API-653 In-Service, Internal Inspection Report

Prepared for:

Northeast Generation Services
South Meadow Jet Station
Hartford, CT

Subject Tank:

Tank 6
Jet-A Tank

Prepared by:

InTANK

InTANK, LLC
Project No. NU-2009-1 Rev. 00

InTANK, LLC
5443 Trail Ride Ct
Moseley, VA 23120
www.intank.com

API-653 In-Service, Internal Inspection Report

Northeast Generation Services South Meadow Jet Station

Tank 6

Inspection Date:

August 10 – 21, 2009

It is recommended that this document, containing valuable historical information, be retained for the lifetime of the tank.

Michael O'Connell
API-653 Certified Inspector, Certificate # 24021

InTANK

Executive Summary

During the week of August 17, 2009, InTANK, LLC completed an inspection on Tank 6, the main Jet Fuel storage tank located at the Connecticut Resources Recovery Authority's (CRRA), South Meadow facility in Hartford, CT, operated by Northeast Generation Services Company (NGS). The purpose of the inspection was to assist in the evaluation of external, chime[1] / bottom plate corrosion that was identified during a recent external inspection. The most severe corrosion was found on the chime along a 7-foot section on the west side of the tank.

An external, under tank inspection was completed by hand-excavating the tank foundation in the area of the worst chime corrosion. The foundation was removed to a distance of approximately 6" under the tank shell. The external surface of the tank bottom was then cleaned by hand using scrapers, files and wire brushes.

The underside of the tank bottom was too rough to perform a complete UT scan, but thickness readings in discrete locations were obtained using manual ultrasonics. The thickness readings ranged from 0.136" to 0.210" indicating significant corrosion in this area of the tank bottom. The most severe metal loss was found closest to the tank perimeter.

The main focus of the inspection was an internal, robotic inspection of the tank bottom. Special attention was made to the tank perimeter in the area of the external chime corrosion on the west side of the tank.

As with the external inspection, the robotic inspection also found significant external (underside) corrosion on the west perimeter of the tank. The minimum thickness found by the robotic system was 0.159".

Based on the available data and using both long-term and short term corrosion rates, it is our opinion that the remaining service life of Tank 6 is less than three-years.

Given the difficulty in predicting exact corrosion rates and given the age of Tank 6, it is our recommendation that the tank be removed from service within 2 years from this date (removed from service no later than August 2011). The tank could be inspected and repaired at that time if desired.

The tank should also be monitored on a frequent basis for signs of leaking or other distress. It is also recommended that the amount of oil stored in the tank be kept to the minimum needed for normal plant operation until the tank can be removed from service.

[1] The "chime" is the portion of the tank bottom that extends outward from under the tank shell. This is also known as the "sketch plate extension".

Tank 6

All Field Data Can Be Found In the Attached Appendices

INTRODUCTION AND HISTORY

During the week of August 17, 2009, InTANK, LLC completed an inspection on Tank 6, the main Jet Fuel storage tank located at the Connecticut Resources Recovery Authority's (CRRA), South Meadow facility in Hartford, CT, operated by Northeast Generation Services Company (NGS). The purpose of the inspection was to assist in the evaluation of external, chime[2] / bottom plate corrosion that was identified during a recent external inspection. The most severe corrosion was found on the chime along a 7-foot section on the west side of the tank.

History

In 2004, InTANK Services, Inc.[3] completed a robotic internal inspection of Tank 6. The 2004 inspection found no significant corrosion in the tank bottom.

In 2009, an external inspection completed by a third party observed significant corrosion on the tank bottom chime. The most severe corrosion appeared to be on the west side of the tank (see photos in Appendix B).

In reviewing the 2004 InTANK Services report, it appears that the internal perimeter along the west side of the tank was not inspected.

Since the most severe chime corrosion was reported on the west side of the tank and no data from this region of the tank was available from the 2004 inspection, NGS requested that this additional inspection be completed.

[2] The "chime" is the portion of the tank bottom that extends outward from under the tank shell. This is also known as the "sketch plate extension".
[3] InTANK Services, Inc, is not affiliated with InTANK, LLC

INFORMATION AND DATA

Type of Inspection: API-653 In-Service, Internal

Test Methods Used: Visual, Ultrasonic Thickness Survey, Dye Penetrant (PT)

Tank Manufacturer:	CB&I
Year Built:	1946
Code Built To:	API-12C
Diameter:	140’
Height:	48’
Foundation:	Soil
Product Stored:	Jet-A
Specific Gravity:	0.85
Shell Construction	Butt Welded
Bottom Plate Thickness	0.250”
Sketch Plate Thickness	0.3125”
Joint Efficiency:	0.85 (assumed)
Plate Material Specification:	A36 (assumed)

INSPECTION PROCEDURE

The inspection covered by this report consisted of three components; (1) an external, under tank inspection of the area around the most severe corrosion, (2) a dye penetrant (PT) inspection of the welds in the affected area and (3) a robotic internal inspection with special attention to the area not inspected in 2004.

EXTERNAL, UNDERTANK INSPECTION

The external, under tank inspection was completed by hand-excavating the tank foundation in the area of the worst chime corrosion. The foundation was removed to a distance of approximately 6” under the tank shell.

The external surface of the tank bottom was then cleaned by hand using scrapers, files and wire brushes. The underside of the tank bottom was too rough to perform a complete UT scan, but thickness readings in discrete locations were obtained using manual ultrasonics.

The thickness readings ranged from 0.136" to 0.210" in the nominal 5/16" (0.3125") plate indicating significant corrosion in this area of the tank bottom. The most severe metal loss was found closest to the tank perimeter.

Please note that while conditions were not optimal to collect thickness data, we are confident in the data collected.

All of the thickness readings collected from under the tank can be found in Appendix A.

DYE PENETRANT (PT) INSPECTION

Given the severity of the corrosion seen on the chime and lower tank shell, it was decided to complete a PT inspection of approximately 15' of the external corner weld and a 12" section of the nearest vertical weld on the shell.

The results of the PT inspection were negative with no linear indications seen. At this time, it appears that the metal loss to the external corner weld has not caused any distortion or cracking.

Photos documenting the PT inspection can be found in Appendix B.

NOTE: The dye penetrant (PT) inspection was done as an improved visual inspection technique only. It was not conducted as a code inspection and it is not a required component to an API-653 internal inspection.

ROBOTIC INTERNAL INSPECTION

The main focus of the inspection was an internal, robotic inspection of the tank bottom. Special attention was made to the internal tank perimeter in the area of the external chime corrosion on the west side of the tank.

As with the external inspection, the robotic inspection also found significant external (underside) corrosion on the west perimeter of the tank. The minimum thickness found by the robotic system was 0.159" in the nominal 5/16" (0.3125") plate[4].

Outside of the west perimeter of the tank, additional corrosion was found along the tank perimeter, but the remaining thickness found ranged from 0.228" to 0.312", indicating

[4] The perimeter or "sketch" plates are nominally 5/16" (0.3125") thick; the bottom plates away from the perimeter are nominal 1/4" (0.250") plate.

less severe corrosion than the west perimeter. The average thickness of the sketch plates away from the west perimeter was 0.281".

Other than the perimeter corrosion noted, the remainder of the tank bottom showed no signs of significant metal loss and the thickness readings appeared consistent with the readings from the 2004 robotic inspection.

A summary of the robotic inspection is presented below. All of the thickness data can be found in Appendix A. **(NOTE: The data shown in Appendix A represents the minimum thickness obtained from a 12" or 24" scan contained within each grid location).**

TANK PERIMETER (Sketch Plates)		TANK BOTTOM (Bottom Plates)	
Number of Runs:	243	Number of Runs:	182
Nominal Thickness:	0.312"	Nominal Thickness:	0.250"
Average Thickness:	0.269"	Average Thickness:	0.251"
Minimum Thickness:	0.159"	Minimum Thickness:	0.220"
Standard Deviation:	0.030"	Standard Deviation:	0.010"

EXTREME VALUE ANALYSIS

As part of this evaluation, an Extreme Value Analysis (EVA) was completed on the thickness data collected from the tank's sketch plates.

EVA is a recognized statistical method for determining the statistical minimum from a sample of data collected. EVA is routinely used to determine theoretical minimums from thickness data collected from tanks, piping and other structures.

Based on the data collected from the perimeter of Tank 6, our EVA predicted that the minimum thickness in the sketch plates would equate to 0.135" using a confidence factor of 95.2%.

Please note that the EVA minimum of 0.135" is almost identical to the minimum thickness of 0.136" found during the manual, under tank inspection.

While not definitive, the agreement between the actual minimum and the statistical minimum is a good indication of the accuracy of the overall results from this inspection.

The EVA data plot can be found in Appendix C of this report.

CORROSION RATE AND REMAINING LIFE CALCULATIONS

Based on the data collected from this inspection, we have made the following corrosion rate and remaining life calculations for the tank sketch plates (the bottom plates show no significant corrosion at this time):

Long Term Corrosion Rate	0.312" – 0.136" / 2009 – 1945 = 0.00275"/yr
Short Term Corrosion Rate	0.269" – 0.136" / 2009 –2004 = 0.0266"/yr
Average Corrosion Rate	0.0266" + 0.00275 / 2 = 0.01468"/yr
Remaining Service Life[5]	0.136" – 0.100" / 0.01468"/yr = 2.45 years

Using the average corrosion rate shown above, it can be calculated that Tank 6 has a remaining service life as defined in API-653 of 2.45 years.

CONCLUSION AND RECOMMENDATION

Based on the findings from our inspection, it appears that Tank 6 is not in imminent danger of failure, but the tank has experienced significant corrosion and is reaching the end of its service life.

Given the difficulty in predicting exact corrosion rates and given the age of Tank 6, it is our recommendation that the tank be removed from service within 2 years from this date (removed from service no later than August 2011). The tank could be and inspected and repaired at that time if so desired.

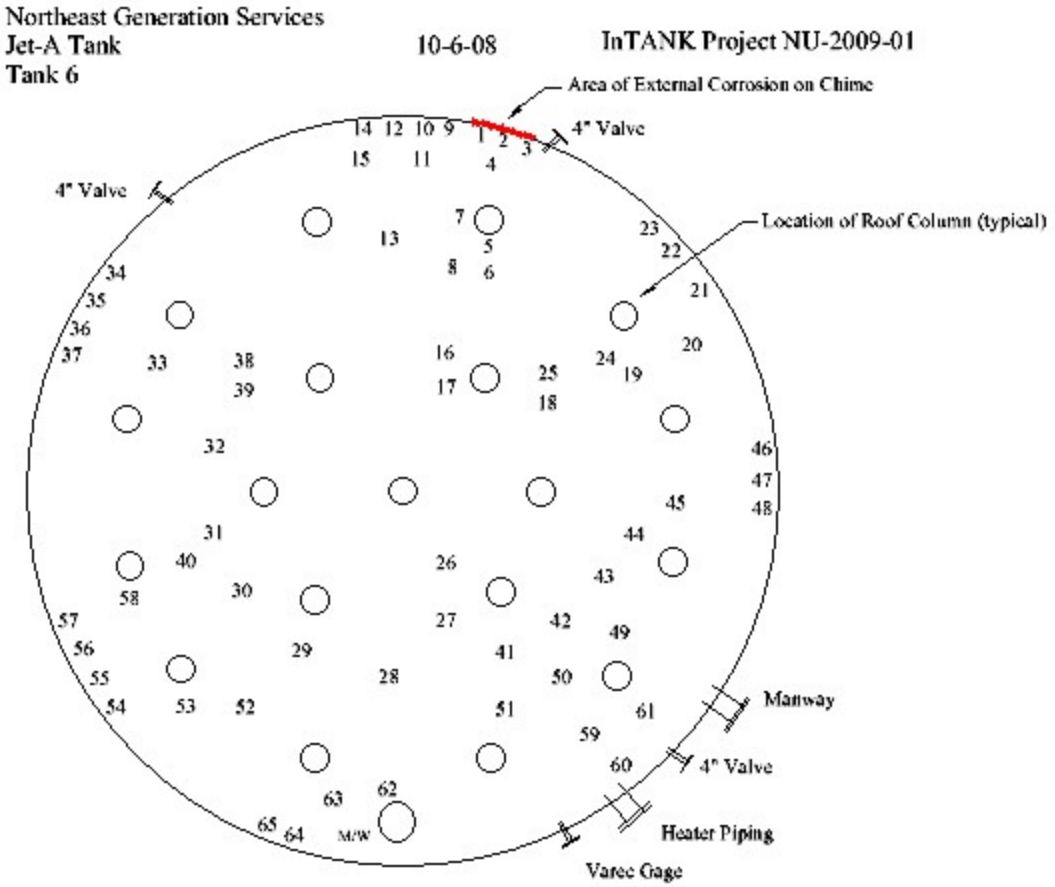
In addition, we make the following discretionary recommendations:

1. The tank should be monitored on a frequent basis for signs of leaking or other distress.
2. The amount of oil stored in the tank should be kept to the minimum needed for normal plant operation until the tank can be removed from service.

[5] As defined in API-653

Appendix A – Field Data

The following drawings show the thickness and other data obtained during the internal inspection.



Location of Bottom Plate Runs
(see next page for UT Data)

Northeast Utilities Tank No. 6							
Nominal 1/4" Bottom Plates							
Grid 4	266	260			Grid 11	248	221
	268	260				258	243
	278	244				252	259
	264	257				251	249
	254						
Grid 5	251	245			Grid 24	238	255
	262	248				244	249
	264					242	
	254					252	
	246						
					Grid 25	260	266
Grid 6	260	254				264	254
	248	224				258	252
	220	239				252	
	262	240					
					Grid 26	243	251
Grid 7	266	259				239	249
	259	244				257	
	254					255	
	263						
	270				Grid 27	258	248
						260	249
Grid 8	260	255				254	
	254	248				244	
	262	260					
	249	238			Grid 28	253	245
						251	251
Grid 9	268	280				248	251
	264	282				247	
	278	287					
	254	263			Grid 29	248	237
	248	258				248	239
						254	250
						239	255

Northeast Utilities Tank No. 6							
Nominal 1/4" Bottom Plates							
Grid 30	249	250			Grid 50	241	250
	259	248				243	249
	255	255				251	246
	254	250				254	243
						255	
Grid 31	234	250					
	238	245			Grid 51	243	255
	252	247				246	253
	252	246				255	253
	254						
	246				Grid 52	249	257
						250	252
Grid 44	245	248				249	250
	245	262					
	244				Grid 53	228	224
	260					234	241
						240	238
Grid 45	244	248				240	236
	256	250				257	
	258	255				255	
	252	256					
	249	250					
Grid 49	254	262					
	251	253					
	254	255					
	253	257					
	260	258					

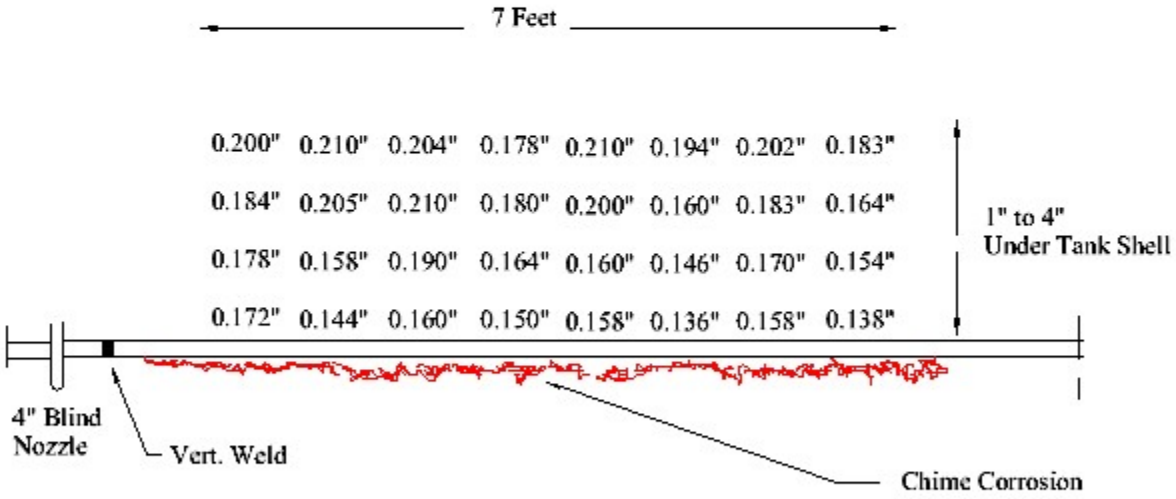
Northeast Utilities Tank No. 6								
Nominal 5/16" Sketch Plates								
Grid 1	229	241	223		Grid 12	262	255	251
	240	250	221			248	258	249
	258	220	218			244	264	241
	216	248	163			238	255	239
	220	260	229			240	250	242
	244	258	232					
	238	252	208		Grid 14	280	269	
	184	179	159			259	287	
						279	301	
Grid 2	226	292	219			289	290	
	248	251	220			287	290	
	248	244	238					
	242	229	240		Grid 21	280	281	303
	245	216	222			310	280	300
	224	227	219			285	293	
	234	244	230			290	301	
Grid 3	266	274	218		Grid 22	312	304	
	280	259	216			300	288	
	264	301	222			300	293	
	245	249	240			289	300	
	220	221	239					
	224	240	240		Grid 23	279	308	
						301	307	
Grid 9	268	280				288		
	264	282				284		
	278	287						
	254	263			Grid 34	288	306	
	248	258				294	279	
						295	301	
Grid 10	257	232	228			304	306	
	255	264	237				293	
	238	268	255					
					Grid 35	N/A		

Northeast Utilities Tank No. 6						
Nominal 5/16" Sketch Plates						
Grid 36	300	303		Grid 54	290	285
	285	284			292	281
	290	281			300	
		278			301	
		281			284	
Grid 37	296	297		Grid 55	298	244
	294	294			300	228
	288	254			260	275
	288	260			254	301
	248	262			240	289
	288				231	231
				Grid 56	300	276
Grid 46	280	294			274	303
	285	290			279	301
	274	285			280	
	272	285				
	281	291		Grid 57	295	306
	295	292			293	298
					298	304
Grid 47	300	288			296	301
	301	288			301	293
	289	300				
	290	301		Grid 64	300	289
	284	293			297	289
					294	294
Grid 48	290	251			296	303
	284	290			301	
	270	300				
	274			Grid 65	301	303
	268				287	304
					286	303
					288	301

Northeast Generation Services
Jet-A Tank
Tank 6

10-6-08

InTANK Project NU-2009-01



External UT on Tank Bottom
in Area of West Chime Corrosion
Area Excivated Under Shell

(NOTE: Plan View -- Location of
Readings is Approximate)

Appendix B
Photographs (External)

Tank 6

Northeast Generation Services
Hartford, CT

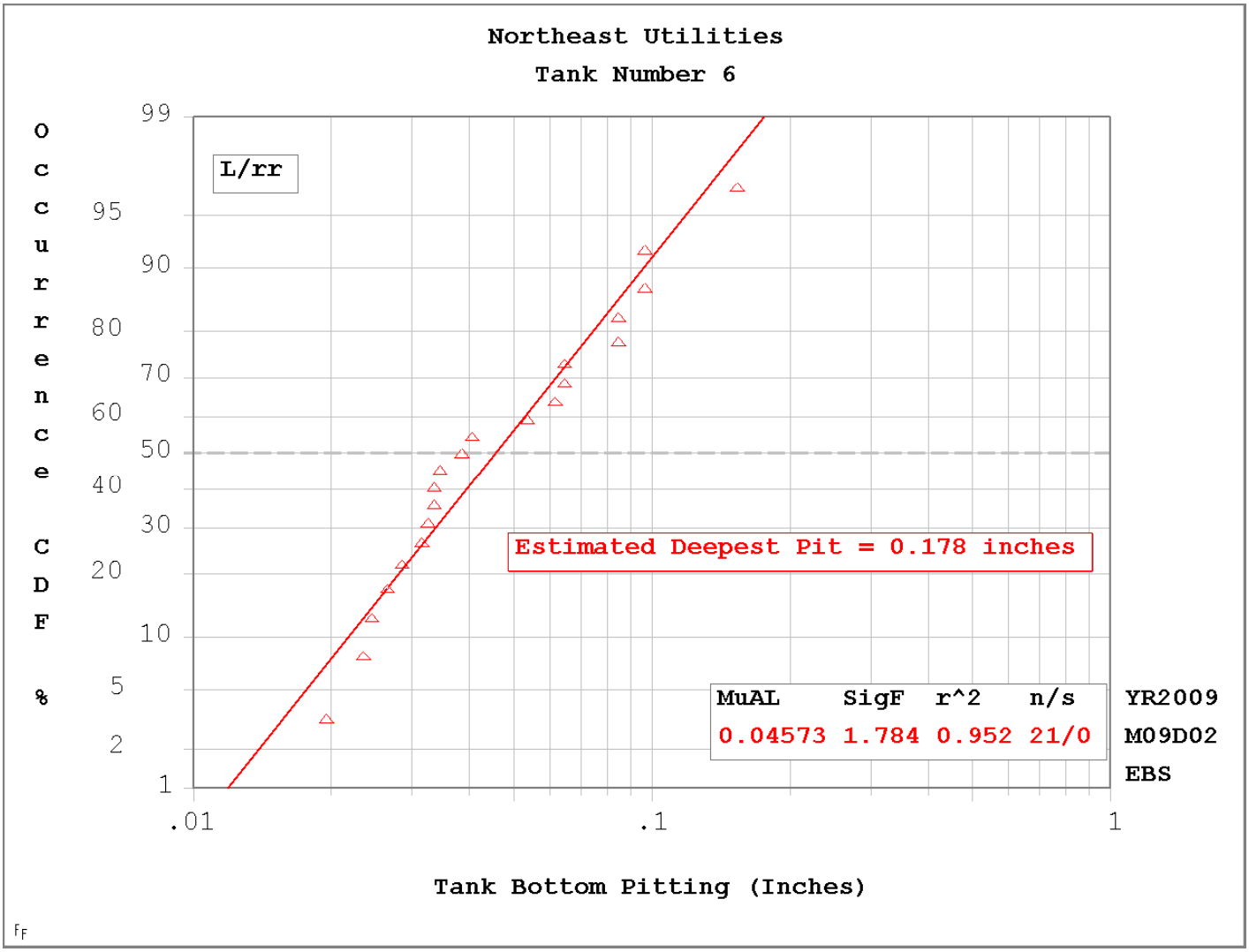
Photo 1: General View of Tank 6

Photo 2: Area of Most Severe Chime Corrosion (west side of tank)

Photo 3: Results of Dye Penetrant Examination (Note absence of linear indications)

Photo 4: Close-up View of Dye Penetrant Inspection

Appendix C
Extreme Value Analysis (EVA) Plot


Northeast Utilities
Tank Number 6
Occurrence CDF %
99
95
90
80
70
60
50
40
30
20
10
5
2
1
L/rr
Estimated Deepest Pit = 0.178 inches
MuAL SigF r^2 n/s
0.04573 1.784 0.952 21/0
YR2009
M09D02
EBS
.01
.1
1
Tank Bottom Pitting (Inches)
FF