AST CLEANING AND FUEL DISPOSAL
MICHAEL ROAD FUEL FARM B-20 TANK

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

August 11, 2009

Navy Contract No. N62470-05-D-6200
Delivery Order No. 0070
CATLIN Project No. 209-038

Prepared by:

CATLIN Engineers and Scientists
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(910) 452-5861
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AST CLEANING AND FUEL DISPOSAL
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MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CATLIN PROJECT NO. 209-038

AUGUST 11, 2009

1.0 BACKGROUND INFORMATION

1.1 PURPOSE OF INVESTIGATION

Marine Corps Base (MCB), Camp Lejeune received an off-specification shipment of B-20 bio-diesel fuel (A-A-59693) to tank number HP961-03A at the Michael Road Fuel Farm (MRFF). Refer to Appendix B for laboratory data.

The purpose of this Aboveground Storage Tank (AST) Cleaning and Fuel Disposal project was to complete the removal and disposal of out of specification B–20 fuel and cleaning one 15,000 gallon AST located at the MRFF aboard MCB, Camp Lejeune, North Carolina. The tank was emptied of approximately 4,000 gallons of B-20 bio-diesel fuel, which had been compromised due to high water content. One of the goals was to dispose of the compromised fuel in a manner that could give the base recycle credit. The tank was then cleaned and visually inspected in order to be put back into service.

1.2 SCOPE OF WORK

The fuel first had to be removed from the tank, the fuel disposed of accordingly, and the tank cleaned in preparation of another shipment of B-20 being received and operations resumed. The subject tank last had an out-of-service inspection performed in October 2004. The next API653 inspection is to be an in-service inspection, which is currently scheduled for the summer of 2009.

2.0 PREVIOUS INVESTIGATIONS, REMEDIATION AND/OR CLOSURE

Information obtained from previous assessment reports conducted by Environmental Technology, Inc., dated October 11, 2004, indicates the vertical tank identified as HP961-03A was cleaned and inspected on October 4, 2004. A document titled: *API Standard 653 Inspection Report Out-of Service Inspection Tank #HP961-03A MCB Camp Lejeune* summarizing the findings of the original testing is on file with the MCB Camp Lejeune. A copy of the inspection report is included in Appendix B.

3.0 SITE DESCRIPTION

3.1 AREA OF INVESTIGATION

The MRFF complex is located just off Michael Road, west of Snead's Ferry Road, east of Ash Street and south of Holcomb Boulevard aboard the MCB, Camp Lejeune in Onslow County, North Carolina. The Fuel Farm and AST location are presented on Figures 1 and 2.

3.2 AST INVENTORY

The AST scheduled for cleaning contained approximately 4,000 gallons of out of specification B-20 bio-diesel fuel. Available information pertaining to the container and contents is summarized below. Refer to Table 1 for additional AST system information.

Tank #	Type of Inspection	Configuration	Size
HP961-03A	Out-of-Service-visual only	Vertical	10.5' Diam x 23.375' Height

3.3 SITE HISTORY AND OPERATION

Refer to Table 2 for AST owner/operator information.

4.0 SITE FIELD INVESTIGATION

Field services commenced on 16 June 2009 and were completed on 17 June 2009. Prior to the beginning of fieldwork the appropriate inter agency departments along with the base fire department were contacted and provided a tentative schedule of activities. In addition a safety meeting was held onsite prior to the commencement of work and lock-out/ tag-out was performed in conjunction with Hawthorne Services Inc., the fuel farm managing service. Other parties present included Environmental and Industrial Resources (EVO), providing cleaning and disposal and Catlin Engineers and Scientists (CATLIN) providing oversite, coordination and documentation. The following tasks were performed to complete the project:

Empting of the AST began with decanting of 350 gallons of nuisance water from the bottom of the tank directly into EVO's vacuum truck. The water was disposed through direct coordination with the MCB Camp Lejeune Environmental Management Division (EMD) at the oil/water separator at Building 977. The remaining contaminated fuel was drained from the AST into the vacuum truck and then transferred to a waiting tanker truck for transportation to the recycling center. A total of 4090 gallons of product was taken to Triangle Bio-Fuels in Wilson, NC for recycling.

Once the AST was emptied the man way covers were removed for inspection/cleaning. After the lower man way cover was removed the remaining 150 gallons of sludge in the bottom of the tank was pumped into the vacuum truck. The hydro blasting cleaning equipment was set up and the area below the floating roof was cleaned using pressurized water and Simple Green biodegradable cleaning solvent. The dosing rate of the cleaning solution was 4 gallons Simple Green mixed with 100 gallons of clean water. This dosage was applied three times then a triple rinse was completed with pressurized clean water. During this potion of the cleaning process, Randy Acosta (Camp Lejeune ROICC) made a site visit.

After the lower portion of the AST was cleaned, the area above the floating roof was cleaned using the hydro blasting technique and dosage rate previously discussed. All cleaning fluids were containerized via vacuuming into the vacuum truck. A total of 1004 gallons of nuisance water (including the 150 gallons of sludge from the previous day) were containerized in the vacuum truck.

Originally EMD had indicated that the cleaning/nuisance water from the tank cleaning process could go into the oil/water separator at Building 977 however, based on the amount of sludge present, EMD would not accept the additional fluids. Therefore, the fluids were transported to a certified offsite disposal facility. Manifests were completed with signatures from MCB EMD for transportation of the product and nuisance/cleaning fluids. In addition EMD requested the vacuum truck obtain a weigh ticket from the base certified scales. Copies of all transportation paperwork were distributed to EMD and Hawthorne Services. Additionally copies of all manifests etc. have been included as Appendix A of this document.

With the cleaning and visual inspection complete, new gaskets were installed on the man way covers and new bolts and nuts were used to re-secure the man way covers. The site was cleaned and once accepted by the fuel farm managing service the lock-out procedure was terminated.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The contaminated product was successfully removed and a large portion was salvaged for recycle. Direct field measurements of fluid quantities indicate the AST contained a total of 5090 gallons total fluids. Breakdown by fluid type was 4090 gallons of biodiesel product, 350 gallons of nuisance water and 150 gallons of particulate sludge. An additional 804 gallons of nuisance water (cleaning solution) and emulsified sludge were generated in the cleaning process. An additional 50 gallons of sludge was generated during the straining of the 4090 gallons at the recycle center. All fluids were properly manifested and disposed at the appropriate certified facilities.

CATLIN recommends the tank remain out of service for the upcoming scheduled maintenance work at the fuel farm. The foam log portion of the floating roof was observed to be worn and may warrant replacement as part of the next scheduled maintenance associated with the fuel farms. CATLIN also recommends that the fuel lines associated with the dispenser of the AST be thoroughly cleaned and purged prior to putting the AST back into service.

6.0 REFERENCES

Environmental Technology, Inc.,*"API Standard 653 Inspection Report Out-of Service Inspection Tank #HP961-03A MCB Camp Lejeune"*, dated October 11, 2004.

TABLES

TABLE 1

SITE HISTORY
AST SYSTEM INFORMATION

AST CLEANING AND FUEL DISPOSAL
MICHAEL ROAD FUEL FARM B-20 TANK
MCB CAMP LEJEUNE, NORTH CAROLINA

AST ID Number	Facility Location	Installation Date	Product (gasoline, diesel, jet fuel, etc.)	Capacity (gallons)	Dimensions	Last Tank Inspection
HP961-03A	Michael Road Fuel Farm	1991	B-20 Bio-diesel	15,200	10.5' Diam. x 23.375' Height	October 2004

TABLE 2

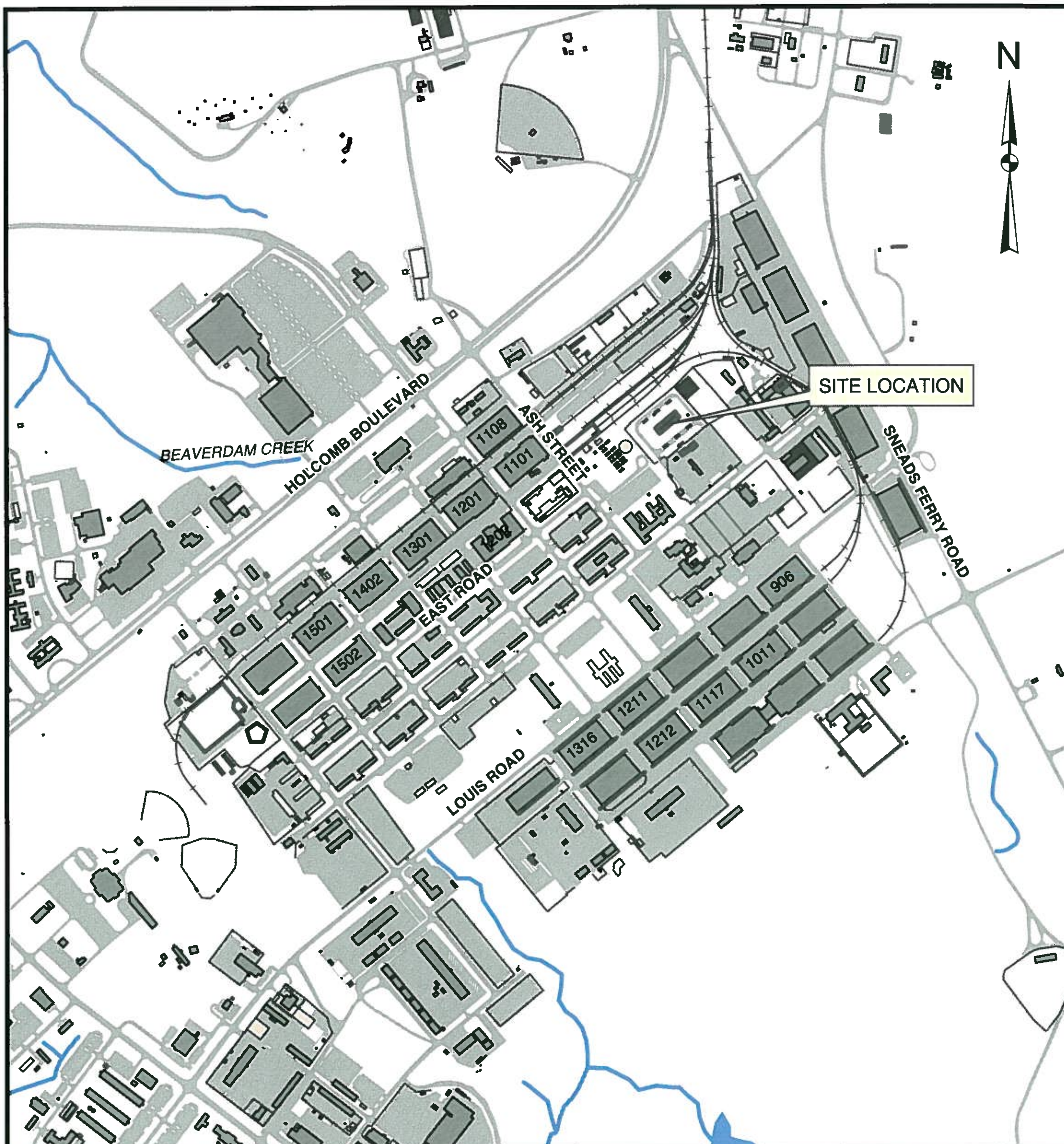
SITE HISTORY
AST OWNER/OPERATOR INFORMATION

AST CLEANING AND FUEL DISPOSAL
MICHAEL ROAD FUEL FARM B-20 TANK
MCB CAMP LEJEUNE, NORTH CAROLINA

Dates of Ownership/Operation	Tank Number	Name of Owner or Operator	Site Use
1991 - currently in use	HP961-03A	MCB Camp Lejeune - Owner Hawthorne Services, Inc.- Operator	Fleet Vehicle Refueling

Contact Address	Telephone Number
Hawthorne Services Inc. BLSD, BLDG 1070 Michael Road Marine Corps Base Camp Lejeune, North Carolina 28542-0004	(910) 451-5186

FIGURES

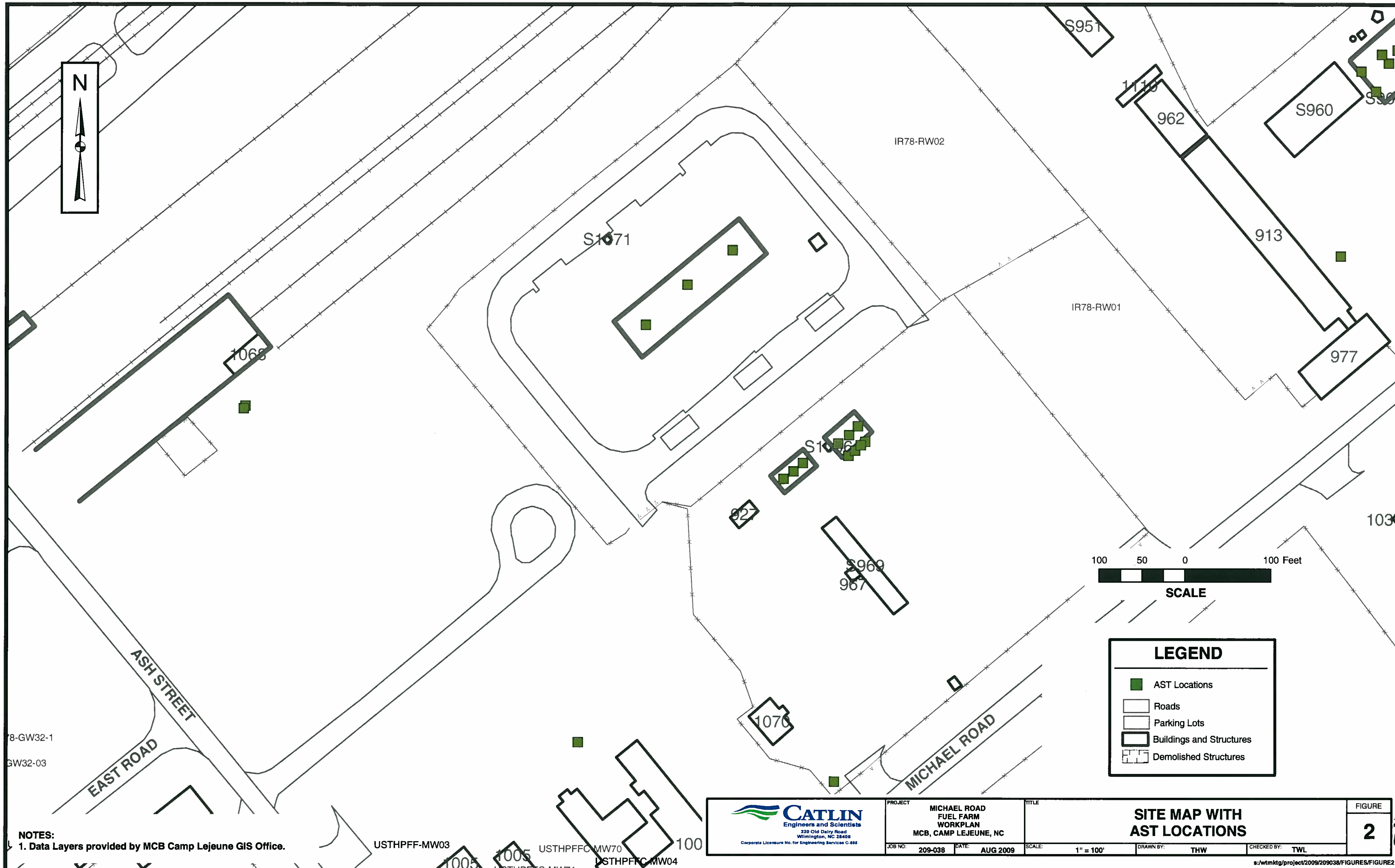


500 250 0 500Feet

SCALE

Data Sources: Data Layers provided by MCB Camp Lejeune GIS Office.

CATLIN Engineers and Scientists WILMINGTON, NC	PROJECT AST CLEANING AND FUEL DISPOSAL MICHAEL ROAD FUEL FARM MCB, CAMP LEJEUNE, NC	TITLE SITE VICINITY MAP			FIGURE 1
	JOB NO: 209-038	DATE: JULY 2009	SCALE: AS SHOWN	DRAWN BY: THW	CHECKED BY: TWL



NOTES:
1. Data Layers provided by MCB Camp Lejeune GIS Office.

CATLIN
Engineers and Scientists
220 Old Dairy Road
Wilmington, NC 28405
Corporate Licensure No. for Engineering Services C-585

PROJECT	TITLE	FIGURE
MICHAEL ROAD FUEL FARM WORKPLAN MCB, CAMP LEJEUNE, NC	SITE MAP WITH AST LOCATIONS	2

JOB NO:	DATE:	SCALE:	DRAWN BY:	CHECKED BY:
209-038	AUG 2009	1" = 100'	THW	TWL

s:/wtmktg/project/2009/209038/FIGURES/FIGURE2

APPENDICES

APPENDIX A

WASTE DISPOSAL DOCUMENTATION

THIS FORM IS SUBJECT TO THE PRIVACY ACT (NAVMC 11000)

WEIGHT CERTIFICATE

TRAFFIC MANAGEMENT OFFIC
MARINE CORPS BASE
CAMP LEJEUNE

CUSTOMER	EVO TRkg	RANK	
SSN		AGENCY	
CARRIER/VEHICLE TYPE			
VEHICLE #	402		
VEHICLE ID #			
DESTINATION/BLDG. #			
GBL/DOC # P.O. #			
COMMODITY	Waste Disposal		
SHIPPER			
WEIGHMASTER	[illegible signature]		

MCBCL 4600/2 (REV 2-95)

06-17-09 02:36 PM

G 47000 lb
T 00 lb
N 47000 lb

(F)

EVO# 060123

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.	Manifest Document No.	2. Page 1 of

3. Generator's Name and Mailing Address MCI

4. Generator's Phone ( )

5. Transporter 1 Company Name	6. US EPA ID Number	A. Transporter's Phone
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone
9. Designated Facility Name and Site Address	10. US EPA ID Number	C. Facility's Phone

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a.	1		89	
b. Biodiesel Sludge	1	TT	200	Gal
c.				
d.				

D. Additional Descriptions for Materials Listed Above

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month	Day	Year
		06		09

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
Jack Graham		06	12	09

GENERATOR / TRANSPORTER / FACILITY

GENERATOR'S COPY

Straight Bill of Lading — Short Form

Original — Not Negotiable

Shippers No. 060923

Evo Corporations — Carrier's No.

1703 Vargrave St Winston-Salem NC (Name of Carrier) 27107

Received, subject to the classifications and tariffs in affect on the date of the issue of this Bill of Lading

19 From

the property described below, in apparent good order, except noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being being understood throughout this contract as meaning any customer or corporation in possession of the property under contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any said property over all or any portion of said route to said destination and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois freight classification in affect on the date hereof, if this is a rail or a rail-water shipment or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed by the shipper and accepted for himself and his assigns.

Consigned to Triangle Bio Fuels Industry, Inc.

(Mail or street address of consignee — for purpose of notification only.)

Destination 1724 Baldree Rd S **State** Wilson, NC **Country** USA **Delivery address ★**

Route See attached

(★ To be filled in only when shipper desires and governing tariffs provide for delivery thereat.)

Delivery Carrier **Car or Vehicle Initials** **No.**

No. Packages	Kind of Package, Description of Articles, Special Marks, and Exceptions	* Weight (Subject to Correction)	Class or Rate	Check Column
1	B20 Bio Diesel, Combustible Liquid,	29,983 lbs		
	3, UN1993, PG II			
		4040 gallons		

C.O.D. charge to be paid by: Shipper ☐ Consignee ☐

Subject to section 7 of conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

[signature]

(Signature of consignor)

If charges are not to be prepaid, write or stamp here, "to be prepaid."

Received $ ____________ to apply in prepayment of the charges on the property hereon.

Agent or Cashier

Per ____________ (The signature here acknowledges only the amount prepaid.)

Charges Advanced:

$ ____________

Shippers imprint in lieu of stamp; not a part of Bill of Lading approved by the Interstate Commerce Commission.

• If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is carrier's or shippers weight

NOTE — Where the rate is dependent on the value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

per

This is to certify that the above named articles are properly classified, described, packaged, marked and labeled, are in the proper condition for transportation, according to the applicable regulations of the Department of Transportation.

The fibre boxes used for this shipment conform to the specifications set forth in the box maker's certificate thereon, and all other requirements of the Consolidated Freight Classification.

Evo Corporation **Shipper, Per** [signature] **Agent, Per**

Permanent post-office address of shipper, 1703 Vargrave Street, Winston-Salem, NC, 27107

FORM #49

Triangle Biofuels Industries, Inc.

Wilson, NC 27894-1611
Phone (252) 360-4274 Fax (252) 360-4254
http://www.trianglebiofuels.com

Certificate of Disposal

DATE 6/21/2009
Certificate #: 20090621A

Disposal For:
CATLIN Engineers and Scientists
220 Old Dairy Road
Wilmington, N.C. 28405
Ph. (910) 452-5861

Comments or Special Instructions:
Fuel contaminated with water and algae. Fuel decanted and filtered upon intake at plant.
Mixed fuel with B100 biodiesel and burned.

STAFF	REF #	P.O. NUMBER	SHIP DATE	SHIP VIA	DISP DATE	CERT #
ZH		N/A	6/17/09	Customer	6/19/09	090621-23A

QTY	Gals/Lbs	DESCRIPTION	DISPOSITION	PRICE
4040	Gals	Biodiesel B20 - Off-spec	Filtered, spun, recycled and burned in boiler.	N/A
			SUBTOTAL	
			TAX RATE	
			SALES TAX	
			OTHER	-
			TOTAL	

THANK YOU FOR YOUR BUSINESS!

ENVIRONMENTAL AND INDUSTRIAL RESOURCES

1703 Vargrave Street
Winston-Salem, NC 27107
ph 336-725-5844
fax 336-725-6244

CERTIFICATE OF DISPOSAL

Evo Corporation does hereby certify that 804 gallons of non-hazardous contaminated water received on 06/17/2009 from:

Generator: MCB Camp Lejeune

Originating at: Michael Road Fuel Farm
Camp Lejeune, NC

EC Waste ID #: 060923

has been disposed of by Evo Corporation in a manner approved by the North Carolina Department of Environment and Natural Resources.

Signature

Thomas W. Hammett
CEO
Evo Corporation

ENVIRONMENTAL AND INDUSTRIAL RESOURCES

1703 Vargrave Street
Winston-Salem, NC 27107
ph 336-725-5844
fax 336-725-6244

CERTIFICATE OF DISPOSAL

Evo Corporation. does hereby certify that 200 gallons of non-hazardous contaminated sludge received on 06/17/2009 from:

Generator: MCB Camp Lejeune

Originating at: Michael Road Fuel Farm
Camp Lejeune, NC

EC Waste ID #: 060923

has been disposed of by Evo Corporation. in a manner approved by the North Carolina Department of Environment and Natural Resources.

Signature

Thomas W. Hammett
CEO
Evo Corporation

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.	Manifest Document No.	2. Page 1 of	01458

3. Generator's Name and Mailing Address ACB
I & E, EMD (RCRS)
PSC Box 20004
Camp Lejeune, NC 28542-0004

4. Generator's Phone ( )

5. Transporter 1 Company Name: Evo Corporation	6. US EPA ID Number	A. Transporter's Phone: 336-725-5844
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone
9. Designated Facility Name and Site Address: HOH 1700 Vargrave St Winston-Salem NC	10. US EPA ID Number	C. Facility's Phone

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
Oily Hydroblasting Water				
a.	1	Bulk	1064	gal
b.				
c.				
d.				

D. Additional Descriptions for Materials Listed Above

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month	Day	Year
Eugene [illegible]	[signature]	6	17	09

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Harley Addair	[signature]	6	17	09

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year

GENERATOR
TRANSPORTER
FACILITY

APPENDIX B

PREVIOUS INSPECTION REPORT and LABORATORY DATA

API STANDARD 653 INSPECTION REPORT
OUT-OF-SERVICE INSPECTION
TANK #HP961-03A
MCB CAMP LEJEUNE
CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

Naval Facilities Engineering Command, Atlantic Division
1510 Gilbert Street
Norfolk, Virginia 23511-2699
Contract No. N62470-03-D-4001
Delivery Order No. 0009

Prepared by:

Environmental Technology, Incorporated
441 South Independence Boulevard, Suite 4
Virginia Beach, Virginia 23452
(757) 499-2175

October 11, 2004

API Standard 653 recommends this document containing valuable historical information be retained for the life of the tank.

Signatures:

Inspector: Eric B. Ricks
Certified API-653 Inspector, #1667

Engineer: Vincent D. Elko, PE

11/12/04

NORTH CAROLINA PROFESSIONAL SEAL 029695 ENGINEER VINCENT D. ELKO

EXECUTIVE SUMMARY

An API Standard 653 Out-of-Service Inspection of Tank #HP961-03A was completed on October 4, 2004, to collect data and establish a data base for present and future inspections and evaluations. Nozzle and reinforcement evaluations of the accessible shell nozzles show that the nozzles are adequately reinforced and have a minimum remaining life of 25 years. A shell service life evaluation performed on all shell courses shows that the shell has 230 years of remaining life under current conditions, thereby, the next external visual inspection should be accomplished by a Certified Inspector prior to October 2009, and the next external ultrasonic thickness measurement inspection should be accomplished by a Certified Inspector prior to October 2019 in accordance with API Standard 653. A bottom service life evaluation shows the in-service interval of operation (years to next internal inspection) to be twenty years under current conditions, thereby, the next internal inspection should be accomplished by a Certified Inspector prior to October 2024 in accordance with API Standard 653. Inspection Results are listed in 4.0. Recommendations for Compliance with API Standard 653 are made in 5.0, and Other Recommendations are made in 6.0.

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LIST OF ACRONYMS AND ABBREVIATIONS

API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
CFR	Code of Federal Regulations
CP	Cathodic Protection
ETI	Environmental Technology, Incorporated
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
RP	Recommended Practice
RT	Radiography Testing
UT	Ultrasonic Testing
VT	Visual Testing

1.0 INTRODUCTION

1.1 Purpose:

1.1.1 This report provides an engineering evaluation of Tank #HP961-03A located at the MCB Camp Lejeune in Jacksonville, NC. The report summarizes the results of an API Standard 653 Out-of-Service Inspection conducted by *Environmental Technology, Inc.,* Project Number 100142. This inspection was completed on October 4, 2004. Our policy is: "Provide to the storage tank owner and/or manager the most precise and complete inspection and report possible."

2.0 REFERENCES

2.1 American Petroleum Institute:

2.1.1 API Recommended Practice 574, Inspection Practices for Piping System Components.

2.1.2 API Recommended Practice 575, Inspection of Atmospheric and Low-Pressure Storage Tanks.

2.1.3 API Standard 650, Welded Steel Tanks for Oil Storage.

2.1.4 API Recommended Practice 651, Cathodic Protection of Aboveground Petroleum Storage Tanks.

2.1.5 API Recommended Practice 652, Lining of Aboveground Petroleum Storage Tank Bottoms.

2.1.6 API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction.

2.2 Underwriters Laboratories Standards:

2.2.1 UL Standard 142, Steel Aboveground Tanks for Flammable and Combustible Liquids.

2.3 American Society of Mechanical Engineers Codes:

2.3.1 ASME Boiler and Pressure Vessel Code; Section V, Non-Destructive Examination.

2.3.2 ASME Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications.

2.3.3 ASME Boiler and Pressure Vessel Code; Section VIII, Division 1, Rules for Construction of Pressure Vessels.

2.4 Code of Federal Regulations:

2.4.1 29 CFR 1910, Permit-Required Confined Spaces for General Industry.

2.4.2 40 CFR 112, Oil Pollution Prevention.

2.5 National Association of Corrosion Engineers:

2.5.1 NACE Recommended Practice, RP0184-91, Repair of Lining Systems.

2.5.2 NACE Recommended Practice, RP0193-93, External Cathodic Protection of On-Grade Metallic Storage Tank Bottoms.

2.5.3 NACE Recommended Practice, RP0288-94, Inspection of Linings on Steel and Concrete.

2.6 National Fire Protection Association:

2.6.1 NFPA-30, Flammable and Combustible Liquids Code.

3.0 TANK DESCRIPTION

3.1 Tank Description:

Owner/Operator:	MCB Camp Lejeune		
Location:	Jacksonville, NC		
Tank Number:	HP961-03A		
Service:	Diesel		
Specific Gravity:	0.84		
Diameter:	10.5 feet		
Shell Height:	23.375 feet		
Capacity:	15,200 gallons		
Configuration:	Vertical		
Foundation:	Concrete Pad		
Construction:	Bottom:	Butt-Welded	
	Shell:	Course #1:	Butt-Welded
		Course #2:	Butt-Welded
		Course #3:	Butt-Welded
		Course #4:	Butt-Welded
		Course #5:	Butt-Welded
	Fixed Roof:	Butt-Welded	
Material:	Bottom:	Carbon Steel, Unknown Grade	
	Shell:	Course #1:	Unknown
		Course #2:	Unknown
		Course #3:	Unknown
		Course #4:	Unknown
		Course #5:	Unknown
	Fixed Roof:	Carbon Steel, Unknown Grade	
Built:	1991		
Age:	13 years		
Operating Limits:	Minimum Metal Temperature:		30°F
	Maximum Metal Temperature:		Ambient
	Minimum Pressure:		Atmospheric (no vacuum)
	Maximum Pressure:		Product
Seismic Zone:	1		
Construction Code:	UL-142		
Inspection Type:	Out-of-Service Inspection		
Inspection Date:	October 4, 2004		

Last External Visual Inspection Year: Unknown
Last External Ultrasonic Thickness Inspection Year: 1991
Last Out-of-Service Inspection Year: Unknown

4.0 INSPECTION RESULTS

4.1 Containment: The secondary containment area is concrete, and does not have a liner. The secondary containment appears to be properly graded to drain water away from the tank bottom in accordance with NFPA 30-2.3.4.3(a). The secondary containment area has a dike drain and is in satisfactory condition. The secondary containment area volume appears to be sufficient to contain the stored product and impervious to the stored product. The secondary containment is in satisfactory condition.

4.2 Foundation: The foundation consists of a concrete pad. A bottom-to-foundation seal is not evident. The foundation in satisfactory condition.

4.3 Cathodic Protection: The tank does not have a cathodic protection system installed.

4.4 Bottom: The tank has a butt-welded flat bottom. The nominal thickness of the bottom is 0.25 inches. The bottom was scanned (approximately 95%) for underside corrosion using Magnetic Flux Leakage (MFL) technology and revealed no significant underside corrosion. Two electronic coupons (100% ultrasonic thickness scan over a one foot square area) were examined on the bottom to determine the presence of underside corrosion. The electronic coupon thicknesses ranged from a minimum of 0.241 inches to a maximum of 0.254 inches (see Bottom Electronic Coupon Measurement table in Appendix C). The bottom was examined visually with the aid of a light held parallel to the bottom plates, which illuminates pitting and other discrepancies. Random thickness measurements of the bottom plates range from a minimum of 0.248 inches to a maximum of 0.256 inches, excluding the underside corrosion indications located by the MFL scan. Random thickness measurements are listed in the Bottom Plate Thickness Measurements table in Appendix C. A bottom service life evaluation shows that the in-service interval of operation (years to next internal inspection) is twenty years under current conditions, thereby, the next internal inspection should be accomplished by a Certified Inspector prior to October 2024 in accordance with API Standard 653. The bottom service life evaluation is shown in Appendix A. The bottom butt welds were tested with a vacuum box and are in satisfactory condition. A visual examination of the welds shows them to be in satisfactory condition.

4.5 Shell: The tank consists of five (5) butt-welded courses. The exterior of the shell has a thin coating system. The exterior coating of the shell is in satisfactory condition. The shell was evaluated for remaining metal thickness using ultrasonic technology. Thickness measurements are listed in the Shell Plate Thickness Measurements table in Appendix C. A shell service life evaluation performed on all shell courses shows the shell as having 230 years of remaining life under current conditions, thereby, the next external visual inspection should be accomplished by a Certified Inspector prior to October 2009, and the next external ultrasonic thickness measurement inspection should be accomplished by a Certified Inspector prior to October 2019 in accordance with API Standard 653. The shell service life evaluation is shown in the Shell Service Life Evaluation table in Appendix A. Roundness, plumbness, peaking, and banding of the shell are within the allowable tolerances of API Standard 653. The shell is in satisfactory condition.

4.6 Shell Appurtenances: The nozzles were evaluated in accordance with API Standards 650 and 653. The accessible shell nozzles were evaluated for remaining metal thickness using ultrasonic technology. Thickness measurements are listed in the Shell Nozzle Measurements table in Appendix C. None of the nozzles with the exception of the Manway have full penetration welds on the internal side of the shell. Nozzle "A" (4" Plug) has product residue seeping through the threads, nozzle "C" (4" product) has product residue seeping at the valve handle. A shell nozzle evaluation was performed on all accessible nozzles. Ultrasonic thickness measurements on the nozzles reveal no significant loss of metal from corrosion and erosion. All nozzles that were accessible to ultrasonic examination have a minimum remaining life of 25 years. All nozzles are adequately reinforced. The shell nozzle evaluation is shown in the Shell Nozzle and Reinforcement Evaluation table in Appendix A. The product level is monitored by by an electronic level indicator. The ATG was not tested for accuracy against actual soundings since no product was in the tank. The ATG system is in satisfactory condition.

4.7 Accessways: The fixed roof is accessible via a ladder The vertical ladder is enclosed in a cage. The fixed roof accessway is welded directly to the shell as opposed to reinforcement pads as required by API Standard 653. The accessway is not anchored to the containment floor. The accessway is in satisfactory condition.

4.8 Floating Roof: The floating roof is an internal sandwich-panel floating roof with a primary foam log seal. The primary seal shows some wear on the outer skin. The maximum seal-to-shell gap measured 4 inches. The annular space between the floating roof and the shell measured between 3 and 4 inches. The floating roof is in satisfactory condition.

4.9 Fixed Roof: The fixed roof is a supported cone roof. The roof is supported by a 3" pipe column also used as a gauge well. The column is intermittantly welded to a reinforcement pad which is lap welded to the floor. The coating system is in satisfactory condition. The nominal thickness of the fixed roof is 0.1875 inches. The fixed roof was evaluated for remaining metal thickness using ultrasonic technology. The fixed roof thickness ranges from a minimum of 0.169 inches to a maximum of 0.173 inches. Thickness measurements are listed in the Fixed Roof Plate Thickness Measurements table in Appendix C. The fixed roof is in satisfactory condition.

5.0 RECOMMENDATIONS FOR COMPLIANCE WITH API STANDARD 653

5.1 Containment: None.

5.2 Foundation: None.

5.3 Cathodic Protection: None.

5.4 Bottom: None.

5.5 Shell: None.

5.6 Shell Appurtenances: Remove the male plug from nozzle "A", clean and retape all threads before reinstalling plug to prevent any further seepage. Repair/replace the valve for nozzle "E" to prevent any further product seepage through valve handle.

5.7 Accessways: None.

5.8 Floating Roof: None.

5.9 Fixed Roof: None.

6.0 OTHER RECOMMENDATIONS

6.1 Containment: None.

6.2 Foundation: Install sealant between the bottom and the concrete foundation.

6.3 Cathodic Protection: None.

6.4 Bottom: None.

6.5 Shell: None.

6.6 Shell Appurtenances: None.

6.7 Accessways: None.

6.8 Floating Roof: None.

6.9 Fixed Roof: None.

7.0 SERVICEABILITY

7.1 Upon completion of the repairs to Tank #HP961-03A described in 5.0, the tank will be in compliance with the requirements of API Standard 653, and the following schedule may be implemented:

7.1.1 The next external visual inspection should be accomplished by a Certified Inspector prior to October 2009 in accordance with API Standard 653.

7.1.2 The next external ultrasonic thickness measurement inspection should be accomplished by a Certified Inspector prior to October 2019 in accordance with API Standard 653.

7.1.3 The next internal inspection should be accomplished by a Certified Inspector prior to October 2024 in accordance with API Standard 653.

Appendix A

Engineering Calculations

1. Bottom Service Life Evaluation
2. Shell Service Life Evaluation
3. Shell Nozzle and Reinforcement Evaluation

Bottom Service Life Evaluation

$$MRT_{bc} = RT_{bc} - O_{rbc}(StP_r + UP_r)$$

$$MRT_{ip} = RT_{ip} - O_{rip}(StP_r + UP_r)$$

$$O_{rbc} = \frac{RT_{bc} - MRT_{bc}}{(StP_r + UP_r)}$$

$$O_{rip} = \frac{RT_{ip} - MRT_{ip}}{(StP_r + UP_r)}$$

Where:

MRT_{bc} or MRT_{ip} = Minimum remaining thickness at the end of the in-service period of operation, in inches.

O_r or O_{rbc} or O_{rip} = In-service interval of operation (years to next internal inspection), in years; however, O_r shall not exceed 20 years.

RT_{bc} = Minimum remaining thickness from bottom side corrosion after repairs, in inches.

RT_{ip} = Minimum remaining thickness from internal corrosion after repairs, in inches.

StP_r = Maximum rate of corrosion not repaired on the top side, in inches per year. $StP_r = 0$ for coated areas of the bottom. The expected service life of the coating must equal or exceed O_{rip} to use $StP_r = 0$.

UP_r = Maximum rate of corrosion on the bottom, in inches per year. To calculate the corrosion rate, use the minimum remaining thicknesses after repairs. Assume a linear rate based on the age of the tanks. $UP_r = 0$ for areas that have effective cathodic protection.

Note: For areas of a bottom that have been scanned by the magnetic flux leakage (or exclusion) process, and do not have effective cathodic protection, the thickness used for calculating UP_r must be the lesser of the MFL threshold or the minimum thickness of corrosion areas that are not repaired. The MFL threshold is defined as the minimum remaining thickness to be detected in the areas inspected. The MFL unit used for scanning the bottom does not have a threshold set point. This unit visually displays all anomalies. The confidence level of this unit diminishes greatly for underside pitting/corrosion that is less than 0.04 inches in depth, based on company experience.

Areas of bottom side corrosion that are repaired should be evaluated with the corrosion rate for the repaired area unless the cause of corrosion has been removed. The evaluation is done by using the corrosion rate of the repaired area for UP_r, and adding the patch plate (if used) thickness to the term "minimum of RT_{bc} or RT_{ip}".

NOTE: The engineering data used to calculate the in-service interval of operation (O_r) assumes the tank remains in the same service and all corrosion rates remain constant.

Bottom Service Life Evaluation

Present Condition: The tank bottom does not have a lining system. The tank bottom does not have a cathodic protection system. The tank bottom does not have leak detection or secondary containment.

MRT_{bc} or $MRT_{ip} = 0.1\ inches$
$RT_{ip} = 0.25\ inches$
$RT_{bc} = 0.21\ inches$ *
$StP_r = 0\ inches/year$
$UP_r = 0.0031\ inches/year$

* The MFL unit used for scanning the bottom does not have a threshold set point. This unit visually displays all anomalies. The confidence level of this unit diminishes greatly for underside pitting/corrosion that is less than 0.04 inches in depth, based on company experience. No significant underside corrosion was detected. Therefore, RT_{bc} is established at 0.21 inches (original thickness of 0.25 inches minus the 0.04 inches).

$$O_{rbc} = \frac{RT_{bc} - MRT_{bc}}{(StP_r + UP_r)} = \frac{0.21 - 0.1}{(0 + 0.0031)} = 35 \text{ years}$$

$$O_{rip} = \frac{RT_{ip} - MRT_{ip}}{(StP_r + UP_r)} = \frac{0.25 - 0.1}{(0 + 0.0031)} = 48 \text{ years}$$

Therefore, the in-service interval of operation (years to next internal inspection) is:

$$O_r = 20 \text{ years}$$

Shell Service Life Evaluation

The maximum inspection intervals are determined by the most restrictive shell course in regard to the remaining life and the corrosion rate calculations for each shell course using the following formulas:

$$t_{min} = \frac{2.6(H-1)DG}{SE}$$

$$L_r = \frac{t_{act} - t_{min}}{C_r} \qquad C_r = \frac{t_{prev} - t_{act}}{\Delta Y} \qquad I_{ut} = \frac{t_{act} - t_{min}}{2C_r} \qquad I_v = \frac{t_{act} - t_{min}}{4C_r}$$

Where:

t_{min} = The minimum acceptable shell thickness for each course, in inches; however, t_{min} shall not be less than 0.1 inch for any tank course.
t_{norm} = The nominal shell thickness, in inches.
t_{act} = The current measured shell thickness, excluding pits and corrosion, in inches.
t_{prev} = The previous measured shell thickness, excluding pits and corrosion or t_{norm}, in inches.
D = The nominal diameter of the tank, in feet.
H = The height from the bottom of each shell course to the maximum liquid level, in feet.
H_c = The calculated safe fill height, in feet, for the current product.
G = The highest specific gravity of the contents.
Y = Specified minimum yield strength of the plate; use 30,000 pounds per square inch if not known (N/A for riveted tanks).
T = The smaller of the specified minimum tensile strength of the plate or 80,000 pounds per square inch; use 55,000 psi if not known (N/A for riveted tanks).
S = The maximum allowable stress, in pounds per square inch. For welded tanks, use the smaller of 0.80Y or 0.429T for the bottom and the second course or the smaller of 0.88Y or 0.472T for all other courses. For riveted tanks, use S=21,000 psi. For elevated temperatures above 200^{O}F, the maximum allowable stress shall be the smaller of 2/3 the minimum yield strength multiplied by the M-factor (M) of API-650 Appendix M or the product design stress value listed in Table 3-2 of API-650.
E = The original joint efficiency for the tank. Use Table 2-1 from API Standard 653 if original E is unknown; 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 or twice the plate thickness. For riveted tanks, use E=1.0 for shell plates when greater than 6 inches from rivets; use the value of E from API-653 Table 2-1 when within 6 inches of rivets.
L_r = The remaining life of the shell, in years.
C_r = The shell corrosion rate, in inches per year.
I_{ut} = The inspection interval for the next ultrasonic inspection, in years (not to exceed 15 years).
I_v = The inspection interval for the next visual external inspection, in years (not to exceed 5 years).
ΔY = The years between the previous measured shell thickness (t_{prev}) and the current measured shell thickness (t_{act}), in years.

Shell Service Life Evaluation

Present Condition:

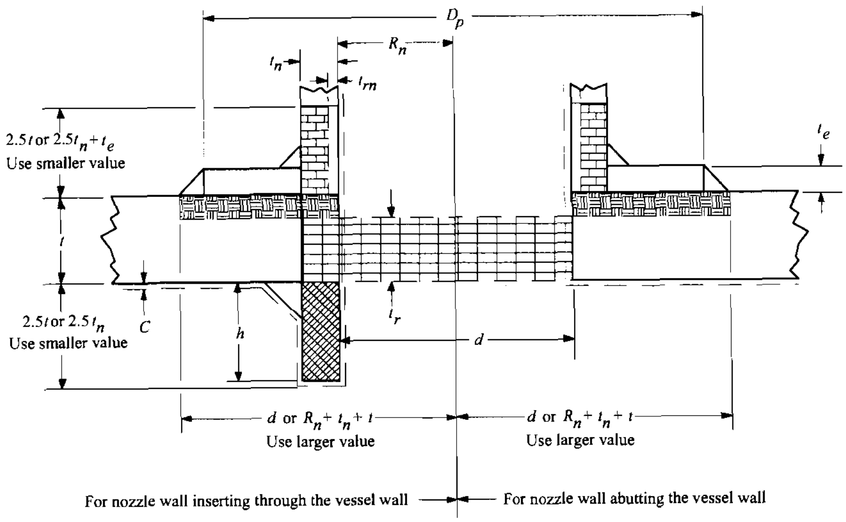
Plate Material: Carbon Steel, Unknown Grade

D = 10.5 *feet*
H = 23.375 *feet*
G = 0.84
ΔY = 13 *years*

Course No.	Course Height (feet)	Maximum Allowable Stress (psi) (S)	Joint Efficiency (E)	Previous Measured Thickness (inches) (t_{prev})	Current Measured Thickness (inches) (t_{act})	Minimum Acceptable Thickness (inches) (t_{min})	Corrosion Rate (in./yr) (C_r)	Remaining Life (years) (L_r)	Next Visual Inspection (years) (I_v)	Next Ultrasonic Thickness Inspection (years) (I_{ut})
1	5.29	23,595	1.00	0.25	0.242	0.1	0.000615	230	5	15
2	5.29	23,595	1.00	0.25	0.243	0.1	0.000538	265	5	15
3	5.25	25,960	1.00	0.25	0.243	0.1	0.000538	265	5	15
4	5.29	25,960	1.00	0.25	0.242	0.1	0.000615	230	5	15
5	2.25	25,960	1.00	0.25	0.243	0.1	0.000538	265	5	15

The current measured thickness is based on the lowest ultrasonic thickness measurement for that course. The remaining life of the shell is 230 years under present conditions. The current maximum operating level of 23.375 feet is satisfactory. The next external visual inspection should be accomplished by a Certified Inspector prior to October 2009 in accordance with API Standard 653. The next external ultrasonic thickness measurement inspection should be accomplished by a Certified Inspector prior to October 2019 in accordance with API Standard 653.

Shell Nozzle and Reinforcement Evaluation



Without Reinforcing Element

A	$= d t_r F + 2 t_n t_r F(1-f_{r1})$	Area required
A_1	$= d(E_1 t - F t_r) - 2t_n(E_1 t - F t_r)(1-f_{r1})$ $= 2(t+t_n)(E_1 t - F t_r) - 2t_n(E_1 t - F t_r)(1-f_{r1})$	Area available in shell; use larger value
A_2	$= 5(t_n - t_{rn}) f_{r2} t$ $= 5(t_n - t_{rn}) f_{r2} t_n$	Area available in nozzle projecting outward; use smaller value
A_3	$= 5\, t\, t_i f_{r2}$ $= 5\, t_i\, t_i f_{r2}$ $= 2\, h\, t_i f_{r2}$	Area available in inward nozzle; use the smallest value
A_{41}	= outward nozzle weld = $(\text{leg})^2 f_{r2}$	Area available in outward weld
A_{43}	= inward nozzle weld = $(\text{leg})^2 f_{r2}$	Area available in inward weld

If $A_1 + A_2 + A_3 + A_{41} + A_{42} \geq A$ — Opening is adequately reinforced

If $A_1 + A_2 + A_3 + A_{41} + A_{42} < A$ — Opening is NOT adequately reinforced; reinforcement required

With Reinforcing Element

A	= Same as A, above	Area required
A_1	= Same as A_1, above	Area available in shell
A_2	$= 5(t_n - t_{rn}) f_{r2} t$ $= 5(t_n - t_{rn}) f_{r2} t (2.5 t_n + t_e) f_{r2}$	Area available in nozzle projecting outward; use smaller value
A_3	= Same as A_3, above	Area available in inward nozzle
A_{41}	= outward nozzle weld = $(\text{leg})^2 f_{r3}$	Area available in outward welds
A_{42}	= outer element weld = $(\text{leg})^2 f_{r4}$	Area available in outer welds
A_{43}	= inward nozzle weld = $(\text{leg})^2 f_{r2}$	Area available in inward welds
A_5	$= (D_p - d - 2t_n) t_e f_{r4}$	Area available in element

If $A_1 + A_2 + A_3 + A_{41} + A_{42} + A_{43} + A_5 \geq A$ — Opening is adequately reinforced

Shell Nozzle and Reinforcement Evaluation

Minimum Required Thickness for Nozzles shall be determine from ASME Section VIII, Division 1, Part UG-27 as follows:

$$t_{rn} = \frac{PR_n}{SE - 0.6P}$$

The remaining life of a tank or any of its components shall be determined using the formulas from API RP 575 as follows:

$$C_r = \frac{t_{prev} - t_{act}}{\Delta Y} \qquad L_r = \frac{t_{act} - t_{rn}}{C_r}$$

Where:

- D_p = outside diameter of reinforcing element as measured vertically, inches.
- D = outside diameter of pipe, inches.
- d = finished diameter of circular opening in shell (inside diameter of nozzle), inches; Where $d = D - 2t_n$
- E = joint efficiency of nozzle; Use E = 1.0 for API calculations.
- F = correction factor for different plane variations; Use F = 1.0 for API calculations.
- h = distance nozzle projects beyond the inner surface of the wall, inches. Not to exceed $4t_n$ for API calculations.
- P = internal design pressure, psi. Where, $P = 0.433GH$
- R_n = inside radius of nozzle, inches; Where $R_n = d/2$
- S_n = allowable stress in nozzle, psi.
- f_r = strength reduction factor; Use f_r = 1.0 for API calculations.
- leg = weld leg length, inches; Use leg = 0 for API calculations.
- t = actual measured thickness of shell, inches; Use t_{act} from Shell Service Life Evaluation.
- t_{act} = actual measured thickness of nozzle, inches.
- t_{prev} = previous measured thickness of nozzle or t_n, inches.
- t_e = thickness of reinforcement plate or thickness of thickened insert less the actual measured thickness of the shell (t), inches.
- t_r = minimum required shell thickness, inches; Use t_{min} from Shell Service Life Evaluation.
- t_n = external nominal pipe wall thickness, inches.
- t_i = internal nominal pipe wall thickness, inches; Use $t_i = t_n$ if nozzle projects inward for API calculations.
- t_{rn} = required thickness of nozzle wall, inches.
- G = product specific gravity; Use G from Shell Service Life Evaluation.
- H = height of tank, feet; Use H from Shell Service Life Evaluation.
- C_r = corrosion rate of nozzle, inches per year; Use C_r = 0.0002 inches/year, if C_r calculates to be less than 0.0002 inches/year.
- L_R = remaining life of nozzle, years.
- ΔY = years between t_{prev} and t_{act}, in years.

Shell Nozzle and Reinforcement Evaluation

Nozzle A: 4" Threaded Plug

$d = 4.5 - 2(0.337) = 3.826$ *inches*
$R_n = 3.826/2 = 1.913$ *inches*
$P = 0.433(0.84)(23.37) = 9$ *psi*
$h = 0$ *inches*
$S_n = 20{,}000$ *psi*
$E = 1$

$t = 0.242$ *inches*
$t_r = 0.1$ *inches*
$t_n = 0.337$ *inches*
$t_i = 0$ *inches*
$t_{prev} = 0.337$ *inches*
$t_{act} =$ N/A

$\Delta Y = 13$ *years*
$D_p =$ N/A
$t_e =$ N/A

Minimum Required Thickness Calculation:

$$t_{rn} = \frac{PR_n}{SE - 0.6P} = \frac{(9)(1.913)}{(20{,}000)(1) - (0.6)(9)} = 0.0009 \text{ inches}$$

As a conservative approach, let t_{rn}=0.1 *inches.*

The Corrosion Rate Remaining Life Calculations cannot be calculated since thickness measurements cannot be taken on this nozzle. Visual inspection revealed no active corrosion. The remaining life of this nozzle is estimated to be greater than 50 years.

Reinforcement Calculations:

Formulas are simplified						
A	=	dt_r	=	(3.826)(0.1)	=	0.3826 in^2
A_1	=	$d(t-t_r)$	=	(3.826)(0.242-0.1)	=	0.5433 in^2
	=	$2(t+t_n)(t-t_r)$	=	(2)(0.242+0.337)(0.242-0.1)	=	0.1644 in^2
A_2	=	$5(t_n-t_{rn})t$	=	(5)(0.337-0.1)(0.1)	=	0.2868 in^2
	=	$5(t_n-t_{rn})t_n$	=	(5)(0.337-0.1)(0.337)	=	0.3993 in^2
A_3	=	$5t\,t_i$	=	(5)(0.242)(0)	=	0 in^2
	=	$5t_it_i$	=	(5)(0)(0)	=	0 in^2
	=	$2ht_i$	=	(2)(0)(0)	=	0 in^2

Area provided by $A_1 + A_2 + A_3$=0.5433 in^2 + 0.2868 in^2 + 0 in^2=0.8301 $inches^2$. This is greater than the required area of 0.3826 $inches^2$, therefore, the reinforcement is adequate.

Shell Nozzle and Reinforcement Evaluation

Nozzle B: 24" Manway

d = 24 - 2(0.25) = 23.5 *inches*
R_n = 23.5/2 = 11.75 *inches*
P = 0.433(0.84)(23.37) = 9 *psi*
h = 0 *inches*
S_n = 20,000 *psi*
E = 1

t = 0.242 *inches*
t_r = 0.1 *inches*
t_n = 0.25 *inches*
t_i = 0 *inches*
t_{prev} = 0.25 *inches*
t_{act} = 0.242 *inches*

ΔY = 13 *years*
D_p = N/A
t_e = N/A

Minimum Required Thickness Calculation:

$$t_{rn} = \frac{PR_n}{SE - 0.6P} = \frac{(9)(11.75)}{(20{,}000)(1) - (0.6)(9)} = 0.0053 \textit{ inches}$$

As a conservative approach, let t_{rn}=0.1 *inches.*

Corrosion Rate Calculation:

$$C_r = \frac{t_{prev} - t_{act}}{\Delta Y} = \frac{0.25 - 0.242}{13} = 0.000615 \textit{ inches/year}$$

Remaining Life Calculation:

$$L_R = \frac{t_{act} - t_{rn}}{C_r} = \frac{0.242 - 0.1}{0.000615} = 231 \textit{ years}$$

Reinforcement Calculations:

Formulas are simplified							
A	=	dt_r	=	(23.5)(0.1)	=	2.35 in^2
A_1	=	$d(t-t_r)$	=	(23.5)(0.242-0.1)	=	3.337 in^2
	=	$2(t+t_n)(t-t_r)$	=	(2)(0.242+0.25)(0.242-0.1)	=	0.1397 in^2
A_2	=	$5(t_n-t_{rn})t$	=	(5)(0.25-0.1)(0.1)	=	0.1815 in^2
	=	$5(t_n-t_{rn})t_n$	=	(5)(0.25-0.1)(0.25)	=	0.1875 in^2
A_3	=	$5t\ t_i$	=	(5)(0.242)(0)	=	0 in^2
	=	$5t_i t_i$	=	(5)(0)(0)	=	0 in^2
	=	$2ht_i$	=	(2)(0)(0)	=	0 in^2

Area provided by $A_1 + A_2 + A_3$=3.337 in^2 + 0.1815 in^2 + 0 in^2=3.5185 *inches*^{2}. This is greater than the required area of 2.35 *inches*^{2}, therefore, the reinforcement is adequate.

Shell Nozzle and Reinforcement Evaluation

Nozzle C: 4" Product

$d = 4.5 - 2(0.237) = 4.026$ *inches*	$t = 0.242$ *inches*	$\Delta Y = 13$ *years*
$R_n = 4.026/2 = 2.013$ *inches*	$t_r = 0.1$ *inches*	$D_p =$ N/A
$P = 0.433(0.84)(23.37) = 9$ *psi*	$t_n = 0.237$ *inches*	$t_e =$ N/A
$h = 0.9480$ *inches*	$t_i = 0.237$ *inches*	
$S_n = 20{,}000$ *psi*	$t_{prev} = 0.237$ *inches*	
$E = 1$	$t_{act} = 0.191$ *inches*	

Minimum Required Thickness Calculation:

$$t_{rn} = \frac{PR_n}{SE - 0.6P} = \frac{(9)(2.013)}{(20{,}000)(1) - (0.6)(9)} = 0.0009 \textit{ inches}$$

As a conservative approach, let t_{rn}=0.1 *inches.*

Corrosion Rate Calculation:

$$C_r = \frac{t_{prev} - t_{act}}{\Delta Y} = \frac{0.237 - 0.191}{13} = 0.003538 \textit{ inches/year}$$

Remaining Life Calculation:

$$L_R = \frac{t_{act} - t_{rn}}{C_r} = \frac{0.191 - 0.1}{0.003538} = 26 \textit{ years}$$

Reinforcement Calculations:

Formulas are simplified							
A	=	dt_r	=	(4.026)(0.1)	=	0.4026 in^2
A_1	=	$d(t-t_r)$	=	(4.026)(0.242-0.1)	=	0.5717 in^2
	=	$2(t+t_n)(t-t_r)$	=	(2)(0.242+0.237)(0.242-0.1)	=	0.136 in^2
A_2	=	$5(t_n-t_{rn})t$	=	(5)(0.237-0.1)(0.1)	=	0.1658 in^2
	=	$5(t_n-t_{rn})t_n$	=	(5)(0.237-0.1)(0.237)	=	0.1623 in^2
A_3	=	$5t\,t_i$	=	(5)(0.242)(0.237)	=	0.2868 in^2
	=	$5t_i t_i$	=	(5)(0.237)(0.237)	=	0.2808 in^2
	=	$2ht_i$	=	(2)(0.9480)(0.237)	=	0.4494 in^2

Area provided by $A_1 + A_2 + A_3$=0.5717 in^2 + 0.1623 in^2 + 0.2808 in^2=1.0148 *inches*^{2}. This is greater than the required area of 0.4026 *inches*^{2}, therefore, the reinforcement is adequate.

Shell Nozzle and Reinforcement Evaluation

Nozzle D: 6" Fire Fighting

d = 6.625 - 2(0.28) = 6.065 *inches*
R_n = 6.065/2 = 3.0325 *inches*
P = 0.433(0.84)(23.37) = 9 *psi*
h = 0 *inches*
S_n = 20,000 *psi*
E = 1

t = 0.243 *inches*
t_r = 0.1 *inches*
t_n = 0.28 *inches*
t_i = 0 *inches*
t_{prev} = 0.28 *inches*
t_{act} = N/A

ΔY = 13 *years*
D_p = N/A
t_e = N/A

Minimum Required Thickness Calculation:

$$t_{rn} = \frac{PR_n}{SE - 0.6P} = \frac{(9)(3.0325)}{(20{,}000)(1) - (0.6)(9)} = 0.0014 \ inches$$

As a conservative approach, let t_{rn}=0.1 *inches.*

The Corrosion Rate Remaining Life Calculations cannot be calculated since thickness measurements cannot be taken on this nozzle. Visual inspection revealed no active corrosion. The remaining life of this nozzle is estimated to be greater than 50 years.

Reinforcement Calculations:

Formulas are simplified						
A	=	dt_r	=	(6.065)(0.1)	=	0.6065 in^2
A_1	=	$d(t-t_r)$	=	(6.065)(0.243-0.1)	=	0.8673 in^2
	=	$2(t+t_n)(t-t_r)$	=	(2)(0.243+0.28)(0.243-0.1)	=	0.1496 in^2
A_2	=	$5(t_n-t_{rn})t$	=	(5)(0.28-0.1)(0.1)	=	0.2187 in^2
	=	$5(t_n-t_{rn})t_n$	=	(5)(0.28-0.1)(0.28)	=	0.252 in^2
A_3	=	$5t\,t_i$	=	(5)(0.243)(0)	=	0 in^2
	=	$5t_it_i$	=	(5)(0)(0)	=	0 in^2
	=	$2ht_i$	=	(2)(0)(0)	=	0 in^2

Area provided by $A_1 + A_2 + A_3$=0.8673 in^2 + 0.2187 in^2 + 0 in^2=1.086 $inches^2$. This is greater than the required area of 0.6065 $inches^2$, therefore, the reinforcement is adequate.

Shell Nozzle and Reinforcement Evaluation

Nozzle E: 4" Product

$d =$ 4.5 - 2(0.237) = 4.026 *inches*
$R_n =$ 4.026/2 = 2.013 *inches*
$P =$ 0.433(0.84)(23.37) = 9 *psi*
$h =$ 0.9480 *inches*
$S_n =$ 20,000 *psi*
$E =$ 1

$t =$ 0.242 *inches*
$t_r =$ 0.1 *inches*
$t_n =$ 0.237 *inches*
$t_i =$ 0.237 *inches*
$t_{prev} =$ 0.237 *inches*
$t_{act} =$ 0.19 *inches*

$\Delta Y =$ 13 *years*
$D_p =$ N/A
$t_e =$ N/A

Minimum Required Thickness Calculation:

$$t_{rn} = \frac{PR_n}{SE - 0.6P} = \frac{(9)(2.013)}{(20{,}000)(1) - (0.6)(9)} = 0.0009 \text{ inches}$$

As a conservative approach, let t_{rn}=0.1 *inches.*

Corrosion Rate Calculation:

$$C_r = \frac{t_{prev} - t_{act}}{\Delta Y} = \frac{0.237 - 0.19}{13} = 0.003615 \text{ inches/year}$$

Remaining Life Calculation:

$$L_R = \frac{t_{act} - t_{rn}}{C_r} = \frac{0.19 - 0.1}{0.003615} = 25 \text{ years}$$

Reinforcement Calculations:

Formulas are simplified						
A	=	dt_r	=	(4.026)(0.1)	=	0.4026 in^2
A_1	=	$d(t-t_r)$	=	(4.026)(0.242-0.1)	=	0.5717 in^2
	=	$2(t+t_n)(t-t_r)$	=	(2)(0.242+0.237)(0.242-0.1)	=	0.136 in^2
A_2	=	$5(t_n-t_{rn})t$	=	(5)(0.237-0.1)(0.1)	=	0.1658 in^2
	=	$5(t_n-t_{rn})t_n$	=	(5)(0.237-0.1)(0.237)	=	0.1623 in^2
A_3	=	$5t\,t_i$	=	(5)(0.242)(0.237)	=	0.2868 in^2
	=	$5t_i t_i$	=	(5)(0.237)(0.237)	=	0.2808 in^2
	=	$2ht_i$	=	(2)(0.9480)(0.237)	=	0.4494 in^2

Area provided by $A_1 + A_2 + A_3$=0.5717 in^2 + 0.1623 in^2 + 0.2808 in^2=1.0148 $inches^2$. This is greater than the required area of 0.4026 $inches^2$, therefore, the reinforcement is adequate.

Shell Nozzle and Reinforcement Evaluation

Nozzle F: 1" Water Draw

$d =$ 1.315 - 2(0.179) = 0.957 *inches*	$t =$ 0.242 *inches*	$\Delta Y =$ 13 *years*
$R_n =$ 0.957/2 = 0.4785 *inches*	$t_r =$ 0.1 *inches*	$D_p =$ N/A
$P =$ 0.433(0.84)(23.37) = 9 *psi*	$t_n =$ 0.179 *inches*	$t_e =$ N/A
$h =$ 0 *inches*	$t_i =$ 0 *inches*	
$S_n =$ 20,000 *psi*	$t_{prev} =$ 0.179 *inches*	
$E =$ 1	$t_{act} =$ N/A	

Minimum Required Thickness Calculation:

$$t_{rn} = \frac{PR_n}{SE - 0.6P} = \frac{(9)(0.4785)}{(20{,}000)(1) - (0.6)(9)} = 0.0002 \textit{ inches}$$

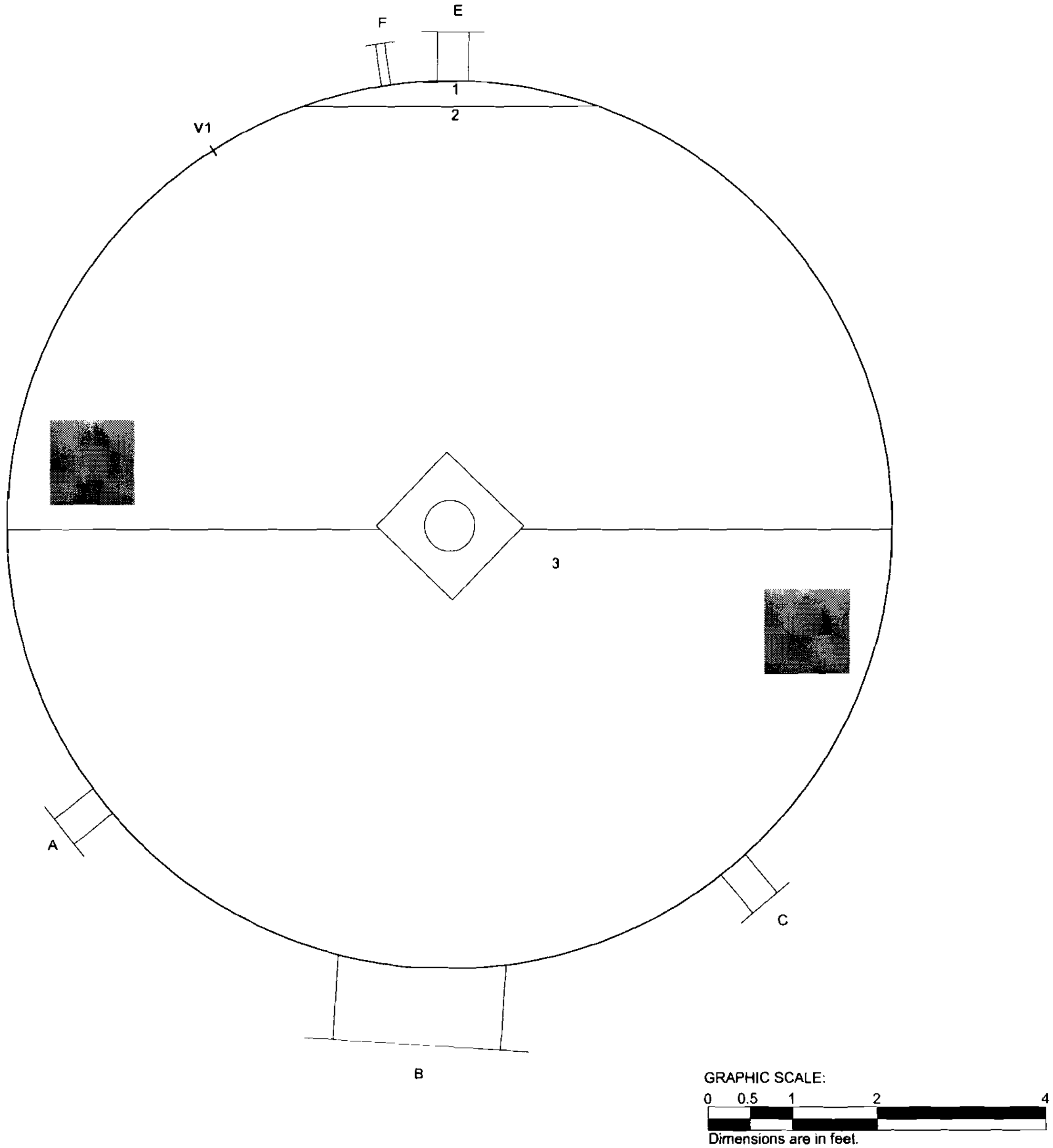
As a conservative approach, let t_{rn}=0.1 *inches.*

The Corrosion Rate Remaining Life Calculations cannot be calculated since thickness measurements cannot be taken on this nozzle. Visual inspection revealed no active corrosion. The remaining life of this nozzle is estimated to be greater than 50 years.

Appendix B

Engineering Drawings

1. Bottom Layout
2. Shell Layout
3. Fixed Roof Layout



Remarks/Legend:

Measured Inside Diameter is 10.5 feet.
Tank bottom has 3 plates.

See Bottom Electronic Coupon Measurements table for detailed measurements.

See Bottom Plate Flaw Measurements table for detailed measurements.

V# - Vertical Seam Number of Shell Course #1

Shell Nozzles in Course #1
A - 4" Threaded Plug
B - 24" Manway
C - 4" Product
E - 4" Product
F - 1" Water Draw

PLAN NORTH

■ Electronic Coupon

XY Orientation

NW NE SW SE

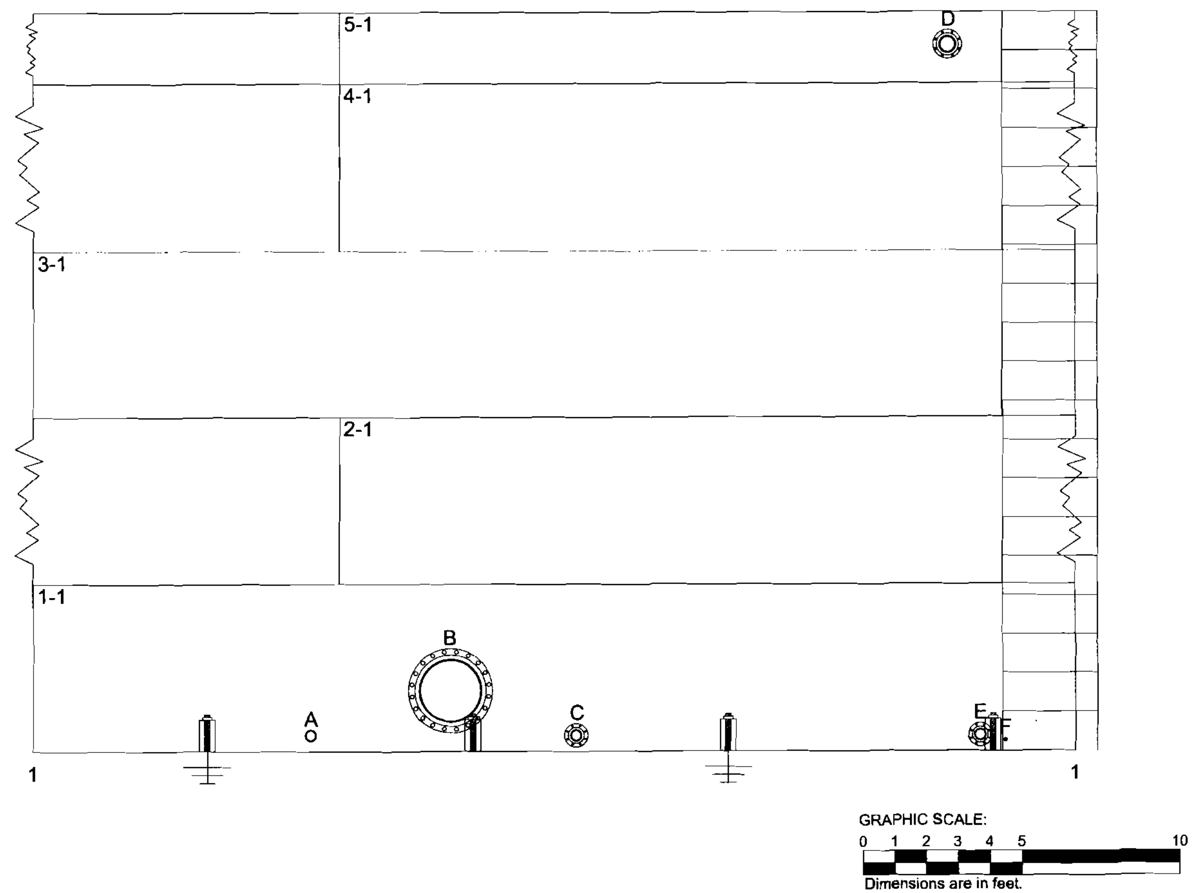
XY Orientation is in reference to Plan North

Owner/Operator: MCAS Camp Lejeune

Inspection Firm: Environmental Technology Inc.

Date:	Revision Number:	Revision Date:
10/11/04	N/A	N/A

Drawing Title:	Tank Description:	Drawing Number:
Bottom Layout	Tank HP961-03A	B-1



Remarks/Legend:

Seam #1 is the first seam left of the first manway left of the ladder in the first shell course viewing from the outside.
The number in the upper left corner of each plate identifies the plate by the course and position of the plate in that course.

Anchor Bolt

A - 4" Threaded Plug
B - 24" Manway
C - 4" Product
D - 6" Fire Fighting
E - 4" Product
F - 1" Water Draw

Owner/Operator: MCAS Camp Lejeune

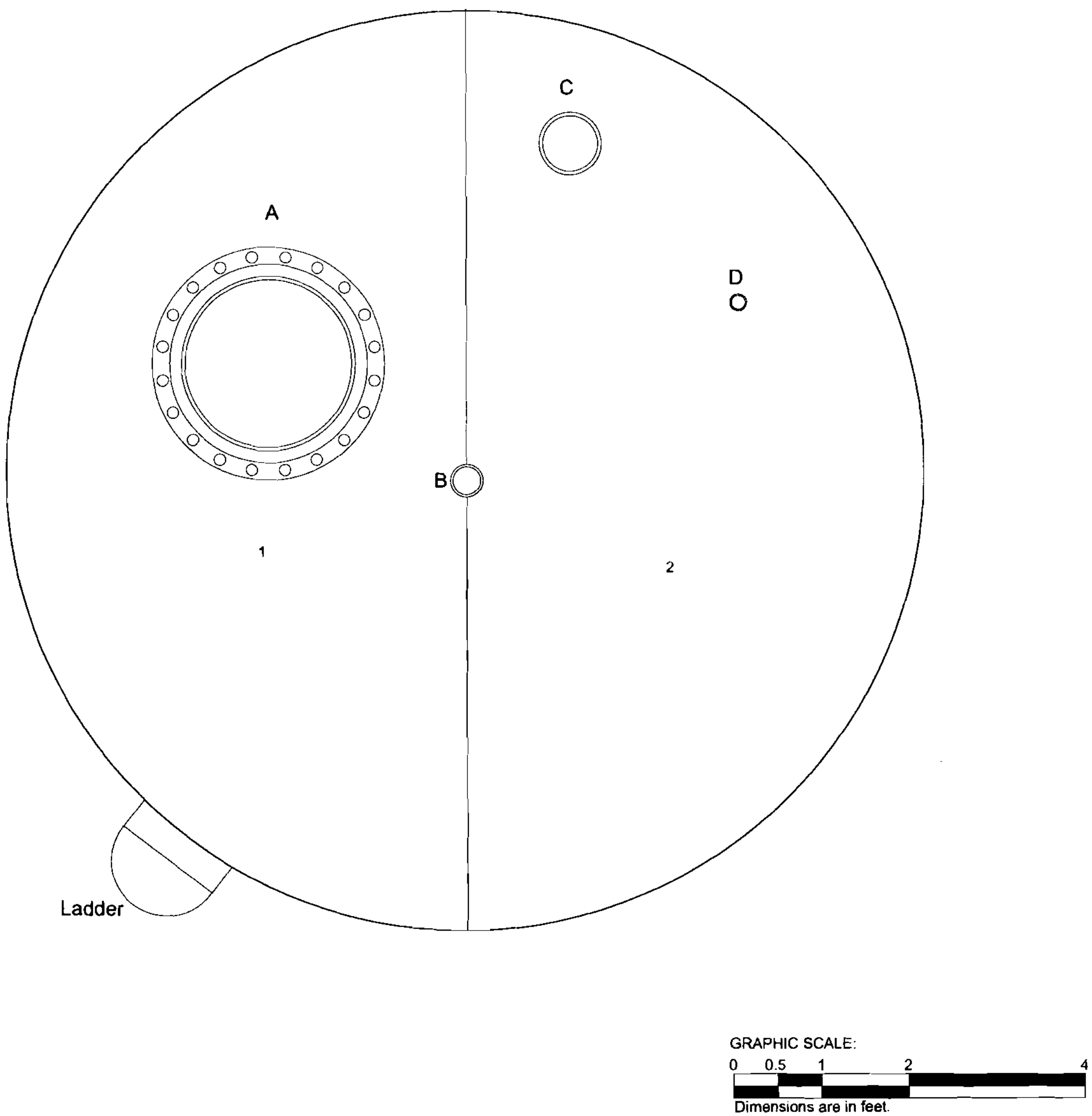
Inspection Firm: Environmental Technology Inc.

Date:	Revision Number:	Revision Date:
10/11/04	N/A	N/A

Drawing Title: Shell Layout

Tank Description: Tank HP961-03A

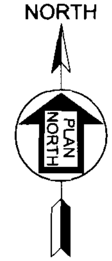
Drawing Number: S-1



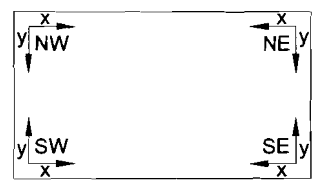
Remarks/Legend:

Measured Diameter is 10.5 feet.
Fixed roof has 3 plates.

A - 24" Manway
B - 4" Level Indicator
C - 2" Threaded Plug
D - 8" Gauge Tube



XY Orientation



XY Orientation is in reference to Plan North

Owner/Operator: MCAS Camp Lejeune		
Inspection Firm: Environmental Technology Inc.		
Date: 10/11/04	Revision Number: N/A	Revision Date: N/A

Drawing Title:	Tank Description:	Drawing Number:
Fixed Roof Layout	Tank HP961-03A	R-1

Appendix C

Engineering Data

1. Bottom Plate Thickness Measurements
2. Bottom Circumferential Thickness Measurements
3. Bottom Electronic Coupon Measurements
4. Shell Plate Thickness Measurements
5. Shell Nozzle Measurements
6. Floating Roof Annular Space Measurements
7. Fixed Roof Plate Thickness Measurements

Bottom Plate Thickness Measurements

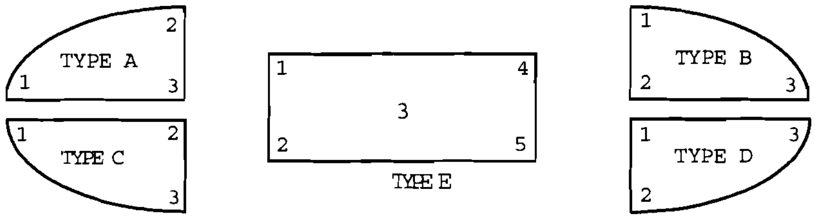


Plate Number	Thickness Measurements (in inches)					Plate Type
	Point Numbers					
	1	2	3	4	5	
1	0.250	0.256	0.248	0.252	0.252	E
2	0.253	0.248	0.249	0.252	0.251	E
3	0.250	0.250	0.254	0.255	0.256	E

NOTE: The lowest UT measurements are in RED, and the highest UT measurements are in GREEN.

Bottom Circumferential Thickness Measurements

Point No.	Plate No.	Thickness Measurement (in inches)
1	1	0.251
2	1	0.254
3	1	0.248
4	1	0.247
5	1	0.252
6	1	0.246
7	1	0.249
8	2	0.255
9	2	0.255
10	2	0.249
11	2	0.247
12	3	0.249
13	3	0.252
14	3	0.254
15	3	0.256
16	2	0.252
17	2	0.250
18	2	0.254
19	2	0.248
20	2	0.251

NOTE: Thickness measurements were taken within two (2) inches of the shell-to-bottom weld.

Bottom Electronic Coupon Measurements

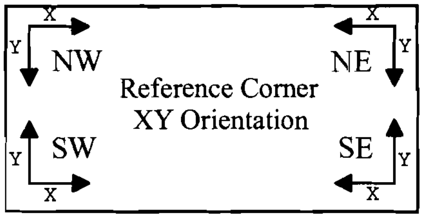
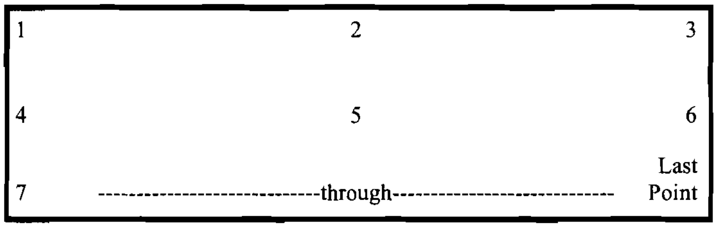


Plate No.	Coupon No.	Lowest Thickness Measurement (in inches)	Highest Thickness Measurement (in inches)	Reference Corner	X-Coordinate (in inches)	Y-Coordinate (in inches)
2	1	0.246	0.251	SW	12	12
3	2	0.241	0.254	NE	12	12

Shell Plate Thickness Measurements



(Typical)

Course #1	
Point No.	Plate 1-1
1	0.243
2	0.242
3	0.243
4	0.243
5	0.243
6	0.243
7	0.243
8	0.244
9	0.243
10	0.243
11	0.244
12	0.244
13	0.243
14	0.243
15	0.244
16	0.244
17	0.244
18	0.243
19	0.244
20	0.244
21	0.245

NOTE: Thickness measurements are evenly spaced across the bottom of each plate. The thickness measurements are in inches. The lowest UT measurements are in **RED**, and the highest UT measurements are in **GREEN** for each shell course.

Shell Plate Thickness Measurements

Vertical Ladder (Drop #1) (X-Coord=32.2 ft in Sheet #1)					
Point No.	Course #5	Course #4	Course #3	Course #2	Course #1
1	0.243	0.242	0.243	0.243	0.242
2	0.244	0.243	0.244	0.244	0.244
3	0.243	0.244	0.244	0.245	0.244
4	NA	0.243	0.243	0.243	0.244
5	NA	0.242	0.243	0.243	0.243

NOTE: Thickness measurements are evenly spaced down each course along the path of each drop. Each shell course starts with Point #1 at the top of the course and ends with the last point at the bottom of the course. Thickness measurements are in inches. The lowest UT measurements are in **RED**, and the highest UT measurements are in **GREEN** for each shell course.

Shell Nozzle Measurements

Nozzle Measurements									
Nozzle Desig.	Sheet Number	Description	X-Coord (feet)	Y-Coord (feet)	Thickness Measurements (inches)				
					Nominal	0°	90°	180°	270°
A	1	4" Threaded Plug	8.8	0.5	0.3370	NA	NA	NA	NA
B	1	24" Manway	13.2	1.91	0.250	0.246	0.242	0.243	0.244
C	1	4" Product	17.2	0.5	0.2370	0.191	0.203	0.202	0.196
D	1	6" Fire Fighting	29	22.32	0.280	NA	NA	NA	NA
E	1	4" Product	30	0.5	0.2370	0.196	0.198	0.190	0.209
F	1	1" Water Draw	30.8	0.33	0.1790	NA	NA	NA	NA

NOTE: The Sheet Number corresponds to the shell plate in the first shell course. The X-Coord is measured from the first seam left of the nozzle in the first shell course to the center of the nozzle. The Y-Coord is measured from the tank bottom to the center of the nozzle.

Floating Roof Annular Space Measurements

Point Number	Space Measurement (in inches)		Point Number	Space Measurment (in inches)
1	3.25	Points are opposite of each other	5	3.25
2	3	Points are opposite of each other	6	3
3	3	Points are opposite of each other	7	3.25
4	3	Points are opposite of each other	8	3

NOTE: Point #1 is at Seam #1 and each point is 4.1 feet apart to the left viewing from inside. Seam #1 is the first seam left of the first manway left of the ladder in the first shell course viewing from the outside. The minimum and maximum annular space between the floating roof and the shell measured between 3 inches and 3.25 inches respectively.

Fixed Roof Plate Thickness Measurements

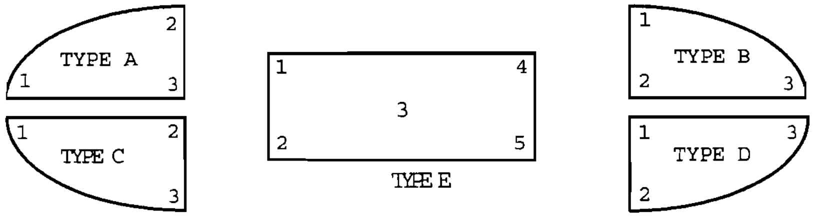


Plate Number	Thickness Measurements (in inches)					Plate Type
	Point Numbers					
	1	2	3	4	5	
1	0.171	0.173	0.172	0.173	0.172	E
2	0.172	0.172	0.169	0.172	0.172	E

NOTE: The lowest UT measurements are in RED, and the highest UT measurements are in GREEN.

Appendix D

API Standard 653
Checklist for
Tank Inspection

1. Tank In-Service Inspection Checklist
2. Tank Out-of-Service Inspection Checklist

Checklist Legend:

✔ - Item was satisfactory.
X - Item has comment (see section 4.0).
NA - Item was not applicable to this tank.

Tank In-Service Inspection Checklist

1.1 FOUNDATION

a. NA Measure foundation levelness and bottom elevations.

1.1.1 Concrete Ring

a. NA Inspect for broken concrete, spalling and cracks, particularly under backup bars used in welding butt welded annular rings under the shell.
b. NA Inspect drain openings in ring, back of waterdraw basins and top surface of ring for indications of bottom leakage.
c. NA Inspect for cavities under foundation and vegetation against bottom of tank.
d. NA Check that runoff rainwater from the shell drains away from the tank.
e. NA Check for settlement around perimeter of tank.

1.1.2 Asphalt

a. NA Check for settling of tank into asphalt base which would direct runoff rain water under the tank instead of away from it.
b. NA Look for areas where leaching of oil has left rock filler exposed, which indicates hydrocarbon leakage.

1.1.3 Oiled Dirt or Sand

a. NA Check for settlement into the base which would direct runoff rain water under the tank rather than away from it.

1.1.4 Rock

a. NA 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.

1.1.5 Site Drainage

a. ✔ Check site for drainage away from the tank and associated piping and manifolds.
b. ✔ Check operating condition of dike drains.

1.1.6 Housekeeping

a. ✔ Inspect the area for buildup of trash, vegetation, and other inflammables buildup.

Tank In-Service Inspection Checklist

1.2 SHELLS

1.2.1 External Visual Inspection

a. __✔__ Visually inspect for paint failures, pitting, and corrosion.
b. __NA__ Clean off the bottom angle area and inspect for corrosion and thinning on plate and weld.
c. __X__ Inspect the bottom-to-foundation seal.

1.2.2 Internal (Floating Roof Tank)

a. __✔__ Visually inspect for grooving, corrosion, pitting, and coating failures.

1.2.3 Riveted Shell Inspection

a. __NA__ Inspect external surface for rivet and seam leaks.
b. __NA__ Locate leaks by sketch or photo (location will be lost when shell is abrasively cleaned for painting).
c. __NA__ Inspect rivets for corrosion loss and wear.
d. __NA__ Inspect vertical seams to see if they have been full fillet lap welded to increase joint efficiency.
e. __NA__ 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.

1.2.4 Wind Girder (Floating Roof Tanks)

a. __NA__ Inspect wind girder and handrail for corrosion damage (paint failure, pitting, corrosion product buildup), especially where it occurs at tack welded junctions, and for broken welds.
b. __NA__ Check support welds to shell for pitting, especially on shell plates.
c. __NA__ Note whether supports have reinforcing pads welded to shell.

1.3 SHELL APPURTENANCES

1.3.1 Manways and Nozzles

a. __X__ Inspect for cracks or signs of leakage on weld joints at nozzles, manways, and reinforcing plates.
b. __NA__ Inspect for shell plate dimpling around nozzles, caused by excessive pipe deflection.
c. __NA__ Inspect for flange leaks and leaks around bolting.
d. __NA__ Inspect sealing of insulation around manways and nozzles.
e. __NA__ Check for inadequate manway flange and cover thickness on mixer manways.

Tank In-Service Inspection Checklist

1.3.2 Tank Piping Manifolds

a. _NA_ Inspect manifold piping, flanges, and valves for leaks.
b. _NA_ Inspect fire fighting system components.
c. _NA_ Check for anchored piping which would be hazardous to the tank shell or bottom connections during earth movement.
d. _NA_ Check for adequate thermal pressure relief of piping to the tank.
e. _NA_ Check operation of regulators for tanks with purge gas systems.
f. _NA_ Check sample connections for leaks and for proper valve operation.
g. _NA_ Check for damage and test the accuracy of temperature indicators.
h. _NA_ Check welds on shell-mounted davit clips above valves 6 inches and larger.

1.3.3 Autogauge System

a. _NA_ Inspect autogauge tape guide and lower sheave housing (floating swings) for leaks.
b. _NA_ Inspect autogauge head for damage.
c. _NA_ Bump the checker on autogauge head for proper movement of tape.
d. _NA_ Identify size and construction material of autogauge tape guide (floating roof tanks).
e. _NA_ Ask operator if tape tends to hang up during tank roof movement (floating roof tanks).
f. _NA_ Compare actual product level to the reading on the autogauge (maximum variation is 2 inches).
g. _NA_ On floating roof tanks, when the roof is in the lowest position, check that no more than two feet of tape are exposed at the end of the tape guide.
h. _NA_ Inspect condition of board and legibility of board-type autogauges.
i. _NA_ Test freedom of movement of marker and float.

1.3.4 Shell-Mounted Sample Station

a. _NA_ Inspect sample lines for function of valves and plugging of lines, including drain or return-to-tank line.
b. _NA_ Check circulation pump for leaks and operating problems.
c. _NA_ Test bracing and supports of sample system lines and equipment.

1.3.5 Heater (Shell Manway Mounted)

a. _NA_ Inspect condensate drain for presence of oil indicating leakage.

Tank In-Service Inspection Checklist

1.3.6 Mixer

a. NA Inspect for proper mounting flange and support.
b. NA Inspect for leakage.
c. NA Inspect condition of power lines and connections to mixer.

1.3.7 Swing Lines: Winch Operation

a. NA Nonfloating. Raise, then lower the swing line with the winch, and check for cable tightness to confirm that swing line lowered properly.
b. NA 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. NA 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.

1.3.8 Swing Lines: External Guide System

a. NA Check for leaks at threaded and flanged joints.

1.3.9 Swing Lines: Identify Ballast Varying Need

a. NA Check for significant difference in stock specific gravity.

1.3.10 Swing Lines: Cable Material and Condition

a. NA For non-stainless steel cable, check for corrosion over entire length.
b. NA All cable: check for wear or fraying.

1.3.11 Swing Lines: Product Sample Comparison

a. NA Check for water or gravity differences that would indicate a leaking swing joint.

1.3.12 Swing Lines: Target

a. NA Target should indicate direction of swing opening (up or down) and height above bottom where suction will be lost with swing on bottom support.

Tank In-Service Inspection Checklist

1.4 ROOFS

1.4.1 Deck Plate Internal Corrosion

a. __✔__ 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.)

1.4.2 Deck Plate External Corrosion

a. __✔__ Visually inspect for paint failure, holes, pitting, and corrosion product on the roof deck.

1.4.3 Roof Deck Drainage

a. __✔__ 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, an unlevel roof with possible leaking pontoons).

1.4.4 Level of Floating Roof

a. __NA__ 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 hangup. On small diameter tanks, an unlevel condition can indicate unequal loading at that level.

1.4.5 Gas Test Internal Floating Roof

a. __✔__ 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.

1.4.6 Roof Insulation

a. __NA__ Visually inspect for cracks or leaks in the insulation weather coat where runoff rain water could penetrate the insulation.
b. __NA__ Inspect for wet insulation under the weather coat.
c. __NA__ Remove small test sections of insulation and check roof deck for corrosion and holes near the edge of the insulated area.

Tank In-Service Inspection Checklist

1.4.7 Floating Roof Seal Systems

a. __✔__ Measure and record maximum seal-to-shell gaps:
  __3.5__ at low pump out
  ______ at midshell
  ______ at high liquid level
b. __✔__ Measure and record annular space at 30 foot spacing (minimum of 4 quadrants) around roof and record. Measurements should be taken in directly opposite pairs.
c. __NA__ Check if seal fabric on primary shoe seals is pulling shoes away from shell (fabric not wide enough).
d. __X__ Inspect fabric for deterioration, holes, tears, and cracks.
e. __NA__ Inspect visible metallic parts for corrosion and wear.
f. __NA__ Inspect for openings in seals that would permit vapor emissions.
g. __NA__ Inspect for protruding bolt or rivet heads against the shell.
h. __NA__ Pull both primary and secondary seal systems back all around the shell to check their operation.
i. __NA__ Inspect secondary seals for signs of buckling or indications that their angle with the shell is too shallow.
j. __NA__ Inspect wedge-type wiper seals for flexibility, resilience, cracks and tears.

1.5 ROOF APPURTENANCES

1.5.1 Sample Hatch

a. __NA__ Inspect condition and functioning of sample hatch cover.
b. __NA__ On tanks governed by Air Quality Monitoring District rules, check for the condition of seal inside hatch cover.
c. __NA__ Check for corrosion and plugging on thief and gauge hatch cover.
d. __NA__ Where sample hatch is used to reel gauge stock level, check for marker and tab stating hold off distance.
e. __NA__ Check for reinforcing pad where sample hatch pipe penetrates the roof deck.
f. __NA__ On floating roof sample hatch and recoil systems, inspect operation of recoil reel and condition of rope.
g. __NA__ Test operation of system.
h. __NA__ 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).

1.5.2 Gauge Well

a. __NA__ Inspect visible portion of the gauge well for thinning, size of slots, and cover condition.
b. __NA__ Check for a hold off distance marker and tab with hold off distance (legible).
c. __NA__ On floating roofs, inspect condition of roof guide for gauge well, particularly the condition of the rollers for grooving.

Tank In-Service Inspection Checklist

d. __NA__ If accessible, check the distance from the gauge well pipe to the tank shell at different levels.
e. __NA__ If tank has a gauge well washer, check valve for leakage and for presence of a bull plug or blind flange.

1.5.3 Fixed Roof Scaffold Support

a. __NA__ Inspect scaffold support for corrosion, wear, and structural soundness.

1.5.4 Autogauge: Inspection Hatch and Guides (Fixed Roof)

a. __NA__ Check the hatch for corrosion and missing bolts.
b. __NA__ Look for corrosion on the tape guide's and float guide's wire anchors.

1.5.5 Autogage: Float Well Cover

a. __NA__ Inspect for corrosion.
b. __NA__ Check tape cable for wear or fraying caused by rubbing on the cover.

1.5.6 Sample Hatch (Internal Floating Roof)

a. __NA__ Check overall conditions.
b. __NA__ When equipped with a fabric seal, check for automatic sealing after sampling.
c. __NA__ When equipped with a recoil reel opening device, check for proper operation.

1.5.7 Roof-Mounted Vents (Internal Floating Roof)

a. __NA__ Check condition of screens, locking and pivot pins.

1.5.8 Gauging Platform Drip Ring

a. __NA__ On fixed roof tanks with drip rings under the gauging platform or sampling area, inspect for plugged drain return to the tank.

1.5.9 Emergency Roof Drains

a. __NA__ 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.

1.5.10 Removable Roof Leg Racks

a. __NA__ Check for leg racks on roof.

Tank In-Service Inspection Checklist

1.5.11 Vacuum Breakers

a. NA Report size, number and type of vacuum breakers. Inspect vacuum breakers. If high legs are set, check for setting of mechanical vacuum breaker in high leg position.

1.5.12 Rim Vents

a. NA Check condition of the screen on the rim vent cover.
b. NA Check for plating off or removal of rim vents where jurisdictional rules do not permit removal.

1.5.13 Pontoon Inspection Hatches

a. NA Open pontoon inspection hatch covers and visually check inside for pontoon leakage.
b. NA Test for explosive gas (an indicator of vapor space leaks).
c. NA 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.

1.6 ACCESSWAYS

1.6.1 Handrails

a. NA Identify and report type (steel pipe, galvanized pipe, square tube, angle) and size of handrails.
b. NA Inspect for pitting and holes, paint failure.
c. ✔ Inspect attachment welds.
d. NA Identify cold joints and sharp edges. Inspect the handrails and midrails.
e. NA Inspect safety drop bar (or safety chain) for corrosion, functioning and length.
f. NA Inspect the handrail between the rolling ladder and the gauging platform for a hazardous opening when the floating roof is at its lowest level.

1.6.2 Platform Frame

a. NA Inspect frame for corrosion and paint failure.
b. NA Inspect the attachment of frame to supports and supports to tank for corrosion and weld failure.
c. NA Check reinforcing pads where supports are attached to shell or roof.
d. NA Inspect the surface that deck plate or grating rests on for thinning and holes.
e. NA Check that flat-surface to flat-surface junctures are seal welded.

Tank In-Service Inspection Checklist

1.6.3 Deck Plate and Grating

a. NA Inspect deck plate for corrosion-caused thinning or holes (not drain holes) and paint failure.
b. NA Inspect plate-to-frame weld for rust scale buildup.
c. NA Inspect grating for corrosion-caused thinning of bars and failure of welds.
d. NA Check grating tie down clips. Where grating has been retrofitted to replace plate, measure the rise of the step below and above the grating surface and compare with other risers on the stairway.

1.6.4 Stairway Stringers

a. NA Inspect spiral stairway stringers for corrosion, paint failure and weld failure. Inspect attachment of stairway treads to stringer.
b. NA Inspect stairway supports to shell welds and reinforcing pads.
c. NA Inspect steel support attachment to concrete base for corrosion.

1.6.5 Rolling Ladder

a. NA Inspect rolling ladder stringers for corrosion.
b. NA Identify and inspect ladder fixed rungs (square bar, round bar, angles) for weld attachment to stringers and corrosion, particularly where angle rungs are welded to stringers.
c. NA Check for wear and corrosion where rolling ladder attaches to gauging platform.
d. NA Inspect pivot bar for wear and secureness.
e. NA Inspect operation of self-leveling stairway treads.
f. NA Inspect for corrosion and wear on moving parts.
g. NA Inspect rolling ladder wheels for freedom of movement, flat spots and wear on axle.
h. NA Inspect alignment of rolling ladder with roof rack.
i. NA Inspect top surface of rolling ladder track for wear by wheels to assure at least 18 inches of unworn track (track long enough).
j. NA Inspect rolling ladder track welds for corrosion.
k. NA Inspect track supports on roof for reinforcing pads seal welded to deck plate.
l. NA Check by dimensioning, the maximum angle of the rolling ladder when the roof is on low legs.
_______ Maximum angle.
m. NA If rolling ladder track extends to within five feet of the edge of the roof on the far side, check for a handrail on the top of the shell on that side.

Tank Out-of-Service Inspection Checklist

2.1 OVERVIEW

a. ✔ Check that tank has been cleaned, is gas free, and safe for entry.
b. ✔ Check that the tank is completely isolated from product lines, all electrical power, and steam lines.
c. ✔ Check that roof is adequately supported, including fixed roof structure and floating roof legs.
d. ✔ Check for presence of falling object hazards, such as corroded-through roof rafters, asphalt stalactites, and trapped hydrocarbons in unopened or plugged equipment or appurtenances, ledges, etc.
e. ✔ Inspect for slipping hazards on the bottom and roof decks.
f. NA Inspect structural welds on accessways and clips.
g. ✔ Check surfaces needing inspection for a heavy-scale buildup and check weld seams and oily surfaces where welding is to be done. Note areas needing more cleaning, including blasting.

2.2 TANK EXTERIOR

a. NA Inspect appurtenances opened during cleaning such as lower floating swing sheave assemblies, nozzle interiors (after removal of valves).
b. ✔ Hammer test or ultrasonically test the roof.
c. NA Enter and inspect the floating roof pontoon compartments.

2.3 BOTTOM INTERIOR SURFACE

a. ✔ Using a flashlight held close to and parallel to the bottom plates, and using the bottom plate layout as a guide, visually inspect and hammer test the entire bottom.
b. ✔ Measure the depth of pitting and describe the pitting appearance (sharp edged, lake type, dense, scattered, etc).
c. NA Mark areas requiring patching or further inspection.
d. NA Mark locations for turning coupons for inspection.
e. ✔ Inspect all welds for corrosion and leaks, particularly the shell-to-bottom weld.
f. NA Inspect sketch plates for corrosion.
g. ✔ Locate and mark voids under the bottom.
h. NA Record bottom data on a layout sketch using the existing bottom plates as a grid. List the number and sizes of patches required.
i. NA Vacuum test the bottom lap welds.
j. NA Hammer test or ultrasonically examine any slightly discolored spots or damp areas.
k. ✔ Check for reinforcing pads under all bottom attached clips, brackets, and supports.
l. NA Inspect floating roof leg pads for pitting or cutting, and excessive dimpling (indicating excessive loading).

Tank Out-of-Service Inspection Checklist

m. ✔ Check the column bases of fixed roof supports for adequate pads and restraining clips.
n. NA In earthquake zones 3 and 4, check that roof supports are not welded down to the tank bottom, but are only restrained from horizontal movement.
o. NA Check area beneath swing line cable for indications of cable cutting or dragging.
p. NA Mark old oil and air test connections for removal and patching.
q. ✔ Identify and report low areas on the bottom that do not drain adequately.
r. NA Inspect coating for holes, disbonding, deterioration, and discolorization.

2.4 SHELL SEAMS AND PLATE

a. NA On cone up bottoms, closely inspect and gauge the depth of metal loss on the lower 2 to 4 inches of the shell (area of standing liquid).
b. NA Measure the depth of pitting on each course.
c. NA Inspect and estimate the amount of metal loss on the heads of rivets and bolts.
d. NA Inspect shell-to-bottom riveted lap joints.
e. NA Inspect for vertical grooving damage from seal assembly protrusions.
f. NA Inspect existing protective coatings for damage, deterioration, and disbonding.
g. NA Check for areas of rubbing (indicating too much pressure by the seal assembly shoes or inadequate annular space).
h. NA Visually inspect the shell plates and seams for indications of leakage.
i. NA If the shell has riveted or bolted seams, record the leak locations by film or chart in case the locations are lost during surface preparation for painting.
j. NA Measure annular space at 40-foot intervals.
k. NA Survey the shell to check for roundness and plumb.

2.5 SHELL-MOUNTED OVERFLOWS

a. NA Inspect overflow for corrosion and adequate screening.
b. NA Check location of overflow that it is not above any tank valves or equipment.

2.6 ROOF INTERIOR SURFACE

2.6.1 General

a. NA Visually inspect the underside surface of the roof plates for holes, scale buildup and pitting.
b. NA Hammer test or ultrasonically examine to check for thin areas, particularly in the vapor space of floating roofs and at the edge of the roof on cone roof tank.
c. NA Check all clips, brackets, braces, etc., welded to the roof deck plate for welded reinforcing pads and see that they have not broken free.
d. NA If no pad is present, penetrant test for cracking of the weld or deck plate.

Tank Out-of-Service Inspection Checklist

e. NA Inspect the protective coating for breaks, disbondment, and deterioration.
f. NA Spark test the interior surface coating if recoating is not planned.

2.6.2 Fixed Roof Support Structure

a. ✔ Inspect the support columns for thinning in the upper two feet.
b. NA On API columns (two channels welded together) check for corrosion scale breaking the rack welds, unless the joint between the channels is completely seal welded.
c. NA Check that the reinforcing pad on the bottom is seal welded to the tank bottom with horizontal movement restraining clips welded to the pad.
d. NA Determine if pipe column supports are concrete filled or open pipe. If open pipe, check for a drain opening in the bottom of the pipe.
e. NA Inspect and gauge rafters for thinning, particularly near the center of the roof. Report metal loss.
f. ✔ Check for loose or twisted rafters.
g. NA Inspect girders for thinning and check that they are attached securely to the top of the columns.
h. NA Report if the columns have cross bracing in the area between the low pump out of the top of the shell (for future internal floating roof installation).
i. NA Inspect and report the presence of any roof-mounted swing line bumpers.
j. NA Photograph the roof structure if no rafter layout drawing exists.

2.7 FIXED ROOF APPURTENANCES

2.7.1 Inspection and Light Hatches

a. NA Inspect the hatches for corrosion, paint and coating failures, holes, and cover sealing.
b. NA On loose covers, check for a safety chain in good condition.
c. NA On light hatches over 30 inches across, check for safety rods.
d. NA Inspect the condition of the gaskets on bolted or latched down hatch covers.

2.7.2 Staging Support Connection

a. NA Inspect the condition of the staging support for corrosion.

2.7.3 Breathers and Vents

a. NA Inspect and service the breather.
b. NA Inspect screens on vents and breathers.

Tank Out-of-Service Inspection Checklist

2.7.4 Emergency P/V Hatches

a. NA Inspect and service pressure/vacuum hatches. (Setting should be high enough to prevent chattering of breather during normal operation. See breather manufacturer's guide.)

b. NA Inspect liquid seal hatches for corrosion and proper liquid level in the seal.

2.7.5 Sample Hatch

a. NA Inspect sample hatch for corrosion.

b. NA Check that the cover operates properly.

c. NA If the tank has no gauge well, check for a hold off distance marker and check measurement.

2.8 FLOATING ROOF

2.8.1 Roof Deck

a. NA Hammer test the area between roof rim and shell. (If access for hammer testing is inadequate, measure the distance from the bottom edge of the roof to the corroded area and then hammer test from inside the pontoon.)

b. NA In sour water service, clean and test all deck plate weld seams for cracking unless the lower laps have been seal welded.

c. NA Check that either the roof drain is open or the drain plug in the roof is open in case of unexpected rain.

d. NA On flat bottomed and cone down bottom roof decks, check for a vapor dam around the periphery of the roof. The dam should be continuous without break to prevent escape of vapors to the seal area from under the center of the roof.

2.8.2 Floating Roof Pontoons

a. NA Visually inspect each pontoon for liquid leakage.

b. NA Run a light wire through the gooseneck vents on locked down inspection hatch covers to make sure they are open.

c. NA Inspect lockdown latches on each cover.

d. NA Check and report if each pontoon is:

   NA (1) Vapor tight (bulkhead seal welded on one side on bottom, sides, and top),

   NA (2) Liquid tight (seal welded on bottom and sides only), or

   NA (3) Unacceptable (minimum acceptable condition is liquid tight).

Tank Out-of-Service Inspection Checklist

2.8.3 Floating Roof Cutouts

a. NA Inspect underside of cutouts for mechanical damage.
b. NA Inspect welds for cracks.
c. NA Inspect plate for thinning, pitting, and erosion.
d. NA Measure mixer cutouts and record plate thickness for future mixer installation or replacement.
_______ Plate thickness.

2.8.4 Floating Roof Supports

a. NA Inspect fixed low and removable high floating roof legs for thinning.
b. NA Inspect for notching at bottom of legs for drainage.
c. NA Inspect for leg buckling or felling at bottom.
d. NA Inspect pin hole in roof guide for tears.
e. NA Check plumb of all legs.
f. NA Inspect for adequate reinforcing gussets on all legs through a single portion of the roof.
g. NA Inspect the area around the roof legs for cracking if there is no internal reinforcing pad or if the topside pad is not welded to the deck plate on the underside.
h. NA Inspect the sealing system on the two-position legs and the vapor plugs in the fixed low leg for deterioration of the gaskets.
i. NA On all mounted roof supports, check for adequate clearance based on the maximum floating roof movement as determined by the position of the roof relative to the gauge well and/or counter rotational device.

2.9 FLOATING ROOF SEAL ASSEMBLIES

2.9.1 Primary Shoe Assembly

a. NA Remove four sections of foam log (foam filled seals) for inspection on 90 degree locations.
b. NA Inspect hanger attachment to roof rim for thinning, bending, broken welds, and wear of pin holes.
c. NA Inspect clips welded to roof rim for thinning.
d. NA Shoes: Inspect for thinning and holes in shoes.
e. NA Inspect for bit-metal bolts, clips, and attachments.
f. NA Seal fabric: Inspect for deterioration, stiffening, holes, and tears in fabric.
g. NA Measure length of fabric from top of shoe to roof rim, and check against maximum anticipated annular space as roof operates.
h. NA Inspect any modification of shoes over shell nozzles, mixers, etc., for clearance.
i. NA Inspect shoes for damage caused by striking shell nozzles, mixers, etc.

Tank Out-of-Service Inspection Checklist

2.9.2 Primary Toroidal Assembly

a. NA Inspect seal fabric for wear, deterioration, holes, and tears.
b. NA Inspect hold down system for buckling or bending.
c. X Inspect foam for liquid absorption and deterioration.

2.9.3 Rim Mounted Secondaries

a. NA Inspect the rim-mounted bolting bar for corrosion and broken welds.
b. ✔ Measure and chart seal-to-shell gaps.
c. NA Visually inspect seal from below, looking for holes as evident by light.
d. NA Inspect fabric for deterioration and stiffness.
e. NA Inspect for mechanical damage, corrosion, and wear on tip in contact with shell.
f. NA Inspect for contact with obstructions above top of shell.

2.10 FLOATING ROOF APPURTENANCES

2.10.1 Roof Manways

a. NA Inspect walls of manways for pitting and thinning.
b. NA On tanks with interface autogauges, check seal around gauge tape cable and guide wires through manway cover.
c. NA Inspect cover gasket and bolts.

2.10.2 Rim Vent

a. NA Check rim vent for pitting and holes.
b. NA Check vent for condition of screen.
c. NA On floating roof tanks where the environmental rules require closing off the vent, check the vent pipe for corrosion at the pipe-to-rim joint and check that the blinding is adequate.

2.10.3 Vacuum Breaker, Breather Type

a. NA Service and check operation of breather valve.
b. NA Check that nozzle pipe projects no more than 1/2 inch below roof deck.
c. NA Inspect reinforcing pad and pad welds.

Tank Out-of-Service Inspection Checklist

2.10.4 Vacuum Breaker, Mechanical Type

a. NA Inspect the stem for thinning. Measure how far the vacuum breaker cover is raised off the pipe when the roof is resting on high or low legs.

NA On high legs.

NA On low legs.

2.10.5 Roof Drains: Open Systems, Including Emergency Drains

a. NA Check liquid level inside open roof drains for adequate freeboard. Report if there is insufficient distance between liquid level and top of drain.

b. NA If tank comes under Air Quality Monitoring District rules, inspect the roof drain vapor plug.

c. NA If emergency drain is not at the center of the roof, check that there are at least three emergency drains.

2.10.6 Closed Drain Systems: Drain Basins

a. NA Inspect for thinning and pitting.

b. NA Inspect protective coating (topside).

c. NA Inspect basin cover or screen for corrosion.

d. NA Test operation of check valve.

e. NA Check for presence of check valve where bottom of basin is below product level.

f. NA Inspect drain basin(s) to roof deck welds for cracking.

g. NA Check drain basin(s) outlet pipe for adequate reinforcement to roof deck (including reinforcing pad).

2.10.7 Closed Drain Systems: Fixed Drain Line on Tank Bottom

a. NA Hammer test fixed drain line on tank bottom for thinning and scale/debris plugging.

b. NA Inspect supports and reinforcing pads for weld failures and corrosion.

c. NA Check that pipe is guided, not rigidly locked to supports, to avoid tearing of tank bottom plate.

2.10.8 Closed Drain Systems: Flexible Pipe Drain

a. NA Inspect for damage to exterior of pipe.

b. NA Check for obstructions that pipe could catch on.

c. NA Inspect shields to protect pipe from snagging.

d. NA Inspect results of hydrotest on flexible roof drain system.

Tank Out-of-Service Inspection Checklist

2.10.9 Closed Drain Systems: Articulated Joint Drain

a. NA Hammer test rigid pipe in flexible joint system for thinning and scale/debris plugging.
b. NA Inspect system for signs of bending or strain.
c. NA Inspect results of system hydrotest.
d. NA Inspect landing leg and pad.

2.10.10 Autogauge System and Alarms

a. NA Check freedom of movement of tape through autogauge tape guide.
b. NA Inspect sheaves for freedom of movement.
c. NA Test operation checker.
d. NA Inspect tape and tape cable for twisting and fraying.
e. NA Test the tape's freedom of movement through guide sheaves and tape guide pipe.
f. NA On open-top tanks, check that gate tapes with cables have no more than one foot of tape exposed with float at lowest point.
g. NA Check float for leakage.
h. NA Test float guide wire anchors for spring action by pulling on wire and releasing.
i. NA Inspect floatwells in floating roofs for thinning and pitting of walls just above the liquid level.
j. NA Check that the autogauge tape is firmly attached to the float.
k. NA Inspect the tape cable and float guide wire fabric seals through the float well cover.
l. NA Inspect the bottom guide wire attachment clip. Inspect for a temporary weighted bar instead of a permanent welded down clip.
m. NA Inspect board-type autogauge indicators for legibility and freedom of movement of indicator.
n. NA Measure and record these distances to determine if seal damage will occur if tank is run over:
   ______ (1) From shell top angle to underside of tape guide system.
   ______ (2) From liquid level on floating top to top of secondary seal.
o. NA Identify floating roofs where the tape is connected directly to the roof.
p. NA Overfill alarm: Inspect tank overfill prevention alarm switches for proper operation.

Tank Out-of-Service Inspection Checklist

2.11 COMMON TANK APPURTENANCES

2.11.1 Gauge Well

a. NA Inspect gauge well pipe for thinning at about two-thirds distance above the bottom: look for thinning at the edge of the slots.
b. NA Check for corrosion on the pipe joint. Check that sample cords, weights, thermometers, etc., have been removed from the pipe.
c. NA Check for cone at bottom end of pipe about one foot above the bottom.
d. NA Check condition of well washer pipe and that its flared end is directed at the near side of the hold off pad.
e. NA Check that supports for gauge well are welded to pad or to shell and not directly to bottom plate.
f. NA Check operation of gauge well cover.
g. NA Check presence of a hold-off distance marker in well pipe and record hold-off distance.
_______ Hold-off Distance.
h. NA Identify and report size and pipe schedule, and whether pipe is solid or slotted. Report slot size.
i. NA Check that the hold-off distance plate is seal welded to the bottom and that any gauge well supports are welded to the plate and not directly to the bottom.
j. NA Inspect vapor control float and cable.
k. NA Check for presence and condition of gauge well washer.
l. NA Check for bull plug or plate blind on gauge well washer valve.
m. NA Inspect gage well guide in floating roof for pitting and thinning.
n. NA Inspect the guide rollers and sliding plates for freedom of movement.
o. NA Inspect condition of gauge well pipe seal system.
p. NA On black oil and diesel services: if gauge well is also used for sampling, check for presence of a thief- and gauge-type hatch to avoid spillage.
q. NA Visually inspect inside of pipe for pipe weld protrusions which could catch or damage vapor control float.

2.11.2 Sampling Systems: Roof Sample Hatches

a. NA Inspect roof mounted sample hatches for reinforcing pads and cracking.
b. NA Inspect cover for operation.
c. NA For tanks complying with Air Quality Monitoring District rules, inspect sample hatch covers for adequate sealing.
d. NA Check horizontal alignment of internal floating roof sample hatches under fixed roof hatches.
e. NA Inspect the sealing system on the internal floating roof sample hatch cover.
f. NA Inspect floating roof sample hatch cover recoil reel and rope.

Tank Out-of-Service Inspection Checklist

2.11.3 Shell Nozzles

a. ✔ Inspect shell nozzles for thinning and pitting.
b. NA Inspect hot tap nozzles for trimming of holes.
c. ✔ Identify type of shell nozzles.
d. NA Identify and describe internal piping, including elbow up and elbow down types.

2.11.4 For Nozzles Extended Into the Tank

a. NA Inspect pipe support pads welded to tank bottom.
b. NA Inspect to see that pipe is free to move along support without strain or tearing action on bottom plate.
c. NA Inspect nozzle valves for packing leaks and damaged flange faces.
d. NA Inspect heater steam nozzle flanges and valves for wire cutting.
e. NA Report which nozzles have thermal pressure relief bosses and valves.
f. NA In internal elbow-down fill line nozzles, inspect the wear plate on the tank bottom.
g. NA On elbow-up fill lines in floating roof tanks, check that opening is directed against underside of roof, not against vapor space. Inspect impact area for erosion.

2.11.5 Diffusers and Air Rolling Systems

a. NA Inspect diffuser pipe for erosion and thinning.
b. NA Check holes in diffuser for excessive wear and enlargement.
c. NA Inspect diffuser supports for damage and corrosion.
d. NA Check that diffuser supports restrain, not anchor, longitudinal line movement.
e. NA Inspect air spiders on bottom of lube oil tanks for plugging and damaged or broken threaded joints.

2.11.6 Swing Lines

a. NA Inspect flexible joint for cracks and leaks.
b. NA Scribe the flexible joint across the two moving faces and raise end of swing line to check the joint's freedom of movement, indicated by separation of scribe marks.
c. NA Check that flexible joints over six inches are supported.
d. NA Inspect the swing pipe for deep pitting and weld corrosion.
e. NA Loosen the vent plugs in the pontoons and listen for a vacuum. Lack of a vacuum indicates a leaking pontoon.
f. NA Check the results of air tests on pontoons during repairs.
g. NA Inspect the pontoons for pitting.
h. NA Inspect the pull-down cable connections to the swing.

Tank Out-of-Service Inspection Checklist

i. NA Inspect the condition of the bottom-mounted support, fixed roof limiting bumper or shell mounted limiting bumper for wood condition, weld and bolt corrosion and seal welding to bottom or shell.

j. NA Inspect safety hold-down chain for corrosion and weak links.

k. NA Check that there is a welded reinforcing pad where the chain connects to the bottom.

l. NA If the floating swing in a floating or internal floating roof tank does not have a limiting device preventing the swing from exceeding 60 degrees, measure and calculate the maximum angle possible with the roof on overflow.

   ______ Max. angle on overflow (If the calculated angle exceeds 65 degrees, recommend installation of a limiting bracket.)

m. NA Inspect pull down cable for fraying.

n. NA Inspect for three cable clamps where cable attaches to end of swingline (single-reeved) or to roof assembly (double-reeved). Inspect sheaves for freedom of movement.

o. NA Inspect winch operation and check the height indicator for legibility and accuracy.

p. NA Inspect bottom-mounted sheave assembly at end of pontoon for freedom of rotation of sheave.

q. NA Inspect shell-mounted lower sheave assembly for freedom of rotation of sheave, corrosion thinning and pitting of sheave housing.

r. NA Inspect upper sheave assembly for freedom of movement of sheave.

s. NA Inspect the cable counterbalance assembly for corrosion and freedom of operation.

2.11.7 Manway Heater Racks

a. NA Inspect the manway heater racks for heater welds and bending of the sliding rails.

b. NA Measure and record the length of the heater and length of the rack.

2.11.8 Mixer Wear Plates and Deflector Stands

a. NA Inspect bottom and shell plates and deflector stands.

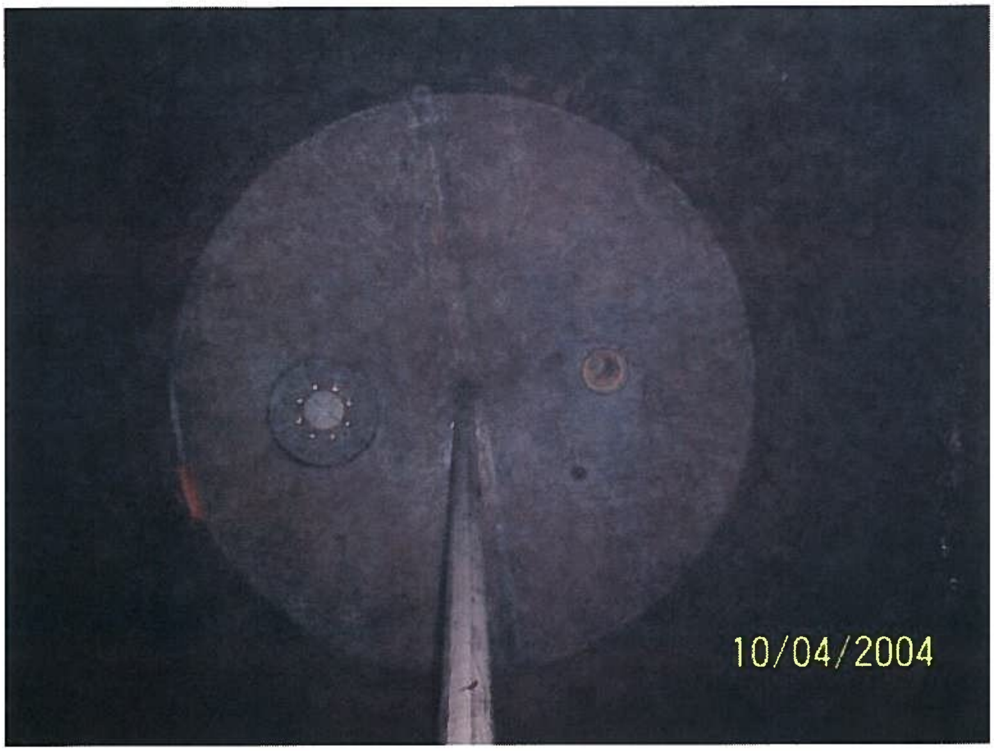
b. NA Inspect for erosion and corrosion on the wear plates. Inspect for rigidity, structural soundness, corrosion and erosion of deck plates and reinforcing pads that are seal welded to the bottom under the deflector stand legs.

c. NA Measure for propeller clearance between the bottom of deflector stand and roof when the roof is on low legs.

2.12 ACCESS STRUCTURES (See In-Service Inspection Checklist sec. 1.6.)

Appendix E

Photographs



Underside of the Fixed Roof

Fixed Roof Support/Gauge Well

Topside of Foam Log Seal

Liquid side of Foam Log Seal

Anchor Bolt and Grounding Cable

Floating Roof Low Position Support

Nozzle "A" Plug

Nozzle "E" Product

TYPE A REPORT
Tank #20
Fuel Farm

DEPARTMENT OF THE ARMY
U.S. ARMY QUARTERMASTER CENTER AND SCHOOL
FORT LEE, VIRGINIA 23801-1801

SEAMAN PETROLEUM LABORATORY ANALYSIS REPORT

Submitting Unit Name/Tel#: Camp Lejeune- Hawthorne Services Inc		
Date sample received: 17 March 2009	Date sample taken: 17 March 2009	Date test started: 17 March 2009
Date test complete: 19 March 2009	Test Level: Modified B-2	Sample Number: bottom sample
Lab Number: Fort Lee Laboratory	Sample taken by: James McConnahey	Product Type: BioDiesel
Sample Source: Tank	Spec Number: ASTM D975	Amount Sample Represents: 15000 gal

SPECIFICATIONS

	Test Name	Min	Max	Results	Status
1	Api Gravity@ °60F	Rpt		34.1	
2	Density, kg/L at 15°C	Rpt		0.8544	
3	ASTM Color				
4	Saybolt Color				
5	Visual Color	Rpt		Amber/Brown	
6a	Workmanship	C&B		Fail	
b	Appearance				
7	Water and Sediment, % vol,		0.05	48.00	
8	Calculated Cetane index	40		48.5	
9	Cetane number				
10a	Distillation: (IBP) REC °C				
b	(10%)REC °C				
c	(20%)REC °C				
d	(50%)REC °C				
e	(90%)REC °C	282	338	334.0	
f	FBP (End Point)REC °C				
g	(Residue)vol %				
h	(Loss)vol %				
11	Sulfur Content		0.05	-0.0044	
12	Flash Pt. °C	52		70.0	
13a	Copper strip corrosion, 2hr @100°C				
b	3hr @50°C		No. 3	No. 2C	
14	Total Acid number, mg KOH/gm				
15	Water Reaction interface. Rating				
16	Fuel system icing inhibitor,%vol.				
17a	Thermal Stability; Change in pressure drop, mm Hg				
b	Heater tube deposit, visual rating				
18	Solvent Washed gum, mg/100ml				
19a	Particulate matter, mg/L,/ Vol.				
b	Filtration Time, minutes				
20	Vapor pressure 38 °C kPa				
21	Viscosity, mm^2/s @100 °C D445				
22	Viscosity, mm^2/s @40 °C D445	1.9	4.1	2.741	
23	Water separation index				
24	Cloud Pt., °C		-5	0	
25	Pour Pt.,°C				
26	Ramsbottom carbon residue on 10% Distillation residue, %mass,				
27	Electric Conductivity, ps/m/Temp F				
28	Ash Content		0.01	0.002	

Product disposition/Remarks:
NSFU- Not Suitable for Use. Product as represented by sample is not suitable for use for items 6a, 7, and 24. Possible cause is Contamination by water and sediment. There was a visible amount of sediment, water, and microbiological growth in the sample. Do not issue. Resample and resubmit.

P.O.C for this memorandum is the undersigned at 804-734-0653

Cox, Danielle B./ SSGT, USMC/ 19 March 2009

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Analytical Report

(consolidated)

WO#: 0904595

Date Reported: 5/5/2009

CLIENT: Applied Technology, Inc.
Collection Date: 4/14/2009 8:15:00 AM
Project: 0727, Camp LeJeune
Lab ID: 0904595-001
Matrix: LIQUID
Client Sample ID 03697-D Tank 20

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
CLIN 6431 WASTE OIL PACKAGE METALS ANALYSIS BY ICP				**SW6010B**		Analyst: **RLG**
Arsenic	ND	0.475		mg/Kg	1	4/23/2009 10:31:30 AM
Cadmium	ND	0.475		mg/Kg	1	4/23/2009 10:31:30 AM
Chromium	ND	0.475		mg/Kg	1	4/23/2009 10:31:30 AM
Lead	ND	0.475		mg/Kg	1	4/23/2009 10:31:30 AM
CLIN 6431 WASTE OIL PACKAGE POLYCHLORINATED BIPHENYLS (PCBS), SOLID				**SW8082**		Analyst: **MIM**
Aroclor 1016	ND	1.04		mg/Kg	1	4/23/2009
Aroclor 1221	ND	1.04		mg/Kg	1	4/23/2009
Aroclor 1232	ND	1.04		mg/Kg	1	4/23/2009
Aroclor 1242	ND	1.04		mg/Kg	1	4/23/2009
Aroclor 1248	ND	1.04		mg/Kg	1	4/23/2009
Aroclor 1254	ND	1.04		mg/Kg	1	4/23/2009
Aroclor 1260	ND	1.04		mg/Kg	1	4/23/2009
Surr: Decachlorobiphenyl	48.4	30-150		%REC	1	4/23/2009
Surr: Tetrachloro-m-xylene	76.4	30-150		%REC	1	4/23/2009
CLIN 6431 WASTE OIL PACKAGE TOTAL ORGANIC HALIDES (TOX)				**SW9076**		Analyst: **CAM**
Total Organic Halides	ND	10.0		mg/Kg	1	4/23/2009
CLIN 6431 WASTE OIL PACKAGE % ASH				**A2540G**		Analyst: **VM**
% Ash	ND	0.500		%	1	4/22/2009 5:20:27 PM
CLIN 6431 WASTE OIL PACKAGE BTU				**ASTM-D24087**		Analyst: **VM**
BTU	5,600	500		BTU/lb.	1	4/22/2009 5:20:27 PM
CLIN 6401 (RCI) CYANIDE, REACTIVE				**SW7.3.3.2**		Analyst: **DR**
Cyanide, Reactive	9.05	6.25		mg/Kg	25	5/4/2009

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
DF	Dilution Factor	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
MDL	Method Detection Limit	ND	Not Detected at the Reporting Limit
PL	Permit Limit	RL	Reporting Detection Limit (PQL)

PRECISION ANALYTICAL, INC

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Analytical Report

(consolidated)

WO#: 0904595

Date Reported: 5/5/2009

CLIENT: Applied Technology, Inc.

Project: 0727, Camp LeJeune

Lab ID: 0904595-001

Client Sample ID 03697-D Tank 20

Collection Date: 4/14/2009 8:15:00 AM

Matrix: LIQUID

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
CLIN 6401 (RCI) FLASHPOINT				**SW1010**		Analyst: **EC**
Ignitability	142	0		°F	1	4/23/2009
CLIN APP 6429 %WATER KARL FISCHER TITRIMETRIC				**ASTM-E203**		Analyst: **ACS**
% Water, Karl Fischer	93.9	0.00500		%	1	4/29/2009 10:05:00 AM
PH, LIQUID				**SW9040B**		Analyst: **EC**
Hydrogen Ion (pH)	4.03	0	H	S.U.	1	4/22/2009 5:06:00 PM
CLIN 6433 SPECIFIC GRAVITY SPECIFIC GRAVITY				**A2710F**		Analyst: **EC**
Specific Gravity	0.84000	0			1	4/23/2009
CLIN 6401 (RCI) SULFIDE, REACTIVE				**SW7.3.4.2**		Analyst: **DR**
Sulfide, Reactive	ND	5.00		mg/Kg	1	5/4/2009
CLIN 6431 WASTE OIL PACKAGE SULFUR BY BOMB				**ASTM-D129**		Analyst: **VM**
Sulfur	ND	0		%	1	4/22/2009 5:20:27 PM

Qualifiers:

- */X Value exceeds Maximum Contaminant Level
- DF Dilution Factor
- H Holding times for preparation or analysis exceeded
- MDL Method Detection Limit
- PL Permit Limit
- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- M Manual Integration used to determine area response
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit (PQL)

APPENDIX C

PHOTO DOCUMENTATION

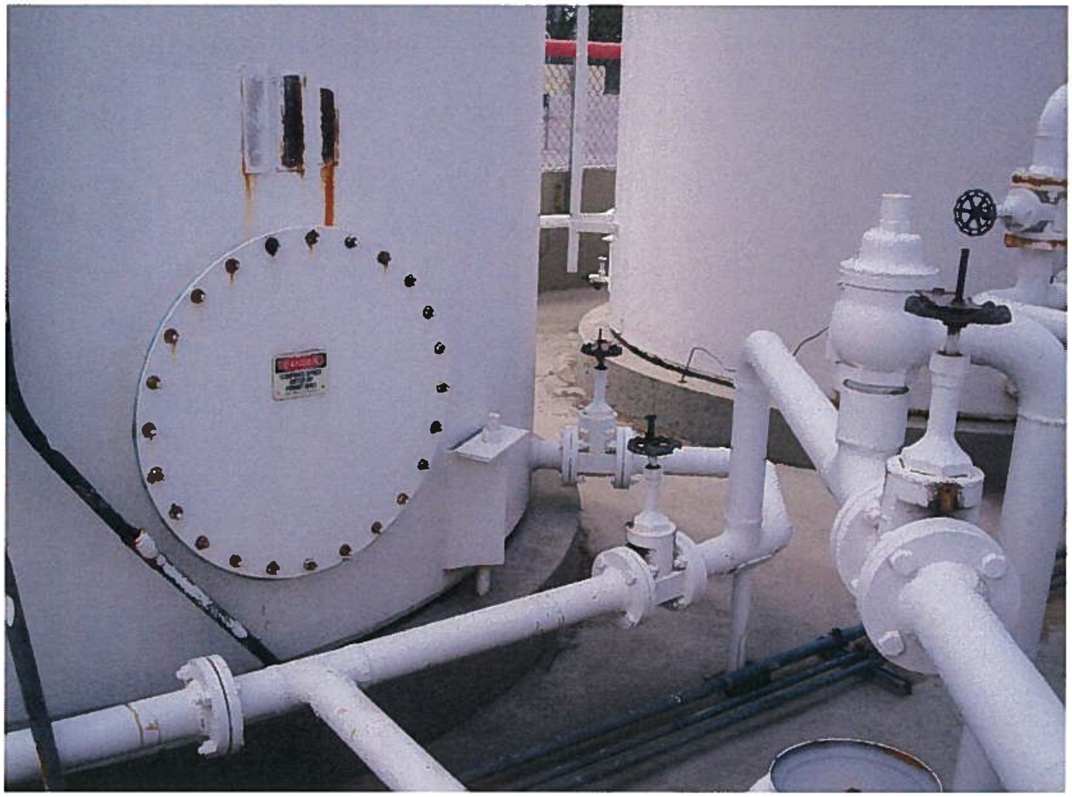


Photo 1; Lower man way and associated AST piping.

Photo 2; Decanting nuisance water from bottom of tank for disposal at EMD.

Photo 3; Transfer of contaminated fuel to tanker for transport to recycle center.

Photo 4; Sludge remaining after fuel removed from the AST.

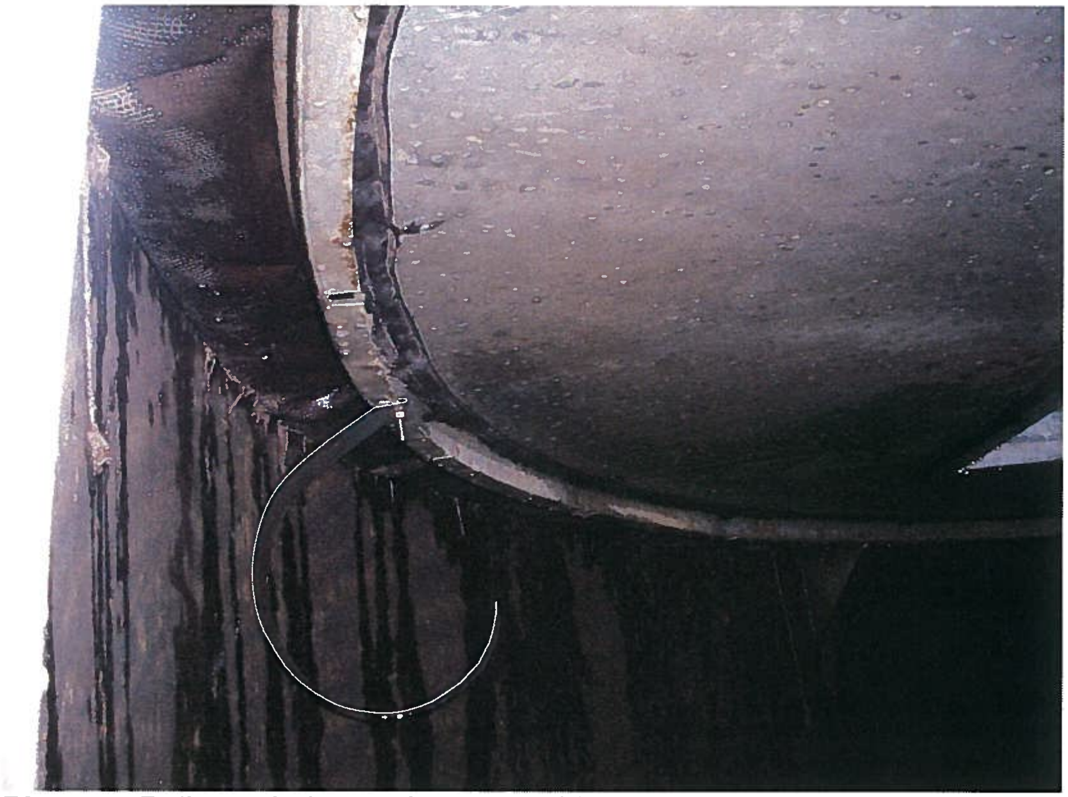


Photo 5; Built up sludge on foam log of floating roof prior to cleaning.

Photo 6; AST cleaning materials, dosage 4 gallons Simple Green to 100 gallons clean water.

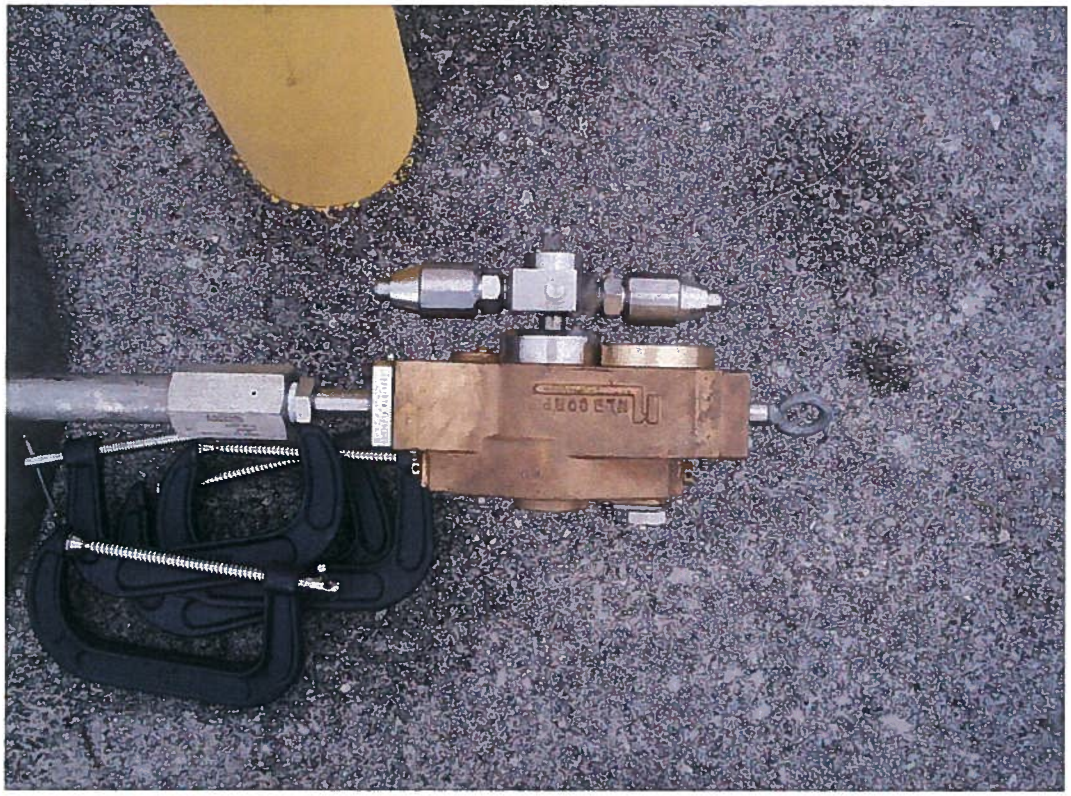


Photo 7; Hydro blaster rotating head and spray nozzle assembly.

Photo 8; Man way mounting plate and spray nozzle assembly.

Photo 9; Final preparations for cleaning lower portion of AST.

Photo 10; Gaining access to upper potion of AST for cleaning.

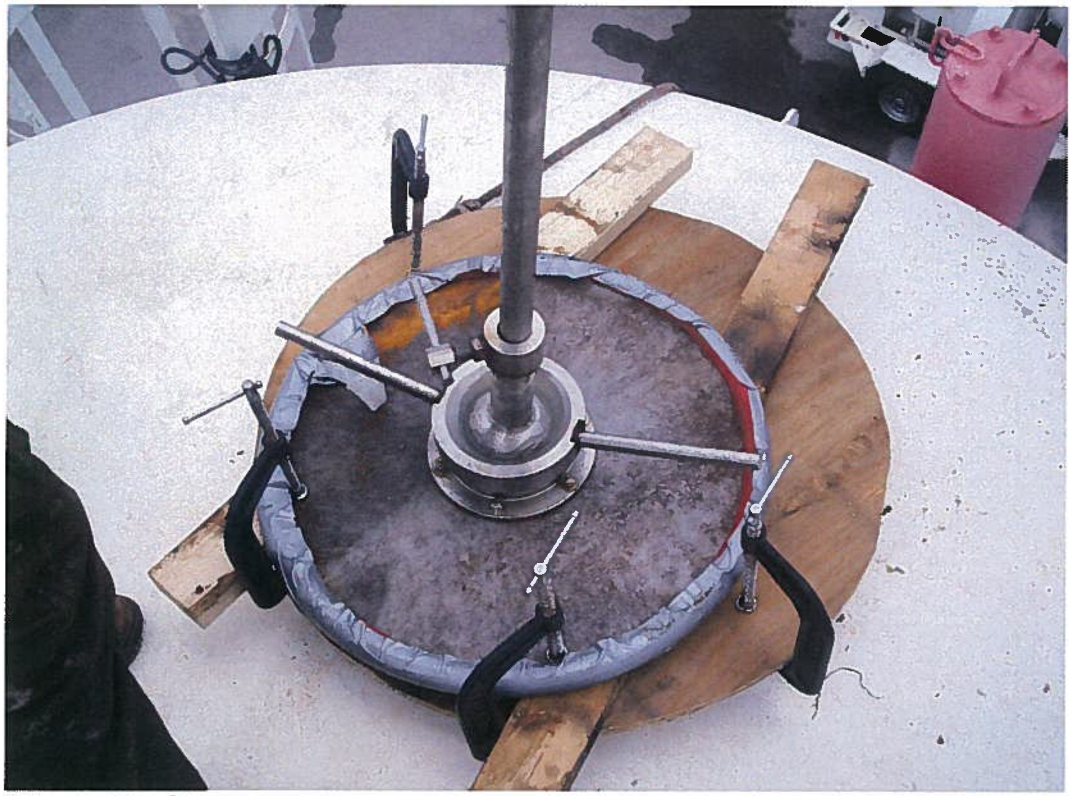


Photo 11; Cleaning apparatus mounted to upper man way.

Photo 12; Emulsification of residual bio-diesel and cleaning solution.

Photo 13; Triple application of cleaning solution in progress.

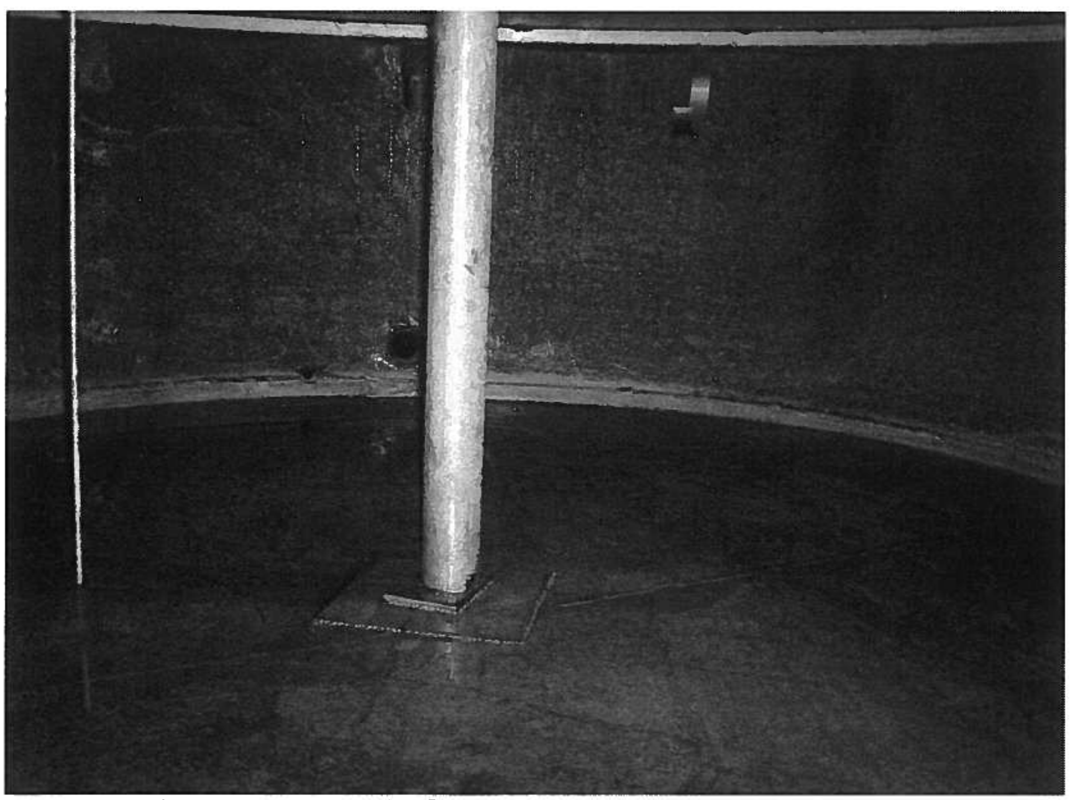
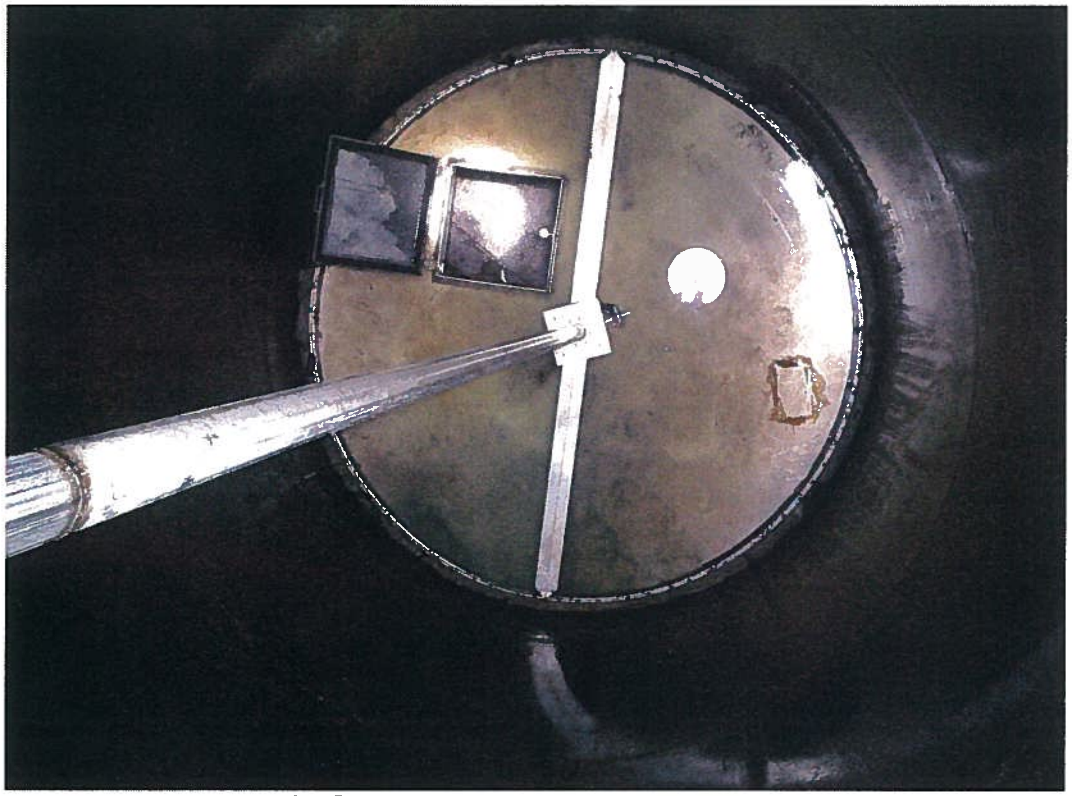


Photo 14; Lower portion of AST after cleaning completed.



<u>Photo 15;</u> Portion of AST above floating roof after cleaning completed. (looking down from above)

<u>Photo 16;</u> Completion of cleaning with installation of man ways using new gaskets and new nuts and bolts