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		Design Agent	N/A			1-3	-1	E.A. Fredenburg	R2-89
1	1	Cog. Eng. T. J. Bowman	<i>T.J. Bowman</i>	9/20/99	R1-30				
1	1	Cog. Mgr. <i>BB Smith</i>	<i>BB Smith</i>	9-21-99		3	-	M.J. SUTLEY	55-07
		QA	N/A						
		Safety	N/A						
1	1	Env. <i>R.W. Szalmecza</i>	<i>R.W. Szalmecza</i>	10/27/99					

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1998 Annual Cathodic Protection Survey Report For the 242-A Evaporator Area

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Key Words: cathodic protection, polarization, rectifiers, protected piping, anodes, continuity

Abstract: This report is the second annual cathodic protection report for the 242-A evaporator. The report documents and trends annual polarization survey data, rectifier inspection data, and continuity data from 1994 through mid-1999.

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**1998 ANNUAL CATHODIC PROTECTION SURVEY REPORT
FOR THE 242-A EVAPORATOR AREA**

1.0 TABLE OF CONTENTS

	<u>Page</u>
1.0 TABLE OF CONTENTS	1
2.0 INTRODUCTION	3
3.0 DATA COLLECTION	4
4.0 1998 POLARIZATION SURVEY RESULTS AND ANALYSES	4
5.0 1998 CONTINUITY SURVEY RESULTS AND ANALYSES	6
6.0 CONCLUSIONS	6
7.0 RECOMMENDATIONS	7
8.0 REFERENCES	7

TABLES

Table 1 - Continuity Testing during the 1998 annual survey	7
--	---

SPREADSHEETS

Cathodic and Polarized Potentials relative to portable reference	8
electrode (1994 through 1998 annual surveys)	
1998 CP Annual Survey Data	9

GRAPHS (Cathodic Polarization during 1994 through 1998 annual surveys)**Evaporator Area**

Test Station T(33-38)	10
Test Station T(33-39)	11
Test Station T(33-40)	12
Test Station T(33-41)	13
Test Station 93-T3	14
Test Station 93-T4	15

A-Farm Area

Test Station T(42-16)	16
Test Station T(42-17)	17
Test Station T(42-18)	18
Test Station T(42-19)	19
Test Station T(42-21)	20
Test Station T(42-38)	21
Test Station T(42-39)	22
Test Station T(42-40)	23

AW-Farm Area

Test Station T(33-17)	24
Test Station T(33-22)	25
Test Station T(33-27)	26
Test Station T(33-34)	27
Test Station T(33-35)	28
Test Station T(33-37)	29

GRAPHS (Rectifier DC Outputs during 1994 to 1998 annual surveys)

EN-RECT-2018 (Rectifier 18) DC volts and amps	30
AW241-CATH-RECT-100 (Rectifier 19) DC volts and amps	31
AP241-CATH-RECT-100 (Rectifier R1) DC volts and amps	32

1998 ANNUAL CATHODIC PROTECTION SURVEY REPORT
FOR THE 242-A EVAPORATOR AREA

1.0 TABLE OF CONTENTS (contd.)

Page

<u>GRAPHS (Rectifier Inspections from 1994 to 1998)</u>	
Baseline, Resurvey, Bimonthly Inspection EN-RECT-2818 (Rect. #18).....	33
Baseline, Resurvey, Bimonthly Inspection AW241-CATH-RECT-100 (Rect. 19) ..	34
Baseline, Resurvey, Bimonthly Inspection AP241-CATH-RECT-100 (Rect. R1)	35

**1998 ANNUAL CATHODIC PROTECTION SURVEY REPORT
FOR THE 242-A EVAPORATOR AREA**

2.0 INTRODUCTION

This cathodic protection (CP) report documents results of the 1998 CP surveys of the underground piping entering and leaving the 242-A evaporator area. An annual survey of CP systems is required by DOE Order 5820.2A and Washington Administrative Code (WAC) 173-303-640.

Two spreadsheets to document the 1994 through 1998 annual survey polarization data are included in this report. Graphs are included to trend the cathodic polarization at each test station from 1994 through 1998. Graphs are included to trend voltage and amperage outputs of each rectifier during the annual surveys. Graphs are included to trend voltage and amperage outputs of each rectifier during the bimonthly rectifier inspections from 1994 through mid-1999. A table is developed to document the lack of continuity between piping at four evaporator test stations.

Analyses of the 1998 annual CP survey are included and conclusions and recommendations are made from the analyses.

Not included in this report is the baseline information developed for the 1997 annual report. The 1997 ANNUAL CATHODIC PROTECTION REPORT FOR THE 242-A EVAPORATOR, HNF-3379 Rev. 0, contains the following information:

1. A detailed description of the layout of the CP systems and piping systems of the 242-A evaporator;
2. Time sequences involved in the collection of annual survey data from 1994 through 1997;
3. CP criteria at Hanford site;
4. River Protection Project (RPP) CP system testing procedure and CP system configurations during annual surveys;
5. 1994 through 1997 CP survey data of voltage and continuity measurements at the test stations of the following areas:
 - a. 242-A evaporator property;
 - b. A-Farm property in proximity of the A-Farm valve pits; and
 - c. AW-Farm property in proximity of the AW-Farm valve pits and in proximity of tanks 241-AW-101 and 241-AW-102;
6. Spreadsheets and tables to tabulate the data, and graphs to trend the data;
7. Bimonthly inspection graph of evaporator Rectifier 18 (EN-RECT-2818) DC voltage and amperage outputs from 7/94 to 7/98;
8. Analysis, conclusions, and recommendations of the 1997 annual CP survey results;
9. Tables listing the attributes of the three rectifier systems associated with the evaporator;
10. Tables listing the attributes of the piping of the evaporator area and associated areas;
11. Table listing continuity measurements at the test stations on evaporator property;
12. Table listing the nameplate output data of the three rectifiers associated with the evaporator;
13. Graphs of three rectifiers DC outputs during the 1994 to 1997 annual surveys;
14. Appendix documenting applicable Washington Administrative Code (WAC) requirements and National Association of Corrosion Engineers (NACE) standard recommended practices pertaining to CP criteria of corrosion protection;
15. Discussion of potential refurbishments required in the year 2005; and
16. References

3.0 DATA COLLECTION

The collection of annual survey data and bimonthly inspection data for this report was accomplished as follows:

1998 Test Station Surveys

Data was collected at the direction of the RPP CP cognizant engineer. Testing was performed per Tank Farm Maintenance Procedures 3-CATH-357 Cathodic Protection System Testing and 3-CATH-357ET Cathodic Protection System Testing East Tank Farms (ET).

The 1998 annual survey on the evaporator property was performed per work package EL-98-00797.

The 1998 annual surveys on the AW-Farm and A-Farm property were performed per work package 2E-98-1755.

Inspection of EN-RECT-2818 (Rectifier 18), AW241-CATH-RECT-100 (Rectifier 19), and AP241-CATH-RECT-100 (Rectifier R1)

EN-RECT-2818 (Rectifier 18) was inspected on a bimonthly basis by the evaporator personnel per Tank Farm Maintenance Procedure, 6-TF-221, Inspection of Cathodic Protection System Rectifiers.

AW241-CATH-RECT-100 (Rectifier 19) and AP241-CATH-RECT-100 (Rectifier R1) were inspected on a bimonthly basis by the east tank farm personnel per Tank Farm Maintenance Procedure, 6-TF-221, Inspection of Cathodic Protection System Rectifiers.

CP System Configuration During Annual Survey

Rectifiers EN-RECT-2818 (18), AW241-CATH-RECT-100 (19), AP241-CATH-RECT-100 (R1), 15, and 16 were equipped with pulse generators during the annual surveys. The pulse generators allow the "polarized potential" across the piping to be calculated. The pulse generators are specified as not drifting and do not have to be synchronized with each other.

Rectifier AP241-CATH-RECT-100 (R1) system was operating with a non-pulsing pulse generator during the 1997 annual survey. The resulting uninterrupted current affected the polarization measurements at two test stations in the evaporator area. However, correlation with 1996 survey readings allowed the polarized potentials to be estimated. The estimated polarized potentials are shown on the graphs of test stations 93-T3 and 93-T4.

4.0 1998 POLARIZATION SURVEY RESULTS AND ANALYSES

Rectifier Outputs Influencing Voltages at Evaporator Area Test Stations

Cathodic polarization across underground piping is measured at six test stations in the evaporator area. EN-RECT-2818 (Rectifier 18) and AP241-CATH-RECT-100 (Rectifier R1) systems created the bulk of the polarization values at the six test stations. EN-RECT-2818 (Rectifier 18) system was running at 18.9 amps (nameplate = 40 amps) and AP241-CATH-RECT-100 (Rectifier R1) system was running at 20.9 amps (nameplate = 60 amps) during the 1998 annual survey.

Polarization voltages at test stations T(33-38), T(33-39), 93-T3, 93-T4
Measurements at four of the six test stations showed that the underground piping was protected above the NACE RP0285-95 4.2.1.2 standard (a negative polarized potential of at least 850 millivolts relative to a saturated copper/copper sulfate electrode). Reference the polarization graphs of test stations T(33-38), T(33-39), 93-T3, and 93-T4. The four-year polarization trends at these test stations shows fairly constant polarization values. The OFF polarization values at 93-T3 and 93-T4 during the 1997 survey are skewed because the AP241-CATH-RECT-100 rectifier was not pulsing due to a faulty pulse generator.

Polarization voltages at test stations T(33-40), T(33-41)

Measurements at the other two test stations on the evaporator property gave polarization values of -0.77 and -0.58 volts across the underground piping. Reference the polarization graphs of test stations T(33-40) and T(33-41). Polarization at T(33-40) increased by 40 millivolts from the 1997 value. Polarization at T(33-41) dropped by 150 millivolts from the 1997 value.

Native potentials of the underground piping have not been measured at the two test stations. The average native potential of the east area is between -0.3 to -0.35 volts. Assuming that the native potential of the underground piping at the two test stations is -0.35 volts, the piping at these two test stations gained at least 230 millivolts of polarization. NACE RP0285-95 4.2.1.3 standard (a minimum of 100 mV of cathodic polarization) would be exceeded by 130 millivolts.

A-Farm Valve Pit Area Test Stations

Cathodic polarization across underground piping is measured at eight EN-RECT-2818 (Rectifier 18) test stations in the A-Farm area. EN-RECT-2818 (Rectifier 18) system created the bulk of the polarization values across the piping at six of the eight test stations and contributed significantly to the polarization values across the piping at two of the test stations. EN-RECT-2818 (Rectifier 18) system was running at 18.9 amps (nameplate = 40 amps) during the 1998 annual survey. Rectifier 15 system and Rectifier 16 system contributed significantly to the polarization values across the piping at five test stations.

Polarization voltages at test stations T(42-16), T(42-17), T(42-19), T(42-21), T(42-38), T(42-39), T(42-40)

Measurements at seven of the eight test stations showed that the underground piping was protected above the NACE RP0285-95 4.2.1.2 standard (a negative polarized potential of at least 850 millivolts relative to a saturated copper/copper sulfate electrode). Reference the polarization graphs of test stations T(42-16), T(42-17), T(42-19), T(42-21), T(42-38), T(42-39), and T(42-40). The four-year polarization trends at these test stations shows fairly constant polarization values.

The operation of Rectifier 15 system and Rectifier 16 system contributed significantly to the polarization values across the piping at test stations T(42-16), T(42-17), T(42-18), T(42-21), T(42-40).

Polarization voltage at test stations T(42-18)

Cathodic measurements across the piping at one test station gave a polarization value of -0.813 volts. Reference the polarization graph of test station T(42-18). The four-year polarization trend at test station T(42-18) shows a moderate polarization loss.

A native potential of the piping has not been measured at the test station. At an assumed native potential of -0.35 volts, the piping at the test station would have gained 463 millivolts of polarization. NACE RP0285-95 4.2.1.3 standard (a minimum of 100 mV of cathodic polarization) would be exceeded by 363 millivolts.

AW-Farm (Valve Pit Area, Tank 101 Area and Tank 102 Area) Test Stations

Cathodic polarization is measured across the evaporator and A-Farm piping at six test stations in the AW-Farm area. AW241-CATH-RECT-100 (Rectifier 19) system created the bulk of the polarization values at the six test stations. AW241-CATH-RECT-100 (Rectifier 19) system was running at 5.75 amps (nameplate = 12 amps) during the 1998 annual survey.

Polarization voltage at test stations T(33-22), T(33-37), T(33-35), T(33-34),

T(33-27)

Measurements at five of the six test stations showed that the underground piping was protected above the NACE RP0285-95 4.2.1.2 standard (a negative polarized potential of at least 850 millivolts relative to a saturated copper/copper sulfate electrode). Reference the polarization graphs of test stations T(33-22), T(33-37), T(33-35), T(33-34), and T(33-27). T(33-22) gained 220 millivolts of polarization from 1994 to 1998. The four-year polarization trends at the other four test stations shows fairly constant polarization values.

Polarization voltage at test stations T(33-17)

Measurements at one of the six test station gave a polarization value of -0.70 volts in 1997. Reference the polarization graph of test station T(33-17). The test station was inaccessible during the 1998 survey. A native potential of the piping has not been measured at the test station. At an assumed native potential of -0.35 volts, the piping at the test station would gain 350 millivolts of polarization. NACE RP0285-95 4.2.1.3 standard (a minimum of 100 mV of cathodic polarization) would be exceeded by 250 millivolts.

5.0 1998 CONTINUITY SURVEY RESULTS AND ANALYSES

Continuity measurements were performed in 1998 at all six of the CP test stations located on the evaporator property. The continuity measurements that were greater than 100 ohms between piping conductors are tabulated in Table 1.

The underground piping connected to the "Resistive terminals" of Table 1 is not bonded to the "Specified Test Terminals" of Table 1.

6.0 CONCLUSIONSEvaporator EN-RECT-2818 (Rectifier 18) operation

During the 1998 annual survey, the rectifier was running at 15% of its kilowatt DC output capacity. At this low output, the rectifier is running at 45% efficiency. This efficiency is commonplace for low kilowatt output percentages.

The rectifier was running at 39.2 DC volts and 18.9 DC amps, or 1/3 the nameplate voltage of 120 DC volts and 1/2 the nameplate amperage of 40 DC amps.

As the underground anodes deteriorate, the system resistance would increase and more voltage would be required for the same amperage. The rectifier has ample voltage left, i.e., 80 volts, to compensate for any future anode deterioration. The EN-RECT-2818 (Rectifier 18) system was installed in 1985 and a slight system resistance increase has been shown over the last three years. The rectifier voltage has remained constant at the same tap settings.

Evaporator EN-RECT-2818 (Rectifier 18) system operation

All piping originating on the evaporator property, i.e., DR-335, DR-334, DR-343, DR-338, SL-168, SN-269, SN-270, SL-113, SL-114, and SL-167, and designed to be protected by the EN-RECT-2818 (Rectifier 18) system, is protected to the NACE standards implicitly recommended in the WAC. The aforementioned piping is protected within the evaporator area by EN-RECT-2818 (Rectifier 18) system.

DR-335, DR-334, DR-343, SL-114, and SL-113 are also protected within A-Farm by EN-RECT-2818 (Rectifier 18) system.

All piping originating on the A-Farm property, i.e., SN-220, SN-219, 4001, 4004, SL-100, SL-101, SN-215, SN-216, AND LIQW-702, and designed to be protected by the EN-RECT-2818 (Rectifier 18) system, is protected to the NACE standards implicitly recommended in the WAC.

AP-Farm AP241-CATH-RECT-100 (Rectifier R1) system operation

Piping SN-650, originating from AP-Farm, is designed to be protected by the AP241-CATH-RECT-100 (Rectifier R1) system on Evaporator property and is protected to the NACE standards implicitly recommended in the WAC.

AW-Farm AW241-CATH-RECT-100 (Rectifier 19) system operation

All piping originating on the evaporator property or A-Farm property that enters AW-Farm from the evaporator property, i.e., DR-335, DR-334, DR-343, SL-168, SN-269, SN-270, SL-167, SN-220, and SN-219, is protected to the NACE standards implicitly recommended in the WAC. The aforementioned piping is protected within AW-Farm by EN-RECT-2818 (Rectifier 19) system.

Bonding on Evaporator Property

All the identified "Resistive terminals" in the test stations of Table 1 require bonding jumpers to be installed between the "Resistive Terminals" and the "Specified Test Terminals" (or equivalent path) of Table 1.

7.0 RECOMMENDATIONS

Leave tap settings of Rectifier 18 at B-1.

Attached bonding jumpers between the aforementioned terminals of Table 1.

8.0 REFERENCES

HNF-3379 Rev. 0, 1997 Annual Cathodic Protection Survey Report for the 242-A Evaporator

NACE Standard RP0285-95, Item No. RP02085-95, Standard Recommended Practice, *Corrosion Control of Underground Storage Tank Systems by Cathodic Protection*
H-2-91042 Sh 1 Rev. 3 - Cathodic Protection Plot Plan Test Stations and Jumpers

H-2-91042 Sh 2 Rev. 3 - Cathodic Protection Plot Plan Anode Installation
H-2-91033 Sh 1 Rev. 2 - Cathodic Protection Plot Plan Test Stations and Jumpers

H-2-91033 Sh 2 Rev. 1 - Cathodic Protection Plot Plan Anode Installation

H-2-76993 Sh 1 Rev. 1 - Electrical Cathodic Protection Plan & Det

WAC 173-303-640 Tank Systems, Washington State Department of Ecology,
Dangerous Waste Regulations, Chapter 173-303 WAC, Publication 92-91

TABLE 1
Continuity Testing during 1998 annual survey

Test Station	Specified Test Terminals	Resistive Terminals (> 100 ohms in conductive path) and their resistance value to the Specified Test Terminals
T(33-38)	5 & 6	1 & 2 at 1.2 Mohms 13 & 14 at 3.1 Mohms
T(33-39)	5 & 6	13 & 14 at 6.8 Mohms
(93-T4)	1 & 2	9 & 10 at 20 Kohms 11 & 12 at 10 Mohms
(93-T3)	5 & 6	3 & 4 at 1.1 Mohms 1 & 2 at 0.8 Mohms 9 & 10 at OPEN circuit 11 & 12 at OPEN circuit

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1														
2	CATHODIC AND POLARIZED POTENTIALS RELATIVE TO PORTABLE REFERENCE ELECTRODE (1994 through 1998 annual surveys)													
3	Test Station	Line numbers		Portable	Portable	Portable	Portable	Portable		Portable	Portable	Portable	Portable	Portable
4				Reference	Reference	Reference	Reference	Reference		Reference	Reference	Reference	Reference	Reference
5				OFF value	OFF value	OFF value	OFF value	OFF value		ON value	ON value	ON value	ON value	ON value
6														
7										1994 Bas	1995 Cath	1996 Ann	1997 Ann	1998
8		1997		1994	1995	1996	1997	1998		1994	1995	1996	1997	1998
9	Evaporator													
10	Area		Standard	0.85	0.85	0.85	0.85	0.85						
11	Rectifier 18													
12	tap settings	B-1		B-2	B-1	B-1	B-1	B-1						
13	volts	38.3		44	38.5	38.4	38.3	39.2						
14	amps	19.3		32.9	21.2	25.5	19.3	18.9						
15	efficiency	51					51	44.8						
16	33-38	both		1.37		1.28	1.34	1.31		4.41		2.78	2.98	3.08
17		4" SW		0.94			1	1.32		2.91			2.15	3.09
18	33-39	both		1.37		1.25	1.33	1.305		4.4		2.78	2.65	2.89
19				0.97						2.92				
20	33-40 #1	both		0.78		1.05	0.73	0.768		1.33		2.14	0.97	1.101
21	33-40 #2	both		0.78		1.05	0.73	0.763		1.33		2.14	0.97	1.093
22	33-41 #1	both		0.89			0.72	0.579		1.18			0.97	0.783
23	33-41 #2	both		0.89			0.73	0.578		1.18			0.97	0.778
24	Rectifier R1													
25	tap settings	B-5		A-4	B-1	B-5	B-5	B-5						
26	volts	58.2		21.8	32.8	55	58.2	55.6						
27	amps	20.8		13.2	16.4	33.9	20.8	20.9						
28	efficiency	72					72	80						
29	93-3	both		1.11	1.17	1.27	3.23	1.26		2.15	2.65	3.5	3.4	3.108
30		8" RW		0.39	0.31					0.79	0.82			
31		4" SW		0.57	0.6					1.04	1.23			
32	93-4	1 1/2" PAM7		1.17		1.16	1.9	1.055		2.43		3	2.6	2.504
33		4" SW		0.7		0.83	1.58	1.048		1.15		1.92	1.83	2.464
34		SN-650		1.17						2.45				
35				1.02						1.62		calc PAM7		
36	A farm								1998	1994	1995	1996	1997	1998
37	Area													
38	Rectifier 18													
39	42-16	both		1.75		1.97	1.48	1.45		5.15		4.24	4	3.9
40	42-17	both		1.85		1.97	1.47	1.42		5.41		4	4	3.89
41	42-18	both		0.92	0.87		0.87	0.813		1.94	1.77		1.9	1.563
42	42-19	both		0.87		0.94	0.75	0.902		1.43		1.81	1.17	1.432
43	42-20													
44	42-21 #1	both		1.11	1.12	0.98	1.01	0.94		2.54	2.44	1.8	2	1.603
45	42-21 #2	both		1.11		0.98	1	0.94		2.54		1.8	1.99	1.595
46	42-38	both				1.6	1.43	1.41				4.28	4.14	4.44
47	42-39	both				1.28	1.09	1.099				2.8	1.85	2.372
48	42-40	both		1.06	1.08	1.03	1	0.959		2.81	2.51	2.13	1.99	1.98
49														
50	AW farm								1998	1994	1995	1996	1997	1998
51	Area													
52	Rectifier 19													
53	tap settings	C-2		B-4	D-5	C-2	C-2	C-2						
54	volts	27		10.5	45.2	26.5	27	27						
55	amps	5.5		4.7	13.2	9.4	5.5	5.75						
56	efficiency							51						
57	33-17	both		0.58			0.7			0.82			1.08	
58	33-22			0.78				1.001		1.12				1.847
59	33-27 #1	both		0.77		1.09	1.01	1.08		1.44		2.47	2.23	2.42
60	33-27 #2	both		0.78		1.09	1.01	1.08		1.45		2.46	2.23	2.42
61	33-34	both		0.73		1.01	1	0.985		0.99		1.78	1.64	1.591
62	33-35	both		1.09		1.01	1.01	0.964		2.04		1.78	1.65	1.599
63	33-37	both		0.98		1.18	0.92	0.978		1.83		2.22	1.61	1.788

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	SPREADSHEET 5 - 1998 CP Annual Survey Data												
2	1998 CP Annual Survey Data												
3	Test Station	terminal numbers	Portable Reference	Portable Reference	Permanent Reference	Permanent Reference	Portable to Permanent	Portable to Permanent		Permanent Reference	Permanent Reference	Portable to Permanent	Portable to Permanent
4			ON value	OFF value	ON value	OFF value	ON value	OFF value		ON value	OFF value	ON value	OFF value
5													
6													
7			1997 Annual Cathodic Protection Survey Data										
8		1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998
9	Evaporator												
10	Area												
11	Rectifier 18												
12	tap settings	B-1											
13	volts	38.2											
14	amps	18.9											
15	efficiency	44.8											
16	33-38	5&6	3.08	1.31	2.72	1.21	0.38	0.1					
17		3&4	3.09	1.32	1.02	0.73	1.82	0.49					
18	33-39	5&6 and 3&4	2.89	1.305	1.45	0.87	1.44	0.41		2.61	1.18	0.19	0.03
19													
20	33-40 #1	3&4 and 1&2	1.101	0.788	0.339	0.321	0.743	0.427					
21	33-40 #2	5&6 and 3&4	1.083	0.783	1.497	0.831	-0.397	-0.043					
22	33-41 #1	5&6 and 3&4	0.783	0.579	0.75	0.533	0.033	0.041					
23	33-41 #2	9&10/11&12	0.778	0.578	0.837	0.553	-0.088	0.004					
24	Rectifier R1												
25	tap settings	B-5											
26	volts	55.8											
27	amps	20.9											
28	efficiency	80											
29	93-3	5&6 and 3&4	3.108	1.28	2.743	1.322	0.372	-0.055		3.42	1.24	-0.3	0.013
30		8" RW											
31		4" SW											
32	93-4	1&2	2.504	1.056						2.95	1.08	-0.455	-0.018
33		9&10	2.464	1.048									
34		SN-850			???	???							
35													
36	A farm	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998
37	Area												
38	Rectifier 18												
39	42-16	3&4 and 1&2	3.9	1.45	3.99	1.33	-0.097	0.097					
40	42-17	5&6 and 3&4	3.89	1.42	3.063	1.205	0.833	0.237					
41	42-18	5&6 and 3&4	1.553	0.813	2.151	0.925	-0.599	-0.094					
42	42-19	5&6 and 3&4	1.432	0.902	1.581	1.022	-0.154	-0.12		1.438	0.884	-0.011	0.037
43	42-20								at 42-21				
44	42-21 #1	3&4 and 1&2	1.803	0.94	0.878	0.672	0.719	0.284					
45	42-21 #2	1&2/ 9&10	1.585	0.94	1.477	0.878	0.109	0.063					
46	42-38	5&6 and 3&4	4.44	1.41	4.1	1.38	0.335	0.051					
47	42-39	5&6 and 3&4	2.372	1.099	0.802	0.716	1.567	0.377					
48	42-40	5&6 and 3&4	1.96	0.969	2.017	0.942	-0.073	0.01					
49													
50	AW farm	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998
51	Area												
52	Rectifier 19												
53	tap settings	C-2											
54	volts	27											
55	amps	5.75											
56	efficiency	51											
57	33-17								covered				
58	33-22	5&6 and 3&4	1.647	1.001	2.004	0.951	-0.361	0.011					
59	33-27 #1	5&6 and 3&4	2.42	1.08	2.193	0.974	0.228	0.105					
60	33-27 #2	3&4 and 1&2	2.42	1.08	2.421	1.08	0.204	0.048					
61	33-34	9&10/11&12	1.581	0.965	1.567	0.834	0.309	0.075		1.39	0.822	0.192	0.133
62	33-35	5&6 and 3&4	1.599	0.984	1.959	0.989	-0.361	-0.019					
63	33-37	5&6 and 3&4	1.788	0.978	1.781	0.99	0.028	-0.019					

**Test Station T(33-38), SW Evaporator Area, Portable Reference Electrode Measurement,
Rectifier 18 Amperage, Protected Pipes SN-269, SN-270, SL-167, SN-219**

**Test Station T(33-39), SW Evaporator Area, Portable Reference Electrode Measurement,
Rectifier 18 Amperage, Protected Pipes DR-335, DR-334, DR-343, SN-220, SL-168**

**Test Station T(33-40), N Evaporator Area, Portable Reference Electrode Measurement,
Rectifier 18 Amperage, Protected Pipes DR-338, DR-343**

**Test Station T(33-41), N Evaporator Area, Portable Reference Electrode Measurement,
Rectifier 18 Amperage, Protected Pipes DR-343, DR-338**

**Test Station 93-T3, SE Evaporator Area, Portable Reference Electrode Measurement, Rectifier
R1 Amperage, Protected Pipe SN-650**

**Test Station 93-T4, S Evaporator Area, Portable Reference Electrode Measurement, Rectifier
R1 Amperage, Protected Pipe SN-650**

**Test Station T(42-16), A-Farm S of VPs, Portable Reference Electrode Measurement, Rectifier
18 Amperage, Protected Pipes SN-219, SN-220**

**Test Station T(42-17), A-Farm S of VPs, Portable Reference Electrode Measurement, Rectifier
18 Amperage, Protected Pipes SN-215, SN-216, SL-114, SL-113**

**Test Station T(42-18), A-Farm A-A, Portable Reference Electrode Measurement, Rectifier 18
Amperage, Protected Pipes LIQW-702, 4001, 4004**

Test Station T(42-19), A-Farm A-A, Portable Reference Electrode Measurement, Rectifier 18
Amperage, Protected Pipes LIQW-702, 4001, 4004, SL-101

**Test Station T(42-21), A-Farm N of VPs, Portable Reference Electrode Measurement, Rectifier
18 Amperage, Protected Pipes SL-100, SL-101**

**Test Station T(42-38), A-Farm N of 242-A, Portable Reference Electrode Measurement,
Rectifier 18 Amperage, Protected Pipes DR-343, DR-334, DR-335**

**Test Station T(42-39), A-Farm N of 242-A, Portable Reference Electrode Measurement,
Rectifier 18 Amperage, Protected Pipes DR-343, DR-334, DR-335**

**Test Station T(42-40), A-Farm N of VPs, Portable Reference Electrode Measurement, Rectifier
18 Amperage, Protected Pipes SL-100, SL-101**

**Test Station T(33-17), AW-Farm AW-A, Portable Reference Electrode Measurement, Rectifier
19 Amperage, Protected Pipes SL-168, SN-220, SN-267**

**Test Station T(33-22), AW-Farm AW-B, Portable Reference Electrode Measurement, Rectifier
19 Amperage, Protected Pipes SL-167, SN-219, SN-268**

Test Station T(33-27), AW-Farm N of VPs, Portable Reference Electrode Measurement, Rectifier 19 Amperage, Protected Pipes SL-167, SN-219, SN-269, SN-270, SN-220, SL-168

**Test Station T(33-34), AW-Farm N of 101, Portable Reference Electrode Measurement,
Rectifier 19 Amperage, Protected Pipes SN-219, SN-220, SL-168**

**Test Station T(33-35), AW-Farm N of 101, Portable Reference Electrode Measurement,
Rectifier 19 Amperage, Protected Pipes SN-269, SN-270, SL-167**

**Test Station T(33-37), AW-Farm N of 102, Portable Reference Electrode Measurement,
Rectifier 19 Amperage, Protected Pipes DR-335, DR-334, DR-343**

EN-RECT-2018 (Rectifier 18) DC volts and ampe

AW241-CATH-RECT-100 (Rectifier 19) DC volts and amps

AP241-CATH-RECT-100 (Rectifier R1) DC volts and amps

PERF--#18 - NAMEPLATE 120 VOLTS / 40 AMPS
 BASELINE DATE - 7/94; RESURVEY DATE - 1/95

BASELINE, RESURVEY, BIMONTHLY INSPECTIONS AW241-CATH-RECT-100 (RECT. 19)
LAST DATE 6/23/99

PERF-#19 - NAMEPLATE 40 VOLTS / 12 AMPS
BASELINE DATE - 7/94; RESURVEY DATE - 1/95

HNF-4689, Rev. 0

BASELINE, RESURVEY, BIMONTHLY INSPECTION AP241-CATH-RECT-100 (RECT. R1)
LAST DATE 6/23/99

PERF-#R1 - NAMEPLATE 100 VOLTS / 60 AMPS
BASELINE DATE - 7/94; RESURVEY DATE - 1/95