



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

HUSKY ENERGY

UNWIN SALT WATER DISPOSAL

LSD: 15-23-45-27 W3

TANK # T-101

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-101:

1.1 BOTTOM PLATE

- 1.1.1 The bottom plate was observed to be coned down. There was no access to visually inspect the underside of the bottom plate as the manway was bolted at the time of inspection.
- 1.1.2 As per on-site representative, a Magnetic Flux Exclusion (MFE) scan was not performed on the tank bottom plate.
- 1.1.3 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 0.377 inch utilizing the echo to echo technique with a nominal plate thickness of 0.375 inch.
- 1.1.4 The bottom plate butt welds and the shell-to-bottom weld were observed to be in acceptable condition (inspection performed through the coating).
- 1.1.5 Coating failures were observed on the bottom plate particularly around the centre of the tank. Refer to Bottom Plate Layout drawing for additional details.
- 1.1.6 Areas of coating failure were observed on the internal shell-to-bottom weld.
- 1.1.7 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 elevated concrete ring wall.
- 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 0.369 inch utilizing the echo to echo technique with a nominal plate thickness of 0.375 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	8
3	TANK INFORMATION	9
4	OVERVIEW PHOTOGRAPHS	10
5	FOUNDATION	13
5.1	Foundation Checklist	13
5.2	Foundation Photographs	14
6	BOTTOM PLATE	16
6.1	Bottom Plate Checklist	16
6.2	Tank Floor Remaining Life Calculations	17
6.3	Bottom Plate Layout Drawing	18
6.4	Bottom Plate Photographs	20
7	TANK SHELL	23
7.1	Tank Shell Checklist	23
7.2	Tank Shell Manual Ultrasonic Examination	24
7.3	Tank Shell Photographs	25
8	SHELL PENETRATIONS AND ATTACHMENTS	26
8.1	Shell Penetrations and Attachments Checklists	26
8.2	Shell Penetrations and Attachments Photographs	27
9	FIXED ROOF	36
9.1	Fixed Roof Checklist	36
9.2	Fixed Roof Photographs	37
10	REPAIR RECOMMENDATIONS	39
10.1	Bottom Plate	39
10.2	Foundation	39
10.3	Shell Plate	39

10.4	Shell Penetrations and Attachments	39
10.5	Fixed Roof	39
11	EQUIPMENT	40
12	WARRANTY.....	41

Table of Photographs

Photograph 1: Site Signage / LSD: 15-23-45-27 W3M	10
Photograph 2: Tank Nameplate	10
Photograph 3: Tank Overview	11
Photograph 4: Tank Overview	11
Photograph 5: Tank Overview	12
Photograph 6: Foundation Overview.....	14
Photograph 7: Foundation Concrete Ring Wall	14
Photograph 8: Foundation Concrete Ring Wall	15
Photograph 9: Foundation Concrete Ring Wall	15
Photograph 10: Bottom Plate Overview	20
Photograph 11: Bottom Plate Overview.....	20
Photograph 12: Bottom Plate Overview.....	21
Photograph 13: Coating Failure on Pipe Support Reinforcing Pad	21
Photograph 14: Coating Failure on Bottom Plate.....	22
Photograph 15: Bottom Plate Overview	22
Photograph 16: Internal Shell Plate Overview.....	25
Photograph 17: Internal Shell Plate Overview.....	25
Photograph 18: Internal View of Nameplate Entrance Manway	27
Photograph 19: Internal Nozzles	27
Photograph 20: Internal Nozzles	28
Photograph 21: Coating Failures on Entrance Manway	28
Photograph 22: Skim Suction Float.....	29
Photograph 23: Internal Piping.....	29
Photograph 24: Internal Nozzle	30
Photograph 25: Nozzle Interior.....	30
Photograph 26: Anode and Temperature Probe	31
Photograph 27: Coating Failure on Manway	31
Photograph 28: Coating Failures Around Internal Manway	32
Photograph 29: Nozzle Interior.....	32
Photograph 30: Anode Nozzle	33
Photograph 31: Internal Nozzles	33
Photograph 32: Internal Nozzle	34
Photograph 33: Nozzle Interior.....	34
Photograph 34: Nozzle Interior.....	35
Photograph 35: Nozzle Interior.....	35
Photograph 36: Fixed Roof Internal Surface.....	37
Photograph 37: Fixed Roof Internal Surface.....	37

Photograph 38: Fixed Roof Internal Surface.....	38
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2 INTRODUCTION

The purpose of this report is to present the findings of the API 653 Out of Service inspection of tank # T-101 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

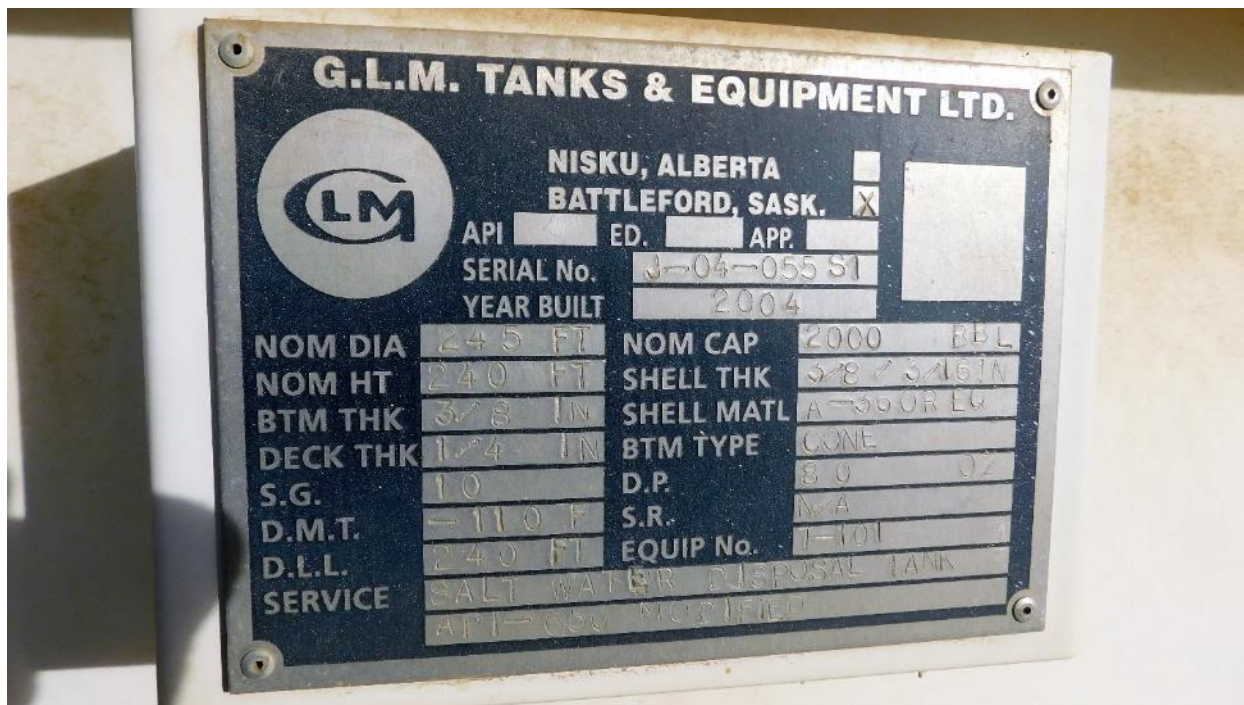
3 TANK INFORMATION

JOB NUMBER	16240
TANK NUMBER	T-101
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 S1
DIAMETER	24.5 feet
HEIGHT	24 feet
CAPACITY	2000 bbl
SERVICE	Salt Water Disposal Tank
DESIGN PRESSURE	8 oz.
INSULATED	No
BOTTOM TYPE	Cone Down
BOTTOM THICKNESS	0.375 inch
SHELL THICKNESS	First Course: 0.375 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

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	Concrete ringwall	
8.	Elevated tank foundation (skirt) present	Yes	Cone down tank
9.	Inspect for tank settlement into foundation	Acceptable condition	Tank above grade of 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 6: Foundation Overview



Photograph 7: Foundation Concrete Ring Wall



Photograph 8: Foundation Concrete Ring Wall



Photograph 9: Foundation Concrete Ring Wall

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 **(0.377 in.)**

RT_{ip} : minimum remaining thickness from top side corrosion **(0.375 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 **(0.0000 in.)**

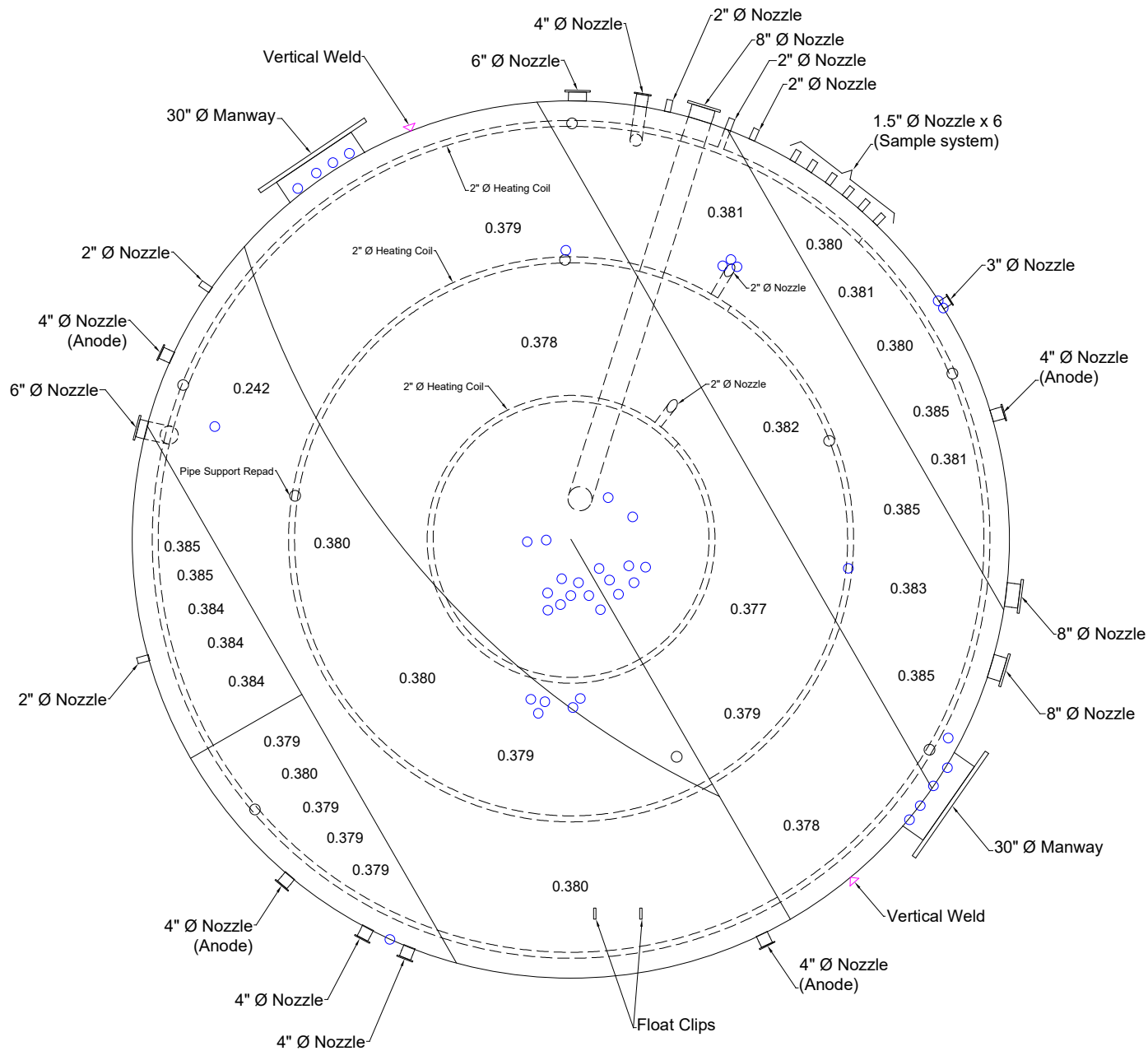
The calculations were made using a bottom plate age of 13 years.

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

$$MRT = 0.375 \text{ inch}$$

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

0.380 Random UT Readings
(Echo to Echo)



CLIENT:

HUSKY ENERGY

LOCATION:

UNWIN S.W.D

TANK:

T- 101

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 10: Bottom Plate Overview



Photograph 11: Bottom Plate Overview



Photograph 12: Bottom Plate Overview



Photograph 13: Coating Failure on Pipe Support Reinforcing Pad



Photograph 14: Coating Failure on Bottom Plate



Photograph 15: Bottom Plate Overview

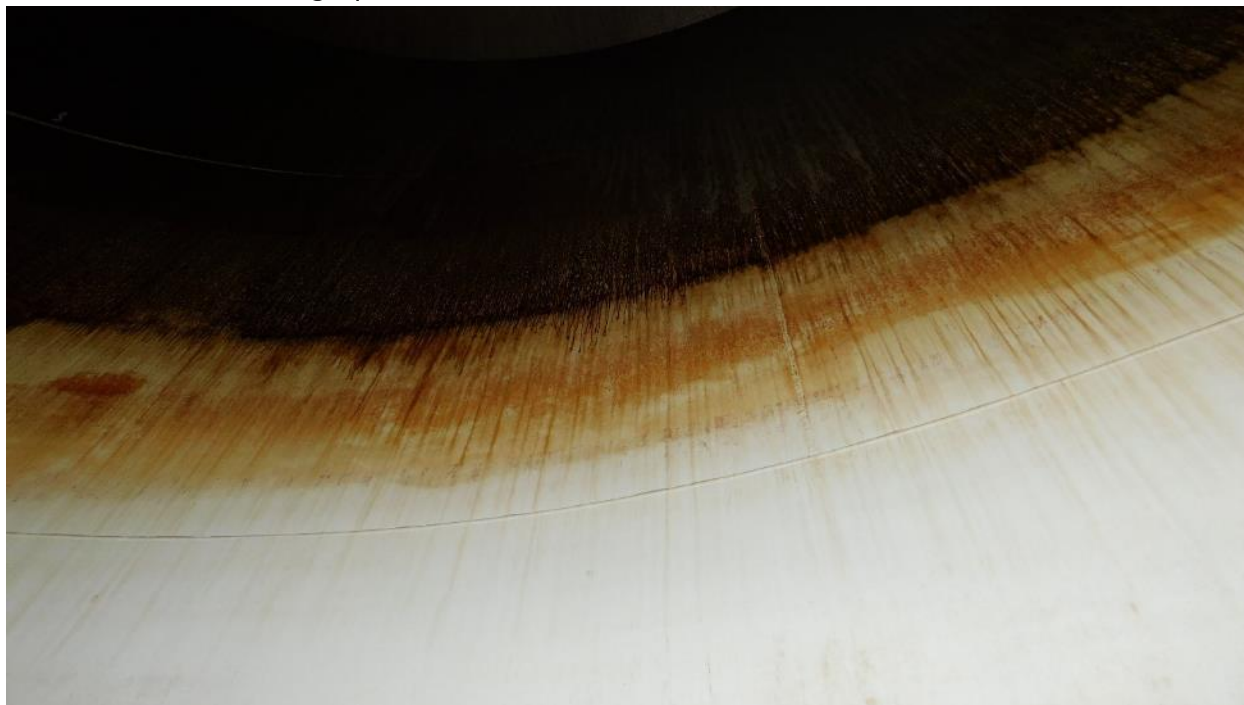
7 TANK SHELL

7.1 Tank Shell Checklist

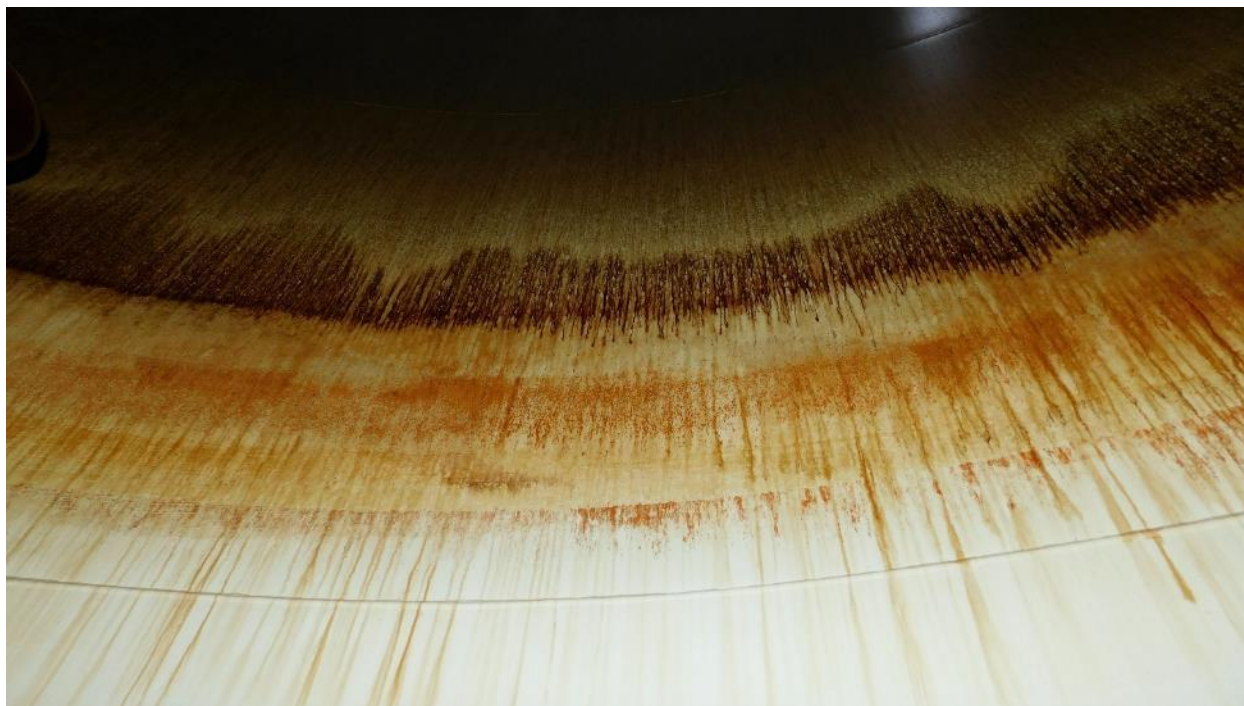
Tank Shell Checklist		Condition	Comments
1.	Visually inspect externally for paint failures, pitting and corrosion	Acceptable condition	
2.	Inspect shell- to- bottom weld and surrounding HAZ (heat affected zone) for corrosion	Acceptable condition	
3.	On cone up bottoms, closely inspect and gauge the depth of metal loss on the 2 in. to 4in. of the shell (area of standing water)	Acceptable condition	Cone down 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

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	0.374	0.369	0.371	0.370	0.370	0.369	0.379	0.370	0.372	0.375	0.373	0.373	0.374	0.372	0.367	0.376
2	0.372	0.372	0.371	0.374	0.373	0.374	0.372	0.371	0.371	0.371	0.375	0.374	0.373	0.374	0.371	0.372
Min: 0.367								Max: 0.379								
Readings recorded in inches																

7.3 Tank Shell Photographs



Photograph 16: Internal Shell Plate Overview



Photograph 17: 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 18: Internal View of Nameplate Entrance Manway



Photograph 19: Internal Nozzles



Photograph 20: Internal Nozzles



Photograph 21: Coating Failures on Entrance Manway



Photograph 22: Skim Suction Float



Photograph 23: Internal Piping



Photograph 24: Internal Nozzle



Photograph 25: Nozzle Interior



Photograph 26: Anode and Temperature Probe



Photograph 27: Coating Failure on Manway



Photograph 28: Coating Failures Around Internal Manway



Photograph 29: Nozzle Interior



Photograph 30: Anode Nozzle



Photograph 31: Internal Nozzles



Photograph 32: Internal Nozzle



Photograph 33: Nozzle Interior



Photograph 34: Nozzle Interior



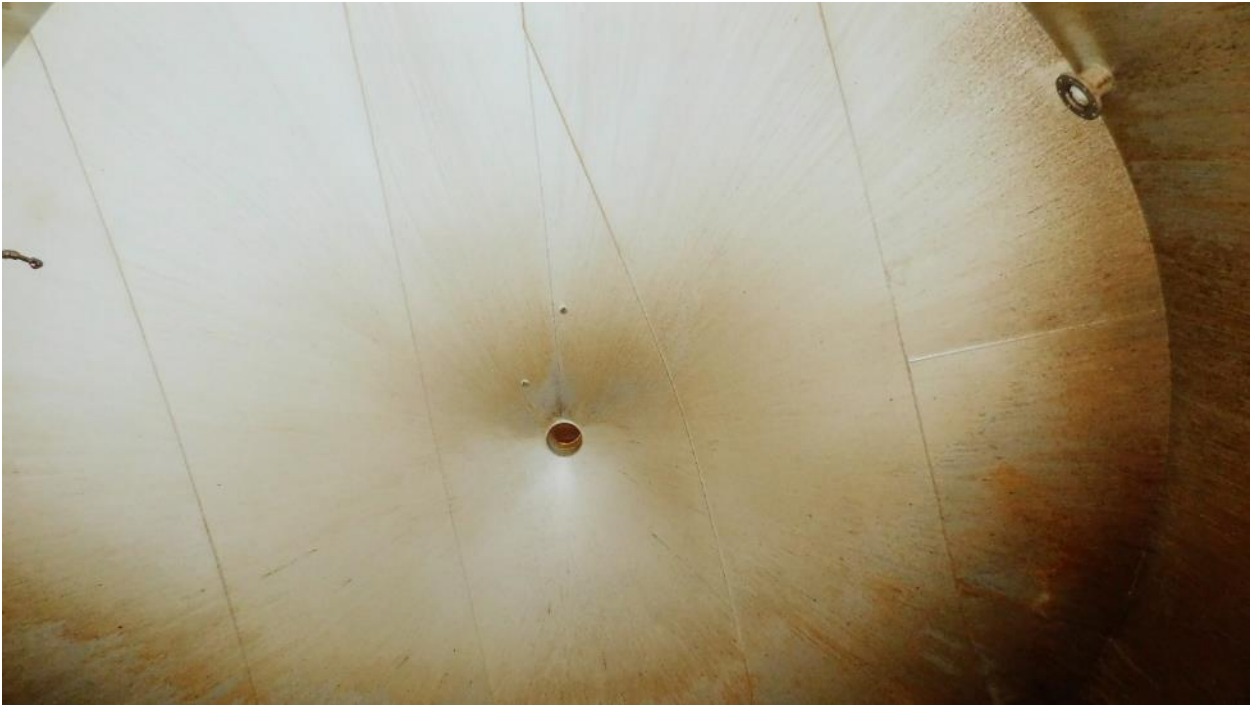
Photograph 35: Nozzle Interior

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	Flat bar ladder	
9.	Inspect for pitting, holes and paint failures	Acceptable	
10.	Inspect attachment welds	Acceptable condition	
11.	Identify cold joints and sharp edges. Inspect handrails and mid-rails	Acceptable condition	
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 36: Fixed Roof Internal Surface



Photograph 37: Fixed Roof Internal Surface



Photograph 38: Fixed Roof Internal Surface

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 are 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.