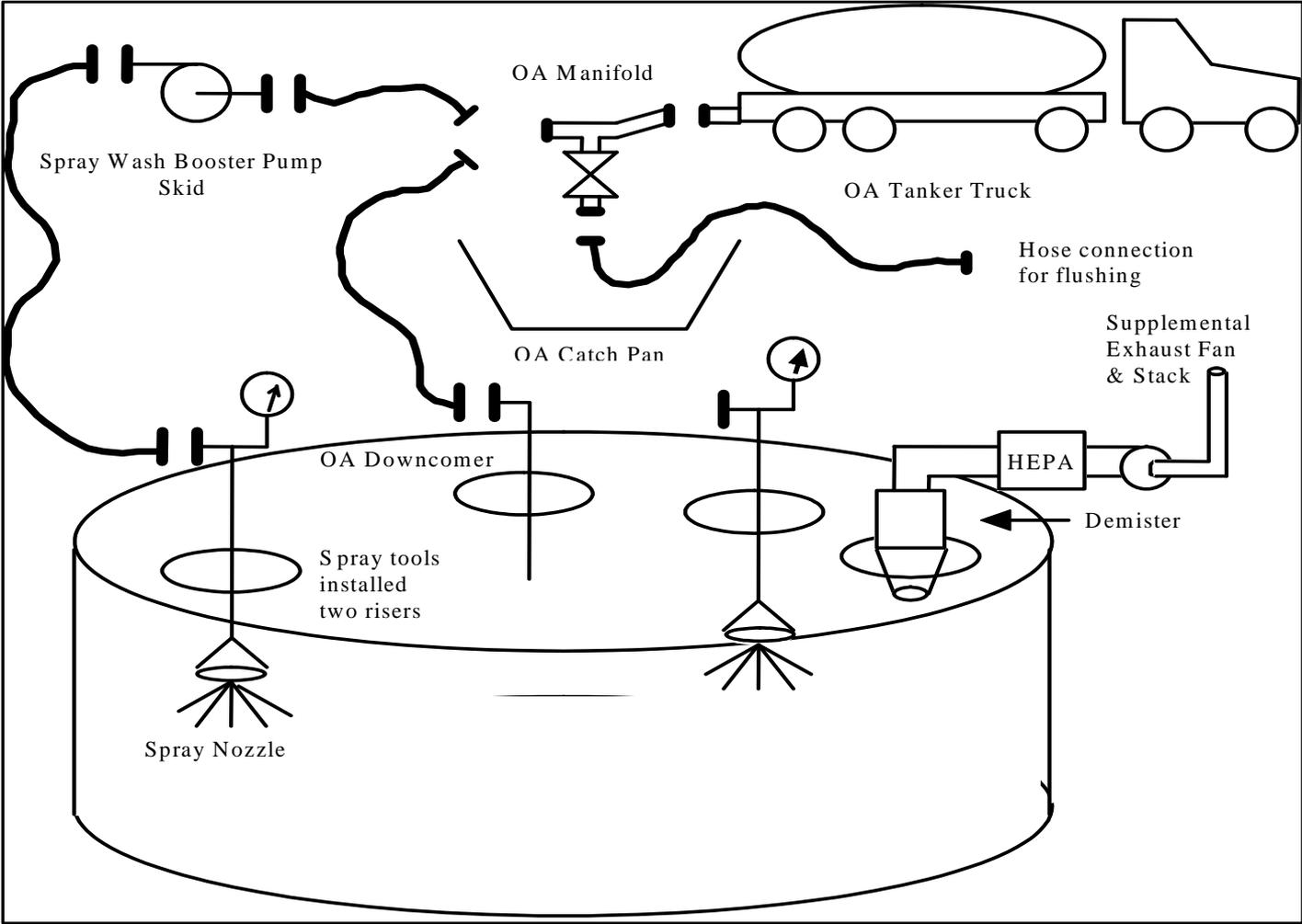
Process Steps – Water Wash



- Spray wash primary tank interior with water
- Add additional water and run SMPs
- Transfer wash water solution to Receipt Tank

Tanks 5 & 6 Chemical Cleaning

Tank Configuration for Chemical Cleaning



Tanks 5 & 6 Chemical Cleaning

Chemical Cleaning – Major Technical Issues

- **Corrosion induced hydrogen generation (explosion hazard)**
- **Accelerated corrosion of carbon steel tank walls and components**
- **Trapped hydrogen in floating solids layer in Receipt Tank (where acid waste stream will be neutralized/pH adjusted)**
- **Total gas generation leading to Tank pressurization (contamination issue)**
- **High humidity in Tank vapor space leading to HEPA filter wetting**
- **Criticality**

Chemical Cleaning – Issue Resolution

Tests performed at the Savannah River National Laboratory (SRNL) to resolve issues

- Included simulant and real waste tests (used Tank 5 sludge)
- Tests executed at 25, 50, and 75 degrees C in two modes of operation – mixed and unmixed
- Scope included tests in aerobic and anaerobic conditions
- Scope included irradiated tests using a Cobalt source
- Determined worst case hydrogen generation rate
- Determined worst case carbon steel corrosion rate
- Determined worst case total gas generation rate (found to be primarily carbon dioxide)

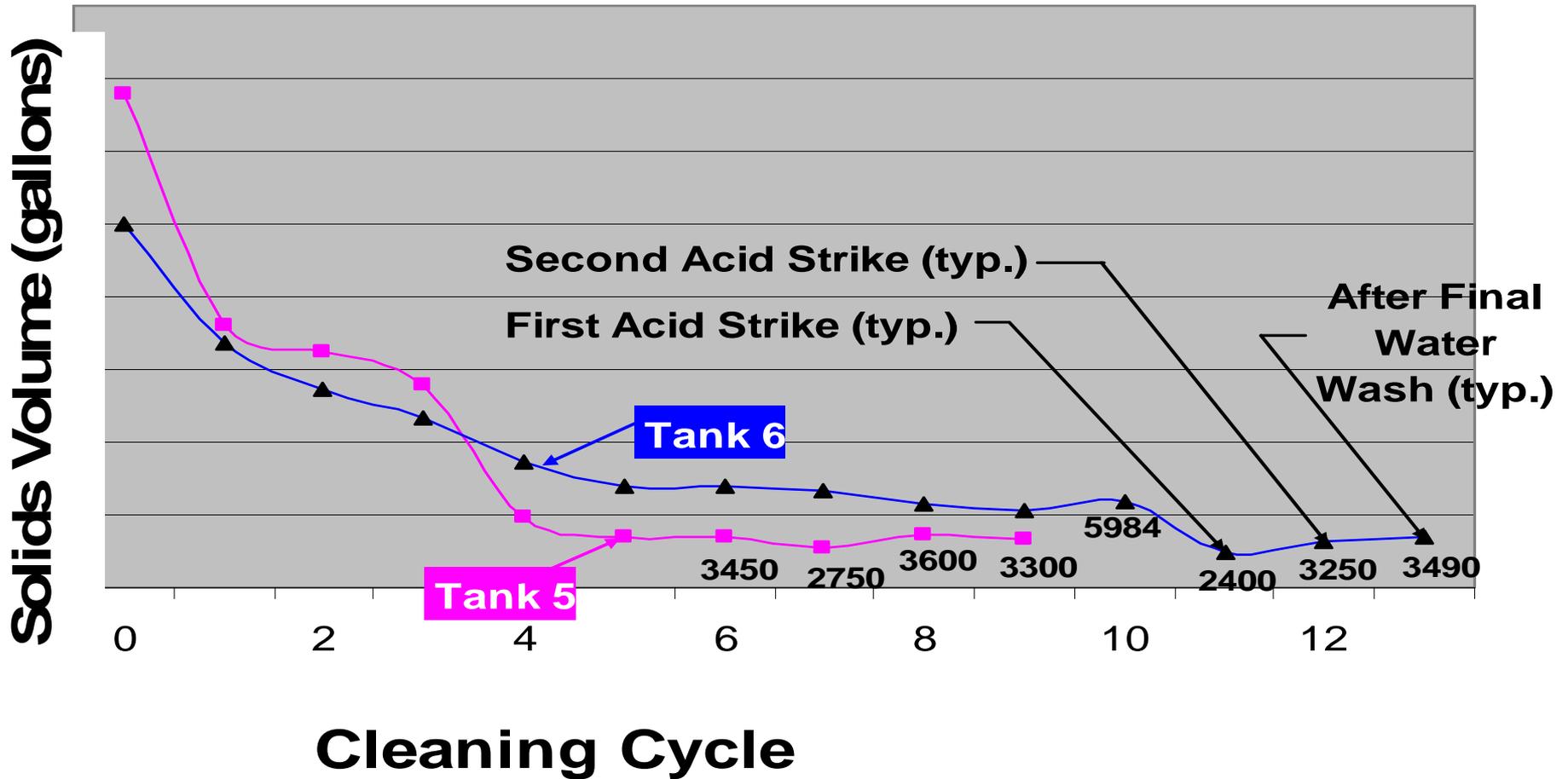
Chemical Cleaning – Issue Resolution

- **Corrosion/hydrogen generation rates found to be manageable**
- **Floating solids in receipt tank did not trap hydrogen and settled readily**
- **Floating layer of acid formed in receipt tank - dispersed with gentle mixing**
- **Added supplemental ventilation system with demister to prevent tank pressurization/HEPA filter wetting**
- **Nuclear criticality remains non-credible**

Cleaning Status/Results

- **Process flowsheet has been completed for both Tanks 5 and 6.**
- **Residual solids volume decreased after first strike but increased after the second strike (new solids formed)**
- **Volume for Third Acid Strike reduced to minimum required for Acid Spray Wash**
- **First acid strike in Tank 5 was not as effective as expected, pH of acid waste solution in Tank 5 after first acid strike was 5 versus expected value of 2 (probable cause is higher levels of basic ions in sludge than expected)**
- **Process sampling is in progress to determine composition of residual solids**

Solids Volume Remaining



Tank 6 Dissolution Results

	First Acid Strike	Second Acid Strike	Third Strike/Spray Wash
Species	Amount Dissolved (kg)	Amount Dissolved (kg)	Amount Dissolved (kg)
Al	444	≤ 1	12.8
Fe	5,062	≤ 1	226
Mn	256	≤ 1	5.8
U (ICPES)	2,130	22	112
U(ICPMS)	2,058	15	107
Sr	15	≤ 1	0.2
	Amount Dissolved (mCi)	Amount Dissolved (mCi)	Amount Dissolved (mCi)
²³⁸ Pu	22,000	< 100	390
²³⁹ Pu	27,000	< 100	490
⁹⁰ Sr	4.5 x 10 ⁸	4.6 x 10 ⁶	8.2 x 10 ⁶

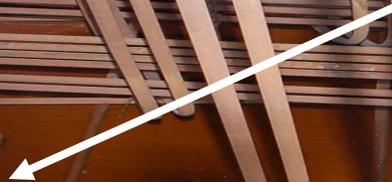
Tank 5 – After Bulk Sludge Removal, Prior to Mechanical Sludge Heel Removal



Tank 5 Interior Pictures – After Chemical Cleaning



Base plate is
4.5" from tank
bottom





Tanks 5 & 6 Chemical Cleaning

Tank 5 Interior Showing Remaining Solids – After Chemical Cleaning



Questions and Answers

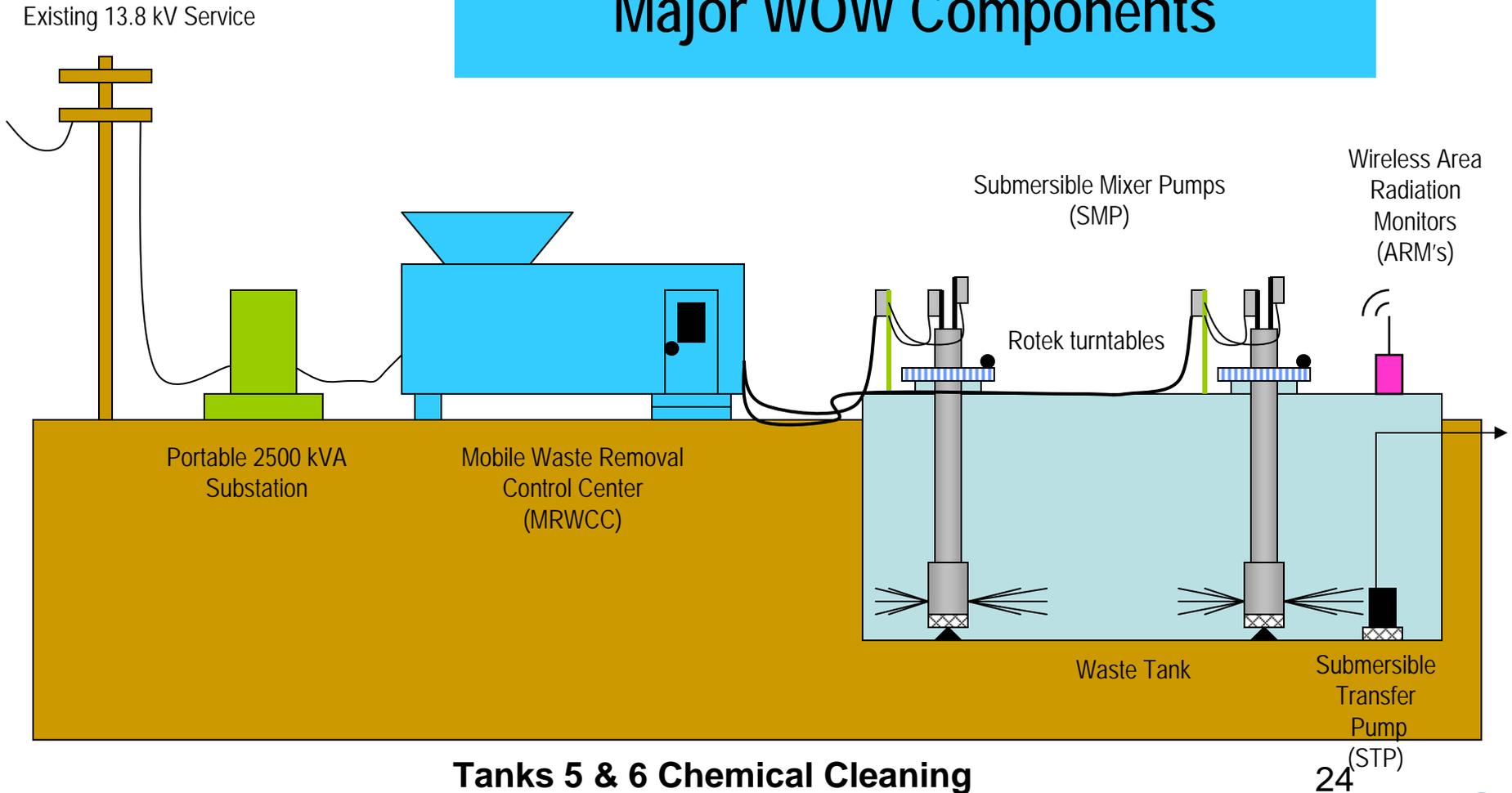
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Back-Up Slides

Tank 5 & 6 Mechanical Sludge Removal Utilizing Waste on Wheels (WOW)

Major WOW Components



Tank 5 Dissolution Results

	First Acid Strike	Second Acid Strike	Third Strike/Spray Wash
Species	Amount Dissolved (kg)	Amount Dissolved (kg)	Amount Dissolved (kg)
Al	286	7	7
Fe	1,506	394	281.5
Mn	695	50	19.5
U (ICPES)	3020	34	42.3
U(ICPMS)	2806	34	36.1
Sr	19	0.3	0.3
	Amount Dissolved (mCi)	Amount Dissolved (mCi)	Amount Dissolved (mCi)
Pu-238	2,683	1,000	10
Pu-239	12,800	2,900	610
⁹⁰ Sr	6.2 x 10 ⁸	2.1 x 10 ⁷	1.3 x 10 ⁷