API 653 TANK INSPECTION, TANK MAINTENANCE, AND CAUSES OF TANK FAILURE

Sarajevo 2023

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API 653 Tank Inspections

Why Inspect Your Tanks?

- Prevent leaks into your secondary containment or to groundwater (if you do not have a secondary containment system)
- Establish a baseline of tank condition and corrosion rates
- Identify problems to perform repairs before you have a significant leak or release - **Maintain your capital asset**
- Minimize chance of catastrophic tank failure

PROPER INSPECTION PROTOCOL

INSPECTOR CREDENTIALS

- Certified API 653 Inspector
  - Four years minimum experience with storage tanks
  - Must pass test conducted by American Petroleum Institute (API)
    - Inspectors receive an individual inspector number
    - Inspector testing required every three years

PROPER INSPECTION PROTOCOL

- Visual inspection of welds, plates, and appurtenances
- UT (Ultra-sonic Thickness) testing of shell courses, floor, and roof
- Vacuum testing of all floor weld seams – unless epoxy coated
- Identify bottom side corrosion on floors
- Settlement Survey
  - Checking for planar tilt
  - Check for floor bulges or depressions
- Provide calculations for safe or maximum fill height

Weld deterioration

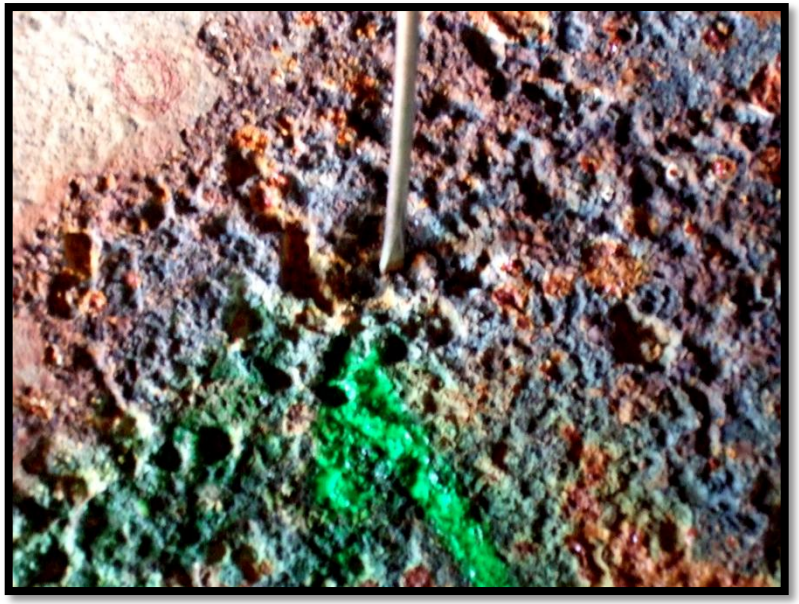


Plate corrosion

Interior piping corrosion

Shell corrosion

Weld deterioration and four-way junction – NON API

Four-corner insert with reinforcing backup – NON API

Evidence of interior shell corrosion

Foundation evaluation

Floor plate corrosion

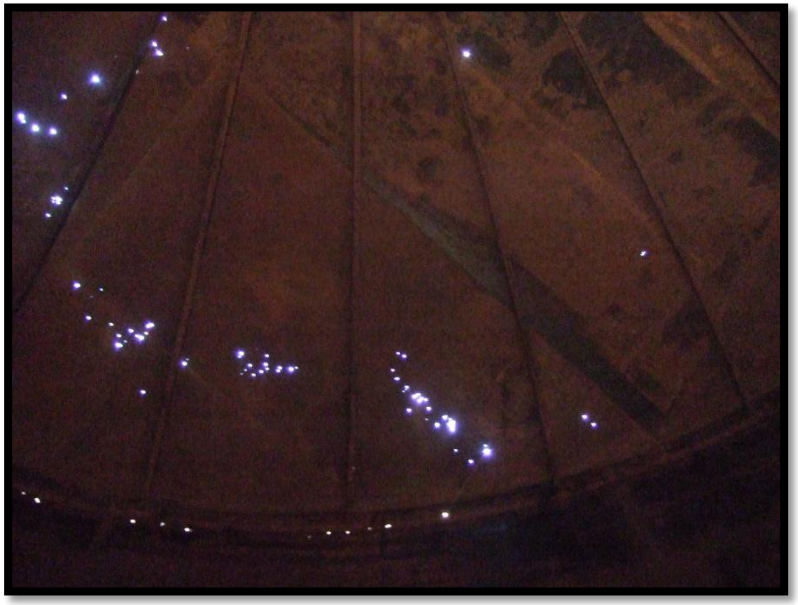
Lap-welded seam leak

Floor coupon with bottom side corrosion

Floor top side corrosion

Severe roof corrosion

Star light . . . Star bright!



1.0 Executive Summary

On August 5, 2010, an API Standard 653 Out-of-Service inspection was completed on the primary tank of a double-wall above ground storage tank used for storing 28% Nitrogen Solution at the Martin, Ohio facility owned by Helena Chemical Company, Inc. This inspection was conducted to collect data in order to evaluate the tank's mechanical integrity and fitness for continued service. The inspection was conducted in accordance with client criterion for Non Destructive Examination (NDE) which included visual, vacuum and Ultrasonic Thickness (UT) Examinations.

Tank #1 was built in 2000 by Ebert Enterprises using A-36 materials to API 650 specifications for storing 28% Nitrogen Solution. The primary tank measures 73' diameter x 32' high. External welds on the shell, roof and floor of the primary tank were visually examined. The joints on the shell plates were butt-welded vertically and horizontally. Joints on roof and floor plates were lap-welded. External shell was visually examined and there is no external coating of primary tank #1.Neither radiograph nor soil reports were available at the time of the inspection.

Ultrasonic Thickness (UT) measurements were performed on the tank's shell plates in six (6) locations according to a consistent test pattern. On the lower courses, every sheet was numbered and tested. On the upper courses, four (4) sheets on each course were numbered and tested. On the roof plates, a single measurement was taken in the center of each plate. The sheet numbers and locations are depicted in Appendix C

Summary Conclusions:

- The thicknesses of all shell courses and roof plates are above API minimum thickness requirements.
- MAXIMUM FILL HEIGHT IS 31.2' WITH 28% NITROGEN SOLUTION.
- All floor plates are above API minimum thickness requirements.
- Internal vertical & horizontal shell welds are in good condition.
- External shell and welds are in good condition.

Summary of Recommendations:

- Coat the internal shell and floor with proper epoxy coating to prevent corrosion.
- Keep product below the internal roof structure.

Based in The Fertilizer Institute recommendations and the state of Ohio permit requirements, this tank's next inspection intervals are.

- UT Thickness: 08/05/15
- Internal: 08/05/15
- External: 08/05/15

2.0 Tank Data

Tank #:	#2	***Diameter:***	53'
Client:		***Height/Length:***	32'
Location:	, Nebraska	***Corr. Allowance***	0.000
Inspection Date:	August 17, 2010	***Joint Eff:***	1.00
Type Inspection:	API 653 Out-of-Service	***Specific Gravity***	1.35
Test Methods:	Visual & UT	***Plate Spec:***	A 36M
Manufacturer:	HMT, Inc.	***Course 1 t:***	0.312
Year Built:	1998	***Course 2 t:***	0.250
Const. Code:	API 650	***Course 3 t:***	0.250
Capacity:	528,073 gallons	***Course 4 t:***	0.250
Shell Const:	Butt-Welded	***Course 5 t:***	
Roof Type:	Fixed / Cone	***Course 6 t:***	
Foundation:	Earthen	***Course 7 t:***	
Fill Height without Liner:	32'	***Course 8 t:***	
Fill Height with Liner:	30' 2"	***Roof / Head 1 t:***	0.187
Product:	10-34-0 Nitrogen Solution	***Bttm / Head 2 t:***	

3.0 Inspection Results

3.1 Foundation:

3.1.1 The PRIMARY TANK was constructed inside a larger secondary containment tank and seal welded to secondary tank floor. Welds were visually examined and found to be in good condition.

3.1.2 A settlement survey of the primary tank was completed from the inside of the tank. Beginning at the shell man-way moving clockwise around the tank, eight (8) equally-spaced measurements were performed around the outer circumference of the tank at the chime. Results reveal the primary tank was found to be within the parameters allowed by API Specifications and the tank is fit for continued service.

3.2 Shell:

3.2.1 UT measurements were performed on all shell courses on the primary tank. A weld joint efficiency of 0.90 and a specific gravity of 1.33 were used in the minimum thickness calculations. Results reveal all shell courses to be above the API minimum thickness requirements. All shell courses are fit for continued service.

3.2.2 Calculation results from this inspection reveal the maximum fill height of the primary tank is 32.0' according to API Specifications. However, fill height should remain below the roof rafter system.

3.2.3 During the external visual examination of the primary tank's shell plates, an overall smooth surface texture was observed.

3.2.4 Welds in the external vertical and horizontal shell weld joints were visually examined and found to be in good condition.

3.2.5 Welds on the internal side of the shell were visually examined and generalized corrosion was observed.

3.3 Appurtenances:

3.3.1 The primary tank is equipped with:

- two (2) 6" nozzles located in the lower first shell course on the south side of tank.
- two (2) leak monitors attached to secondary tank.

3.3.2 Welds on all nozzles and re-pads were visually examined and found to be in good condition and fit for continued service. Welds on valve couplings were visually examined and found to be in good condition.

3.4 Roof:

3.4.1 UT measurements were performed in the center of each roof plate on the primary tank. Results reveal all roof plates to be above API minimum thickness requirements and are fit for continued service.

3.4.2 Welds in roof plate joints were visually examined and found to be in good condition with no corrosion present.

3.4.3 The primary tank is equipped with one (1) 10" roof vent and one (1) 12" roof vent. Welds on roof vents were visually examined and found to be in good condition. The roof vents are equipped with proper screens and were found to be in good condition.

3.4.4 Roof of the primary tank is equipped with one (1) 24" roof man-way. Welds on man-way and attachments were visually examined and found to be in good condition and fit for continued service.

3.4.5 Roof of the primary tank is equipped with one (1) 6" gauge hatch, three (3) 1 ¼ " gauge pipes, and one (1) 38" x 38" access hatch on the east side of the roof between the primary and secondary tanks. Welds on all roof attachments were visually examined and found to be in good condition.

Tank Shell Minimum Thickness and Remaining Life Calculations

Date: 8/17/2010

File No	Report No	Client	Inspector	Tank No	Temp. (°F)
41	HTS-10- 118		Richard Buntt	#2	

SHELL MINIMUM THICKNESS CALCULATIONS

$$tmin = \frac{2.6D(H-1)G}{SE}$$

Where:

H = The height above the bottom of the course of study to the maximum liquid level height of the product, in feet (meters). For corroded or pitted areas, H = the height from the bottom of the corroded or pitted area to the maximum liquid level height of the product, in feet (meters).

tmin = The calculated minimum acceptable shell thickness, in inches (must be greater than 0.1 inch (2.5 mm) for any course). The minimum acceptable shell thickness allowed by API-653 for tank size, in inches (mm) or an alternate tmin based on low pressure calulations (int and/or ext pressures) or nominal thickness minus design corrosion allowance.

D = Nominal diameter of tank, in feet (meters).

G = Highest specific gravity of the contents (including test water if tank will, or may, be tested in the future).

S = Maximum allowable stress, in psi. For welded tanks; use the smaller of 0.80Y of 0.429T for bottom and second course or the smaller of 0.88Y or 0.472T for all other courses. For riveted tanks; S = 21,000 psi. (145 MPa)

Y = Specified minimum yield strength of the plate, in psi; use 30,000 psi (200 MPa) if not known (N/A for riveted tanks).

T = The smaller of the specified minimum tensile strength of the plate or 80k psi (550 MPa); use 55,000 psi (380 MPa) if not known (N/A for riveted tanks).

E = Original joint efficiency for the tank. For welded tanks; use API-653, Table 4-2 ; use E = 1.0 when evaluating the retirement thickness in a corroded plate, when away from welds or joints by at least the greater of one inch (250 mm) or twice the plate thickness. For riveted tanks; use E = 1.0 for shell plates greater than 6 inches (150 mm) away from rivets; use the value of E from API-653 Table 2-1 when within 6 inches (150 mm) of rivets.

D (ft): 53 G: 1.35 E: 1.00 Fill Height (ft): 32.0

	Material	Crs H (ft)	H (ft)	S (psi)	tmin (in)
Course 1	A 36M	8.00	32.00	24900	0.232
Course 2	A 36M	8.00	24.00	24900	0.172
Course 3	A 36M	8.00	16.00	27400	0.102
Course 4	A 36M	8.00	8.00	27400	0.100

Tank Shell Minimum Thickness and Remaining Life Calculations

Date: 8/17/2010

File No	Report No	Client	Inspector	Tank No	Temp. (°F)
41	HTS-10- 118		Richard Buntt	#2	

SHELL REMAINING LIFE CALCULATIONS

Ca = tact-tmin = Remaining Corrosion Allowance (inches (mm))
Cr = tprev-tact / Y = Corrosion Rate (inches (mm) per year)
RL = Ca / Cr = Remaining Life (years)
Y = 12 = Tank age (years)

Where:

Ca = Remaining corrosion allowance of the shell course under consideration, in inches (mm).

Cr = Corrosion rate of the shell course under consideration, in inches (mm) per year.

FHc = Calculated Fill Height = SEtact/2.6DG+1 (SEtact/4.6DG+.3)

tact = Minimum thickness measurement of the shell course under consideration, as recorded at the time of inspection, in inches (mm).

tmin = minimum required thickness of shell course, at the maximum allowable fill height, in inches (mm)

tprev = previous thickness measurement of shell course under consideration, as recorded at last inspection or nominal thickness if no previous thickness measurements, in inches (mm).

RL = Estimated remaining life of the shell course under consideration, in years.

Y = Time span between thickness readings or age of the tank if nominal thickness is used for tprev, in years.

Course	tprev	tact	tmin	Ca	Cr	RL	FHc
Course 1	0.312	0.301	0.232	0.069	0.0009	75.7	41.29
Course 2	0.250	0.240	0.172	0.068	0.0008	81.8	41.12
Course 3	0.250	0.241	0.102	0.139	0.0008	185.5	52.50
Course 4	0.250	0.234	0.100	0.134	0.0013	100.5	59.47

SHELL SETTELMENT SURVEY
API-653 APPENDIX B SETTLEMENT EVALUATION

Date: 6/9/2010

File No	Report No	Client	Inspector	Tank No	1st Crs Plt Spec
7	HTS-10-221		Doug Perry	#1	Unknown

$$S <= 11L^2Y/2EH$$

U = Measured out-of-plane settlement in relation to a cosine curve, in feet
S = Deflection, in feet, (out-of-plane distortion)
L = Arc length between measurement points, in feet
Y = Yield strength, in pounds per square inch (psi)
E - Young's modulus, in pounds per square inch (psi)
H = Tank height, in feet

D	L	Y	E	H	S - Max Permissible
52	20.42	30000	29000000	31.5	0.075

	Feet	Inches	Feet	U	S	Results
Point 1	3	9.000	3.75	0.000	0.002	SAT
Point 2	3	9.200	3.77	0.007	0.000	SAT
Point 3	3	9.400	3.78	0.014	-0.001	SAT
Point 4	3	9.600	3.80	0.022	0.016	SAT
Point 5	3	9.400	3.78	-0.002	-0.009	SAT
Point 6	3	9.400	3.78	-0.008	0.008	SAT
Point 7	3	9.200	3.77	-0.030	-0.010	SAT
Point 8	3	9.200	3.77	-0.032	0.008	SAT
Point 9	3	9.000	3.75	-0.050	-0.010	SAT
Point 10	3	9.000	3.75	-0.049	-0.024	SAT
Point 11	3	9.000	3.75	-0.046	-0.009	SAT
Point 12	3	9.200	3.77	-0.025	0.008	SAT
Point 13	3	9.200	3.77	-0.019	-0.010	SAT
Point 14	3	9.400	3.78	0.006	0.017	SAT
Point 15	3	9.200	3.77	-0.002	0.000	SAT
Point 16	3	9.000	3.75	-0.010	-0.009	SAT

High Point: 3.75 Ft

Low Point: 3.80 Ft

Planar Tilt: 0.05 Ft / 0.60 In.

Cosine Curve R^2: 0.24

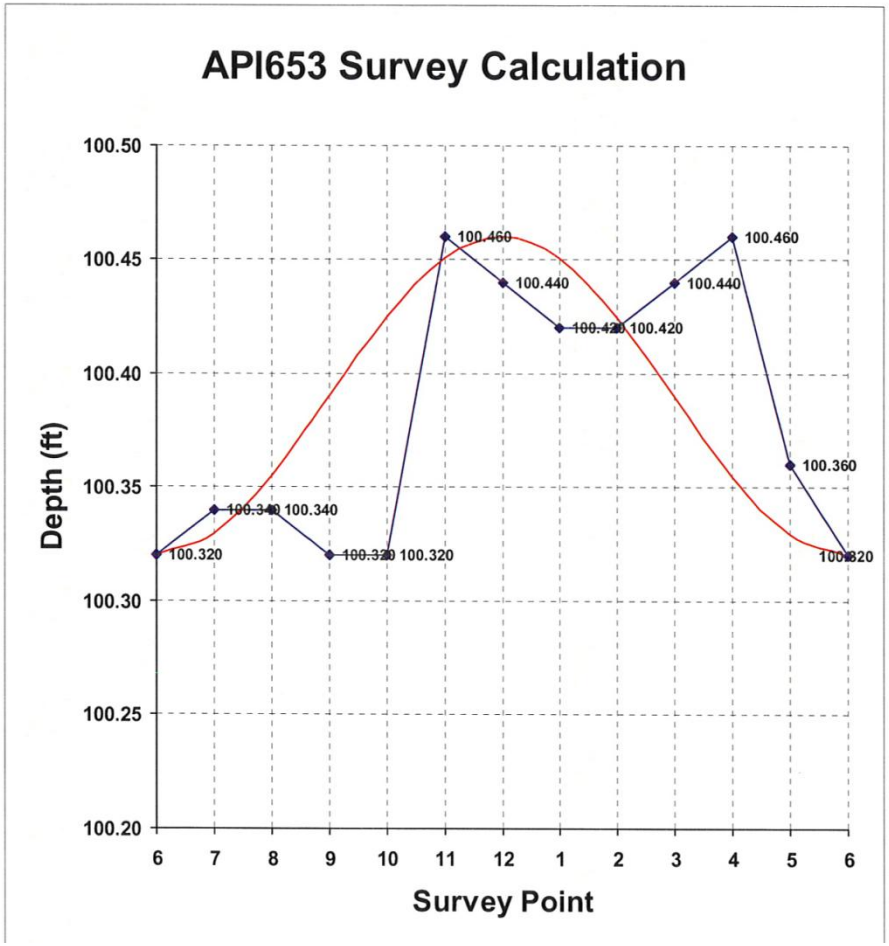
Notes:

Sixteen equally spaced settlement measurements were performed around the outside circumference of the tank at the floor plate that sticks out beyond the shell.

SHELL SETTELMENT SURVEY
API-653 APPENDIX B SETTLEMENT EVALUATION

Date 8/7/2010

Report No	Client	Inspector	Tank No	1st Crs Plt Spec
HTS-10-155		Richard Buntt	#17	A 36M



API-653 ATMOSPHERIC STORAGE TANK FIXED ROOF EVALUATION
MINIMUM THICKNESS, REMAINING LIFE, PRESSURE CALCULATIONS

Date: 10/12/2010

File No	Report No	Client	Inspector	Tank No	Temp. °F	Ca
60	HTS-10-271		Doug Perry	#1		0.000

Where;
Ca = remaining corrosion allowance of the tank component under consideration, in inches (t act - t min).
Cr = corrosion rate of the tank component under consideration, in inches per year (t prev - t act / Y).
oz = unit of measurement, (weight, in ounces, per square inch), (16 oz per pound)
psi = unit of measurement, (weight, in pounds, per square inch)
RL = estimated remaining life of the tank component under consideration, in years (Ca / Cr).
t act = actual thickness measurement of the tank component under consideration, as recorded at the time of inspection, in inches.
t min = minimum required thickness of tank component, at the design MAWP at the design temperature (200°F for atm AST's), in inches (greater of psi/wt or 0.090").
t nom = design nominal thickness of tank component under consideration, in inches.
t prev = previous thickness measurement of the tank component under consideration, as recorded at last inspection or nominal thickness if no previous thickness measurements, in inches.
t yn = thickness of the tank component under consideration at the next inspection at twice the calculated corrosion rate, in inches (t act - (2*Cr*Yn).
wt = weight of plate per cubic inch.
wc = unit of measurement, (height, in inches, of water column bearing on 1 square inch area), (27.7 wc per pound)
Y = time span between thickness readings or age of the tank component if tnom is used for tprev, in years.
Yn = estimated time span to next inspection of the tank component under consideration, in years

ROOF PLATES - REMAINING LIFE

Y	t prev	t act	t min	Cr	Ca	RL
15	0.187	0.176	0.090	0.00073	0.086	117

ROOF MAXIMUM ALLOWABLE INTERNAL PRESSURE

Material Catagory	wt	Yn	t yn	psi	oz.	wc
CS/Crom. Stl	0.2833	5	0.169	0.048	0.765	1.32

RELIEF VALVE SETTING EVALUATION

Setting	Unit			Max Allowed	
		=	(psi)	0.765	oz

Relief setting is satisfactory

Ultrasonic Thickness Measurements were performed in the center of each roof plate at the time of the examination.

STORAGE TANK FLOOR EVALUATION
MINIMUM REMAINING THICKNESS (MRT) CALCULATIONS

Date: 10/12/2010

File No	Report No	Client	Initials	Tank No	Temp. °F
60	HTS-10-271		Doug Perry	#1	

Liner	CP Protec.	50mil Liner	Leak Det.	Ca	Shell tmin	Shell tnom	D	H	S
No	No	No	No						

Where;
Ca = corrosion allowance, in inches.
MRT = minimum remaining thickness at the end of interval Or. This value must meet the requirements of Table 4-1 and sections 2.4.7.4 and 2.4.8.
Or = In-service interval of operation (years to next internal inspection) not to exceed that allowed by 4.4.2.
RTbc = minimum remaining thickness from bottom side corrosion after repairs.
RTip = minimum remaining thickness from internal corrosion after repairs.
StPr = maximum rate of corrosion not repaired on the top side. StPr = 0 for coated areas of the bottom. The expected life of the floor must equal or exceed Or to use StPr = 0.
tmin = minimum allowable thickness in accordance with requirements of Table 4-1 and sections 2.4.7.4 and 2.4.8
to = original (nominal) thickness of floor plate under consideration, in inches.
UPr = maximum rate of corrosion on the bottom side. To calculate the corrosion rate, use the minimum remaining thickness after repairs. Assume a linear rate based on the age of the tanks. UPr = 0 for areas that have effective cathodic protection.
D = nominal diameter of tank, in ft.,
H =Height, in feet, from the bottom of the 1st shell course to the maximum allowable fill height
S = Stresses are calculated from [2.34 D (H-1)]/t

GENERAL PLATES - AFTER INSPECTION / REPAIRS

Age	to	RTbc	RTip	UPr	StPr	Or	MRT	tmin	Results
15	0.250	0.237	0.237	0.00087	0.00087	5	0.228	0.100	ACCEPTABLE

PLATES IN CRITICAL ZONE (3") - AFTER INSPECTION / REPAIRS

Age	to	RTbc	RTip	UPr	StPr	Or	MRT	tmin	Results
15	0.250	0.237	0.237	0.00087	0.00087	5	0.228	0.100	ACCEPTABLE

ANNULAR PLATES - AFTER INSPECTION / REPAIRS

Age	to	RTbc	RTip	UPr	StPr	Or	MRT	tmin	Results

Ultrasonic Thickness Measurements were performed in five designated locations on each floor plate.

API-653 STORAGE TANK EVALUATION

AST Component Inspection Data

Report No	Client	Inspector	Vessel	Date
HTS-10			#2	

Component Thickness Measurements (in inches)

CML	Component	Location	tml-1	tml-2	tml-3	tml-4	tml-5	tml-6	Minimum
001	Shell Crs 1	Plt1	0.342	0.345	0.334	0.336	0.345	0.335	0.334
002	Shell Crs 1	Plt2	0.340	0.328	0.350	0.357	0.333	0.371	0.328
003	Shell Crs 1	Plt3	0.323	0.337	0.325	0.316	0.323	0.332	0.316
004	Shell Crs 1	Plt4	0.327	0.364	0.355	0.361	0.325	0.366	0.325
005	Shell Crs 1	Plt5	0.334	0.348	0.344	0.363	0.340	0.373	0.334
006	Shell Crs 1	Plt6	0.352	0.355	0.358	0.359	0.350	0.347	0.347
007	Shell Crs 2	Plt1	0.221	0.282	0.247	0.218	0.226	0.243	0.218
008	Shell Crs 2	Plt2	0.224	0.231	0.226	0.229	0.222	0.256	0.222
009	Shell Crs 2	Plt3	0.219	0.224	0.229	0.220	0.218	0.270	0.218
010	Shell Crs 2	Plt4	0.213	0.233	0.209	0.252	0.207	0.252	0.207
011	Shell Crs 2	Plt5	0.214	0.266	0.248	0.226	0.227	0.250	0.214
012	Shell Crs 2	Plt6	0.251	0.233	0.223	0.253	0.223	0.273	0.223
013	Shell Crs 3	Plt1 N.	0.212	0.204	0.195				0.195
014	Shell Crs 3	Plt2 S.	0.210	0.205	0.204				0.204
015	Shell Crs 3	Plt3 E.	0.189	0.185	0.183				0.183
016	Shell Crs 3	Plt4 W.	0.211	0.204	0.207				0.204
017	Shell Crs 4	Plt1 N.	0.196	0.217	0.194				0.194
018	Shell Crs 3	Plt2 S.	0.203	0.200	0.212				0.200
019	Shell Crs 4	Plt3 E.	0.189	0.190	0.195				0.189
020	Shell Crs 4	Plt4 W.	0.189	0.183	0.187				0.183
021	Roof	Plt1	0.213						0.213
022	Roof	Plt2	0.185						0.185
023	Roof	Plt3	0.186						0.186

Shell CML Locations

Primrose, NE
Tank #1
15' diameter x 55' high
October 13, 2010

Course 3, 4, 5 & 6

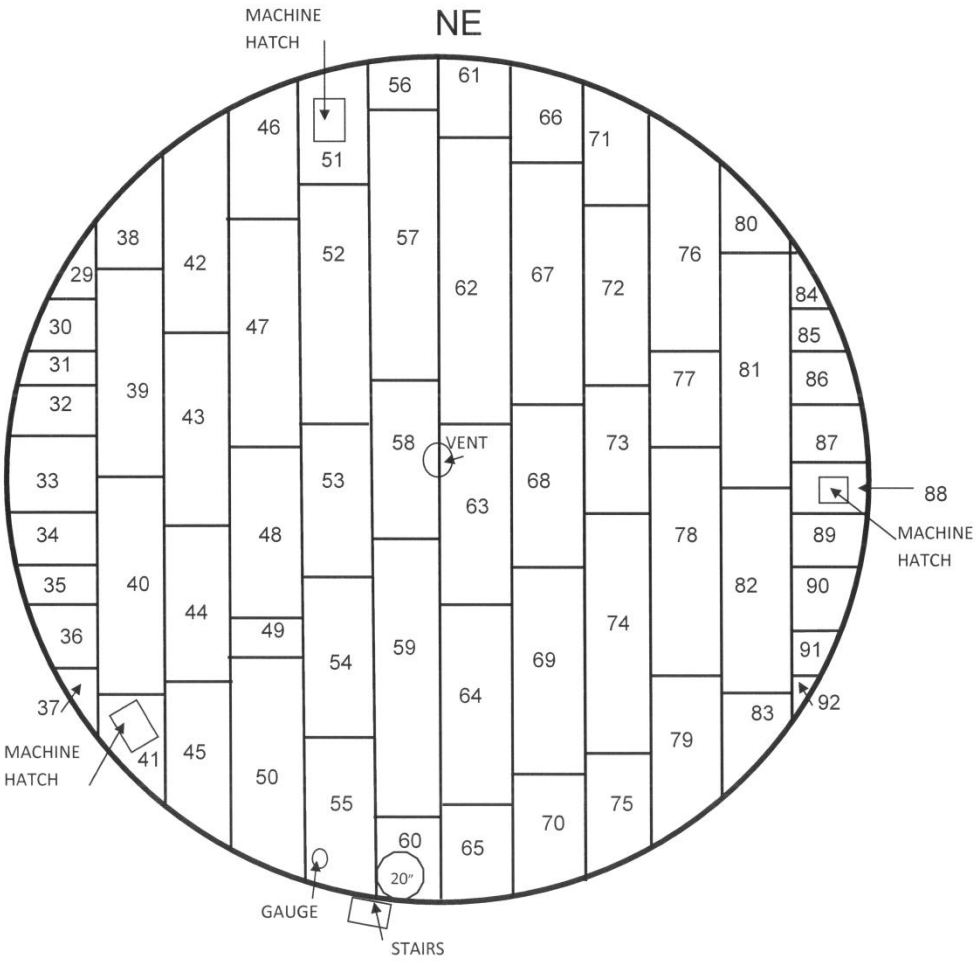
NORTH	SOUTH	EAST	WEST
21	22	23	24
17	18	19	20
13	14	15	16
9	10	11	12

Courses 1 & 2

5	6	7	8
1	2	3	4

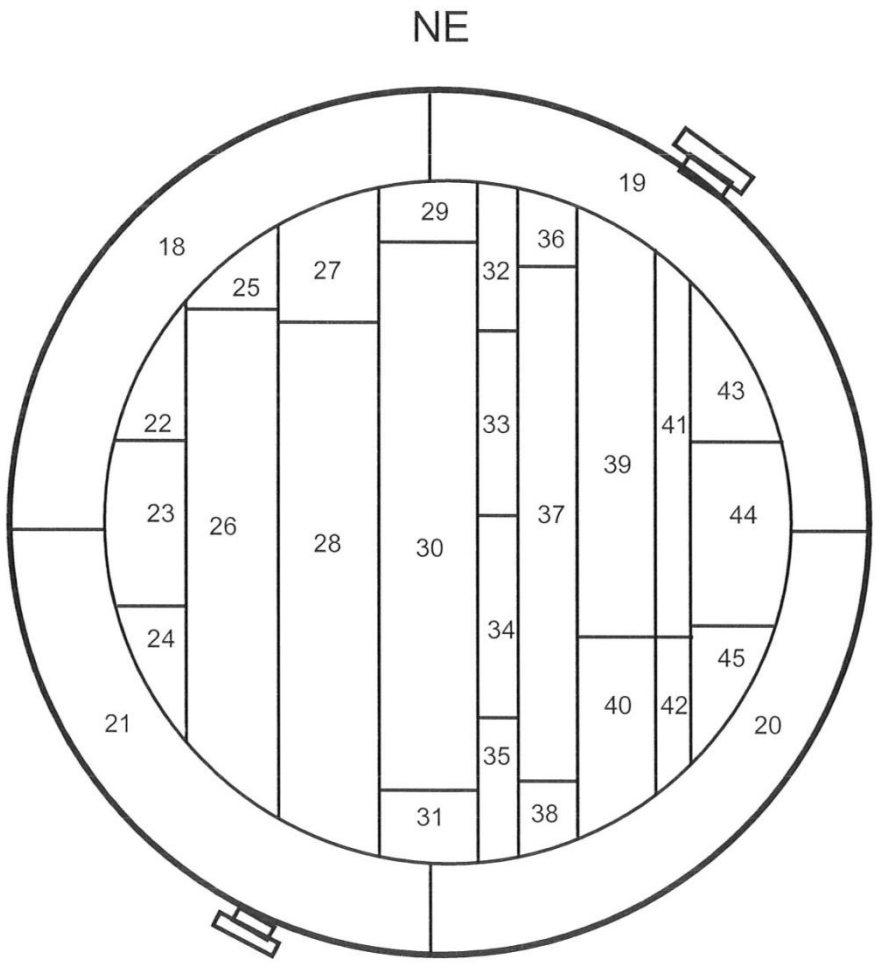
Roof CML Locations

Garden City, KS
Tank #8
104' diameter x 32' high
August 5, 2010



Floor CML Locations

Crop Production Services, Inc.
Alpaugh, CA
Tank #150
33.2' diameter x 32' high
June 7, 2010




08/18/2010


08/11/2010

TANK MAINTENANCE – COMMON SENSE APPROACH

- Conduct monthly/weekly walk-around of your tank(s)
  - Look for stains on steel where leak may be occurring
  - Check valve function and nozzle welds
  - Check associated piping
  - Check foundation for wash-out/deterioration
- Keep good records of product in and out

TANK MAINTENANCE – COMMON SENSE APPROACH

- Open up your tank a minimum of every two years and conduct your own visual inspection inside
  - Check for weld deterioration and corrosion
  - If tank is coated, visually check coating for blisters or cracks
- Keep a record of inspections and results
- If tank has an internal containment liner, check leak monitor weekly
- Conduct an API-653 inspection of your tank every five years as recommended by **TFI (The Fertilizer Institute)**

WHAT IS THE API 650 SPECIFICATION

API - AMERICAN PETROLEUM INSTITUTE

Worldwide Standard for Above Ground Storage Tank Design and Construction

- Provides requirements for calculations of shell plate thickness, man-way and nozzle design
- Provides procedures for shell, roof and floor construction
- Specifies material requirements and minimum thickness requirements
- Specifies weld construction requirements, weld spacing, and x-ray requirements

CAUSES OF CATASTROPHIC TANK FAILURE

TANK FAILURES – COMMON CAUSES

- Tank shell plates not thick enough for specific gravity of product stored
- Over-filling of tank – over pressure
- Cut-down and re-erected tanks using improper cutting and re-welding procedures
- Improper weld procedures
  - Lack of full weld penetrations (lack of weld fusion)
  - Improper weld seam spacing
  - Lack of radiograph (x-ray) of newly constructed tanks or on repaired tanks

TANK FAILURES – COMMON CAUSES

- Lack of weld fusion - #1 common cause
  - Welders not certified and tested to weld procedure
- Weld deterioration/corrosion – especially in lower horizontal and vertical weld seams
- Brittle fracture of steel
- Lack of proper certified inspections
- Tank erectors who know little about API Specifications and procedures – these companies attract customers with a “cheap” price. Make certain your contractor can verify that your tank meets API Specifications. **DO YOUR OWN HOMEWORK**

Cut-down and re-welded tank

Improper weld spacing

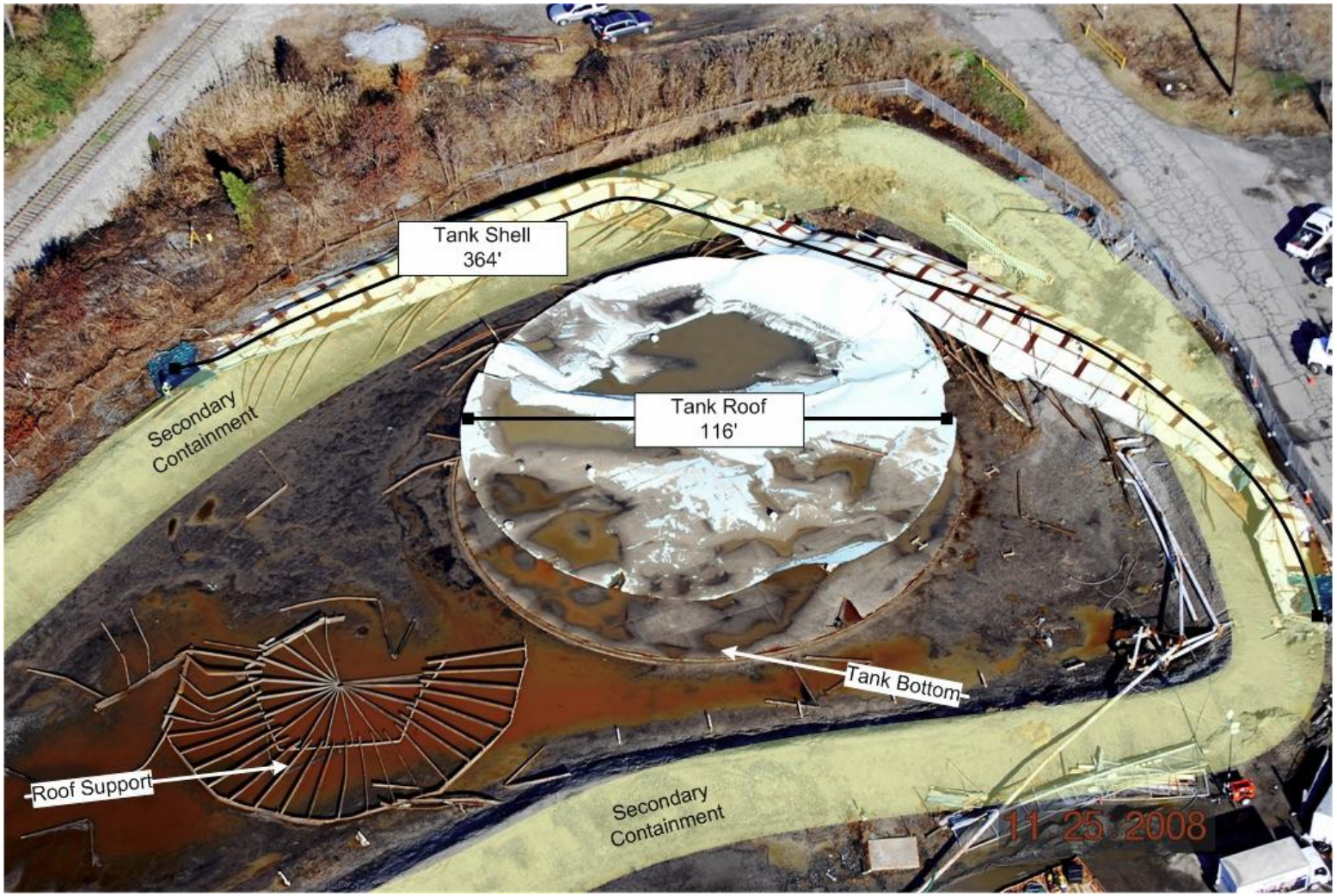
Double wall 500,000 gallon tank, Illinois 2008

Cause – overfilling and lack of fusion on weld seams

Yards of destruction

Original tank foundation

Weld seam rupture. Force of rupture “pushes back”. Rupture on side of camera location.


Tank Shell
364'
Tank Roof
116'
Secondary
Containment
Tank Bottom
Roof Support
Secondary
Containment
11 25 2008

Aboveground Storage Tank Inspection

This Standard Operating Procedure describes the steps that campus units that manage aboveground oil storage tanks (ASTs) or containers must follow to perform visual tank inspections. Checklists are attached.

Monthly Tank Inspection (e.g., Aboveground Storage Tanks, Generator Tanks):

- **Use and complete the Aboveground Storage Tank Monthly Inspection Checklist** – Designate a knowledgeable individual to inspect tanks according to the attached checklist or an equivalent method pre-approved by the Division of Safety and Compliance.
- **Monthly** – Inspect aboveground tanks and associated valves, piping, and appurtenances. Visually assess the general condition of the tank or container and its appurtenances such as flange joints, expansion joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces. Also observe shells for signs of leaks or potential leaks, such as cracks, holes, rust, bulges, dents, residues, stains or other visual evidence.
- For oil/fuel containers that lack secondary containment and cannot be inspected or viewed on all sides for the presence of leaks, **accurately inventory** quantities at least monthly. Reconcile the amount of product used with the amount of product purchased to account for all inventory and confirm that product is not slowly leaking from the container.
- **Keep written procedures** and a **record of inspections**, inventories and tests, signed by the appropriate supervisor or designated inspector, with the SPCC Plan at your unit for at least **3 years**. Certified inspector integrity tests records should be retained for the life of the tank.
- **Report problems** to the Unit Coordinator for corrective action.
- If you witness or discover a release of a petroleum product notify the appropriate personnel in accordance with SOP-1 Spill Reporting Procedures for University Personnel and Students.

AST Inspection Checklist Guidance (Adopted from the Steel Tank Institute (STI) SP0001 inspection standard):

- For equipment not included in the STI SP0001 inspection standard, follow the manufacturer recommended inspection/testing schedules and procedures.
- The monthly AST Inspection is intended for monitoring the external AST condition and its containment structure. This visual inspection does not require a certified inspector. It shall be performed by an owner's inspector who is familiar with the site and can identify changes and developing problems.
- Upon discovery of water in the primary tank, secondary containment area, interstice, or spill container, remove promptly or take other corrective action. Before discharge to the environment, inspect the liquid for regulated products or other contaminants and dispose of it properly.
- (*) designates an item in a non-conformance status. This indicates that action is required to address a problem.
- Non-conforming items important to tank or containment integrity require evaluation by an engineer experienced in AST design, a certified inspector, or a tank manufacturer who will determine the corrective action. Note the non-conformance and corresponding corrective action in the comment section.
- Retain the completed checklists for at least 3 years.
- **In the event of severe weather (snow, ice, wind storms) or maintenance (such as painting) that could affect the operation of critical components (e.g., normal and emergency vents, valves), an inspection of these components is required immediately following the event.**

Monthly AST Inspection Checklist

Unit: _____ **Inspection Date:** _____

Inspector Name: _____

Container/System: _____

(*) designates an item in a non-conformance status. This indicates that action is required to address a problem.

Item	Status	Comments
1.0 Tank Containment		
Water in primary tank, secondary containment, interstice, or spill container?	☐ Yes* ☐ No	
Debris or fire hazard in containment?	☐ Yes* ☐ No	
Drain valves operable and in a closed position?	☐ Yes ☐ No*	
Containment egress pathways clear and gates/doors operable?	☐ Yes ☐ No*	
Secondary containment or ground is damaged or stained?	☐ Yes* ☐ No	
2.0 Leak Detection		
Visible signs of leakage around the tank, concrete pad, containment, ringwall or ground?	☐ Yes* ☐ No	
Valve seals or gaskets are leaking?	☐ Yes* ☐ No	
Cracks in hosing present?	☐ Yes* ☐ No	
3.0 Tank Attachments and Appurtances		
Ladder and platform structure secure with no sign of severe corrosion or damage?	☐ Yes ☐ No*	
Tank Liquid level gauge and alarms readable and in good condition?	☐ Yes ☐ No*	
All tank openings are properly sealed?	☐ Yes ☐ No*	
Vents are obstructed?	☐ Yes* ☐ No	
Pipelines or supports are damaged or deteriorated?	☐ Yes* ☐ No	
Buried pipelines exposed?	☐ Yes* ☐ No	

4.0 Tank Structure		
Tank is dented, bulging, rusted, damaged, or deteriorated?	☐ Yes* ☐ No	
Bolts, rivets, or seams are cracked or damaged?	☐ Yes* ☐ No	
Tank supports are deteriorated or buckled?	☐ Yes* ☐ No	
Tank foundations have eroded or settled?	☐ Yes* ☐ No	
Double-walled tanks – Space between inner and outer walls is free of oil?	☐ Yes ☐ No*	
5.0 Other Conditions		
Oil/water separator is functioning properly?	☐ Yes ☐ No*	
Are there other conditions that should be addressed for continued safe operation or that may affect the site SPCC plan?	☐ Yes* ☐ No	
Security fencing, gates, locks, lighting are functional?	☐ Yes ☐ No*	

Deficiencies and corrective actions must be documented on this inspection form. All leaks must be reported to the Division of Safety and Compliance at 217.265.9828.

Remarks_____

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Signature *(Inspector or Supervisor)* _____ Date:_____

Annual Aboveground Storage Tank Inspection:

- **Use and complete the <u>Aboveground Storage Tank Annual Inspection Checklist</u>** – Designate a knowledgeable individual to inspect tanks according to the attached checklist or an equivalent method pre-approved by the Division of Safety and Compliance.

<u>Annually</u>:

1. Inspect the AST shell and associated piping, valves, and pumps including inspection of the coating for Paint Failure.
2. Inspect earthen containment structures including examination for holes, washout, and cracking in addition to liner degradation and tank settling.
3. Inspect concrete containment structures and tank foundations/supports including examination for holes, washout, settling, paint failure, in addition to examination for corrosion and leakage.
4. Inspect steel containment structures and tank foundations/supports including examination for washout, settling, cracking, and for paint failure, in addition to examination for corrosion and leakage.
5. Inspect cathodic protection system, if applicable, including the wire connections for galvanic systems and visual inspection of the operational components (power switch, meters, and alarms) of impressed current systems.
6. Remove promptly upon discovery standing water or liquid in the primary tank, secondary containment area, interstice, or spill container. Before discharge to the environment, inspect the liquid for regulated products or other contaminants and dispose of it properly.

- **<u>Keep written procedures</u>** and a **<u>record of inspections</u>**, inventories and tests, signed by the appropriate supervisor or designated inspector, with the SPCC Plan at your unit for at least **<u>3 years</u>**. Records produced as a result of certified inspections should be retained for the life of the tank.
- **<u>Report problems</u>** to the Unit Coordinator for corrective action.
- If you witness or discover a release of a petroleum product notify the appropriate personnel in accordance with SOP-1 Spill Reporting Procedures for University Personnel and Students.

AST Inspection Checklist Guidance (Adopted from STI SP0001 inspection standard):

- For equipment not included in the STI SP0001 inspection standard, follow the manufacturer recommended inspection/testing schedules and procedures.
- The annual AST Inspection is intended for monitoring the external AST condition and its containment structure. This visual inspection does not require a certified inspector. It shall be performed by an owner's inspector who is familiar with the site and can identify changes and developing problems.
- Upon discovery of water in the primary tank, secondary containment area, interstice, or spill container, remove promptly or take other corrective action. Before discharge to the environment, inspect the liquid for regulated products or other contaminants and disposed of it properly.
- (*) designates an item in a non-conformance status. This indicates that action is required to address a problem.
- Non-conforming items <u>important to tank or containment integrity</u> require evaluation by an engineer experienced in AST design, a certified inspector, or a tank manufacturer who will determine the corrective action. Note the non-conformance and corresponding corrective action in the comment section.
- Retain the completed checklists for at least 3 years.
- **In the event of severe weather (snow, ice, wind storms) or maintenance (such as painting) that could affect the operation of critical components (normal and emergency vents, valves), an inspection of these components is required immediately following the event.**

Annual AST Inspection Checklist

Unit: _____ **Inspection Date:** _____

Inspector Name: _____

Container/System: _____

(*) designates an item in a non-conformance status. This indicates that action is required to address a problem.

Item	Status	Comments
1.0 Tank Containment		
Containment structure in satisfactory condition?	☐ Yes ☐ No*	
Drainage pipes/valves fit for continued service?	☐ Yes ☐ No* ☐ N/A	
2.0 Tank Foundation and Supports		
Evidence of tank settlement or foundation washout?	☐ Yes* ☐ No	
Cracking or spalling of concrete pad or ring wall?	☐ Yes* ☐ No	
Tank supports in satisfactory condition?	☐ Yes ☐ No*	
Water able to drain away from tank?	☐ Yes ☐ No*	
Grounding strap secured and in good condition?	☐ Yes ☐ No*	
3.0 Cathodic Protection		
CP system functional?	☐ Yes ☐ No* ☐ N/A	
Rectifier Reading:	☐ Yes ☐ No*	
4.0 Tank External Coating		
Evidence of paint failure?	☐ Yes* ☐ No	
5.0 Tank Shell/Heads		
Noticeable shell/head distortions, buckling, denting or bulging?	☐ Yes* ☐ No	
Evidence of shell/head corrosion or cracking?	☐ Yes* ☐ No	
6.0 Tank Manways, Piping and Equipment within Secondary Containment		
Flanged connection bolts tight and fully engaged with no sign of wear or corrosion?	☐ Yes ☐ No*	

Item	Status	Comments
7.0 Tank Roof		
Standing water on roof?	☐ Yes* ☐ No	
Evidence of coating cracking, crazing, peeling, blistering?	☐ Yes* ☐ No	
Holes in roof?	☐ Yes* ☐ No	
8.0 Venting		
Vents free of obstructions?	☐ Yes ☐ No*	
Emergency vent operable? Lift as required?	☐ Yes ☐ No*	
9.0 Insulated Roofs		
Insulation missing?	☐ Yes* ☐ No	
Are there noticeable areas of moisture on the insulation?	☐ Yes* ☐ No	
Mold on insulation?	☐ Yes* ☐ No	
Insulation exhibiting damage?	☐ Yes* ☐ No	
Is the insulation sufficiently protected from water intrusion?	☐ Yes ☐ No*	
10.0 Level and Overfill Prevention Instrumentation of Shop-Fabricated Tanks		
Has the tank liquid level sensing device been tested to ensure proper operation?	☐ Yes ☐ No*	
Does the tank liquid level sensing device operate as required?	☐ Yes ☐ No*	
Are overfill prevention devices in proper working condition?	☐ Yes ☐ No* ☐ N/A	
11.0 Electrical Equipment		
Are tank grounding lines in good condition?	☐ Yes ☐ No* ☐ N/A	
Is electrical wiring for control boxes/lights in good condition?	☐ Yes ☐ No* ☐ N/A	

Deficiencies and corrective actions must be documented on this inspection form. All leaks must be reported to the Division of Safety and Compliance at 217.265.9828.

Remarks_____

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Signature *(Inspector or Supervisor)* _____ Date:_____

Short-Term Container Inspection (e.g., drums 55 gallons or more):

"Short-term" containers are containers 55 gallons or greater that are used for storage of oil for less than 10 years. Short-term containers must be visually inspected at least monthly and the visual inspection must be documented.

- **Use and complete the Short-Term Container Inspection Checklist** – Designate an individual to conduct container inspections according to the attached checklist or an equivalent method pre-approved by the Division of Safety and Compliance.
- At least monthly – Inspect the top, bottom and sides of the container to observe for exterior dents, bulges, holes, missing bungs or caps, rust or other signs that might indicate leakage or potential leakage of contents.
- Ensure that the container is not in contact with the ground surface. If in contact with ground, note on checklist and immediately notify the Division of Safety and Compliance.
- Remove from service any "short-term" container that appears to pose risk of oil discharge and replace with an approved container if a substitute container.
- Remove from service all "short-term" containers **prior to ten years of age**.
- Document the inspection on the attached Short-Term Container Inspection Checklist (SOP-5b) and keep with the SPCC Plan at your unit for at least **3 years.**
- Report problems to the unit coordinator for corrective action.

Short-Term Container Inspection Guidance:

- The monthly Short-Term Container Inspection is intended for monitoring the external AST condition and its containment structure. This visual inspection does not require a certified inspector. Designated facility personnel who is familiar with the site and can identify changes and developing problems may perform the inspections.
- (*) designates an item in a non-conformance status. This indicates that action is required to address a problem.
- If 55-gallon drums are found to have non-conforming items that are important to containment integrity, the drum must be replaced.
- Retain the completed checklists for at least 3 years.

Monthly Inspection Checklist – Portable Containers

University Unit: _____ Storage Location (bldg/room):_____

Container/System (drum, contents, etc): _____

(*) designates an item in a non-conformance status. This indicates that action is required to address a problem.

Item	Inspection Date:	Inspection Date:	Inspection Date:
1.0 Tank Containment / Storage Area			
ASTs within designated storage area?	☐ Yes ☐ No*	☐ Yes ☐ No*	☐ Yes ☐ No*
Debris, spills or other fire hazard in containment or storage area?	☐ Yes* ☐ No	☐ Yes* ☐ No	☐ Yes* ☐ No
Water in outdoor secondary containment?	☐ Yes* ☐ No	☐ Yes* ☐ No	☐ Yes* ☐ No
Drain valves operable and in a closed position?	☐ Yes ☐ No*	☐ Yes ☐ No*	☐ Yes ☐ No*
Containment egress pathways clear and gates/doors operable?	☐ Yes ☐ No*	☐ Yes ☐ No*	☐ Yes ☐ No*
Secondary containment or ground is damaged or stained?	☐ Yes* ☐ No	☐ Yes* ☐ No	☐ Yes* ☐ No
2.0 Leak Detection			
Visible signs of leakage around the container, storage area or ground?	☐ Yes* ☐ No	☐ Yes* ☐ No	☐ Yes* ☐ No
3.0 Container			
Noticeable container distortions, buckling, denting, bulging or leaking?	☐ Yes* ☐ No	☐ Yes* ☐ No	☐ Yes* ☐ No
4.0 Inspector			
Inspector Signature			

Deficiencies and corrective actions must be documented on this inspection form. All leaks must be reported to the Division of Safety and Compliance at 217.265.9828.

Remarks_____

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Transformer and other Oil-Filled Operational Equipment Inspection:

"Oil-filled operational equipment" is equipment that includes an oil storage container which is present solely to support the function of the apparatus or the device. Oil-filled operational equipment is not considered a bulk storage container, and does not include oil-filled manufacturing equipment (flow-through process).

Examples of oil-filled operational equipment include, but are not limited to:

- hydraulic systems
- lubricating systems
- gear boxes
- machining coolant systems
- heat transfer systems
- transformers
- circuit breakers
- electrical switches
- wind turbines

Oil-filled operational equipment must be visually inspected at least annually and the visual inspection must be documented.

- **Use and complete the Oil-filled Operational Equipment Inspection Checklist** – Designate an individual to conduct container inspections according to the attached checklist or an equivalent method pre-approved by the Division of Safety and Compliance.
- At least annually – Inspect the equipment to observe for exterior dents, bulges, holes, missing bungs or caps, rust or other signs that might indicate leakage or potential leakage of contents.
- Remove from service or maintenance any oil-filled operational equipment that appears to pose risk of oil discharge.
- **Keep written procedures** and a **record of inspections**, inventories and tests, signed by the appropriate supervisor or designated inspector, with the SPCC Plan at your unit for at least **3 years**.
- **Report problems** to the Unit Coordinator for corrective action.
- If you witness or discover a release of a petroleum product notify the appropriate personnel in accordance with SOP-1 Spill Reporting Procedures for University Personnel and Students.

Annual Inspection Checklist – Oil-Filled Equipment

University Unit: _____ Storage Location (bldg/room):_____

Container/System (drum, contents, etc): _____

(*) designates an item in a non-conformance status. This indicates that action is required to address a problem.

Item	Inspection Date:		Inspection Date:		Inspection Date:	
1.0 Containment / Storage Area						
ASTs within designated storage area?	☐ Yes	☐ No*	☐ Yes	☐ No*	☐ Yes	☐ No*
Debris, spills or other fire hazard in containment or storage area?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No
Water in outdoor secondary containment?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No
Drain valves operable and in a closed position?	☐ Yes	☐ No*	☐ Yes	☐ No*	☐ Yes	☐ No*
Containment egress pathways clear and gates/doors operable?	☐ Yes	☐ No*	☐ Yes	☐ No*	☐ Yes	☐ No*
Secondary containment or ground is damaged or stained?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No
2.0 Leak Detection						
Visible signs of leakage around the container, storage area or ground?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No
Valve seals or gaskets are leaking?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No
Visible signs of leakage around the tank, concrete pad, containment, ringwall or ground?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No
Cracks in hosing present?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No
3.0 Container/Equipment						
Noticeable container distortions, buckling, denting, bulging or leaking?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No
Equipment is dented, bulging, damaged, or deteriorated?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No

4.0 Other Conditions						
Are there other conditions that should be addressed for continued safe operation or that may affect the site SPCC plan?	☐ Yes*	☐ No	☐ Yes*	☐ No	☐ Yes*	☐ No
Ladder and platform structure secure with no sign of severe corrosion or damage?	☐ Yes	☐ No*	☐ Yes	☐ No*	☐ Yes	☐ No*
Security fencing, gates, locks, lighting are functional?	☐ Yes	☐ No*	☐ Yes	☐ No*	☐ Yes	☐ No*
5.0 Inspector						
Inspector Signature						

Deficiencies and corrective actions must be documented on this inspection form. All leaks must be reported to the Division of Safety and Compliance at 217.265.9828.

Remarks_____