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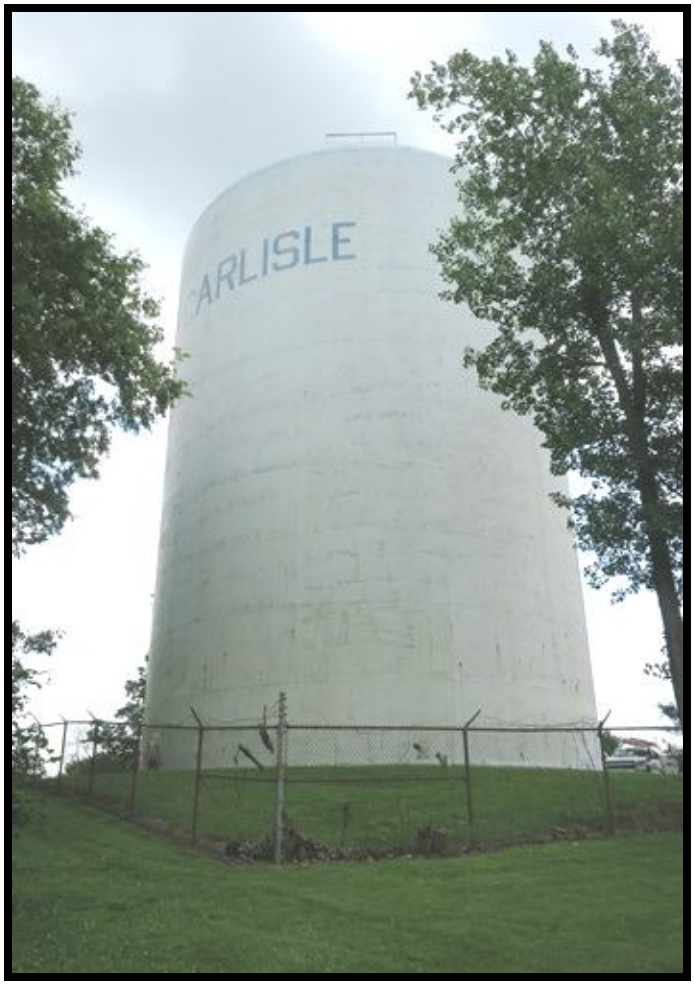

EVALUATION OF THE

1,730,000 GALLON STANDPIPE

NEW CARLISLE, OHIO

FOR

CITY OF NEW CARLISLE
NEW CARLISLE, OHIO

July 14, 2017

17.096.H1664.001

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August 11, 2017

SUBJECT:

The subject of this report is the field evaluation of the 1,730,000 gallon standpipe in New Carlisle, Ohio. The tank was owned by the City of New Carlisle, Ohio. The field evaluation was performed on July 14, 2017 by Gregory P. Cannon, NACE Certified Coating Inspector Level 3, Certificate No. 10339, Jamie Stewart, NACE Coating Inspector Level 1 Certified, Certificate No. 64809, and Jared Colahan, NACE Certified Inspector Level 3, Certificate No. 47251 of Tank Industry Consultants. The Owner's representative on the site at the time of the field evaluation was Jason Rose. The column and rafter supported roof tank was of welded steel construction. According to information on the tank nameplate, the tank was built in 1975 by Chicago Bridge and Iron Company under contract number 74-20814, and had a capacity of 1,730,000 gallons. The tank nameplate also stated that the tank diameter was 60 ft, and the nominal shell height was 82 ft.

OBJECTIVE:

The purpose of this washout, and evaluation was to determine the condition of the tank interior, exterior, exposed foundation, and accessories. The purpose of this report is to present the findings of the evaluation and to make recommendations for recoating, repairing, corrosion protection, and maintenance. Budget estimates for the work, anticipated life of the coating and the structure, and the replacement cost of the tank are also included.

AUTHORIZATION:

This washout, evaluation, disinfecting, and report were authorized in the Standard Agreement signed by Randy Bridge dated June 5, 2017.

EXECUTIVE SUMMARY:

The exterior coating system did not appear to be providing adequate protection to the surfaces. Tank Industry Consultants believes that the exterior of the tank should be repainted within the next 3 years from a corrosion standpoint, or sooner to improve aesthetics. The interior coating system appeared to be in poor condition. Spot coating failures in the shell and floor had allowed pitting to occur. Tank Industry Consultants recommends that the interior surfaces of this tank should be recoated in 1 to 2 years.

Structural Deficiencies: There was a structural deficiency observed on this tank. This deficiency included:

- bolts missing from rafter-to-shell connections.

ANSI/OSHA and Safety-Related Deficiencies: There were OSHA and safety-related deficiencies observed on this tank. These deficiencies included:

- exterior ladder safe-climbing device installed incorrectly,
- gap between roof and toe bar exceeded maximum allowed,
- conduit attached to exterior ladder,
- valve vault electrical equipment did not appear to include ground fault interrupt circuits,
- valve vault ladder head clearance was too small (29 CFR 1910.23(d)(12)(i),
- valve vault ladder toe room was too small (29 CFR 1910.23(d)(2)), and
- roof safety railing does not have a self-closing (29 CFR 1910.28(3)(iv))

If the Owner wishes to fully comply with OSHA and safety-related standards, it is recommended that these deficiencies be rectified.

AWWA and Operational Deficiency: There was a sanitary and operating deficiency observed on this tank as well. This deficiency was:

- roof manholes were not locked.

This deficiency should be corrected.

The safety-related, sanitary, and operating deficiencies listed above are not intended to be a complete list of deficiencies on this tank. The Owner should refer to the complete report text and accompanying photographs for a complete account of all observed deficiencies.

This evaluation and the reporting of the condition of this tank do not warrant the original structural condition of the tank or any of the original design for seismic loadings. Likewise, recommendations for this tank do not include modifications which may be required for compliance with present structural codes.

PHOTOGRAPHS:

Color photographs were taken of the visible portions of the foundation, the tank interior and exterior and are included as a part of this report. The significant photographs are keyed to the observations.

NOMENCLATURE:

The terms used in describing the various components of water tanks are unique to the industry. In fact, the terms vary from firm to firm and from person to person. In an attempt to define the terms used in this report, a sketch of the general type of tank covered is included at the end of the narrative portion of this report. Each horizontal row of steel plates on the tank is referred to as a "shell ring" or "ring." To

aid in referencing the shell rings, the bottom ring is referred to as shell ring 1 and the top ring is shell ring 10. **Warning: Some appurtenances on this tank may be referred to as erection or rigging attachments, lugs, or brackets. This does not mean that they are safe for rigging. Each attachment for each tank should be evaluated on an individual basis by a structural engineer or an experienced rigger before being used. These devices may have been intended for only the original erectors and painters to use with specialized equipment.**

ADHESION TESTS:

All adhesion tests performed during this evaluation were done in general accordance with ASTM D3359. The results are reported herein using the ASTM scale. The ASTM scale is a relative scale to rate adhesion from 0 to 5 with 5 being the best. A table of adhesion test results classification is included with this report following the sketch of the tank.

HEAVY METALS TESTS:

Samples of the exterior and interior coating systems were sent to a laboratory for inductively coupled plasma-atomic emission spectrometry analyses. The test results were as follows:

	Cadmium		Chromium		Lead	
	mg/kg	percent	mg/kg	percent	mg/kg	percent
Exterior	<25	<0.0025%	1,150	0.115%	173,000	17.3%
Interior	<25	<0.0025%	<250	<0.025%	<250	<0.025%

Tank Industry Consultants performs this test only to determine if there is lead, cadmium, or chromium present in the coating samples. To limit damage to the existing coating, only small areas were tested. The small number of samples taken and the difficulty of retrieving all primer from the steel profile may cause the tests performed to not accurately represent the total coating system. Variations in thickness, types of coatings applied, and the interim cleaning and painting operations will also affect the actual readings. The reliability of the results is also dependent on the amount of primer included in the sample. Additional testing to determine the amount of leachable contaminants present in the spent cleaning debris will need to be performed following cleaning operations at the time of repainting. Results from the laboratory analysis are included following the adhesion tables.

ULTRASONIC THICKNESS MEASUREMENTS:

(all readings were taken through coating)

Roof:		
	Plates:	0.229 in. to 0.232 in.
	Knuckle:	0.321 in. to 0.324 in.
Shell:		
	Ring #10:	0.304 in. to 0.307 in.
	Ring #9:	0.269 in. to 0.272 in.
	Ring #8:	0.267 in. to 0.272 in.
	Ring #7:	0.284 in. to 0.287 in.
	Ring #6:	0.301 in. to 0.304 in.
	Ring #5:	0.349 in. to 0.353 in.
	Ring #4:	0.405 in. to 0.409 in.
	Ring #3:	0.490 in. to 0.493 in.
	Ring #2:	0.529 in. to 0.532 in.
	Ring #1:	0.608 in. to 0.616 in.
Bottom Plate:		0.285 in. to 0.289 in., bottom

OBSERVATIONS:

A. Foundation and Site

SITE:

Size: approx. 125 ft x 155 ft

Fence:

Type: chain link, with 3 strands of barbed wire

Height: 6 ft

Gate:

Location: southwest side of site

Width: 16 ft 6 in.

Locked: yes

Nearest Structures:

Type: antenna tower

Direction: south

Distance: approx. 67 ft

Type: residence

Direction: south

Distance: approx. 130 ft

Type: residence

Direction: west

Distance: approx. 210 ft

Nearest Overhead Power Lines:
Direction: west
Distance: approx. 100 ft

Direction: south
Distance: approx. 120 ft

FOUNDATION:
Type: concrete ringwall
Projection Above Grade:
North: 2-1/2 in. to 6-1/4 in.
South: 1 in. to 3-1/2 in.
East: 2-3/8 in. to 3-1/4 in.
West: 7-1/2 in. to 9-3/4 in.
Grout: 7/8 in. to 1-3/8 in.
Sealant: none
Fiberboard: none

VALVE VAULT:
Location: approx. 19 ft west of tank
Size: 12 ft 6 in. x 9 ft x 7 ft deep
Access:
Size: 33-1/4 in. x 39 in.
Locked: yes
Ladder:
Side Rails: 2-1/2 in. x 1/2 in., flat bar
Width: 16 in.
Rung Size: 1 in.
Spacing: 12 in. diameter
Toe Room: 6 in.
Head Clearance: 28 in.

1. **Site Location**: The tank was located at 1102 Scarff Road in New Carlisle, Ohio. The nearest residence was located south of the tank site. Open fields and buildings were adjacent to the tank site. Overhead power lines were located outside of the site on the south and west sides. Access to the site was through a gate on the southwest side of the site. (See photos 1-11)

2. **Site Conditions**: **There was a safety deficiency: electrical cables were exposed at a broken conduit adjacent to the tank.** The tank site was covered with grass and was not graded to provide adequate drainage away from the foundation. The tank site was fenced. The chain link fence was topped with barbed wire and was equipped with a locked gate on the west side of the site. The fence appeared to be in fair overall condition with the exception of a damaged section of barbed wire on the northwest corner of the site. An informational sign was posted in site fence. Shed, electronic meter, and an antenna tower were located on site. (See photos 1-11)

3. **Foundation**: The tank foundation appeared to be a concrete ringwall. Except for minor cracking and some spalled areas, the exposed surface of the foundation appeared to be in nearly its

original structural condition at the time of this field evaluation. The foundation did not exhibit the AWWA recommended 6 in. to 12 in. projection above grade. Coating was visible on the exposed concrete surfaces at the time of this field evaluation. (See photos 17-22)

4. **Grout**: There was a pad of grout between the tank bottom plate and the concrete foundation. The grout appeared to be in poor condition as numerous voids were observed. There was no sealant located at the grout-to-bottom plate interface. (See photos 18-22)

5. **Valve Vault: There were a safety and OSHA deficiencies noted: (1) the 6 in. toe room did not meet the required 7 in. minimum, (2) the 28 in. minimum head clearance did not meet the minimum required 30 in., (3) the electrical equipment did not appear to include ground fault interrupt circuits, and (4) water was located on floor and vault contained electrical equipment.** There was a valve vault located on the west side of the tank site. Access into the valve vault was locked prior to or after this field evaluation. The piping in the valve vault was in poor condition with widespread corrosion. The vault was equipped with a heater vent, and inoperable light fixtures. An electrical meter was immediately adjacent to valve exterior. Water was observed in the bottom of the vault. (See photos 12-15)

B. Exterior Surfaces

DESCRIPTION:

Construction: welded steel
Diameter: approx. 60 ft
Shell Height: approx. 82 ft
Shell Rings: 10
Roof Type: column and rafter supported

NAMEPLATE:

Location: above shell manhole on south east side of shell

HORTON TANK
AWWA D100 APP. C

74-2081 U		**1975**
CONTRACT NO.		**YEAR**
60-0	**82' H.W.L**	**1,730,000**
Nom. Diameter Ft	**Nom. Height Ft.**	**Capacity Gal.**
A516-70. A131B		**None**
A-283-C		
Material	**Heat Treatment**	

Fabricated and Erected By CBI Chicago Bridge & Iron Company
Oak Brook, Illinois 5108

BOTTOM PLATE PROJECTION: 2 in. to 2-7/8 in. from shell

SHELL MANHOLES:
- Number: 2
- Location: southeast side of shell ring #1
  - Type: flanged and bolted
  - Size: 24 in. diameter
  - Neck: 7-1/2 in. projection from shell x 0.898 to 0.901 in. thick
  - Flange: 32-3/4 in. O.D. x 7/8 in. thick
  - Bolts:
    - Number: 28
    - Size: 3/4 in. diameter x 3 in. long
  - Cover Plate:
    - Size: 32-7/8 in. diameter
    - Hinged: yes, exterior

- Location: north side of shell ring #1
  - Type: flanged and bolted
  - Size: 24 in. diameter
  - Neck: 7-1/2 in. projection from shell x 0.898 to 0.901 in. thick
  - Flange: 32-3/4 in. O.D. x 7/8 in. thick
  - Bolts:
    - Number: 28
    - Size: 3/4 in. diameter x 3 in. long
  - Cover Plate:
    - Size: 32-3/4 in. diameter
    - Hinged: yes, exterior

OVERFLOW PIPE:
- Size: 8 in. diameter
- Visible Air Break: 4-1/4 in. to 15 in. diameter
- Protective Screen: 8 x 8 mesh
- Brackets:
  - Size: 4 in. x 3/8 in., flat bar
  - Spacing: approx. 6 ft 6 in.

SHELL LADDER:
- Number of Rungs: 81
- Distance From Ground to Lowest Rung: 22 in.
- Width: 16 in.
- Side Rails: 2-1/2 in. x 3/8 in., flat bar
- Rung Size: 3/4 in. square
- Spacing: 12 in. on center
- Toe Room: 8 in.

Brackets:
- Construction: welded to shell and bolted to ladder with 5/8 in. diameter bolts
- Size: 5 in. x 3/8 in., flat bar
- Spacing: approx. 12 ft to 14 ft

Vandal Deterrent:
- Size: 24-1/4 in. x 48 in.
- Locked: yes

SIGN: "**NEW CARLISLE**"
- Number: 2
- Color: dark blue
- Locations: south and north sides of shell
- Height: 6 ft tall letters
- Letter Width: 6 ft
- Brush Stroke: 10 in.

LADDER PLATFORM SAFETY RAILING:

Handrail:
- Height: 44 in.
- Size: 7/8 in. diameter

Uprights: 7/8 in. diameter and 2 in. x 2 in. x 1/4 in., angle

Mid-Rail: 3 in. x 1/4 in., flat bar

Toe Bar:
- Size: 4 in. x 1/4 in., flat bar
- Height Above Roof: none

Access Opening Width: 37 in.

Protective Chains: yes

ROOF SAFETY RAILING:
- Number: 2
- Handrail:
  - Height: 43 in.
  - Size: 2 in. x 2 in. x 1/4 in., angle
- Uprights: 2 in. x 2 in. x 1/4 in., angle
- Mid-Rail: 3 in. x 1/4 in., flat bar
- Toe Bar:
  - Size: 4 in. x 1/4 in., flat bar
  - Height Above Roof: 5-1/2 in. to 7 in.
- Handrail:
  - Height: 42-1/4 in.
  - Size: 2 in. x 2 in. x 1/4 in., angle
- Uprights: 2-1/2 in. x 2-1/2 in. x 1/4 in., angle
- Mid-Rail: 2 in. x 3/8 in., flat bar
- Toe Bar:
  - Size: 4 in. x 1/4 in., flat bar
  - Height Above Roof: 4 in. to 5 in.
- Access Opening:
  - Width: 36-1/4 in.
  - Self-Closing Gate: no

ROOF OPENINGS:
- Manhole #1:
  - Size: 24 in. diameter
  - Type: hinged
  - Curb: 4 in. x 1/4 in. thick
  - Welded: exterior only
  - Cover Overlap: 2-1/4 in.
  - Locked: no

- Manhole #2:
  - Size: 24 in. diameter
  - Type: flanged with gasket
  - Curb: 4 in. to 5 in.
  - Welded: exterior only
  - Bolts:
    - Number: 4
    - Size: 5/8 in. diameter x 1-1/2 in. long
  - Cover: 32-7/8 in. diameter x 1/4 in. thick
  - Locked: no

Roof Vent:
Type: clog-resistant
Neck Height: 6 in.
Neck Diameter: 24 in.
Cover Diameter: 48 in.

EXTERIOR COATING AND METAL CONDITION:

	Coating Thickness		Approx. % Failure to		Adhesion	Metal Loss	
	Range	Typical	Underlying Coating	Rust		Typical	Deepest
Shell	3.4 mils to 12.8 mils	7.5 mils	< 1/2 %	1 %	4 S	Neg.	Neg.
Roof	1.9 mils to 11.0 mils	5.0 mils	3 %	1 %	4 S	Neg.	Neg.

Key to Table

Adhesion 5 (very good)
4 (good)
3 (fair)
2 (poor)
1 (very poor)
0 (very poor)

T = Topcoat to Underlying Coating

S = Primer to Steel

Neg. = negligible

1. **Exterior Coating Condition**: The coating on the exterior of the tank appeared to be in fair to poor condition and was not providing adequate protection from corrosion to the steel. The exterior coating exhibited good adhesion to the underlying coating. The coating appeared to be an alkyd coating system.

2. **Bottom Plate**: The tank bottom plate extension appeared to be in nearly its original condition at the time of the field evaluation. Widespread corrosion and pack rust observed along the perimeter edge of the bottom plate. (See photos 19-20)

3. **Shell Condition**: The contour of the tank shell was good with no significant discontinuities observed at the time of this field evaluation. The coating appeared to be in fair to poorwith several spots of peeled coating and corrosion observed. The shell coating had cracked, weathered and chalked. The coating exhibited good adhesion to the underlying coating. A tank nameplate was located on the southeast side of shell ring #1 above the shell manhole. Debris, mildew, and fish eyes were noted in coating. A cathodic protection cabinet was located on the lower south side of the shell. The cabinet housed a manually controlled potential rectifier. Signs were located on the north and south sides of the shell. The signs read, "NEW CARLISLE," and were dark blue. However, the sign coating was in poor condition as it had weathered and chalked significantly. (See photos 29-33)

4. **Shell Manholes**: The tank was equipped with two flanged and bolted circular manholes. One of the manholes was located on the southeast side of the tank, and the other manhole was located on the north side of the tank. The shell plate around each of the manholes was equipped with a circular reinforcing plate. Unplugged weep holes were located in each reinforcing plate. Each manhole cover was equipped with a hinged support which were located on exterior of the tank. (See photos 21, 28)

5. **Overflow Pipe:** The overflow pipe exited through the top shell ring and extended down the shell. The pipe was equipped with an exterior weir box and an above-ground air break. The

discharge end was not adequately screened to prevent the ingress of insects into the tank. The pipe was equipped with welded steel brackets which appeared to be in their original structural condition at the time of this field evaluation. No significant coating failure was observed on the overflow pipe although there was corrosion on the flange surrounding the screening. (See photos 25-27)

6. **Exterior Shell Ladder: There were safety-related and OSHA deficiencies noted: (1) the cables attached to the side rails could interfere with the climbers use of the side rails, and (2) part of the safe-climbing device was installed incorrectly.** The ladder was equipped with a notched-tubular safe-climbing device. The exterior ladder was bolted to brackets which were welded to the shell. The exterior ladder and brackets appeared to be in nearly their original structural condition at the time of this field evaluation. The ladder was equipped with a locked vandal deterrent. The ladder was equipped with a notched-tubular rail safe-climbing device. A section of the device near the top had been installed upside down. (See photos 30-32, 34-35)

7. **Platform: There was a safety-related and OSHA deficiency noted: the safety railing opening was not equipped with a self-closing gate.** The roof platform was equipped with a safety railing at the roof access adjacent to the roof manholes. The safety railing was constructed from welded angle and flat bar members. The coating on the safety railing was in fair condition with corrosion, surface rust, and paint weathering. (See photos 38, 47)

8. **Roof Safety Railing: There was a safety-related and OSHA deficiencies noted: (1) the safety railing opening was not equipped with a self-closing gate, and (2) gap between the toe bar and roof greater than maximum allowed 1/4 in.** The roof was equipped with two sets of safety railing at the roof access and adjacent to the roof manholes. The safety railing was constructed from welded angle and flat bar members. The coating on the railing was in good condition. An antenna was attached to the railing. (See photos 38-39, 47)

9. **Roof Condition:** The contour of the roof was adequate at the time of this evaluation. The coating on the roof had good adhesion to the primer. There were several areas of peeled coating and corrosion coating observed at the time of this field evaluation. The roof coating had experienced heavy chalking, heavy weathering, fading, popping, cracking, and fish eyes. Coaxial cable extended across roof to the vent antenna. Eighteen capped couplings and a welded steel rectangular patch plate were located in the roof. (See photos 38-53)

10. **Roof Manholes: There was a sanitary, AWWA, and operational deficiency noted: the manhole covers were not locked.** The roof was equipped with two manholes. One of the manholes was equipped with a hinged cover. The other manhole was flanged and equipped with a bolted cover. The bolted cover was equipped with a retaining chain which was welded to both the cover and to the roof. The roof manholes were not locked prior to or after this evaluation. The roof manholes were welded on the exterior only. Corrosion was observed on both manholes. (See photos 39-40, 46)

11. **Roof Vent:** The roof was equipped with what appeared to be a clog-resistant vent in the approximate center of the roof. The vent appeared to be equipped with pallets which would facilitate ventilation during filling or draining of the tank. The proper operation or design of the pallets was not verified during this evaluation. The visible pallet and screening appeared to be in good condition. Corrosion was located on vent neck. An antenna was attached to vent neck. A lug was located on roof vent cover. **The lug should not be used for rigging purposes.** (See photos 41-43)

C. Interior Surfaces

ROOF SUPPORT SYSTEM:
- Main Rafters:
  - Number: 27
  - Size: 7 in. x 2-1/8 in., channel
- Purlins:
  - Number: 27
  - Size: 2 in. x 2 in. x 1/4 in., angle
- Center Hub:
  - Type: approx. 20 in. square x 3/4 in. plate with 2 ft diameter x 1/2 in. thick plate
- Center Post:
  - Size: 16 in. diameter x 0.375 in. to 0.384 in.
- Base:
  - Sleeve: 18 in. diameter x 30 in. tall
  - Plate: 38 in. diameter
  - Gussets: 8 in. x 8 in. x 3/8 in., angle

CATHODIC PROTECTION:
- Anodes: submerged wire with floats
- Manufacturer: Harco
- Serial Number: 11753
- Reference Electrodes: lying on floor

OVERFLOW:
- Inlet Type: 12 in. x 24 in. rectangular opening with exterior weir box
- Location: approx. 6 in. below the roof-to-shell connection.

INTERIOR PIPING:
- Inlet/Outlet Pipe:
  - Size: 15 in. diameter
  - Projection: 16-3/4 in. above floor
  - Brackets:
    - Size: 2 in. x 3/8 in., flat bar
    - Spacing: approx. 4 in.
  - Protective Cover:
    - Size: 24 in. diameter
    - Removable: yes

- Drain Pipe:
  - Size: 8 in. diameter
  - Projection: flush with floor
  - Protective Cover:
    - Size: 18-1/4 in. diameter
    - Location Above Pipe: 3 in.
    - Removable: yes

INTERIOR COATING AND METAL CONDITION:

	Coating Thickness		% Failure to		Adhesion	Metal Loss	
	Range	Typical	Primer	Rust		Typical	Deepest
Roof	10.8 mils to 15.0 mils	13.0 mils	Neg.	< 1 %	4 T	Neg.	Neg.
Shell	7.3 mils to 11.0 mils	9.0 mils	Neg.	< 1 %	4 S	0.02 in.	0.04 in.
Floor	7.9 mils to 10.3 mils	9.0mils	< 1/2 %	< 1/2 %	4 S	Neg.	0.02 in.

Key to Table

Adhesion 5 (very good)
4 (good)
3 (fair)
2 (poor)
1 (very poor)
0 (very poor)

T = Topcoat to Underlying Coating

S = Primer to Steel

Neg. = negligible

1. **Interior Coating Condition**: The coating on the interior surfaces of the tank appeared to be in poor condition and was not providing adequate corrosion protection to the underlying steel. The interior coating exhibited good adhesion to the underlying coating. The coating appeared to be an epoxy coating system.

2. **Roof Condition**: **There was a structural deficiency noted: bolts missing from rafter-to-shell connections.** The coating on the roof plates appeared to be in fair overall condition. Rust staining was noted along the top of the roof rafters, along the roof plate lap seams, and along the rafter edges. The interior roof support structure consisted of a center column, purlins, and a set of roof rafters. The inner ends of the roof rafters rested on a center hub which was located at the top of the center column. The outer ends of rafters were bolted to steel clips which were welded to the shell. A single bolt was missing from at least two of the attachment clip connections. Rust staining and corrosion were observed at this connection. Corrosion and rust straining were observed on the rafters and on the center column. Lugs were located near top of the column. Circular and rectangular patch plates were observed near the top of the shell and on the roof. Rust staining located around a welded steel circular patch plate in roof. **It is the opinion of Tank Industry Consultants that the center column lugs should not be used for rigging purposes.** (See photos 54-67)

3. **Shell Condition**: The coating on the shell interior appeared to be in fair overall condition. The shell coating was discolored due to mineral staining from the water. Spots of corrosion were located throughout the shell. The coating on the lower shell had blistered, and corrosion was located in these areas. Corrosion was also located at the cathodic protection penetration. Metal loss measurements taken during this evaluation indicated a typical pit depth of 0.02 in., and the deepest pit found measured 0.04 in. deep. (See photos 55-77)

4. **Overflow Pipe**: The overflow pipe was equipped with an open slot inlet and an exterior weir box. The location of the overflow inlet was such that the top capacity level was below the shell-to-roof connection. (See photo 66-68)

5. **Bottom Plate Condition**: The coating on the tank bottom appeared to be in poor overall condition. The coating had blistered. Corrosion was located at these areas. Metal loss had occurred on the floor and measured less than 1/32 in. deep. (See photos 78-86)

6. **Cathodic Protection**: The tank was equipped with a cathodic protection system. The system consisted of a submerged wire anode. The cathodic protection anode system was anchored from the lower portions of the shell and was equipped with floats. The wiring appeared to be intact. It did not appear that the system was operating properly as areas of corrosion were observed. Fitting at shell penetration was broken. (See photos 78-80, 86)

7. **Interior Piping**: The inlet/outlet pipe was located in the tank floor. The inlet/outlet pipe projected 16-3/4 in. above the bottom plates. The inlet/outlet pipe was equipped with a removable protective cover. The tank was equipped with a drain pipe in the bottom plate. (See photos 84-85)

RECOMMENDATIONS:

A. Foundation and Site

1. **Site Maintenance**: The site should be regraded so that the top of the foundation projects a minimum of 6 in. to a maximum of 12 in. above grade and so that proper drainage away from the foundation occurs. Site maintenance should be performed with the mower discharge directed away from the base of the tank to prevent rock chips in the coating and the accumulation of grass on the bottom plate. The damaged fencing should be repaired or replaced. The gate should continue to be locked at all times to deter unauthorized entry and limit liability for the Owner.

2. **Site Access and Restoration**: The open field on the site should be adequate for a contractor to stage equipment. Provisions should be included in the specifications for the restoration of any paving, curbing, sidewalks, fences, sod, or other surfaces and structures disturbed by the contractor's work.

3. **Tank and Site Security**: Water tanks have been defined by some courts under certain circumstances as attractive nuisances. As such, there may be a significant potential liability to the Owner for injury to persons on the tank and tank site, even if access is not authorized. Recent events have prompted the entire water industry to consider measures that inhibit intentional acts that could threaten the water supply. A review of the security requirements for the tank and site is recommended to confirm that the existing measures are consistent with the Owner's security requirements for their water system. Primary tank and site security should be focused on eliminating, preventing, and detecting unauthorized access to the tank. Such security measures might include routinely and periodically verifying all, manholes, gates are locked, and all exterior ladders have suitable deterrents. Other security measures might include installing no-trespass signs, cutting the vegetation away from the tank and fence to improve visibility, improving the fence, installing alarms on gates, and arranging more frequent site visits by law enforcement agencies.

4. **Foundation**: When the tank exterior is repainted, any unsound concrete should be chipped to sound material and the concrete should be brush-off blasted. Any deteriorated areas or voids found should have a bonding agent and a vinyl emollient modified concrete patching mortar applied to build up the surface to its original contour. The concrete should then be painted with a concrete sealer.

5. **Grout Maintenance**: All loose grout should be chipped away to solid material when the tank is empty. Any shim plates which can be easily removed should be taken out. Any voids in the grout should be filled with a nonshrinking, nonstaining, structural grout material. The grout should be placed as far back under the bottom plate as possible and squared off vertically with the edge of the

bottom plate. Any gap between the steel bottom plate and the grout should be filled with a flexible sealant.

6. **Valve Vault**: The piping and valves located in the valve vault should be cleaned and painted in accordance with the interior coating recommendations at the time of the tank cleaning and coating. The exterior concrete surfaces should be cleaned to the equivalent of a brush-off blast cleaning and painted with a concrete sealer. The valve vault access should continue to be locked at all times in order to limit liability to the Owner and to protect water system security. Freeze protection should be provided for on all control piping and static water lines. The existing ladder should be modified to allow adequate head clearance and toe room. The electrical equipment should be modified to include ground fault interrupt circuits. Inoperable lights should be fixed or repaired and a small pump should be used to eliminate standing water.

B. Exterior Surfaces

1. **Life of the Exterior Coating**: The exterior coating system did not appear to be providing adequate protection to the steel surfaces. Tank Industry Consultants believes that the exterior of the tank should be repainted within the next 3 years from a corrosion standpoint, or sooner to improve asthetics. Due to the fair adhesion of the existing exterior coating, topcoating appears to be an option. The exterior coating system should be evaluated immediately prior to preparing specifications to determine if the coating adhesion is still adequate to accept a topcoat.

2. **Coating Testing**: Prior to preparation of specifications for the cleaning and coating of the exterior of the tank, samples of the exterior coating system should be subjected to laboratory analysis to test for ingredients which may at that time be subject to regulations concerning their handling and disposal.

3. **Cleaning**: Due to the fact that the present exterior coatings appear to contain lead and chronium, coating removal should be performed in accordance with local, state, and federal regulations relative to the removal of heavy-metal based coatings. When the exterior is to be cleaned, all varieties of containment should be investigated. Containment of the wind-blown debris will be required, and containment of paint droplets will be required due to the proximity of the adjacent residences.

4. **Recommended Coating System**:

a. **Spot Clean and Topcoat**: If the exterior is to be repainted within the next few years, then spot cleaning and topcoating the tank appears to be the recommended option. The typical life of a spot cleaned and topcoated system is approximately 7 to 8 years, but is highly dependent on previous surface preparation and the condition of the underlying coating system.

b. **Coating Application**: The entire exterior surfaces of the tank should be high-pressure washed to remove chalked coating, mildew, and contaminants. After washing, the damaged and rusted areas should be spot cleaned to the equivalent of an SSPC-SP 6, Commercial Blast Cleaning, or SSPC-SP 11, Power Tool Cleaning to Bare Metal. All areas of excessive coating thickness and runs in the coating should be cleaned to the equivalent of an SSPC-SP 7, Brush-Off Blast Cleaning, to remove the excessive mils. The spot cleaned areas should receive a

spot prime coat compatible with the present coating system. The entire exterior surfaces should then be intermediate coated and topcoated with a compatible coating system.

5. **Alternative Coating System**:

a. **Complete Cleaning and Repainting**: The optimum long-life coating system presently available for this site is an epoxy-polyurethane coating system. Properly formulated and applied polyurethanes have good resistance to condensation, mildew, and chipping. The polyurethanes also have excellent color and gloss retention and the longest expected service life of any of the common exterior tank coatings. The typical life of a properly applied epoxy-polyurethane coating system is approximately 15 to 20 years. These coatings are also presently manufactured to meet current VOC requirements.

b. **Coating Application**: The entire tank exterior should be cleaned to the equivalent of an SSPC-SP 6, Commercial Blast Cleaning and have an epoxy-primed, epoxy intermediate and polyurethane finish coating system applied. However, care must be taken during the application of this particular coating system because this coating does have poor dry-fall characteristics, and potential damage to the surrounding property must be taken into consideration. The polyurethane coatings also require close monitoring of temperature and humidity during application.

6. **Effective Service Life**: Tank Industry Consultants defines the life of a coating as the amount of time before repainting becomes necessary due to coating failure and corrosion. During the coating life the Owner should expect the coating to lose its gloss, start to chalk, show signs of weathering, and possibly some rust staining. Future touch-up may be required on isolated coating failures. If aesthetics are a concern, the Owner may have to topcoat the repainted tank prior to the end of the expected service life. However, future topcoating would be less expensive than complete cleaning and recoating and could delay the next complete cleaning and repainting for many years.

7. **Other Systems**: With air emission volatile organic compounds (VOC) restrictions being put in place around the nation, alternative coating systems may become available which would be viable options for this tank. The Owner should review the available systems prior to preparing specifications for the recoating project.

8. **Coating Curing**: It would be more economical to paint the tank exterior at the same time the interior is painted, since the tank must be drained while the exterior is painted, and the applied coatings cure. This will also reduce mobilization and observation costs.

9. **Rehabilitation Schedule**: To obtain the lowest possible prices for the work outlined in the recommendations, the Owner should have the specifications prepared and the work bid in the spring, with the work scheduled to start in early summer (if possible).

10. **Grinding and Bracket Removal**: Any unused brackets or erection lugs should be removed prior to the exterior repainting. Any weld burrs, weld spatter, or erection scars should be ground off to provide a smooth surface for the application of the coating.

11. **Nameplate:** The tank nameplate should be removed for the cleaning and coating of the tank. The nameplate should be cleaned and reattached to the tank using a new bracket.

12. **Electrical Apparatus**: All unused antennas, fixtures, electrical metering equipment, cathodic protection apparatus, and control cabinets should be removed from the tank and tank site. The broken conduit at grade needs to be repaired. All required equipment should be repaired and maintained in accordance with the National Electric Code (NEC).

13. **Existing Shell Manholes**: At the time of recoating and repairs, the gaskets for the shell manholes should be replaced. The weep holes in reinforcing plates should be tapped and plugged.

14. **Overflow Pipe**: The overflow pipe discharge 8 x 8 screen mesh should be replaced with a 24 mesh to prevent the ingress of birds, small animals, and insects into the tank. The air break should be adequately sized to allow the proper functioning of the new flap gate.

15. **Exterior Ladders**: The power lines relocated away from the ladder side rails/the electrical conduit should be relocated away from the side rails. Slip-resistant rungs are required for all ladders constructed after March 1991 by the OSHA Construction standards. However, slip-resistant rungs are not required by the OSHA General Industry standards for ladders or by AWWA D100.

16. **Roof Safety Railing:** The toe bar should be modified so the gap between it and the roof is less than 1/4 in. wide. The existing safety railing should be equipped with a self-closing gate across the access opening.

17. **Roof Manholes**: The flanged and bolted roof manhole should have two additional holes fitted with locks to improve water system security. Both manholes should be locked at all times.

18. **Roof Vent:** The proper operation of the roof vent should be periodically verified. The antenna on the vent should be relocated to its own bracket.

C. Interior Surfaces

1. **Life of the Interior Coating**: The interior coating system appeared to be in poor condition. Spot coating failures in the shell and floor had allowed pitting to occur. Tank Industry Consultants recommends that the interior surfaces of this tank should be recoated in 1 to 2 years. It is recommended that when the interior is completely cleaned and repainted, an epoxy coating system should be used.

2. **Coating Testing**: Prior to preparation of specifications for the cleaning and coating of the interior of the tank, samples of the interior coating system should be subjected to laboratory analysis to test for ingredients which may at that time be subject to regulations concerning their handling and disposal.

3. **Cathodic Protection**: The tank cathodic protection system should be equipped with an automatically controlled potential rectifier. The manufacturer should then recalibrate and make necessary adjustments. The broken penetration connection should be repaired.

4. **Recommended Interior Coating System**:

a. **Epoxy Coating System**: The optimum long-life coating system presently available for the interior of water tanks is a two-component epoxy coating system. A three-coat epoxy

system is recommended for the interior of this tank. This coating system should meet the certification criteria of ANSI/NSF 61 and state department of health regulations.

b. **Coating Application**: When the interior is to be repainted, the entire tank interior should be cleaned to the equivalent of an SSPC-SP 10, Near-White Blast Cleaning and an epoxy coating system applied.

c. **Service Life**: The typical life of a properly formulated and applied epoxy coating system is approximately 12 to 15 years in immersion service. Tank Industry Consultants defines the life of a coating as the expected service life before repainting becomes necessary due to coating failure and corrosion. The Owner could extend the service life of the coating by installing, properly maintaining and operating a cathodic protection system to help protect the steel surfaces in areas which have experienced coating failure.

5. **Pit Welding and Pit Filling**: After initial cleaning, all significant pitting which is found should be welded, and all pitting with rough edges that would make the pitting difficult to coat properly should be filled with a solventless epoxy seam sealer. (It was estimated that approximately 25 square inches of pits will require welding, and approximately 2 gallons of seam sealer will be required for pit repair.)

6. **Rough Edges**: All unused brackets should be removed from the interior and exterior surfaces at the time of the next recoating. Any weld burrs, spatter, scars or rough edges in the steel should be ground smooth to provide a better surface for coating. (It was estimated that approximately 15 man-hours of grinding will be required on the interior of the tank.)

7. **Roof Support Structure:** After abrasive blast cleaning, the roof support structure should be carefully evaluated as metal loss repairs may be necessary at areas where the metal loss was not previously visible. All rafters ends should be accessed and 2 bolts installed where currently only 1 bolt is present.

ECONOMIC FACTORS:

Item	Cost	Life in Years
Replacement of tank with a new one	$2,500,000[1]	75+

The following is a complete list of repairs and estimated costs for their respective recommendations found in the RECOMMENDATION section of this report.

Item	Sanitary & Safety	Scheduled Maintenance Repairs
Clean and Paint Exterior:		
Spot Repair and Topcoat		$ 250,000
Containment		120,000
[2]Heavy Metal Abatement & Disposal		15,500
SP 6, Complete Clean, Epoxy/Polyurethane System		350,000
Containment		150,000
[2]Heavy Metal Abatement & Disposal		31,000
Clean and Paint Interior:		
SP 10, 3-Coat Epoxy System		400,000
Miscellaneous Chipping and Grinding		2,000
Pit Repair		3,000
Grout Repair		3,000
Foundation Repair		2,000
Rafter-To-Shell Repair		10,000
Replace Cathodic Protection Rectifier and Repair System		8,000
Exterior Ladder Safe-Climbing Device Repairs	$ 1,500	
Roof Safety Railing Modifications and Platform	8,000	
Contingency Items	15,000	18,000

Estimates are believed to be a high average of bids that would be received in 2017.

[1] The replacement estimate includes costs associated with new tank fabrication and erection, foundation, painting, and engineering. The budget estimate given does not include costs associated with tank demolition, site acquisition, and distribution interruptions.

[2] Heavy metal abatement is included in the economic factors; however, the hazardous disposal will not be required unless the abrasive residue is determined to be hazardous.

The following economic factors include only those work items that the Engineer believes to be the minimum to properly maintain this tank from an operational standpoint. Other items related to safety and risk management should be evaluated by the Owner.

Item	Cost
Clean and Paint Exterior:	
Spot Repair and Topcoat	$ 250,000
Containment	120,000
[2]Heavy Metal Abatement & Disposal	15,500
Clean and Paint Interior:	
SP 10, 3-Coat Epoxy System	400,000
Miscellaneous Chipping and Grinding	2,000
Pit Repair	3,000
Grout Repair	3,000
Foundation Repair	2,000
Rafter-To-Shell Repair	10,000
Replace Cathodic Protection Rectifier	8,000
Install Overflow Elastomeric Check Valve	5,000
Exterior Ladder Safe-Climbing Device Repairs	1,500
Roof Safety Railing Modifications and Platform	8,000
Contingency Items	18,000
Total of Engineer's Recommendations	**$ 846,000**

Tank Industry Consultants has no control over the cost of labor, materials, or equipment, or over the contractors' methods of determining prices, or over competitive bidding, or the market conditions. Opinions of probable cost, as provided for herein, are to be made on the basis of our experience and qualifications and represent our best judgment as design professionals familiar with the design, maintenance, and construction of concrete and steel plate structures. However, Tank Industry Consultants cannot and does not guarantee that proposals, bids, or the construction cost will not vary from opinions of probable cost prepared for the Owner.

Due to the numerous potential scopes of work which exist, the Owner should obtain an updated budget estimate once the final scope of work has been determined. This would enable the Owner to accurately budget monies for additional mobilization costs and damaged coating rehabilitation costs.

Engineering and resident observation costs are not included in the Total of the Engineer's Recommendations because these fees are dependent upon the scope of work to be performed. Tank Industry Consultants performs all facets of the engineering services which would be required for this project. Estimated fees for engineering and resident observation will be furnished upon request.

CLOSURE:

Brief Summation: The City of New Carlisle owns and operates a 1,730,000 gallon standpipe in New Carlisle, Ohio. The exterior coating system did not appear to be providing adequate protection to the steel surfaces. Tank Industry Consultants believes that the exterior of the tank should be repainted within the next 3 years from a corrosion standpoint, or sooner to improve aesthetics. The interior coating system appeared to be in poor condition. Spot coating failures in the shell and floor had allowed pitting to occur. Tank Industry Consultants recommends that the interior surfaces of this tank

should be recoated in 1 to 2 years. Proper maintenance after completing the recommendations herein would include periodic washouts and evaluations approximately every 3 to 5 years in accordance with AWWA recommendations, and the recommended modifications to the cathodic protection system with long-life anodes.

Contractor Selection: The work should be performed by a competent bonded contractor, chosen from competitive bids taken on complete and concise specifications. The coatings used should be furnished by an experienced water tank coating manufacturer, supplying the field service required for application of technical coatings.

Standards for Repairs and Coatings: All work done and coatings applied should be applied in accordance with NACE, ANSI/NSF Standard 61, the manufacturer's recommendation, AWWA D100 and AWWA D102 (latest revisions), and the SSPC: The Society for Protective Coatings.

Observation of Work: Observation of the work in progress by experienced personnel will offer additional assurance of quality protective coating application. Observations can be performed on a continuous basis or spot (critical phase) basis. The actual cost of observation may be less using spot as opposed to full-time resident observation; however, with spot observation it is often necessary for work to be redone to comply with the specifications. This somewhat lowers the quality of the finished product, lengthens the job, and is frequently a cause of conflict between the contractor, Owner, and field technician. Resident full-time observation minimizes the amount of "rework" required.

Anniversary and Maintenance Evaluations: An anniversary evaluation should be conducted prior to the end of the one year bonded guarantee. Washouts and coating, structural, sanitary, safety, and corrosion evaluations should be conducted not less than every 3 to 5 years.

Time Frame: If the work is not performed within the next 12 months, the structure should be reevaluated prior to the preparation of specifications and solicitation of bids.

Specifications and Bidding Documents: The recommendations in this report are not intended to be specifications on which a contractor can bid. Complete bidding documents must include general and special conditions, detailed technical specifications, and other information necessary for the competitive bidding process. To properly protect the interests of the Owner, Contractor, and Engineer; the initial evaluation, the technical specifications, legal portions of the contract documents, and the observation should be performed by the same firm or with close coordination of all parties involved.

Limitations of Evaluation: It is believed that the conditions reported herein reflect the condition of the tank as observed on the date of the evaluation, using reasonable care in making the observations, and safety in gaining access to the tank. Should latent defects be discovered during the cleaning of the structure, they should be brought to the attention of the Owner and the Engineer.

Seismic and Wind Loadings: This tank is located in or near a region of low seismic activity. This evaluation and the reporting of the condition of this tank do not warrant the structural condition of the tank or any of the original design for seismic loadings. Likewise, recommendations for this tank do not include modifications which may be required for compliance with present structural codes. It is possible the tank was erected in compliance with pre-existing industry standards which have since been replaced by more restrictive standards.

Hazardous Materials in Coatings: Samples taken of the coatings on the exterior of this structure indicated a presence of lead, chromium and possibly other heavy-metal pigments. It should be taken into consideration that Federal, State, and local environmental agencies have placed stricter controls on the removal of lead-based and other heavy-metal based coatings from steel structures by the use of conventional abrasive blasting techniques. The paint and blast residue may be considered to be hazardous waste depending on the concentration of lead or other particles in residue.

Please contact Tank Industry Consultants if you have any questions or comments.

Respectfully submitted,

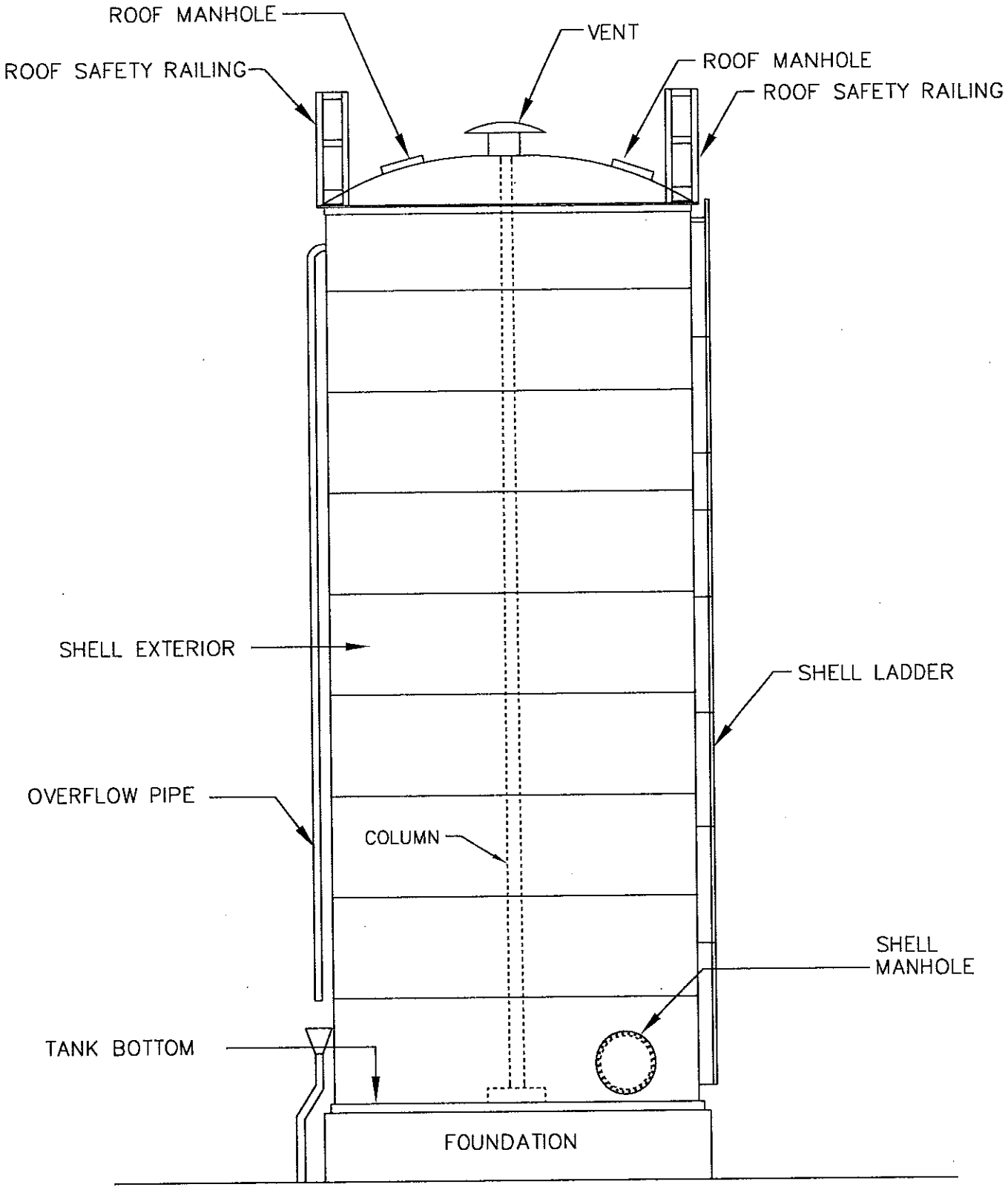
Tank Industry Consultants

Bradley Rostron, E.I.
Project Engineer

Gregory R. "Chip" Stein, P.E.
Managing Principal

STATE OF OHIO GREGORY STEIN E-68712 REGISTERED PROFESSIONAL ENGINEER

STANDPIPE



NOMENCLATURE

Classification of Adhesion Test Results

Method A – X Cut Tape Test Approx. 1.5 in. long cuts at 30 deg. to 45 deg. apart.	Surface	Classification
No peeling or removal.		5
Trace peeling or removal along incisions.		4
Jagged removal along incisions up to 1/16 in. (1.6mm) on either side.		3
Jagged removal along most of incisions up to 1/8 in. (3.2mm) on either side.		2
Removal from most of the area of the X under the tape.		1
Removal beyond the area of the X.		0

Method B – Lattice Cut Tape Test Six parallel cuts at 2mm apart.	Surface	Classification
The edges of the cuts are completely smooth; none of the squares of the lattice are detached.	No Failure	5
Small flakes of the coating are detached at intersections; less than 5% of the lattice is affected.		4
Small flakes of the coating are detached along edges and at intersections of cuts. The area affected is 5% to 15% of the lattice.		3
The coating has flaked along the edges and on parts of the squares. The area affected is 15% to 35% of the lattice.		2
The coating has flaked along the edges of cuts in large ribbons and whole squares have detached. The area affected is 35% to 65% of the lattice.		1
Flaking and detachment worse than grade 1.		0

ASTM 3359 Standard Test Methods for Measuring Adhesion by Tape Test

Tank Industry Consultants

7740 West New York Street
Indianapolis, Indiana 46214

Telephone – 317/271-3100
FAX – 317/271-3300

- CERTIFICATE OF ANALYSIS -

Disp. Code: E I

Report Date: *21-Jul-17 12:42 PM*

Client ID: TANK_INDUST

Tank Industry Consultants
7740 West New York Street
Indianapolis, Indiana 46214

Attn: Bruce Hobbs

Phone: (317) 271-3100
FAX: (317) 271-3300

Our Lab # 17011283-001
Your Sample ID: Int. Post
Sample Composition: Grab

Your Project # 17096.H1664.001
Your Project Name: **Paint Samples**
Sample Type: Paint Chips

Collection Date: 07/14/17
Collected By: Client
Receipt Date: 07/18/17 10:45

Total Metals, ICP-AES

Analytical Method	Prep Method	Prep Date	By
SW846 6010B	SW846 3050B	7/21/2017	spotts

Parameter	Result	Units	Qual	Quant. Limit	CAS #	Analysis Date	By
Cadmium, Cd	< 25.0	mg/kg		25.0	7440-43-9	07/21/17 11:45	rmccoskey
Chromium, Cr	< 250	mg/kg		250	7440-47-3	07/21/17 11:45	rmccoskey
Lead, Pb	< 250	mg/kg		250	7439-92-1	07/21/17 11:45	rmccoskey

Our Lab # 17011283-002
Your Sample ID: Ext. Shell
Sample Composition: Grab

Your Project # 17096.H1664.001
Your Project Name: **Paint Samples**
Sample Type: Paint Chips

Collection Date: 07/14/17
Collected By: Client
Receipt Date: 07/18/17 10:45

Total Metals, ICP-AES

Analytical Method	Prep Method	Prep Date	By
SW846 6010B	SW846 3050B	7/21/2017	spotts

Parameter	Result	Units	Qual	Quant. Limit	CAS #	Analysis Date	By
Cadmium, Cd	< 25.0	mg/kg		25.0	7440-43-9	07/21/17 11:45	rmccoskey
Chromium, Cr	1150	mg/kg		250	7440-47-3	07/21/17 11:45	rmccoskey
Lead, Pb	173000	mg/kg		4000	7439-92-1	07/21/17 11:45	rmccoskey

ESG Laboratories
5940 WEST RAYMOND STREET
INDIANAPOLIS, INDIANA 46241

PHONE (317) 290-1471
FAX (317) 290-1670
www.ESGLaboratories.com

Roy C. B

7/21/2017

Lab Manager **Date**

Lab # 17011283-002 **Sample ID:** Ext. Shell

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5940 WEST RAYMOND STREET
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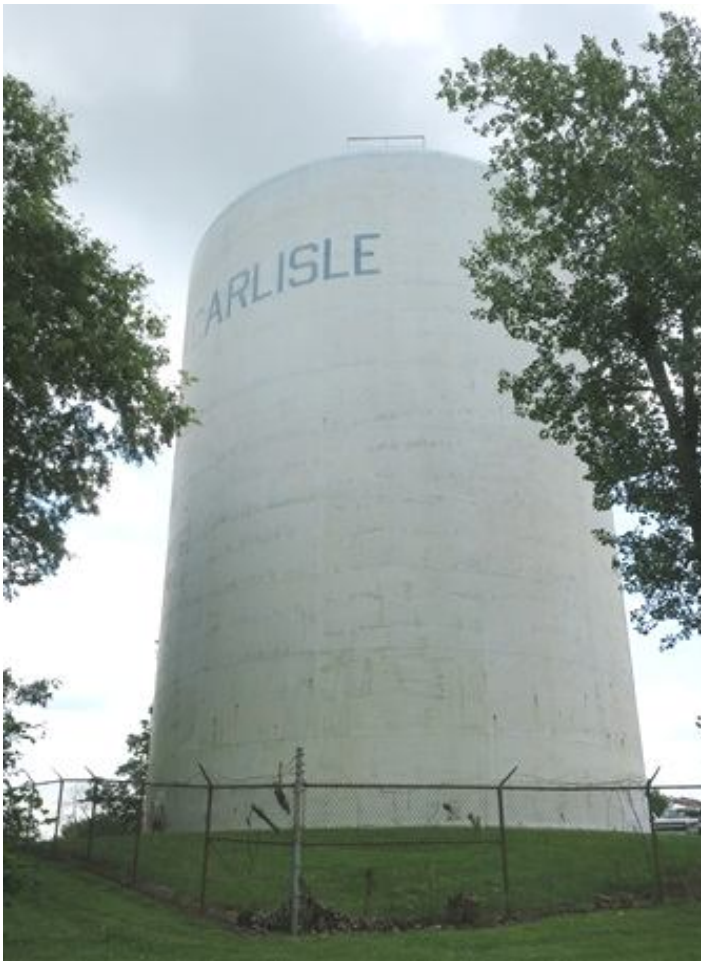
1. Tank and site.

2. Tank.



3. Tank and site.

4. Tank logo.

5. Road up to site entrance.

6. Site I.D. and emergency contact sign.

7. Surrounding site. Note damaged fence.

8. Surrounding area.

9. Surrounding area.

10. Surrounding area.

11. Surrounding area.

12. Valve vault access, shed, and electric meter.

13. Valve vault access.

14. Valve vault ladder. Note standing water.

15. Piping and valves in vault.

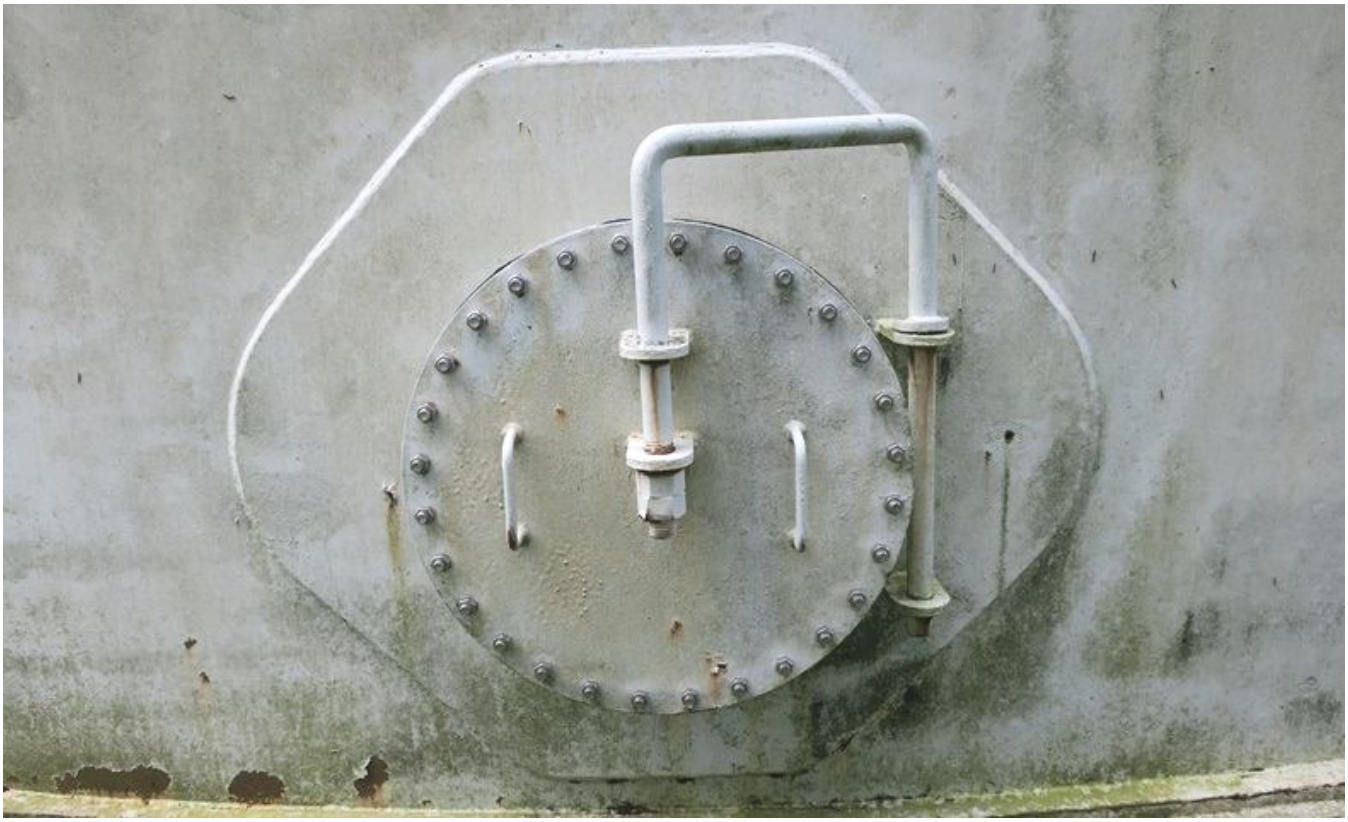
16. Tank nameplate.

17. Broken electrical conduit exposing cables.

18. Shell exterior with spot corrosion.

19. Tank foundation. Note coating cracking and chipping.

20. Tank foundation. Note coating cracking and chipping.



21. Shell manhole.

22. Shell exterior with spot corrosion.

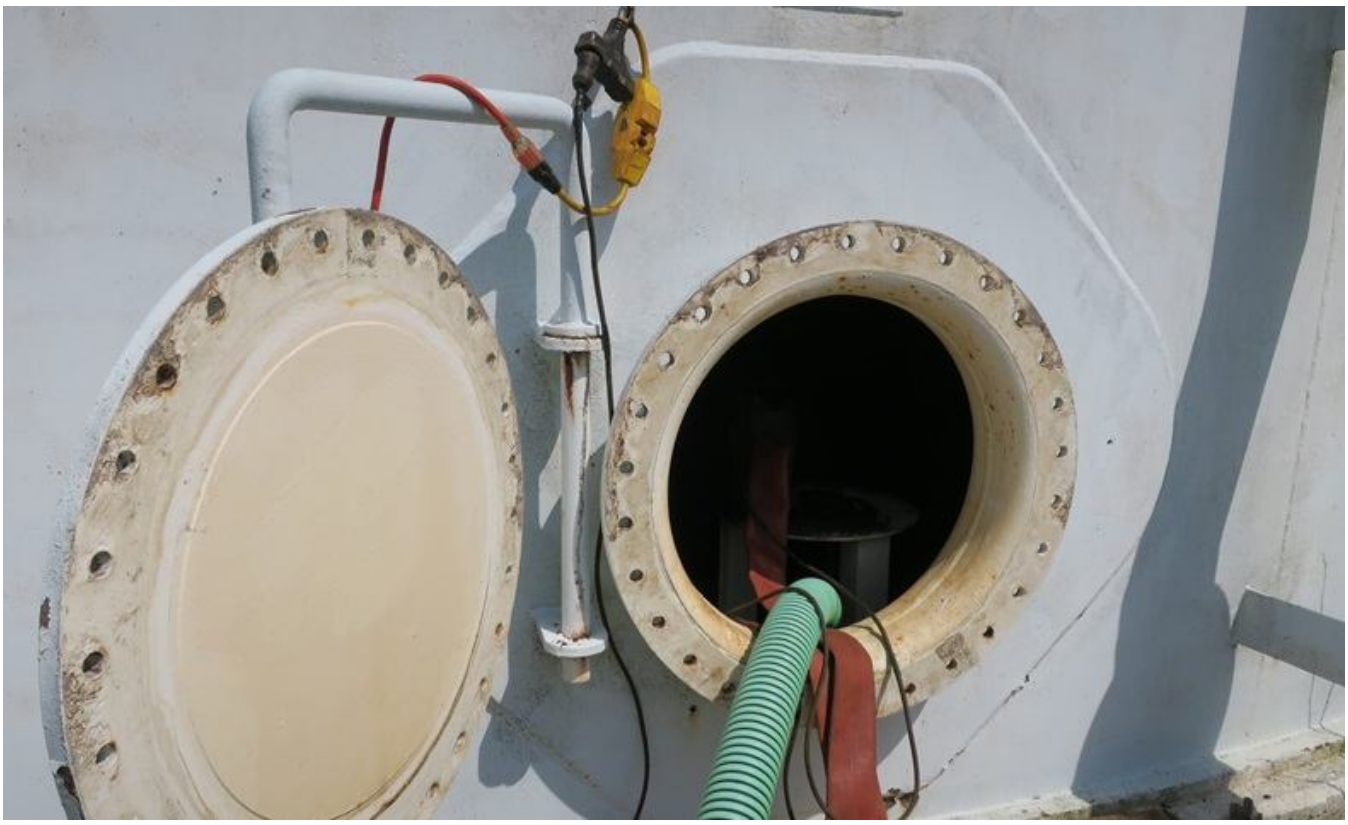
23. Cathodic protection cabinet.

24. Cathodic protection cabinet.

25. Overflow pipe air break and drain.

26. Overflow pipe drain. Note corrosion.

27. Overflow pipe.



28. Shell manhole.

29. Shell exterior with spot corrosion.

30. Exterior ladder and vandal deterrent.

31. Exterior ladder and vandal deterrent.

32. Paint failure along shell exterior.

33. Shell exterior weld seam.

34. Exterior ladder connection.

35. Exterior ladder safe-climbing device installed incorrectly.

36. Overflow pipe bracket.

37. Shell exterior weld seam.

38. Roof access, platform, antennas, manhole, and safety railings.

39. Roof manhole and safety railing.

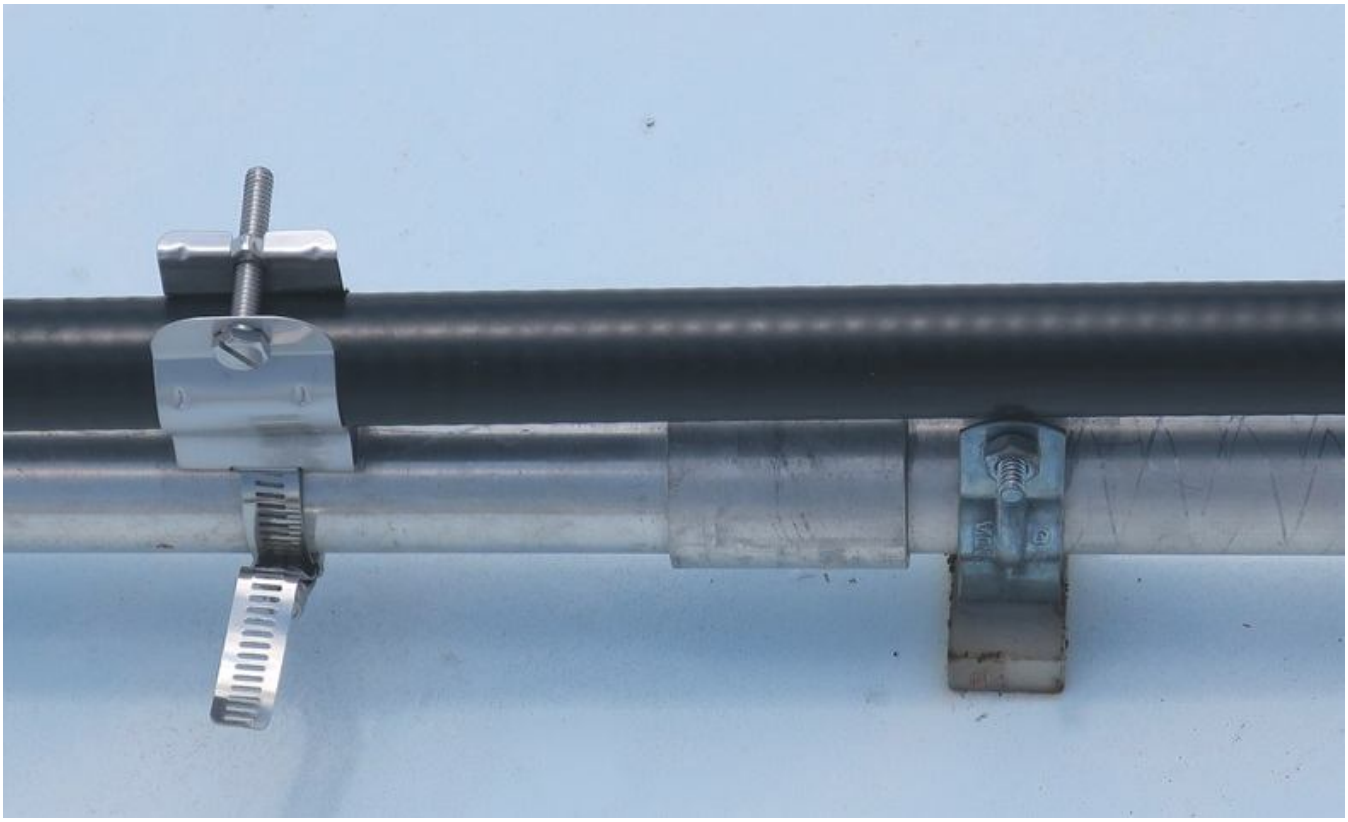
40. Corrosion on roof manhole cover.

41. Roof vent and antenna.

42. Roof vent and antenna. Note vent lug.

43. Roof vent. Note spot corrosion.

44. Roof antenna cable.



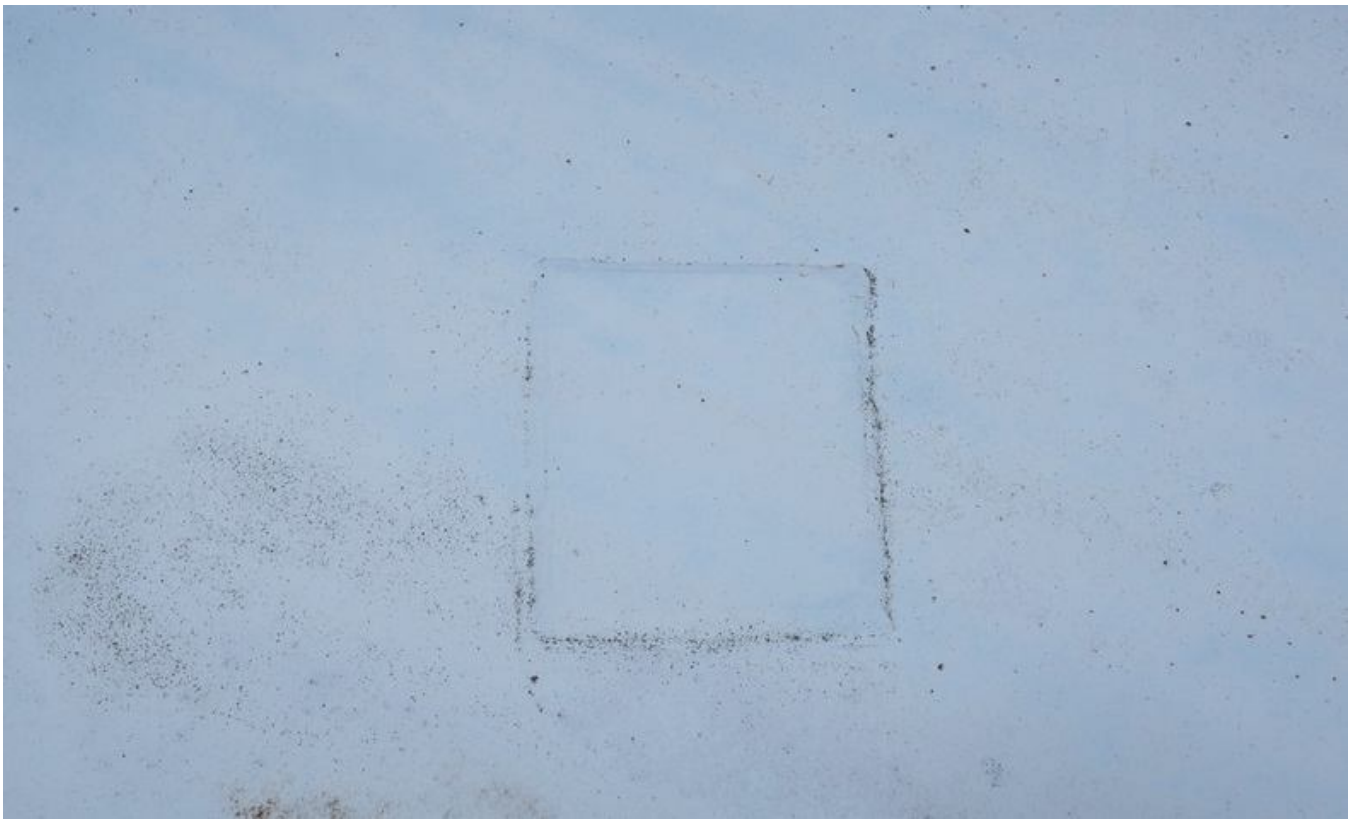
45. Roof antenna cable connection.

46. Roof manhole.

47. Roof access and safety railing. Note closure chains.

48. Exterior overflow weir box.

49. Roof plugged coupling.



50. Patch plate weld.

51. Roof corrosion.

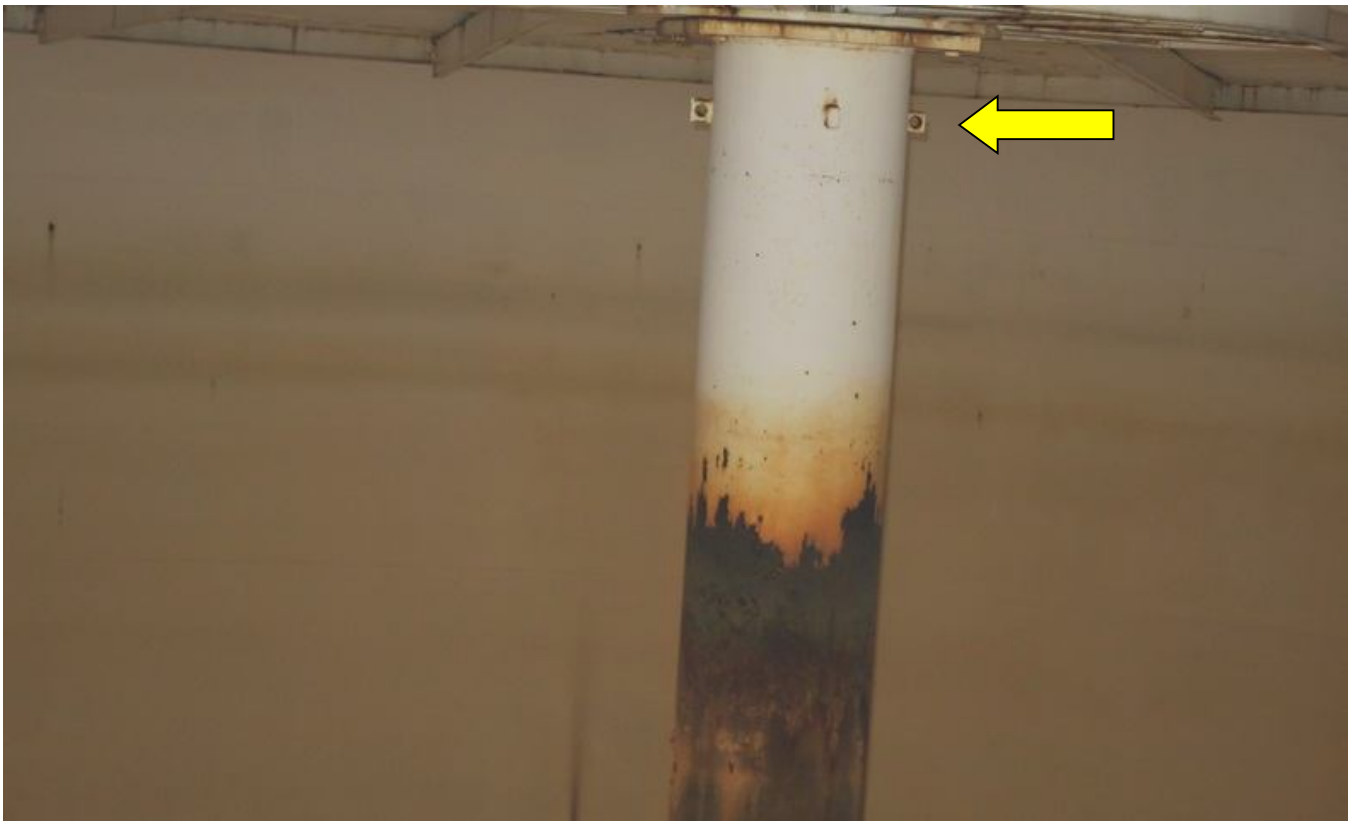
52. Weathered roof coating.

53. Roof corrosion and weathered coating.

54. View of roof interior.

55. View of roof interior.

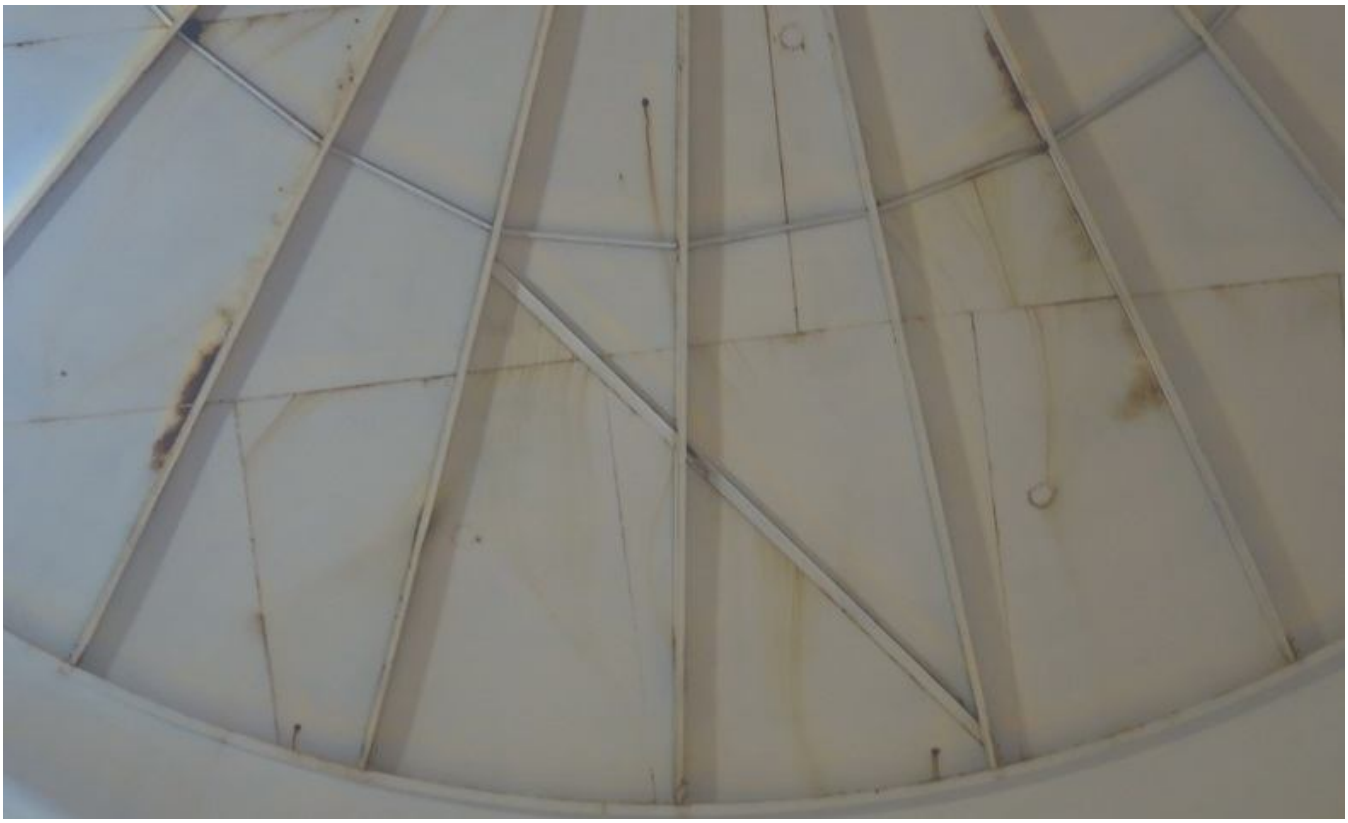
56. Interior roof, support column, and rafters.



57. Support column, and rafters. Note corrosion on column and lungs on column.

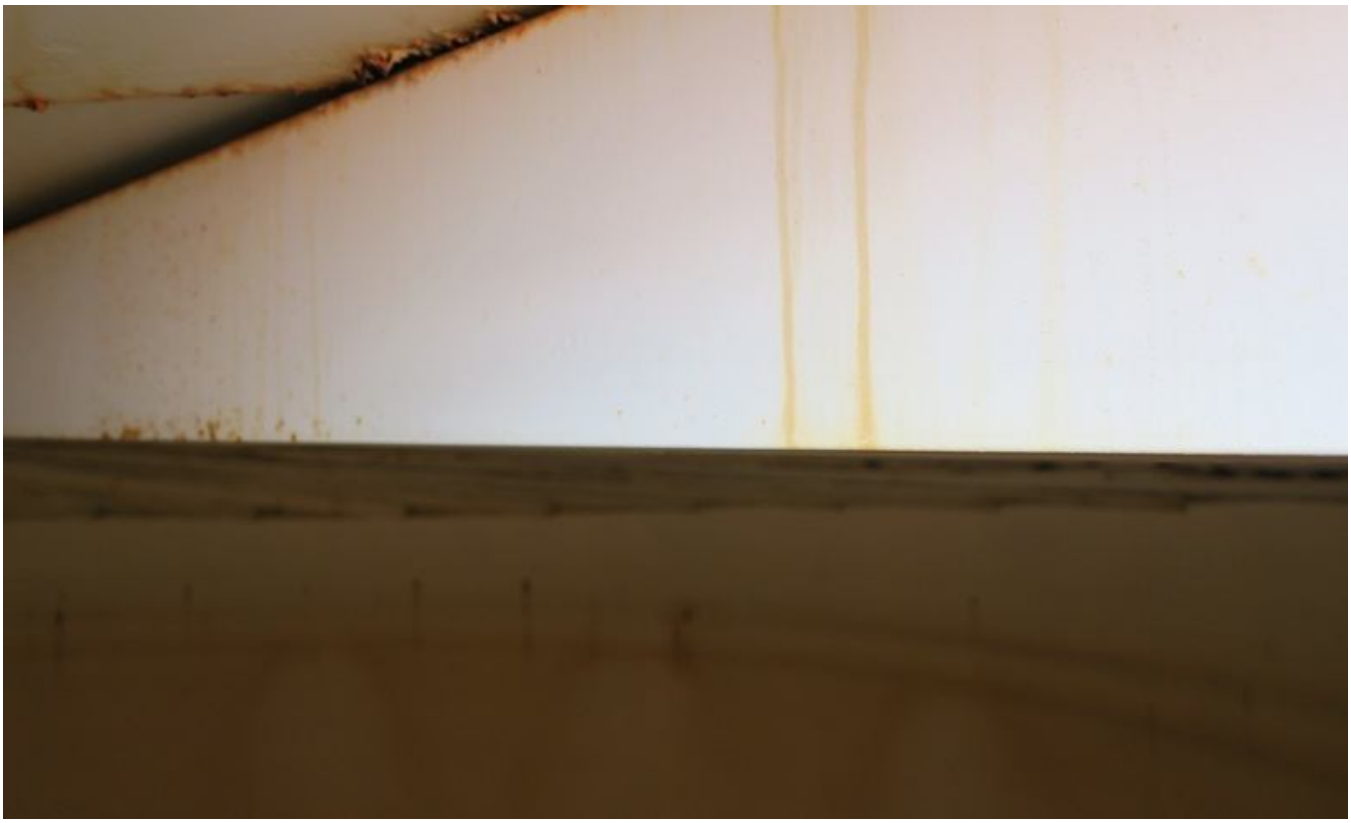
58. Interior roof, support column, and rafters.

59. Interior roof, support column, and rafters.



60. View of roof interior support rafters.

61. Support rafters. Note corrosion along rafters and circular welded patch plate.



62. Support rafter.

63. Corrosion on roof interior.

64. Rafter with bolted connections. Note corrosion.

65. Rafter with bolted connections. Note corrosion and missing bolt.

66. Support rafter and bolted connection. Note corrosion and missing bolt.

67. Rafter and bolted connection. Note corrosion, missing bolt, and overflow inlet.

68. Overflow inlet and roof manhole opening.

69. Tank interior and support column. Note corrosion along column.

70. Tank interior.

71. Tank interior. Note corrosion.

72. Tank interior. Note corrosion.

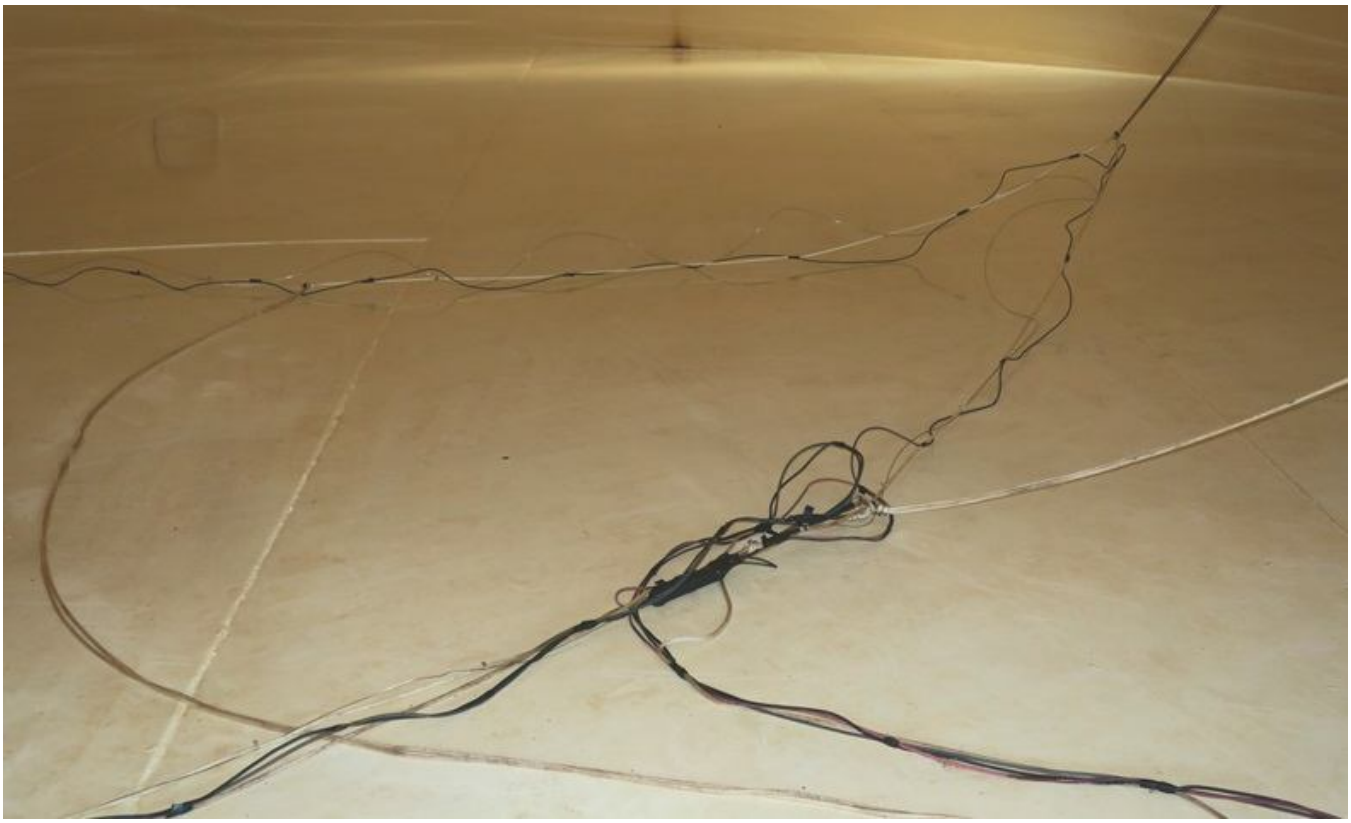
73. Tank interior. Note corrosion.

74. Tank interior. Note corrosion.

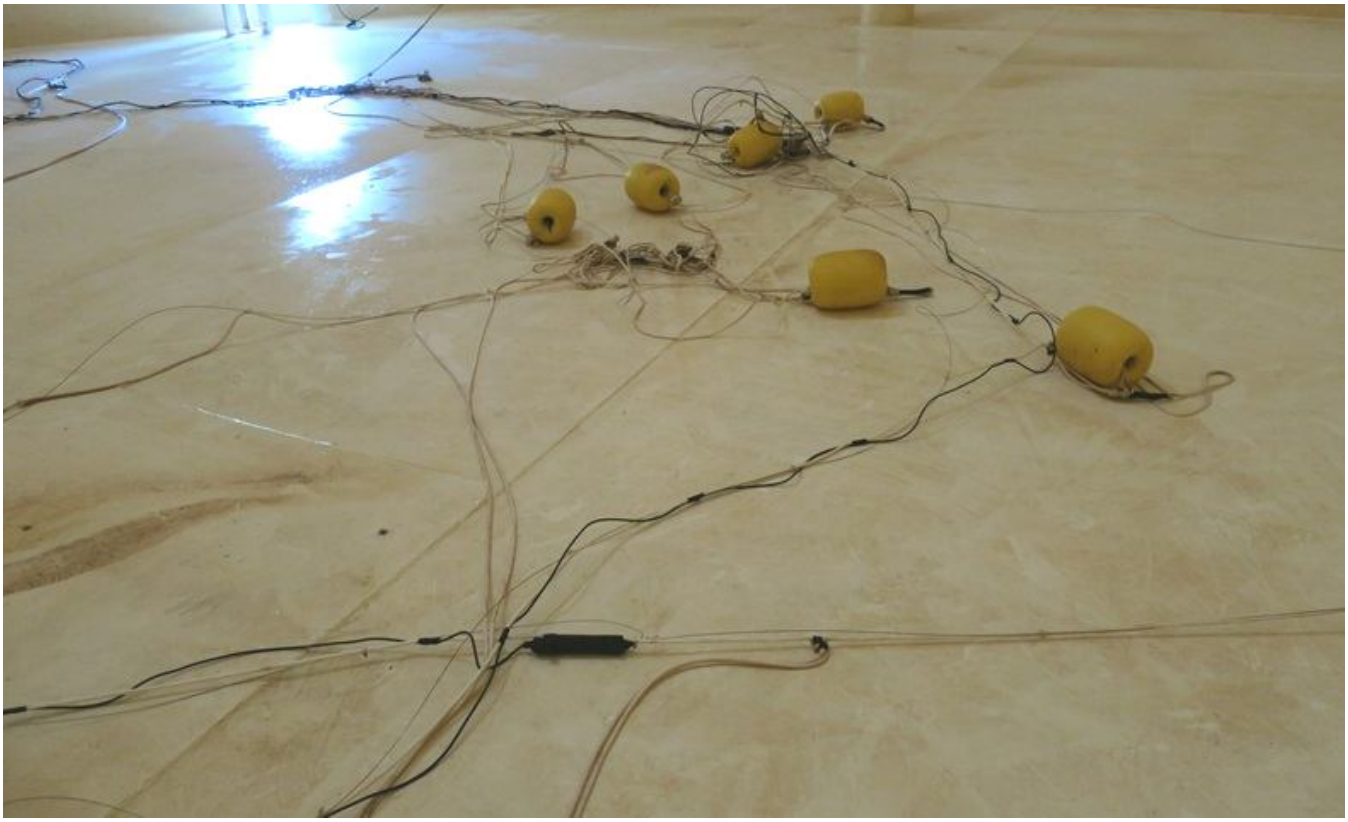
75. Shell manhole interior

76. Blistered coating and corrosion on tank shell.

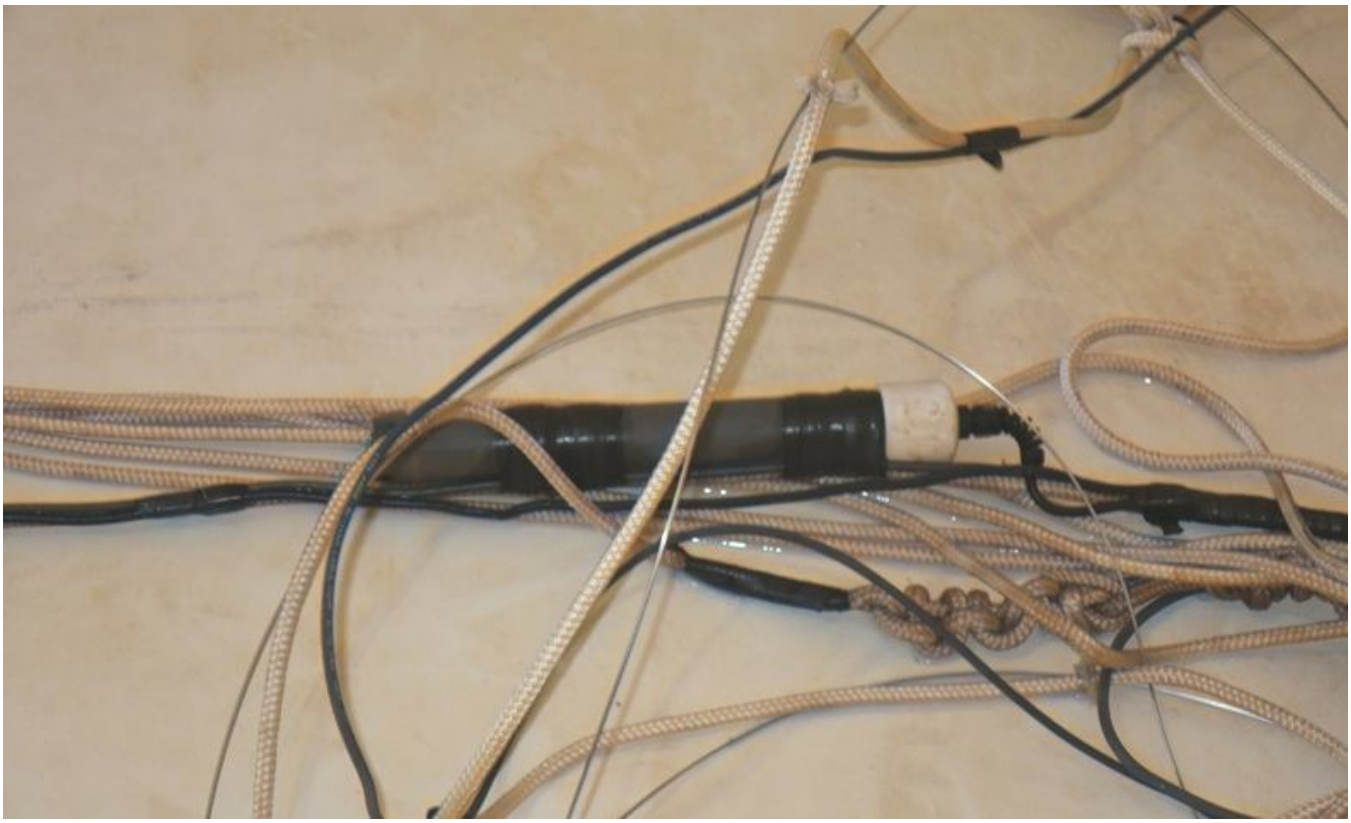
77. Broken cathodic protection equipment fitting.



78. Cathodic protection equipment on tank floor.



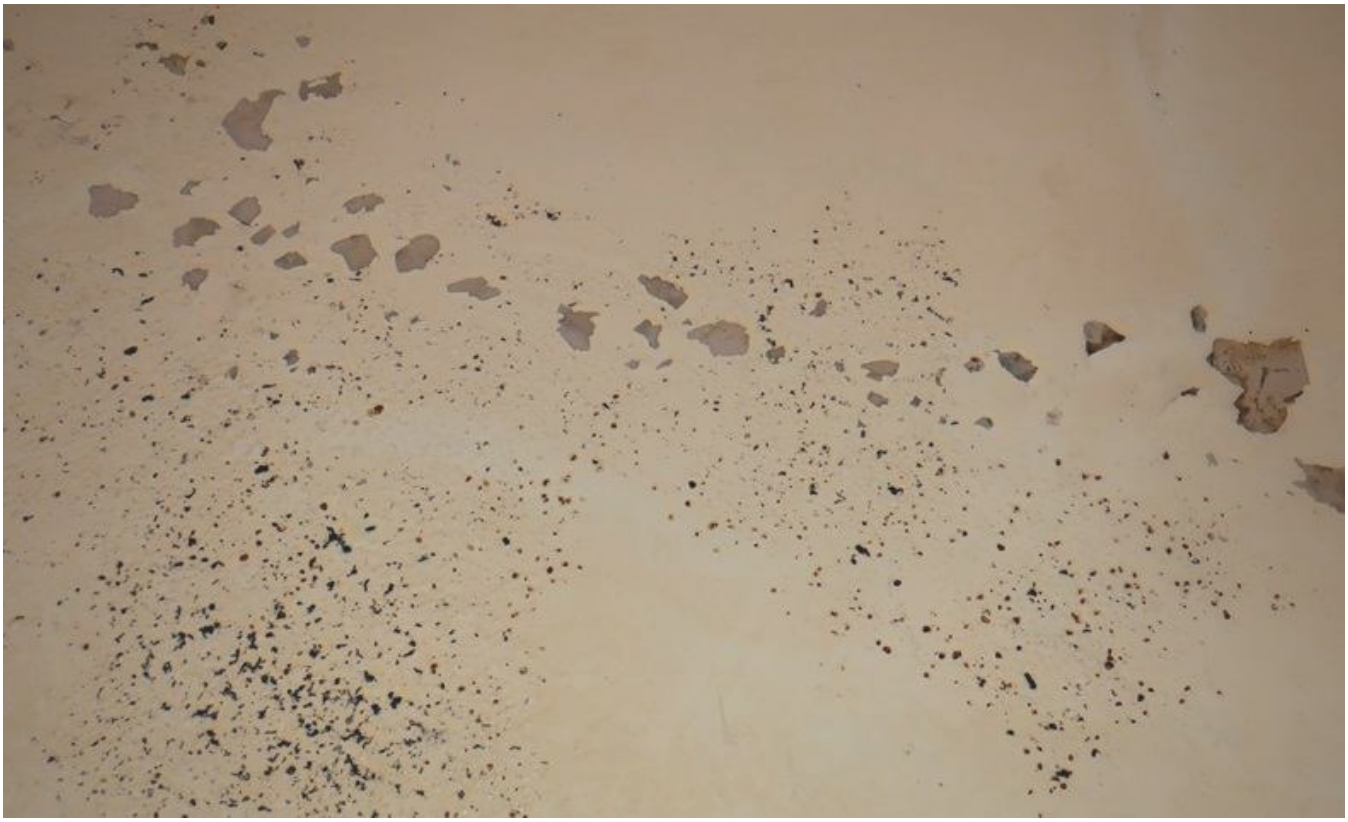
79. Cathodic protection equipment on floor.



80. Cathodic protection reference electrode on floor.

81. Blistered coating and corrosion on tank floor.

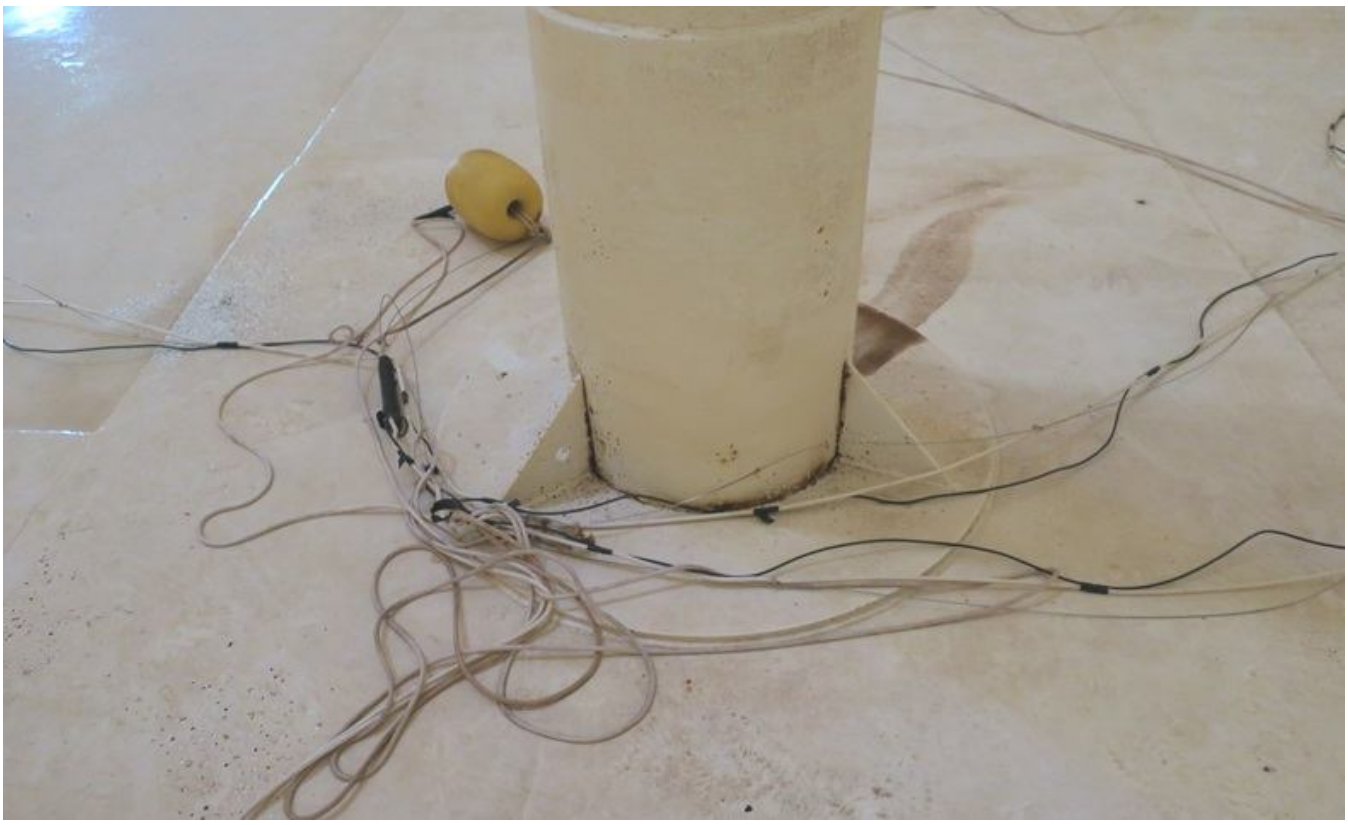
82. Blistered corrosion on coating and tank floor.



83. Blistered coating and corrosion on tank floor.

84. Inlet/outlet pipe and removeable cover.

85. Drain pipe and removable cover.



86. Roof support column base and cathodic protection anode.