

1. Tank Inspections



Overview

- Why?
- When?
- Who?
- How?
- Testing
- Budget
- Tips
- DIY



Why?

- Clean out silt.
- Enhance water quality.
- Prior to rehab - determine scope of work.
- Leaking.
- Looks like crap.
- Premature coating failure.
- Part of maintenance plan.
- Someone made you: government agency.
- Take care of small problems before they become big costly repairs.

When?

#1: Anniversary

- 1 year after new construction or rehab.
- Include verbiage in specs.
- Little to no cost.
- Typically use ROV, don't drain tank.
- Touch-up painting - ensures full life-span of coatings is achieved.
- Repairs done:
 - at no cost.
 - while under warranty.
 - contractor still in business.

Anniversary







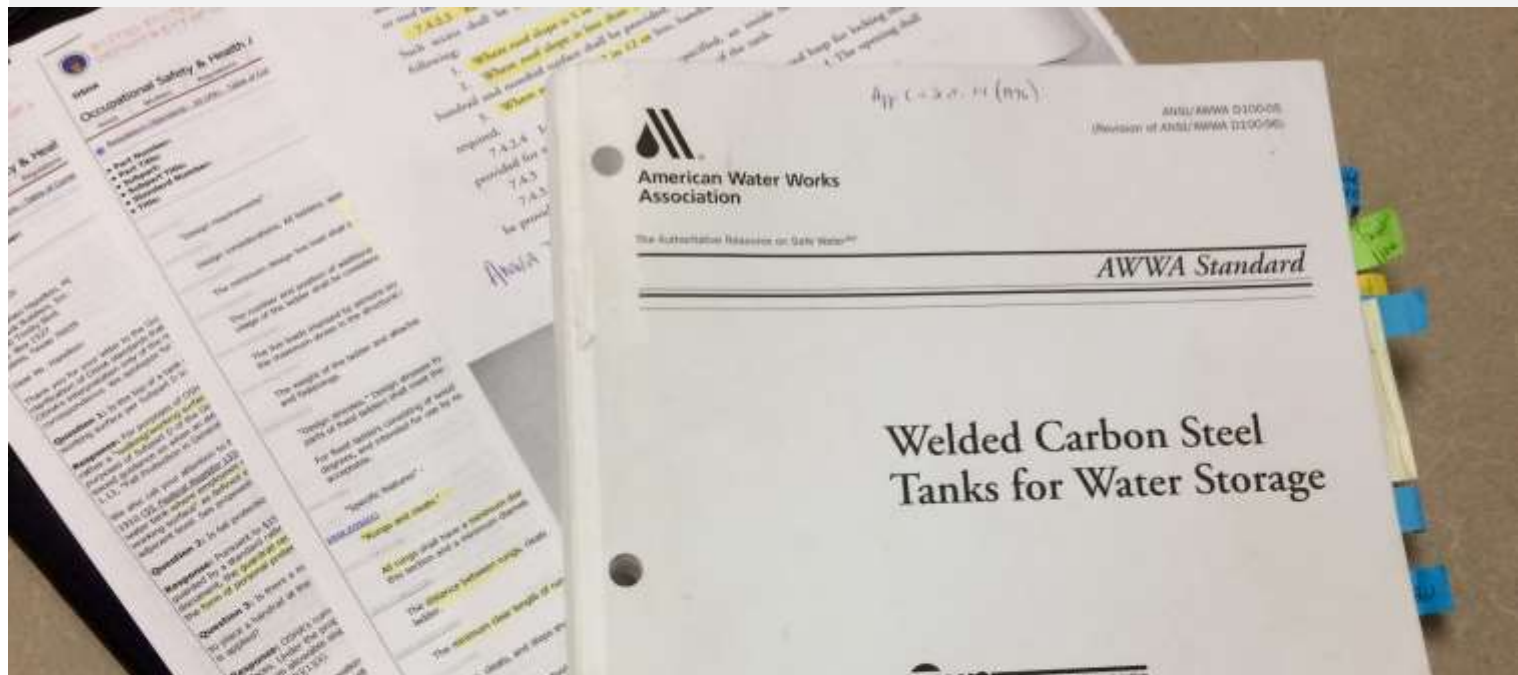




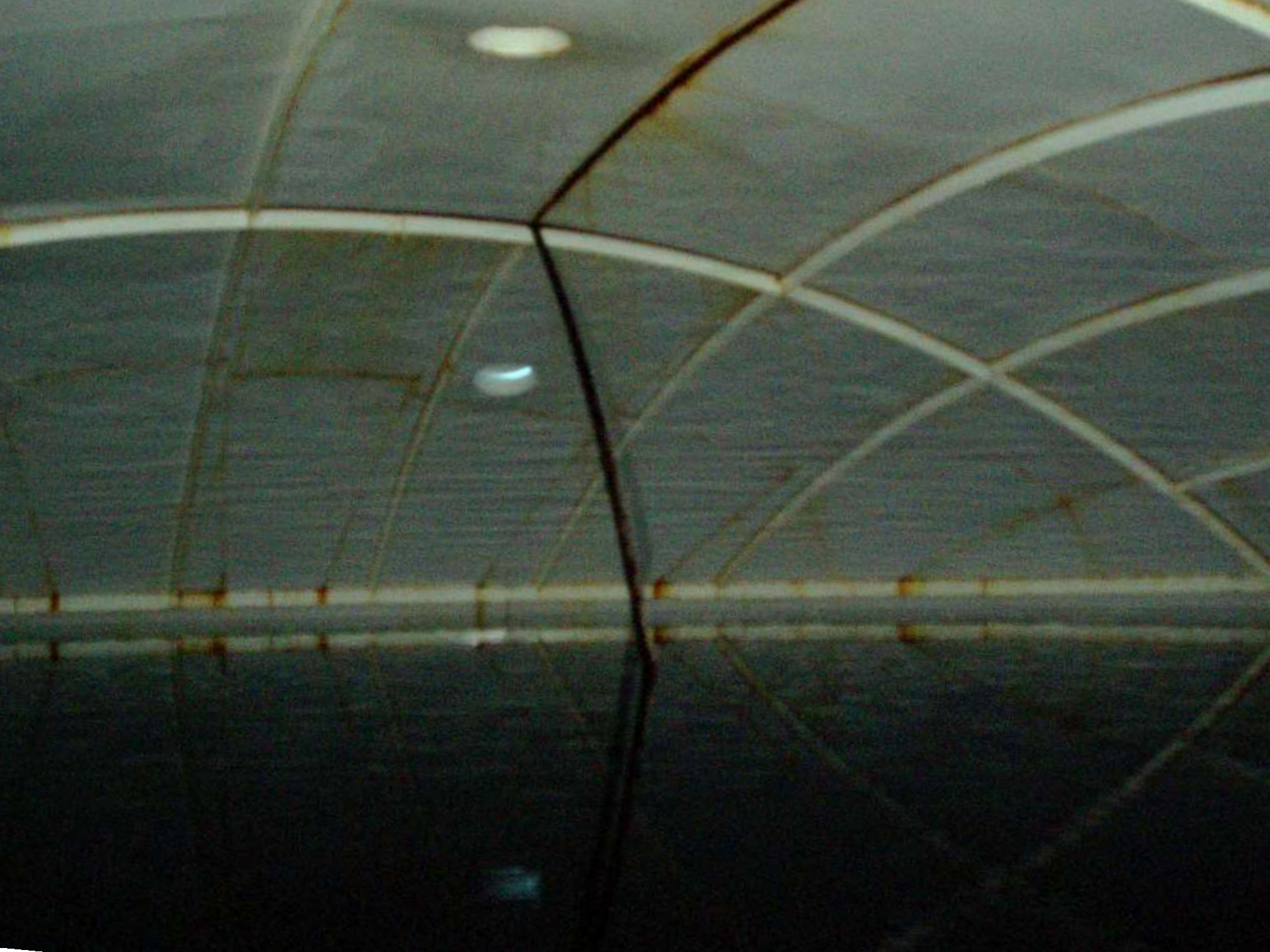
When?

#2: AWWA Standards

- Recommend inside and out every 3 years.
- For welded steel, bolted steel, and concrete.
- Within 1 year of planned rehab.









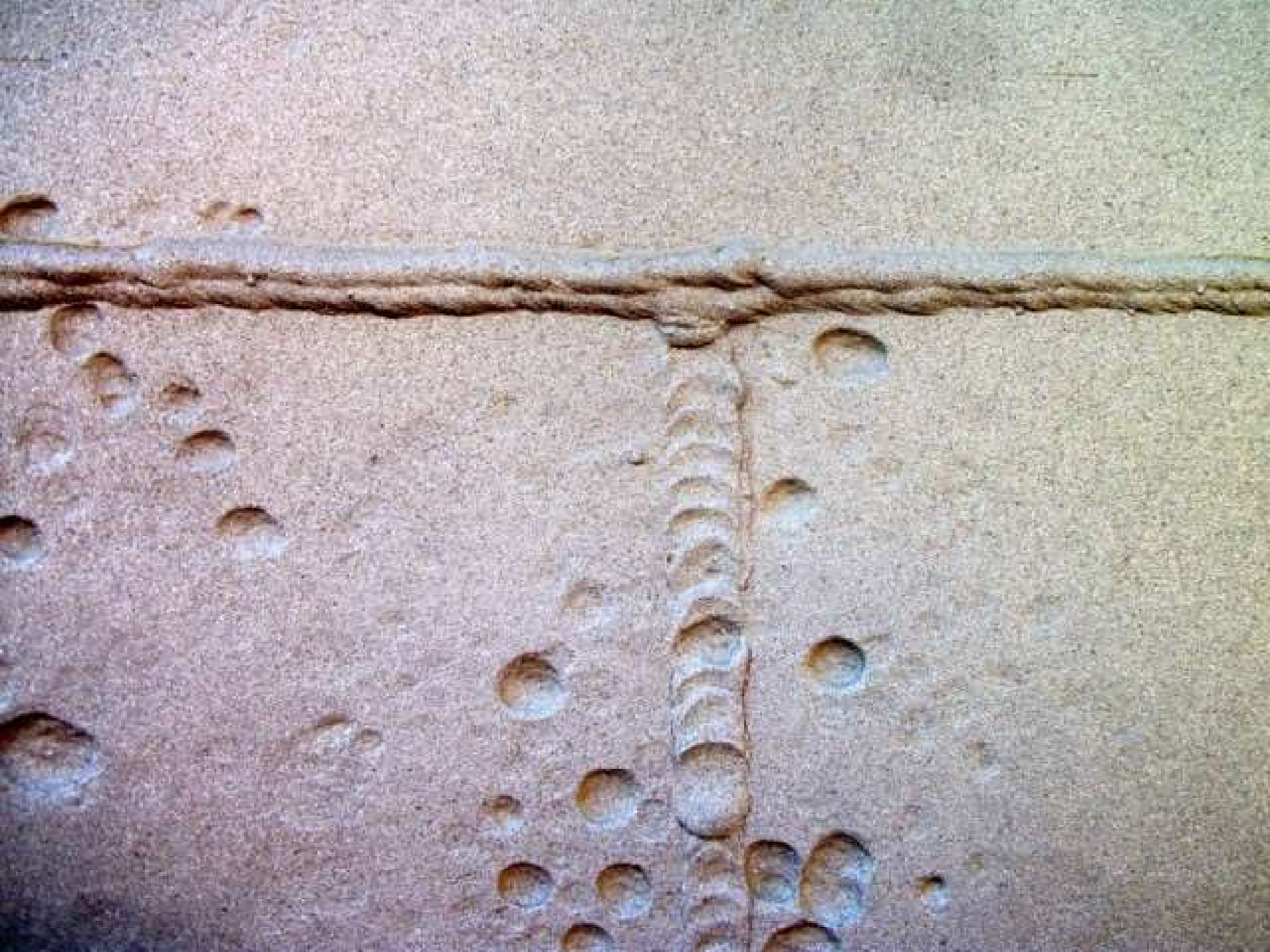
When?

#3: Wastewater Tanks

- No requirements.
- Be proactive instead of reactive.
- Can cost less in long run, allows you to plan outages.
- Budget for repairs.
- Perform during cleanout – visual inspection of concrete and metals, looking for:
 - Cracks, spalling, exposed aggregate.
 - Rust, pitting, peeling paint.







When?

NFPA 25 – Fire Protection

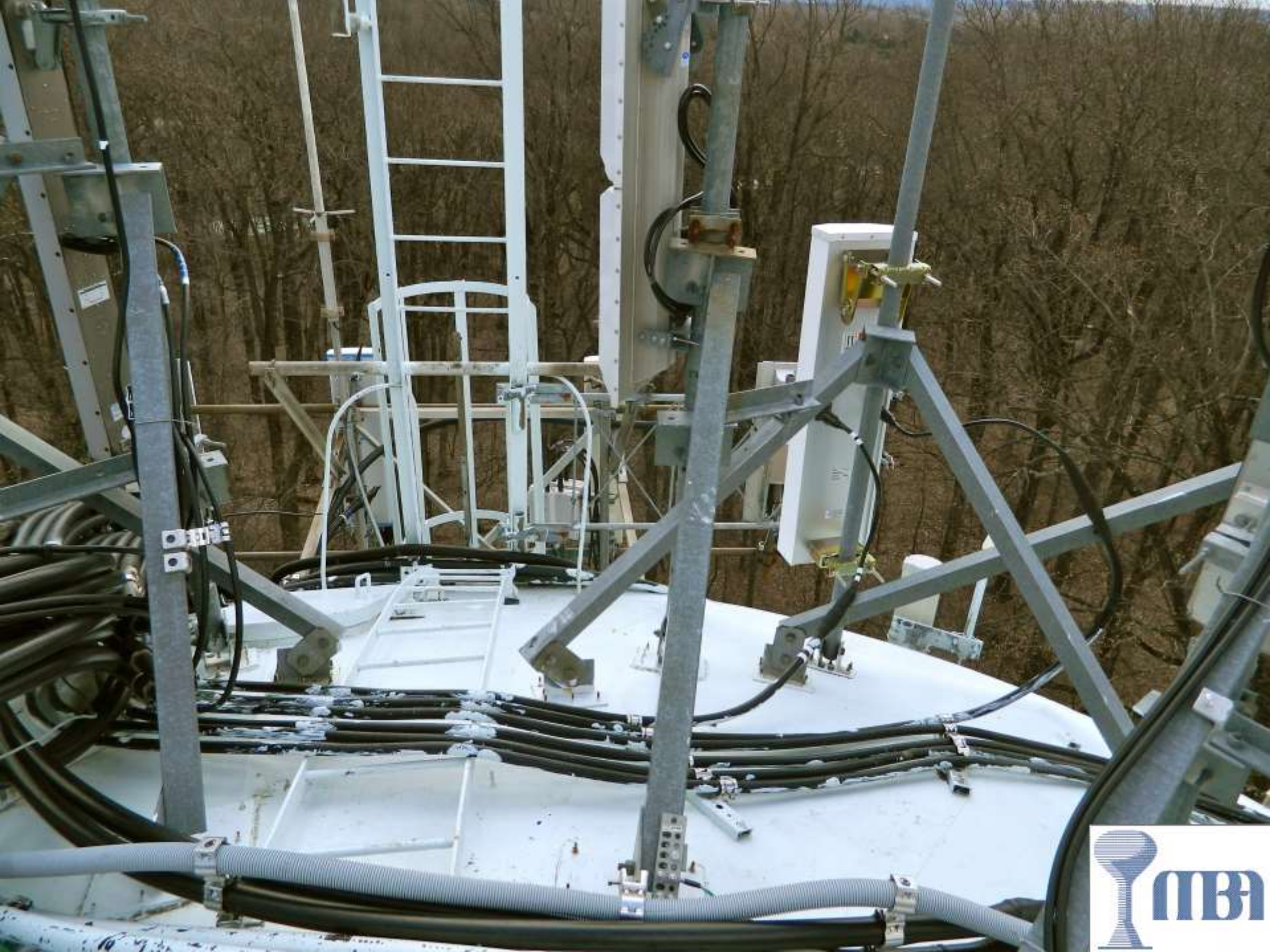
- Required inside every 5 years.



When?

#4: Cell Carrier Antennas

- ***Pre-Antenna Installation***
 - Document conditions prior to work.
- ***Post-Antenna Installation***
 - Document conditions after work.
 - Ensures completed per specs.
 - Checks for coatings damage.
- ***FREE*** – If a condition of contract.







Who?



Tank Manufacturer?
Buddy with a drone?
Your Engineer?
You?
NACE Inspector?
Tank Painter?
Paint Manufacturer?
Me?

Who?

Qualified Tank Inspection Firm

- Performs 100+ tank inspections per year.
- Knows AWWA, OSHA, State Regs.
- NACE Level 1 minimum Training.
- Safety Trained – heights, confined spaces.

You get what you pay for.



Which report do you want?

Good Inspection Report

- Easy to read and understand.
- References applicable standards: AWWA, OSHA, PA DEP.
- Knowledge of and practical use of standards.
- Documents condition of the coatings and structure.
- Notes size, location, condition of all accessories.
- Pictures (50 minimum) and video if underwater inspection.

Therefore, these Standards are to be used as a guideline only, are not to be construed or interpreted as any type of requirement, and abiding by any of the requirements of these Standards are voluntary and not mandatory.

Item	Description	Yes	No	N/A
1.	This tank has two shell manholes located in the first ring that are at least 20" in diameter:			
2.	An additional upper access hatch is installed near the center of the tank roof which has a at least a 4" high tank riser and a door plate with flanged edges so that a ventilation fan can be installed:			
3.	The existing upper access hatch has at least a 4" high tank riser and a door plate with edges that extends down over the riser at least 2" and is at least 20" in diameter:			
4.	The existing lower access hatch into the riser pipe is at least 20" in diameter:			



Quadrant 1

Quadrant 2

Quadrant 3

STAINING IN ALL QUADRANTS

UNIFORM SURFACE CORROSION AND COATING FAILURE IN ALL QUADRANTS

BLISTERING IN ALL QUADRANTS

ROOF

Testing and Discrepancy Locations

FLOOR

Q4

Q1

Q4

MINOR UNIFORM SURFACE CORROSION
IN ALL QUADRANTS

STAINING IN ALL QUADRANTS
MINOR UNIFORM SURFACE
IN ALL QUADRANTS

4. **Repair Items**

- ☐ Epoxy Coating Repairs: NONE RECOMMENDED
- ☐ Temporary Leak Repairs: NOT NEEDED
- ☐ Float Operated Level Indicator Repairs / Maintenance: NOT NEEDED
- ☐ Hypalon Repairs: N/A

5. **Security Related Items** *(Critical security upgrade information is immediately available)*

- ☒ Tank vents are not equipped with a security vent shroud:
- ☒ Tank hatches are not equipped with a security hatch locking device:
- ☐ Tank perimeter not adequately secured:

The above mentioned additional work is considered immediately necessary and is recommended to be completed. Some items in conjunction with work currently being performed while the crew is on site.

Reservoir Inspection Condition Supplemental

RECOMMEND CLEAN & INSPECT EVERY 3 YEARS

SECURITY ITEMS CHECKED ABOVE

RECOMEND THAT THE TANK HAVE A BLAST AND RECOAT DUE TO THE COATING FAILURE AND BLISTERING.



Channel 2

12C
1



13
1

62

Full Frame 4.7x

Watermark: 0011

11C
2



ASSET MANAGEMENT PROGRAM - SCHEDULE OF WORK

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
RT 356 GST Tank 750K #1	Ext & Int Renovation Repair	Visual Insp. Repairs Emer-Serv	Washout Inspection	Visual Insp. Repairs Emer-Serv	Washout Inspection	Visual Insp. Repairs Emer-Serv	Washout Inspection	Visual Insp. Repairs Emer-Serv	Washout Inspection	Visual Insp. Repairs Emer-Serv	Exterior Overcoat	Visual Insp. Repairs Emer-Serv	Washout Inspection	Interior Renovation	Washout Inspection
SPREAD	\$ 143,003	\$ 143,003	\$ 143,003	\$ 143,003	\$ 143,003	\$ 32,116	\$ 33,252	\$ 34,429	\$ 35,648	\$ 36,910	\$ 38,220	\$ 39,577	\$ 40,982	\$ 42,436	\$ 43,943
Total Annual	\$ 143,003	\$ 143,003	\$ 143,003	\$ 143,003	\$ 143,003	\$ 32,116	\$ 33,252	\$ 34,429	\$ 35,648	\$ 36,910	\$ 38,220	\$ 39,577	\$ 40,982	\$ 42,436	\$ 43,943
Quarterly	\$ 35,751	\$ 35,751	\$ 35,751	\$ 35,751	\$ 35,751	\$ 8,029	\$ 8,313	\$ 8,607	\$ 8,912	\$ 9,228	\$ 9,555	\$ 9,894	\$ 10,246	\$ 10,609	\$ 10,986
Monthly	\$ 11,917	\$ 11,917	\$ 11,917	\$ 11,917	\$ 11,917	\$ 2,676	\$ 2,771	\$ 2,869	\$ 2,971	\$ 3,076	\$ 3,187	\$ 3,298	\$ 3,409	\$ 3,526	\$ 3,662

Services:

- Yearly Inspections
- Yearly Reports
- Bi-Yearly Washouts
- Emergency Services
- Spread Payments
- Annual Budget
- NO Change Orders

Exterior:

- Contain & Blast
- Lead Disposal
- SP6-3 Coat System

Interior:

- Blast
- Lead Disposal
- SP10-2 Coat System

Renovations:

- Extend Overflow
- Install Flapper/Screen
- Install 30" Manway
- Install Ladder Gate
- Install Frost Proof Vent
- Repair Target System





Photo #61

Date

12/14/2015

Location

Exterior

Notes

Spots of active corrosion on shell.



Photo #62

Date

12/14/2015

Location

Exterior

Notes

Typical spot of active corrosion on shell.

minuscule amount of sloped grout appeared to be present at the base of the riser, and was in poor condition. See photographs #12-#21.

3. Protective Coating - The coating is an acrylic overcoat system that was found to be in fair condition. Total dry film thickness readings retrieved measured 4-12 mils. Coating adhesion testing was performed in accordance with ASTM D3359, Method A (X-cut). The ASTM adhesion rating for Method A range from 0A-5A, with a 0A rating being the worst, and a 5A rating being the best. The exterior coating met the criteria of a 3A rating, indicating jagged removal of most of the coating up to 1/16" on either side of the incision. See photograph #33.

Minor weathering and mildew growth were present on all surfaces below the catwalk. The coating on the legs, riser, bowl, anchor bolts, rods, base plate, struts, riser manhole, leg ladder, and ladder cage was exhibiting isolated top coat delamination and coating delamination down to substrate, resulting in active corrosion and rust emanation. The only evidence of metal loss was detected at the riser base plate, where minor base plate knifing was noted. Sporadic active corrosion was present along the catwalk platform to



Good Inspection Report

Conclusions must include:

- Recommendations for repair and repainting, if needed.
- Time-frame for repairs.
- Cost estimate for repairs and repainting.





Rehab Estimate Sheet

By Qualified Tank Painter*

P.O. Box 733
New Castle, DE 19720
Phone: (800) 486-4841
Fax: (302) 655-8260
www.mbatanks.com

Customer **Entech Engineering**

Location

Tank Name

Type of Tank

Capacity

Total
Lead
Test

Int. Wet

Int. Dry

Exterior

950

N/A

3200

Estimated Coating Repair Cost

	Square Foot	\$ / sq.ft.	Coating Repair		
Int. Wet	4000	15.00	Spot SP10 / Full SP7	Int. Wet Cost	\$60,000.00
Int. Dry	N/A	N/A	N/A	Int. Dry Cost	\$0.00
Exterior	8000	30.00	Full SP6 w/ 2A Contain	Exterior Cost	\$240,000.00
Total Coating Cost					\$300,000.00

Estimated Metal Repair Cost

Remove vegetation from site.	\$2,500.00
Replace valve vault piping.	\$10,000.00
Perform foundation and grout repairs. Apply sealant.	\$7,000.00
Extend overflow pipe to grade.	\$15,000.00
Install new 24" diameter riser manhole.	\$9,000.00
Install hinge/davit arm on existing riser manhole.	\$2,500.00
Remove all exterior ladders and replace with OSHA compliant ladders.	\$15,000.00
Install new galvanized flexible cable safety climbs on exterior ladders.	\$4,000.00

How?

- Dry
- Wet
 - ROV
 - Dive
 - Raft
- Drone





Dry Evaluation

Dry Evaluation

Benefits

- Cleanout silt.
- Can make repairs, if prepared.
- Thorough bottom inspection.

Limitations

- Tank is out of service for 4-7 days minimum; may be impossible.
- Coordination and time for Owner's work.
- Need to disinfect tank and test water after.
- Most costly option.
- Limited visibility of upper shell & roof.



Remotely Operated Vehicle (ROV)



Remotely Operated Vehicle (ROV)



ROV Evaluation

Benefits

- Tank remains in service.
- Owner provides access – that's it (usually).
- Lowest cost option, most popular.
- Skilled operator can gather valuable data.

Limitations

- No repairs. Limited turns. No sharp objects.
- No visibility in murky water.
- Limits of tether – 300'.
- Limited thrusting capacity – no currents.
- Need 16" diameter access to drop and retrieve.



Diver



Diver Evaluation

Benefits

- Tank remains in service, but off-line during dive.
- Medium cost option.
- Cleanout & minimal repairs are possible.
- More of roof and entire shell are visible.

Limitations

- No visibility in murky water.
- Limit of water depth – 100'.
- Safety concerns.
- Need tank full to access; warmer weather.
- May result in turbidity issues.



Drone

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ter tower—
are effective
or safety
tions.





Drone Footage

Drone Evaluation

Benefits

- No climbing required.
- Check for safe roof access prior to climbing.
- Close visual of all surfaces except interior roof.
- Unique perspective.

Limitations

- Not hands-on.
- No measurements.
- Safety issues - power lines, cell antennas, lose signal, crashing.

Use in conjunction with other methods.

Additional Testing Options

Adhesion of Coatings

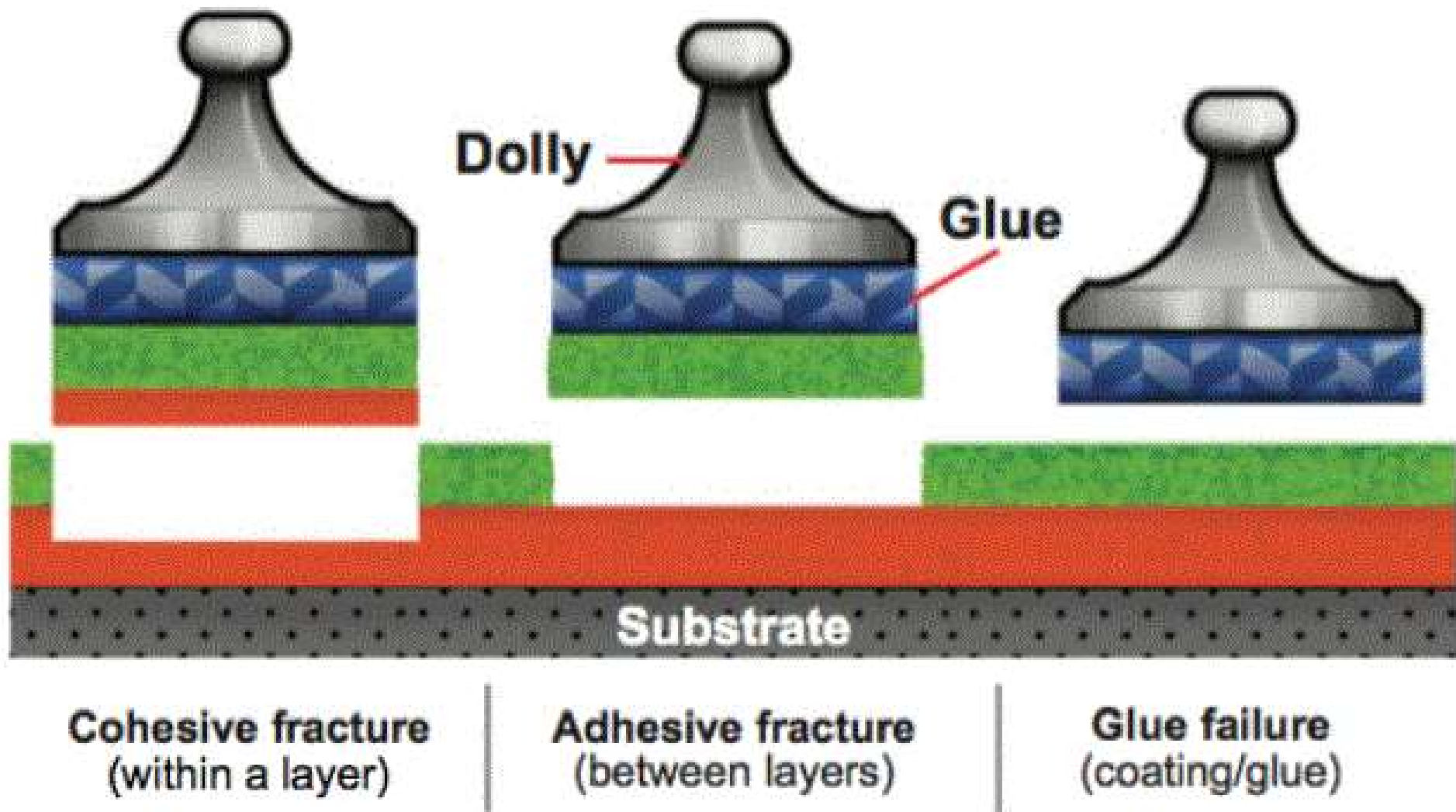
- Ensure proper curing and adhesion during painting.
- Determine cause of premature coating failure.
- Determine if overcoating is option on large project.
- Note – these are DESTRUCTION testing methods, will need coating repair.



Tape Test – ASTM D3359



Pull-Off Strength



Additional Testing Options

Steel Thickness

Ultrasonic Thickness (UT) Testing

- Thickness of shell plates or pipe walls.
- Accurate on smooth surface, no pitting.
- One tiny data point; results may be unclear.



UT Testing

Additional Testing Options

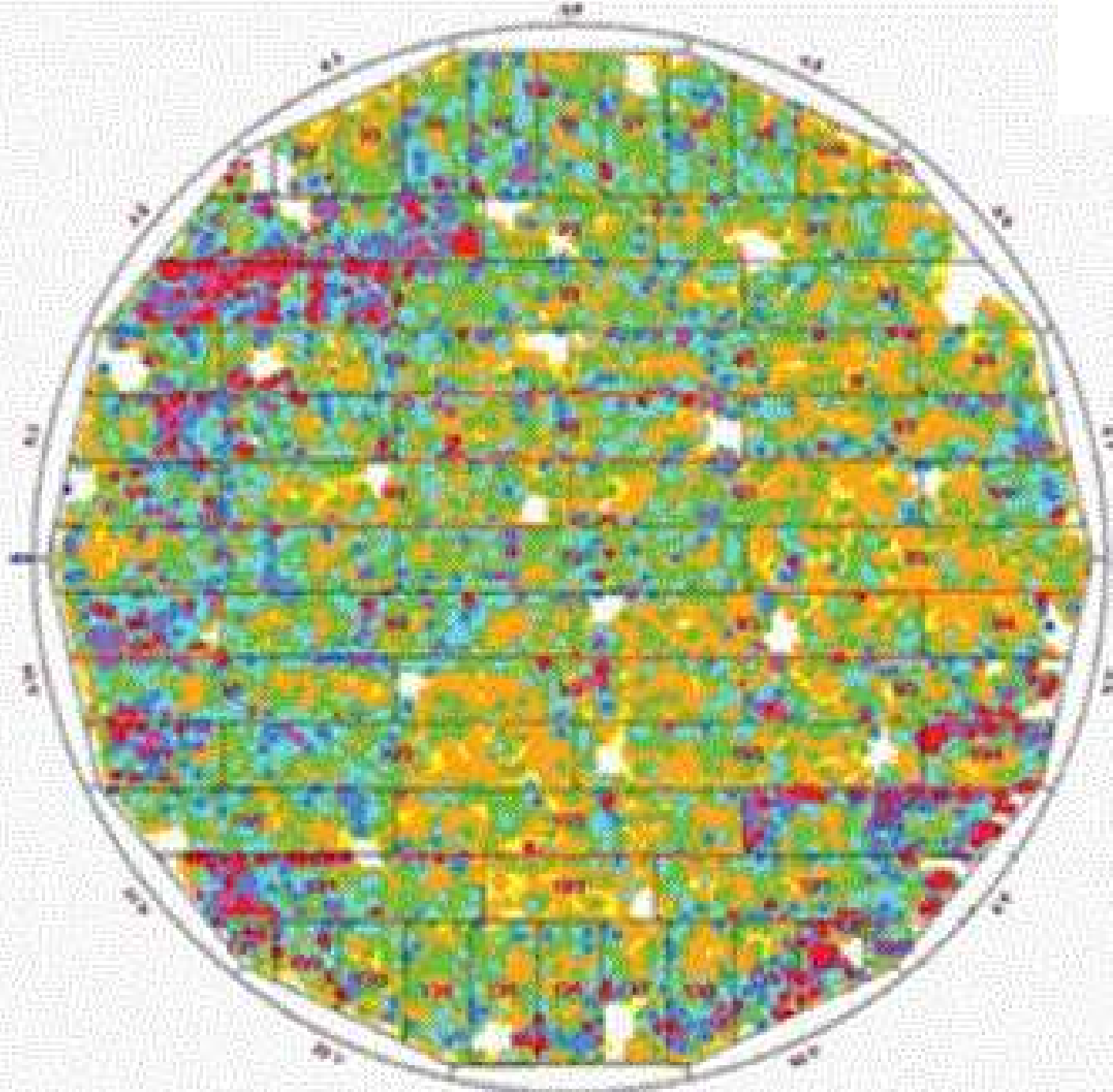
Steel Thickness

Magnetic Flux Leakage (MFL) Testing

- Floor plates with underside corrosion, pipes.
- Typical in petroleum industry, larger tanks.



MFL Testing



Additional Testing Options

Survey

- For settlement of foundation or bottom.

Concrete Testing

- Hammer test for soundness.
- Windsor Probe test for strength.

Budget – Dry Evaluation

<u>Task</u>	
Evaluation	\$3,000
Heavy Metals Testing	\$ 200
Cleanout/Disinfect	\$1,500
TOTAL	\$4,700
Coordination	\$1,000
Drain/Fill Tank	\$1,600
Water Testing	\$1,200
TOTAL	\$3,800
GRAND TOTAL	\$8,500



Inspector



Owner

Budget – ROV Evaluation

<u>Task</u>		
Evaluation	\$3,000	Inspector
Heavy Metals Testing	\$ 200	
Cleanout/Disinfect		
TOTAL	\$3,200	
Coordination	\$ 300	Owner
Drain/Fill Tank		
Water Testing		
TOTAL	\$ 300	
GRAND TOTAL	\$3,500	

Budget – Dive Evaluation

<u>Task</u>		
Evaluation	\$4,500	Inspector
Heavy Metals Testing	\$ 200	
Cleanout/Disinfect		
TOTAL	\$4,700	
Coordination	\$ 300	Owner
Drain/Fill Tank		
Water Testing		
TOTAL	\$ 300	
GRAND TOTAL	\$5,000	

Budget

<u>Task</u>	<u>Dry</u>	<u>ROV</u>	<u>Dive</u>
Evaluation	\$3,000	\$3,000	\$4,500
Heavy Metals Testing	\$ 200	\$ 200	\$ 200
Cleanout/Disinfect	\$1,500		
TOTAL	\$4,700	\$3,200	\$4,700
Coordination	\$1,000	\$ 300	\$ 300
Drain/Fill Tank	\$1,600		
Water Testing	\$1,200		
TOTAL	\$3,800	\$ 300	\$ 300
GRAND TOTAL	\$8,500	\$3,500	\$5,000

Tips

Scheduling

- 1-2 months in advance.
- From 2-3 hours to 2 days to perform.

Info to Provide

- Dimensions, height to ladder, is there a ladder?
- Tank history, when built, last painted, old reports.
- Problems with the tank, reason for inspection.

Preparation

- Water level as high as possible (ROV/dive).
- Keys for locks on ladder gate & hatches.
- Valves work/close properly, system still working.

DIY Tank Inspection

- Be safe – stay on the ground.
- Still need PPE:
 - Hard Hat
 - Safety Glasses
 - Boots
- What to look for?
 - Leaks.
 - Openings into site and tank are secure.
 - Changes to tank.
 - Rust.





Site





Foundation & Chime















Leaks



Shell







Coating Deterioration



Rust, Metal Loss, Water Seepage



Overflow Screen Clear





Valve Vault

DIY Tank Inspection – Climb?

- Be safe. ONLY climb if you:
 - Know you can – physically able.
 - Have the right safety gear.
 - Harness, lanyard, sleeve for safety climb.
 - Have climb training.
 - No fear of heights.
 - Secure objects to your body.



Roof





Hatches Secured





Vent Screen



Cathodic Protection Holes



Perimeter of Aluminum Roofs



Tank Inspections Review

Why + When + Who + How
Special Testing + Budget + Tips + DIY



Questions?



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