API 653 In-Service Inspection Report:
City of Saint Paul Bulk Fuel Storage Facility

Tank #6

September 24 - October 2, 2023

Prepared for:
City of Saint Paul
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LIST OF ACRONYMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASNT	The American Society for Nondestructive Testing
CP	Cathodic Protection
DFT	Dry Film Thickness (coating measurements)
LTF	Lower Tank Farm
NDE	Non-Destructive Examination
SC	Shell Course
SCA	Secondary Containment Area
TTLR	Tank Truck Loading Rack
UT	Ultrasonic Inspection (Ultrasonic Testing)
UTT	Ultrasonic Thickness Testing (UT measurements)
UTF	Upper Tank Farm
VT	Visual Examination (Visual Testing)

Section 1.0 Executive Summary

Integrity Environmental LLC performed an American Petroleum Institute (API) 653 In-Service inspection of all accessible external components of the diesel fuel storage tank (Tank #6) located at the City of Saint Paul Bulk Fuel Storage Facility in the City of Saint Paul, Alaska on September 24 - October 2, 2023. All examination results were evaluated and accepted by an API 653 certified inspector. The observations and results of this inspection are summarized in Section 2.0 and detailed in Section 3.0 of this report.

Table 1-1 Inspection Schedule

Inspection Type:	Due Dates:
Next Recommended API 653 In-Service Inspection:	In-Service inspection is due on or before **September 2028**.
Next Recommended API 653 Out-of-Service Inspection:	Out-of-Service inspection is due on or before **September 2026**, **per client records.**[1]

[1] *The date above represents the 10-year interval from the previous September 2016 Out-of-Service inspection report.*

Certified Inspector: C. House API 653 Cert#: 53363
Camille House Level II Technician: UTT

Section 1.1 Background

According to API Standard 653, 5th Edition, 2014, periodic in-service inspection of aboveground storage tanks shall be performed to assure continued tank integrity. Visual external examination and Ultrasonic Thickness Testing (UTT) were conducted to collect data in order to evaluate the mechanical integrity and fitness for continued service of the tank. Previous tank records provided by the client were reviewed by the inspector.

This routine in-service inspection consisted of observing and evaluating the exterior surfaces of the tank and tank components. A visual external examination was documented for evidence of leaks, shell distortions, signs of settlement, corrosion, foundation conditions, paint coatings, and condition of the appurtenances. The non-destructive examination (NDE) methods conducted to evaluate the external surfaces of the tank and tank components are detailed in Section 4.0 of this report.

Section 1.2 Tank Data Summary

Based on the tank records provided by the client, the tank was originally constructed in 1961 per API Standard 12C, then reconstructed in 1988 at the current location in

accordance with the API Standard 653. The vertical single wall cylindrical tank is welded carbon steel, with valves and flanges constructed to American National Standards Institute (ANSI) requirements as labeled on components.

Table 1-2 Tank Data Sheet

General:	
Tank Number / I.D.:	#6
Client / Owner:	City of Saint Paul
Facility Location:	City of Saint Paul Bulk Fuel Storage Facility
Tank Location:	57° 08' 02.2" N 170° 16' 01.0" W
Inspector:	Camille House, API 653 Cert#: 53363
Employer:	Integrity Environmental LLC
Inspection Date:	In-Service, September 2023
Last Inspection Date:	Out-of-Service, September 2016 per client records; In-Service, September 2016 per client records
Design/Construction:	Original: API 12C, per client records; Reconstruction: API 653, per client records
Name Plate Present:	Yes, illegible
Manufacturer:	Original: Perron Co., per client records; Reconstruction: Alaska Mechanical Inc., per client records
Year of Construction:	Original: 1961, per client records; Reconstruction: 1988, per client records
Construction:	
Roof:	Fixed cone roof - lap welded with internal rafters supported by center column, per the previous API 653 report
Floor:	Lap welded, per the previous API 653 report
Foundation:	Gravel pad, per client records
Shell Construction:	Butt welded, 3 shell courses
Product:	No. 2 Diesel, per client records
Specific Gravity – Product:	0.84 to 0.88, per safety data sheet
Specific Gravity – Design:	1.0, per previous API 653 report
Design Pressure:	Atmospheric
Operating Temperature:	Ambient
Cathodic Protection:	Yes (installer: Norton Corrosion), per client records

Table 1-2 Tank Data Sheet

Bottom Leak Detection Ports:	Not applicable
Release Prevention System:	Earthen diked berm with an impermeable bentonite liner, per client records
Coatings / Linings:	
Floor:	Internal – Epoxy, per previous API 653 report
Shell:	External – white Internal – approximately 18” up shell course 1, per previous API 653 report
Fixed Roof:	External – white Internal – none, per previous API 653 report
Dimensions:	
Diameter (ft)	25.00 feet per client records
Height/Length (ft)	22.00 feet per client records
Nominal Capacity:	80,000 gallons per client records
Safe Fill Level:	21 feet, maximum operating liquid level per tank nameplate
API Design Fill Height:	No data available
Access:	
External access via ground level, stairs attached to tank, and adjacent tank rooftops	

Section 1.3 Scope of Inspection & Limitations

The following inspections were performed on all accessible components of the tank and secondary containment. Refer to Section 3.0 for details of the NDE results. The NDE methods and equipment referenced in Section 4.0. Inspection photos are in Appendix A. Refer to Appendix C for the tank shell and roof layouts.

Section 1.3.1 Inspections Completed

- Visual external examinations of the tank shell courses were performed using the provided access from the ground level, stairs attached to tank, and adjacent rooftops.
- UTT of the exterior shell courses were recorded at the areas accessible from the ground level and where accessible from the tank stairs to determine the rate of uniform general corrosion and inspection interval frequency.
- UTT of external shell and roof nozzles, including reinforcing plates, were recorded to determine nominal thickness and provide an indication of integrity of the nozzle and reinforcing plates, as applicable.
- UTT of the external roof plates at spot locations were recorded to determine the nominal thickness and provide an indication of integrity of the roof.
- Shell settlement survey of the foundation was recorded and evaluated using external elevation measurements.

Section 1.3.2 Inspection Limitations

- Limited visual examinations were performed on the upper section of the tank only where safely accessible from the tank stairs.
- UTT of the external bottom plate extension could not be recorded due to coating failure.

Section 2.0 Inspection Summary Recommendations

It is the responsibility of the owner/operator to review the inspection findings and recommendations as well as establish a repair scope, if needed, and determine the appropriate timing for repairs, monitoring, and/or maintenance activities. In order to conform to API Standard 653, recommendations are stated below for major and/or minor repairs, as well as monitoring, which may be necessary to restore the integrity of the tank, and/or maintain integrity until the next inspection. Applicable federal, state, local laws, codes, or regulations concerning tank inspections shall apply when more stringent than the requirements of API Standard 653.

Section 2.1 Inspection Action Items

The following summary recommendations can be prioritized as high (repairs or mandatory compliance necessary to maintain or restore a tank to a condition suitable for safe operation), moderate (minor repairs, maintenance activity or best engineering practices), or low (less critical observations and recommendations). Action items with noted observations are below in Tables 2-1 through 2-3. The detailed descriptions of the summarized inspection results are in Section 3.0. Inspection photos are in Appendix A.

Table 2-1 Action Items – High Priority

High Priority:	
Venting	● No emergency relief venting was observed. Refer to Appendix A, photo no.(s): 32 – 35. ○ Install and document emergency relief venting per manufacturer design or engineering best practices. ○ No manufacturer tank drawing or design information was available to determine the form of construction that provides emergency relief venting. Emergency relief venting is required in the form of construction or device(s) to relieve excessive internal pressure in the event of an emergency, such as a fire. ● Both of the 6-inch atmospheric gooseneck vents were missing mesh screens to prevent bird entry. Refer to Appendix A, photo no.(s): 37, 38, 45, 46. ○ Verify and install a mesh screen per manufacturer sizing. ○ The screen should be a corrosion-resistant and coarse-mesh screen to prevent bird entry but not restrict airflow. ○ It is recommended that in areas where snow drifting or icing may be an issue the screen mesh should be appropriately sized to prevent clogging.

Table 2-1 Action Items – High Priority

High Priority:	
Labeling	● Product, tank capacity, safe fill height, tank gauging heights, OSHA, and NFPA 704 labels were not observed on tank. Refer to Appendix A, photo no.(s): 1 – 8. ○ Add product, tank capacity, safe fill height, tank gauging heights, OSHA, and NFPA 704 labeling onto the tank so they clearly communicate the hazards related to the contents and fuel transfers. ○ Monitor and maintain labeling to make sure it is legible or replace as practicable.
Overfill Prevention	● Unable to verify overfill prevention system was operational at time of inspection. Refer to photos: 16 – 18, 36, 40. ○ Verify and document the operation of overfill prevention system such as liquid level gauging and high-level alarm. ○ Repair/replace overfill prevention system devices and components, as necessary, to keep operational.

Table 2-2 Action Items – Moderate Priority

Moderate Priority:	
Shell and Shell Nozzles / Appurtenances	● Moderate to severe coating failures with general surface corrosion were observed throughout. Refer to Appendix A, photo no.(s): 1 – 29. ○ Areas of coating failures should be cleaned and recoated, as necessary, to prevent further deterioration of coating and mitigate corrosion. Coatings should be applied in accordance with industry standards. ○ Monitor and maintain acceptable condition of the coatings to prevent damage from the atmospheric conditions.

Table 2-2 Action Items – Moderate Priority

Moderate Priority:	
Fixed Roof and Fixed Nozzles / Appurtenances	● Areas of standing water with biological growth observed on the roof plates around the perimeter. Refer to Appendix A, photo no.(s): 32 – 35. ○ Areas of coating failures should be cleaned and recoated, as necessary, to prevent further deterioration of coating and mitigate corrosion. Coatings should be applied in accordance with industry standards. ○ Monitor and maintain acceptable condition of the coatings to prevent damage from the atmospheric conditions. ● Moderate to severe coating failures with general surface corrosion were observed throughout. Refer to Appendix A, photo no.(s): 36 – 52. ○ Areas of coating failures should be cleaned and recoated, as necessary, to prevent further deterioration of coating and mitigate corrosion. Coatings should be applied in accordance with industry standards. ○ Monitor and maintain acceptable condition of the coatings to prevent damage from the atmospheric conditions.
Tank Accessways	● Moderate to severe coating failures with general surface corrosion were observed throughout. Refer to Appendix A, photo no.(s): 1, 2, 8, 13 – 15, 32, 54 – 56. ○ Areas of coating failures should be cleaned and recoated, as necessary, to prevent further deterioration of coating and mitigate corrosion. Coatings should be applied in accordance with industry standards. ○ Monitor and maintain acceptable condition of the coatings to prevent damage from the atmospheric conditions.

Table 2-3 Action Items – Low Priority

Low Priority:	
Secondary Containment Area (SCA) Liner	● The SCA liner had visible areas where the top layer had erosion and areas of overgrown vegetation. Refer to Appendix A, photo no.(s): 58 – 60. ○ Remove overgrown vegetation as practicable. ○ Monitor SCA liner for wear and tear, then repair as practicable.

Section 2.2 In-Service Inspection Calculations Summary

In-Service inspection intervals were based on uniform general corrosion rates and minimum required thicknesses of the shell and roof plates. Table 2-4 summarizes the shell and roof inspection frequency for external visual examinations and ultrasonic thicknesses. Refer to tables in Section 3.0 for details of the calculations for the minimum required thicknesses.

Table 2-4 External Visual & Ultrasonic Inspection Frequency Summary

Item	Previous Thickness (inch) t_{prev}	Actual Measured Thickness (inch) t_{act}	Minimum Required Thickness (inch) t_{min}	Remaining Corrosion Allowance (inch) RCA	Corrosion Rate (inch / year) N	VT (years) I_{VT}	UT (years) I_{UT}
SC 1	0.188	0.183	0.100	0.083	0.0001	5.0	15.0
SC 2	0.188	0.193	0.100	0.093	0.0000	5.0	15.0
SC 3	0.188	0.194	0.100	0.094	0.0000	5.0	15.0
Roof	0.188	0.177	0.090	0.087	0.0002	5.0	15.0

External Inspection Formulas:

$$RCA = t_{act} - t_{min}$$
$$N = (t_{prev} - t_{act}) / Y$$
$$I_{VT} = (t_{act} - t_{min}) / 4N$$

Ultrasonic Inspection Formulas:

$$RCA = t_{act} - t_{min}$$
$$N = (t_{prev} - t_{act}) / Y$$
$$I_{UT} = (t_{act} - t_{min}) / 2N$$

t_{prev} = is the previous thickness (inch), assumed nominal thickness based on current average and/or tank records provided by client.
t_{act} = is the actual measured thickness (inch), average (or minimum, if applicable) from current inspection.
t_{min} = is the minimum required thickness (inch), calculated per API 653 5th ed., 2014, Section 4.
RCA = is the remaining corrosion allowance (inch), calculated per API 653 5th ed., 2014, Section 6.
N = is the corrosion rate (inch/year), calculated per API 653 5th ed., 2014, Section 6.
Y = is the time span (years), between thickness readings or age of the tank if nominal thickness is used for t_{prev}.
I_{VT} or I_{UT} = is the inspection interval (years), for the next External Visual (VT) or Ultrasonic Inspection (UT), API 653 5th ed., 2014, Section 6.

Section 3.0 Tank In-Service Inspection

The following NDE results were documented on all accessible components of the tank and secondary containment. The NDE methods and equipment referenced in Section 4.0 of this report. Inspection photos are in Appendix A. Refer to Appendix C for the tank shell and roof layouts.

Section 3.1 Foundation

Per client records, the tank sits on a gravel pad foundation. No previous tank history of differential or edge settlement was reported in previous API 653 reports. Refer to Section 3.1.2 and Appendix E for details of the current settlement survey analysis.

Section 3.1.1 Foundation Visual Examination Checklist

Observations from the foundation and secondary containment area visual examinations are below. A visual examination checklist was used to document inspection observations, in accordance with API 653, Annex C. Inspection action items are summarized in Section 2 of this report.

Table 3-1 Foundation Visual Examination Checklist

Item	Comments
Foundation	
Measure foundation levelness and bottom elevation.	No action required.
Site Drainage	
Check site for drainage away from the tank and associated piping and manifolds.	No action required.
Check operating conditions of the dike drain.	No action required.
Housekeeping	
Inspect the area for buildup of trash, vegetation, and other inflammables buildup.	Refer to Table 2-3 Action Items – Low Priority.

Section 3.1.2 Foundation Settlement Survey

Settlement survey of the foundation was performed using the external survey measurements evaluated per Annex B, API 653, 5th edition, 2014. Settlements that relate to the tank shell and bottom plate were recorded by taking elevation measurements around the tank

circumference at the shell. Settlement of a tank is the result of either uniform, planar (rigid body tilting of a tank), out-of-plane, or a combination. Settlement can occur when the tank shell settles sharply around the edge, resulting in deformation of the bottom plate near the shell-to-bottom corner junction.

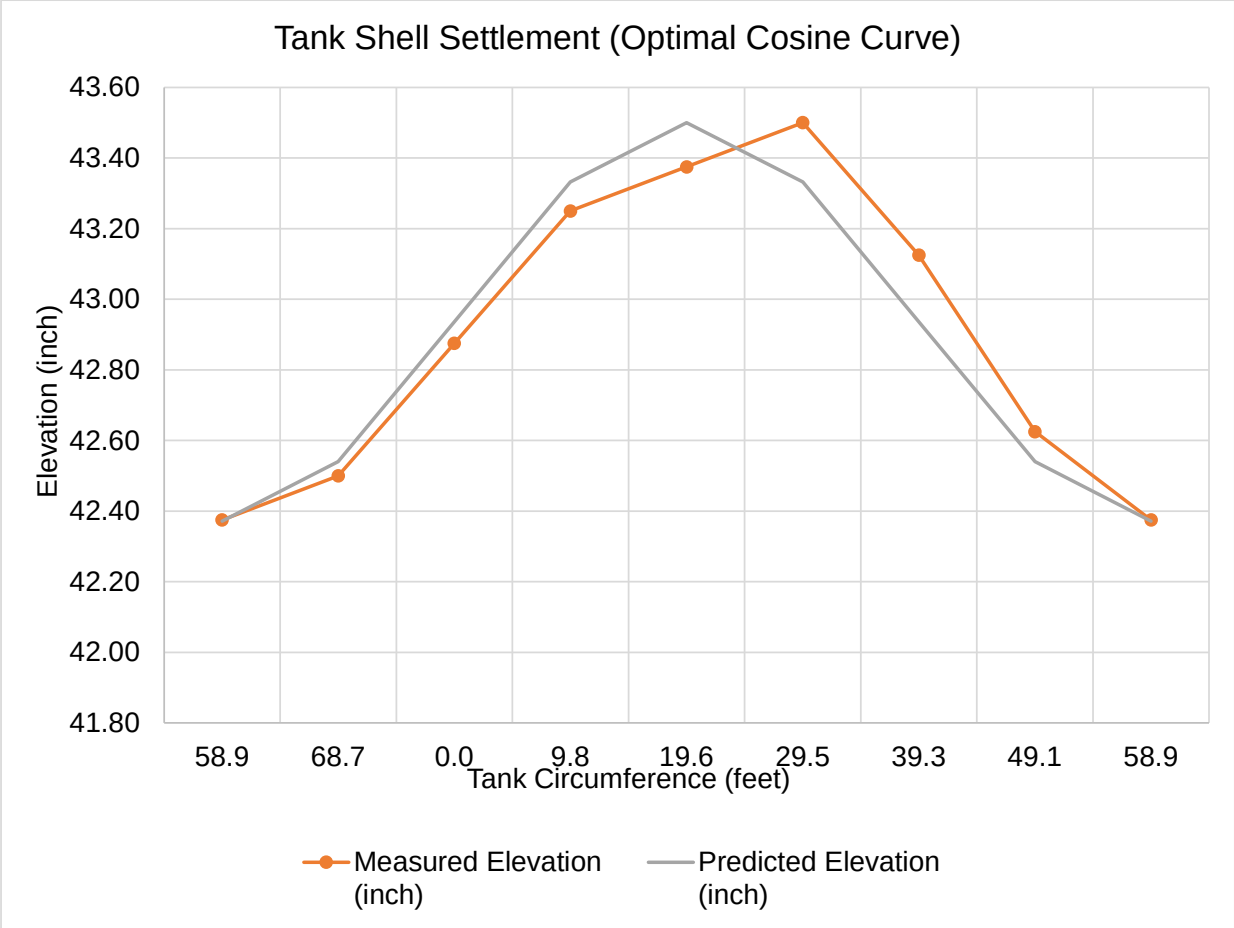
The settlement evaluation for the tank is planer or roughly approximates the shape of a cosine curve. The evaluation of this “out-of-levelness” or settlement, utilizing the criterion for “out-of-plane distortion” as described in API 653 Annex B, indicates that the settlement is within the acceptable limits.

Table 3-2 shows settlement measurements recorded externally at the shell. Graph 3-1 shows the shell settlement along the circumference. Refer to Appendix E for details of the current settlement survey analysis.

Table 3-2 Foundation Elevation Measurements (inch)

Station ID	Rod Height at 0’ - Shell
1	42.875
2	43.250
3	43.375
4	43.500
5	43.125
6	42.625
7	42.375
8	42.500

Graph 3-1 Foundation Settlement Evaluation



Section 3.2 Shell

Section 3.2.1 Shell Visual Examination Checklist

Observations from the visual examinations of the external surfaces of the shell courses are below. A visual examination checklist was used to document inspection observations, in accordance with API 653, Annex C. Inspection action items are summarized in Section 2 of this report.

Table 3-3 Shell Visual Examination Checklist

Item	Comments
External Visual Inspection	
Visually inspected for paint failures, pitting, corrosion, and product leaks on shell plate and welds including attachment welds with reinforcing plates.	Refer to Table 2-2 Action Items – Moderate Priority.
Clean off the bottom angle and inspect for corrosion and thinning on plate and weld.	Refer to Table 2-2 Action Items – Moderate Priority.
Inspect the bottom-to-foundation seal, if any.	Not applicable.

Section 3.2.2 Shell Ultrasonic Thickness Testing

Average and minimum measured thicknesses per shell course are listed below. All measured thicknesses were within the acceptable mill tolerances of the nominal material thicknesses. Refer to Section 4.0 for details on the NDE methods and equipment utilized during the inspection. Refer to Appendix C for the tank shell layout.

Table 3-4 Shell Ultrasonic Thickness Testing – Shell Course 1

Data No. (0° to 360°)	Shell Course (SC)	0° UTT (inch)	90° UTT (inch)	180° UTT (inch)	270° UTT (inch)
1	SC 1	0.191	0.186	0.183	0.183
2	SC 1	0.199	0.192	0.194	0.192
3	SC 1	0.200	0.188	0.192	0.191
4	SC 1	0.198	0.190	0.194	0.194
5	SC 1	0.196	0.191	0.191	0.192
6	SC 1	0.195	0.187	0.191	0.191
				Average:	**0.192**
				Minimum:	**0.183**

Table 3-5 Shell Ultrasonic Thickness Testing – Shell Course(s) 2 – 3

Data No. (From Stairs)	Shell Course (SC)	Spot UTT (inch)
1	SC 2	0.193
2	SC 2	0.195
3	SC 2	0.196
4	SC 2	0.196
5	SC 2	0.196
6	SC 2	0.196
	Average:	**0.195**
	Minimum:	**0.193**
1	SC 3	0.194
2	SC 3	0.198
3	SC 3	0.198
4	SC 3	0.198
5	SC 3	0.198
6	SC 3	0.197
	Average:	**0.197**
	Minimum:	**0.194**

Section 3.2.3 Shell External Calculations

The minimum acceptable shell plate thicknesses for continued service were computed in accordance with API 653, Section 4.3.3.1. Calculations to determine the minimum acceptable shell plate thicknesses were based on the averaged measured shell thicknesses collected during the inspection.

Table 3-6 Shell Plate Minimum Thickness Calculations

Shell Course	Shell Course Height (feet)	Height (feet)	Allowable Stress (psi)	Joint Efficiency	Minimum Required Thickness[1] (inch)
SC	SCh	H	S	E	t_{min}
SC 1	7.33	22.00	23,600	0.85	0.100
SC 2	7.33	14.67	23,600	0.85	0.100
SC 3	7.33	7.33	26,000	0.85	0.100

Minimum Required Thickness Formula[1]:

$$t_{min}=((2.6D(H-1)G))/SE$$

D = is the nominal diameter of tank (25.00 feet).
H = is the height from the bottom of the shell course under consideration to the maximum liquid level when evaluating an entire shell course in feet (see table above).
G = is the highest specific gravity of contents (1.00 used for calculations).
S = is the maximum allowable stress in pound force per square inch (lbf/in.^{2}); use the smaller of 0.80Y or 0.429T for bottom and second course; use the smaller of 0.88Y or 0.472T for all other courses. Allowable shell stresses are shown in API 653 5th ed., 2014, Table 4.1. Minimum thickness calculation for riveted tank shell courses with unknown Y or T, use 21,000 lbf/in.^{2}, refer to API 653 5th ed., 2014, Section 4.3.4.
E = is the original joint efficiency of the tank. If original joint efficiency is unknown, use API 653 5th ed., 2014, Table 4.2. For minimum thickness calculation for riveted tank shell courses, refer to API 653 5th ed., 2014, Section 4.3.4.

[1] *Minimum acceptable thickness, in inches for each course as calculated from the above equation; however, t_{min} shall not be less than 0.100 in. for any tank course, API 653 5th ed., 2014, Section 4.3.3.1.a.*

Section 3.3 Roof

Section 3.3.1 Roof Visual Examination Checklist

Observations from the roof plates visual examination are below. A visual examination checklist was used to document inspection observations, in accordance with API 653, Annex C. Inspection action items are summarized in Section 2.

Table 3-7 Roof Visual Examination Checklist

Item	Comments
Roof Deck Plate Internal Corrosion	
For safety, before accessing the roof, check with ultrasonic instrument or lightly use a ball peen hammer to test the deck plate near the edge of the roof for thinning. (Corrosion normally attacks the deck plate at the edge of a fixed roof and at the rafters in the center of the roof first.) Roof plates corroded to an average thickness of less than 0.09 inch in any 100 square inch area or any holes through shall be repaired or replaced.	No action required.
Roof Deck Plate External Corrosion	
Visually inspect for paint failure, holes, pitting, and corrosion product on the roof deck.	Refer to Table 2-2 Action Items – Moderate Priority.
Roof Deck Drainage	
Look for indication of standing water. (Significant sagging of fixed roof deck indicates potential rafter failure. Large standing water areas on a floating roof indicate inadequate drainage design or, if to one side, a non-level roof with possible leaking pontoons.)	Refer to Table 2-2 Action Items – Moderate Priority.

Section 3.3.2 Roof Ultrasonic Thickness Testing

Overall roof plate average and minimum measured thicknesses are notated below. All measured thicknesses were within the acceptable mill tolerances of the nominal material thicknesses. Refer to Section 4.0 for details of the NDE methods and equipment utilized during the inspection. Refer to Appendix C for the tank roof layout. Data was collected only on roof plates that were safely accessible from the guardrail.

Table 3-8 Roof Ultrasonic Thickness Testing

Plate No.	Spot UTT (inch)	Spot UTT (inch)	Spot UTT (inch)
1	0.183	0.182	0.183
2	0.193	0.190	0.188
3	0.198	0.198	0.191
4	0.188	0.189	0.184
5	0.199	0.196	0.196
6	0.194	0.193	0.195
7	0.181	0.177	0.177
8	0.182	0.186	0.181
		Average:	**0.189**
		Minimum:	**0.177**

Section 3.4 Nozzles and Appurtenances

Section 3.4.1 Nozzles and Appurtenances Visual Examination Checklist

Observations from the visual examinations of the shell and roof nozzles and appurtenances are discussed below. A visual examination checklist was used to document inspection observations in accordance with API 653, Annex C. Inspection action items are summarized in Section 2 of this report.

Table 3-9 Nozzles and Appurtenances Visual Examination Checklist

Item	Comments
Shell Appurtenances: Manways and Nozzles	
Inspect for corrosion, cracks or signs of leakage on weld joints at nozzles, manways, and reinforcing plates.	Refer to Table 2-2 Action Items – Moderate Priority.
Inspect for shell plate dimpling around nozzles, caused by excessive pipe deflection.	No action required.
Inspect for flange leaks and leaks around bolting.	No action required.
Shell Appurtenances: Tank Piping Manifolds	
Inspect manifold piping, flanges, and valves for leaks.	No action required.

Table 3-9 Nozzles and Appurtenances Visual Examination Checklist

Item	Comments
Inspect firefighting system components.	No action required.
Check for anchored piping which would be hazardous to the tank shell or bottom connections during earth movement.	No action required.
Check for adequate thermal pressure relief of piping to the tank.	Not applicable. Service and Cargo lines are both blind flanges
Check sample connections for leaks and for proper valve operation.	No action required.
Check for damage and test the accuracy of temperature indicators.	Not applicable
Shell Appurtenances: Autogauge System	
Inspect autogauge tape guide and lower sheave housing (floating swings) for leaks.	Refer to Table 2-1 Action Items – High Priority.
Inspect autogauge head for damage.	Refer to Table 2-1 Action Items – High Priority.
Bump the checker on autogauge head for proper movement of tape.	Refer to Table 2-1 Action Items – High Priority.
Compare actual product level to the reading on the autogauge (maximum variation is 2 in.).	Refer to Table 2-1 Action Items – High Priority.
Test freedom of movement of marker and float.	Refer to Table 2-1 Action Items – High Priority.
Roof Appurtenances: High Level Alarm	
Inspect condition and functioning of alarm: visible and/or audible.	Refer to Table 2-1 Action Items – High Priority.
Roof Appurtenances: Sample Hatch	
Inspect condition and functioning of sample hatch cover.	No action required.
On tanks governed by Air Quality Monitoring District rules, check for the condition of seal inside hatch cover.	No action required.
Check for corrosion and plugging on thief and gauge hatch cover.	Refer to Table 2-2 Action Items – Moderate Priority.
Where sample hatch is used to reel gauge stock level, check for marker and tab stating hold-off distance.	Refer to Table 2-1 Action Items – High Priority.

Table 3-9 Nozzles and Appurtenances Visual Examination Checklist

Item	Comments
Check for reinforcing pad where sample hatch pipe penetrates the roof deck.	No action required.
Test operation of system.	No action required.
Roof Appurtenances: Autogauge: Inspection Hatch and Guides (Fixed Roof)	
Check the hatch for corrosion and missing bolts.	Refer to Table 2-2 Action Items – Moderate Priority.
Look for corrosion on the tape guide and float guide wire anchoring and components.	Refer to Table 2-2 Action Items – Moderate Priority.
Roof Appurtenances: Autogauge: Float Well Cover	
Inspect for corrosion.	Refer to Table 2-2 Action Items – Moderate Priority.
Check tape cable for wear or fraying caused by rubbing on the cover.	Not applicable.
Roof Appurtenances: Venting	
Normal or Emergency: Report size, number, type and condition of vent. Note if screen is present.	Refer to Table 2-1 Action Items – High Priority.
Tank Accessways:	
Inspect for safe access, damage, corrosion, paint failure, and weld failure: Handrails, platform frame, deck plate and grating, stairway stringers, ladders, reinforcing pads.	Refer to Table 2-2 Action Items – Moderate Priority.

Section 3.4.2 Nozzles and Appurtenances Ultrasonic Thickness Testing

Measured thicknesses of external shell and roof nozzles, including reinforcing plates, were recorded to determine nominal thickness and provide an indication of integrity of the nozzle and reinforcing plates, as applicable. All measured thicknesses were within the acceptable mill tolerances of the nominal pipe size standard thicknesses. Refer to Section 4.0 for details of the NDE methods and equipment utilized during the inspection. Refer to Appendix C for the tank shell and roof layouts.

Table 3-10 Nozzles and Appurtenances Ultrasonic Thickness Testing

Item No.	Description	Location	Size (inch)	UTT (inch)
A[1]	Manway	Shell course 1	24	0.185
B	Stair bottom	Shell course 1	--	--
C	Autogauge head	Shell course 1	--	--
D[1]	Blind flange (fuel transfer valve)	Shell course 1	6	0.401
E	Lap plate	Shell course 1	12 x 12	0.251
F[1]	Water draw-off nozzle	Shell course 1	2	0.121
G	Capped nipple	Shell course 3	--	--
H	Capped nipple	Shell course 3	--	--
I[1]	Blind flange (fuel transfer line)	Shell course 1	6	0.390
J	Lap plate	Roof plate 4	6 x 5	0.363
K	Autogauge nipple / float tape guide	Roof plate 4	2	0.192
L	Lap plate	Roof plate 4	6 x 5	0.367
M	Atmospheric gooseneck vent (no screen)	Roof plate 4	6	0.275
N	Electronic gauge through manway cover	Roof plate 4 / 5	--	--
O	Manway with electronic gauge	Roof plate 4 / 5	24	0.258
P	Anchor tie offf	Roof plate 3 / 5	4	0.216
Q	Manual gauge	Roof plate 5 / 6	6	0.284
R	Atmospheric gooseneck vent (no screen)	Roof plate 6	6	0.272
S	Manway	Roof plate 7	24	0.252
T	Capped nipple	Roof plate 7	1.5	0.194
U	Plugged nipple	Roof plate 7	1.75	--
V	Capped nipple	Roof plate 7	1.5	0.189

[1] *Supplemental information below*

Item No.	*Repad Shape*	*Repad Width (inch)*	*Repad Height (inch)*	*Repad Thickness (inch)*	*Flange Thickness (inch)*	*Cover Thickness (inch)*	*Tell-tale / Weep hole*
A	*Octagon*	*65.0*	*54.0*	*0.189*	*0.376*	*0.513*	*None*
D	*Circle*	*19.625*	*19.625*	*0.186*	--	--	*None*
F	*Circle*	*8.0*	*8.0*	--	--	--	*None*
I	*Circle*	*19.0*	*19.0*	*0.187*	--	--	*None*

Section 4.0 Non-Destructive Examination (NDE)

Section 4.1 NDE Methods

The following NDE methods were conducted to evaluate the external surfaces of the tank and tank components. The components included the exterior of foundation, shell, and roof, as well as associated nozzles and appurtenances on tank shell and roof. Refer to Appendix C for the tank shell and roof layouts. All NDE methods were evaluated and accepted by the API authorized inspector.

Section 4.1.1 Foundation NDE

- Visual examination was performed on the exterior surfaces of the tank in accordance with API 653 Section 6.3 and Annex C.
- Settlement survey technique utilized per API 653 Annex B. The survey was conducted counterclockwise from the shell manway. The circumferential distance between eight stations for elevation measurements equally spaced at 9.8 feet.

Section 4.1.2 Shell NDE

- Visual examination was performed on the exterior surfaces of the tank in accordance with API 653 Section 6.3 and Annex C.
- Ultrasonic thickness testing was utilized in accordance with API 653 Section 6.3.3 and Integrity Environmental LLC procedure NDE-UT-001.
  - Ultrasonic thickness measurements were recorded where accessible from the ground level and tank accessways at four quadrants (0°, 90°, 180°, 270°) counterclockwise where the entry manway is 0°. Scanning started 2”- 6” from the bottom where water may collect then evenly spaced up the shell course vertically. A total of 6 readings were recorded per quadrant on shell course 1.
  - A total of 6 readings were recorded on shell course(s) 2 - 3.

Section 4.1.3 Roof NDE

- Visual examination was performed on the exterior surfaces of the tank in accordance with API 653 Section 6.3 and Annex C.
- Ultrasonic thickness technique was utilized in accordance with API 653 Section 6.3.3 and Integrity Environmental LLC procedure NDE-UT-001.
  - Ultrasonic thickness measurements were recorded at least 3 spot readings per roof plate where safely accessible from guardrail and numbered in an S-pattern.

Section 4.1.4 Nozzles and Appurtenances NDE

- Visual examination was performed on the exterior surfaces of the tank in accordance with API 653 Section 6.3 and Annex C.
- Ultrasonic thickness technique was utilized in accordance with API 653 Section

6.3.3 and Integrity Environmental LLC procedure NDE-UT-001.

- Nozzles/Appurtenances are referenced counterclockwise from entry manway on shell at 0°. UTT of the neck was measured, when applicable. One reading per reinforcing pad, flange face, and cover were recorded when applicable.

Section 4.2 NDE Equipment

The following NDE equipment was utilized by the API authorized inspector and qualified personnel, as necessary, to perform the inspections of the tank and tank components.

Section 4.2.1 Ultrasonic Thickness Equipment

- Flaw Detector/Thickness Gauge: Danatronics EHC-09DL-W
- Transducer: Danatronics DK-718EE, 7.5 MHz, 0.187 inch dual element
- Couplant: Ultragel
- Cal Block: 1018 Steel 5-Step Wedge

Section 4.2.2 Pit Gauging Equipment

- Basic Pit Gauge: Western Instruments N88-2-I Inch, 912548E, Master Set #MG50565

Section 4.2.3 Coating Thickness Equipment

- Defelsko DFT Coating Thickness Gauge, Model FT1-E PosiTector 6000, Range: 0-250 mils

Section 4.2.4 Settlement Survey Equipment

- Survey Rotating Laser Level equipment: Leica Rugby 610/810

Section 5.0 Warranty

Integrity Environmental LLC (Integrity) has evaluated the condition of this equipment based on the observations and measurements made by the Integrity inspector. Regarding inspection and testing, inspection services provided by Integrity Environmental LLC warrants our evaluation by an accurate description of the condition of the accessible equipment at the time of inspection and that the services have been performed in accordance with accepted industry practices.

If any services fail to meet the accepted industry practices, Integrity will re-perform the service to the same extent and on the same conditions as the original service. The inspection information and reporting provided by Integrity; and any conclusions reached by the owner/operator, as well as any action taken or omitted to be taken, are the sole responsibility of the owner/operator and must be independently assessed by the owner/operator. This paragraph sets forth the exclusive remedy for claims based on failure of materials or services or defects in materials or services, whether 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 preceding 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 will Integrity be liable for any loss or damage whatsoever by its failure to discover, report, repair or modify latent defects or defects inherent in the design of any equipment inspected.** In no event, whether a result of breach of contract, warranty or tort (including negligence) will Integrity 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 Integrity, or any associated damage to facilities, down-time costs, or claims of other damages.

Appendix A

Inspection Photos

Photo 1: View of lower tank section at ~0 degrees.

Photo 2: View of upper tank section at ~0 degrees.

Photo 3: View of lower tank section at ~90 degrees.

Photo 4: View of upper tank section at ~90 degrees.

Photo 5: View of lower tank section at ~180 degrees.

Photo 6: View of upper tank section at ~180 degrees.

Photo 7: View of lower tank section at ~270 degrees.

Photo 8: View of upper tank section at ~270 degrees.

Photo 9: View of manway with nameplate (illegible).

Photo 10: Detail view of nameplate (illegible).

Photo 11: Detail view of manway.

Photo 12: Detail view underneath manway.

Photo 13: View of tank stairs.

Photo 14: Detail view of tank stairs.

Photo 15: Detail view underneath stairs.

Photo 16: View of autogauge head, electronic gauging, and blind flange (fuel transfer valve).

Photo 17: View of autogauge head.

Photo 18: Detail view of autogauge readout.

Photo 19: View of blind flange (fuel transfer valve).

Photo 20: Detail view underneath blind flange (fuel transfer valve).

Photo 21: View of lap plate and water draw-off nozzle (capped).

Photo 22: View of water draw-off nozzle (capped).

Photo 23: Detail view underneath water draw-off nozzle (capped).

Photo 24: View of attachment welds.

Photo 25: View of attachment welds and roof access (stairs).

Photo 26: View of blind flange (fuel transfer line).

Photo 27: Detail view underneath blind flange (fuel transfer line).

Photo 28: Overall view of bonding cable and blind flange (fuel transfer line)..

Photo 29: View of roof access (stairs).

Photo 30: Detail view shell lap plate.

Photo 31: View of tank shell to foundation.

Photo 32: Overall view of tank roof.

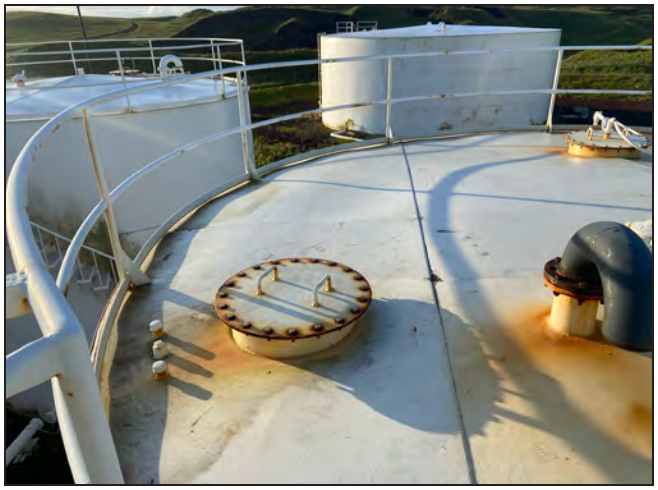


Photo 33: View of tank roof (left).

Photo 34: View of tank roof (center).

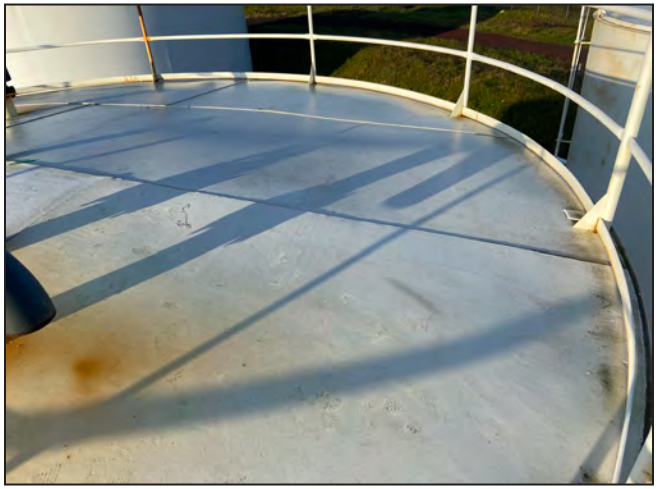


Photo 35: View of tank roof (right).

Photo 36: View of autogauge head and electronic gauging.

Photo 37: View of gooseneck vent.

Photo 38: Detail view underneath gooseneck vent with no screen.

Photo 39: Detail view underneath gooseneck vent.

Photo 40: View of manway with electronic gauging.

Photo 41: Detail view underneath manway with electronic gauging.

Photo 42: View of anchor tie off.

Photo 43: View of manual gauge.

Photo 44: Detail view underneath manual gauge.

Photo 45: View of gooseneck vent.

Photo 46: Detail view underneath gooseneck vent with no screen.

Photo 47: Detail view of gooseneck vent.

Photo 48: Detail view underneath gooseneck vent.

Photo 49: Overall view of manway and capped/plugged nipples.

Photo 50: Detail view underneath manway.

Photo 51: Detail view underneath manway.

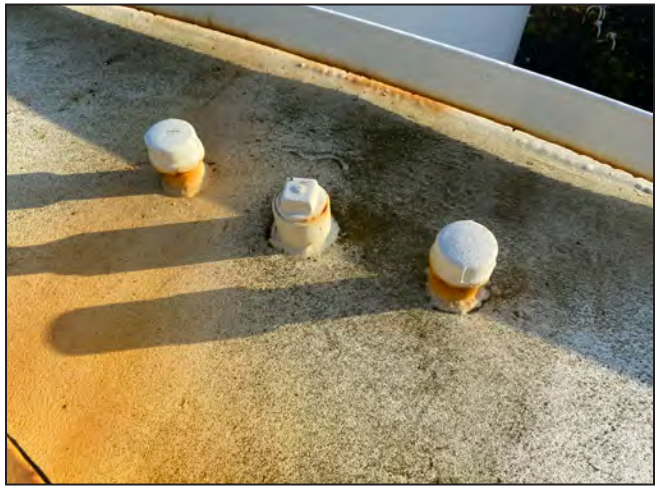


Photo 52: View of capped/plugged nipples.

Photo 53: View of handrails.

Photo 54: View of handrails.

Photo 55: Detail view of handrails.

Photo 56: Detail view of handrails.

Photo 57: Detail view of toe-kicks.

Photo 58: Overall view of tank foundation and earthen pad.

Photo 59: Overall view of tank foundation and earthen pad.

Photo 60: Overall view of tank foundation and earthen pad.

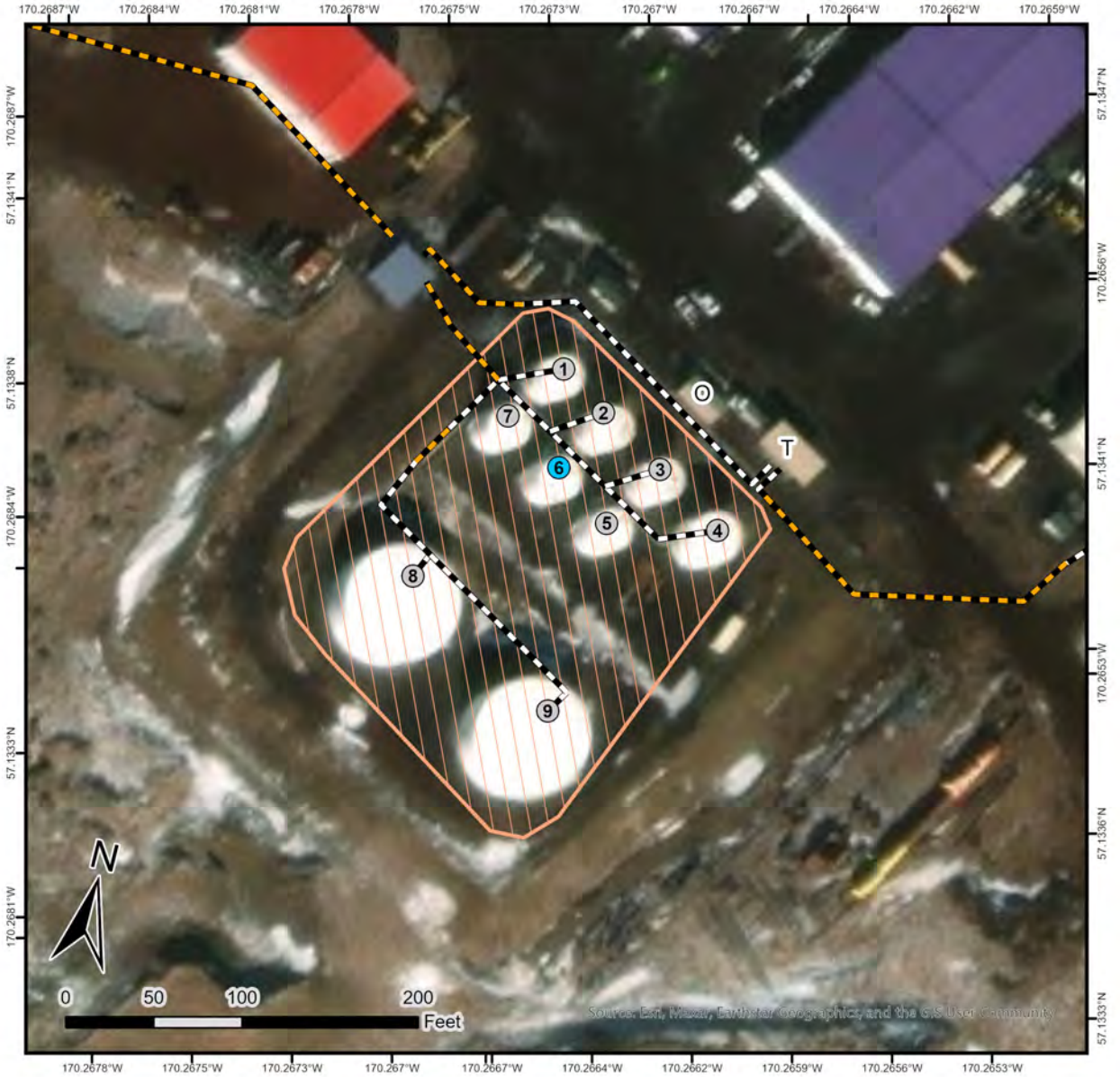
Appendix B
Facility Layout

Figure B-1 Facility Layout

Current to: 09/24/2023
Author: Integrity Environmental LLC
http://www.integrity-env.com

City of Saint Paul
Diamond Hill Road
Saint Paul Island, AK 99660
Within: Sec 19, T. 35 S., R. 131 W.,
Seward Meridian, Alaska.
Tank Farm: 57 8' 1.71"N
170 16' 0.96"W
USGS 63K Quad: Pribilof Islands C-4
Coordinate System:
NAD 1983 Alaska Albers

- API 653 Inspected Tank
- Tank
- O Fuels Office
- T Tank Truck Loading Rack
- Aboveground Pipeline
- Belowground Pipeline
- Secondary Containment Area



Appendix C
Tank Shell & Roof Layouts

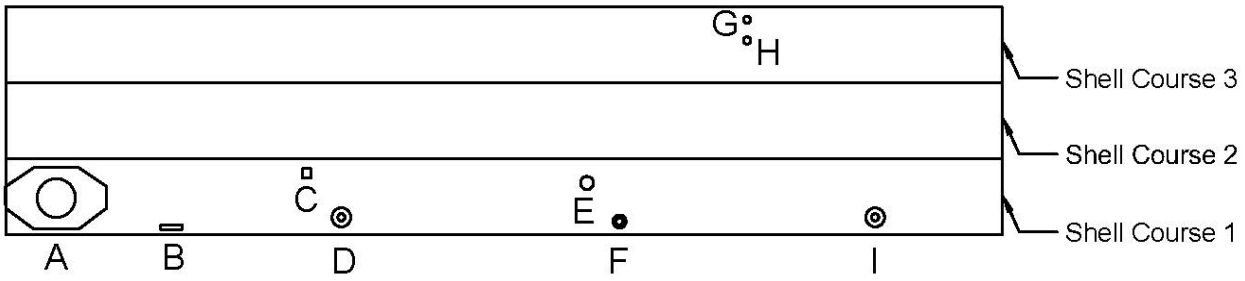


Figure C-1 Shell Layout – Tank #6

Item No.	Description	Location
A	Manway	Shell course 1
B	Stair bottom	Shell course 1
C	Autogauge head	Shell course 1
D	Blind flange (fuel transfer valve)	Shell course 1
E	Lap plate	Shell course 1
F	Water draw-off nozzle	Shell course 1
G	Capped nipple	Shell course 3
H	Capped nipple	Shell course 3
I	Blind flange (fuel transfer line)	Shell course 1

Notes:

- Letters A through I represent nozzles and appurtenances. UTT of shell nozzles and reinforcing plates were acquired on the first shell course from ground level.
- Shell courses were accessed at four quadrants from ground level to acquire UTT.
- Tank overall height is 22.00 feet. Tank diameter is 25.00 feet.

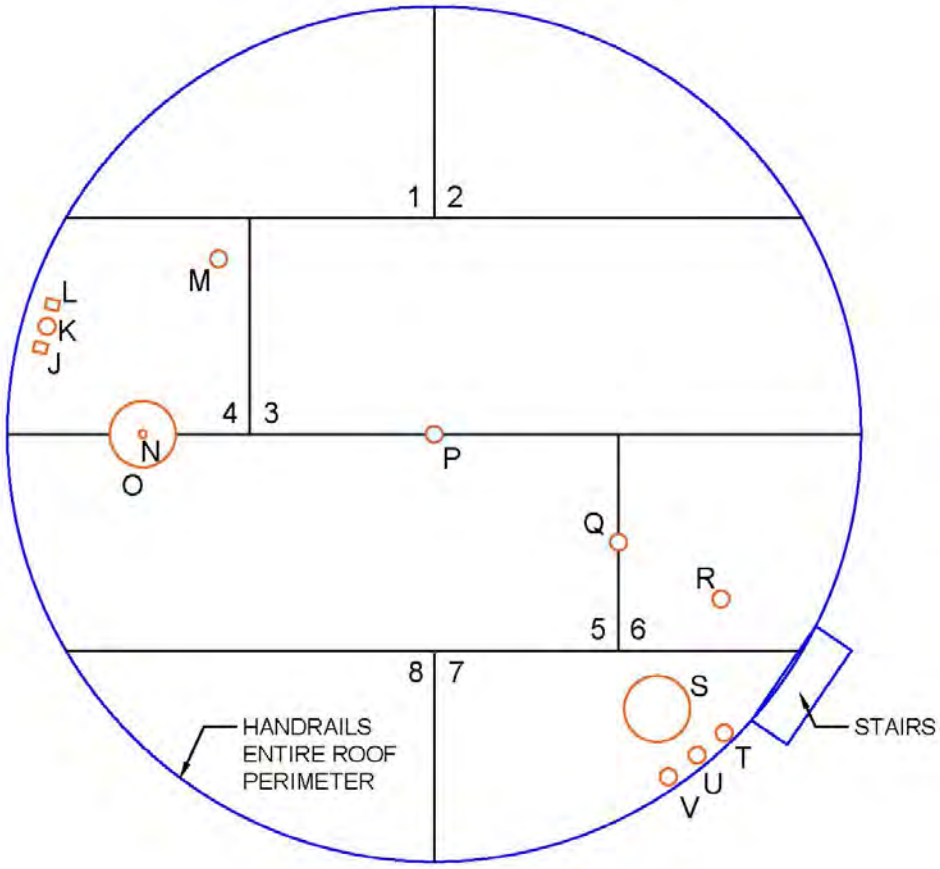


Figure C-2 Roof Layout – Tank #6

Item No.	Description	Location
J	Lap plate	Roof plate 4
K	Autogauge nipple / float tape guide	Roof plate 4
L	Lap plate	Roof plate 4
M	Atmospheric gooseneck vent (no screen)	Roof plate 4
N	Electronic gauge through manway cover	Roof plate 4 / 5
O	Manway with electronic gauge	Roof plate 4 / 5
P	Anchor tie offf	Roof plate 3 / 5
Q	Manual gauge	Roof plate 5 / 6
R	Atmospheric gooseneck vent (no screen)	Roof plate 6
S	Manway	Roof plate 7
T	Capped nipple	Roof plate 7
U	Plugged nipple	Roof plate 7

Figure C-2 Roof Layout – Tank #6

Item No.	Description	Location
V	Capped nipple	Roof plate 7

Notes:

- Letters J through V represent nozzles and appurtenances. Numbers 1 through 8 represent the roof plates. UTT locations were acquired where safely accessible.

Appendix D
Inspector Certifications

API INDIVIDUAL CERTIFICATION PROGRAMS

ANAB
ANSI National Accreditation Board
ACCREDITED
ISO/IEC 17024
PERSONNEL CERTIFICATION BODY

verifies that

Camille Harder House

HAS MET THE ESTABLISHED AND PUBLISHED REQUIREMENTS FOR API CERTIFICATION AS AN

API 653 ABOVEGROUND STORAGE TANK INSPECTOR

IN ACCORDANCE WITH THE KNOWLEDGE DEFINED IN THE **API Standard 653**

CERTIFICATION NUMBER **53363**

ORIGINAL CERTIFICATION DATE	May 31, 2014
CURRENT CERTIFICATION DATE	May 31, 2023
EXPIRATION DATE	May 31, 2026

Director, Individual Certification Programs

API | ICP

INTEGRITY
ENVIRONMENTAL LLC

CERTIFICATE
of QUALIFICATION

Camille House

THIS INDIVIDUAL IS QUALIFIED IN ACCORDANCE WITH THE INTEGRITY ENVIRONMENTAL PROCEDURE FOR QUALIFICATION AND CERTIFICATION OF NONDESTRUCTIVE EXAMINATION PERSONNEL, WHICH IS IN COMPLIANCE WITH THE REQUIREMENTS OF THE AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING RECOMMENDED PRACTICE SNT-TC-1A (2020 EDITION).

METHOD	LEVEL	EXPIRATION DATE
ULTRASONIC	IIA	MAY 4, 2027

Shannon Oelkers

Shannon Oelkers, Principal/Owner
Date: May 4, 2022

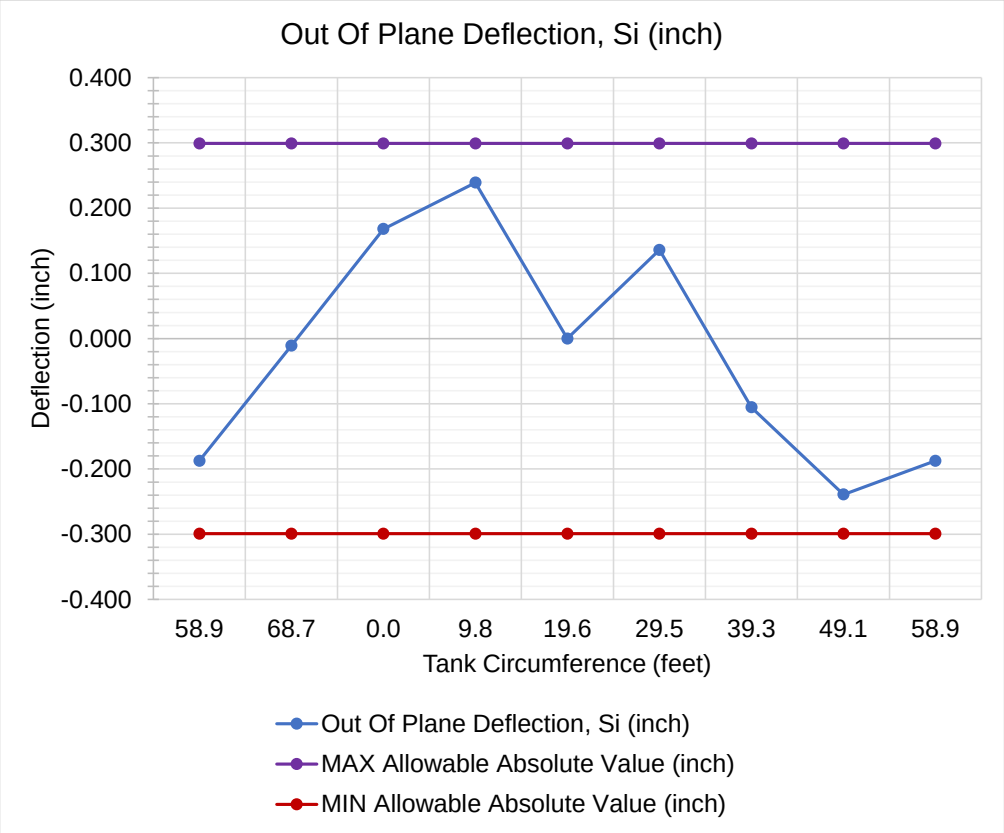
Appendix E
Settlement Survey Analysis

Table E-1 Tank Settlement Survey Analysis (inch)[1]

Station ID	Measured Elevation	Degrees, Theta θ	Predicted Elevation	Out of Plane Settlement, Ui	Out of Plane Deflection	Out of Plane Deflection, Si	Max Allowable Absolute Value (0.299)
1	42.875	0	42.372	0.503		0.168	Pass
2	43.250	45	42.540	0.710		0.239	Pass
3	43.375	90	42.936	0.439		0.000	Pass
4	43.500	135	43.332	0.168		0.136	Pass
5	43.125	180	43.500	-0.375		-0.105	Pass
6	42.625	225	43.332	-0.707	MAX.	-0.239	Pass
7	42.375	270	42.936	-0.561		-0.187	Pass
8	42.500	315	42.540	-0.040		-0.011	Pass

[1]*Tank data used for analysis: Yield Strength 30,000 psi, Modulus of Elasticity 29,000,000 psi.*

Graph E-1 Differential Settlement Evaluation



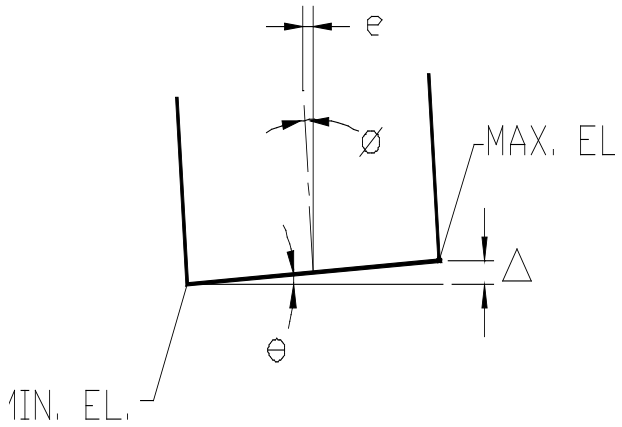


Table E-2 Rigid Body Tilt

Maximum Differential Settlement: Delta Δ	
Maximum Elevation at the shell-to-bottom	3.63 feet
Minimum Elevation at the shell-to-bottom	3.53 feet
Δ Evaluation at the shell-to-bottom	0.09 feet (1.125 inch)
Angle of Slope: Theta θ	
= SIN – 1 (Δ/Diameter) = SIN – 1 (0.094/25)	0.21 degrees
Angle of Tilt: Phi Ø	
Pi Ø = Theta θ	0.21 degrees
Amount of Tilt: e	
= Height SIN(Ø) = 22 SIN(0.21)	0.08 feet (0.99 inch)