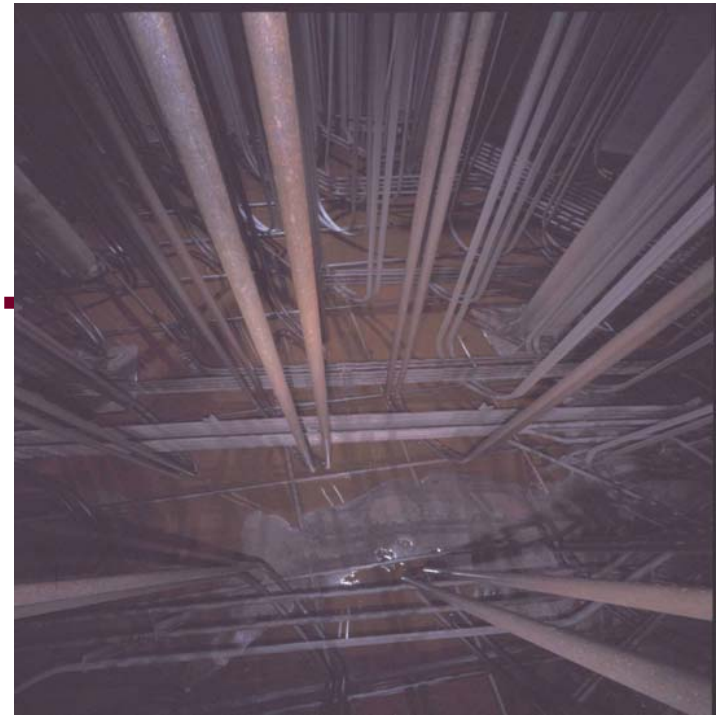
Sludge Waste Removal and Tank Closure



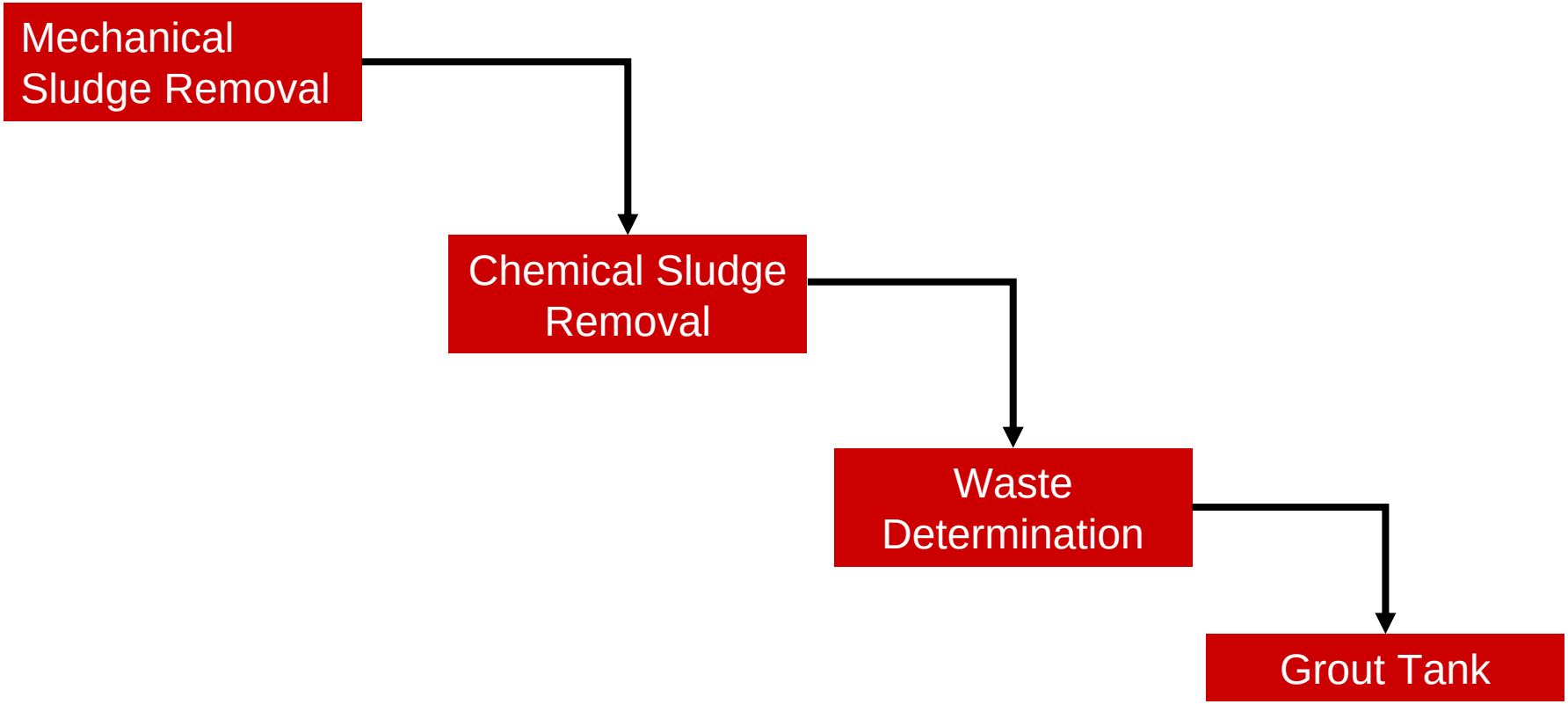
Noel Chapman
F-Tank Farm Closure Engineering
Washington Savannah River Company
Savannah River Site

Tank Closure Driver

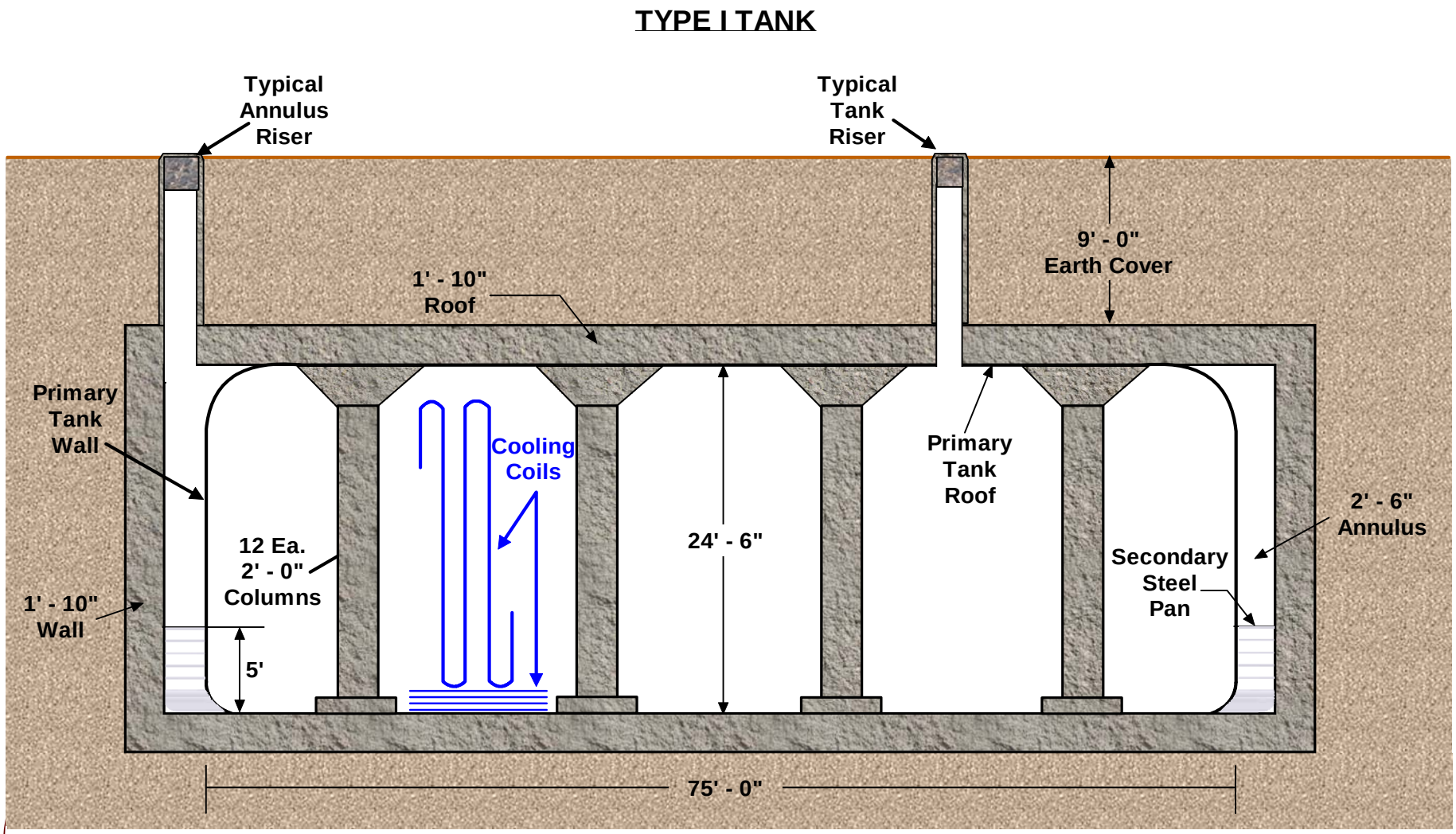
- Federal Facilities Agreement commitment to close two tanks by September, 2010

- Tanks selected for closure are Tanks 5 and 6 in F Tank Farm

Tank Closure Process

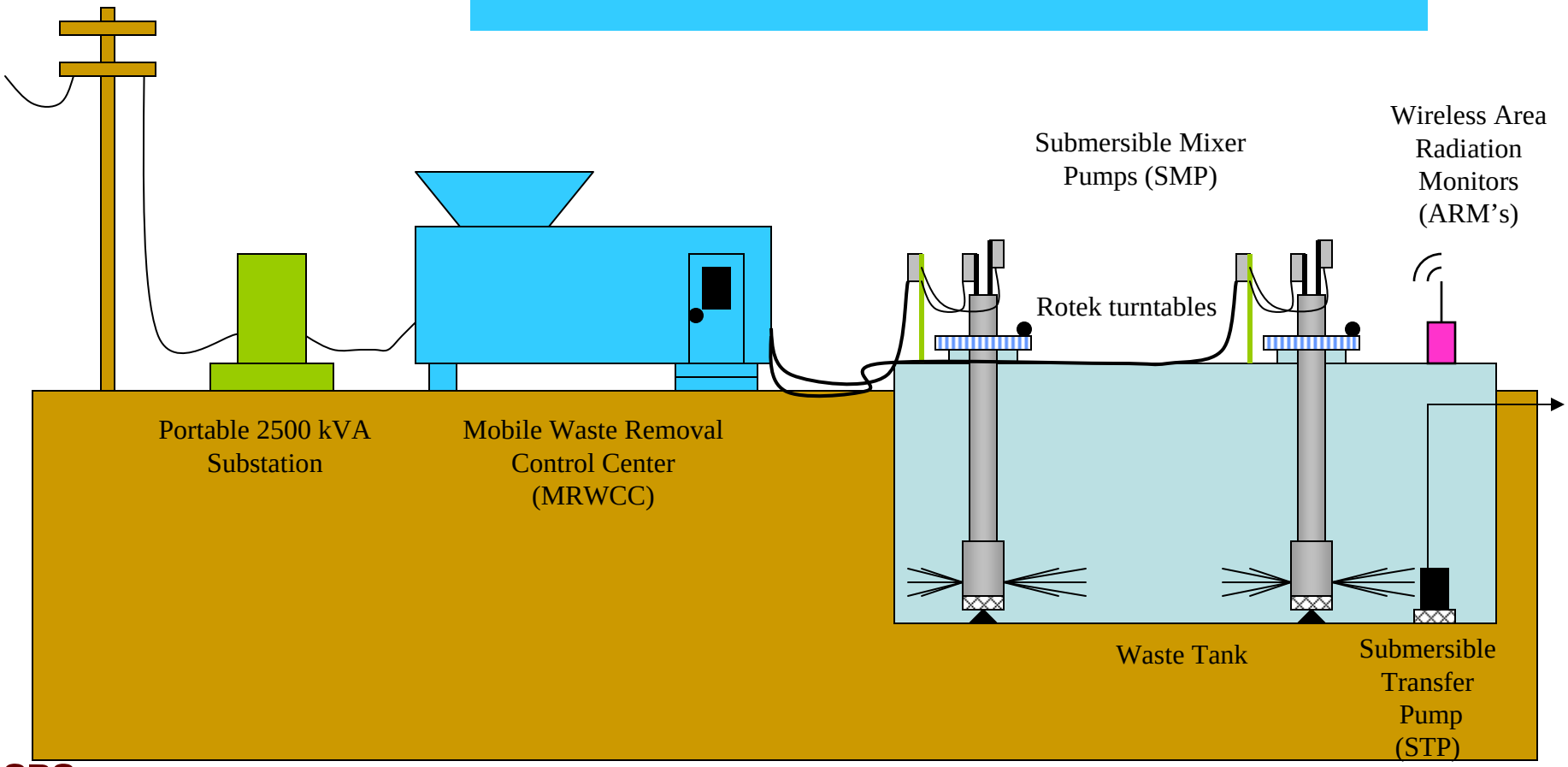


SRS Type I Tank



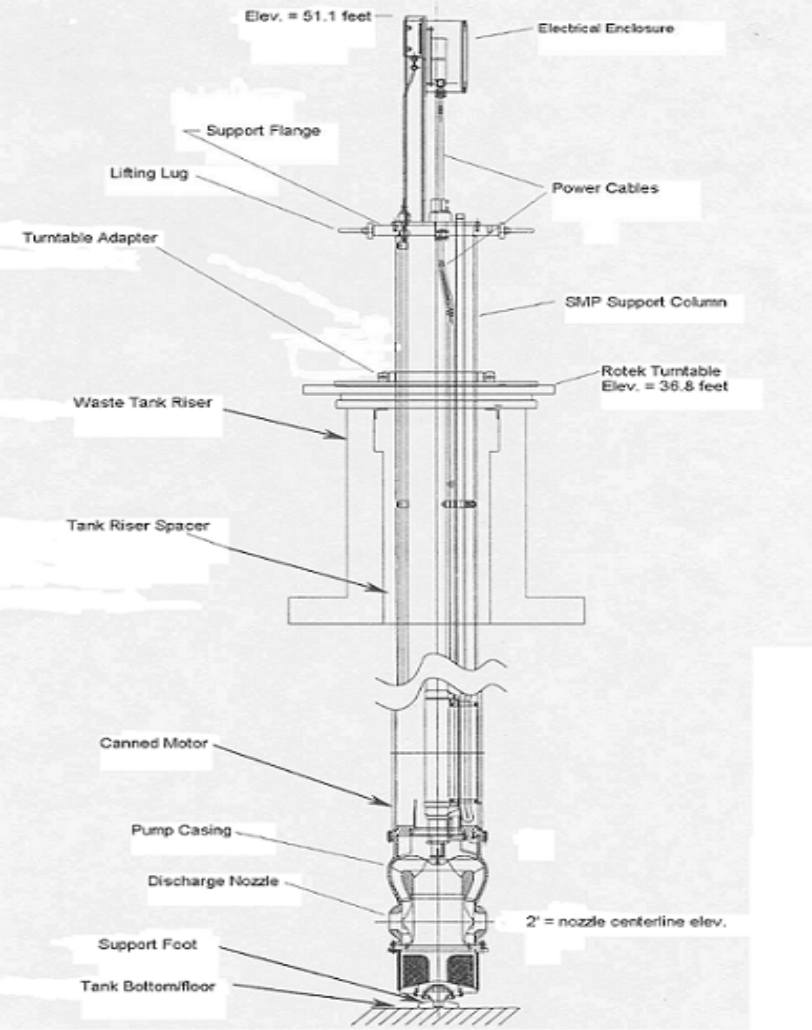
Mechanical Sludge Removal Utilizing Waste on Wheels (WOW)

Major WOW Components

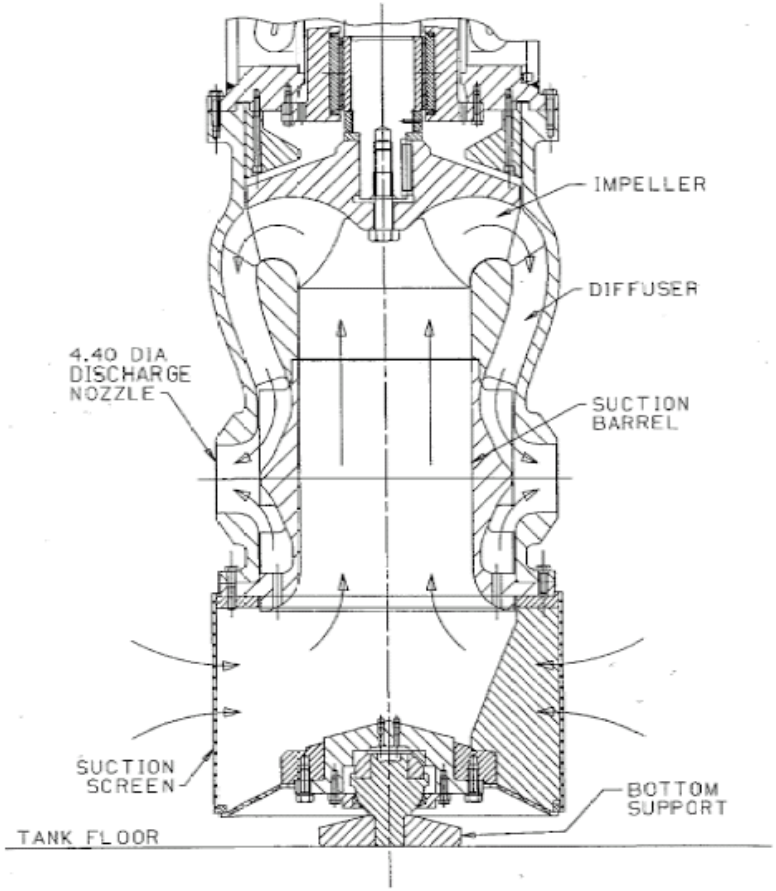


SMP (Submersible Mixer Pump)

- Canned Motor Design
  - Total Flow 7602 gpm
  - Flow Velocity 80.2 ft/s
  - Speed 400 - 1400 rpm
  - Motor 305 Hp
  - Torque 1226 ft-lbs
  - Weight 9600 lbs
- Variable Speed
- Product Cooled
- Floor Supported or Hung
- 51 ft. length
- 18” Pipe Column
- Rotated by Turntable



SMP With Screen and Foot Bearing

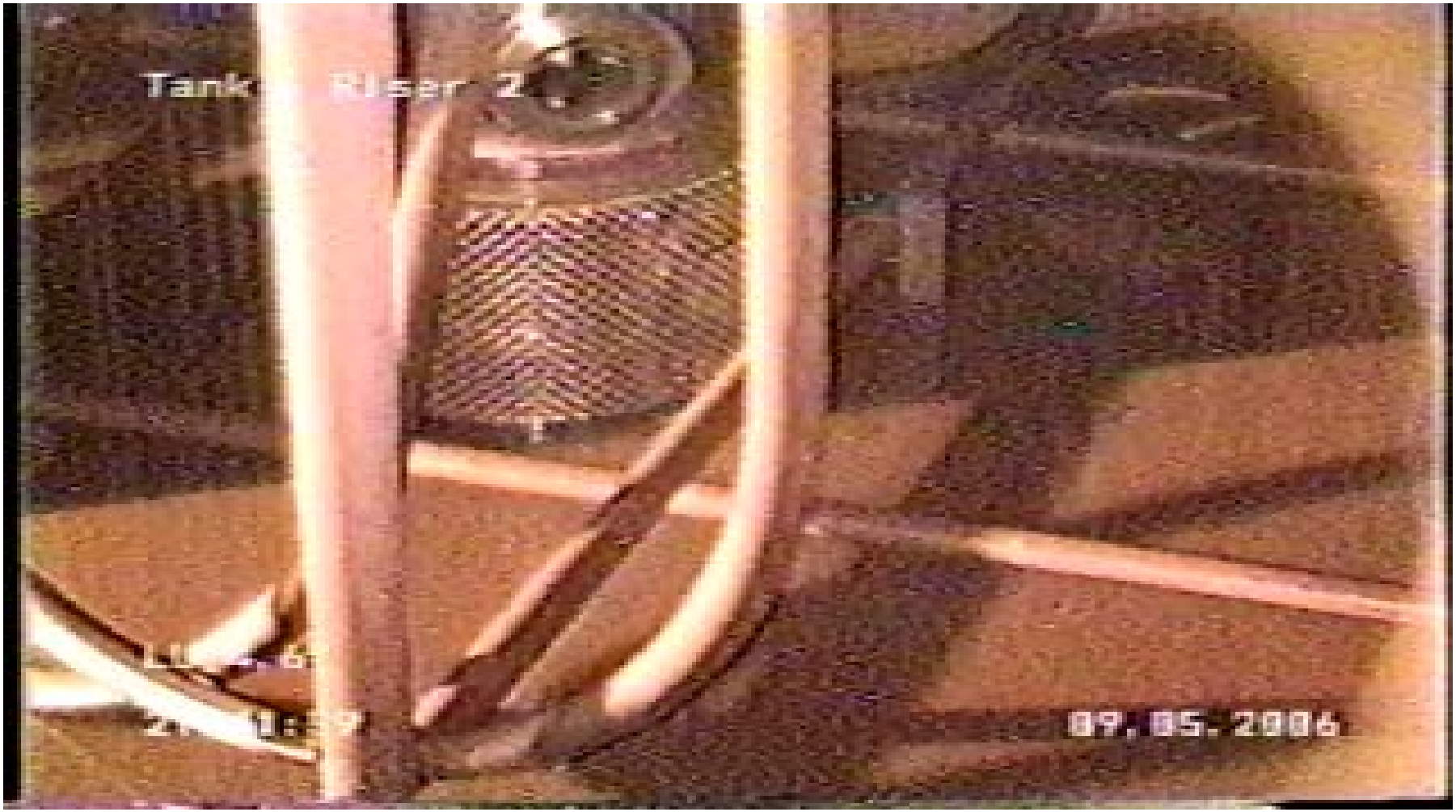


SMP Installation Photos

SMP Installation Photos

Tank 5, Riser 3 SMP Placement

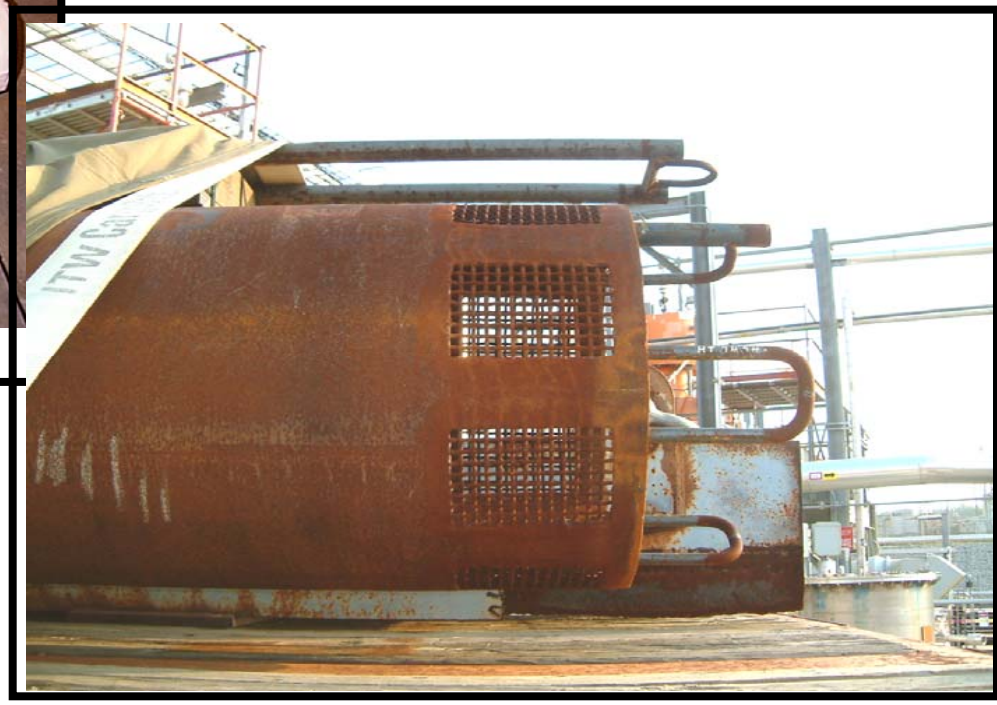
Tank 6 SMP in Riser 3



STP/Caisson Details

STP Motor/Pump Assembly

STP Caisson



Typical Mechanical Sludge Removal Process

Start Mixing w/ Liquid level @ 10 Feet (120”)

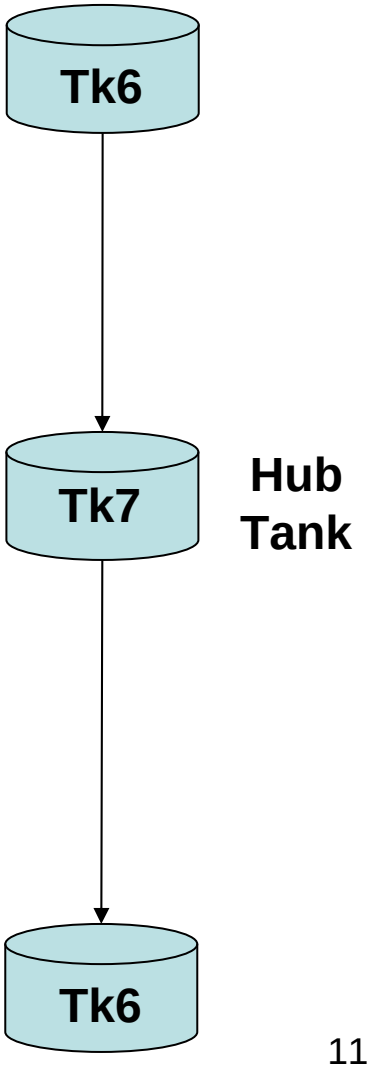
Operate SMPs in Index and Oscillation Mode

Transfer Slurry to Tank 7

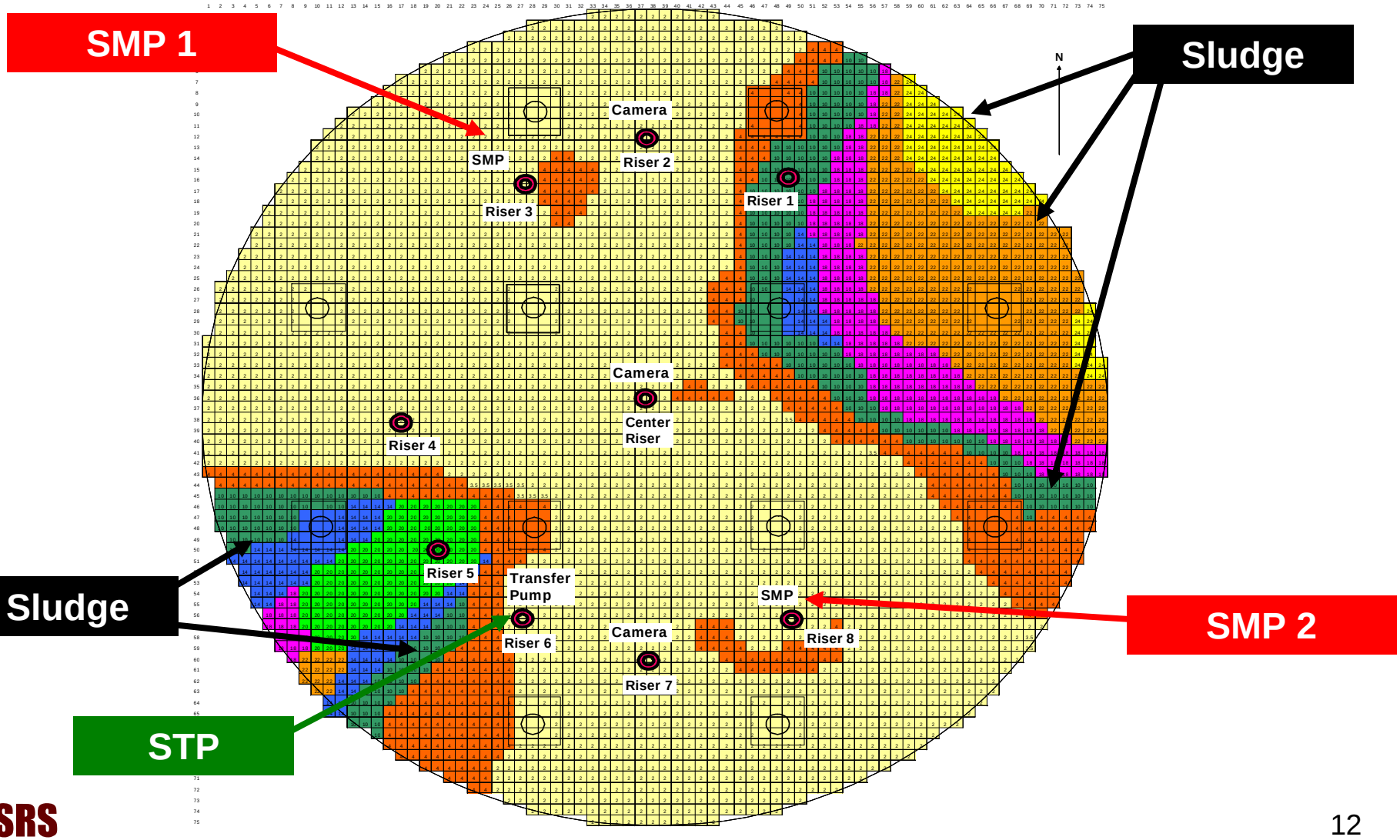
- Continue Mixing until LL = ~ 3 Feet.
- Sludge Mapping begins at ~28 inches
- Transfer Ends w/ LL = ~ 3 inches

Solids Settle in Tank 7

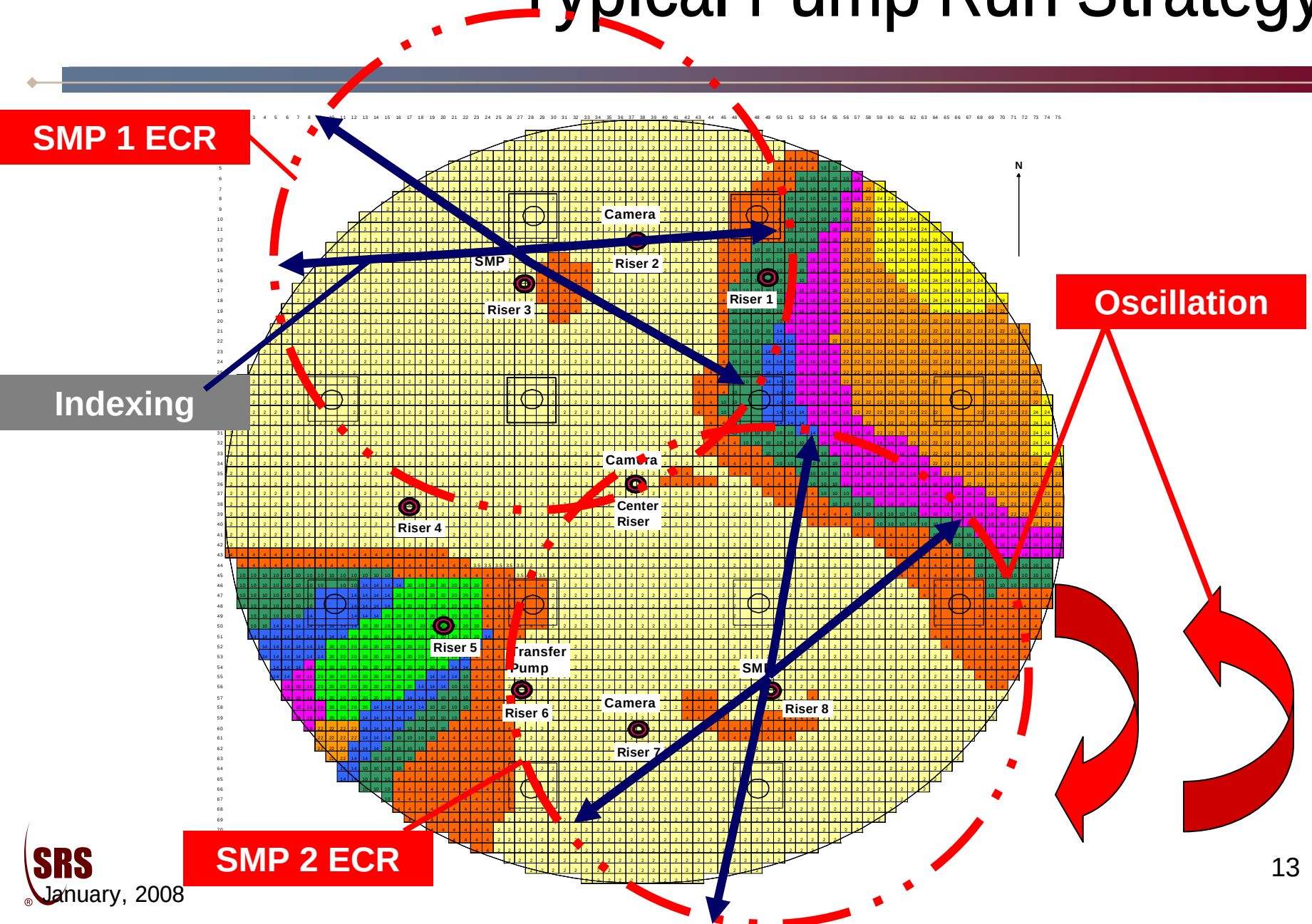
Transfer Supernate Back to Tank 6



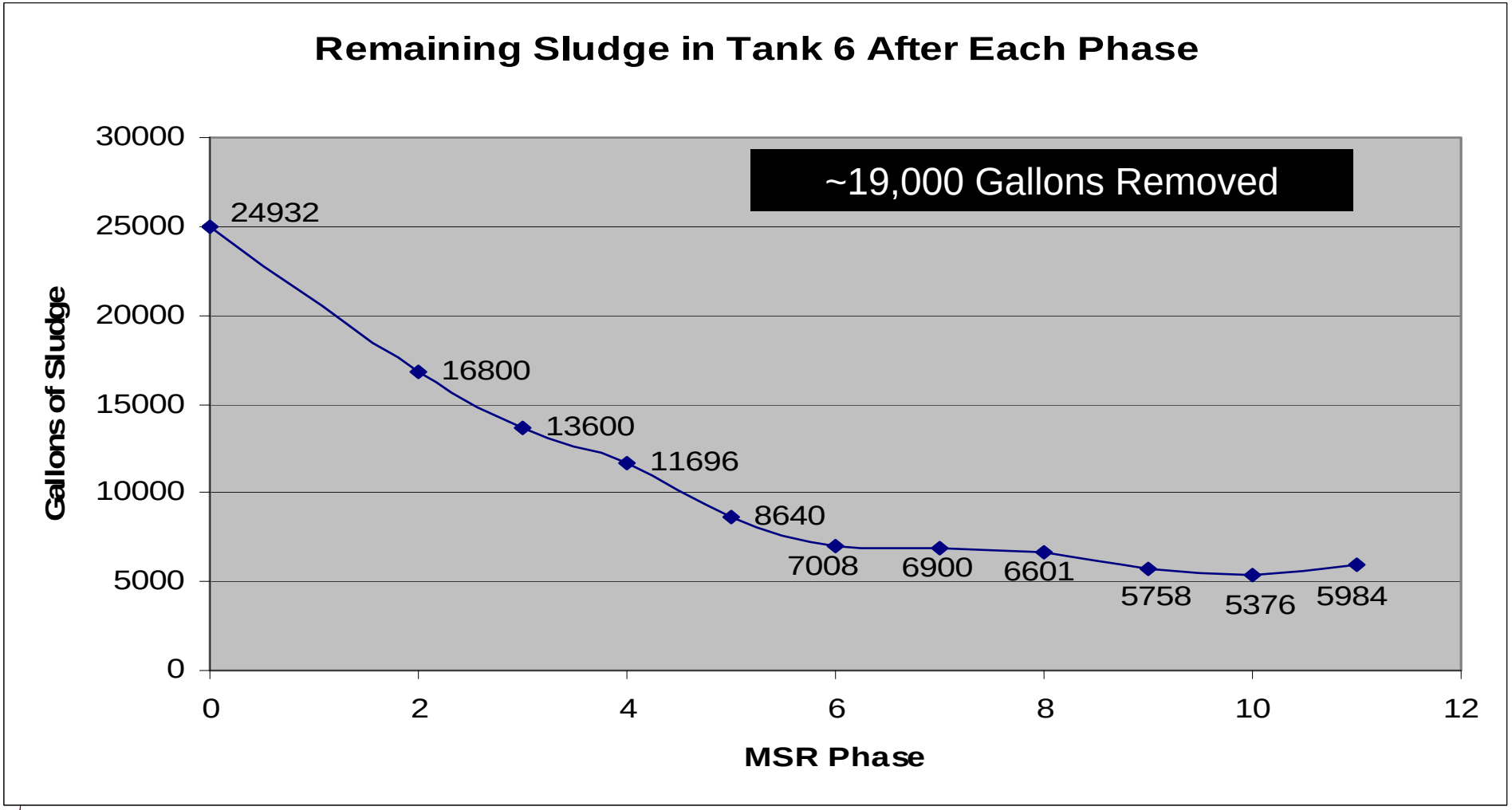
Tank 6 Beginning MSR 7/9/2006 (24932 gals)



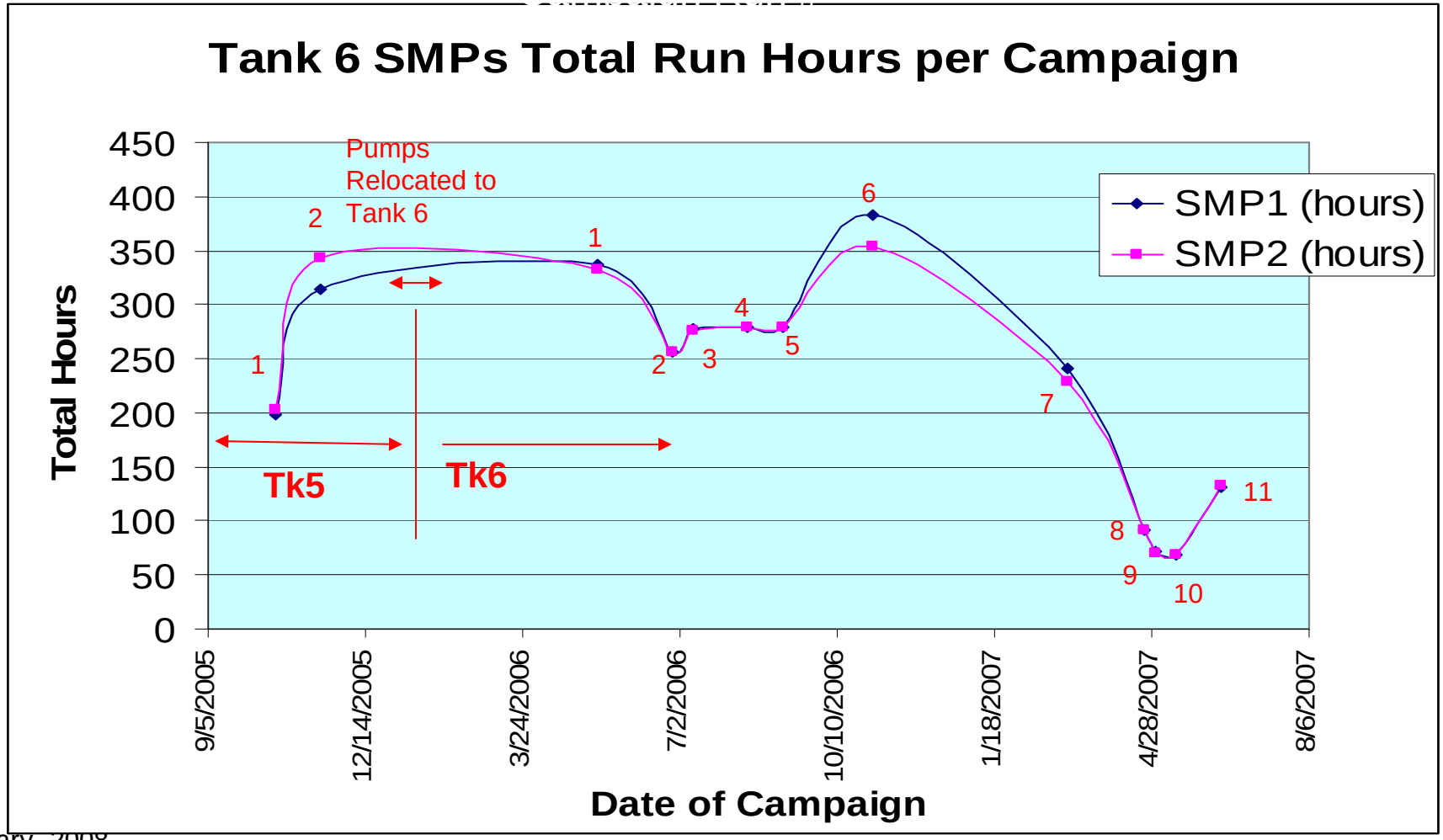
Typical Pump Run Strategy



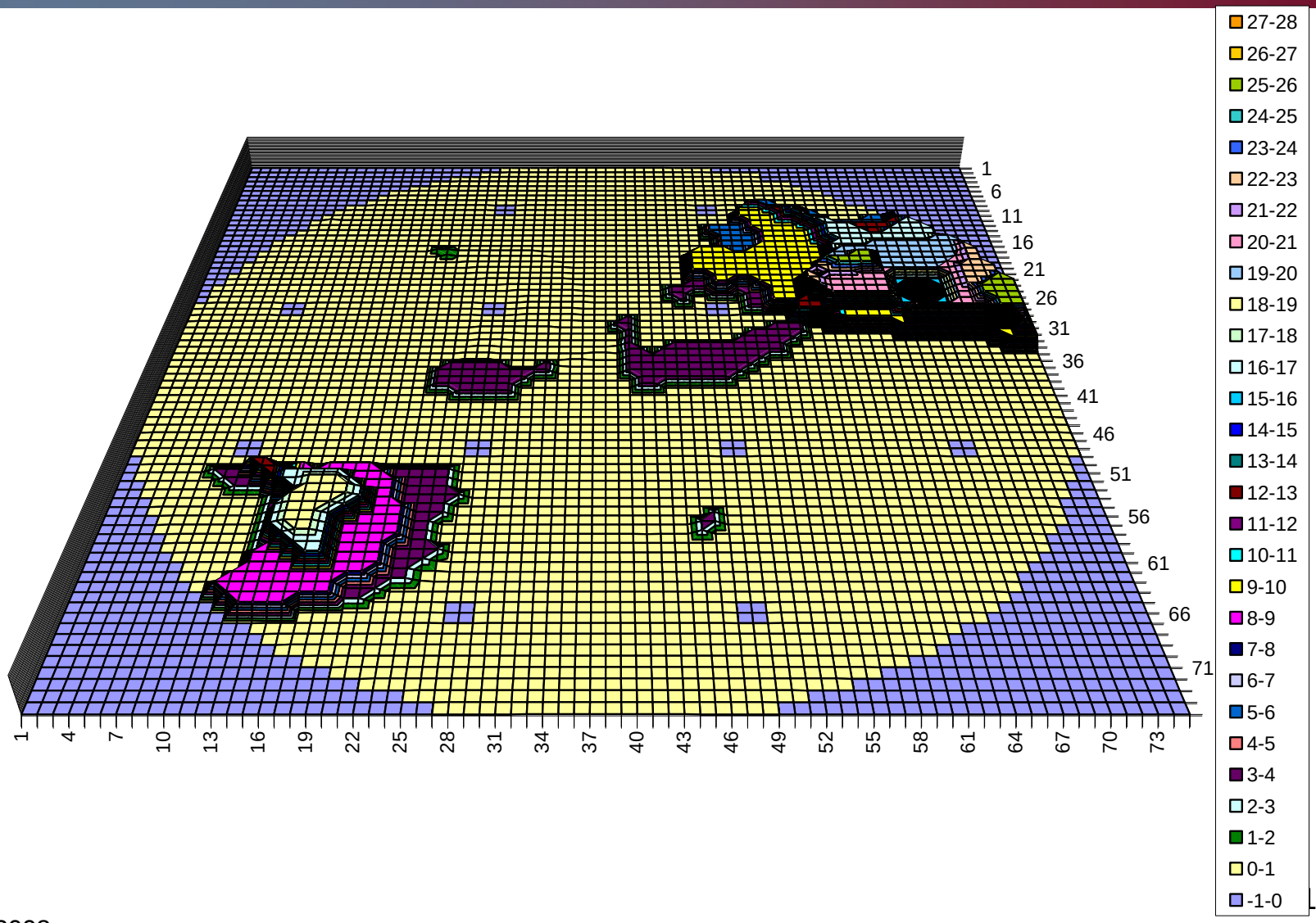
Tank 6 Sludge Volume



SMP Hours of Operation



Tank 6 Today (5984 Gallons)



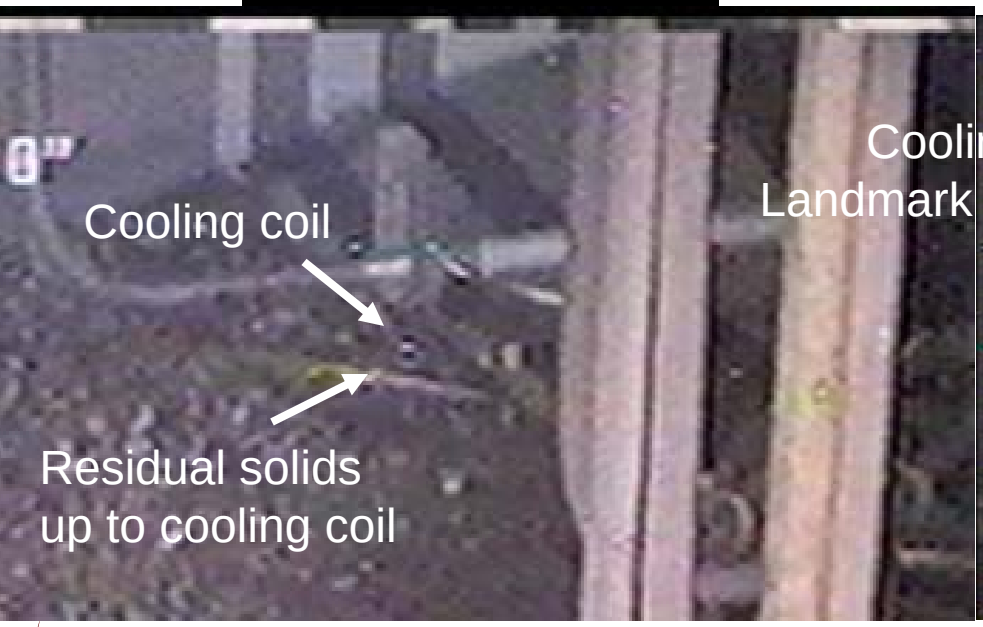
Tank 6 Northeast Mound

After Phase 6 (12/8/06)

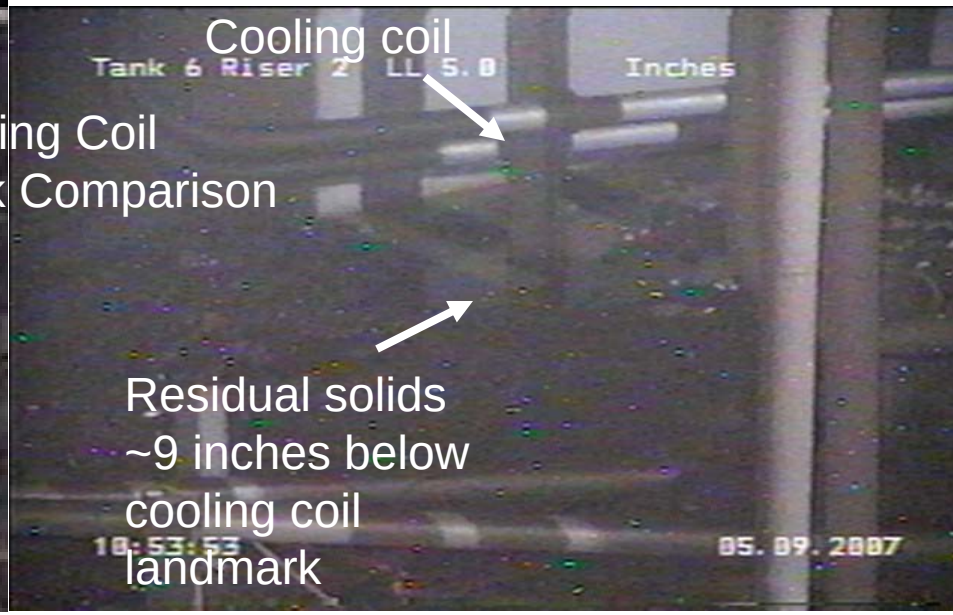
- Residual solids level ~22 inches.
- NE mound volume ~5,200 gallons.

After Phase 9 (5/9/07)

- Residual solids level ~13 inches.
- NE mound volume ~4,000 gallons.

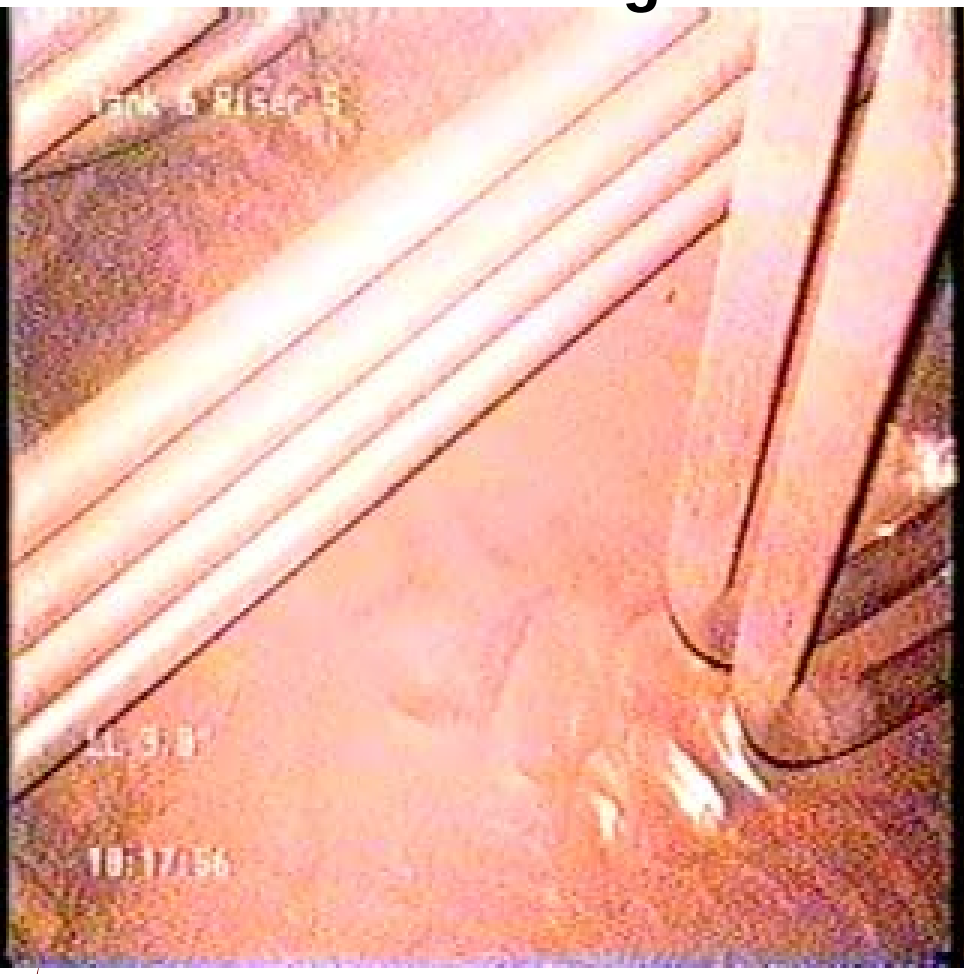


Cooling Coil
Landmark Comparison

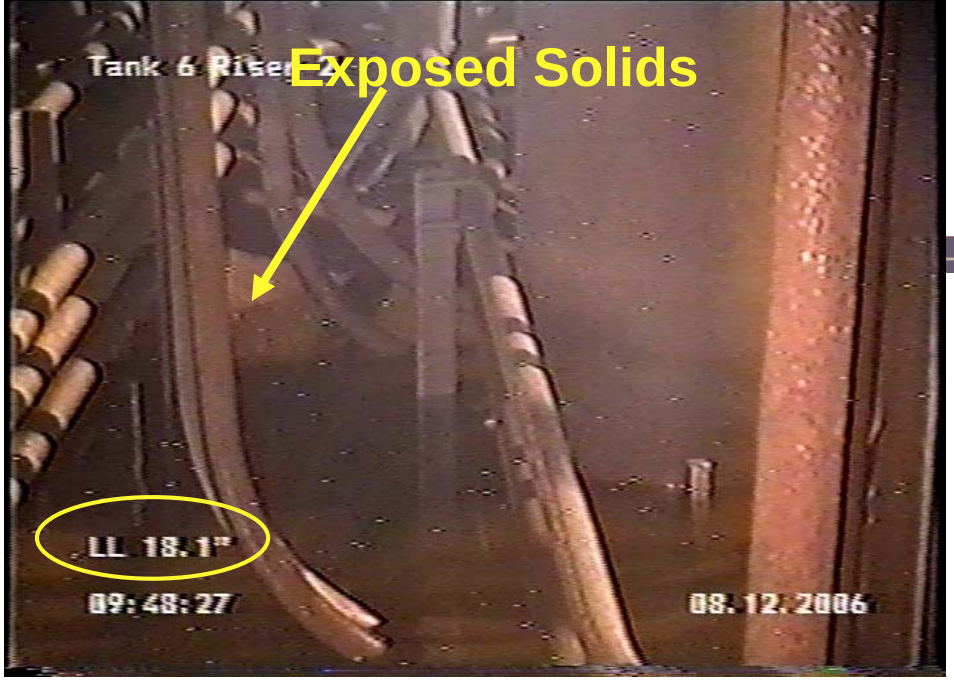


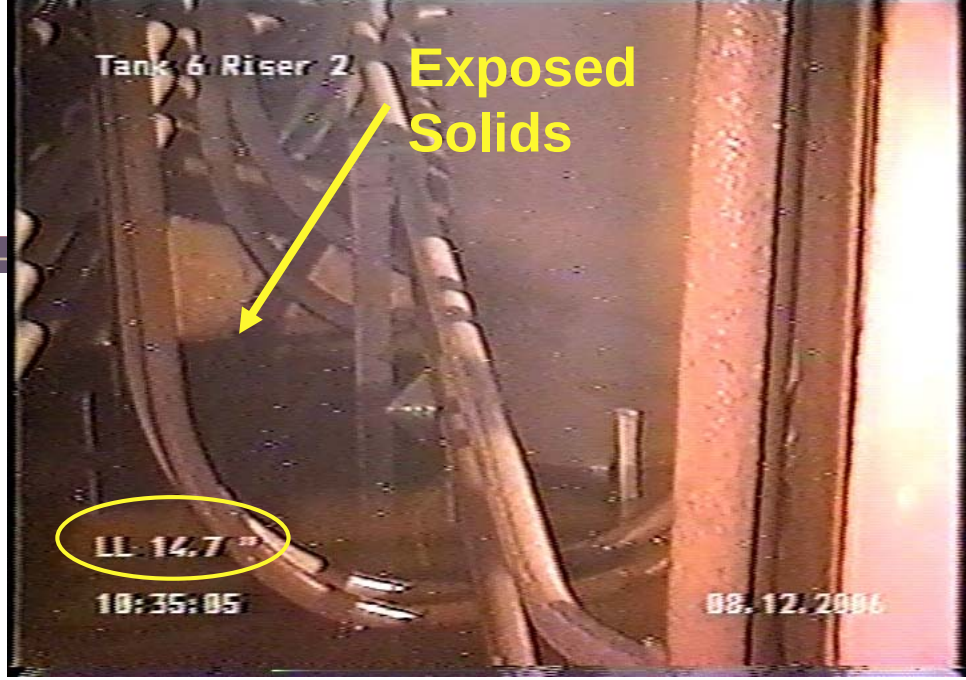
Tank 6 Riser 5

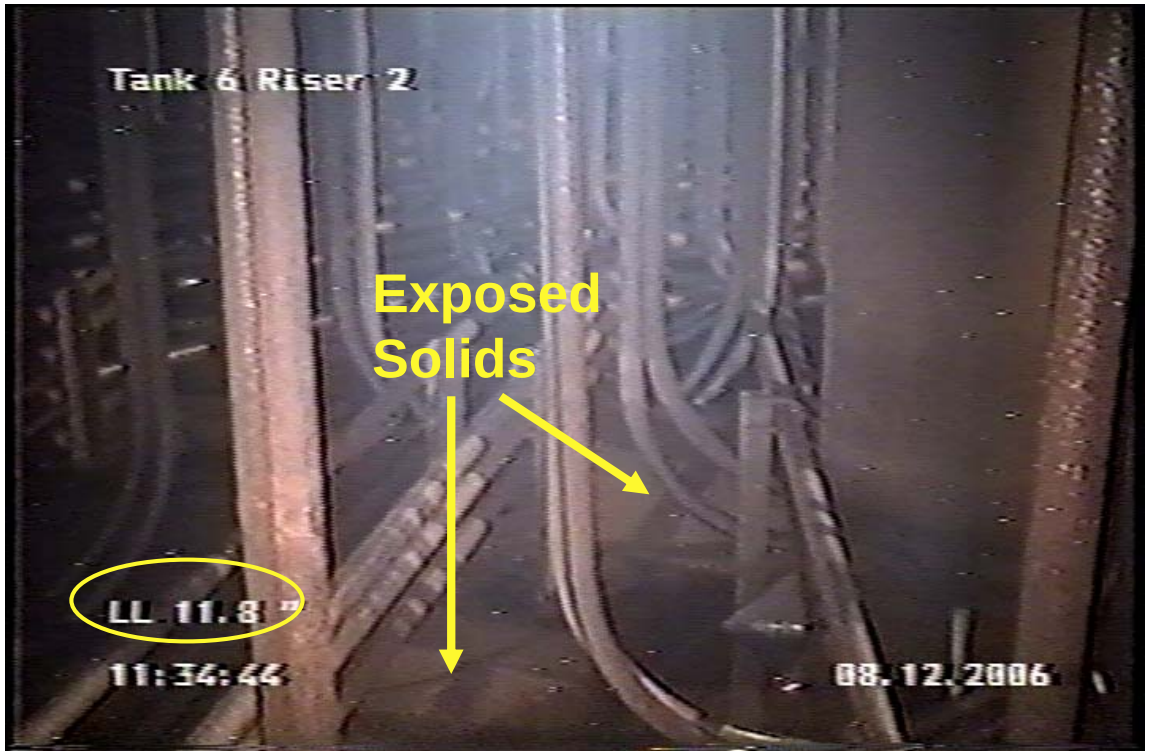
Before Lancing



After Lancing


Tank 6 Riser 2
Exposed Solids
LL 18.1"
09:48:27
08.12.2006


Tank 6 Riser 2
Exposed Solids
LL 14.7"
10:35:05
08.12.2006


Tank 6 Riser 2
Exposed Solids
LL 11.8"
11:34:44
08.12.2006

Mechanical Sludge Removal Lessons Learned

- Cooling Coil routing/congestion created areas of tank which hindered slurry suspension
- Interferences reduce SMP Effective Cleaning Radius (ECR) from 53 feet to approximately 29 feet

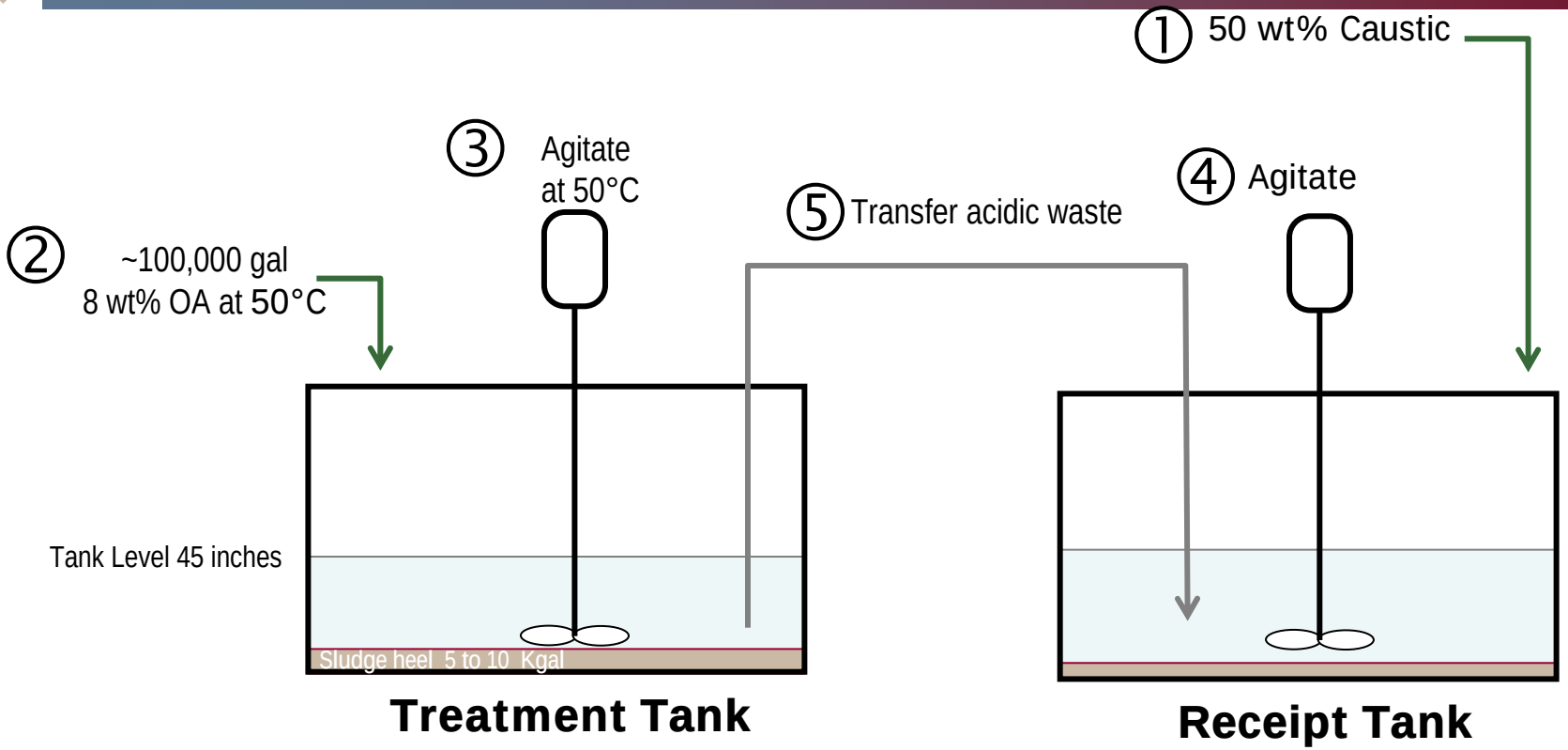
Chemical Cleaning of FTF Type 1 Tanks

- **SRNL testing on actual waste and simulant**
  - **Tests executed at 25, 50, and 75 degrees C in two modes of operation – mixed and unmixed**
  - **Bounding hydrogen generation rate determined based on corrosion of carbon steel**
  - **Total gas generation rate measured**
  - **Corrosion rate of carbon steel quantified**
  - **Neutralization of acidic waste in receipt tank demonstrated**
  - **Dissolution efficiency demonstrated**

Technical Acceptability Chemical Cleaning

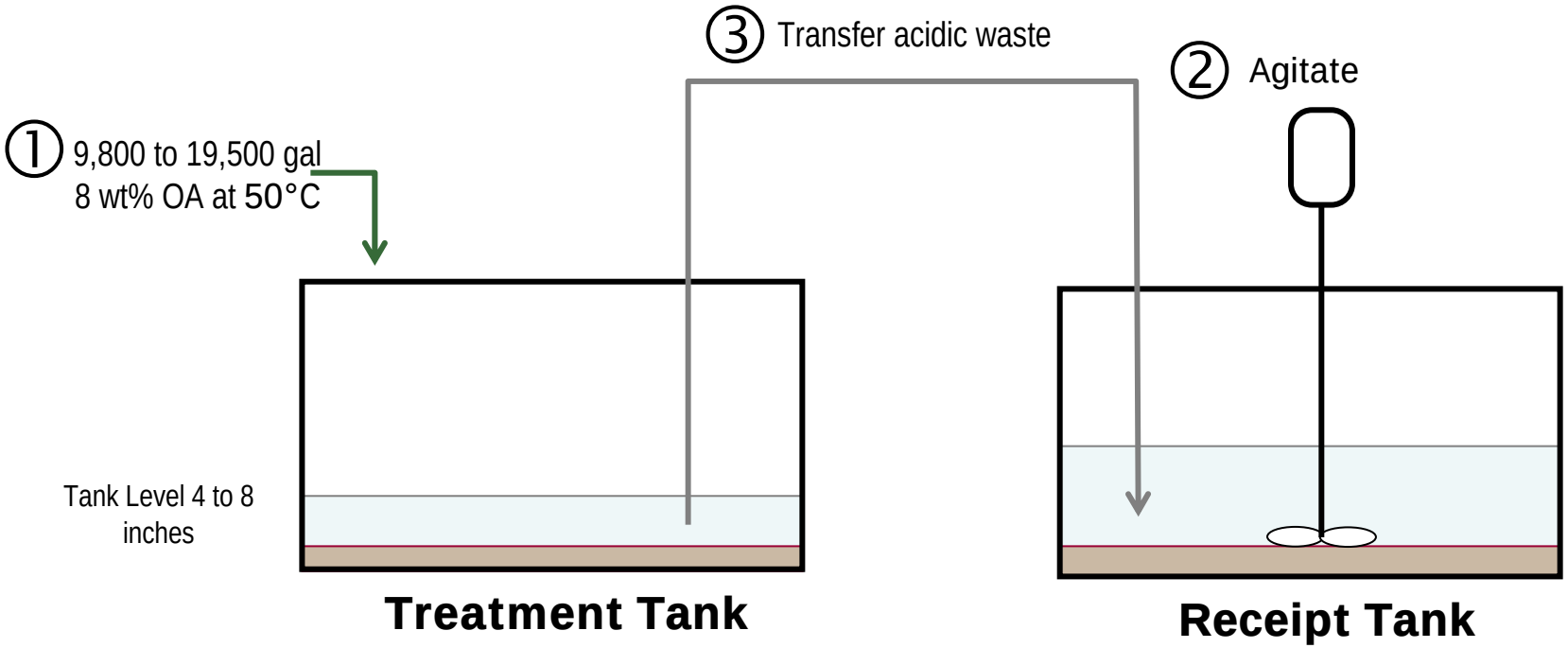
- Dissolution efficiency range from 60 to 99 percent in a first OA strike depending on metal hydroxide.
- H2 generated from both corrosion of carbon steel and radiolysis. Existing tank ventilation system will provide Safety Class function of minimum airflow.
- Tank wall corrosion rates will be on order of 45 to 60 mpy. Corrosion Control Program will define time limitation for OA cleaning to protect waste tank structural integrity.
- Total gas generation rates (CO2 dominates) will require approximately 700 cfm of supplemental exhaust ventilation from the Treatment Tank.
- Treatment Tank and Receipt Tank heating due to chemical reactions manageable with existing cooling systems.
- Materials of Construction in transfer path compatible with OA waste stream.

Planned Process Steps – OA Addition



- Caustic unloaded to Receipt Tank from tankers.
- OA unloaded to Treatment Tank from tankers at 50°C
- SMPs operated in Treatment Tank to aid dissolution and suspension
- Standard Slurry pumps operated in Receipt Tank to enhance neutralization
- Transfer procedures developed per existing Transfer Control Program

Process Steps – Subsequent OA Additions



- OA unloaded to Treatment Tank from tankers at 50°C and allow to soak
- SMPs will not be operated in Treatment Tank
- Heel transferred to Receipt Tank while Receipt Tank is slurried

Status of Chemical Cleaning

- Hazards Analysis and Documented Safety Analysis are approved to allow Chemical Cleaning of FTF Type 1 Tanks
- NCSE is approved and shows criticality is not credible
- Field modifications being implemented to add Oxalic Acid to Tanks 5 and 6
- Chemical cleaning scheduled to begin in April

Questions?

Noel Chapman

LWO F Tank Farm Closure Deputy Project Manager

Building 704-70F, Savannah River Site

Office Phone (803)952-3806

noel.chapman@srs.gov