

Dixon Engineering, Inc.

Preliminary Maintenance Inspection

200,000 Gallon Standpipe

Martinsburg, West Virginia
(Stuckey Court)

Inspection Performed: December 10, 2019
Reviewed by Joseph T. Hoban, P.E.: February 7, 2020

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CONCLUSIONS:

1. The exterior coating is an acrylic system. The coating is in poor condition overall. Coating deterioration includes numerous spot failures to the substrate on the lower sidewall and roof. The coating is heavily faded and there is primer bleedthrough and erosion throughout.
2. The wet interior coating is presumed to be an epoxy system. The coating is in fair to poor condition overall. Below the high-water level coating deterioration includes numerous spot failures to the substrate, topcoat delamination, and blistering on the sidewall. Above the high-water level coating is deteriorating at the roof panels and weld seams with moderate corrosion.

RECOMMENDATIONS (IMMEDIATE WORK):

1. Replace the screen on the end of the overflow pipe with a 24 inch mesh screen. The work can be performed by in-house personnel.

RECOMMENDATIONS:

Complete the recommended work in one to two years. The coating work is the greatest cost and largest part of the recommendations. The repairs and upgrades should be completed during the next major tank rehabilitation project when coating repairs are made.

1. Abrasive blast clean the exterior inside a dust tight containment system and repaint with a urethane system. The estimated cost is \$90,000 plus \$60,000 for containment.
2. Abrasive blast clean the entire wet interior and repaint with an epoxy system. The estimated cost is \$80,000.
3. Install clips and a pressure fitting for future installation of a submerged cathodic protection system. The estimated cost is \$2,000.
4. Abrasive blast clean the pit piping and repaint with an epoxy system. The estimated cost is \$5,000.
5. Coat the foundation to help prevent further deterioration. The cost would be incidental to exterior painting.
6. Install a handrail at the edge of the entire roof. The estimated cost is \$15,000.

7. Install rigging couplings on the roof for temporary fall prevention of workers in the wet interior. The cost would be incidental to the next painting project.
8. Install a 30 inch diameter sidewall manway. The estimated cost is \$9,000.
9. Replace the roof vent with a new frost-free pressure vacuum vent. The estimated cost is \$6,000.
10. Install a step-off platform at the top of the sidewall. The estimated cost is \$6,000.
11. Install deflector bars at the end of the draw pipe in the wet interior. The cost would be incidental to the next paint project.
12. Remove the level indicator. The estimated cost is \$1,000.

COST SUMMARY:

Exterior repaint with containment	\$150,000
Wet interior repaint	80,000
Cathodic clips	2,000
Pit piping repaint	5,000
Roof handrail	15,000
30 inch sidewall manway	9,000
Frost-free roof vent	6,000
Roof step-off platform	6,000
Remove level indicator	1,000
Sub Total	<u>\$274,000</u>
Engineering and Contingencies	<u>\$55,000</u>
Total	<u>\$329,000</u>

Notes: Exterior coating is primarily for aesthetics and can be delayed as long as desired since the next paint job cannot be an overcoat. While the appearance will deteriorate the structural integrity should not be impacted.

INSPECTION:

On December 10, 2019 Dixon Engineering Inc. performed a preliminary maintenance inspection on the 200,000 gallon water storage standpipe (Stuckey Court) owned by the City of Martinsburg, West Virginia. Purposes of the inspection were to evaluate the interior and exterior coating's performance and life expectancy, assess the condition of metal surfaces and appurtenances, review safety and health aspects, and make budgetary recommendations for continued maintenance of the tank. All recommendations with budgeting estimates for repairs are incorporated in this report.

The inspection was performed by John Watson, Engineering Technician. The inspector was assisted by Paul Moore, ROV Operator, and Neceto Leung, Staff Technician. Scheduling and arrangements for the inspection were completed through Narayan Venkatesan.

The wet interior inspection was completed with a remotely operated vehicle (ROV). Video of the inspection and still photos are included with this report. No cleaning was performed in the wet interior during the ROV inspection.

GENERAL INFORMATION:

The tank was built in 1983 by Caldwell Tanks Inc. with a sidewall height of 68 feet 5 inches.

CONDITIONS AND RECOMMENDATIONS:

EXTERIOR COATING CONDITIONS:

A coating sample was taken and sent to Tnemec Paint Company for lab analysis. Lab results indicate that the exterior coating is an acrylic.

The coating is in poor condition overall. The coating is beginning to chalk and fade and there is loss of gloss. Surfaces have faded due to exposure to ultraviolet light, which is a normal occurrence for an exterior coating system.

The sidewall coating is in poor condition with numerous spot failures on the lower panels and there is primer bleedthrough throughout.

The roof coating is in poor condition with numerous spot failures, primer bleedthrough, and erosion throughout.

Coating samples were taken during the inspection and tested for heavy metals. The coating was tested at 0.013 percent (130 ppm) lead by weight and 0.0039 percent (39 ppm) chromium by weight. These are trace levels that should not generate a hazardous waste during future abrasive blast cleaning.

EXTERIOR COATING RECOMMENDATIONS:

Budget for total exterior coating removal and repainting in approximately one to two years or when aesthetics dictate.

Remove the existing coating by dry abrasive blast cleaning the steel to a commercial (SSPC-SP6) condition and apply a urethane system. All blast work would be performed inside a dust tight containment system using negative air pressure.

Total removal is recommended because the coating failures are extensive and it is not practical to attempt to spot repair all failed areas.

Since the existing coating contains heavy metals, during abrasive blast cleaning procedures the waste generated may be considered hazardous waste and groundwater leachable. In addition, the airborne particulate of spent abrasive and heavy metal bearing coating may be considered a threat to public health, not only to workers, but also to pedestrians, houses, and business owners in the immediate vicinity. Special provisions in project specifications will be necessary to address hazardous waste, worker safety, and environmental concerns.

The coating system would consist of a full prime coat on the bare metal, a full coat of epoxy, followed by two full coats of urethane. The urethane system offers excellent abrasion resistance with high gloss and sheen retention. The expected life of this system is fifteen years. The system can be overcoated in fifteen years, and a second time approximately fifteen years after the first overcoat, extending the total life of the coating to approximately forty-five years before total removal would be necessary. The tank would be removed from service during the coating project. This is necessary to reduce condensation on the tank's surface. Urethane coatings have a minimum temperature requirement for application and are sensitive to moisture during the curing process. If moisture is present during the curing process, the appearance will become cloudy with little or no gloss. The estimated cost is \$90,000 plus \$60,000 for containment.

WET INTERIOR COATING CONDITIONS:

The coating is presumed to be an epoxy system based on the color and condition. Determining exact coating type is not essential because spot repair is not typically recommended and overcoating in the wet interior is never recommended.

The roof coating is in poor condition with extensive failures throughout.

The sidewall coating is in fair to poor condition with numerous spot failures, topcoat delamination, and blisters throughout. Some of the blisters have broken open causing rust streaks. There is no significant coating damage at the high-water level which would be the area most affected by ice movement.

The floor was covered with approximately 2 inches of sediment that limited the amount of surface visible with the ROV.

WET INTERIOR COATING RECOMMENDATIONS:

Abrasive blast clean the entire wet interior to a near-white metal (SSPC-SP10) condition. Wet interior coating systems must be approved for potable water storage tanks contingent upon meeting requirements of NSF/ANSI 61.

Apply a three-coat epoxy system to the prepared surfaces. Epoxy coating systems are recommended in most applications because they have good adhesion and abrasion resistant qualities. The estimated cost is \$80,000.

CATHODIC PROTECTION CONDITIONS:

The tank does not contain a cathodic protection system. There are no clips or pressure fitting for future installation of a cathodic protection system.

CATHODIC PROTECTION RECOMMENDATIONS:

Install cathodic clips and a pressure fitting for future installation of floating type cathodic protection system. The estimated cost is \$2,000.

PIT/PUMPHOUSE PIPING CONDITIONS:

There is a pit adjacent to the tank that contains piping and valves. The pit has a metal cover that is in good condition. The piping is in good condition. The coating on the piping is in good condition with minor surface corrosion. Most of the coating failures are on the bolts and flanges.

There is a pumphouse adjacent to the tank that contains piping and valves. The piping is in good condition and above the floor. The coating on the piping is in good condition with no significant deterioration.

PIT/PUMPHOUSE PIPING RECOMMENDATIONS:

Abrasive blast clean the pit piping to a commercial (SSPC-SP6) and repaint with an epoxy system. The estimated cost is \$5,000.

SITE CONDITIONS:

The tank is located on a large fenced site adjacent to residential development.

FOUNDATION AND ANCHOR BOLT CONDITIONS:

The top six to twelve inches of the foundation are exposed. The exposed concrete foundation is in good condition with no significant deterioration.

There are twelve anchor bolts evenly spaced on the baseplate. The anchor bolts are in good condition with minor coating loss on several of the nuts or bolts.

FOUNDATION AND ANCHOR BOLT RECOMMENDATIONS:

Coat the exposed concrete with an epoxy coating system to help prevent deterioration. The cost would be incidental to exterior painting.

GROUT CONDITIONS:

The grout between the baseplate and the foundation is in good condition with none damaged or missing.

ROOF HANDRAIL, PAINTER’S RAILING, AND ROOF RIGGING CONDITIONS:

The tank does not have a roof handrail.

There are no roof rigging couplings for safety and staging lines during wet interior coating work.

ROOF HANDRAIL, PAINTER’S RAILING, AND ROOF RIGGING RECOMMENDATIONS:

Install a handrail at the edge of the roof. The railing will allow someone working on the roof to be tied off and secure. The estimated cost is \$15,000.

Install rigging couplings on the roof for temporary fall prevention of workers in the wet interior. The cost would be incidental to the next painting project.

OVERFLOW PIPE CONDITIONS:

The tank has a 6 inch diameter overflow pipe that exits the upper sidewall and extends down along the exterior of the sidewall. There is an 8 inch air gap cut into the overflow pipe approximately 5 feet above the ground level. The discharge end of the overflow pipe is screened. The screen is in good condition but is oversized. The pipe discharges to a funnel and splash pad below the screen. The discharge area is in good condition.

OVERFLOW PIPE RECOMMENDATIONS:

Replace the screen on the end of the overflow pipe with a 24 inch mesh screen. The work can be performed by in-house personnel.

HATCH AND MANWAY CONDITIONS:

There is a 24 inch diameter roof hatch to the wet interior by the sidewall ladder that is in good condition. The hinged cover is in good condition. The hatch was secured with a padlock.

There is a second 24 inch diameter roof hatch to the wet interior opposite the other hatch, that is in good condition. The hinged cover is in good condition. The hatch was not secured.

There is a 24 inch diameter manway in the sidewall that is in good condition. There is a second 24 inch diameter manway in the sidewall that is in good condition with the fill pipe. The manway gaskets showed no signs of leakage and the bolts are in good condition.

HATCH AND MANWAY RECOMMENDATIONS:

Install a 30 inch manway in the sidewall. Average rescue baskets will not pass through the existing manway. The estimated cost is \$9,000.

VENT CONDITIONS:

The roof vent is a 12 inch flow through design that is in fair condition and the screen is intact. The vent has a hinged cover for access to the wet interior.

VENT RECOMMENDATIONS:

Replace the roof vent with a screened frost-free pressure vacuum vent. The new vent would have a movable plate that would allow air to flow in and out of the tank even if the screens become plugged or frosted over. The estimated cost is \$6,000.

LADDER CONDITIONS:

The exterior sidewall ladder starts approximately 8 inches above ground level and extends up to the roof. The ladder is equipped with a cable-type fall prevention device that is in good condition. There is a vandal guard on the sidewall ladder that is in good condition.

There is a roof ladder that routes from the sidewall to the center near the vent. The ladder is in good condition. The ladder is equipped with a cable-type fall prevention device that is in good condition.

There is no ladder in the wet interior.

LADDER RECOMMENDATIONS:

Install a step-off platform at the top of the ladder. The estimated cost is \$6,000.

FILL/DRAW PIPE CONDITIONS:

The fill pipe penetrates through the west sidewall manway into the tank approximately 24 inches above the floor.

The tank draws from a separate pipe. The draw pipe penetrates through the floor and extends approximately 4 inches into the wet interior. There is no deflector plate over top of the pipe in the wet interior.

FILL/DRAW PIPE RECOMMENDATIONS:

Install deflector bars over the end of the draw pipe. The cost would be incidental to the next paint project.

LEVEL INDICATOR CONDITIONS:

There is a mechanical level indicator on the tank. The float from the level indicator is on the floor and there are no cables.

LEVEL INDICATOR RECOMMENDATIONS:

Remove the level indicator and seal the opening in the roof. The estimated cost is \$1,000.

WET INTERIOR METAL CONDITIONS:

The steel structure is in good condition above and below the high-water level. No pitting was observed at the coating failures in the wet interior.

ANALYTICAL LABORATORY REPORT

Monday, December 30, 2019

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CUSTOMER: Dixon Engineering
1104 3rd Ave
Lake Odessa, MI 48849**DATE RECEIVED:** Monday, December 23, 2019
PO/PROJECT #:
SUBMITTAL #: 2019-12-23-012

LAB NUMBER: AC91509**Sampled By:** John Watson**Date Sampled:** December 10, 2019**Job Location:** Martinsburg, WV 262,000 Standpipe (Stucky Ct)**Sample Description:** Paint Chips**Sample Identification:** 1: Martinsburg, WV 262,00 Standpipe (Stucky Ct) Exterior Sidewall

Preparation Method: EPA 3050B-P-M (Acid Digestion for Paints)**Analysis Method:** EPA 6010C-M (ICP-AES Method for Determination of Metals)**Date Analyzed:** Monday, December 30, 2019

<u>ELEMENT</u>	<u>RESULT (by dry weight)</u>	<u>REPORTING LIMIT (RL)</u>
Cadmium	< RL	0.00075 %
Chromium	0.0039 %	0.0013 %
Lead	0.013 %	0.0025 %

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DIXON ENGINEERING, INC.
STEEL TANK FIELD INSPECTION REPORT
STANDPIPE TANK

DATE: December 10, 2019

OWNER: City of Martinsburg
 CLIENT CODE: 48-02-02-04
 TANK NAME: Stuckey Ct.
 LOCATION: Address: 300 Stuckey Court
 City: Martinsburg
 State: West Virginia
 TANK SIZE: Capacity: 200,000 gallons
 Diameter: 23 feet (from nameplate)
 Overflow (HWL): 66 feet (estimated)
 Sidewall height: 68 feet 5 inches (from nameplate)
 CONSTRUCTION: Welded
 Type: Standpipe
 Type of roof: Hemisphere
 YEAR CONSTRUCTED: 1983
 MANUFACTURER: Caldwell
 CONTRACT NUMBER: E-1A17

COATING HISTORY	EXTERIOR	WET INTERIOR
YEAR LAST COATED	<u>1983</u>	<u>1983</u>
CONTRACTOR	<u>Caldwell</u>	<u>Caldwell</u>
COATING SYSTEM	<u>Acrylic</u>	<u>Presumed epoxy</u>
HEAVY METAL COATING SAMPLES	<u>Yes</u>	<u>No</u>
HEAVY METAL BEARING	<u>Yes</u> <u>0.013% lead</u> <u>0.0039% chrome</u>	<u>No</u>

PERSONNEL: Inspector John Watson, Top person Neceto Leung,
 ROV operator Paul Moore
 TYPE OF INSPECTION: Preliminary Maintenance
 METHOD OF INSPECTION: ROV
 YEAR LAST INSPECTED: Unknown

SITE CONDITIONS

Fenced: Yes
Site large enough for contractor's equipment: Yes
Control building: Yes
Antenna control site: No
Neighborhood: Residential
Power lines within 50 feet: No
Site drainage: Away from tank
Indications of underground leakage: No
Shrub, tree, etc. encroachment: No

EXPOSED PIPING:

Location: Adjacent to tank (in building)
Condition of structure: Good
Structure is: Damp
Pump present: No
Hatch condition: Good
Locked: Yes
Altitude valve: No
Pipe coating condition: Good
Describe coating: No significant coating deterioration
Condition of metal: Good

Location: Adjacent to tank (in pit)
Condition of structure: Good
Structure is: Dry
Pump present: No
Hatch condition: Good
Locked: Yes
Altitude valve: Yes
Pipe coating condition: Poor
Describe coating: Delaminating, spot coating failures to substrate, rust bleedthrough, rust undercutting
Condition of metal: Good
Piping comments: Near complete coating loss

FOUNDATION

Foundation exposed: Yes
Exposed height: 6-12 inches
Exposed foundation condition: Good
Damage or deterioration: No

FOUNDATION

Foundation coated: **No**
Type of baseplate gap filler: **Grout**
Condition: **Good**
Amount missing: **0 feet**
Undermining of foundation: **No**

EXTERIOR COATING

Sidewall:

Lettering: **No**
Logo: **No**
Topcoat condition: **Poor**
Previous coat/system condition: **Fair**
Describe coating: **Fading, spot coating failures to substrate, erosion, rust bleedthrough**
Dry film thickness: **6-9 mils**
Adhesion: **Not taken**
Panel connections: **Welded**
Metal condition: **Good**
Sidewall comments: **Coating is heavily faded and has primer bleedthrough throughout. There are spot coating failures on the baseplate and lower panel, 1/2-3 inch+ diameter (25±)**

Roof:

Topcoat condition: **Poor**
Previous coat/system condition: **Fair**
Describe coating: **Fading, delaminating, spot coating failures to substrate, erosion, rust bleedthrough**
Dry film thickness: **6-9 mils**
Adhesion: **Not taken**
Metal condition: **Good**
Roof comments: **There is primer bleedthrough. There are spot coating failures, 1/2-1 inch diameter**

EXTERIOR APPURTENANCES

Sidewall manway (east):

Size: **24 inches**
Hinged: **Yes**
Coating condition: **Poor**
Metal condition: **Good**

EXTERIOR APPURTENANCES

Sidewall manway (west):

Size: **24 inches**

Hinged: **Yes**

Coating condition: **Poor**

Metal condition: **Good**

Sidewall manway comments: **There is a 12 inch pipe that penetrates the manway into the tank**

Anchor bolts:

Number: **12**

Diameter: **1½ inches**

Coating condition: **Fair**

Metal condition: **Good**

Overflow pipe:

Diameter: **6 inches**

Coating condition: **Poor**

Metal condition: **Good**

Condition of screen: **Good**

Percent of screen open: **100**

Mesh size: **4**

Flap gate: **No**

Air gap: **Yes**

Lowest part of discharge to the ground distance: **66 inches screen to ground, 8 inches between screen and funnel**

Overflow discharges to: **Concrete pad**

Condition: **Good**

Overflow comments: **The pipe discharges into a funnel and pipe to splash pad**

Level indicator:

Type: **Mechanical**

Functioning properly: **Yes**

Decal condition: **Fair**

Roof penetration condition: **Good**

Sample tap:

Location: **In building**

Pipe diameter greater than ¼ inch: **No**

12 inches or more above the floor: **Yes**

EXTERIOR APPURTENANCES

Down turned: **Yes**

Smooth end: **No - threaded**

Condition: **Good**

Sidewall ladder:

Height to start of ladder: **8 inches**

Toe clearance: **7 inches or greater**

Width of rungs: **16 inches**

Thickness of rungs: **5/8 inch**

Shape of rungs: **Round**

Coating condition: **Fair**

Metal condition: **Good**

Fall prevention device: **Yes**

Type: **Cable**

Function properly: **Yes**

Cage: **Yes**

Diameter: **30 inches**

Vandal guard: **Yes**

Condition: **Good**

Step-off platform:

N/A

Roof handrail:

N/A

Painter's rail:

N/A

Roof rigging couplings:

N/A

Wet interior roof hatch (x2):

Neck size: **24 inches**

Distance from center of the tank (to outer edge): **10 feet**

Shape: **Round**

Handhold at opening: **No**

Curb height: **4 inches**

Cover overlap: **2 inches**

Hatch security: **Lock**

EXTERIOR APPURTENANCES

Outside coating condition: **Poor**

Inside coating condition: **Fair**

Metal condition: **Good**

Hatch comments: **The second hatch on opposite side of the roof from ladder**

Bolted ventilation hatch:

N/A

Roof vent:

Number: **1**

Distance from center of the tank (to outer edge): **0 feet**

Type: **Flow-through**

Neck diameter: **12 inches**

Coating condition: **Fair**

Metal condition: **Good**

Screen condition: **Good**

Aviation lights:

N/A

WET INTERIOR COATING

Roof:

Topcoat condition: **Poor**

Primer coating condition: **Poor**

Describe coating: **Spot coating failures to substrate, rust undercutting**

Metal condition: **Good**

Roof comments: **As seen on ROV**

Sidewall:

Topcoat condition: **Fair**

Primer coating condition: **Good**

Describe coating: **Spot coating failures to substrate, rust undercutting, rust bleedthrough, blisters**

Mineral deposits: **Light**

Metal condition: **Good**

Sidewall comments: **There are spot coating failures throughout**

WET INTERIOR COATING

Floor:

Covered in sediment could not inspect with ROV

Depth of sediment: **2 inches (estimated)**

Floor comments: **The float from the level indicator is on the floor.**

There are no cables

WET INTERIOR APPURTENANCES

Tank ladder:

N/A

Cathodic protection:

N/A

Clips: **No**

Pressure fitting: **No**

Roof stiffeners:

N/A

Sidewall stiffener:

N/A

Overflow pipe:

Type: **Weir box**

Coating condition: **Poor**

Metal condition: **Good**

Draw pipe:

Diameter: **8 inches (estimated)**

Height above floor: **4 inches (estimated)**

Configuration: **Stubs inside at floor**

Deflector on end: **No**

Coating condition: **Good**

Metal condition: **Good**

Fill pipe:

Diameter: **8 inches (estimated)**

Height above floor: **24 inches (estimated)**

Deflector over end: **No**

Coating condition: **Good**

Metal condition: **Good**

WET INTERIOR APPURTENANCES

Draw pipe comments: **The draw pipe is connected through the manway**

Drain pipe:

Diameter: **2 inches (estimated)**

Location: **In the wall**

Drain pipe comments: **Capped off from the outside**

Sump:

N/A

Mixer:

N/A

Field Inspection Report is prepared from the contractor's viewpoint. It contains information the contractor needs to prepare his bid for any repair or recoating. The engineer uses it to prepare the engineering report. Cost estimates are more accurate if the contractor's problems can be anticipated. While prepared from the contractor's viewpoint, the only intended beneficiary is the owner. These reports are completed with diligence, but the accuracy is not guaranteed. The contractor is still advised to visit the site.



200,000 gallon standpipe (Stuckey Court) located in Martinsburg, West Virginia.



1) The foundation is in good condition.

2) Same.



3) The grout is in good condition.



4) Typical anchor bolt is in good condition.

5) The sidewall manway is in good condition with minor corrosion on the bolts.



6) The fill pipe penetrates through the second sidewall manway.



7) The overflow pipe discharge is in good condition.

8) The overflow screen is intact but is oversized.



9) The vandal guard and level indicator are in good condition.



10) The sidewall ladder is in good condition.

11) The sidewall coating is faded and there is erosion and rust bleedthrough throughout.



12) Spot coating failures on the lower sidewall.



13) Same.

14) The primary roof hatch is in good condition.



15) Primer bleedthrough and erosion throughout the roof. The secondary roof hatch appears to be in good condition.

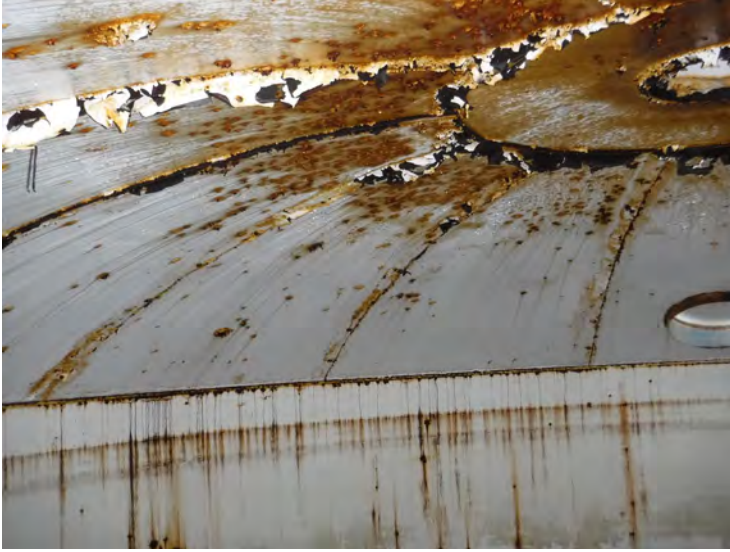


16) Spot coating failures on the roof.

17) The roof vent is in fair condition.

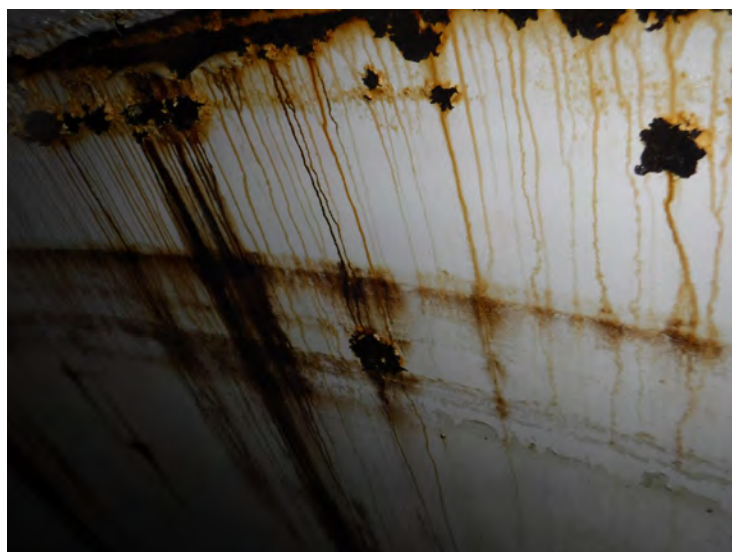


18) Coating failures on the vent neck.



19) There are extensive coating failures on the wet interior roof.

20) Same.



21) Coating failures on the sidewall above the high-water line.



22) The roof viewed from the ROV.

23) Spot coating failures on the sidewall weld seams.



24) Spot coating failures on the sidewall.



25) Same.

26) Topcoat delamination on the sidewall.



27) Same.



28) Coating blisters on the sidewall.

29) The manway penetration is in good condition with rust streaking.



30) Spot coating failures on the second manway with fill pipe penetration.



31) The draw pipe is in good condition.

32) Sediment build-up on the floor.



33) Same.



34) There is piping located in a building next to the tank.

35) The coating on the piping inside the building is in good condition.



36) There are extensive coating failures on the pit piping.