



API 653 ABOVE GROUND STORAGE TANK OUT OF SERVICE INSPECTION FINAL REPORT

HUSKY ENERGY

UNWIN SALT WATER DISPOSAL

LSD: 15-23-45-27 W3M

TANK # T-102

DATE: SEPTEMBER 11 / 2017

NEXTGEN JOB # 16240

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1 EXECUTIVE SUMMARY

The following is a summary of the major findings of the out of service inspection performed on tank # T-102:

1.1 BOTTOM PLATE

- 1.1.1 A Magnetic Flux Exclusion (MFE) scan was performed on all accessible areas of the tank bottom plate. Six (6) MFE indications from underside corrosion were found. The minimum thickness found with ultrasonic examination was 0.160 inch utilizing the echo to echo technique with a nominal plate thickness of 0.250 inch.
- 1.1.2 A random ultrasonic thickness examination was performed on the bottom plate. Five (5) readings were taken per plate. The minimum thickness found with ultrasonic examination was 0.244 inch utilizing the echo to echo technique with a nominal plate thickness of 0.250 inch.
- 1.1.3 The bottom plate butt welds and the shell-to-bottom weld were observed to be in acceptable condition (inspection performed through the coating).
- 1.1.4 Coating failures were observed on the bottom plate and around the float clips.
- 1.1.5 Areas of coating failure were observed on the internal shell-to-bottom weld.
- 1.1.6 The epoxy coating was observed to have been applied unevenly with coating thickness ranging from 10-15 mils.

1.2 FOUNDATION

- 1.2.1 The tank was observed to be placed on an earth and gravel foundation.
- 1.2.2 The entire site (battery) was built in a low-lying area making the whole site a containment.

1.3 SHELL PLATE

- 1.3.1 The shell plate was observed to be epoxy coated internally and painted externally.
- 1.3.2 A random ultrasonic thickness examination was performed on the first course of the shell plate. The minimum ultrasonic thickness reading found was 0.244 inch utilizing the echo to echo technique with a nominal plate thickness of 0.250 inch. Refer to Table A – Manual UT Readings – First Course for additional details.
- 1.3.3 The shell welds were observed to be in acceptable condition with no signs of leakage observed.

1.4 SHELL PENETRATIONS AND ATTACHMENTS

- 1.4.1 Nozzle interiors were visually inspected where possible. No indication of corrosion was observed in the accessible areas.
- 1.4.2 No corrosion was observed in the nozzles externally.
- 1.4.3 Coating failures were observed and marked for repair on the internal nozzles.

1.5 FIXED ROOF

- 1.5.1 The fixed roof was visually inspected from the bottom plate internally. No corrosion or coating failures were observed.

Table of Contents

| | | |
|------|--|----|
| 1 | EXECUTIVE SUMMARY | 2 |
| 1.1 | BOTTOM PLATE | 2 |
| 1.2 | FOUNDATION | 2 |
| 1.3 | SHELL PLATE | 2 |
| 1.4 | SHELL PENETRATIONS AND ATTACHMENTS | 3 |
| 1.5 | FIXED ROOF | 3 |
| 2 | INTRODUCTION | 7 |
| 3 | TANK INFORMATION | 8 |
| 4 | OVERVIEW PHOTOGRAPHS | 9 |
| 5 | FOUNDATION | 12 |
| 5.1 | Foundation Checklist | 12 |
| 5.2 | Foundation Photographs | 13 |
| 6 | BOTTOM PLATE | 14 |
| 6.1 | Bottom Plate Checklist | 14 |
| 6.2 | Tank Floor Remaining Life Calculations | 15 |
| 6.3 | Bottom Plate Layout Drawing | 16 |
| 6.4 | Bottom Plate Photographs | 18 |
| 7 | TANK SHELL | 21 |
| 7.1 | Tank Shell Checklist | 21 |
| 7.2 | Tank Shell Manual Ultrasonic Examination | 22 |
| 7.3 | Tank Shell Photographs | 23 |
| 8 | SHELL PENETRATIONS AND ATTACHMENTS | 24 |
| 8.1 | Shell Penetrations and Attachments Checklists | 24 |
| 8.2 | Shell Penetrations and Attachments Photographs | 25 |
| 9 | FIXED ROOF | 33 |
| 9.1 | Fixed Roof Checklist | 33 |
| 9.2 | Fixed Roof Photographs | 34 |
| 10 | REPAIR RECOMMENDATIONS | 36 |
| 10.1 | Bottom Plate | 36 |
| 10.2 | Foundation | 36 |
| 10.3 | Shell Plate | 36 |

| | | |
|------|--|----|
| 10.4 | Shell Penetrations and Attachments | 36 |
| 10.5 | Fixed Roof | 36 |
| 11 | EQUIPMENT | 37 |
| 12 | WARRANTY..... | 38 |

Table of Photographs

| | |
|---|----|
| Photograph 1: Site Signage / LSD: 15-23-45-27 W3M | 9 |
| Photograph 2: Tank Nameplate | 9 |
| Photograph 3: Tank Overview | 10 |
| Photograph 4: Tank Overview | 10 |
| Photograph 5: Tank Overview | 11 |
| Photograph 6: Tank Overview | 11 |
| Photograph 7: Foundation Overview..... | 13 |
| Photograph 8: Foundation Material (Gravel) | 13 |
| Photograph 9: Bottom Plate Overview..... | 18 |
| Photograph 10: Bottom Plate Overview..... | 18 |
| Photograph 11: Bottom Plate Overview..... | 19 |
| Photograph 12: MFE Indications..... | 19 |
| Photograph 13: Coating Failures on Bottom Plate | 20 |
| Photograph 14: Bottom Plate Overview..... | 20 |
| Photograph 15: Internal Shell Plate Overview..... | 23 |
| Photograph 16: Internal Shell Plate Overview..... | 23 |
| Photograph 17: Nameplate Entrance Manway | 25 |
| Photograph 18: External Nozzles..... | 25 |
| Photograph 19: Anode Nozzle | 26 |
| Photograph 20: Nozzles Interior | 26 |
| Photograph 21: Nozzle Interior..... | 27 |
| Photograph 22: Nozzle Interior..... | 27 |
| Photograph 23: Nozzle Interior..... | 28 |
| Photograph 24: Nozzle Interior..... | 28 |
| Photograph 25: Anode Nozzle | 29 |
| Photograph 26: Anode Nozzle | 29 |
| Photograph 27: Float Clips..... | 30 |
| Photograph 28: Internal View of Entrance Manway | 30 |
| Photograph 29: Internal Nozzles | 31 |
| Photograph 30: Internal Nozzles | 31 |
| Photograph 31: Skim Suction Floats | 32 |
| Photograph 32: Fixed Roof Internal Surface..... | 34 |
| Photograph 33: Fixed Roof Internal Surface..... | 34 |
| Photograph 34: External Fixed Roof | 35 |
| Photograph 35: External Fixed Roof | 35 |

2 INTRODUCTION

The purpose of this report is to present the findings of the API 653 Out of Service inspection of tank # T-102 performed on September 11, 2017 at the Unwin Salt Water Disposal as stipulated by the owner operator representative Luke Newport.

The following personnel were involved in the completion of this inspection:

Juan Galvez

Project Manager / API Inspector / Report Author
API 653 Certificate # 31297

Ivan Sanchez

MFE Operator

3 TANK INFORMATION

| | |
|---------------------------------|---|
| JOB NUMBER | 16240 |
| TANK NUMBER | T-102 |
| INSPECTION DATE | September 11, 2017 |
| MANUFACTURING DATE | 2004 |
| MANUFACTURER | GLM Tanks and Equipment Ltd. Battleford, SK |
| CONSTRUCTION STANDARD | API 650 Modified |
| SERIAL NUMBER | J-04-055 S2 |
| DIAMETER | 24.5 feet |
| HEIGHT | 24 feet |
| CAPACITY | 2000 bbl |
| SERVICE | Salt Water Disposal Tank |
| DESIGN PRESSURE | 8 oz. |
| INSULATED | No |
| BOTTOM TYPE | Flat |
| BOTTOM THICKNESS | 0.250 inch |
| SHELL THICKNESS | First Course: 0.250 inch Material: A-36 or Equivalent Remaining Courses: 0.188 inch Material: A-36 or Equivalent |
| DECK THICKNESS | 0.250 inch |
| INTERNAL COATING | Epoxy |
| EXTERNAL COATING | Paint |
| SPECIFIC GRAVITY | 1.0 |
| DESIGN METAL TEMPERATURE | -11°F |
| DESIGN LIQUID LEVEL | 24 feet |

4 OVERVIEW PHOTOGRAPHS



Photograph 1: Site Signage / LSD: 15-23-45-27 W3M



Photograph 2: Tank Nameplate



Photograph 3: Tank Overview



Photograph 4: Tank Overview



Photograph 5: Tank Overview



Photograph 6: Tank Overview

5 FOUNDATION

5.1 Foundation Checklist

| Containment | | Condition | Comments |
|--------------------|---|---------------------------|-------------------------------------|
| 1. | Containment details | Sloped berm | Whole site acting as containment |
| 2. | Condition of berm wall | Acceptable condition | |
| 3. | Condition of secondary liner | None present | |
| 4. | Check operating condition of containment drains | None present | |
| 5. | Inspect area for build up of trash, vegetation and other inflammables | Acceptable condition | |
| Foundation | | Condition | Comments |
| 6. | Measure foundation levelness and bottom elevations (see API 653 Annex B for extent of measurements) | Visually acceptable | |
| 7. | Foundation detail | Elevated earth and gravel | |
| 8. | Elevated tank foundation (skirt) present | No | |
| 9. | Inspect for tank settlement into foundation | Acceptable condition | Tank at grade level with foundation |
| 10. | Inspect for cavities under foundation and vegetation against tank bottom | Acceptable condition | None observed |
| Rock | | Condition | Comments |
| 11. | Presence of crushed rock under the steel bottom usually results in severe underside corrosion. Perform additional bottom plate examination. | Acceptable condition | None observed |

5.2 Foundation Photographs



Photograph 7: Foundation Overview



Photograph 8: Foundation Material (Gravel)

6 BOTTOM PLATE

6.1 Bottom Plate Checklist

| Bottom Plate Checklist | | Condition | Comments |
|------------------------|---|--------------------------------------|---------------------------------|
| 1. | Inspect entire bottom plate utilizing MFE / MFL and ultrasonic examination (refer to bottom plate summary for additional information) | Acceptable condition | No material loss found |
| 2. | Measure the depth and appearance of topside pitting (Sharp edged, lake-type, dense, scatter etc.) | Acceptable condition | Epoxy coated |
| 3. | Mark locations for turning coupons for inspection | No coupons required | |
| 4. | Inspect all welds for corrosion and leaks, particularly the shell -to-bottom | Acceptable condition | |
| 5. | Check condition of internal sump, if applicable. Sump bottom and side wall plate and seams need to be evaluated for both product and soil side corrosion. | No sump present | |
| 6. | Locate and mark voids under the bottom | None present | |
| 7. | Record bottom data on a layout sketch using existing bottom plate as a grid. List the number and sizes of patch plates required. | Refer to Bottom Plate Layout drawing | No patch plate repairs required |
| 8. | Vacuum test the bottom lap welds | Not performed | |
| 9. | Check for reinforcing pads under all bottom attached clips, brackets and supports. | Acceptable condition | |
| 10. | Identify and report low areas on the bottom plate that do not drain adequately | Acceptable condition | |
| 11. | Inspect coating for holes, disbonding, deterioration and discoloration | Acceptable condition | |

6.2 Tank Floor Remaining Life Calculations

$$MRT = (\text{minimum of } RT_{bc} \text{ or } RT_{ip}) - O_r (StP_r + UP_r)$$

Where:

MRT: minimum remaining thickness at the end of interval O_r

O_r : in service interval of operation

RT_{bc} : minimum remaining thickness from bottom side corrosion (**0.160 in.**)

RT_{ip} : minimum remaining thickness from top side corrosion (**0.250 in.**)

StP_r : maximum rate of corrosion not repaired on top side, $StP_r=0$ for coated areas of the bottom as long as life expectancy of the coating meets or exceeds O_r . (**0.00000 in.**)

UP_r : maximum rate of corrosion on the bottom side (**0.00692 in.**)

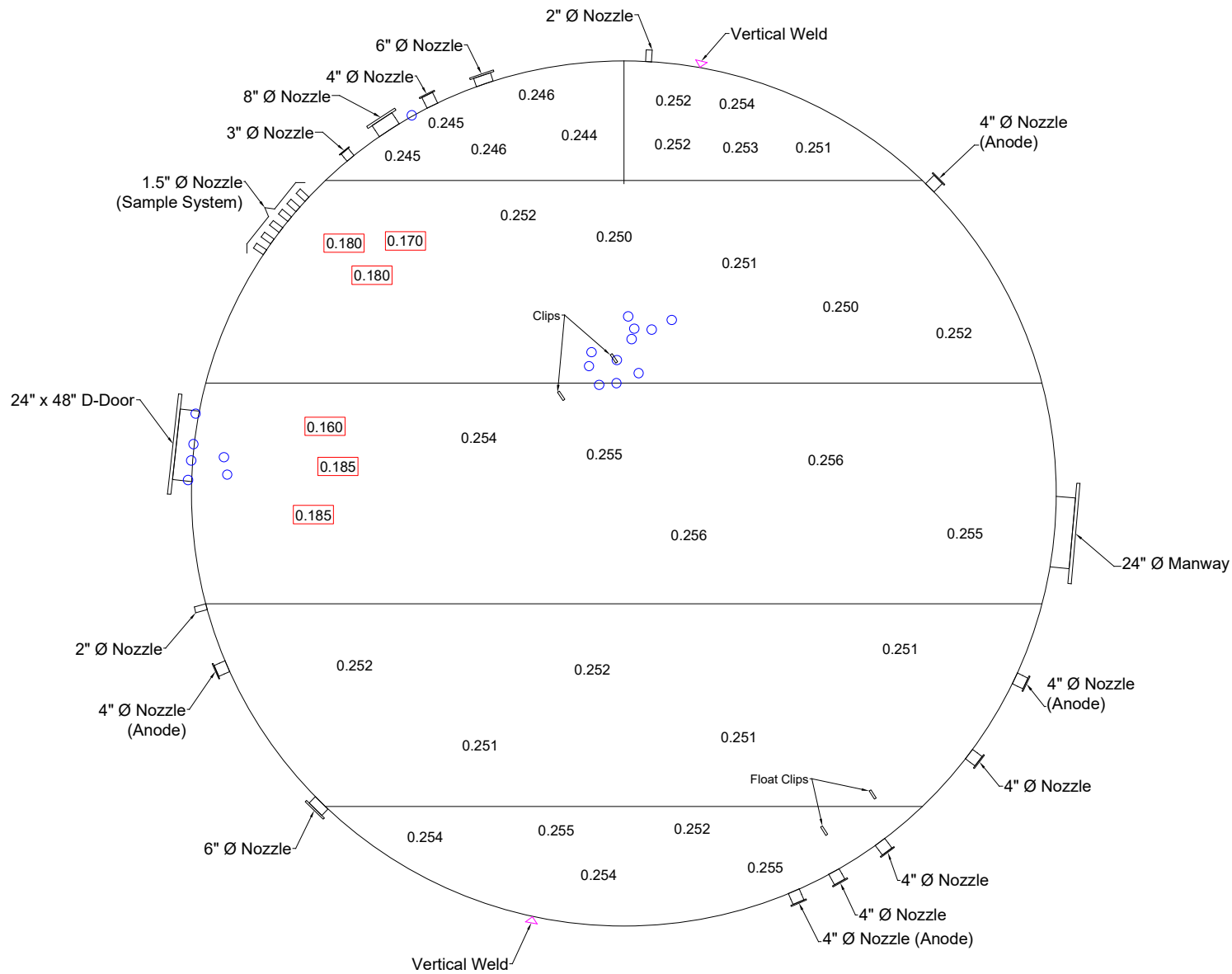
The calculations were made using a bottom plate age of 13 years.

The service interval of operation used in the calculations was 5 years.

$$MRT = 0.125 \text{ inch}$$

Based on remaining life calculations, no bottom plate repairs are recommended at the time of this inspection.

6.3 Bottom Plate Layout Drawing



NOTES:

- Coating Failures
- 0.252 Random UT Readings (Echo to Echo)
- 0.170 MFE Indications



CLIENT:
HUSKY ENERGY

LOCATION:
UNWIN S.W.D

TANK:
T- 102

TITLE:
BOTTOM PLATE LAYOUT

| | | | |
|-------------------------|--------------------------------|-----------------------|-----------------------|
| SIZE: 24.5' Ø | DRAWING No: 1 of 1 | DRAWN: IS | CHECKED: EM |
| JOB NO: 16240 | DATE: SEPT 11 / 2017 | REVISION: 1 | |

6.4 Bottom Plate Photographs



Photograph 9: Bottom Plate Overview



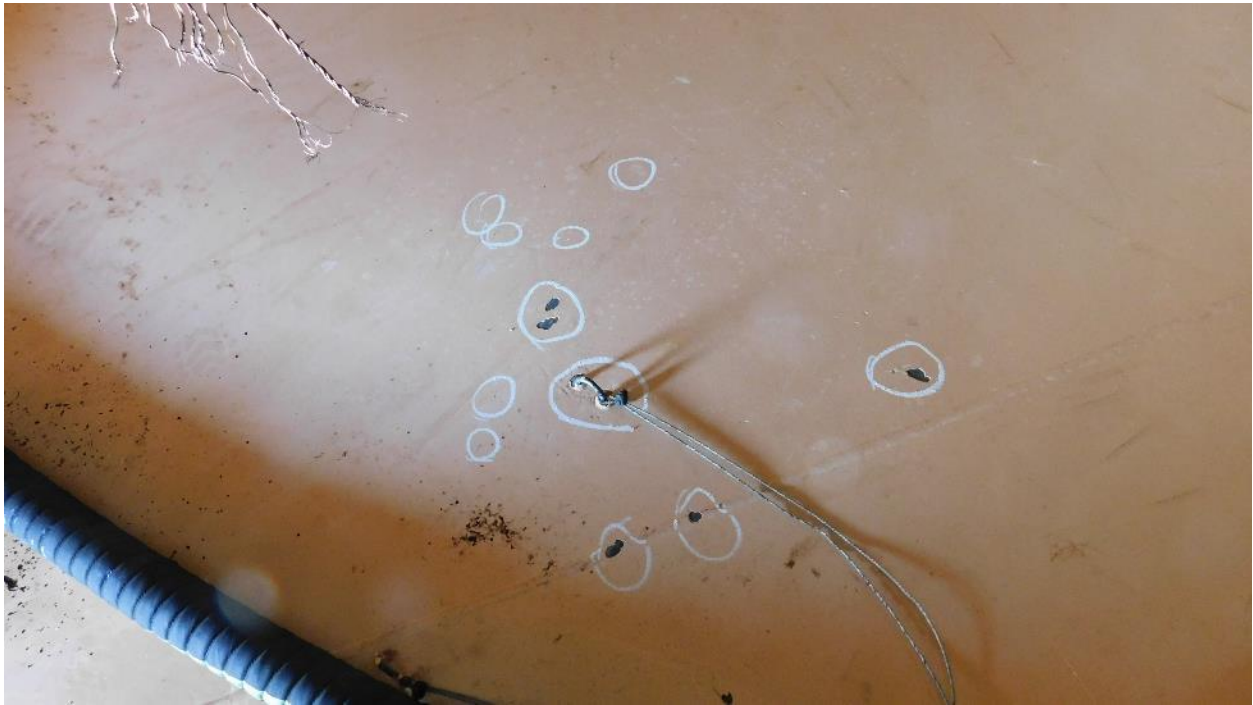
Photograph 10: Bottom Plate Overview



Photograph 11: Bottom Plate Overview



Photograph 12: MFE Indications



Photograph 13: Coating Failures on Bottom Plate



Photograph 14: Bottom Plate Overview

7 TANK SHELL

7.1 Tank Shell Checklist

| Tank Shell Checklist | | Condition | Comments |
|----------------------|--|----------------------|---------------------|
| 1. | Visually inspect externally for paint failures, pitting and corrosion | Acceptable condition | |
| 2. | Inspect shell- to- bottom weld and surrounding HAZ (heat affected zone) for corrosion | Acceptable condition | |
| 3. | On cone up bottoms, closely inspect and gauge the depth of metal loss on the 2 in. to 4in. of the shell (area of standing water) | Acceptable condition | Flat bottom |
| 4. | Measure the depth of pitting on each course | Acceptable condition | |
| 5. | Survey the shell to check for roundness and plumb | Acceptable condition | Visually acceptable |

7.2 Tank Shell Manual Ultrasonic Examination

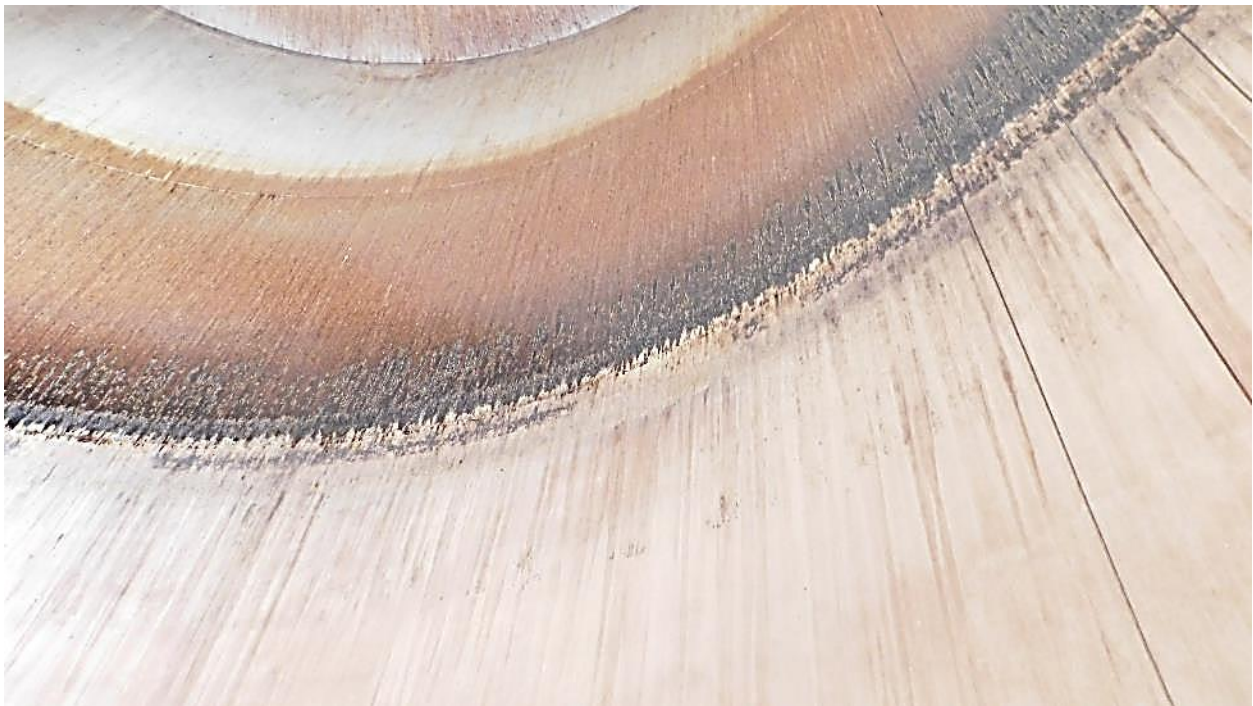
7.2.1 Table A – Manual UT Readings – First Course

| Plate # | UT Through Coating <input type="checkbox"/> UT on Bare Steel <input type="checkbox"/> Echo-to Echo <input checked="" type="checkbox"/> | | | | | | | | | | | | | | | |
|-----------------------------|--|-------|-------|-------|-------|-------|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 1 | 0.244 | 0.246 | 0.244 | 0.245 | 0.251 | 0.248 | 0.248 | 0.250 | 0.250 | 0.251 | 0.249 | 0.247 | 0.251 | 0.250 | 0.248 | 0.246 |
| 2 | 0.248 | 0.247 | 0.246 | 0.246 | 0.246 | 0.244 | 0.247 | 0.251 | 0.251 | 0.248 | 0.249 | 0.250 | 0.247 | 0.246 | 0.252 | 0.248 |
| Min: 0.244 | | | | | | | | Max: 0.252 | | | | | | | | |
| Readings recorded in inches | | | | | | | | | | | | | | | | |

7.3 Tank Shell Photographs



Photograph 15: Internal Shell Plate Overview



Photograph 16: Internal Shell Plate Overview

8 SHELL PENETRATIONS AND ATTACHMENTS

8.1 Shell Penetrations and Attachments Checklists

| Shell Penetrations and Attachments Checklist | | | |
|--|--|----------------------------|-------------------|
| Manways and Nozzles | | Condition | Comments |
| 1. | Inspect for cracks or signs of leakage on weld joints at nozzles, manways and reinforcing plates | Acceptable condition | None observed |
| 2. | Inspect for shell plate dimpling around nozzles, caused by excessive pipe deflection | Acceptable condition | None observed |
| 3. | Inspect for leaks at flanges and around bolts | Acceptable condition | No leaks observed |
| 4. | Test bracing and supports for sample lines and equipment | Acceptable condition | |
| 5. | Inspect appurtenances opened during cleaning such as nozzle interiors (after removal of valves) | Acceptable condition | |
| 6. | Inspect shell nozzles for thinning and pitting | Acceptable condition | Visually examined |
| 7. | Inspect hot tap nozzles for trimming of holes | No hot tap nozzles present | |
| Nozzles Extending into Tank | | Condition | Comments |
| 8. | Inspect pipe support pads welded to tank bottom | None present | |
| 9. | Inspect to see that pipe is free to move along support without strain or tearing action on bottom plate | N/A | |
| 10. | In internal elbow-down fill line nozzles, inspect the wear plate on the tank bottom | None present | |
| Tank Piping Manifolds | | Condition | Comments |
| 11. | Inspect manifold piping, flanges and valves for leaks | Acceptable condition | |
| 12. | Check for anchored piping which would be hazardous to the tank shell or bottom connections during earth movement | Acceptable condition | |
| 13. | Check sample connections for leaks and proper valve operation | Acceptable condition | |
| 14. | Check for damage to temperature indicators | Acceptable condition | |

8.2 Shell Penetrations and Attachments Photographs



Photograph 17: Nameplate Entrance Manway



Photograph 18: External Nozzles



Photograph 19: Anode Nozzle



Photograph 20: Nozzles Interior



Photograph 21: Nozzle Interior



Photograph 22: Nozzle Interior



Photograph 23: Nozzle Interior



Photograph 24: Nozzle Interior



Photograph 25: Anode Nozzle



Photograph 26: Anode Nozzle



Photograph 27: Float Clips



Photograph 28: Internal View of Entrance Manway



Photograph 29: Internal Nozzles



Photograph 30: Internal Nozzles



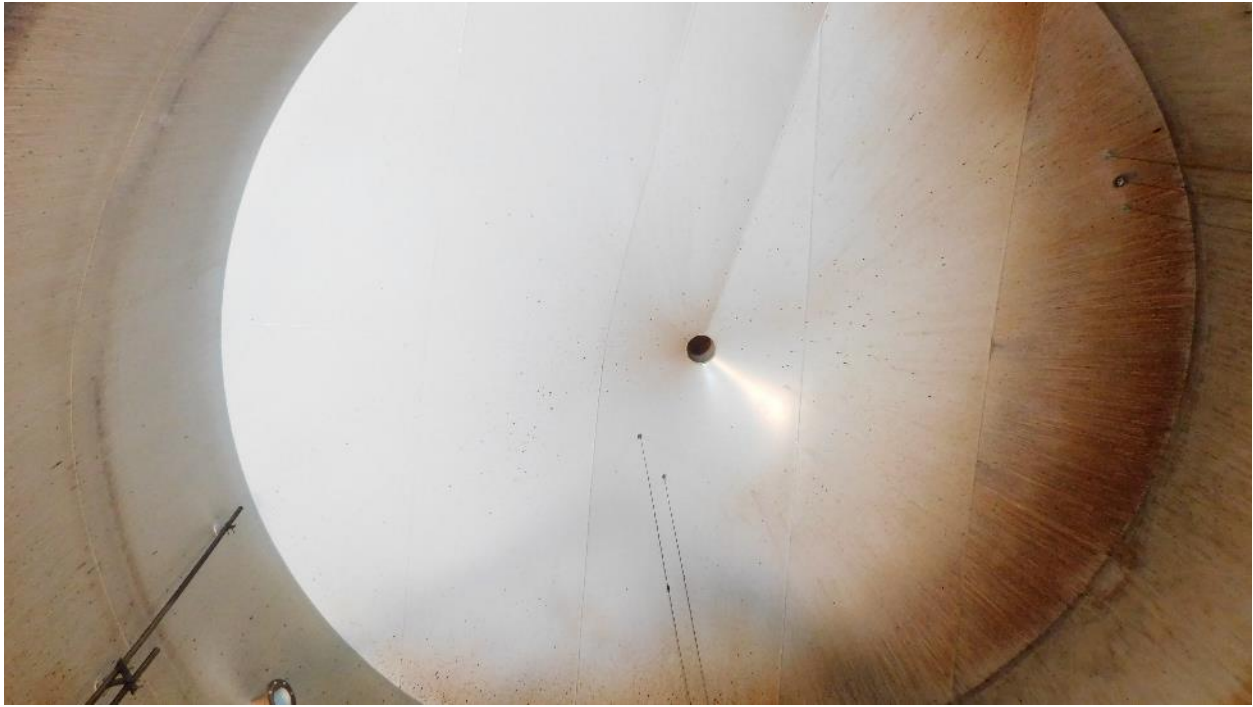
Photograph 31: Skim Suction Floats

9 FIXED ROOF

9.1 Fixed Roof Checklist

| Fixed Roof Checklist | | | |
|-------------------------------|--|----------------------|----------|
| Fixed Roof General | | Condition | Comments |
| 1. | Visually inspect the underside surface of roof plates for holes, scale build up and pitting | Acceptable condition | |
| 2. | Ultrasonically examine for thin areas, particularly the near the shell to roof juncture | Acceptable | |
| 3. | Check all clips, brackets, braces etc., welded to the roof deck plate for welded reinforcing pads and see that they have not broken free | N/A | |
| 4. | Visually inspect externally for paint failure, holes, pitting and corrosion on the roof deck | Acceptable condition | |
| Sampling Hatches / Gauge Well | | Condition | Comments |
| 5. | Inspect sample hatch for corrosion | Acceptable condition | |
| 6. | Check that the cover operates properly | Acceptable condition | |
| 7. | If the tank has no gauge well, check for a hold off distance marker | N/A | |
| Access Structures | | | |
| Handrails | | Condition | Comments |
| 8. | Identify and report type (steel pipe, galvanized pipe, square tube, angle) and size of handrails | No Access Present | |
| 9. | Inspect for pitting, holes and paint failures | N/A | |
| 10. | Inspect attachment welds | N/A | |
| 11. | Identify cold joints and sharp edges. Inspect handrails and mid-rails | N/A | |
| 12. | Inspect safety drop bar (or safety chain) for corrosion, functioning and adequate length | N/A | |
| Platform Frame | | Condition | Comments |
| 13. | Inspect frame for corrosion and paint failure | No Platform Present | |
| 14. | Inspect the attachment of the frame to supports and supports to tank, for corrosion and weld failure | N/A | |
| 15. | Check reinforcing pads where supports are attached to shell or roof | N/A | |
| 16. | Inspect the surface that deck plate or grating rests on for thinning and holes | N/A | |
| 17. | Check that flat surface to flat surface junctures are seal welded | N/A | |
| Deck Plate and Grating | | Condition | Comments |
| 18. | Inspect deck plate for corrosion-caused thinning or holes (not drain holes), and paint failure | No Grating Present | |
| 19. | Inspect grating for corrosion-caused thinning of bars and failure of welds | N/A | |

9.2 Fixed Roof Photographs



Photograph 32: Fixed Roof Internal Surface



Photograph 33: Fixed Roof Internal Surface



Photograph 34: External Fixed Roof



Photograph 35: External Fixed Roof

10 REPAIR RECOMMENDATIONS

10.1 Bottom Plate

10.1.1 It is recommended to repair the coating failures observed on the bottom plate and the shell-to-bottom weld.

10.2 Foundation

10.2.1 No foundation repairs are recommended at the period of this inspection.

10.3 Shell Plate

10.3.1 No shell plate repairs are recommended at the period of this inspection.

10.4 Shell Penetrations and Attachments

10.4.1 It is recommended to repair the coating failures observed on the internal nozzles.

10.5 Fixed Roof

10.5.1 No fixed roof repairs are recommended at the period of this inspection.

11 EQUIPMENT

Floor Scanner

The floor scanner utilized was an MFE Mark III, serial number 0509754 with calibration September 11, 2017.

Ultrasonic Flaw Detector

The ultrasonic flaw detector utilized was an GE Inspection Technologies USM Go, serial number 10010285 with calibration date June 12, 2017. Transducer utilized was a Technisonic 0.375-inch diameter dual crystal 5 MHZ frequency.

12 WARRANTY

This inspection report is based solely on the conditions observed at the time of inspection along with any information provided by the owner operator. Any pertinent information that was not made available or presented to Nextgen Industrial Services Inc. during the course of this inspection, has not been evaluated or included in this report.

Nextgen Industrial Services Inc. has evaluated the condition of this tank based on the observations and measurements as made by Nextgen Industrial Services Inc. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Nextgen and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, we warrant only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, we shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall we be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall we be liable for any consequential or incidental damages including, but not limited to, loss of profit or revenues, loss of use of equipment tested or services by us or any associated claims of other damages.