

EVALUATION OF CATHODIC PROTECTION TESTING & ISSUES IN THE FIELD

KEVIN HENDERSON



UST INSPECTOR TRAINING WEBINAR

FEBRUARY 23, 2011

NEIWPCC

STAINLESS FLEX CONNECTORS



In contact with
soil – No CP

"DRIVE-IN" ANODES



Are these anodes really protecting the flex connectors ?

"ISOLATION" BOOTS



What do the "donuts"
look like on the other
end ?

"ISOLATION" BOOTS

"Yellow Jacket" boots



Loctite & Velcro - Is this a good idea?



STEP:2 APPLY ADH
AND HOSE



STEP:3 APPLY ADH
AND VELCRO



STEP:4 BEFORE SE
TO VELCRO

"ISOLATION" OF FLEX CONNECTORS



Does this "dielectric tape" effectively isolate the flex connector ?

COATED/WRAPPED & CATHODICALLY PROTECTED

What about interstitial communication?



07/01/2008

SACRIFICIAL ANODES

Is this anode protecting the
metallic piping ?



SACRIFICIAL ANODES



Does this answer
the question ?



171b ANODE

Is this anode protecting anything ?



Is this anode protecting anything ?



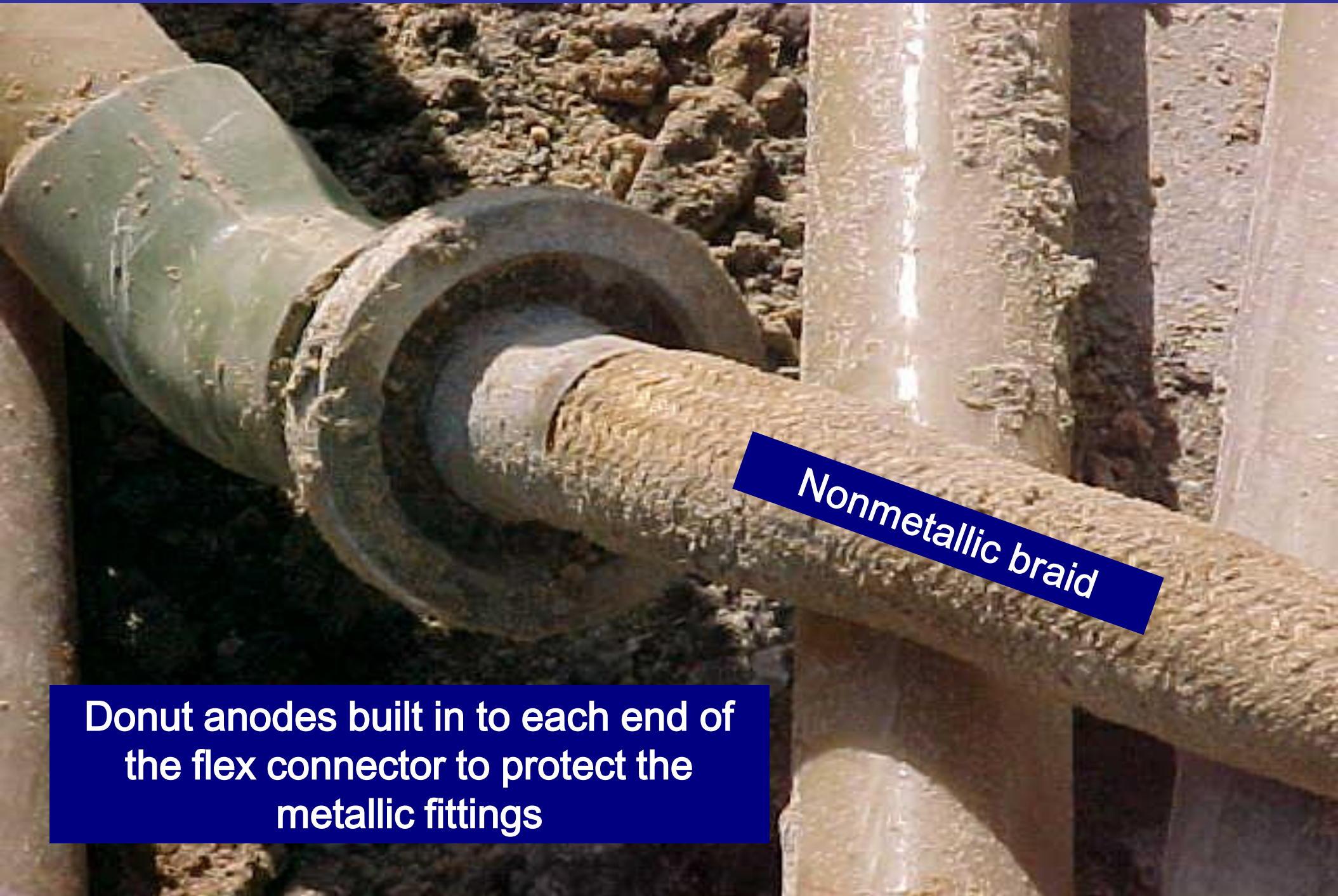


Plenty of current inside
the bucket



Not much escapes
the bucket

"SOIL SAFE" FLEX CONNECTOR

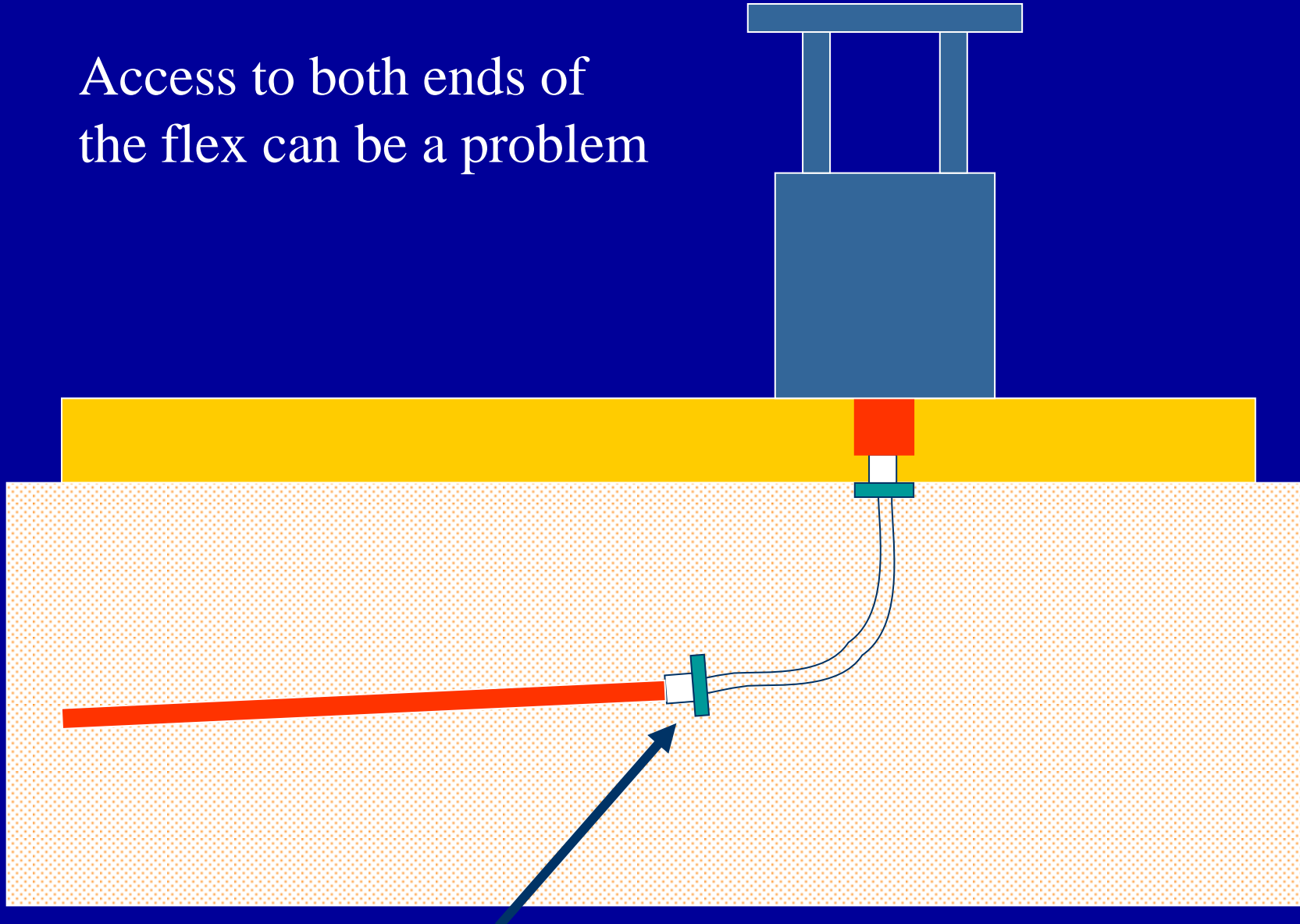


Nonmetallic braid

Donut anodes built in to each end of the flex connector to protect the metallic fittings

"SOIL SAFE" FLEX CONNECTOR

Access to both ends of the flex can be a problem



Is this end protected ?

“DOCUMENTATION”

Typical CP test

ITEM	QTY	DESCRIPTION
service work Mileage		Checked Leak Detectors on all 3 Tanks mileage <u>Cathodic protection</u> Readings: Reg. -0.98 Pre. -1.15 Diesel -0.94 sales tax

“DOCUMENTATION”

NATIONAL ASSOCIATION OF CATHODIC PROTECTION CATHODIC PROTECTION TEST

DATE: 5/3/2001

Typical CP test

COMPANY: HILL CITY OIL COMPANY
LOCATION: JUBILEE SHORT STOP #1124
ADDRESS: HWY. 84 BYPASS
CITY & STATE: MEADVILLE, MS

TANK #	FUEL TYPE	CAPACITY	MILI VOLT READING
1	DIESEL	-	-0.682
2	DIESEL	-	-0.724

CATHODIC PROTECTION SYSTEM PASSES THE NATIONAL ASSOCIATION OF
CATHODIC PROTECTION ENGINEERS TESTING REQUIREMENTS.

TECHNICIANS: Describe ground point and placement of copper to copper sulphate cell for each individual tank in accordance with tank bed.

“DOCUMENTATION”

CATHODIC PROTECTION SYSTEM PASSES THE NATIONAL ASSOCIATION OF CATHODIC PROTECTION ENGINEERS TESTING REQUIREMENTS.

TECHNICIANS: Describe ground point and placement of copper to copper sulphate cell for each individual tank in accordance with tank bed.

TANK #	1	WET CONCRETE
TANK #	2	WET CONCRETE
TANK #	3	
TANK #		

TECHNICIAN

TECHNICIAN'S SIGNATURE

47-4219

CERTIFICATION NUMBER



January 29, 2010

Proposal No.: 10-300-0001

Jesse Lopez
Federal Aviation Administration
16600 John F Kennedy Boulevard
Houston, TX 77092

**UST Cathodic Protection Certification Testing
Federal Aviation Administration
New Orleans International Airport
Kenner, LA**

"Achieve a minimum of -0.18 volts"

Mr. Lopez,

Southern Technical Services, LLC (STS) performed a cathodic protection test on the five (5) fiberglass coated steel Underground Storage Tanks (USTs) at the above referenced facility. We tested the existing UST system for function as to **achieve a minimum of -0.18 DC volts** to ensure proper cathodic protection of each tank. The results of each tank are included in the table on the following page. The MSY-ALSF, MSY-GS, and HOX-GS facilities passed. The JFI-LOC and MSY-E facilities failed. Southern Technical Services recommends replacement of the magnesium anodes at the locations that failed the cathodic protection system test.

**3 tanks passed
2 tanks failed**

STS looks appreciates the opportunity to work with the Federal Aviation Administration in bringing this project to its safe and successful conclusion. If there are any questions I can be reached at (225) 939-4435. Thank you for your consideration on this project.

Respectfully,

A handwritten signature in cursive script that reads "Kesston Shields".

Kesston Shields, Managing Partner
Southern Technical Services, LLC

CATHODIC PROTECTION TEST

Date: 1/29/10

Company: Federal Aviation Administration
Location: New Orleans International Airport
Address: Airline Highway
City/State: Kenner, Louisiana 70062

Tank # (Product)	Native	Capacity	DC/Volts
MSY-ALSF Off Road Diesel	Silty Clay	2,000	-0.58
MSY-GS Off Road Diesel	Silty Clay	500	-0.64
HOX-GS Off Road Diesel	Silty Clay	1,000	-0.56
JFI-LOC Off Road Diesel	Silty Clay	500	2.13
MSY-E Off Road Diesel	Silty Clay	1,000	6.75

“passed”

“failed”

Suction	Native	DC/Volts
MSY-ALSF Off Road Diesel	Silty Clay	-0.58
MSY-GS Off Road Diesel	Silty Clay	-0.64
HOX-GS Off Road Diesel	Silty Clay	-0.56
JFI-LOC Off Road Diesel	Silty Clay	2.13
MSY-E Off Road Diesel	Silty Clay	6.75

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JFI-LOC Off Road Diesel	Silty Clay	500	2.13
MSY-E Off Road Diesel	Silty Clay	1,000	6.75

The structure to soil potential measurements for the UST's must satisfy the -0.18 volt polarization criteria for cathodic protection as established by the "NACE" Standard RPO285-95 recommended practice "Corrosion Control of Underground Storage Tank Systems by Cathodic Protection." This standard is in accordance with the state and federal regulations (40 CFR Part 280.21).

“must satisfy the -0.18 volt polarization criteria for cathodic protection as established by the ‘NACE’ Standard RP0285-95”

XIV. GALVANIC (SACRIFICIAL ANODE) CATHODIC PROTECTION SYSTEM SURVEY

- This section may be utilized to conduct a survey of a galvanic cathodic protection system.
- The reference electrode must be placed in the soil directly over the tested structure.
- Both the local and the remote voltage must be -850mV or more negative, in order for the system to be considered effective.
- Inconclusive is indicated when both the local and the remote structure-to-soil potentials are -850mV or more negative.

FACILITY NAME: **SPEED ZONE - 1785 ELLIS, JACKSON** NOTE: The survey was conducted on **10/10/2018**

No local for diesel STP flex
Prem. Tank local only -838 mV

Location Code	STRUCTURE	CONTACT POINT	LOCAL REFERENCE CELL PLACEMENT	LOCAL VOLTAGE	REMOTE VOLTAGE	PASS/FAIL/INCONCLUSIVE
1	DIESEL TANK BOTTOM		CELL ON SOIL @ MIDTANK	-1086	-1003	PASS
	FLEX @ DIESEL SUBPUMP		CELL ON SOIL @ SUBPUMP MANHOLE		-1136	PASS
2	NOLEAD TANK BOTTOM		CELL ON SOIL @ MIDTANK	-867	-897	PASS
	FLEX @ NOLEAD SUBPUMP		CELL ON SOIL @ SUBPUMP MANHOLE	-901	-850	PASS
3	PREMIUM TANK BOTTOM		CELL ON SOIL @ MIDTANK	-838	-854	PASS
	FLEX @ PREMIUM SUBPUMP		CELL ON SOIL @ SUBPUMP MANHOLE	-1213	-1150	PASS
	FLEX CONNECTORS @ MPD $\frac{1}{2}$		CELL ON SOIL BELOW MPD			
			NOLEAD	-870	-852	PASS
			PREMIUM	-1207	-1189	PASS
			UNUSED PIPE	-1151	-1132	PASS
	FLEX CONNECTORS @ MPD $\frac{3}{4}$		CELL ON SOIL BELOW MPD			
			NOLEAD	-1150	-1132	PASS
			PREMIUM	-1134	-1115	PASS
			UNUSED PIPE	-1125	-1107	PASS
	FLEX CONNECTORS @ MPD $\frac{5}{8}$		CELL ON SOIL BELOW MPD			
			NOLEAD	-856	-864	PASS
			PREMIUM	-1345	-1352	PASS

XIV. GALVANIC (SACRIFICIAL ANODE) CATHODIC PROTECTION SYSTEM SURVEY

- > This section may be utilized to conduct a survey of a galvanic cathodic protection system by obtaining structure to soil potential
- > The reference electrode must be placed in the soil
- > Both the local and the remote voltage must be measured
- > Inconclusive is indicated when both the local and remote voltage are not measured

Only 1 reading for each MPD (actually 3 flex connectors at each MPD)

FACILITY NAME: Pantex # 3395

DESCRIBE LOCATION OF REMOTE REFERENCE ELECTRODE PLACEMENT:

As shown on drawing

LOCATION CODE	STRUCTURE	CONTACT POINT	LOCAL REFERENCE CELL PLACEMENT	LOCAL VOLTAGE	REMOTE VOLTAGE	PASS/FAIL/INCONCLUSIVE
1	Flex's @ MPD 1/2	Flex	Soil under MPD 1/2	.924	1.348	Pass
2	Flex's @ MPD 3/4	Flex	Soil under MPD 3/4	1.070	1.210	Pass
3	Flex's @ MPD 5/6	Flex	Soil under MPD 5/6	.884	1.147	Pass
4	Flex's @ MPD 7/8	Flex	Soil under MPD 7/8	.936	1.116	Pass
5	Diesel flex	flex	Soil under Disp. 10	.960	.848	Incon.
6	Diesel flex	flex	Soil under Disp. 11	.948	.848	Incon.
7	Diesel flex	flex	Soil under Disp. 11	.892	.848	Incon.
8	Diesel flex	flex	Soil under Sat. 11 Disp.	.892	.848	Incon.
9	Diesel flex	flex	Soil under Disp. 12	1.001	.860	Pass
10	Diesel flex	flex	Soil under Disp. 13	1.001	.860	Pass
11	Diesel flex	flex	Soil under Disp. Sat. 12/13 Mast	1.001	.860	Pass
12	Diesel flex	flex	Soil under Disp. Sat 13/14 Mast	.911	.802	Incon.
13	Diesel flex	flex	Soil under Disp. Sat 14/15 Mast	.939	.802	Incon.
14	Diesel flex	flex	Soil under Disp. Sat. 15	.863	.822	Incon.

XIV. GALVANIC (SACRIFICIAL ANODE) CATHODIC PROTECTION SYSTEM SURVEY

- This section may be utilized to conduct a survey of a galvanic cathodic protection system by obtaining structure-to-soil potential measurements.
- The structure-to-soil potential measurements should be taken at the local and remote structure-to-soil potentials (see note).
- Inconclusive results indicate that the local and the remote structure-to-soil potentials do not result in the same outcome (both pass or both fail).

EXCELLENT – 3 locals for each tank and 1 remote

FACILITY NAME: PANTRY #3448

NOTE: The survey is not complete unless all applicable parts of sections I – XIV are also completed

DESCRIBE LOCATION OF REMOTE REFERENCE ELECTRODE PLACEMENT:

30' EAST OF UST PAD

LOCATION ¹ CODE	STRUCTURE ²	CONTACT POINT ³	LOCAL REFERENCE CELL PLACEMENT ⁴	LOCAL VOLTAGE ⁵	REMOTE VOLTAGE ⁶	PASS/FAIL ⁷ INCONCLUSIVE
(example) 1	(example) PLUS TANK	(example) TANK BOTTOM	(example) PLUS TANK STP MANWAY	(example) -928	(example) -810	(example) INCONCLUSIVE
(example) 2	(example) PLUS PIPING	(example) DISPENSER 5/6	(example) UNDER DISPENSER 5/6	(example) -890	(example) -885	(example) PASS
1	DIESEL UST	TANK BOTTOM	SOIL @ FILL	-1359mv		PASS
2	DIESEL UST	TANK BOTTOM	SOIL @ ATG MANWAY	-949mv		PASS
3	DIESEL UST	TANK BOTTOM	SOIL @ SUB CONTAINMENT	-1237mv		PASS
4	DIESEL UST	TANK BOTTOM	REMOTE SOIL		-1216mv	PASS
5	PREMIUM UST	TANK BOTTOM	SOIL @ FILL	-1452mv		PASS
6	PREMIUM UST	TANK BOTTOM	SOIL @ ATG MANWAY	-1442mv		PASS
7	PREMIUM UST	TANK BOTTOM	SOIL @ SOB CONTAINMENT	-1432mv		PASS
4	PREMIUM UST	TANK BOTTOM	REMOTE SOIL		-1381mv	PASS
8	N/L UST	TANK BOTTOM	SOIL @ FILL	-1191mv		PASS
9	N/L UST	TANK BOTTOM	SOIL @ ATG MANWAY	-971mv		PASS
10	N/L UST	TANK BOTTOM	SOIL @ SUB CONTAINMENT	-1071mv		PASS
4	N/L UST	TANK BOTTOM	REMOTE SOIL		-1073mv	PASS

XIV. GALVANIC (SACRIFICIAL ANODE) CATHODIC PROTECTION SYSTEM SURVEY

- > This section may be utilized to conduct a survey of a galvanic cathodic protection system by obtaining structure-to-soil potential measurements.
- > The reference electrode must be placed in the soil directly over the tested structure (local) and 25-100 feet away from the structure (remote).
- > Both the local and the remote voltage must be -850 mV or more negative, in order for the structure to pass.
- > Inconclusive is indicated when both the local and the remote structure-to-soil potentials do not result in the same outcome (both pass or both fail)

FACILITY NAME: *SPRINKLER*

EXCELLENT – All tanks & flex connectors clearly identified


Tanks

STP flexes

MPD flexes

CODE	STRUCTURE	CONTACT POINT	LOCAL REFERENCE CELL PLACEMENT	LOCAL VOLTAGE	REMOTE VOLTAGE	PASS/FAIL/INCONCLUSIVE
(example) 1-	PLUS TANK	TANK BOTTOM	PLUS TANK STP MANWAY	(example) -928	(example) -810	(example) INCONCLUSIVE
(example) 2-	PLUS PIPING	DISPENSER 5/6	UNDER DISPENSER 5/6	(example) -890	(example) -885	(example) PASS
	REGULAR UST	BOTTOM	REGULAR STP MANWAY	916mw	851mw	PASS
	PLUS UST	BOTTOM	PLUS STP MANWAY	937mw	875mw	PASS
	PREMIUM UST	BOTTOM	PREMIUM STP MANWAY	992mw	952mw	PASS
	REGULAR FLEX @ STP		REGULAR STP MANWAY	1240mw	1136mw	PASS
	PLUS FLEX @ STP		PLUS STP MANWAY	1289mw	1146mw	PASS
	PREMIUM FLEX @ STP		PREMIUM STP MANWAY	1365mw	1177mw	PASS
	REGULAR FLEX @ DISP. 1/2		UNDER DISPENSER 1/2	1210mw	1005mw	PASS
	PLUS FLEX @ DISPENSER 1/2		UNDER DISPENSER 1/2	1120mw	1165mw	PASS
	PREMIUM FLEX @ DISP. 1/2		UNDER DISPENSER 1/2	1090mw	1135mw	PASS
	REGULAR FLEX @ DISP. 3/4		UNDER DISPENSER 3/4	898mw	920mw	PASS
	PLUS FLEX @ DISP. 3/4		UNDER DISPENSER 3/4	1120mw	1010mw	PASS
	PREMIUM FLEX @ DISP. 3/4		UNDER DISPENSER 3/4	964mw	898mw	PASS
	REGULAR FLEX @ DISP. 5/6		UNDER DISPENSER 5/6	926mw	1090mw	PASS
	PLUS FLEX @ DISP. 5/6		UNDER DISPENSER 5/6	1112mw	1230mw	PASS
	PREMIUM FLEX @ DISP. 5/6		UNDER DISPENSER 5/6	1019mw	1163mw	PASS
	REGULAR FLEX @ DISP. 7/8		UNDER DISPENSER 7/8	1293mw	1190mw	PASS
	PLUS FLEX @ DISP. 7/8		UNDER DISPENSER 7/8	963mw	1023mw	PASS
	PREMIUM FLEX @ DISP. 7/8		UNDER DISPENSER 7/8	992mw	1064mw	PASS
	REGULAR FLEX @ DISP. 9/10		UNDER DISPENSER 9/10	940mw	1140mw	PASS
	PLUS FLEX @ DISP. 9/10		UNDER DISPENSER 9/10	1019mw	1240mw	PASS
	PREMIUM FLEX @ DISP. 9/10		UNDER DISPENSER 9/10	897mw	1001mw	PASS

COMMENTS:

A photograph showing two electrical meters mounted on a metal structure. The meter on the left is blue and has a rectangular viewing window. The meter on the right is white and has a circular viewing window. Both meters are partially covered by bare, thin branches. In the foreground, there are some green grass and small pink flowers. A blue text box with white text is overlaid on the bottom left of the image.

Impressed Current –
Now the fun really
begins

**Anode lead wires and/or
negative bond wires flapping
in the wind**



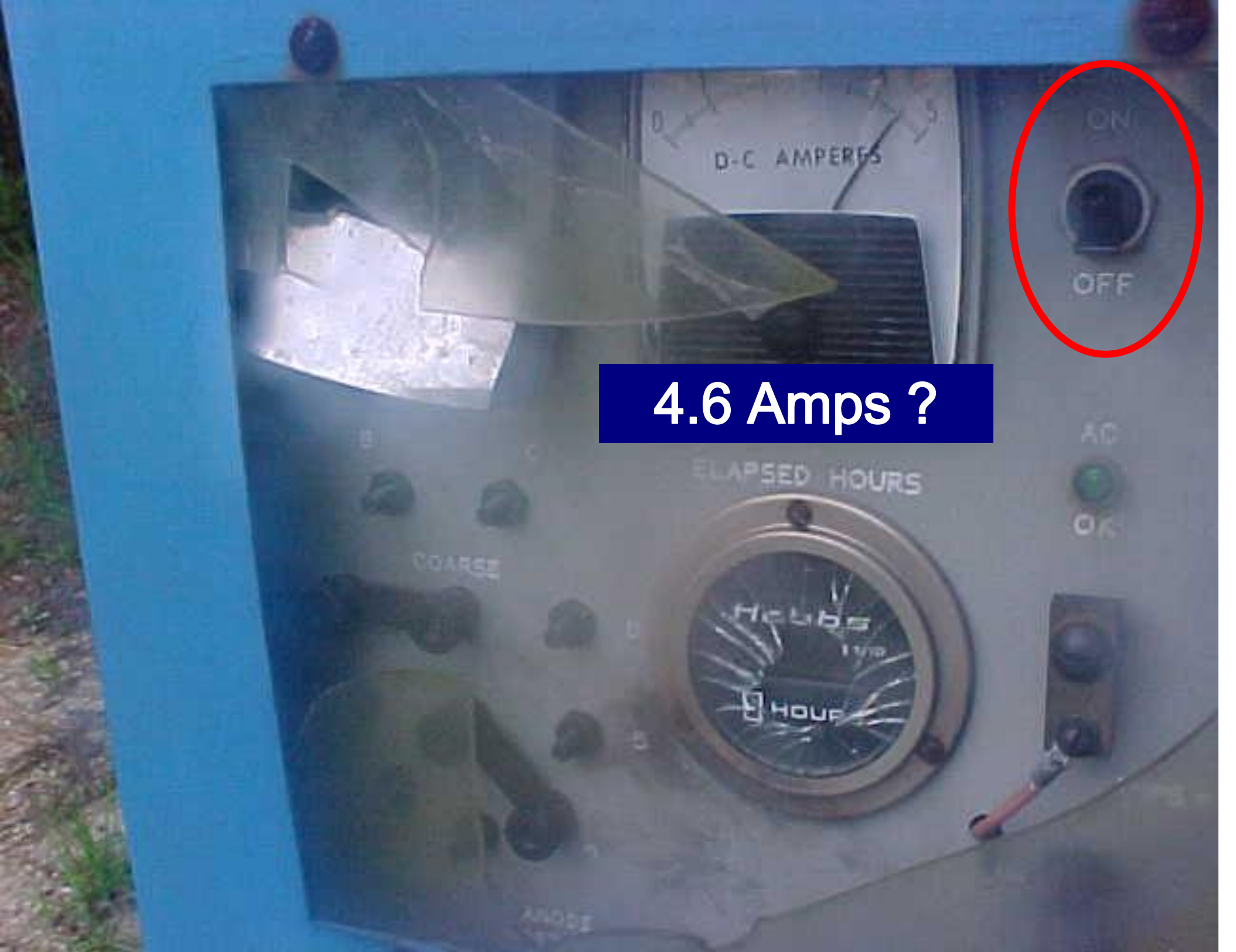


Should not be difficult
to see that nothing is
going on



AC Fuse has been removed

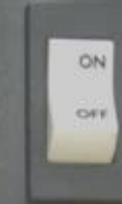
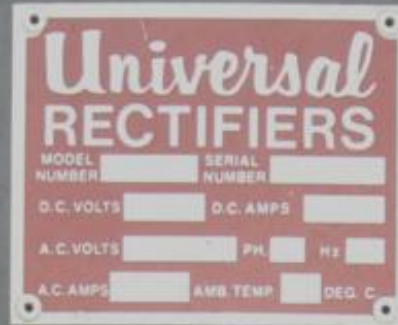




4.6 Amps ?

60 Volts

0 Amps



POSITIVE



NEGATIVE

07/18/2008

10 Volts

0.36 Amps

8382125 h

GRASSLIN



SHUNT

POSITIVE

NEGATIVE

FLUKE 116 TRUE RMS MULTIMETER

1.8 mV AC

HOLD

MIN MAX

RANGE

AUTO-V LoZ

OFF

V Hz

V

mV

Ω

07/18/2008

TESTED DATE
FEB 19 1999
Corpro Companies, Inc.
(403) 447-4565



E D C B A 1 2 3 4 5
COARSE ADJUST FINE ADJUST

Toggle Switch

MDL-12 A FUSE

AMPS.
VOLTS



0 Volts/Amps
?

STRUCTURE

ANODE

115 VOLTS

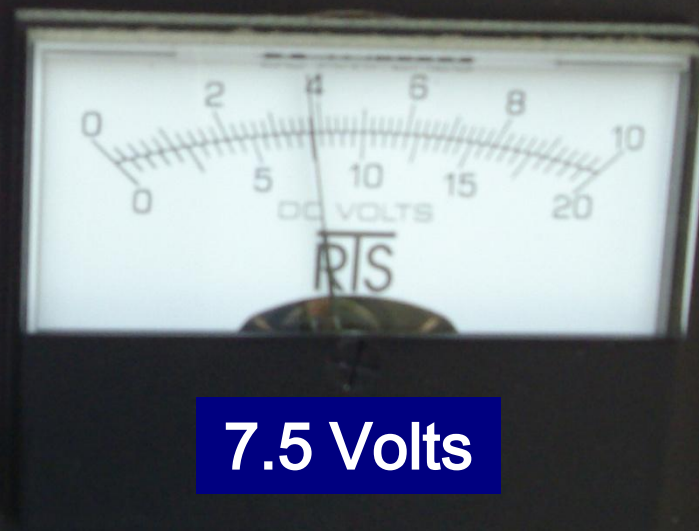
07/16/2008

E D C B A 1 2 3 4 5
COARSE TAPS FINE TAPS

MDL-12 A FUSE



ANODE



7.5 Volts

07/16/2008

E D C B A 1 2 4 5
COARSE TAPS FINE TAPS

MDL-12 A FUSE

AMPS



ANODE

2.3 Amps

07/16/2008

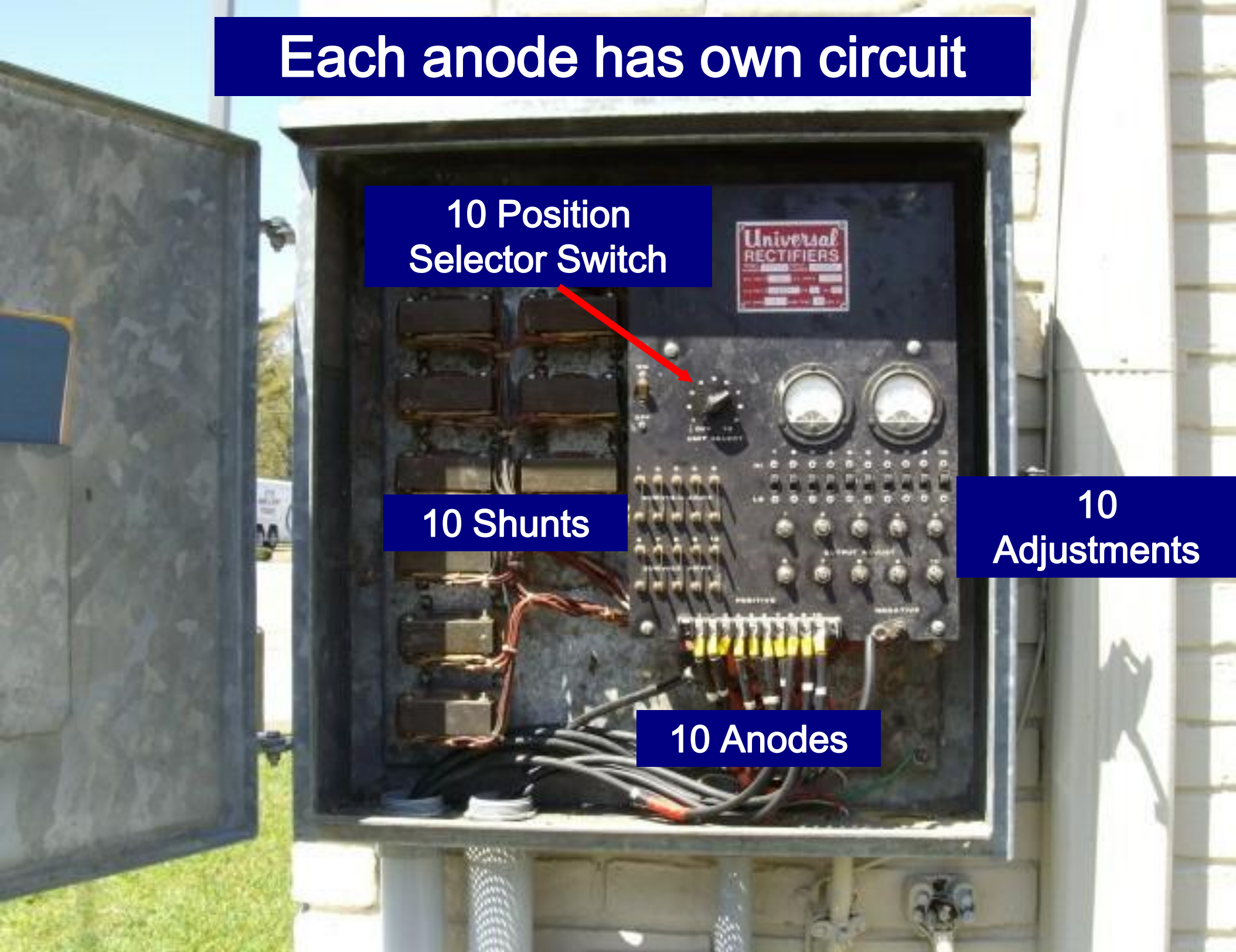
Each anode has own circuit

10 Position
Selector Switch

10 Shunts

10
Adjustments

10 Anodes



3 tanks with steel piping

CORROSION MONITORING COMMISSIONING SURVEY

COC-067

CORROSION TECHNICAL SERVICES - WEST CHESTER, OHIO
(513) 777- 7670

FAC. ID COC-067		LOCATION: Robinson Creek BP Station								
METER: 00000:19		St. Rt. 122 & 2167, Robinson Creek, Kentucky								
DATE OF TEST:		03/26/99	3/26/99	Groundbed Computations						
TESTER INITIALS:		SLV	SLV	Overall (Anode)						
RECTIFIER TAP SETTINGS:		NA	C-1 F-5	(X) E: 6.54 Volts						
RECTIFIER OUTPUT:		0 Volts	6.53 Volts	(Sum) I: 0.80 Amps						
2.80	Shunt: 50mV = 15A	0 Amps	0.84 Amps	R: 8.17 Resistance						
TEST STA.#	DESCRIPTION	NATIVE STATE	STRUCTURE TO SOIL POTENTIALS - VOLTS							
			On	Off	On	Off	Note			
01	Tank - Super UL - S	0.586	1.329					#	Volts	Amps
02	Tank - Super UL - C	0.603	0.905					1	6.51	0.18
03	Tank - Super UL - N	0.677	1.179					2	6.53	0.26
04	Tank - Diesel - N	0.628	1.201					3	6.53	0.12
05	Tank - Diesel - C	0.634	1.149					4	6.55	0.08
06	Tank - Diesel - S	0.589	1.193					5	6.55	0.12
07	Tank - Regular UL - S	0.525	2.109					6	6.56	0.04
08	Tank - Regular UL - C	0.559	2.281					7		
09	Tank - Regular UL - N	0.603	2.391					8		
10	Piping to Dispensers	0.646	1.381					9		
11	Piping - Vent (2)	0.607	1.531					10		
12	Piping - Vent (1)	0.514	1.981					11		
13	Reference Cell (Cu/CuSO4)	0.477	3.310					12		
14								13		
15										
16										
17										
18										
19										
20										
								Average Volts: 6.54		
								Total Amps: 0.80		
								Anode Bed (R): 8.17		

0.84
amps

3 test points per tank

1 test point for all
product piping

2 test points for the
vent piping

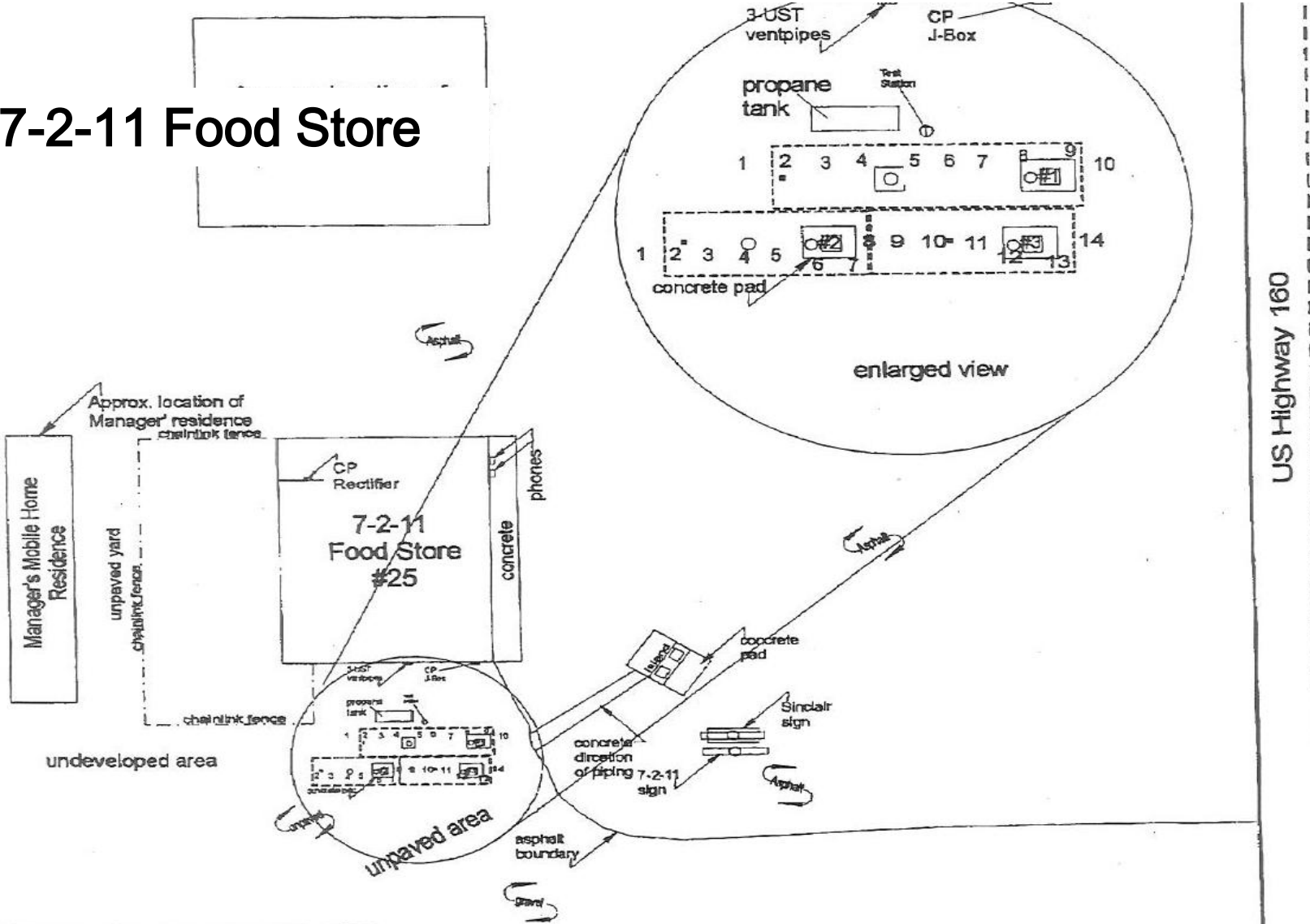
Reference Cell ?

Only have
ON
potentials

NOTE: Soil Information: Normal

MFG: Global CP - Universal
Model: GSAI 24-12
DC: 24 Volts - 12 Amps
AC: 115 Volts - 3.6 Amps
S/N: 985703

7-2-11 Food Store



LEGEND

1,3... Soil to tank potential location with saturated Cu/CuSO₄ half cell electrode

Advanced Corrosion & Environmental Services

Site: 7-2-11 Food Store #25
Address: US Highway 160
Kayenta, Arizona

Fig. 1: Cathodic protection Repair, testing & monitoring Site Plan

Drawn By: Al Chaharlang
Pj Mgr: Al Chaharlang

07/11-25/11-25sep
Date: 07/14/2008

CATHODIC PROTECTION INFORMATION

CP system: Impressed Current
Date CP Repaired: 8/17/2005
Adjusted Rectifier DC Voltage = 9.5 volts
Adjusted Rectifier DC Current = 6.1 Amps
Tab Settings: Fine on 5 & Coarse on A
Date CP Tested: 7/14/2008

Impressed Current

UST Information

#1: 8'x32', 12,000 gallon (unleaded)
#2: 8'x21': 8,000 gallon (super unleaded)
#3: 8'x21': 8,000 gallon (unleaded plus)

7-2-11 Food Store

Misapplication of the -850 mV criterion Misapplication of the 100 mV shift criterion

Date: 7/14/2008

Test Engineer: Al Chaharlang

Sheet No.: 1 of 1

Site Name: 7-2-11 Food Store #25

Site Location: US Highway 160 & Highway 163

City: Kayenta

State: AZ

Zip: 86033

Type of Tanks: Bare Steel

No. of Tanks: 3

System type: Impressed Current

Tank(s) Installation Date:

Test Meter Information: M

(t.) Voltmeter

Surface Condition: Wet (unpaved)

Rectifier DC Voltage = 9.5 v

nt = 6.1 Amps

Rectifier Hour M

Rectifier Setting: Fine: 5 and Coarse: A

Tank Number	Test Point Location	Sacrificial Anode CP Over The Tank (+/- volts)	Rectifier ON				Tank to Soil Potential or Native State Potential Value (+/- volts)	Difference in ON & Off Potential Value (+/-mv)	Is 100 mv Potential Shift Criteria Met?	Remarks
			Tank To Soil Potential			Tank to Soil Potential Value (+/- volts)				
			Over The Tank (+/- volts)	Distance	Direction					
1			-0.862			-0.274	-588	Yes	meet -0.850v & 100 mv criteria	
1			-0.648			-0.294	-354	Yes	meet 100 mv shift criteria	
1			-0.637			-0.31	-327	Yes	meet 100 mv shift criteria	
1			-0.64			-0.386	-254	Yes	meet 100 mv shift criteria	
1			-0.641			-0.425	-216	Yes	meet 100 mv shift criteria	
1			-0.777			-0.431	-346	Yes	meet 100 mv shift criteria	
1			-0.825			-0.455	-370	Yes	meet 100 mv shift criteria	
1			-0.882			-0.428	-454	Yes	meet -0.85v & 100 mv shift criteria	
1			-0.901			-0.432	-469	Yes	meet -0.85v & 100 mv shift criteria	
1			-1.153			-0.426	-727	Yes	meet -0.85v & 100 mv shift criteria	
2			-1.5			-0.437	-1063	Yes	meet -0.85v & 100 mv shift criteria	
2			-1.876			-0.398	-1478	Yes	meet -0.85v & 100 mv shift criteria	
2			-1.675			-0.377	-1298	Yes	meet -0.85v & 100 mv shift criteria	
2			-0.882			-0.362	-520	Yes	meet -0.85v & 100 mv shift criteria	
2			-0.746			-0.316	-430	Yes	meet 100 mv shift criteria	
2			-0.748			-0.325	-423	Yes	meet 100 mv shift criteria	
2			-0.811			-0.353	-458	Yes	meet 100 mv shift criteria	
2&3			-0.801			-0.384	-417	Yes	meet 100 mv shift criteria	
3			-0.661			-0.339	-322	Yes	meet 100 mv shift criteria	
3			-0.726			-0.293	-433	Yes	meet 100 mv shift criteria	
3			-1.248			-0.306	-942	Yes	meet -0.85v & 100 mv shift criteria	
3			-1.47			-0.323	-1147	Yes	meet -0.85v & 100 mv shift criteria	

On Voltage

Native Voltage

10 Test Points for Tank 1

12 Test Points for Tank 2/3

-0.637 V

e:\cp-survey-log

On Voltage

Native Voltage

10 Test Points for Tank 1

12 Test Points for Tank 2/3

-0.637 V

e:\cp-survey-log

Notes: Please note the Rectifier was off just before arrival. The On/Off and the Amps/Volts switches are next to each other. The On/Off switch must not be touched. The volts/Amps must be read from second switch. For volts hold the the switch up and for Amps hold the switch down to read amps. Rectifier is On when the volts/amps switch is in neutral position while volts and amp gauges indicating zeros. These USTs are constructed of bare steel (no protective coating). The -100 millivolts shift in potential and -0.850 volts NACE criteria were used to test for compliance. Based on these several soil to tank potentials readings, these USTs meet satisfactory CP compliance.

> The instant off potential must be -850 mV or more negative or the 100 mV polarization criterion must be satisfied in order to pass.

FACILITY NAME: Plaskolite South			NOTE: This survey is not complete unless all applicable parts of sections I – XIV are also completed					
LOCATION CODE	STRUCTURE	CONTACT POINT	REFERENCE CELL PLACEMENT	ON VOLTAGE	INSTANT OFF VOLTAGE	100 mV POLARIZATION		PASS/ FAIL
						ENDING VOLTAGE	VOLTAGE CHANGE	
1	Tank T-10	Tank Manway	Soil adjacent to manway	-825 mV	-861 mV	N/A	N/A	PASS
1	Tank T-10 Piping	Piplog	Soil adjacent to manway	-817 mV	-721 mV	N/A	N/A	PASS
2	Tank T-11B	Tank Manway	Soil adjacent to manway	-915 mV	-865 mV	N/A	N/A	PASS
2	Tank T-11B Piping	Piping	Soil adjacent to manway	-764 mV	-614 mV	N/A	N/A	PASS
3	Tank T-12	Tank Manway	Soil adjacent to manway	-958 mV	-870 mV	N/A	N/A	PASS
3	Tank T-12 Piping	Piping	Soil adjacent to manway	-820 mV	-758 mV	N/A	N/A	PASS
4	Tank T-14C	Tank Manway	Soil adjacent to manway	-1046 mV	-987 mV	N/A	N/A	PASS
4	Tank T-14C Piping	Piping	Soil adjacent to manway	-754 mV	-603 mV	N/A	N/A	PASS
5	Tank T-13	Tank Manway	Soil adjacent to manway	-915 mV	-872 mV	N/A	N/A	PASS
5	Tank T-13 Piping	Piping	Soil adjacent to manway	-499 mV	-421 mV	N/A	N/A	PASS
6	Tank T-14A	Tank Manway	Soil adjacent to manway	-945 mV	-852 mV	N/A	N/A	PASS
6	Tank T-14A Piping	Piping	Soil adjacent to manway	-636 mV	-500 mV	N/A	N/A	PASS
7	Tank T-14B	Tank Manway	Soil adjacent to manway	-1082 mV	-881 mV	N/A	N/A	PASS
7	Tank T-14B Piping	Piping	Soil adjacent to manway	-880 mV	-829 mV	N/A	N/A	PASS
8	Tank T-111	Tank Manway	Soil adjacent to manway	-1227 mV	-983 mV	N/A	N/A	PASS
8	Tank T-111 Piping	Piping	Soil adjacent to manway	-966 mV	-960 mV	N/A	N/A	PASS
9	Tank T-11A	Tank Manway	Soil adjacent to manway	-1333 mV	-1030 mV	N/A	N/A	PASS
9	Tank T-11A Piping	Piping	Soil adjacent to manway	-1062 mV	-1046 mV	N/A	N/A	PASS
10	MMA Riser-East	Piping below ins.	Soil adjacent to riser	-1338 mV	-987 mV	N/A	N/A	PASS
10	Piping above ins.	Piping above ins.	Soil adjacent to riser	-1256 mV	-968 mV	N/A	N/A	PASS
11	E/A Riser	Piping below ins.	Soil adjacent to riser	-1048 mV	-966 mV	N/A	N/A	PASS
11	Piping above ins.	Piping above ins.	Soil adjacent to riser	-1274 mV	-1016 mV	N/A	N/A	PASS
12	TOL Riser	Piping below ins.	Soil adjacent to riser	-1450 mV	-1018 mV	N/A	N/A	PASS
12	Piping above ins.	Piping above ins.	Soil adjacent to riser	-1309 mV	-982 mV	N/A	N/A	PASS
13	DDM Riser-West	Piping below ins.	Soil adjacent to riser	-1532 mV	-1006 mV	N/A	N/A	PASS
13	Piping above ins.	Piping above ins.	Soil adjacent to riser	-1348 mV	-988 mV	N/A	N/A	PASS

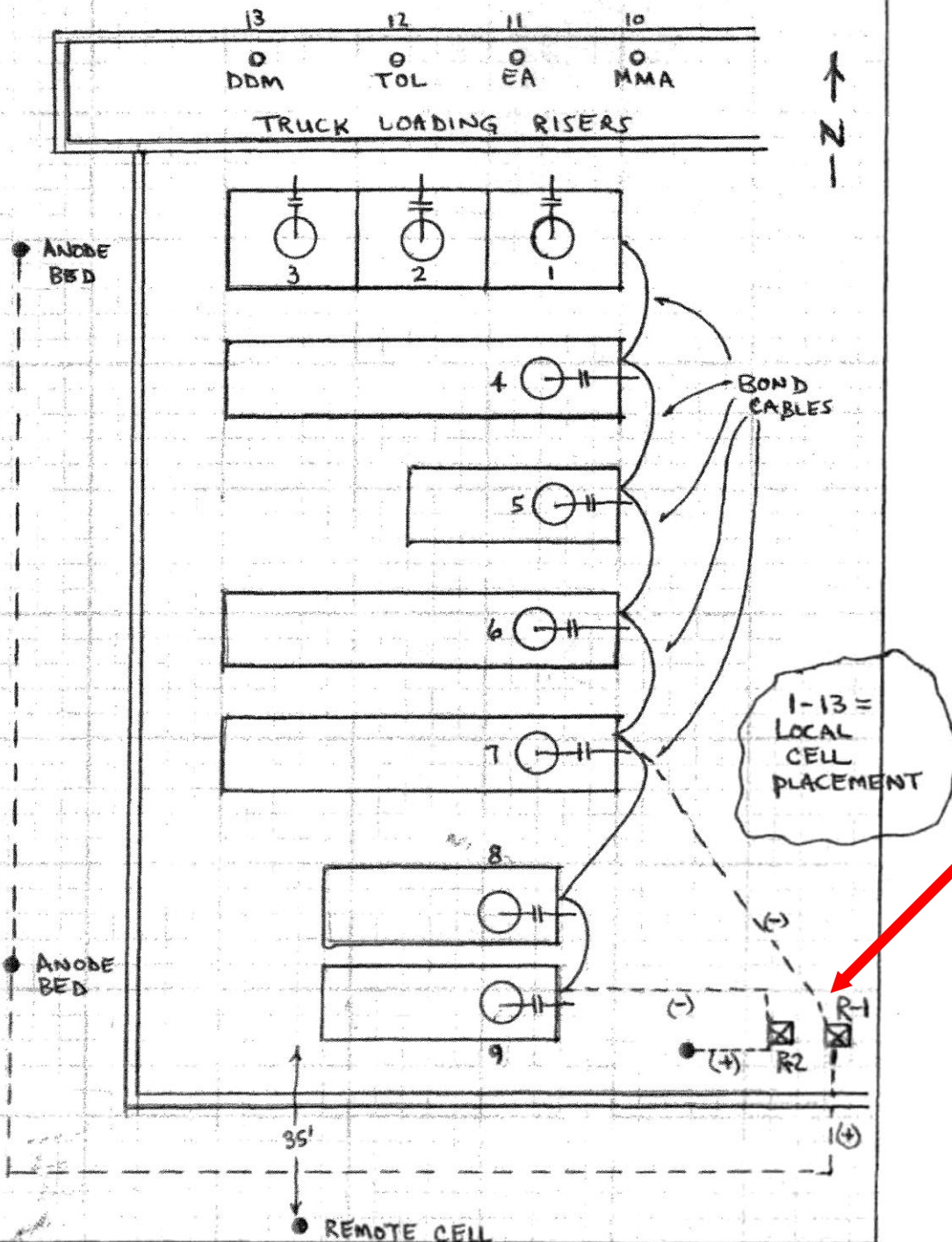
COMMENTS: Site drawing attached.

Instant Off
Voltages
Obtained

Some off
voltages on
the piping do
not meet -
850 mV
criterion



CLIENT	RASKOLITE SOUTH	SHEET NO.	1 OF 1
PROJECT	C P SURVEY - JOB # 332847	DATE	8-5-09
SUBJECT	SITE DRAWING	BY	J.H.



More importantly –
There are 2 rectifiers
Both rectifiers must be
interrupted
simultaneously for it to
be a valid test

Piping tested at both STP end and at every dispenser

[illegible]

XVI. IMPRESSED CURRENT CATHODIC PROTECTION SYSTEM SURVEY

Excellent – 3 test point over each tank

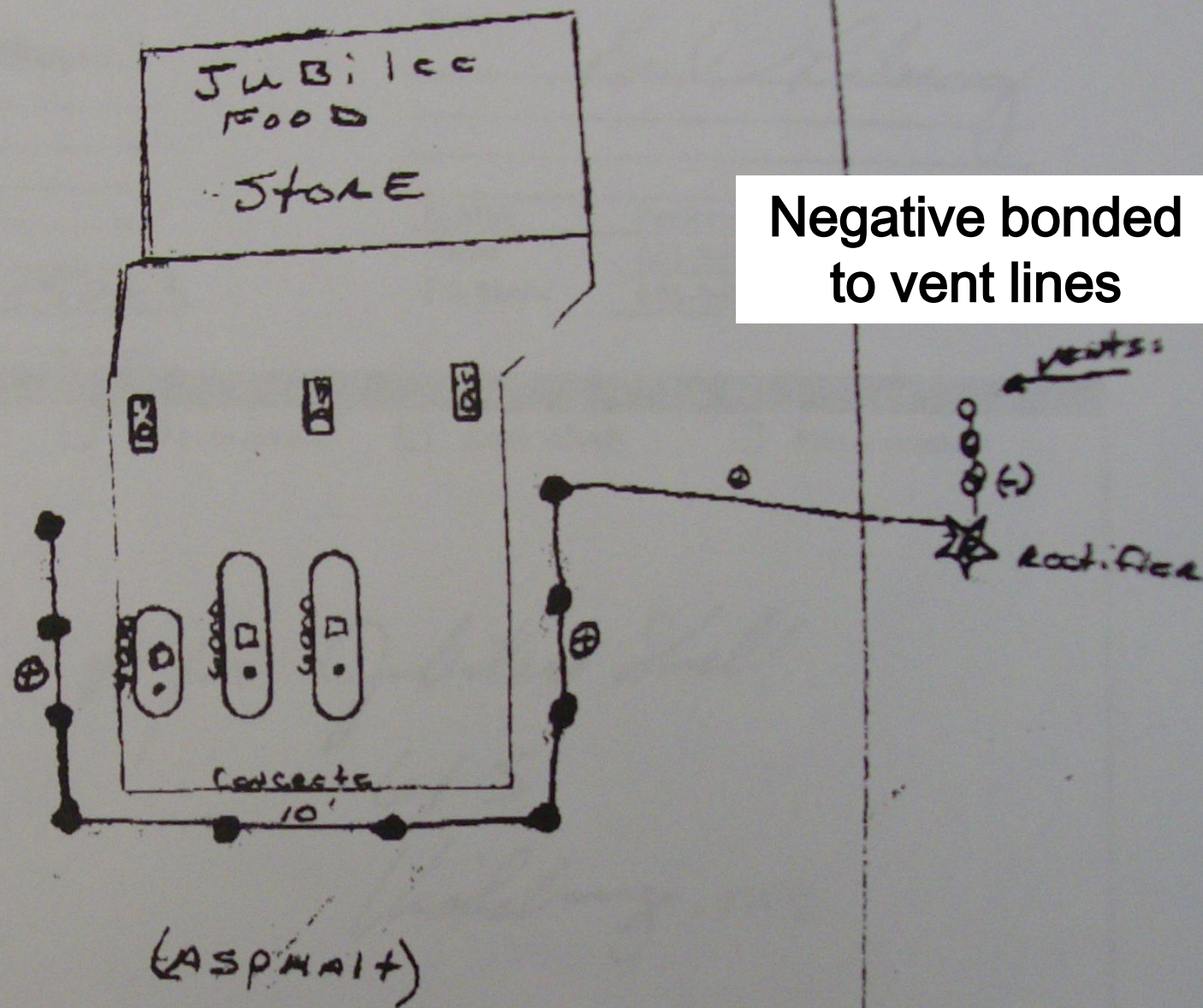
Pipe tested at dispensers since this is a suction system

LOCATION CODE	STRUCTURE	CONTACT POINT	REFERENCE CELL PLACEMENT	ON VOLTAGE	INSTANT OFF VOLTAGE	100 mV POLARIZATION		PASS/FAIL
						ENDING VOLTAGE	VOLTAGE CHANGE	
(example)	PLUSTANK	TANK BOTTOM	SOIL @ REG. TANK ST. MANWAY	-1332	-883	-742		Pass
(example)	DIESEL PIPE	DISPENSER 7/8	SOIL @ DIESEL TANK ST. MANWAY	-819	-705	-572	105 mV	Pass
	DSL Tank	Tank Bottom	soil @ west end of tank	-1332	-883	-742		Pass
	"	"	soil @ center of tank	-2860	-780	-559	221	Pass
	"	"	soil @ east end of tank	-2280	-760	-554	2.06	Pass
	DSL pipe	DSL pipe @ pump	soil near DSL pump	-819	-705	-572	133	Pass
	PRM Tank	Tank Bottom	soil @ south end of tank	-1367	-898	-636		Pass
	"	"	soil @ center of tank	-1255	-856	-671		Pass
	"	"	soil @ north end of tank	-1013	-860	-694		Pass
	PRM pipe	PRM pipe @ pump	soil near PRM pump.	-804	-671	-548	123	Pass
	NOL pipe	NOL pipe @ pump	soil near NOL pump	-895	-705	-555	150	Pass
	NOL Tank	Tank Bottom	soil @ south end of tank	-1023	-857	-690		Pass
	"	"	soil @ center of tank	-1496	-901	-680		Pass
	"	"	soil @ north end of tank	-1409	-1050	-622		Pass

Jubilee Food Store
June 2006

Negative bonded
to vent lines

Heavy 61 South



CASE HISTORY – WHY YOU NEED TO KNOW SOMETHING
ABOUT CATHODIC PROTECTION SYSTEMS

Jubilee Food Store

June 2006

"Qualified" contractor tests CP system
and passes everything

XI. IMPRESSED CURRENT RECTIFIER DATA (complete all applicable)

In order to conduct an effective evaluation of the cathodic protection system, a complete evaluation of rectifier operation is necessary.

RECTIFIER MANUFACTURER: CORRKO CANADA INC.

RATED DC OUTPUT: 20 VOLTS 10 AMPS

RECTIFIER MODEL: CSAYSA 20-10 Z

RECTIFIER SERIAL NUMBER: C-990493

RECTIFIER OUTPUT AS INITIALLY DESIGNED OR LASTLY RECOMMENDED (If available): _____ VOLTS _____ AMPS

EVENT	DATE	TAP SETTINGS		DC OUTPUT		HOUR METER	COMMENTS
		COARSE	FINE	VOLTS	AMPS		
"AS FOUND"							
"AS LEFT"	<u>6/13/06</u>	<u>C</u>	<u>3</u>	<u>16.05</u>	<u>1</u>	<u>NA</u>	<u>NEW SYSTEM</u>

XII. IMPRESSED CURRENT POSITIVE & NEGATIVE CIRCUIT MEASUREMENTS (output amperage)

Complete if the system is designed to allow such measurements (i.e. individual lead wires for each anode are installed and measurement shunts are present).

CIRCUIT	1	2	3	4	5	6	7	8	9	10	TOTAL
ANODE (+)	<u>.001</u>	<u>.001</u>	<u>.001</u>	<u>.001</u>	<u>.001</u>	<u>.001</u>	<u>.001</u>	<u>.001</u>	<u>.001</u>	<u>.001</u>	<u>.01</u>
TANK (-)	<u>NA</u>	<u>NA</u>	<u>NA</u>								

XIII. DESCRIPTION OF CATHODIC PROTECTION SYSTEM REPAIRS AND/OR MODIFICATION

Complete if any repairs or modifications to the cathodic protection system are made OR are necessary. Certain repairs/modifications as explained in the text of the MDEQ cathodic protection guidance document are required to be designed and/or evaluated by a corrosion expert (completion of Section VII required).

- ☐ Additional anodes for an impressed current system (attach corrosion expert's design).
- ☐ Repairs or replacement of rectifier (explain in "Remarks/Other" below).
- ☐ Anode header cables repaired and/or replaced (explain in "Remarks/Other" below).
- ☐ Impressed current protected tanks/piping not electrically continuous (explain in "Remarks/Other" below).

Remarks/Other:

SHUNTS WERE NOT AVAILABLE FOR TANK NEG.

This section may be utilized to conduct a survey of an impressed current cathodic protection system by obtaining structure-to-soil potential measurements. The reference electrode must be placed in the soil directly above the structure that is being tested and as far away from any active anode as practical to obtain structure-to-soil potential (refer to the MDEQ cathodic protection evaluation guidance document for detailed discussion of electrode placement). Measurements must be measured for each structure that is intended to be under cathodic protection. A minimum of -850 mV or more negative or the 100 mV polarization criterion must be satisfied in order to pass.

June 2006

NOTE: This survey is not complete unless all applicable parts of sections I - XIV are also completed.

Contractors test

“Readings not steady because of dry conditions”

COMMENTS: TANKS HAVE BEEN LINED.
READINGS WERE NOT STEADY BECAUSE OF DRY CONDITIONS.

Jubilee Food Store

June 2006

482045

PERFORMANCE OIL EQ

PAGE 04

IMPERVED CURRENT CATHODIC PROTECTION SYSTEM CONTINUITY SURVEY

Conduct measurements of continuity on underground storage tank systems that are protected by cathodic protection systems. In conducting a fixed cell - moving ground survey, the reference electrode must be placed in the soil at a remote location and left undisturbed. Conduct point-to-point test between any two structures for which the fixed cell - moving ground survey is inconclusive or indicates possible isolation. For impressed current systems, the protected structure must be continuous with all other protected structures in order to pass the continuity survey.

FACILITY NAME: JUBILEE FOOD STORE

NOTE: The survey is not complete unless all applicable parts of sections I-XIV are also completed

DESCRIBE LOCATION OF "FIXED REMOTE" REFERENCE ELECTRODE PLACEMENT:

N/A

STRUCTURE "A" ¹	STRUCTURE "B" ²	STRUCTURE "A" ³ FIXED REMOTE INSTANT OFF VOLTAGE	STRUCTURE "B" ⁴ FIXED REMOTE INSTANT OFF VOLTAGE	POINT-TO-POINT ⁵ VOLTAGE DIFFERENCE	ISOLATED ⁶ CONTINUOUS/ INCONCLUSIVE
(example) PLUS TANK BOTTOM	(example) PLUS STEEL PRODUCT LINE @ STP	(example) -988 mV	(example) -988 mV		(example) INCONCLUSIVE
(example) PLUS TANK BOTTOM	(example) PLUS STEEL PRODUCT LINE @ STP			(example) 1 mV	(example) CONTINUOUS
REGULAR FILL RISER	REG. STP HEAD			1 mV	CONTINUOUS
PREMIUM FILL RISER	PREM. STP HEAD			1 mV	CONTINUOUS
DIESEL FILL RISER	DIESEL STP HEAD			1 mV	CONTINUOUS

Contractors test

Continuity Survey proves that tank fill riser is continuous with tank shell (this is needed because tanks internally lined) but nothing else

Jubilee Food Store

March 2008

Routine MDEQ Inspection fails all three tanks

#	Tank#	Fuel Type	Contact Point	Local Reference Cell Placement	Local/On	Remote/Off	Pass	Fail	Incon
4.1	1	Regular	Tank riser	In ATG Manhole	-627mv	-604mv	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4.2	2	Premium	Tank riser	In ATG Manhole	-666mv	-664mv	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4.3	3	Highway (T	Tank riser	In ATG Manhole	-692mv	-688mv	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Question	Yes	No	CC
PIPE CORROSION PROTECTION			
Corrosion protection status of all	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
PIPE TERMINATION CORROSION PROTECTION			
Corrosion protection status of all dispenser pipe terminations can be determined	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Corrosion protection status of all stp pipe terminations can be determined	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
All accessible boots appear to effectively isolate terminations from soil/water	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
All containment sumps appear to effectively isolate terminations from soil/water	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

MDEQ Inspectors test

CP Expert evaluation conducted June 2008 responsive to MDEQ NOV failing all tanks

RECTIFIER MODEL: CS AYSA 20-10 Z

RECTIFIER SERIAL NUMBER: C-990493

RECTIFIER OUTPUT AS INITIALLY DESIGNED OR LASTLY RECOMMENDED (If available)

“Problem with negative diagnosed”

EVENT	DATE	TAP SETTINGS		DC OUTPUT		H ME
		COARSE	FINE	VOLTS	AMPS	
“AS FOUND”	6/24/08	C	3	19.3	0.5	-
“AS LEFT”	11/6/08	B	4	8.46	4.48	-

PROBLEM W/NEGATIVE DIAGNOSED
NEW NEGATIVE CIRCUITS - SURVEY.

XII. IMPRESSED CURRENT POSITIVE & NEGATIVE CIRCUIT MEASUREMENTS (output amperage)

Complete if the system is designed to allow such measurements (i.e. individual lead wires for each anode are installed and measurement shunts are present)

CIRCUIT	1	2	3	4	5	6	7	8	9	10	TOTAL
ANODE (+)	0.61	0.0	0.0	0.09	0.85	0.71	0.49	0.59	0.60	0.45	4.39A
TANK (-)	NO LEAD = 2.7A PREMIUM = 0.8A DIESEL = 0.8A (MEASURED W/CLIP-ON AMMETER)										4.1A

XIII. DESCRIPTION OF CATHODIC PROTECTION SYSTEM REPAIRS AND/OR MODIFICATION

Complete if the MDEQ c

“the vents were fiberglass underground” (portion of underground vents had been replaced with FRP as a result of construction in 2004)

Remarks/Other:

IMPRESSED CURRENT SYSTEM WAS INSTALLED IN JUNE 1996 BY PERFORMANCE OIL EQPT. AS FOUND BY RDCP IN JUNE 2008, THE NEGATIVE CIRCUIT WAS CLAMPED TO THE VENT RISERS & THE VENTS WERE FIBERGLASS, UNDERGROUND. RDCP SPECIFIED NEW INDIVIDUAL NEGATIVE CIRCUITS CLAMPED TO THE SUBPUMPS, WHICH WERE INSTALLED BY PERFORMANCE OIL EQUIPMENT IN NOVEMBER 2008. AFTER THIS WAS DONE, THE SYSTEM OPERATED WELL & PROPERLY & SHOULD BE CAPABLE OF PROVIDING ADEQUATE CATHODIC PROTECTION TO THE TANKS

Jubilee Food Store

November 2008

CP expert test conducted after tanks bonded in

The instant off potential must be -850 mV or more negative or the 100 mV polarization criterion must be met.

FACILITY NAME: SHELL FOOD MART. HWY 615 - VICKSBURG

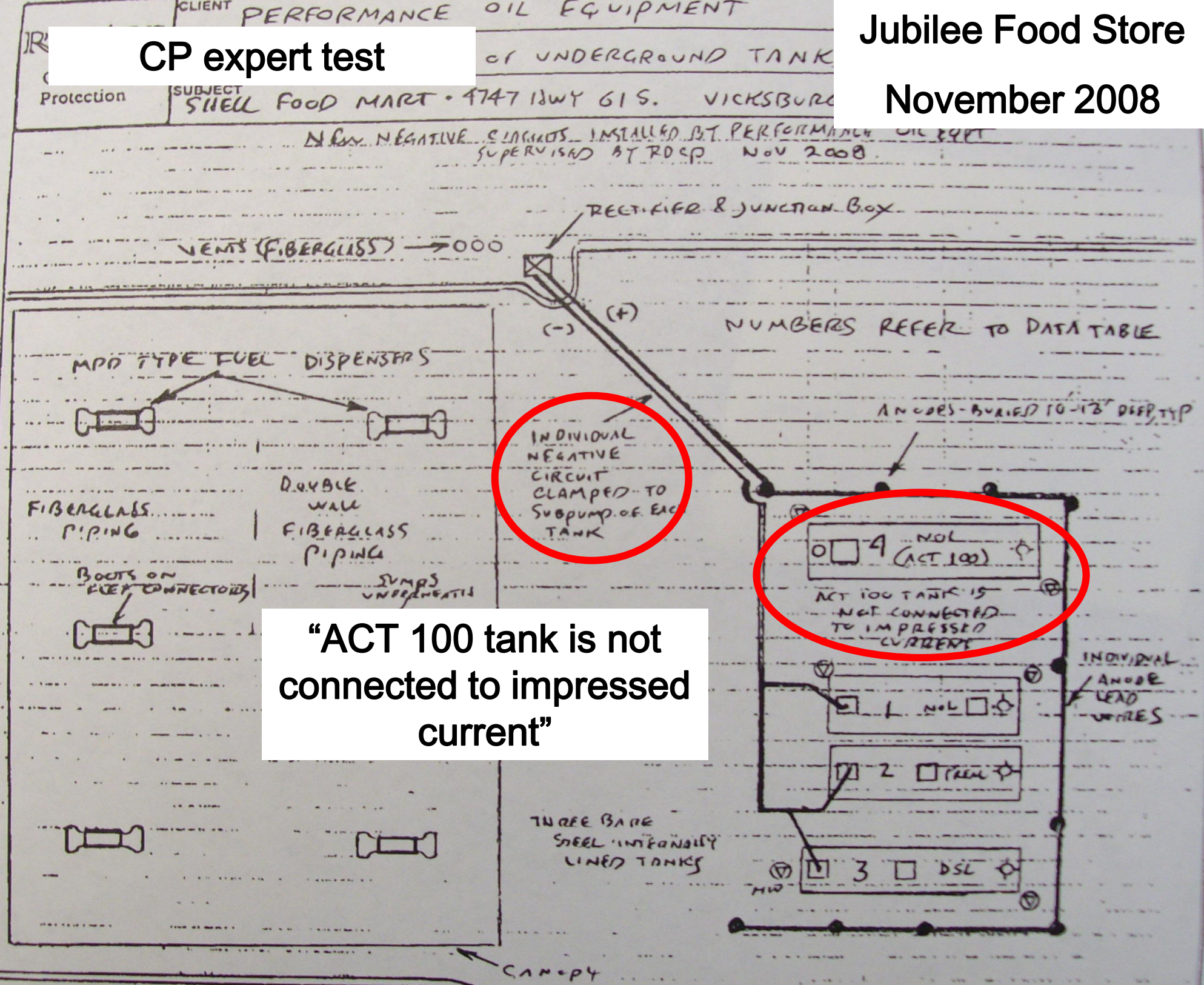
NOTE: The survey is not complete

Location Code	STRUCTURE	CONTACT POINT	REFERENCE CELL PLACEMENT	ON VOLTAGE	INSTANT OFF VOLTAGE	100MV POLARIZATION		PASS/ FAIL
						ENDING VOLTAGE	VOLTAGE CHANGE	
1	NOLEAD TANK SUBPUMP		CELL ON SOIL IN SUBPUMP MANHOLE	-998	-850			PASS
1	NOLEAD TANK FILL RISER		CELL ON SOIL IN MANHOLE NEXT TO FILL RISER	-1050	-970			PASS
2	PREMIUM TANK SUBPUMP		CELL ON SOIL IN SUBPUMP MANHOLE	-1155	-920			PASS
2	PREMIUM TANK FILL RISER		CELL ON SOIL IN MANHOLE @ MID-TANK	-1177	-965			PASS
3	DIESEL TANK SUBPUMP		CELL ON SOIL IN SUBPUMP MANHOLE	-1261	-917			PASS
3	DIESEL TANK FILL RISER		CELL ON SOIL IN MANHOLE @ MID-TANK	-1307	-998			PASS

CP expert test

Jubilee Food Store

November 2008



Galvanic Test

RODE PLACEMENT: > 30' SOUTH OF TANK PAD						
TACT POINT ³		LOCAL REFERENCE CELL PLACEMENT ⁴		LOCAL VOLTAGE ⁵	REMOTE VOLTAGE ⁶	PASS/FAIL ⁷
(example)	TANK BOTTOM	(example)	PLUS TANK STP MANWAY	(example) -928	(example) -810	(example) INCONCLUSIVE
(example)		(example)	UNDER DISPENSER 5/6	(example) -890	(example) -885	(example) PASS
2	PLUS PIPING	DISPENSER 5/6	UNDER DISPENSER 5/6			
1	PLUS TANK	TANK BOTTOM	SOIL @ NORTH END	-1130mv		PASS
2			SOIL @ ATG MANWAY	-1115mv		PASS
3			SOIL @ SUB MANWAY	-1056mv		PASS
4			REMOTE SOIL		-1130mv	PASS
3		SUB-PUMP	SOIL IN SUB MANWAY	-1038mv	-816mv	PASS
5	PREM TANK	TANK BOTTOM	SOIL @ NORTH END	-1098mv		PASS
6			SOIL @ ATG MANWAY	-938mv		PASS
7			SOIL @ SUB MANWAY	-994mv		PASS
			REMOTE SOIL		-1101mv	PASS
		SUB-PUMP	SOIL IN SUB MANWAY	-1040mv	-596mv	PASS
8	REG TANK	TANK BOTTOM	SOIL @ NORTH END	-1101mv		PASS
9			SOIL @ ATG MANWAY	-1037mv		PASS
10			SOIL @ SUB MANWAY	-991mv		PASS
4			REMOTE SOIL		-1083mv	PASS
10		SUB-PUMP	SOIL IN SUB MANWAY	-1751mv	-575mv	PASS
* RISERS UNDER DISPENSERS INSIDE DRY SUMPS						

SUB PUMP ?

Never dreamed 100mV shift would be applied this way

COMMENTS: NATIVE SUB PUMP READINGS PLUS SUB = -420mv

100mv SHIFT FOR SUB-PUMP REMOTES PREM SUB = -463mv

REG SUB = -470mv

1 Designate numerically or by code on the site drawing each "local" reference electrode placement (e.g. 1,2,3 T-1, T-2, P-1, P-2...etc.).



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