

**US Army Corps of Engineers
Omaha District
API 653 In-Service
Inspection Report**

Remove picture
or "Format",
"Change Picture"

**[Location]
[Facility Number]
[Tank Number]**

**US Army Corps of Engineers Center of Expertise for Petroleum, Oils and Lubricants
(USACE POL-MCX)
[DATE]**

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ACRONYMS AND ABBREVIATIONS

API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASNT	American Society of Non-Destructive Testing
ATG	Automatic Tank Gauge
BBL	Barrel
CFR	Code of Federal Regulations
CP	Cathodic Protection
DFT	Dry Film Thickness
HLA	High Level Alarm
HLCS	High Level Control Shutoff
HHLA	High-High Level Alarm
LLA	Low Level Alarm
LLLA	Low-Low Level Alarm
MFL	Magnetic Flux Leakage
MT	Magnetic Particle Testing
NACE	National Association of Corrosion Engineers
NDT	Non-Destructive Testing
NFPA	National Fire Protection Association
PSI	Pounds per Square Inch
PT	Penetrant Testing
P/V	Pressure/Vacuum
RP	Recommended Practice
PST	Product Saver Tank
RT	Radiography Testing
TML	Thickness Measurement Location
TRV	Thermal Relief Valve
UFC	Unified Facilities Criteria
UFGS	Unified Facilities Guide Specifications
ULS	Ultra Low Sulfur
UT	Ultrasonic Testing
VT	Visual Testing

GENERAL SUMMARY
Summary of Inspection

INSPECTION DATE

API In-Service (External) Inspection Date: 1 January 20XX

Equipment Used:

Manufacturer:

Model Number:

Calibration Method:

Inspector(s):

STATE REGULATIONS

State Regulation for API In-Service Tank Inspections XX Years

State Regulation for API Out-of-Service Tank Inspections XX Years

NOTE: If there are no state regulations for tank inspections then N/A shall reside in-place of the number of years between inspections. If state regulations reside, the recommended future inspections dates shall be based on whichever is more stringent between the API inspector’s calculations and the State regulations.

PREVIOUS INSPECTION DATES

API Out-of-Service (Internal) Inspection Date: 1 January 20XX

API In-Service (External) Inspection Date: 1 January 20XX

RECOMMENDED FUTURE INSPECTION DATES (CALCULATIONS SHALL BE PROVIDED)

API Out-of-Service (Internal) Inspection Date: 1 January 20XX

API In-Service (External) Inspection Date: 1 January 20XX

[Name]
[Title]
[Company]
API 653 Certified Inspector No. [XXXX]

GENERAL TANK INFORMATION

ITEM	DESCRIPTION		
Owner			
Location			
Facility Number			
Tank Number			
State / Country			
City			
Inspection Date			
Tank Manufacturer			
Design Standard			
Date of Construction			
Tank Contents			
Tank Serial Number			
Tank Diameter			
Shell Height			
Product Height			
Tank Capacity			
Foundation			
Construction	Bottom		
	Shell		
	Floating Roof		
	Fixed Roof		
Material	Bottom		
	Shell		
	Floating Roof		
	Fixed Roof		
Cathodic Protection			
Interior Coating System			
Exterior Coating System			
Level Gauging			
Overfill Protection			
Piping	Receipt		
	Issue		
	Low Suction		
	Water Draw-Off		
Level Alarms			
Type of Internal Floating			

Roof	
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A. GENERAL PROJECT INFORMATION**1. API 653 Inspection**

XXXX

2. Site Information

XXXX

B. TANK INSPECTION COMMENTS**1. Tank Construction**

XXXX

2. Tank Foundation

XXXX

3. Tank Shell

XXXX

4. Tank Appurtenances**a. Geodesic Dome Roof**

XXXX

b. Gauging

XXXX

c. Level Alarms

XXXX

d. Stairs and Platforms

XXXX

e. Grounding and Bonding

XXXX

5. Tank Coating

XXXX

6. Tank Piping System

XXXX

7. Fire Protection System

XXXX

8. Secondary Containment

XXXX

C. FINDINGS AND RECOMMENDATIONS

XXXX.

1. MANDATORY REPAIRS per API 653, UFC 3-460-01, or AW 78-24-27 Standards

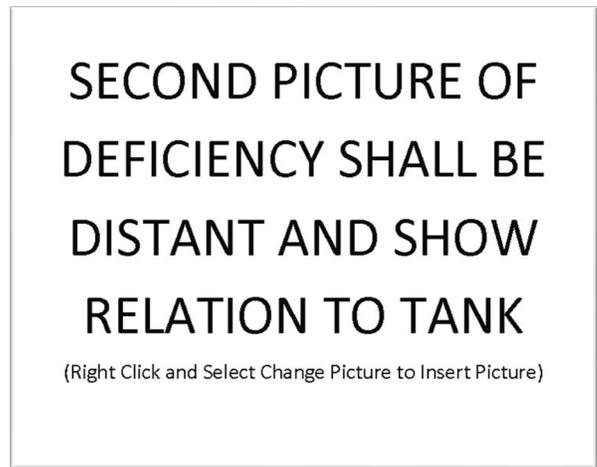
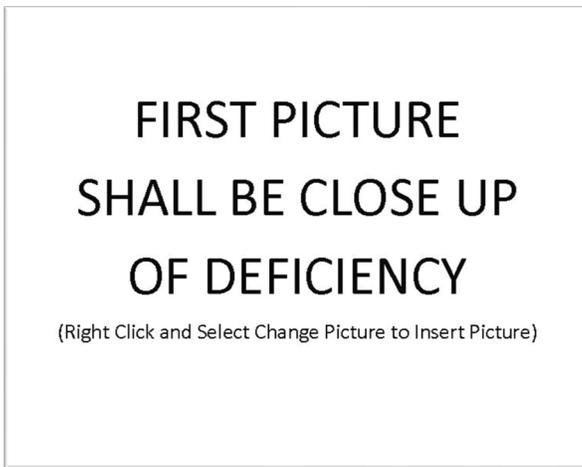
Mandatory repairs represent items that require immediate attention, in order to prevent imminent risk to system operators, equipment integrity, or the adjacent environment. The tank should remain out of service until these repairs are completed.

a. Title

OBSERVATION: Description

REFERENCE: Description

RECOMMENDATION: Description

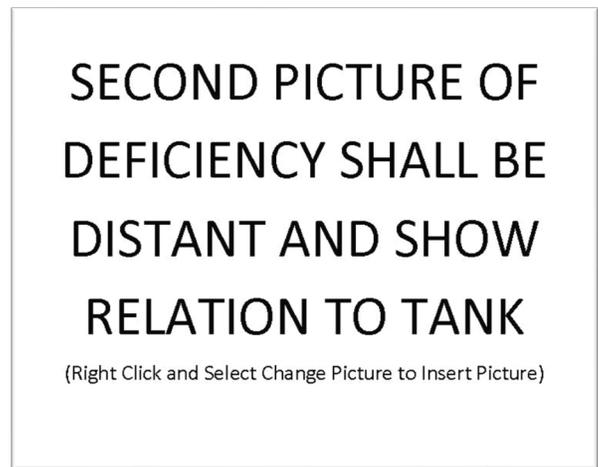
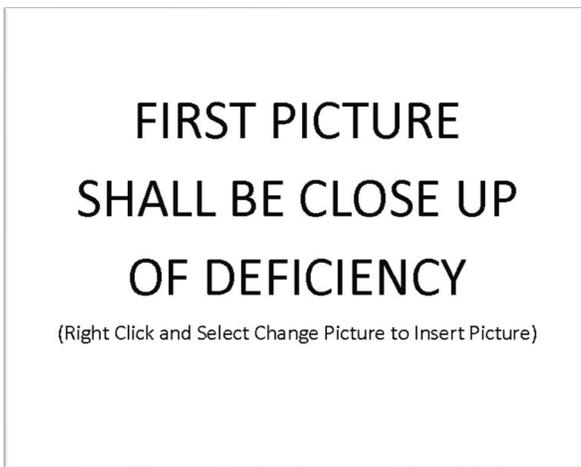


b. Title

OBSERVATION: Description

REFERENCE: Description

RECOMMENDATION: Description



2. RECOMMENDED REPAIRS to Fully Comply with API 653, UFC 3-460-01, or AW 78-24-27 Standards

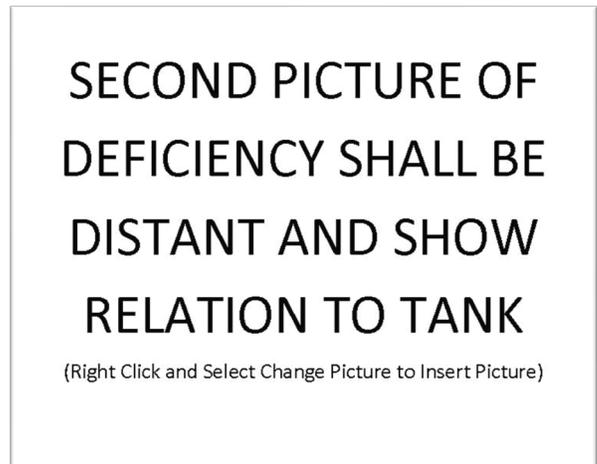
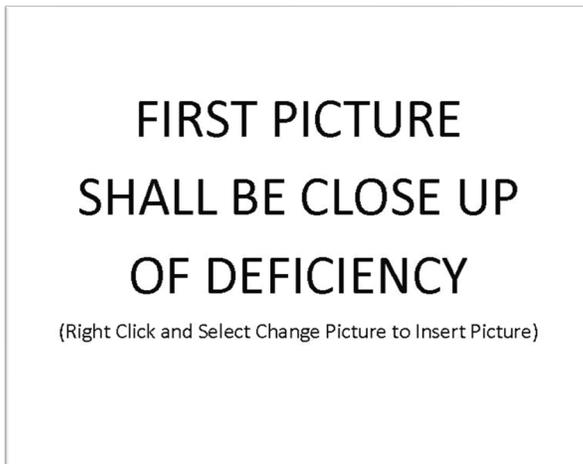
Short-term Repairs that directly relate to the long-term preservation of the asset. Short-term repairs represent items that should be addressed in a timely manner in order to prevent future potential risks to system operators, equipment integrity, or the adjacent environment. These items may be required by Federal, State and Local Codes or by Military Criteria.

a. Title

OBSERVATION: Description

REFERENCE: Description

RECOMMENDATION: Description

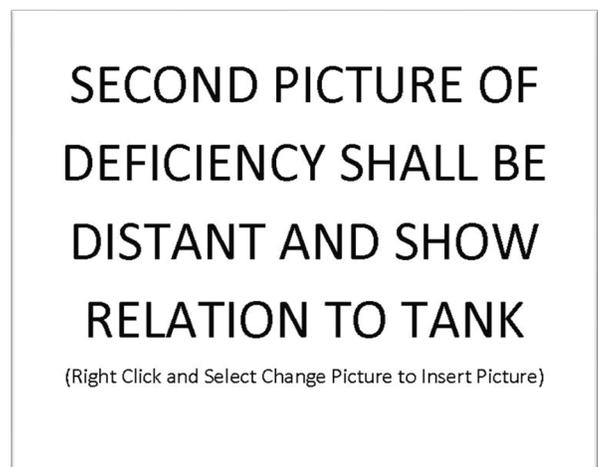
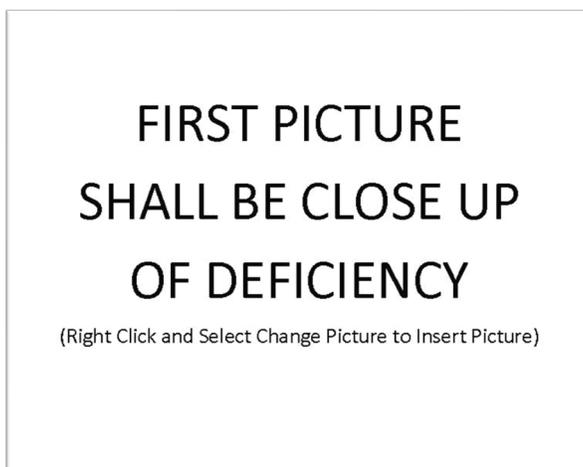


b. Title

OBSERVATION: Description

REFERENCE: Description

RECOMMENDATION: Description



3. RECOMMENDED REPAIRS as Part of Regular Maintenance

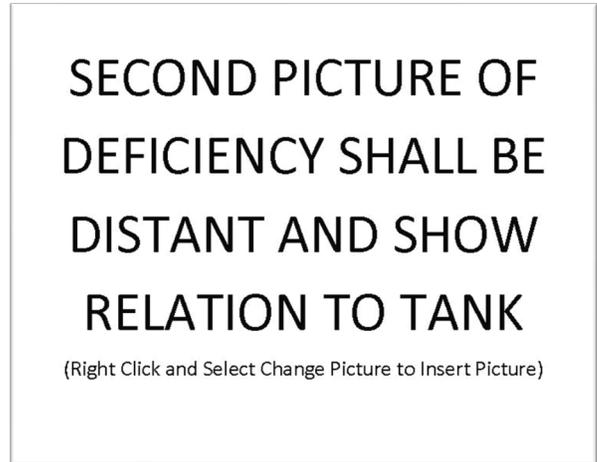
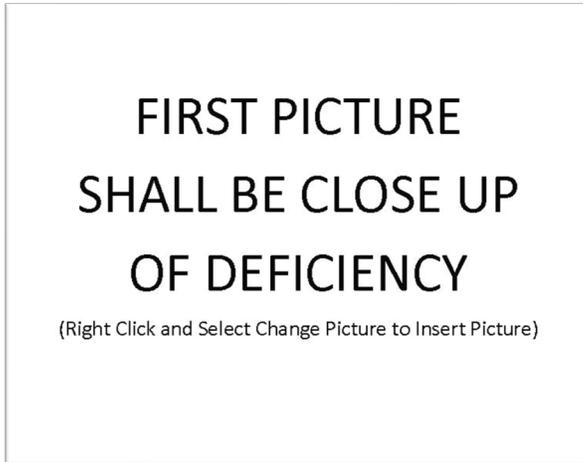
Long-term Repairs that directly relate to repair/upgrade of an asset to bring it up to the current standard from the standard at time of construction. Long-term Repairs represent items that should be addressed in a timely manner in order to prevent future potential risks to system operators, equipment integrity, or the adjacent environment.

a. Title

OBSERVATION: Description

REFERENCE: Description

RECOMMENDATION: Description

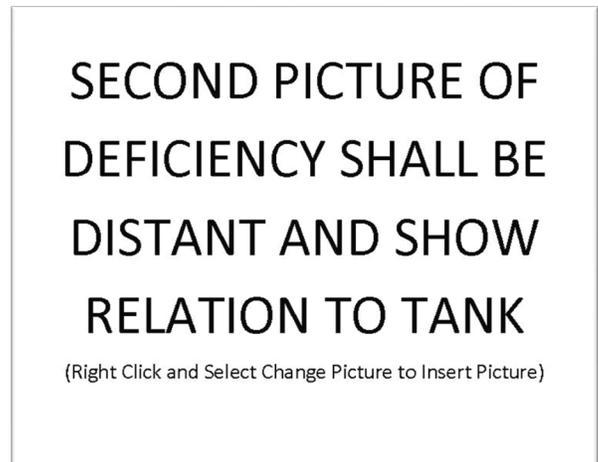
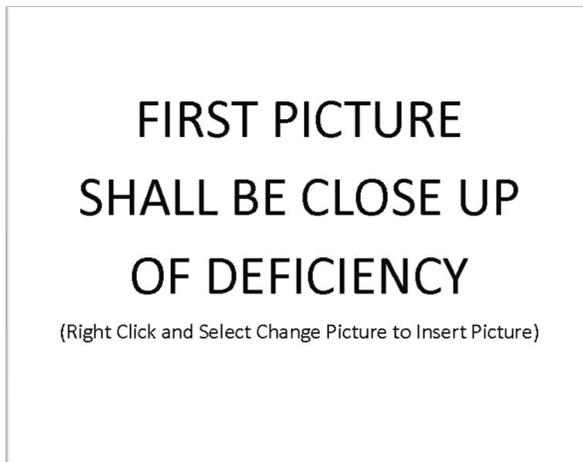


b. Title

OBSERVATION: Description

REFERENCE: Description

RECOMMENDATION: Description



APPENDIX A: ENGINEERING CALCULATIONS AND DRAWINGS

SHELL SETTLEMENT SURVEY

SHELL THICKNESS CALCULATION

SHELL UT MEASUREMENTS

ROOF UT MEASUREMENTS

SHELL NOZZLE / REPAD UT MEASUREMENTS

CRITICAL ZONE SHELL THICKNESS

SHELL LAYOUT DRAWING

ROOF LAYOUT DRAWING

NEXT INSPECTION

OSHA ACCESS STRUCTURE REPORT

APPENDIX B: 3-D DOCUMENTATION AND ANALYSIS

The purpose of this study is to determine the tank shell locations of buckled areas, flat spots, and peaking and banding at weld joints. Shell distortion can be caused by many conditions such as foundation settlement, over- or under-pressuring, high wind, poor shell fabrication, or various repair techniques or tank modifications.

Out-of-Plumbness (Verticality) - The measured out-of-plumbness for this tank is x.xx in. in the worst area located at xxx degrees. Refer to the Out-of-Plumbness (Verticality) diagram.

Isolated Shell distortion - Isolated measurements were also taken along the external shell adjacent to the shell manway and 12-in receipt near the 0 degree mark. . Refer to the Isolated Shell Distortion diagram.

Tank Bottom Elevation - Laser scans were also performed along the tank bottom. Refer to the diagram below for details. Bottom slope is made evident by the point cloud system. No significant edge settlement was noted.

OUT OF PLUMBNESS (VERTICALLY)

ISOLATED SHELL DISTORTION

APPENDIX D: API 653 CHECKLISTS FOR TANK INSPECTIONS

Tank In-Service Inspection Checklist	
Item	Completed X

C.1.1	Foundation	
	Measure foundation levelness and bottom elevations (see Annex B for extent of measurements).	
C.1.1.1	Concrete Ring	
a	Inspect for broken concrete, spalling, and cracks, particularly under backup bars used in welding butt-welded annular rings under the shell.	
b	Inspect drain openings in ring, back of waterdraw basins and top surface of ring for indications of bottom leakage.	
c	Inspect for cavities under foundation and vegetation against bottom of tank.	
d	Check that runoff rainwater from the shell drains away from tank.	
e	Check for settlement around perimeter of tank.	
C.1.1.2	Asphalt	
a	Check for settling of tank into asphalt base which would direct runoff rain water under the tank instead of away from it.	
b	Look for areas where leaching of oil has left rock filler exposed, which indicates hydrocarbon leakage.	
C.1.1.3	Oiled Dirt or Sand	
	Check for settlement into the base which would direct runoff rain water under the tank rather than away from it.	
C.1.1.4	Rock	
	Presence of crushed rock under the steel bottom usually results in severe underside corrosion. Make a note to do additional bottom plate examination (ultrasonic, hammer testing, or turning of coupons) when the tank is out of service.	
C.1.1.5	Site Drainage	
a	Check site for drainage away from the tank and associated piping and manifolds.	
b	Check operating condition of the dike drains.	
C.1.1.6	Housekeeping	
	Inspect the area for buildup of trash, vegetation, and other inflammables buildup.	
C.1.1.7	Cathodic Protection	
	Review cathodic protection potential readings.	
C.1.2	Shells	
C.1.2.1	External Visual Inspection	
a	Visually inspect for paint failures, pitting, and corrosion.	
b	Clean off the bottom angle area and inspect for corrosion and thinning on plate and weld.	
c	Inspect the bottom-to-foundation seal, if any.	
C.1.2.2	Internal (Floating Roof Tank)	
	Visually inspect for grooving, corrosion, pitting, and coating failures.	

C.1.2.3 Riveted Shell Inspection		
a	Inspect external surface for rivet and seam leaks.	
b	Locate leaks by sketch or photo (location will be lost when shell is abrasive cleaned for painting).	
c	Inspect rivets for corrosion loss and wear.	
Tank In-Service Inspection Checklist Continued		
	Item	Completed X
d	Inspect vertical seams to see if they have been full fillet lap-welded to increase joint efficiency.	
e	If no record exists of vertical riveted seams, dimension and sketch (or photograph) the rivet pattern: number of rows, rivet size, pitch length, and note whether the joint is butt-riveted or lap-riveted.	
C.1.2.4 Wind Girder (Floating Roof Tanks)		
a	Inspect wind girder and handrail for corrosion damage (paint failure, pitting, corrosion product buildup), especially where it occurs at tack-welded junction, and for broken welds.	
b	Check support welds to shell for pitting, especially on shell plates.	
c	Note whether supports have reinforcing pads welded to shell.	
C.1.3 Shell Appurtenances		
C.1.3.1 Manways and Nozzles		
a	Inspect for cracks or signs of leakage on weld joint at nozzles, manways, and reinforcing plates.	
b	Inspect for shell plate dimpling around nozzles, caused by excessive pipe deflection.	
c	Inspect for flange leaks and leaks around bolting.	
d	Inspect sealing of insulation around manways and nozzles.	
e	Check for inadequate manway flange and cover thickness on mixer manways.	
C.1.3.2 Tank Piping Manifolds		
a	Inspect manifold piping, flanges, and valves for leaks.	
b	Inspect fire fighting system components.	
c	Check for anchored piping which would be hazardous to the tank shell or bottom connections during earth movement.	
d	Check for adequate thermal pressure relief of piping to the tank.	
e	Check operation of regulators for tanks with purge gas systems.	
f	Check sample connections for leaks and for proper valve operation.	
g	Check for damage and test the accuracy of temperature indicators.	
h	Check welds on shell-mounted davit clips above valves 6 in. and larger.	
C.1.3.3 Autogauge System		
a	Inspect autogauge tape guide and lower sheave housing (floating swings) for leaks.	
b	Inspect autogauge head for damage.	
c	Bump the checker on autogauge head for proper movement of tape.	
d	Identify size and construction material of autogauge tape guide (floating roof tanks).	
e	Ask operator if tape tends to hang up during tank roof movement (floating roof tanks).	
f	Compare actual product level to the reading on the autogauge (maximum variation is 2 in.).	

g	On floating roof tanks, when the roof is in the lowest position, check that no more than two ft of tape are exposed at the end of the tape guide.	
h	Inspect condition of board and legibility of board-type autogauges.	
i	Test freedom of movement of marker and float.	
C.1.3.4 Shell-Mounted Sample Station		
a	Inspect sample lines for function of valves and plugging of lines, including drain or return-to-tank line.	
b	Check circulation pump for leaks and operating problems.	
Tank In-Service Inspection Checklist Continued		
Item		Completed X
c	Test bracing and supports for sample lines and equipment.	
C.1.3.5 Heater (Shell Manway Mounted)		
	Inspect condensate drain for presence of oil indicating leakage.	
C.1.3.6 Mixer		
a	Inspect for proper mounting flange and support.	
b	Inspect for leakage.	
c	Inspect condition of power lines and connections to mixer.	
C.1.3.7 Swing Lines: Winch Operation		
a	Nonfloating. Raise, then lower the swing line with the winch, and check for cable tightness to confirm that swing line lowered properly.	
b	Floating. With tank half full or more, lower the swing line, then let out cable and check if swing has pulled cable tight, indicating that the winch is operating properly.	
c	Indicator. Check that the indicator moves in the proper direction: Floating swing line indicators show a lower level as cable is wound up on the winch. Non-floating swing line indicators show the opposite.	
C.1.3.8 Swing Lines: External Guide System		
	Check for leaks at threaded and flanged joints.	
C.1.3.9 Swing Lines: Identify Ballast Varying Need		
	Check for significant difference in stock specific gravity.	
C.1.3.10 Swing Lines: Cable Material and Condition		
a	For nonstainless steel cable, check for corrosion over entire length.	
b	All cable: check for wear or fraying.	
C.1.3.11 Swing Lines: Product Sample Comparison		
	Check for water or gravity differences that would indicate a leaking swing joint.	
C.1.3.12 Swing Lines: Target		
	Target should indicate direction of swing opening (up or down) and height above bottom where suction will be lost with swing on bottom support.	

C.1.4 Roofs		
C.1.4.1 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.)	
C.1.4.2 Deck Plate External Corrosion		
	Visually inspect for paint failure, holes, pitting, and corrosion product on the roof deck.	
C.1.4.3 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 nonlevel roof with possible leaking pontoons.)	

Tank In-Service Inspection Checklist Continued		
	Item	Completed X
C.1.4.4 Level of Floating Roof		
	At several locations, measure distance from roof rim to a horizontal weld seam above the roof. A variance in the readings indicates a nonlevel roof with possible shell out-of-round, out-of-plumb, leaking pontoons, or hang-up. On small diameter tanks, an unlevel condition can indicate unequal loading at that level.	
C.1.4.5 Gas Test Internal Floating Roof		
	Test for explosive gas on top of the internal floating roof. Readings could indicate a leaking roof, leaking seal system, or inadequate ventilation of the area above the internal floating roof.	
C.1.4.6 Roof Insulation		
a	Visually inspect for cracks or leaks in the insulation weather coat where runoff rain water could penetrate the insulation.	
b	Inspect for wet insulation under the weather coat.	
c	Remove small test sections of insulation and check roof deck for corrosion and holes near the edge of the insulated area.	
C.1.4.7 Floating Roof Seal Systems		

a	Inspect the condition of the seal, measure and record maximum rim spaces and seal-to-shell gaps around the full roof circumference at the level of inspection. NOTE Inspection of the seal and measurement of the rim spaces and seal-to-shell gaps at more than one level may be necessary to more fully determine if any problems exist at other levels of tank operation).	
b	Measure and record annular space at 30-ft spacing (minimum of four quadrants) around roof and record. Measurements should be taken in directly opposite pairs.	
1)	_____ Opposite pair 1.	
2)	_____ Opposite pair 2.	
c	Check if seal fabric on primary shoe seals is pulling shoes away from shell (fabric not wide enough).	
d	Inspect fabric for deterioration, holes, tears, and cracks.	
e	Inspect visible metallic parts for corrosion and wear.	
f	Inspect for openings in seals that would permit vapor emissions.	
g	Inspect for protruding bolt or rivet heads against the shell.	
h	Pull both primary and secondary seal systems back all around the shell to check their operation.	
i	Inspect secondary seals for signs of buckling or indications that their angle with the shell is too shallow.	
j	Inspect wedge-type wiper seals for flexibility, resilience, cracks, and tears.	
C.1.5 Roof Appurtenances		
C.1.5.1 Sample Hatch		
a	Inspect condition and functioning of sample hatch cover.	
b	On tanks governed by Air Quality Monitoring District rules, check for the condition of seal inside hatch cover.	
c	Check for corrosion and plugging on thief and gauge hatch cover.	
d	Where sample hatch is used to reel gauge stock level, check for marker and tab stating hold-off distance.	
e	Check for reinforcing pad where sample hatch pipe penetrates the roof deck.	
Tank In-Service Inspection Checklist Continued		
Item		Completed X
f	On floating roof sample hatch and recoil systems, inspect operation of recoil reel and condition of rope.	
g	Test operation of system.	
h	On ultra clean stocks such as JP4, check for presence and condition of protective coating or liner inside sample hatch (preventing rust from pipe getting into sample).	
C.1.5.2 Gauge Well		
a	Inspect visible portion of the gauge well for thinning, size of slots, and cover condition.	
b	Check for a hold-off distance marker and tab with hold-off distance (legible).	
c	On floating roofs, inspect condition of roof guide for gauge well, particularly the condition of the rollers for grooving.	

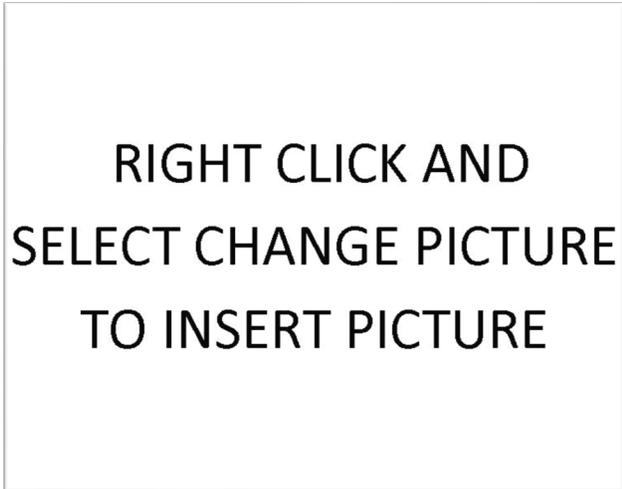
d	If accessible, check the distance from the gauge well pipe to the tank shell at different levels.	
e	If tank has a gauge well washer, check valve for leakage and for presence of a bull plug or blind flange.	
C.1.5.3 Fixed Roof Scaffold Support		
	Inspect scaffold support for corrosion, wear, and structural soundness.	
C.1.5.4 Autogauge: Inspection Hatch and Guides (Fixed Roof)		
a	Check the hatch for corrosion and missing bolts.	
b	Look for corrosion on the tape guide's and float guide's wire anchors.	
C.1.5.5 Autogauge: Float Well Cover		
a	Inspect for corrosion.	
b	Check tape cable for wear or fraying caused by rubbing on the cover.	
C.1.5.6 Sample Hatch (Internal Floating Roof)		
a	Check overall conditions.	
b	When equipped with a fabric seal, check for automatic sealing after sampling.	
c	When equipped with a recoil reel opening device, check for proper operations.	
C.1.5.7 Roof-mounted Vents (Internal Floating Roof)		
	Check condition of screens, locking and pivot pins.	
C.1.5.8 Gauging Platform Drip Ring		
	On fixed roof tanks with drip rings under the gauging platform or sampling area, inspect for plugged drain return to the tank.	
C.1.5.9 Emergency Roof Drains		
	Inspect vapor plugs for emergency drain: that seal fabric discs are slightly smaller than the pipe ID and that fabric seal is above the liquid level.	
C.1.5.10 Removable Roof Leg Racks		
	Check for leg racks on roof.	
C.1.5.11 Vacuum Breakers		
	Report size, number, and type of vacuum breakers. Inspect vacuum breakers. If high legs are set, check for setting of mechanical breaker in high leg position.	
C.1.5.12 Rim Vents		
a	Check condition of the screen on the rim vent cover.	

Tank In-Service Inspection Checklist Continued		
	Item	Completed X
b	Check for plating off or removal of rim vents where jurisdictional rules do not permit removal.	
C.1.5.13 Pontoon Inspection Hatches		
a	Open pontoon inspection hatch covers and visually check inside for pontoon leakage.	

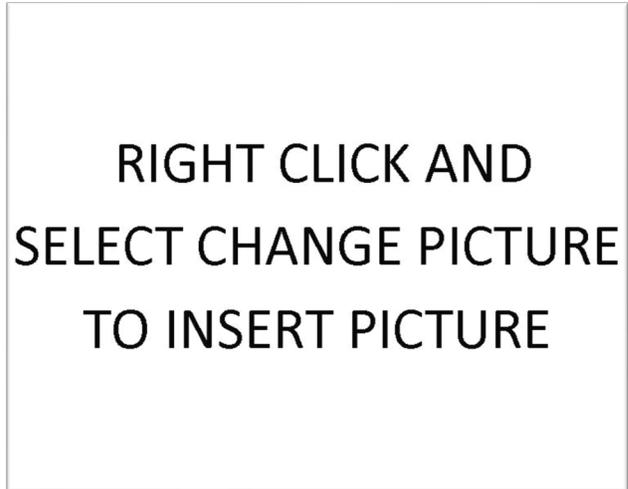
b	Test for explosive gas (an indicator of vapor space leaks).	
c	If pontoon hatches are equipped with locked down covers, check for vent tubes. Check that vent tubes are not plugged up. Inspect lock-down devices for condition and operation.	
C.1.6.1	Accessways	
	See Tank Out-of-service Inspection Checklist, Item C.2.12.	

NOTES:

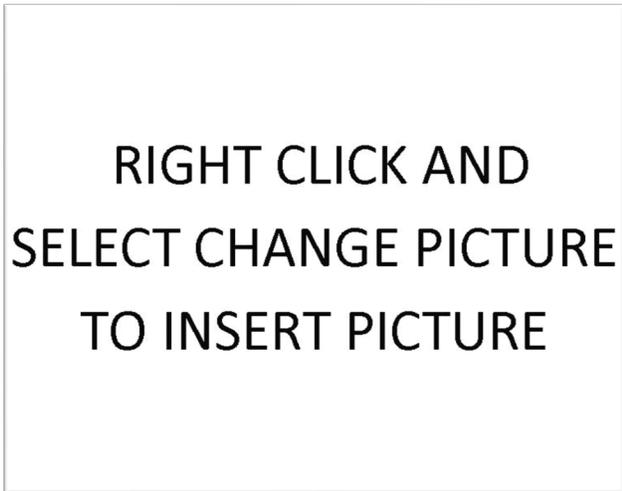
APPENDIX E: PHOTOGRAPHS



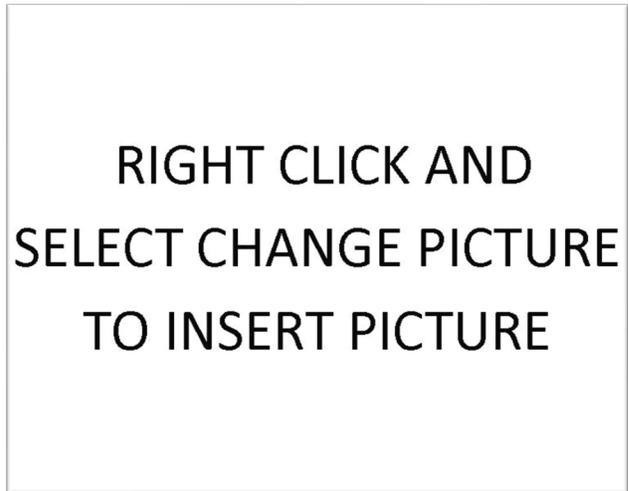
E.1: Tank XX North View



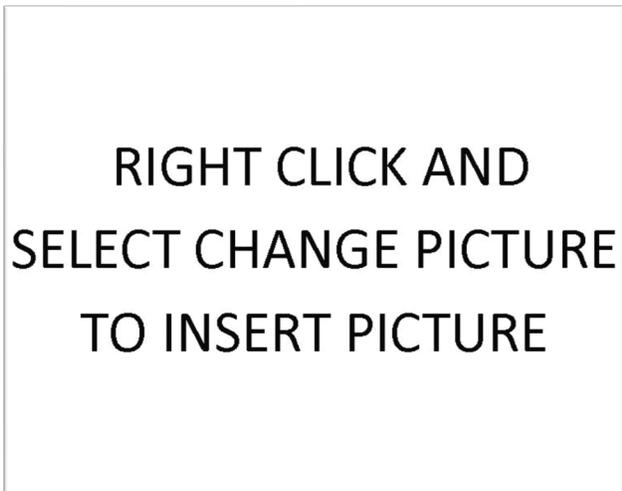
E.2: Tank XX South View



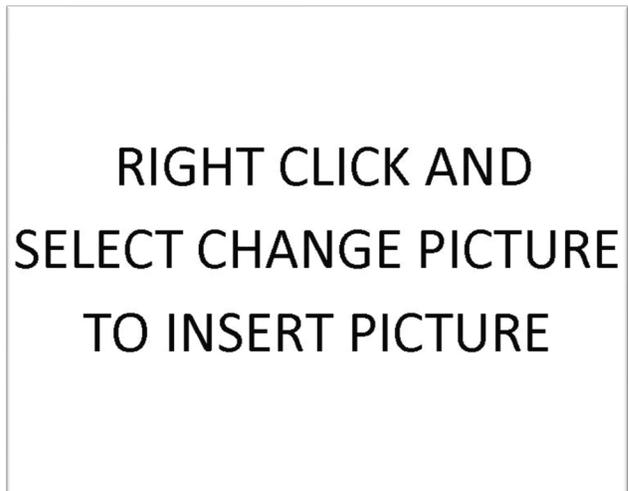
E.3: Tank XX East View



E.4: Tank XX West View



E.5: Picture Description



E.6: Picture Description

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SELECT CHANGE PICTURE
TO INSERT PICTURE

E.7: Picture Description

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E.8: Picture Description

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E.9: Picture Description

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