

AVANTech Inc.

Arizona Public Service
Palo Verde Generating Station
TDS Tank Cleaning Project

Entergy
River Bend Station
FDC Tank Cleaning Project





AVANTech Inc.

AVANTech Inc. and BHI Energy teamed together to perform tank cleaning projects at Palo Verde Generating Station and River Bend Station. Each partner bringing a unique set of expertise and experience to the joint effort.

AVANTech Inc:

- Multiple Fill-Head Systems with Redundant Dewatering capabilities that utilizes High Velocity Vacuum (HVV™) Technology for efficient and reliable sludge handling.
- Specialty Sludge Liners and Solids Collection Filters for comprehensive solids capture
- Robust, Simple, Dependable Sludge Removal and Handling Equipment that is aligned with ALARA principles.

BHI Energy:

- Video Monitoring and Cleaning Equipment
- Floor Drain Cleaning Operations
- An Extensive Qualified Labor Base
- Personnel Management



Scope of Work for Tank Cleaning Projects:

- ❖ Remove Waste from All Tanks.
- ❖ Containerize and Dewater Waste.
- ❖ Reduce dose rates to ALARA conditions
- ❖ Return water to plant for reuse/recycle.
- ❖ Package Waste for disposition per plant.
- ❖ Meet Site Acceptance Criteria for Tank Cleanliness

Palo Verde Generating Station:

- (1) Site, (3) PWR's
- (7) TDS Tanks Total
- Estimated Waste/Tank – 60ft³ – 80ft³
- Estimated Total - 420ft³ - 560ft³
- **Waste/Sediment creating HRA outside of Site Design Criteria.**

River Bend Station:

- Single Unit, BWR
- (3) FDCT's, (1) WCT
- Estimated Waste/Tank – 500ft³ – 750ft³
- Estimated Total – 2,000ft³ – 3,000ft³
- Lost Tank Volume – 15%-22%/Tank
- Waste/Sediment creating LHRA's in RW.



Challenges to Successful Tank Cleaning:

#1 – Safety Concerns:

- ✓ Environmental Conditions (Temperature/Humidity)
- ✓ Actual, Physical Location of Tanks (PVGS–Outside, RBS–Closed Tank Farm)
- ✓ Working at heights in tight quarters from scaffolding.
- ✓ Movement of Tank cleaning equipment (Tank to Tank, Unit to Unit)
- ✓ Tank proximities and minimizing impacts to plant LRW Systems.

#2 – Pre-job Briefings –

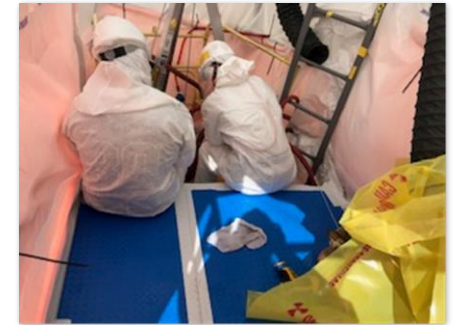
- ✓ Clear, Concise, Efficient to include Plant Status, work activities, schedule adherence, roles and responsibilities, and daily execution of the ALARA plan.

#3 – Communications –

- ✓ Between all work groups involved, up and down the organization.

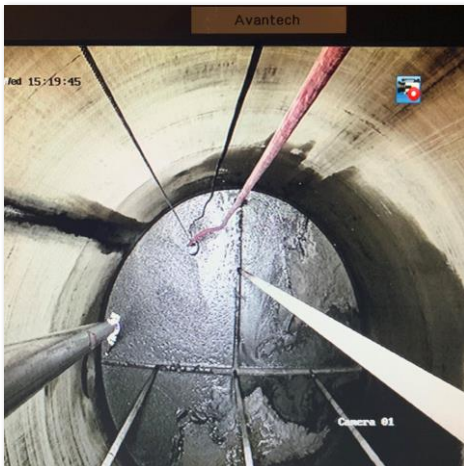
#4 – Personnel –

- ✓ Proper Staffing level and use of remote monitoring of Tank/Process areas including personal electronic dose/dose rate meters.
- ✓ Keeping crew together throughout project promoted better Teamwork.





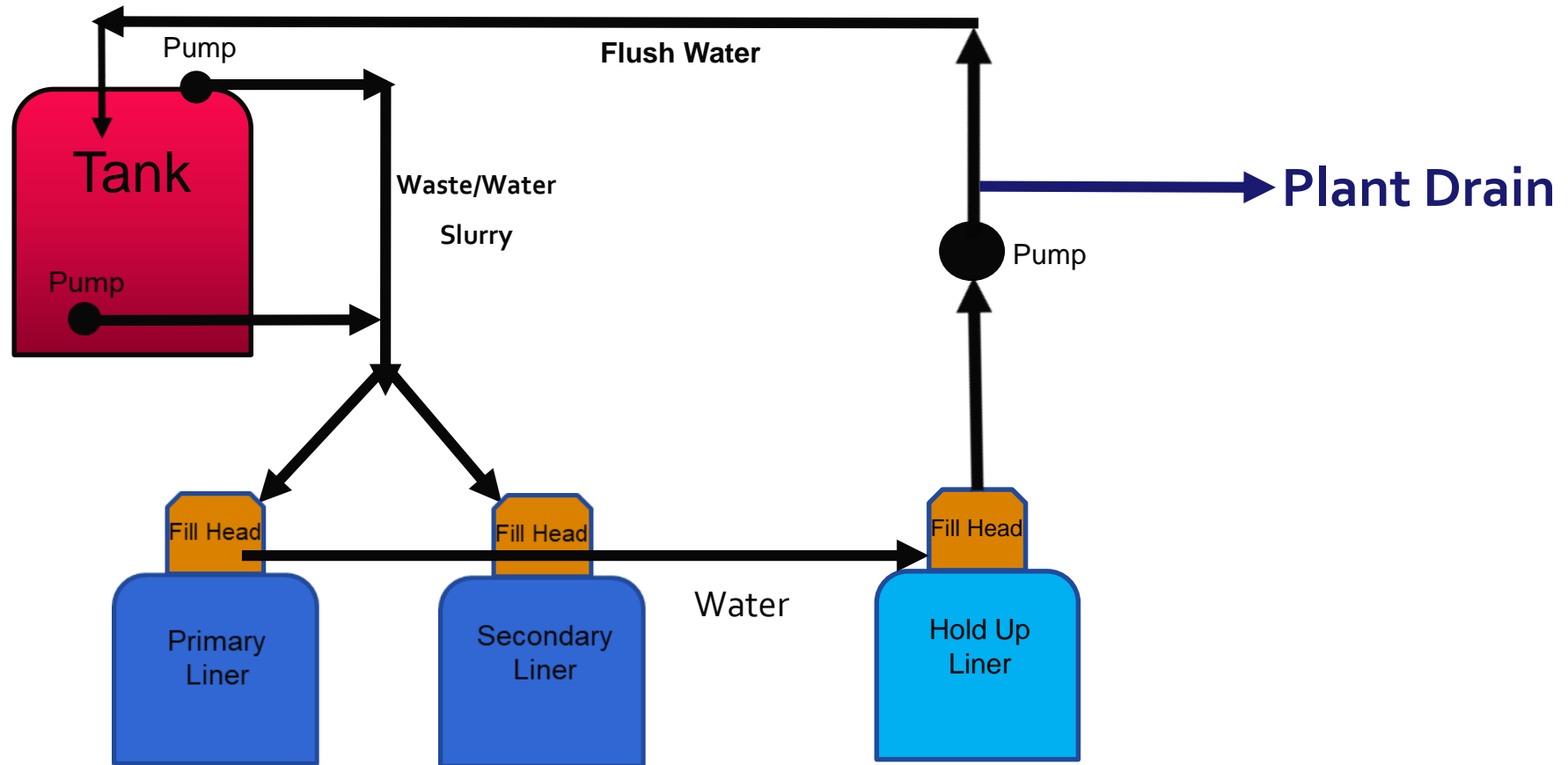
Pre-Determined Tank Cleaning Schedule



- Executed Tank Cleaning Plan by performing first evolutions on a low dose rate Tank.
- Operational experience gained lead to simple modifications to vendor cleaning equipment.
 - Reduced amount of Tank Clean Out time.
 - Enhanced waste/sediment slurry movement.
 - Waste removal by concentrating on one quadrant at a time.
- Lessons Learned from the first Tank cleaning were discussed and applied prior to proceeding.
 - Limit number of personnel needed to perform evolutions.
 - Utilize remote monitoring/viewing more, camera system in area and tank.
 - Keep water level in adjacent tanks higher to provide shielding.
 - Direct communications between work groups at tank and process area.



Simplified Tank Cleaning Process



Proven Technology with Proven Results



Tank Cleaning Results

Common Accomplishments for PVGS & RBS:

- ✓ No significant incidents and No injuries
- ✓ No Personnel Contamination Events
- ✓ No Dose, Dose Rate Alarms or RWP violations (Correct Task #'s/WO Task #'s)
- ✓ ALARA Dose Goals and Waste Collection Estimates were met.

Palo Verde Specific Results:

- **1,015 mR** received by AVANTech and BHI workers.
- **3,102 mR** Total received by all workers, 7 Tanks.
- **~443 mR/Tank** start to finish.
- **~400 ft³ Waste** collected in four liners.
- All TDS Tank areas down posted from HRA's to RA's.
- Each Tank cleaning from opening to closure lasted ~50 hours
- Evolutions included RP Surveys, scaffolding, shielding, manway removal/install, cleaning and Demob from Tank to Tank and Unit to Unit.

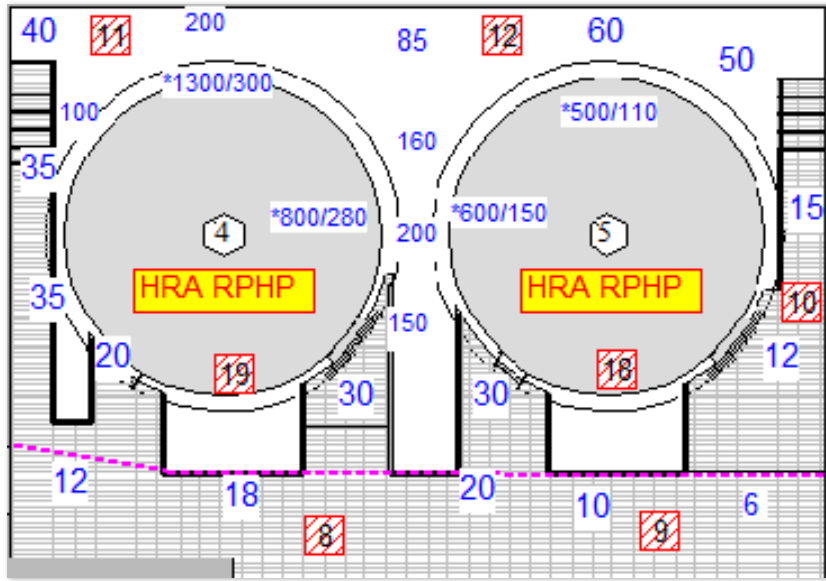
River Bend Specific Results:

- **1,885 mR** received by AVANTech and BHI workers.
- **921 mR** to Demob/Set up next Tank.
- **4,629 mR** Total received by all workers.
- **~1,150 mR/Tank** start to finish.
- **~540 ft³ Waste** collected in four liners.
- Time to clean each tank varied by plant processes.
- Evolutions supporting Tank cleanings included RP Surveys, scaffolding, remove/install floor plugs, shielding, and Demob.
- ❖ RBS added an additional Tank to scope of work.

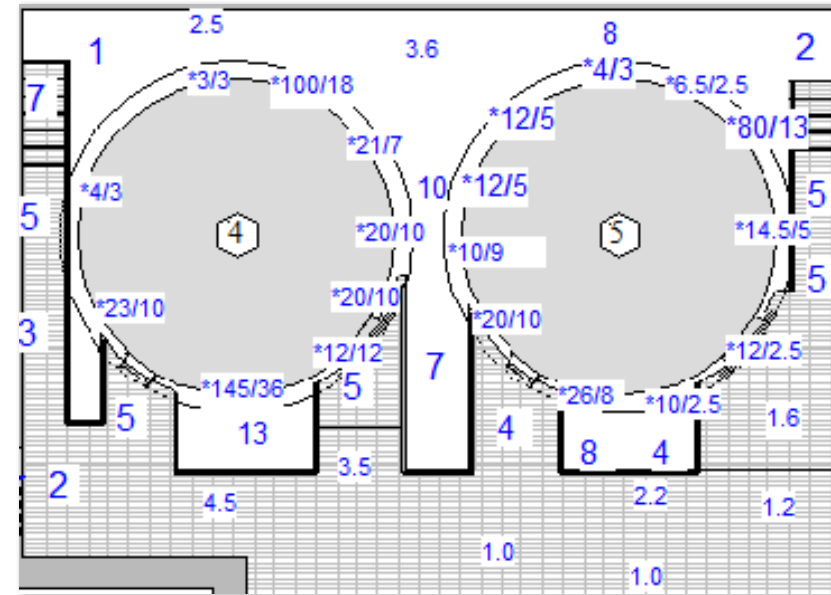


AVANTech Inc. Palo Verde TDS Tank

Pre TDS Tank Cleaning Survey



Post TDS Tank Cleaning Survey





River Bend Addition Work Scope

River Bend Expanded Work Scope:

Clean Floor Drains and Sumps to prevent materials from getting to the cleaned FDC Tanks.

Plant Related Debris - Resin, Walnut Filter Media, Powdex Resin, Dust, Dirt, Rust scale

People Related Debris - Conduit flex nuts, drill bits, tie-wraps, bolts, nuts, tubing flare nuts.

~ 200 gallons of debris removed. Highest canister reading 1R, lowest 350 mR



Benefits Obtained from Floor Drains and Tank Cleaning:

Two less RO filter replacements for 2018, 800mR reduction, \$380,000 less O&M in filters and disposal cost.

Significant improvement in chemistry results.

After a recent flooding event, floors drained in hours versus days.

In process of validating GA dose rate reductions in Radwaste.

Significant reduction on in-let strainer maintenance that feeds the LWP System.



Scope of Work for Tank Cleaning Projects:

- | | |
|---|---------------------|
| ❖ Remove Waste from All Tanks. | ACCOMPLISHED |
| ❖ Containerize and Dewater Waste. | ACCOMPLISHED |
| ❖ Reduce dose rates to ALARA conditions | ACCOMPLISHED |
| ❖ Return water to plant for reuse/recycle. | ACCOMPLISHED |
| ❖ Package Waste for disposition per plant. | ACCOMPLISHED |
| ❖ Meet Site Acceptance Criteria for Tank Cleanliness. | ACCOMPLISHED |



AVANTech Inc.



❖ QUESTIONS?

❖ COMMENTS!

❖ DISCUSSIONS

