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Underground Storage Tanks (UST's) Metal Integrity and Lining Inspections

Understanding the Inspection Process for Owners and Operators

Presented By:
Robert L. McChan II
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Genesis Environmental Solutions, Inc.
8422 South 7 Highway
Blue Springs, MO 64014

Introduction
Robert (Bob) McChan

- ✓ Involved with Underground Storage Tanks (UST's) and Aboveground Storage Tanks (AST's) for more than 25 years;
- ✓ Inspection, Maintenance, Repair, Installation, Removal, Lining Inspections, Lining Applications, Tank Systems and Piping, Regulatory Compliance,
- ✓ American Petroleum Institute (API) 653 Tank Inspector
- ✓ Steel Tank Institute (STI) Level II Tank Inspector (Former)
- ✓ Kansas and Arkansas - UST certified Installation and Removal

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Presentation Overview

- Regulations and Standards
- Worker Qualifications
- Tank Inspection Requirements
- Tank Inspection Processes
- Tank Lining Requirements
- Tank Lining Application
- Summary
- Questions

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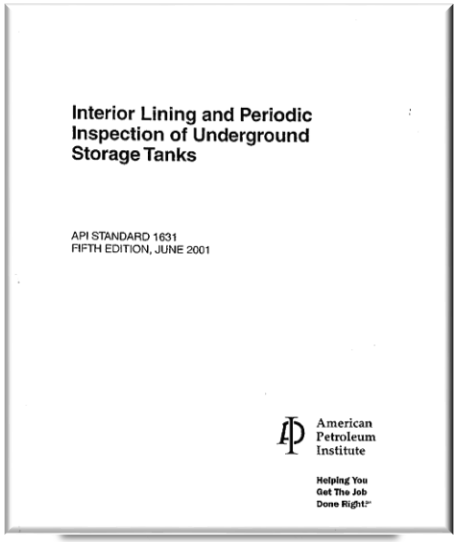
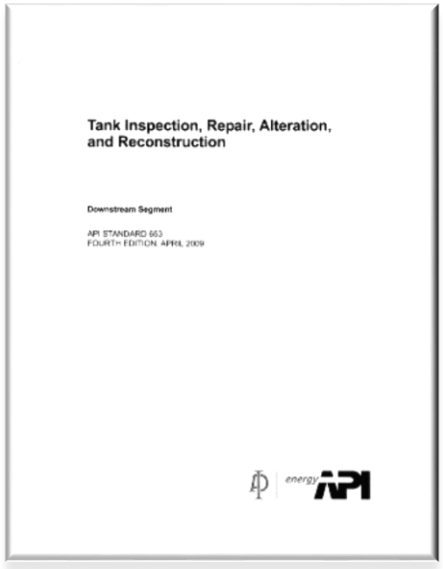
Inspection Guidelines

- Underground Storage Tanks - American Petroleum Institute (API) Standard 1631
- Aboveground Storage Tanks (up to 30 feet diameter) Steel Tank Institute SP001
- Aboveground Storage Tanks > 30 foot diameter – American Petroleum Institute (API) Standard 653





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Worker Qualifications

Occupational Safety and Health Administration (OSHA) Requirements

- 29 CFR 1910.120 Hazardous Waste Operations
- 29 CFR 1910.1200 Hazard Communication
- 29 CFR 1910.146 Permit Required Confined Space
- 29 CFR 1910.147 Energy Isolation (Lockout/Tag out)
- 29 CFR 1910.134 Respiratory Protection

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INSPECTIONS

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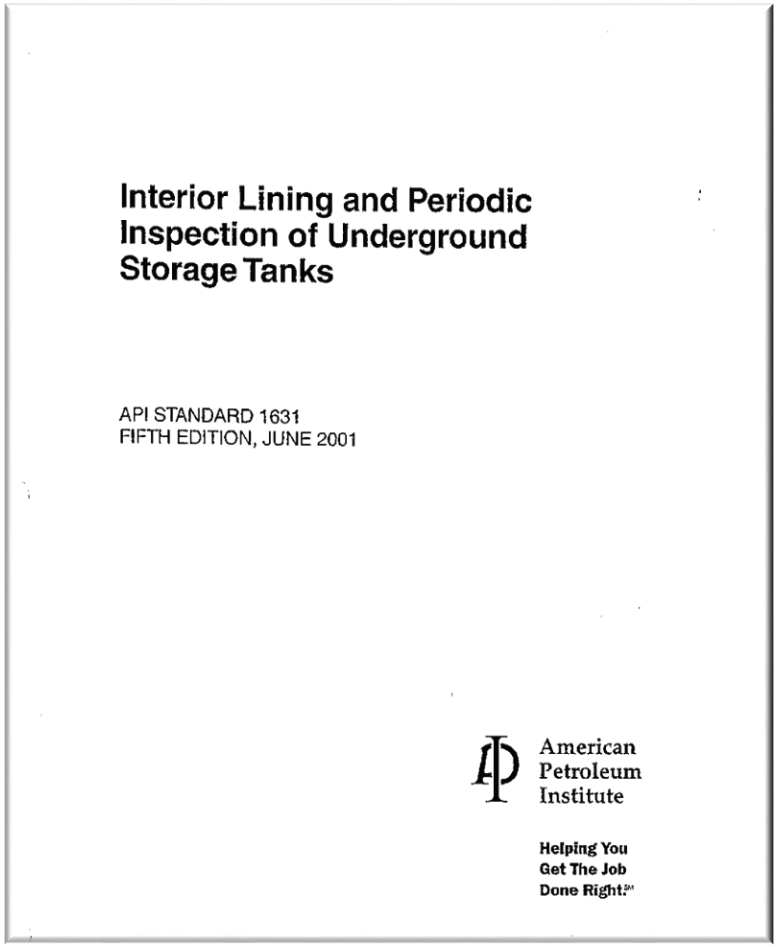
API 1631 – Interior Lining and Periodic Inspection of Underground Storage Tanks



- Section 1 – General
- Section 2 – References
- Section 3 - Definitions
- Section 4 - Objectives, Requirements and Specifications
- Section 5 – Preparation for Opening the Tank
- Section 6 – Tank Entry
- Section 7 – Preparation of the Tank Interior
- Section 8 – Application of Lining

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Un-Lined Steel Tank Inspections Section 7.3 – Tank Inspection

- 7.3.1 General
- 7.3.1.1- 7.3.1.2 - 7.3.1.3 Confined Space Entry Requirements
- 7.3.2 Lighting Equipment
- 7.3.3 Steel Tanks
- 7.3.3.1 For steel tanks, the inspection shall identify those areas where corrosion has taken place and metal thickness has been reduced to 1/8 in. (0.32 cm) or less. Corrosion may take the form of uniform metal loss (general deterioration of a surface area) or may leave a pitted appearance (irregular surface deterioration). Uniform corrosion may be difficult to detect and may require the use on nondestructive techniques, in addition to destructive methods described below, to ensure metal thickness of at least 1/8 in. (0.32 cm).

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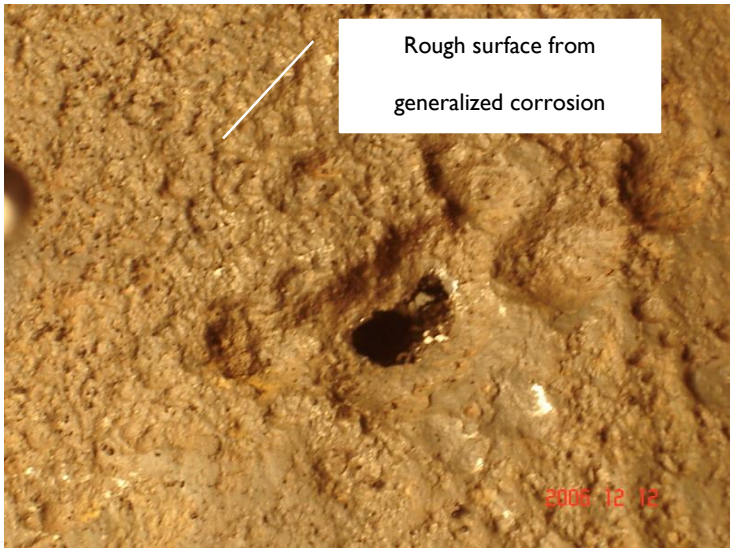
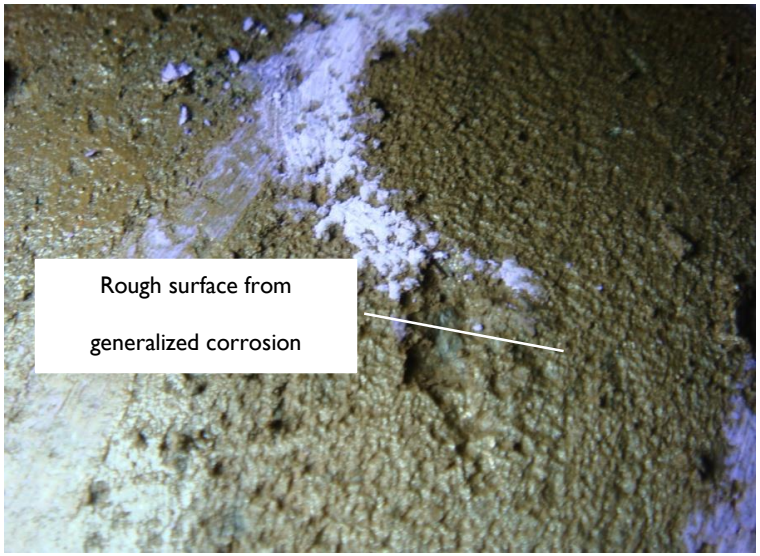
Un-Lined Steel Tank Inspections
Section 7.3 – Tank Inspection (Cont.)

- 7.3.3.2 Pitted surfaces may be difficult to detect when there is a question about original metal thickness. As a result, thickness determinations in non-pitted areas are also necessary to establish an original thickness benchmark for comparisons with the pitted areas. Metal thickness determinations can be made by either destructive or nondestructive methods. Nondestructive metal thickness determinations may be made by ultrasonic or radiographic testing methods.





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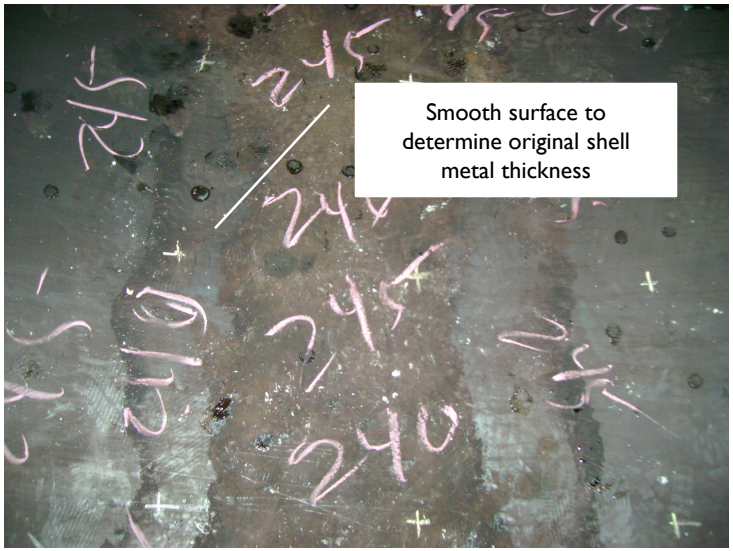
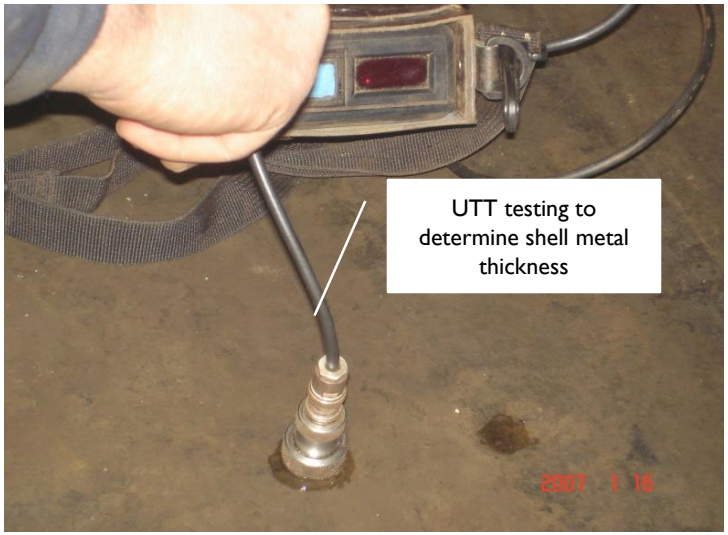
Non Destructive Testing Method – Ultrasonic Thickness Testing to Determine Original Shell Thickness





Un-Lined Steel Tank Inspections
Section 7.3 – Tank Inspection (Cont.)

- 7.3.3.3 A destructive test method involves the use of a brass ball-peen hammer to tap the entire shell (a minimum of one tap in every 1 ft^2 (0.093 m^2) area and sound for thin areas. If a thin area is detected, the metal should be holed with the hammer or a drill to determine the metal thickness. The thin metal shall be removed until a minimum metal thickness on 1/8 in. (0.32 cm) at the edge of the hole is obtained. This method is often used to inspect underground tanks because corrosion typically takes the form of pitting rather that deterioration over the surface.

- Note: It may be preferable to conduct wire brushing or abrasive grit blasting (SSPC SP7 and SP10) of the internal surface of a tank prior to inspection.

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Pit Depth Determinations

What is a pit?
What does it look like?
What are we looking for?
How do we measure?

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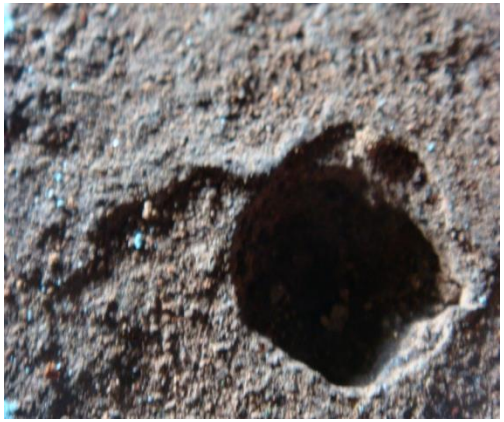
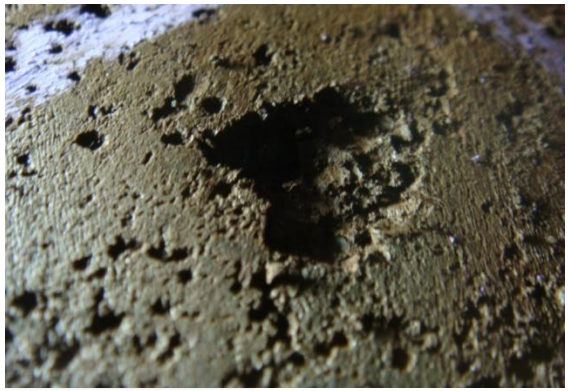
A pit is an area in a tank where corrosion has taken place in a single area or spot. Pits take on different looks, shapes, depths:



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What do we look for?

For steel tanks, the inspection shall identify those areas where corrosion has taken place and metal thickness has been reduced to 1/8 in. (0.32 cm) or less

How are pits measured? Pit Gauges

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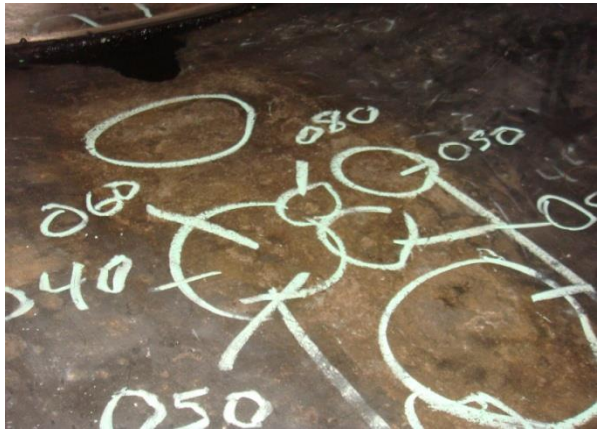
Once the pits are measured, marked and recorded they are compared to the original tank metal thickness to determine whether any exceed the requirements.



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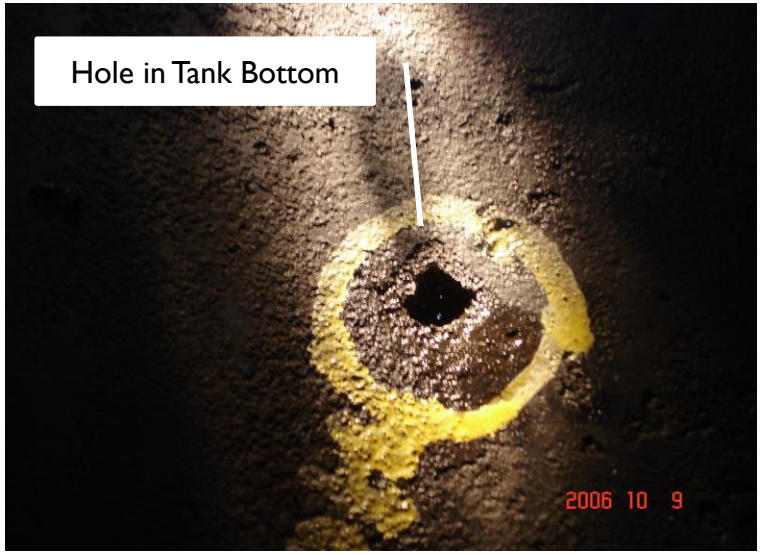
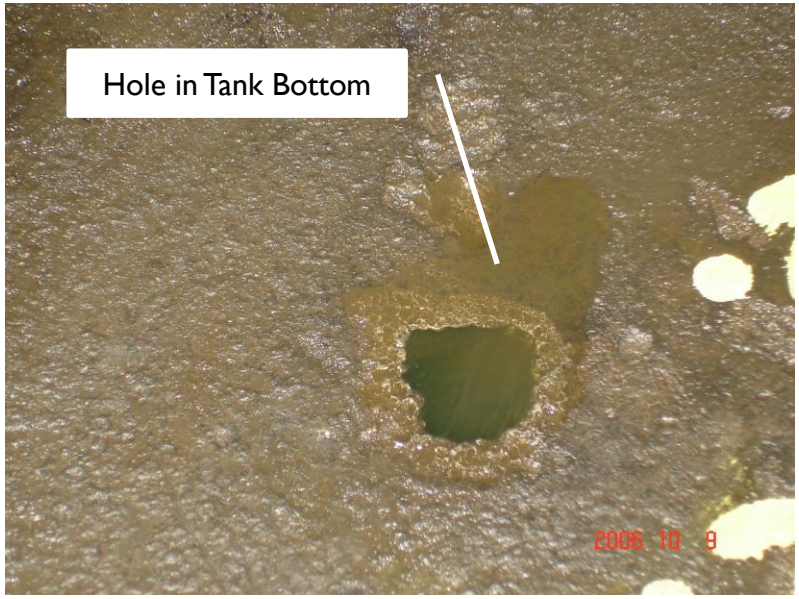
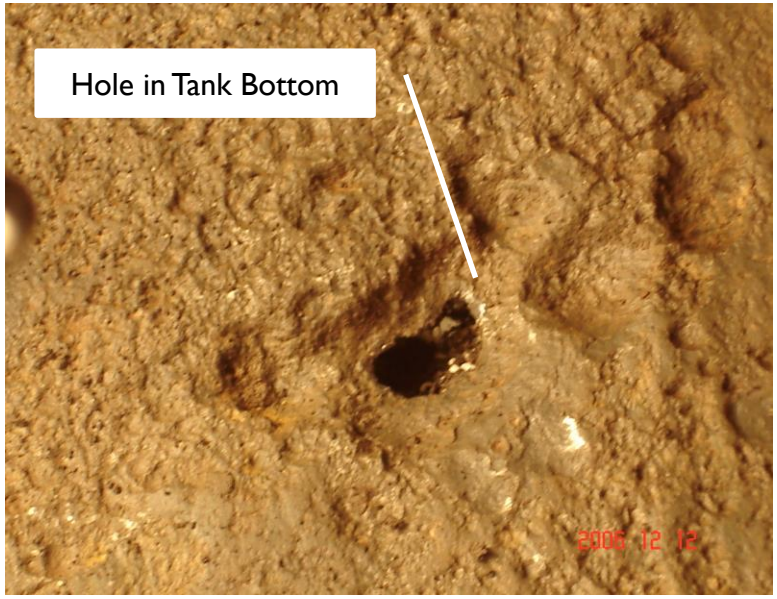
What if we find holes in the tank shell?

Can it still be lined?







7.3.3.4 The following guidelines shall be used to identify a steel tank that is SUITABLE for lining:

a. A tank with a perforation no larger than 1 ½ in. (3.81 cm) in diameter, except under the gauging opening where the perforation may be no larger than 2 ½ in. (6.35 cm) in diameter.
b. A tank with less than 5 perforations [none larger than ½ in. (1.27 cm) diameter] in a 1 ft^2 (0.093 m^2) area.
c. A tank with less than 20 perforations [none larger than ½ in. (1.27 cm) in diameter] in a 500 ft^2 (46.45 m^2) area.

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7.3.3.5 Steel tanks that exceed any of the guidelines in this section shall not be interior lined unless approved by the tank owner and the authority that has jurisdiction. To determine adherence to these guidelines, perforations shall be brass ball peen hammered (before any abrasive blasting) to remove any thin metal and to obtain structurally sound edges. Perforations shall be reamed until the metal thickness at the edges of the holes is a minimum of 1/8 in. (0.032 cm). Steel tanks meeting the criteria set forth in 7.3.2 shall be prepared as described in 7.4.1.

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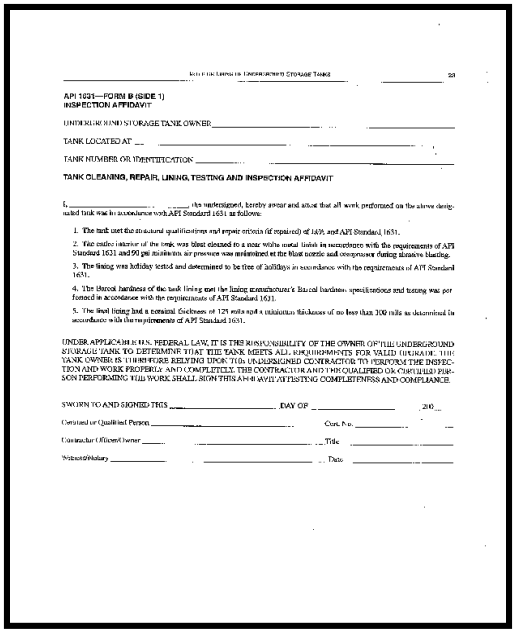
API 1631 Form B (Side 1) -Tank Cleaning, Repair, Lining, Testing and Inspection Affidavit

API 1631 Form B (Side 2) -Tightness Test Certification /Material and Performance Certification

API 1631 Form C – Tank Re-Inspection Affidavit / Tightness Test Certification



API 1631—FORM B (SIDE 1)
INSPECTION AFFIDAVIT

UNDERGROUND STORAGE TANK OWNER _____

TANK LOCATED AT _____

TANK NUMBER OR IDENTIFICATION _____

TANK CLEANING, REPAIR, LINING, TESTING AND INSPECTION AFFIDAVIT

I, _____, the undersigned, hereby swear and attest that all work performed on the above designated tank was in accordance with API Standard 1631 as follows:

1. The tank met the structural qualifications and repair criteria (if repaired) of API, and API Standard, 1631.
2. The entire interior of the tank was blast cleaned to a near white metal finish in accordance with the requirements of API Standard 1631 and 90 psi minimum air pressure was maintained at the blast nozzle and compressor during abrasive blasting.
3. The lining was holiday tested and determined to be free of holidays in accordance with the requirements of API Standard 1631.
4. The Barcol hardness of the tank lining met the lining manufacturer's Barcol hardness specifications and testing was performed in accordance with the requirements of API Standard 1631.
5. The final lining had a nominal thickness of 125 mils and a minimum thickness of no less than 100 mils as determined in accordance with the requirements of API Standard 1631.

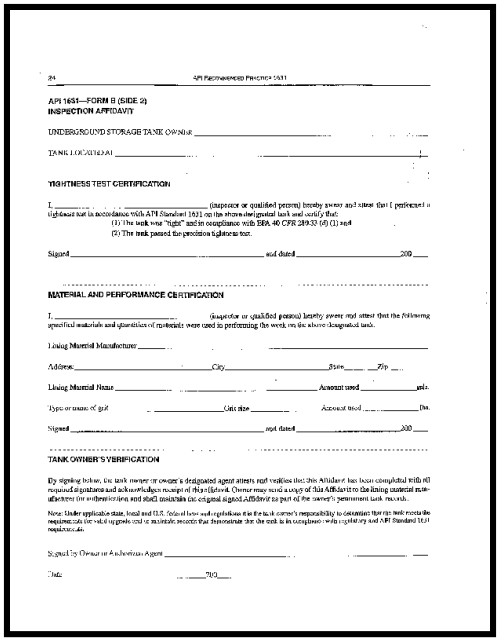
UNDER APPLICABLE LAWS, FEDERAL LAW, IT IS THE RESPONSIBILITY OF THE OWNER OF THE UNDERGROUND STORAGE TANK TO DETERMINE THAT THE TANK MEETS ALL REQUIREMENTS FOR VALID TANK OR LINING. THE TANK OWNER IS THEREFORE RELYING UPON THE UNDERSIGNED CONTRACTOR TO PERFORM THE INSPECTION AND WORK PROPERLY AND COMPLETELY. THE CONTRACTOR AND THE QUALIFIED OR CERTIFIED PERSON PERFORMING THE WORK SHALL SIGN THIS AFFIDAVIT ATTESTING COMPLETENESS AND COMPLIANCE.

SWORN TO AND SIGNED THIS _____ DAY OF _____ 200__

Certified or Qualified Person _____ Cert. # o. _____

Contractor Officer/Owner _____ Title _____

Notary Public _____ Date _____



API 1631—FORM B (SIDE 2)
INSPECTION AFFIDAVIT

UNDERGROUND STORAGE TANK OWNER _____

TANK LOCATED AT _____

TIGHTNESS TEST CERTIFICATION

I, _____ (inspector or qualified person) hereby swear and attest that I performed a tightness test in accordance with API Standard 1631 on the above designated tank and certify that:
(1) The tank was "tight" and in compliance with EPA 40 CFR 280.43 (d) (1) and
(2) The tank passed the precision tightness test.

Signed _____ and dated _____ 200__

MATERIAL AND PERFORMANCE CERTIFICATION

I, _____ (inspector or qualified person) hereby swear and attest that the following specified materials and quantities of materials were used in performing the work on the above designated tank.

Lining Material Manufacturer _____

Address _____ City _____ State _____ Zip ____

Lining Material Name _____ Amount used _____ gals.

Type or name of grit _____ Grit size _____ Amount used _____ lbs.

Signed _____ and dated _____ 200__

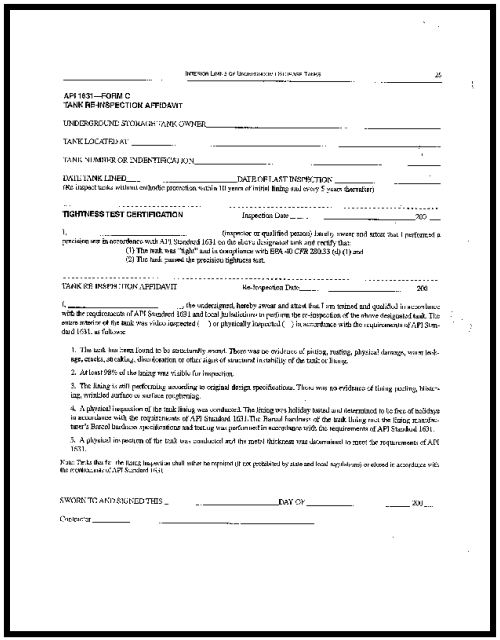
TANK OWNER'S VERIFICATION

By signing below, the tank owner or owner's designated agent attests and verifies that this Affidavit has been completed with all required signatures and acknowledges receipt of this Affidavit. Owner may send a copy of this Affidavit to the lining material manufacturer for authentication and shall maintain the original signed Affidavit as part of the owner's permanent tank records.

Note: Under applicable state, local and U.S. federal laws each regulations it is the tank owner's responsibility to determine that any tank meets the requirements and the valid upgrade and/or materials records that demonstrate that the tank is in compliance with regulatory and API Standard 1631 requirements.

Signed by Owner or Authorized Agent _____

Date _____, 200__



API 1631—FORM C
TANK RE-INSPECTION AFFIDAVIT

UNDERGROUND STORAGE TANK OWNER _____

TANK LOCATED AT _____

TANK NUMBER OR IDENTIFICATION _____

DATE TANK LINED _____ DATE OF LAST INSPECTION _____
(Re-inspect tanks without cathodic protection within 10 years of initial lining and every 5 years thereafter)

TIGHTNESS TEST CERTIFICATION Inspection Date __ __ _____ 200 __

I, _____ (inspector or qualified person) hereby swear and attest that I performed a precision test in accordance with API Standard 1631 on the above designated tank and certify that:
(1) The tank was "tight" and in compliance with EPA 40 CFR 280.43 (d) (1) and
(2) The tank passed the precision tightness test.

TANK RE-INSPECTION AFFIDAVIT Re-Inspection Date_____ _____ 200

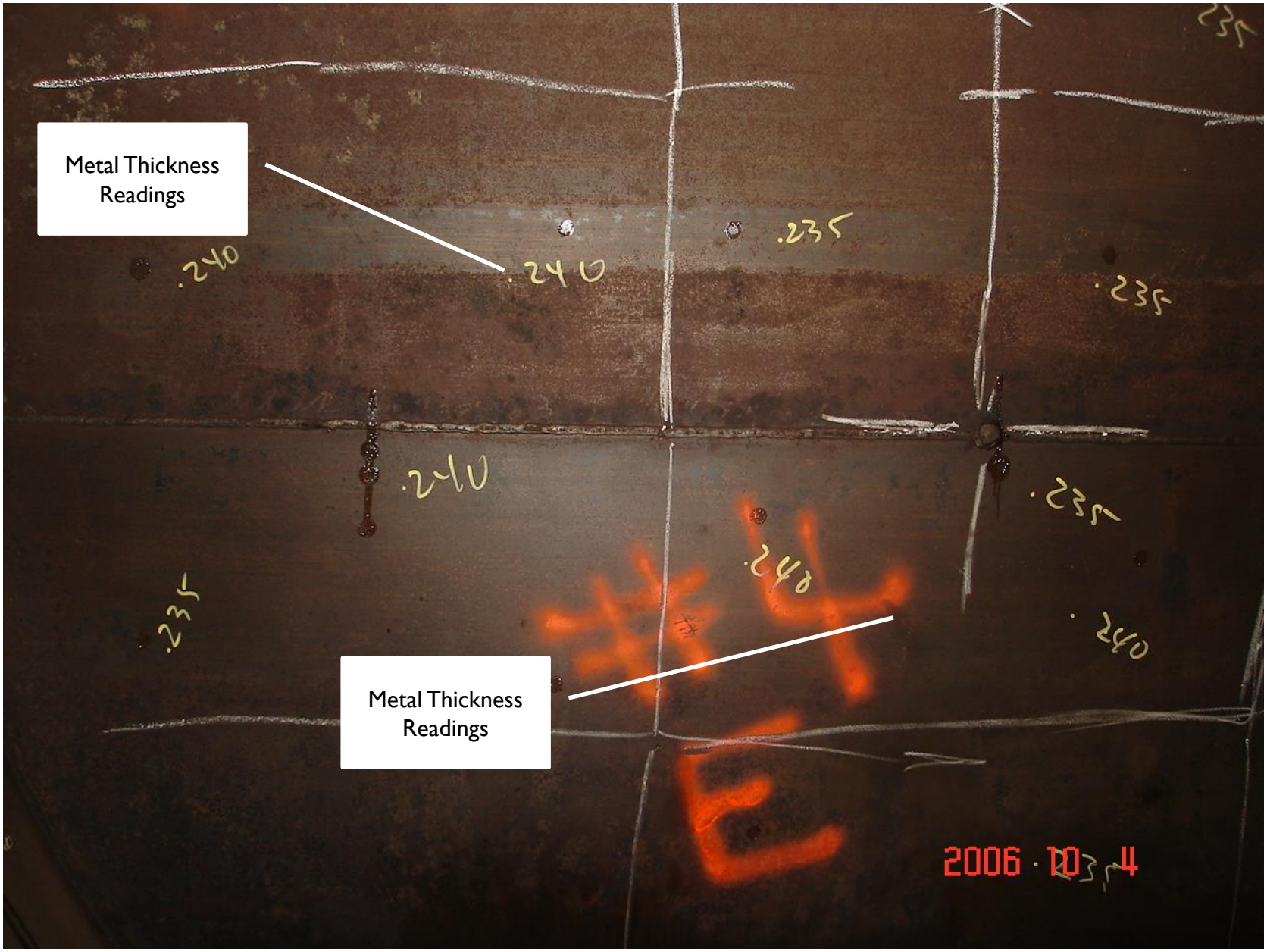
I, _____, the undersigned, hereby swear and attest that I am trained and qualified in accordance with the requirements of API Standard 1631 and local jurisdictions to perform the re-inspection of the above designated tank. The entire interior of the tank was (also inspected ( ) or physically inspected ( ) in accordance with the requirements of API Standard 1631, as follows:

1. The tank has been found to be structurally sound. There was no evidence of pitting, rusting, physical damage, worn welds, cracks, sidewalling, distortion or other signs of structural instability of the tank or lining.
2. At least 98% of the lining was visible for inspection.
3. The lining is still performing according to original design specifications. There was no evidence of lining peeling, bisecting, exhibited surface or surface roughening.
4. A physical inspection of the tank lining was conducted. The lining was holiday tested and determined to be free of holidays in accordance with the requirements of API Standard 1631. The Barcol hardness of the tank lining met the lining manufacturer's Barcol hardness specifications and testing was performed in accordance with the requirements of API Standard 1631.
5. A physical inspection of the tank was conducted and the metal thickness was determined to meet the requirements of API 1631.

Note: Tanks that fail the initial inspection shall either be repaired (if not prohibited by state and local regulations) or closed in accordance with the requirements of API Standard 1631.

SWORN TO AND SIGNED THIS _____ DAY OF _____ 200__

Owner or _____


Metal Thickness Readings
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Metal Thickness Readings
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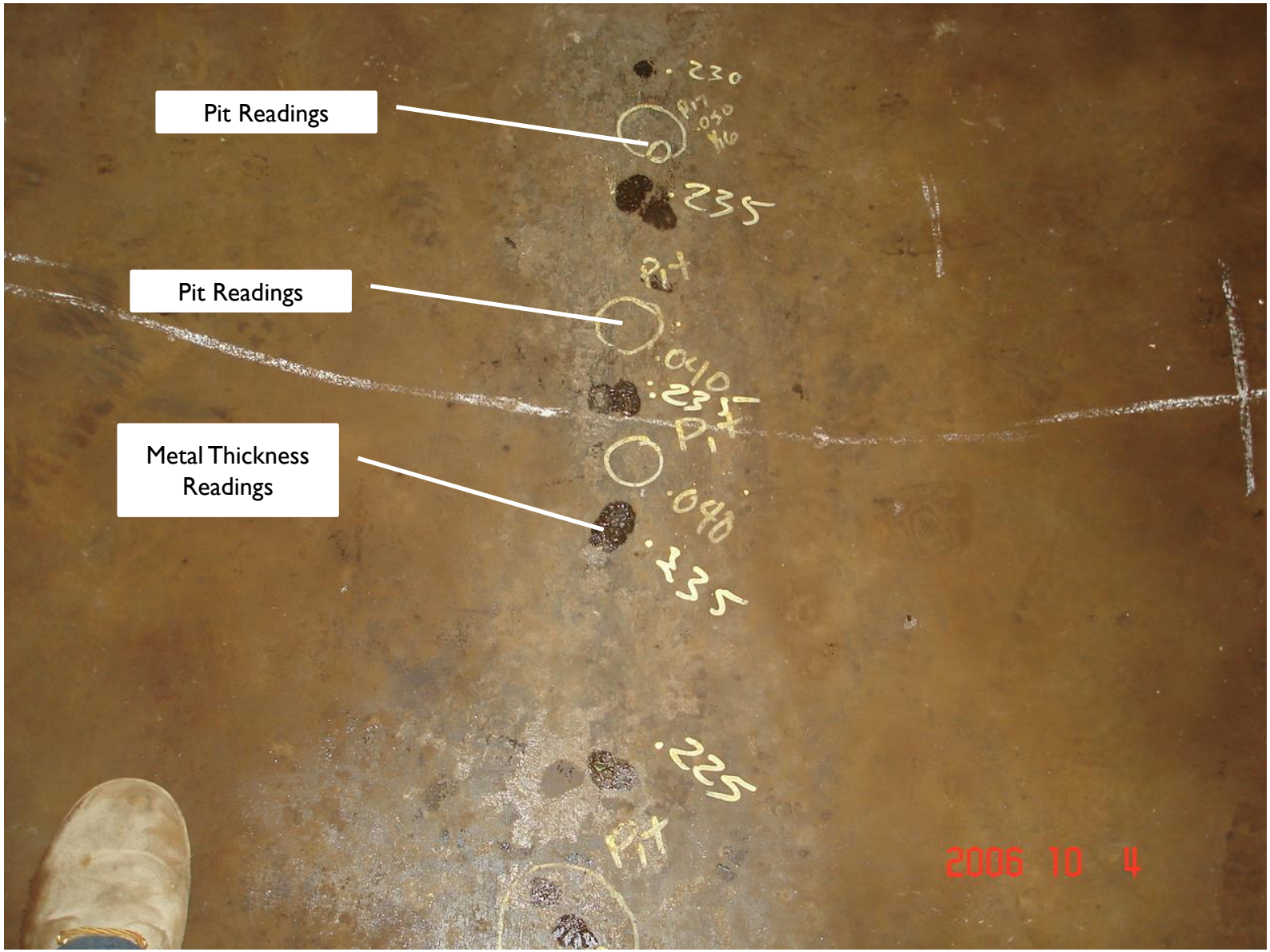

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245
240
245
240

Lining Inspections

Lining inspection are conducted following the guidelines outlined in API 1631 Section 10.4, Paragraph 10.4.3.

- The tank lining is visually inspected for evidence of peeling, blistering, wrinkled surface or surface roughening of the lining material.
- In addition the inspector visually inspects for pitting, rusting, physical damage, water leakage, cracks, streaking, discoloration or other signs of structural instability.
- All areas discovered are marked, noted and photographed.

After the completion of the visual inspection the lining thickness is assessed.

- We utilize a "Elcometer 456" coating thickness gauge to determine existing lining thickness.
- All areas of the lining that do not meet the thickness requirements as outlined in API 1631 Section 8.2 "Lining Requirements", paragraph 8.2.4, (minimum 100 mils with a nominal 125 mils) are noted.

A Barcol Hardness test is then conducted on the lining material to determine material hardness and that it not beginning to soften or has improper curing.

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Elcometer 456 Coating Thickness Gauge

Cygnus 2 Ultrasonic Metal Thickness Tester


72.1
24


.240
.245
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.230
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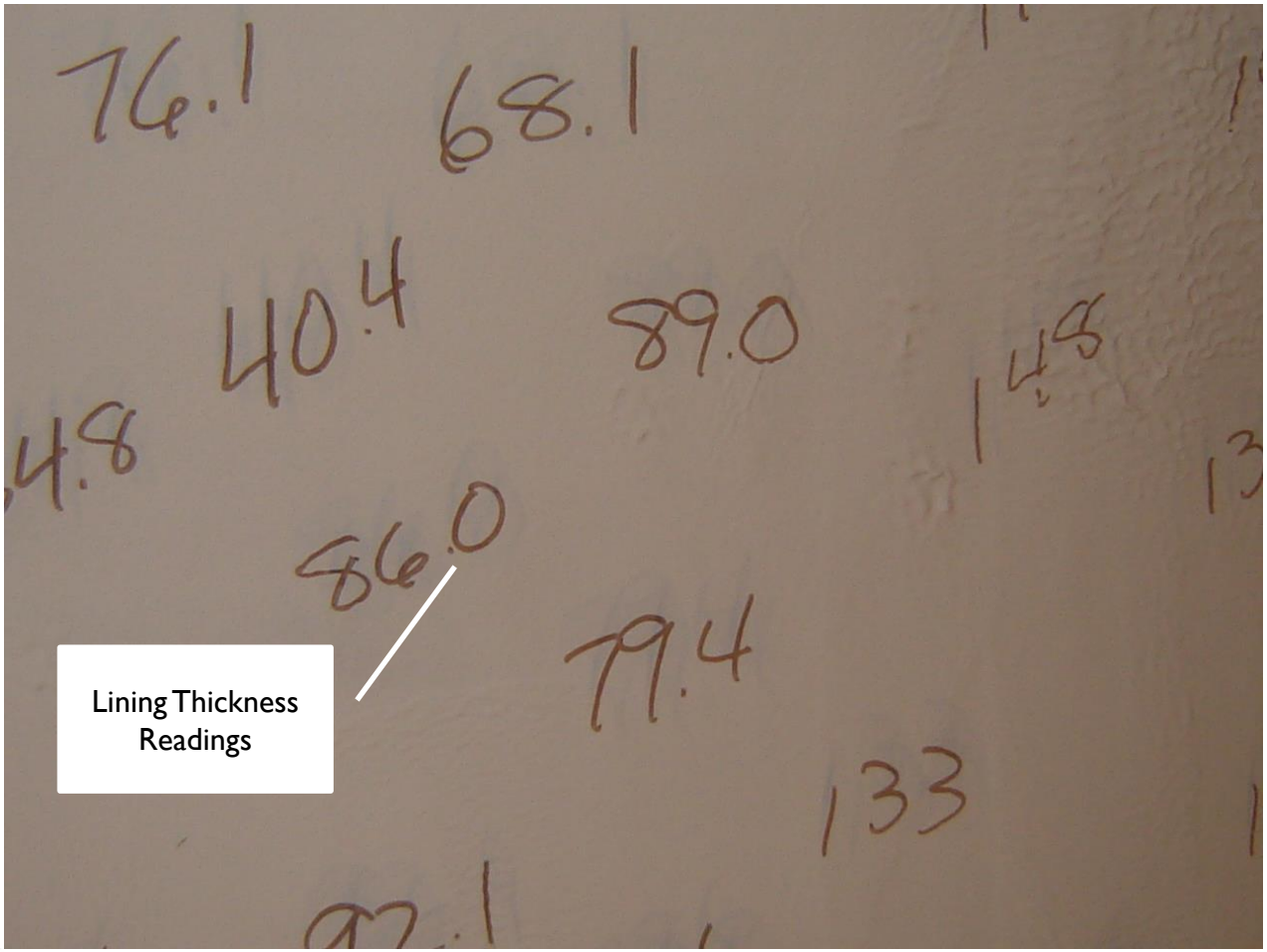
This Tank Fails !!

Lining thickness less than the required minimum 100 mil and nominal 125 mil thickness



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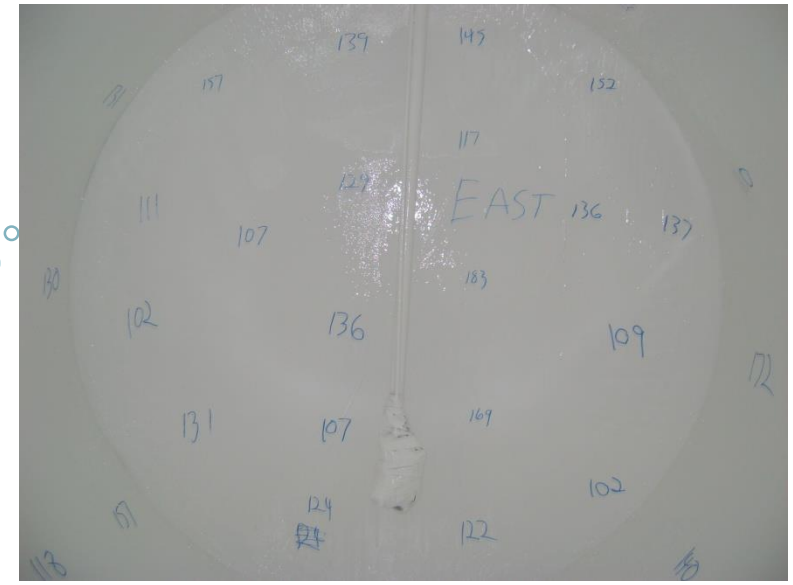
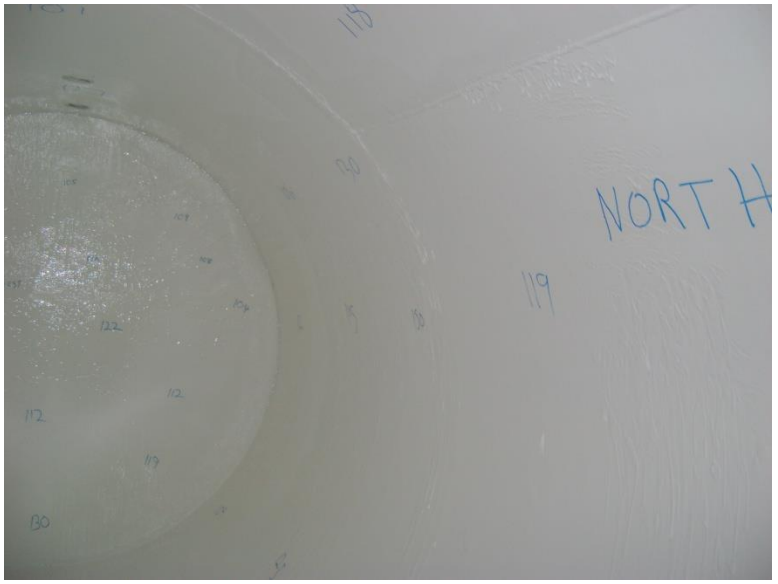
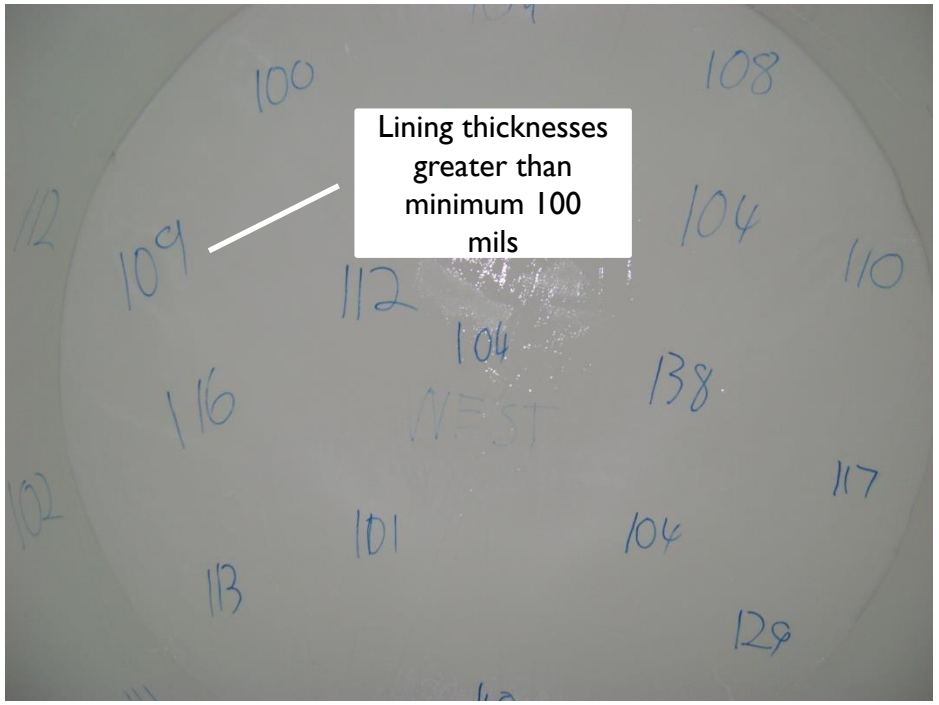




This Tank Passes



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Lining Inspections
What we don't want to find !!!

- The tank lining is visually inspected for evidence of peeling, blistering, wrinkled surface or surface roughening of the lining material.

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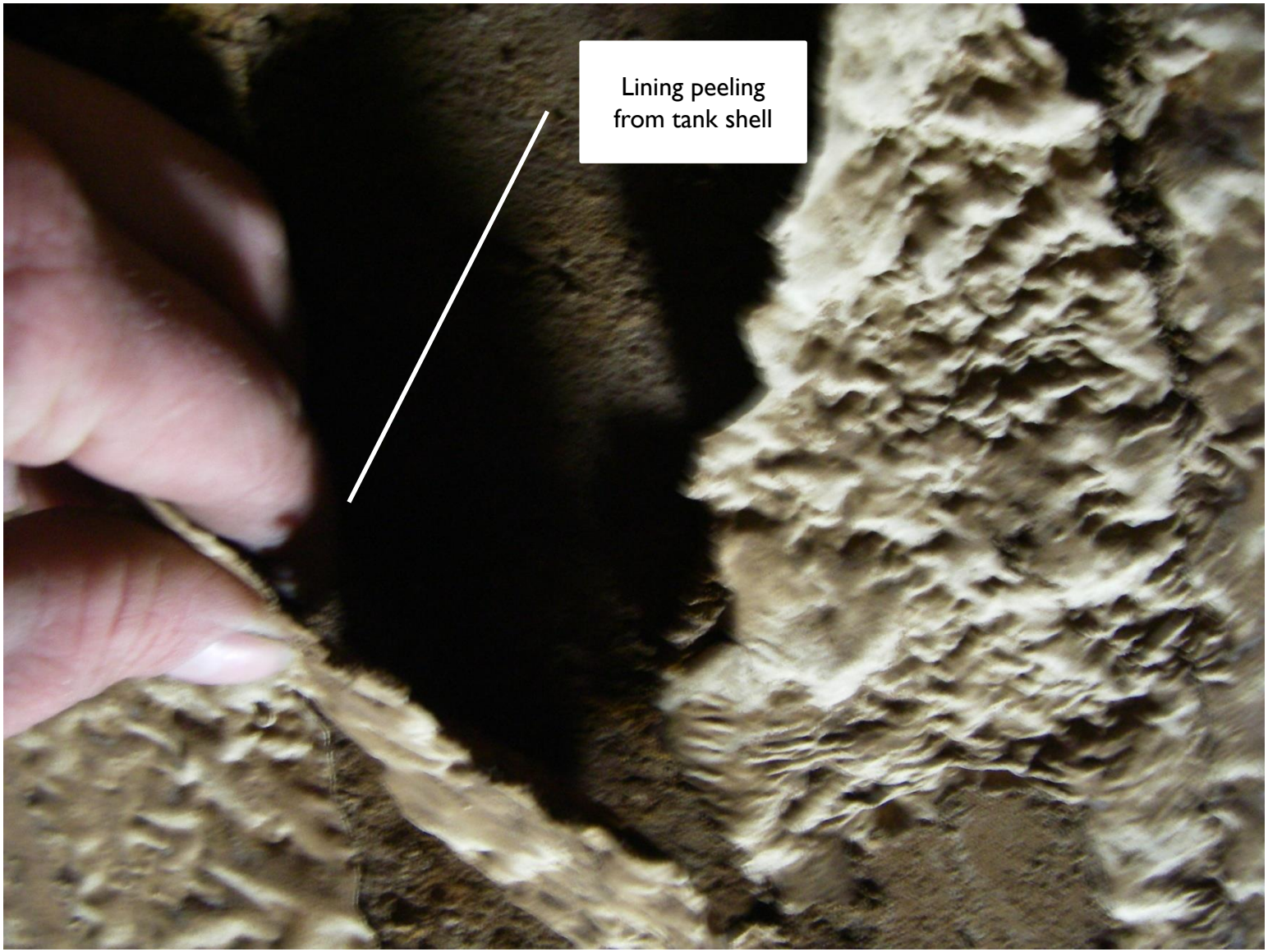

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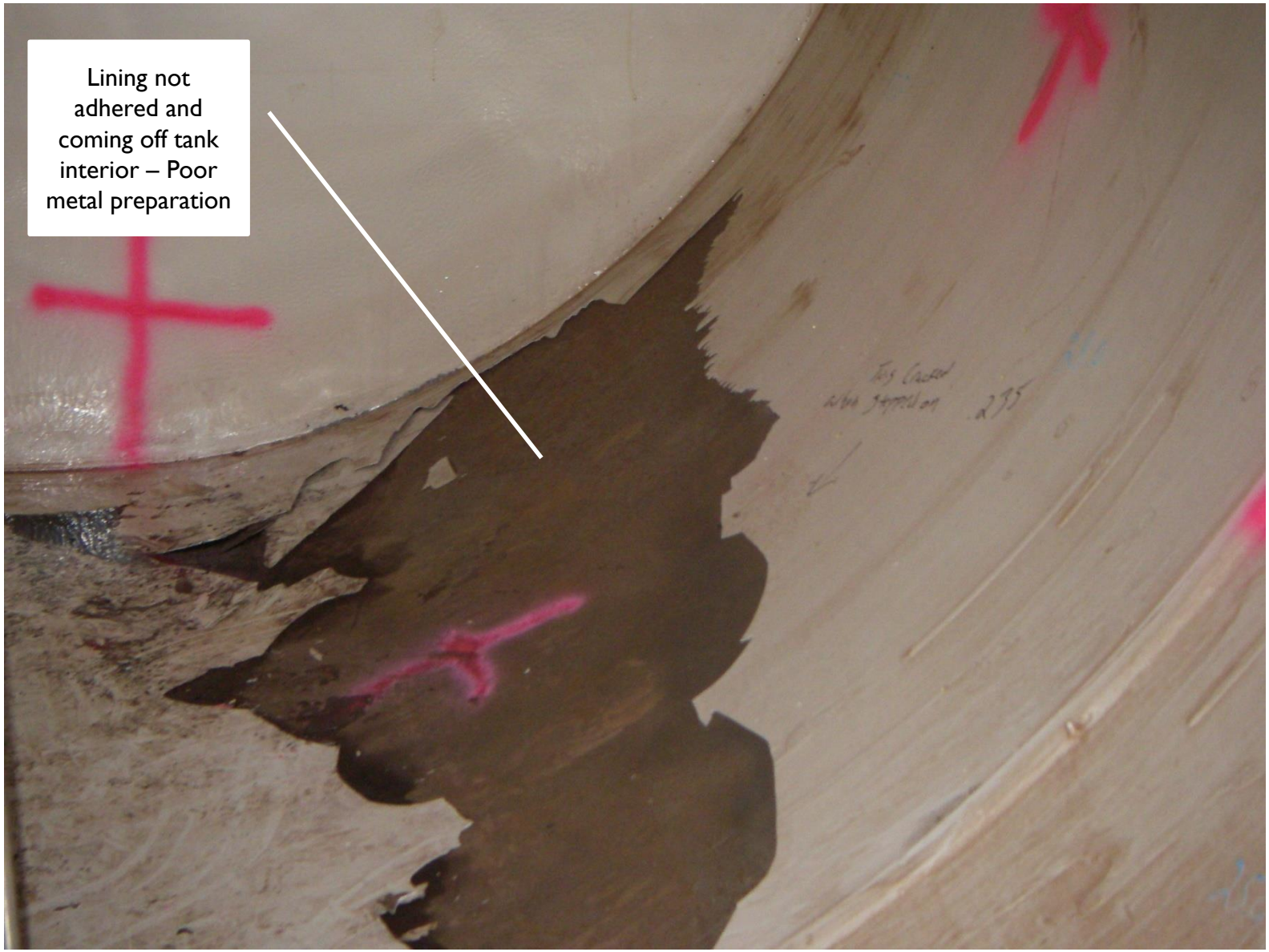

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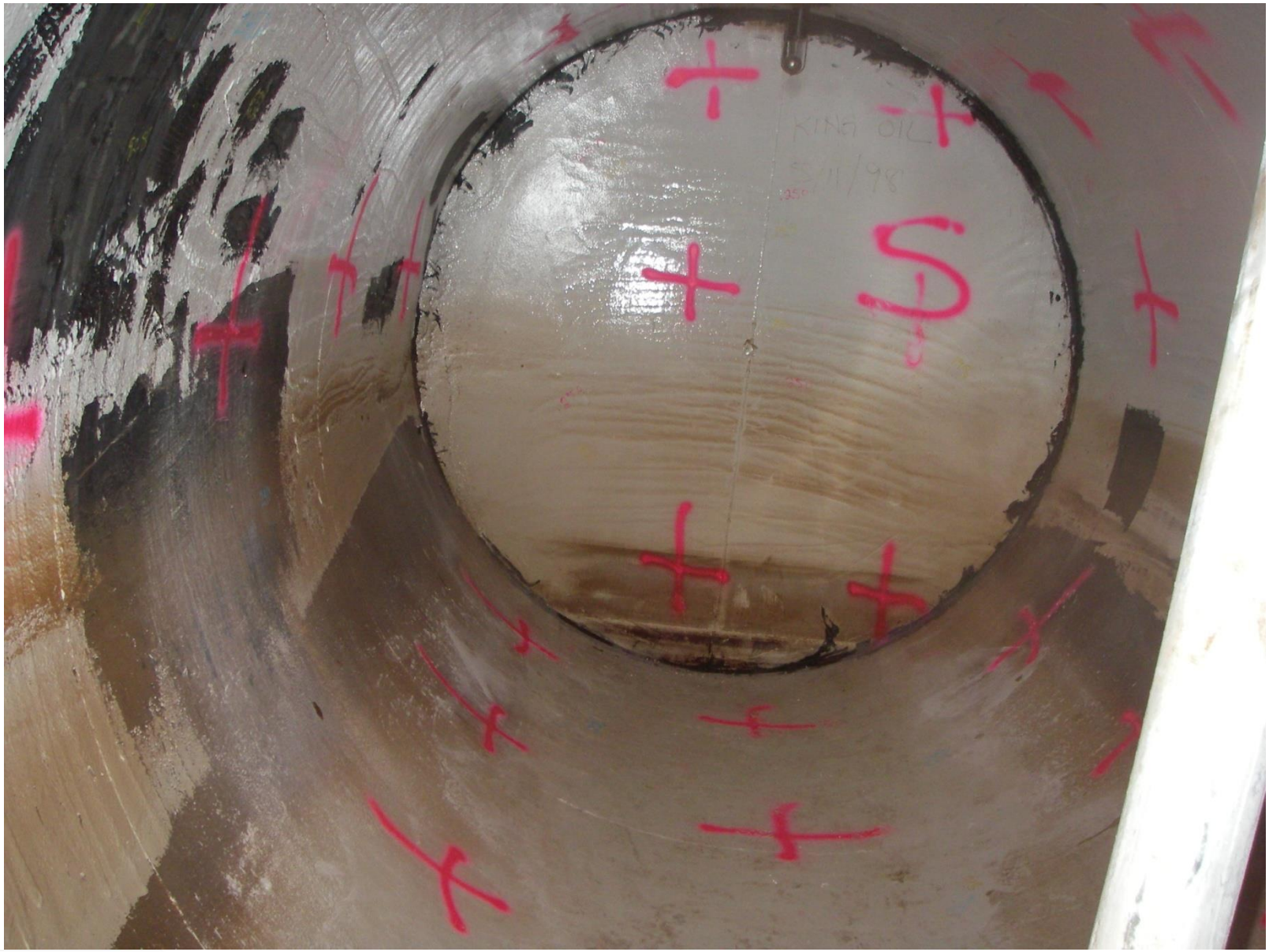

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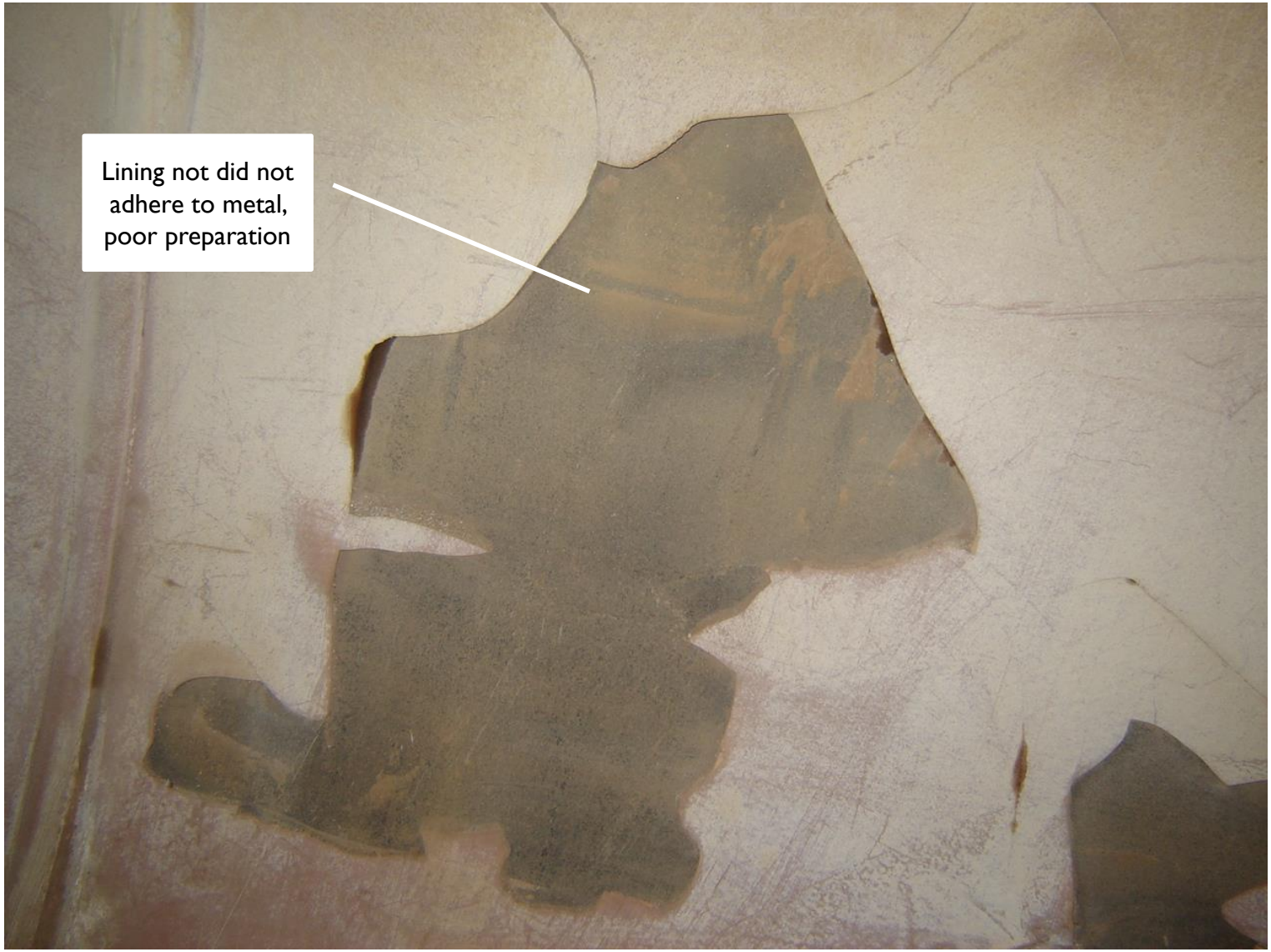
This Cracked
when Stepped on



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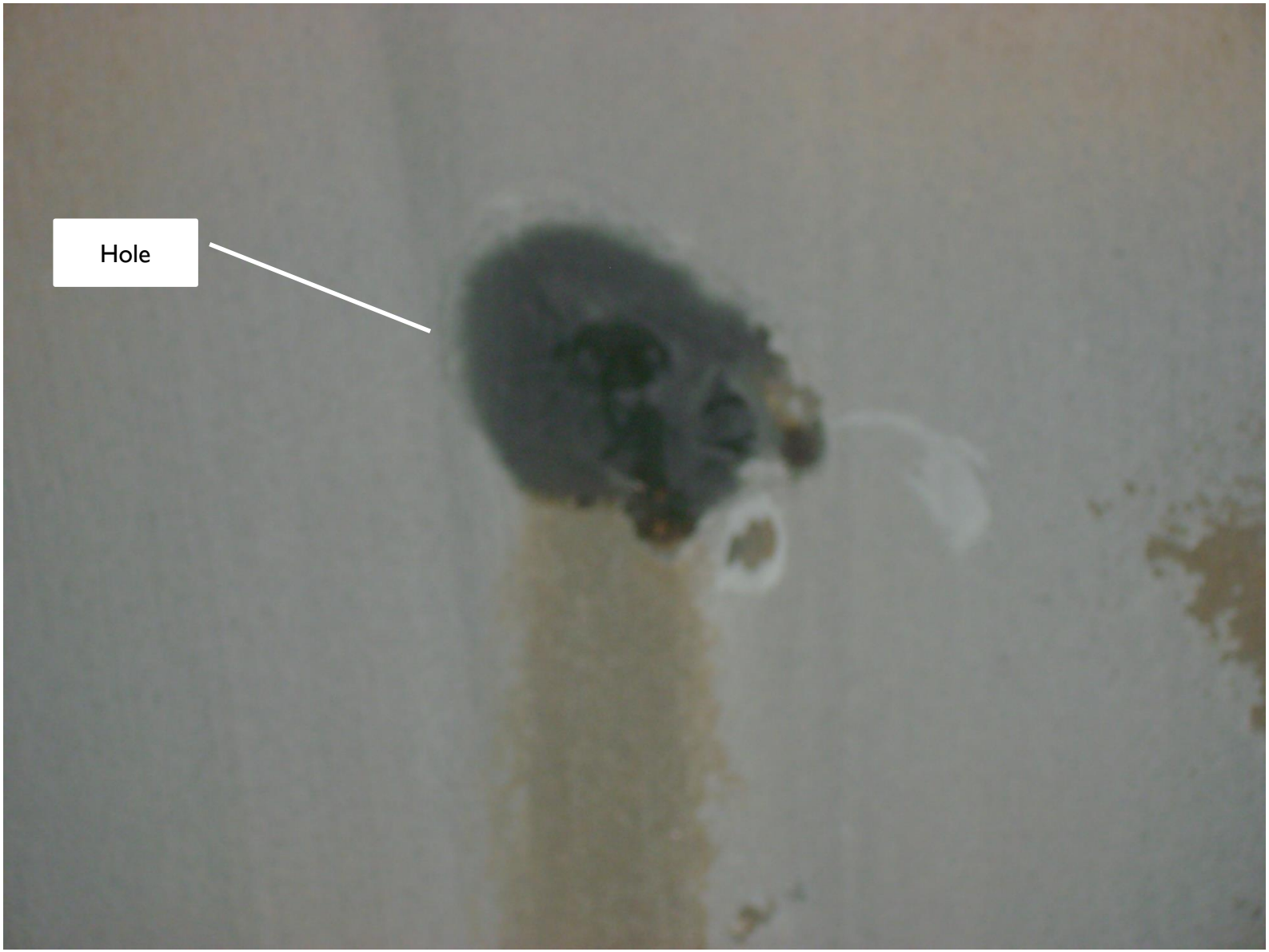
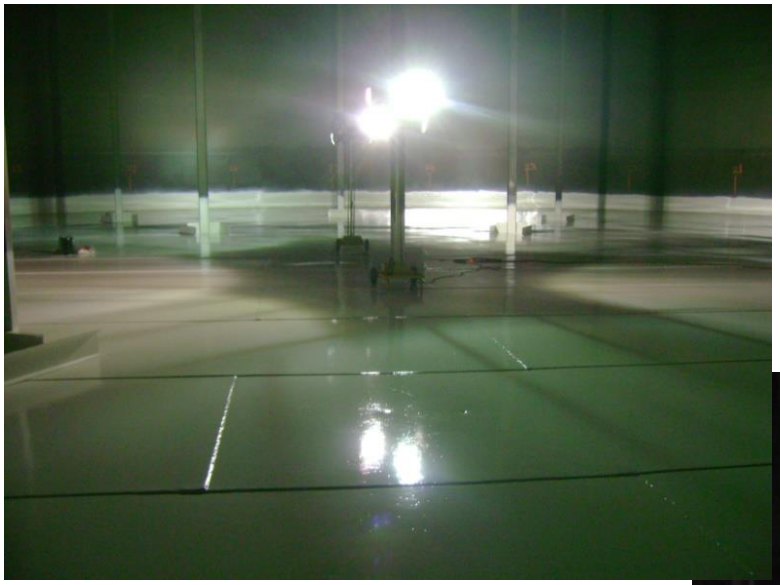
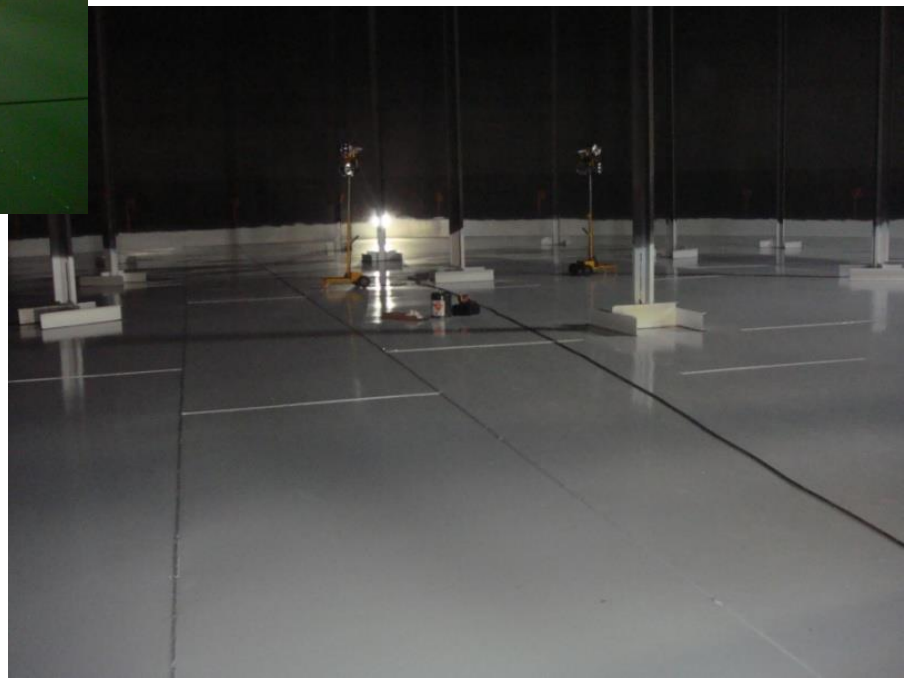

Hole

Vertical AST - Internal Tank Lining
150 Ft. Diameter - 5.2 Million Gallon Tank





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QUESTIONS???

Contact Information:

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API 653 Inspector
bmcchan@genesisenviro.com
Office: 816-229-5900 - Mobile: 816-868-3810

Christopher "Kit" Lewis
API 653 & STI SP001 Inspector
klewis@genesisenviro.com
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QUESTIONS?