CA-IR-40

According to the testimony, "The non-reheat and reheat steam units operating duties are more rigorous than in previous years to meet growing system demands. Non-reheat units used for daily cycling are subjected to additional wear and tear due to a significant increase in daily on/off operation. Reheat units are now experiencing degradation due to daily on/off operation of critical auxiliaries while operating at their minimum loads." Please respond to the following:

a. Provide comparable annual data indicating startups by unit and other operating statistics indicating changed and more rigorous cycling of units and auxiliaries in 2002, 2003, 2004 and anticipated in 2005.

b. Explain and provide documentation of the asserted "additional wear and tear" thought to be caused by daily on/off operation.

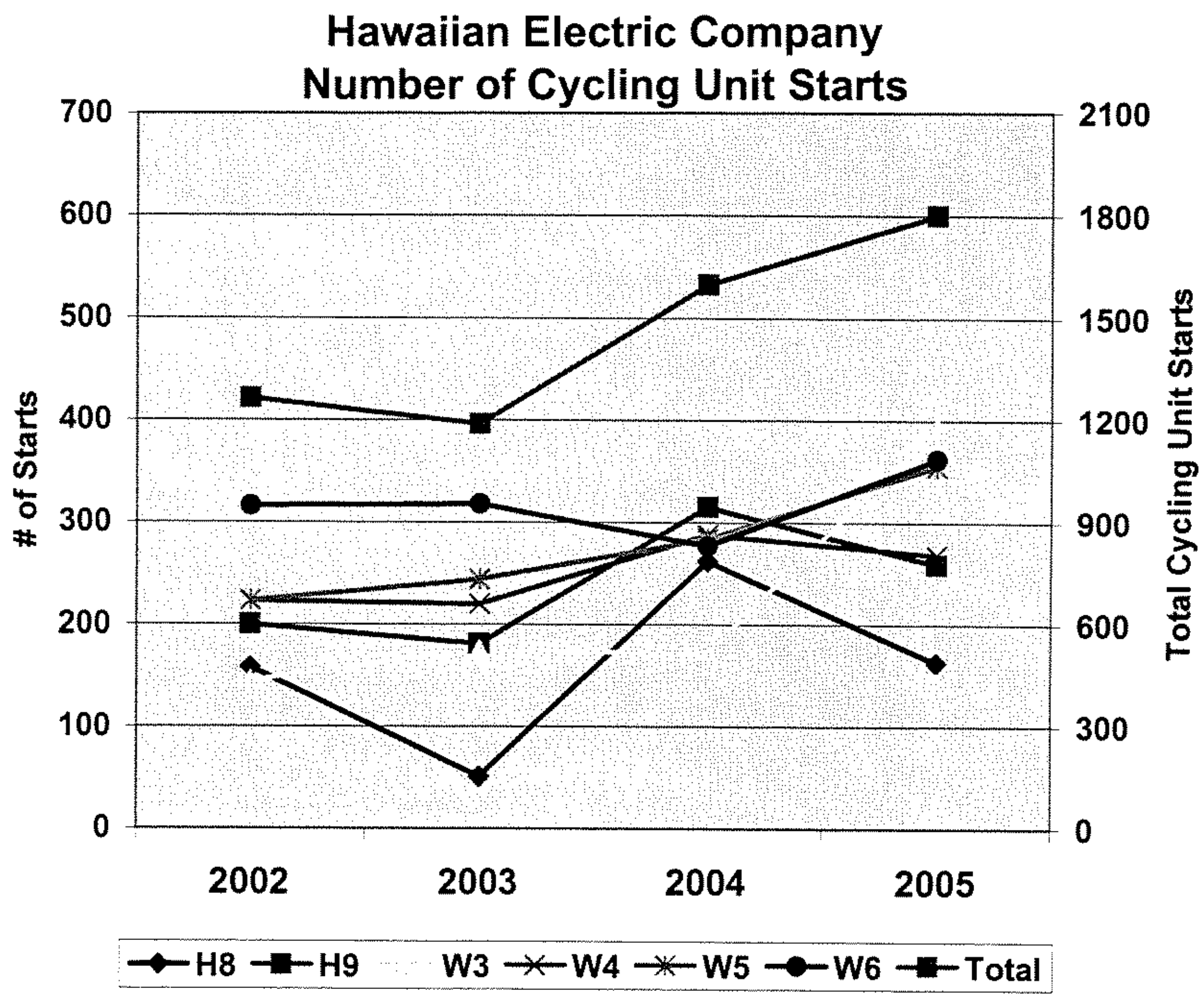
c. Provide comparative capital and expense (by Account/RA) amounts in each year 2000 through 2004 to the projections in the test year that are supportive of the apparent conclusion that cycling service has, in fact, increased production labor and non-labor costs incurred by HECO.

HECO Response:

a. Cycling unit startup information is provided for 2002, 2003, 2004 and anticipated in 2005 on page 3 of this response. "On/off" auxiliary startup statistics are not readily available, and it would require an unreasonable amount of manual labor to research and compile the data into a useable format for all base load units going back to 2000.

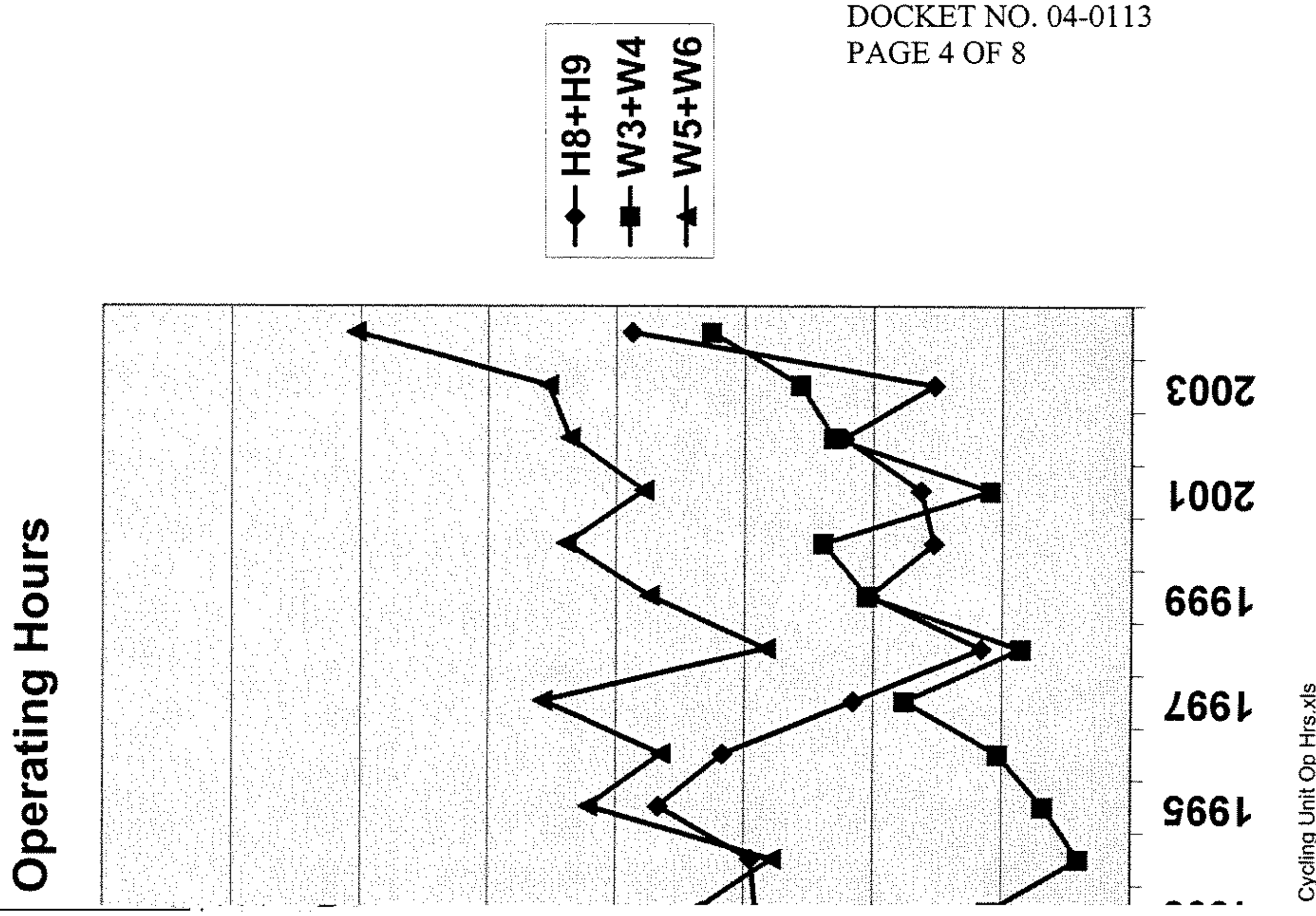
In addition to the startup information requested for cycling units, pages 4 and 5 provide a plot and spreadsheet of service hours by unit pairs of the non-reheat cycling units. This provides a more meaningful trend that illustrates the significant increase in operation system demand grew and larger more efficient units (current reheat units) were brought on line, older non-reheat units were cycled on and off to meet the daily load profile requirements.

The issue with base load units is the daily "on/off" operation of critical auxiliaries such as boiler feed pumps due to turn down of each unit's load to meet



Actual Starts 2002-2004, Forecast 2005

	H8	H9	W3	W4	W5	W6	Total
2002	158	200	145	223	223	316	1265
2003	51	181	175	220	244	318	1189
2004	262	315	172	288	284	277	1598
2005	163	259	394	268	355	362	1801


Operating Hours
H8+H9
W3+W4
W5+W6
2003
2001
1999
1997
1995
Cycling Unit Op Hrs.xls

Paired Cycling Unit Operating Hours

	H8+H9	W3+W4	W5+W6
1981	9614	3746	11492
1982	8186	1960	10933
1983	8273	470	7287
1984	9269	1502	10520
1985	9682	3963	9574
1986	8687	5775	11114
1987	11372	7144	11205
1988	14460	8691	12267
1989	14122	8053	12412
1990	14443	8459	12220
1991	9025	5895	9623
1992	6582	5331	7794
1993	5811	2210	6767
1994	5894	806	5560
1995	7333	1359	8433
1996	6327	2061	7293
1997	4306	3513	9140
1998	2323	1711	5671
1999	4053	4096	7475
2000	3057	4768	8783
2001	3257	2179	7567
2002	4452	4607	8731
2003	3050	5128	9061
2004	7747	6507	12072

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[redacted]

de	2000	2001	2002	2003	2004	2005
50			$119,525			
15	$3,938					
50			$40,137			
44						$170,000
44						$20,000
40	$8,872					
ZZ			$14,334			
ZZ			$10,055			
0					$62,178	
0					$21,923	
19					$6,931	
00					$140	
ZZ		$137,739				
55					$250,369	
45						$170,000
45						$20,000
0		$100,156				
48			$37,808			
ZZ				$50,146		
ZZ				$303,028		
ZZ				$15,377		
ZZ				$19,863		
ZZ				$236,212		
ZZ		$152,105				
ZZ				$396,383		
17			$18,822			

CA-IR-40

Equipment	Account Code	2000	2001	2002	2003	2004	2005
CA-IR-40							
K12 BFP Motor Service	PIT257K01NEP0000012	$11,844					
K11& K12 BFP Motor Service	PIT257K01NEP0000251			$28,143			
K12 BFP Volute Replacement	PIL259K01NENPIZZZZZ			$175,727			
K11 BFP Motor Repairs	PIL259K01NENPIZZZZZ				$34,342		
K12 BFP Motor Repairs	PIL258K01NENPIZZZZZ				$7,653		
K1 BFP Volute Replacement (201 only)	PIT258K01NEP0000846						$170,000
K1 BFP Motor Repairs (501only)	PIT258K01NEP0000846						$20,000
W81 & W82 BFP Motor Service	PIT257W08NEP0000142	$60,580					
W81 BFP Volute Replacement	PIX258W08NENPIZZZZZ	$35,102					
W81 BFP Volute Replacement	PIX259W08NENPIZZZZZ	$113,208					
W82 BFP Motor Repairs	PIX259W08NENPIZZZZZ	$72,956					
W81 BFP Motor Repairs	PIX259W08NENPIZZZZZ					$21,538	
W82 BFP Volute Replacement	PIT259W08NEP0000521					$198,509	
W71 & W72 BFP Motor Service	PIT257W07NEP0000141	$5,088					
W72 BFP Volute Replace	PIT258W07NEP0000141	$119,082					
W71 & W72 BFP Motor Service	PIT257W07NEP0000522					$4,207	
W72 BFP Motor Repairs	PIX258W07NENPIZZZZZ	$39,644					
CYCLING (NON-REHEAT) UNITS							
Waiau 3 boiler casing and refractory repairs	PIX259W03NPIZZZZZ	$1,336	$71,610			$54,854	
Waiau 3 boiler casing and refractory repairs	PIT258W03NEP0000249					$256,328	
Waiau 3 boiler draft duct repairs	PIX259W03NENPIZZZZZ		$17,182		$11,488	$39,687	
Waiau 3 boiler draft duct repairs	PIT258W03NEP0000249					$95,993	
Waiau 4 boiler casing and refractory repairs	PIX259W04NENPIZZZZZ	$15,394	$71,789	$19,199			
Waiau 4 boiler casing and refractory repairs	PIT259W04NEP0000244		$171,447	$1,654			
Waiau 4 boiler casing and refractory, duct repairs	PIT259W04NEP0000847						$535,000

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Equipment	Account Code	2000	2001	2002	2003	2004	2005
Waiau 5 boiler casing and refractory repairs	PIX259W05NENPIZZZZZ	$4,260		$93,610	$26,284	$10,454	
Waiau 5 boiler casing and refractory repairs	PIT259W05NEP0000252				$38,853		
Waiau 5 boiler draft duct repairs	PIX259W05NENPIZZZZZ					$826	
Waiau 5 boiler draft duct repairs	PIT259W05NEP0000252				$94,580		
Waiau 6 boiler casing and refractory repairs	PIX259W06NENPIZZZZZ	$5,901	$15,776	$8,627	$16,992	$65,049	
Waiau 5 boiler draft duct repairs	PIT259W06NEP0000243		$105,376				
Waiau 6 boiler draft duct repairs	PIX259W06NENPIZZZZZ			$83,670	$329		
Honolulu 8 boiler casing and refractory repairs	PIT259H08NEP0000137	$40,015	$27,686		$397,381		
Honolulu 8 boiler casing and refractory repairs	PIN259H08NENPIZZZZZ						
Honolulu 8 boiler casing and refractory repairs	PIT257H08NEP0000523						
Honolulu 9 boiler casing and refractory repairs	PIT259H09NENPIZZZZZ	$19,953		$2,997	$638	$371,013	
Honolulu 9 boiler casing and refractory repairs	PIX257H09NENPIZZZZZ						
Honolulu 9 boiler casing and refractory repairs	PIT258H09NEP0000138						
Honolulu 9 boiler casing and refractory repairs	PIT259H09NEP0000138						
	SUMMARY	**$557,173**	**$870,865**	**$654,307**	**$1,649,551**	**$1,460,000**	**$1,105,000**

CA-IR-41

Ref: HECO 611 –2003 Production Maintenance Schedule – Planned vs. Actual.

a. Please provide the 2003 Planned Outage Schedule Exhibit in color and with all related reports and documentation, including the budgeted capital and O&M costs for each outage within the plan.

b. In addition, please provide the corresponding actual capital and O&M costs for each outage that actually occurred (bottom half of exhibit) and explain each significant variance (more than $100,000) between planned/actual schedule and between planned/actual costs.

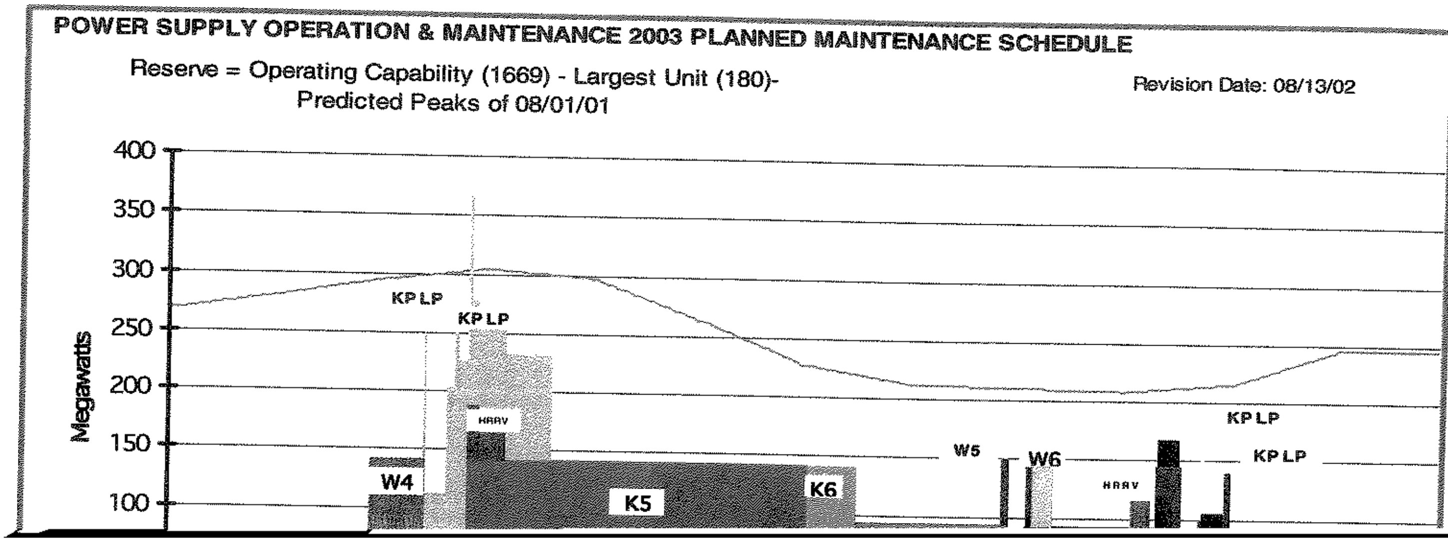
HECO Response:

The color 2003 Planned and Actual Outage Schedules shown in HECO-611 are provided in Attachment 1. Also included with each schedule is a spreadsheet containing specific dates outage durations and remarks that served as the basis for developing the graphical representation of the outages. The 2003 budgeted and actual capital costs for each overhaul are provided in Attachment 2 with variance explanations for items more than $100,000. The 2003 budgeted and actual O&M costs for each overhaul are provided in Attachment 3 with variance explanations for items more than $100,000.

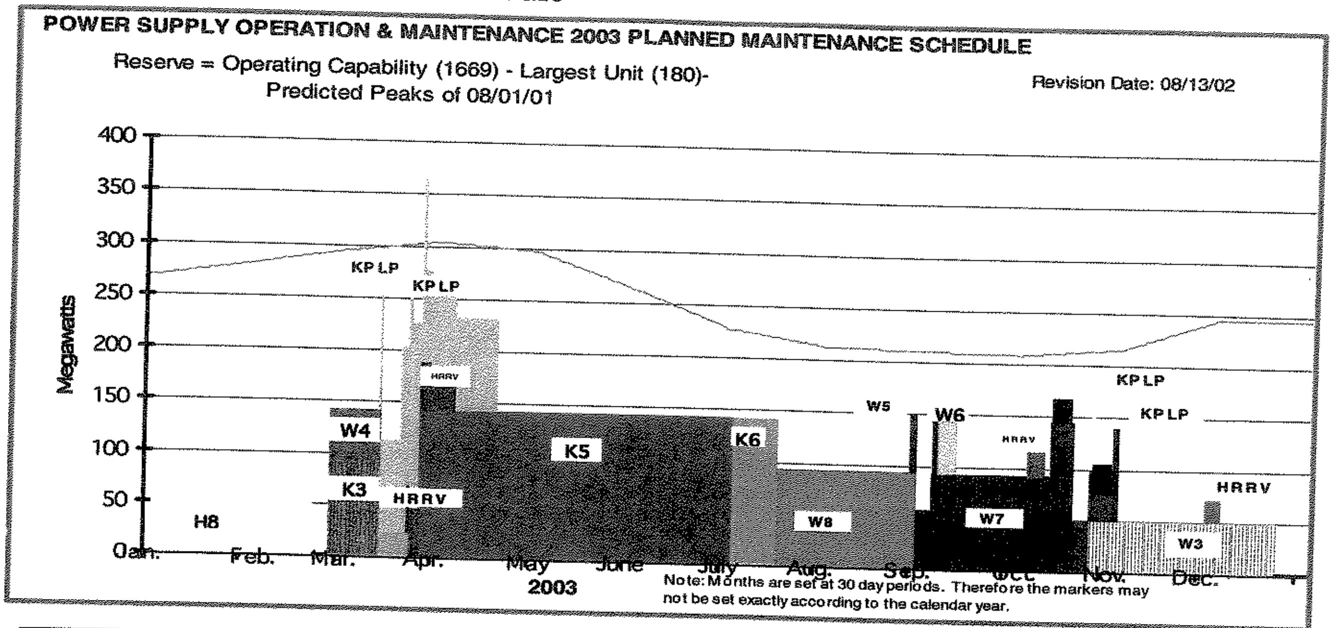
a. Please refer to Attachments 1, 2 and 3 to this response.

b. Please refer to Attachments 1, 2 and 3 to this response. The mix of units in 2003 and the unanticipated problems uncovered during some of the outages were a direct result of aging units, running the units harder due to growing demand, and other factors discussed in HECO T-6. The differences between planned and actual outage schedules, and capital and O&M variances, reflect the shifts in priorities and resources that were necessary to accomplish the required repairs to maintain generating unit reliability within the forecasted reserve margins.

2003 Planned vs. Actual Maintenance Schedule



2003 Planned Maintenance Schedule



UNIT	DATE				Duration	REMARKS
	Brk Op	Start	Bkr Cl	Firm	(Wks.Days)	
H8	01/03/03	01/06/03	02/21/03	02/22/03	7.1	Overhaul
K3	02/28/03	03/03/03	03/14/03	03/15/03	2.1	Outage
W4	02/28/03	03/03/03	03/14/03	03/15/03	2.1	Outage
HRRV-	03/15/03		03/24/03		1.3	23 MW Loss to System, 1 Blr
KPLP-	03/15/03		03/21/03		1.0	90 MW Loss to System, CT1 B Inspection
KPLP	03/22/03		03/28/03		1.0	180 MW Loss to System
KPLP-	03/29/03		04/20/03		3.2	90 MW Loss to System, CT2 C Inspection
HRRV	03/24/03		03/30/03		1.0	46 MW Loss to System
HRRV-	03/31/03		04/07/03		1.1	23 MW Loss to System, 1 Blr
K5	03/28/03	03/31/03	06/20/03	07/03/03	12.1	Overhaul (unit testing from 6/20 to 7/3)
K6	07/04/03	07/07/03	07/16/03	07/17/03	1.6	Boiler Wash
W8	07/18/03	07/21/03	08/29/03	08/30/03	6.1	Overhaul
W5	08/29/03	09/01/03	09/05/03	09/06/03	1.1	Outage
W7	09/05/03	09/08/03	10/17/03	10/18/03	6.1	Overhaul
W6	09/07/03	09/08/03	09/11/03	09/12/03	0.5	Boiler Inspection
HRRV-	10/05/03		10/09/03		0.5	23 MW Loss to System, 1 Blr
W9	10/12/03	10/13/03	10/18/03	10/18/03	1.0	Outage
W10	10/19/03	10/20/03	10/31/03	10/31/03	1.6	Outage
W3	10/24/03	10/27/03	12/19/03	12/20/03	8.1	Overhaul
KPLP-	10/25/03		10/25/03		0.1	90 MW Loss to System, CT2 A Inspection
KPLP-	11/01/03		11/01/03		0.1	90 MW Loss to System, CT1 A Inspection
HRRV-	11/29/03		12/03/03		0.5	23 MW Loss to System, 1 Blr

2003 Actual Maintenance Schedule

POWER SUPPLY OPERATION & MAINTENANCE 2003 ACTUAL MAINTENANCE SCHEDULE

Reserve = Operating Capability (1669) - Largest Unit (180)-
Predicted Peaks of 08/01/02

Revision Date: 01/12/04

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Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005

2003 Overhaul Capital Projects

	Budget	Actual	Variance	Explanation
Kahe 5				Overhaul moved into 2004
P0000078 K5 Boiler Controls Upgrade	811,923	1,076,300	264,377	2002 forecasted payments made in 2003
P0000084 K5 Blr Wtr Chem Analyzer Replace(CCI)	20,000	104,867	84,867	
P0000228 K5 SH & RH Attemp Spray Valves	0	77,906	77,906	
P0000267 K5 Data Acquisition & Monitoring	130,000	167,914	37,914	
P0000328 K5 Flue Gas Oxy Analyzr Upg	50,000	31,661	-18,339	
P0000511 K5 BFP Automated Test	45,238	0	-45,238	
P0000601 K5 Generator Protective Relay Upgrade	26,093	35,219	9,126	
P0000651 K5 AEH Limit Switch Upgrd	50,000	31,203	-18,797	
P0000750 K5 Reheater Element Replacements	300,000	891,278	591,278	2002 forecasted payments made in 2003
	1,433,254	2,416,348	983,094	
Waiau 3				Overhaul moved into 2004
P0000208 W3 Cycle Chem Instr.	3,005	1,332	-1,673	
P0000254 W3 Stack & Breeching Rpl	0	0	0	
P0000260 W3 Data Acq & Monitoring	45,758	0	-45,758	
P0000330 Waiau 3 Ignitor Replacement	129,956	10,183	-119,773	
P0000441 W3 Soot Blower Upgrade	0	0	0	
P0000459 Waiau 3 ERV Replacement	67,947	129	-67,818	
P0000485 WPP FWH #35 Replacement	0	3,768	3,768	
P0000510 Circ Water Temperature Monitor	31,712	33,403	1,691	
P0000511 BFP Automated Test	45,238		-45,238	
P0000601 Generator Protective Relay Upg	26,093	35,219	9,126	
P0000605 W3 and W4 Stack Drain	102,399	0	-102,399	
P0000638 W3 Air Heater Tube Replmnt	0	14,371	14,371	
P0000664 W3 UPS (& Battery Charger)	0	2,516	2,516	
P0000803 W3 Operator Console Upgrade	0	0	0	
P0000832 W3 Main Xfmr Replacement	0	19,266	19,266	
	[illegible]	[illegible]	[illegible]	
Waiau 8				Overhaul moved into 2004
P0000097 Waiau 8 Sootblower Ctls Upg	107,502	5,106	-102,396	
P0000213 W8 Cycle Chem Instr.	290,880	6,737	-284,143	
P0000231 W8 BFP Rec Ctrl Valves Upg	57,986	7,300	-50,686	
P0000232 W8 SH & RH Attemp Spray	111,141	32,411	-78,730	
P0000303 Waiau FWH #82 Replacement	0	3,864	3,864	
P0000313 W8 APH Sootblower Upgrade	0	0	0	
P0000463 Waiau 8 ERV Replacement	67,441	2,242	-65,199	
P0000510 Waiau Circ Water Temperature Monitor	31,712	33,403	1,691	
P0000511 W8 BFP Automated Test	45,238		-45,238	
P0000955 W8 BFP Rotating Elem/Volute	0	0	0	
	711,900	91,063	-620,837	
Honolulu 9				Overhaul continued from 2002
P0000057 H9 Blr Elec Warm Sys	36,681	179,415	142,734	Forecasted 2002 payments made in 2003
P0000091 H9 Attemperator Block Valve	0	33,731	33,731	
P0000195 H9 Boiler Safety Valve Upg	1,747	13,856	12,109	
P0000264 H9 Data Acq & Monitoring	59,663	84,209	24,546	
P0000457 H9 Stack Lining	121,187	135,655	14,468	
P0000488 H9 Hydrogen Purity Meter	12,050	32,343	20,293	
P0000582 H9 Turbine Supv Instr	79,670	106,583	26,913	
P0000751 H9 LP L-1 Turb/End Blades	208,505	231,477	22,972	
P0000752 H9 LP L-1 Col/End Blades	208,505	218,131	9,626	
P0000753 H9 LP L-0 Turb/End Blades	343,372	362,308	18,936	
P0000754 H9 LP L-0 Col/End Blades	343,372	360,933	17,561	
P0000755 H9 HP Curtis R1 Blades	69,613	77,326	7,713	
P0000756 H9 HP Curtis R2 Blades	71,462	79,393	7,931	
P0000757 H9 HP Stg 2 Rotor Blades	47,549	52,671	5,122	

Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005

2003 Overhaul Capital Projects

	Budget	Actual	Variance	Explanation
P0000758 H9 HP Stg 3 Rotor Blades	48,496	53,729	5,233	
P0000759 H9 HP Stat Rows C1-C4 Blades	200,479	223,918	23,439	
P0000760 H9 Curtis Stationary Blades	66,182	62,696	-3,486	
P0000761 H9 LP Cyl Liner/Retainer	170,635	172,834	2,199	
P0000762 H9 L-2 Turb/End Blades	197,174	175,941	-21,233	
P0000763 H9 L-2 Col/End Blades	197,174	179,845	-17,329	
P9027000 H9 Primary Fuel Oil Pumps	0	45,003	45,003	
P9453000 H9 Coriolis FO Flowmeter	24,977	29,217	4,240	
	2,508,493	2,911,214	402,721	
Waiau 5				Overhaul continued from 2002
P0000210 Cycle Chemistry Instruments	0	0	0	
P0000262 Data Acquisitioning & Monitoring	5,392	2,110	-3,282	
P0000268 Curtis R1 Blades	229	0	-229	
P0000416 Hydrogen Purity Meter	1,744	5,044	3,300	
P0000461 ERV Replacement	229	971	742	
P0000483 FWH #54 Replacement	22,082	26,774	4,692	
P0000510 Circ Water Temp Monitor	31,712	33,403	1,691	
P0000511 BFP Automated Test	45,238	79,472	34,234	
P0000601 Generator Protective Relay Upgrade	26,803	35,219	8,416	
	133,429	182,993	49,564	
Honolulu 8				
P0000056 H8 Blr Elec Warm Sys		84,553	84,553	
P0000216 H8 Cycle Chem Instr.	159,997	153,432	-6,565	
P0000265 H8 Data Acq & Monitoring	29,581	47,616	18,035	
P0000331 H8 Turbine Steam Gland Conv	228,017	258,903	30,886	
P0000771 H81 TVL Screen Repl	140,000	150,626	10,626	
P0000773 H8 HP/LP Turbine Blading	2,200,000	2,219,075	19,075	
P0000893 H8 Generator Rotor Rewind	0	800,265	800,265	Emergency work required
	2,757,595	3,714,470	956,875	
Waiau 7				
P0000096 W7 Sootblower Controls Upgr	29,235	28,947	-288	
P0000204 W7 BFP Recirc Ctrl Valve Upgr	57,967	37,161	-20,806	
P0000212 W7 Cycle Chem Instruments	292,960	388,340	95,380	
P0000230 W7 SH & RH Attemp Spray	111,188	86,083	-25,105	
P0000462 W7 ERV Replacement	67,929	0	-67,929	
P0000510 W7 Circ Water Temp Monitor		33,403	33,403	
P0000511 W7 BFP Automated Test	45,238	79,472	34,234	
P0000601 W7 Generator Protective Relay	26,803	35,219	8,416	
	631,320	688,625	57,305	
Kahe 4				OH moved up from 2004 to start late 2003
P0000083 K4 Blr Wtr Chem Alyz Repl(CCI)	307,069	302,967	-4,102	
P0000242 K4 SH & RH Attemp Spray	117,277	80,564	-36,713	
P0000327 K4 Flue Gas O2 Analyzer	107,028	80,210	-26,818	
P0000492 K4 HP Turb Row 9-11 Blades	282,162	194	-281,968	
P0000601 K4 Generator Protective Relay - program	26,803	35,219	8,416	
P0000633 K4 Exciter/Regulator Upgrade	335,779	287,144	-48,635	
P0000822 K4 Recorder Replacement		57,971	57,971	
P0000863 K4 Generator Rotor Rewind		389,731	389,731	
	1,176,118	1,234,000	57,882	

Hawaiian Electric Company Inc.
2005 TEST YEAR
2003 O&M Overhaul Projects

Project #	Project Description	2003 Budget	2003 Actual	Variance	Var Expl
Operation-					
P0000252	Waiau 5 2002 Overhaul	0	80,618	80,618	
Operation Total		0	80,618	80,618	
Maintenance-					
P0000138	Honolulu 9 Overhaul	777,700	2,537,334	1,759,634	A
P0000139	Kahe 4 Overhaul	0	(100,869)	(100,869)	B
P0000244	Waiau 4 2001 Overhaul	0	6,654	6,654	
P0000247	Kahe 2 2001 Overhaul	0	107	107	
P0000248	Kahe 3 2001 Overhaul	0	(51,567)	(51,567)	
P0000249	Waiau 3 2002 Overhaul	2,128,987	511	(2,128,476)	C
P0000250	Kahe 6 2002 Overhaul	0	1,897	1,897	
P0000251	Kahe 1 2002 Overhaul	0	9,245	9,245	
P0000252	Waiau 5 2002 Overhaul	210,000	1,177,916	967,916	D
P0000519	Kahe 5 Overhaul (2003)	3,394,942	366,499	(3,028,443)	E
P0000520	Kahe 4 Overhaul (2003)	0	3,658	3,658	
P0000521	Waiau 8 Overhaul (2003)	2,036,741	0	(2,036,741)	F
P0000522	Waiau 7 Overhaul (2003)	1,689,081	1,866,027	176,946	G
P0000523	Honolulu 8 Overhaul (2003)	1,806,022	4,900,033	3,094,011	H
P0000655	Kahe 4 Overhaul (2004)	0	1,378,271	1,378,271	I
Maintenance Total		12,043,473	12,095,716	52,243	
Total		12,043,473	12,176,334	132,861	
All Other Costs		38,805,962	32,875,895	(5,930,067)	
Grand Total Production O&M Expense		50,849,435	45,052,229	(5,797,206)	

Explanations-

A H-9 Overhaul originally scheduled from 10/04/02 to 12/20/2002.
Actual Overhaul dates 11/30/2002 to 3/23/2003. Budgeted amount was for carry over cost from 2002. Actuals reflect overhaul costs.

B K-4 Reclass of costs originally charged as O&M but later determined to be Capital

C W-3 Overhaul originally scheduled from 10/24/03 to 12/20/2003.
Overhaul moved to 2004 due to continuation of H-9 and W-5 overhauls from 2002 and advancement of the K-4 overhaul into 2003 to rewind the generator rotor due to a field ground.

D W-5 actual overhaul dates from 9/12/02 to 3/23/03, extended due to generator repairs. Actuals reflect higher scope in 2003 than anticipated.

E K-5 Overhaul originally scheduled from 3/28/03 to 7/03/03.
Overhaul moved to 2004 due to continuation of H-9 and W-5 overhauls from 2002 and the advancement of the K-4 overhaul into 2003 to rewind the generator rotor due to a field ground.

Explanations -

F W-8 Overhaul originally scheduled from 7/18/03 to 8/30/03. Overhaul moved to 2004 due to H-8 and W-5 overhauls carried over from 2002 and K-4 overhaul moved into 2003 to rewind generator rotor due to field ground.

G W-7 Overhaul actual cost reflects increased scope due to more insulation and generator work than anticipated.

H H-8 Overhaul actual cost reflects increased scope of work on the generator, boiler waterwall repairs, boiler insulation work, non-destructive testing (NDT), and turbine repairs.

I K-4 moved from 2004 into 2003, due to the need to address the generator field ground.

CA-IR-42

[redacted]

a. Please provide a color copy of the 2004 Planned Outage Schedule Exhibit, together with copies of all related reports and documentation, including the budgeted capital and O&M costs for each outage within the plan.

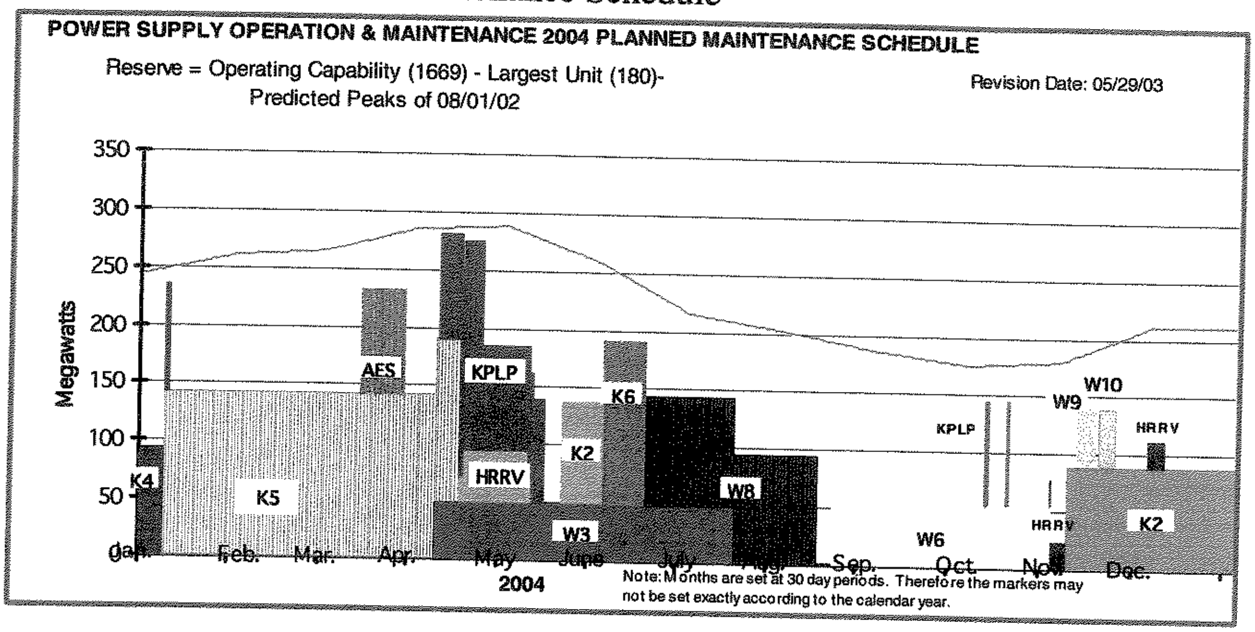
b. In addition, please provide the corresponding actual capital and O&M costs for each outage that actually occurred (bottom half of exhibit) and explain each significant variance (in excess of $100,000) between the planned versus actual schedule and the between planned versus actual costs.

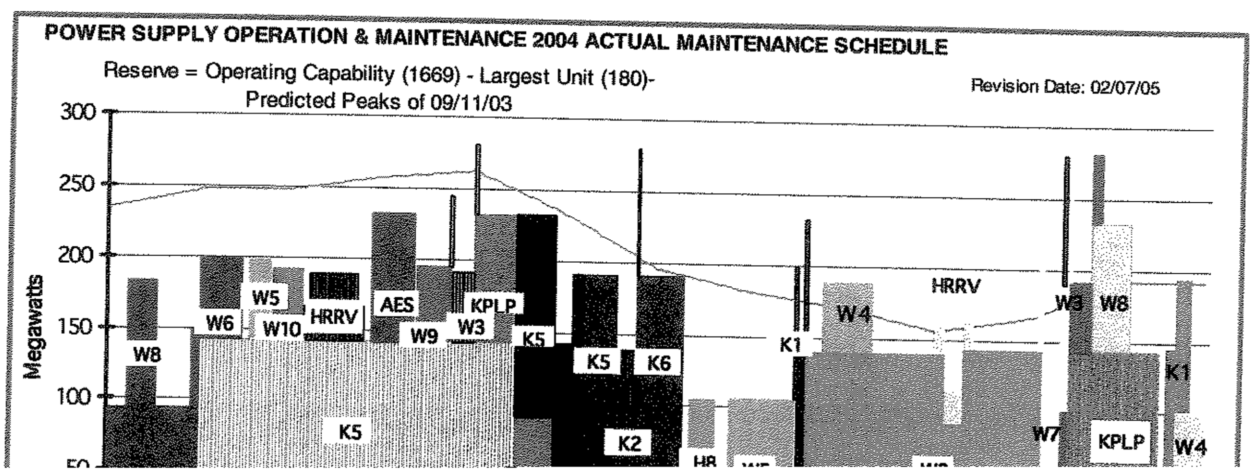
HECO Response:

Attachment 1 provides the color version of the 2004 Planned and Actual Outage Schedules in HECO-612. Note that the "2004 Actual" outage schedule provided in HECO-612 reflected year-to-date maintenance outages through October 6, 2004. The 2004 Actual Outage schedule in Attachment 1 was updated on 2/7/05 to reflect the full year 2004 results. Also included are the

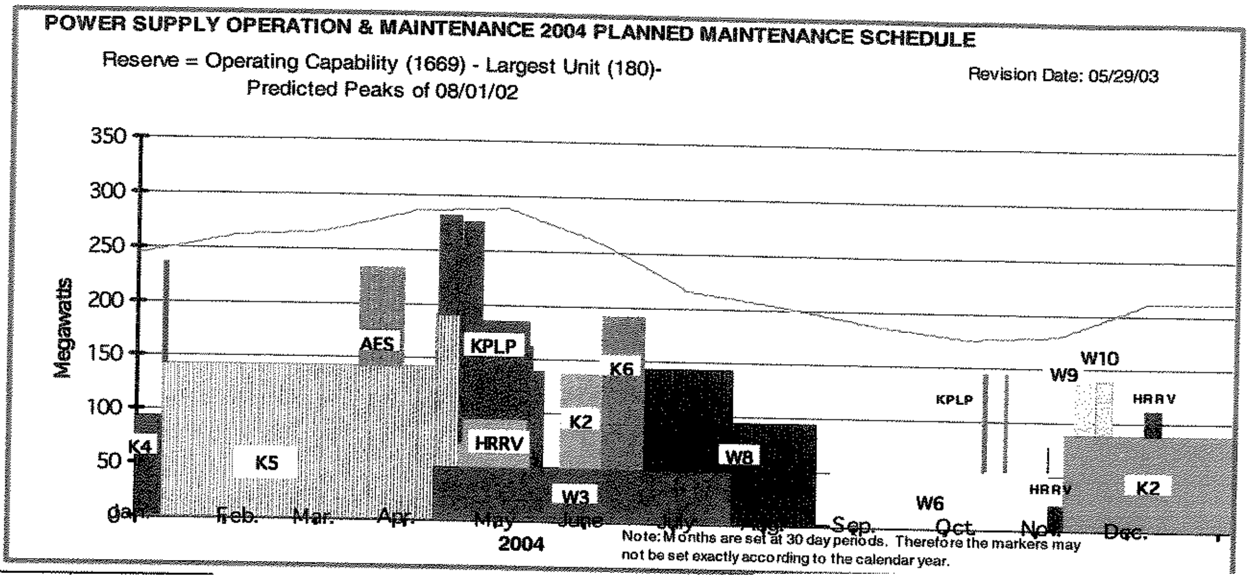
Attachment 2 provides the budgeted and actual capital cost for each outage with variance

2004 Planned vs. Actual Maintenance Schedule

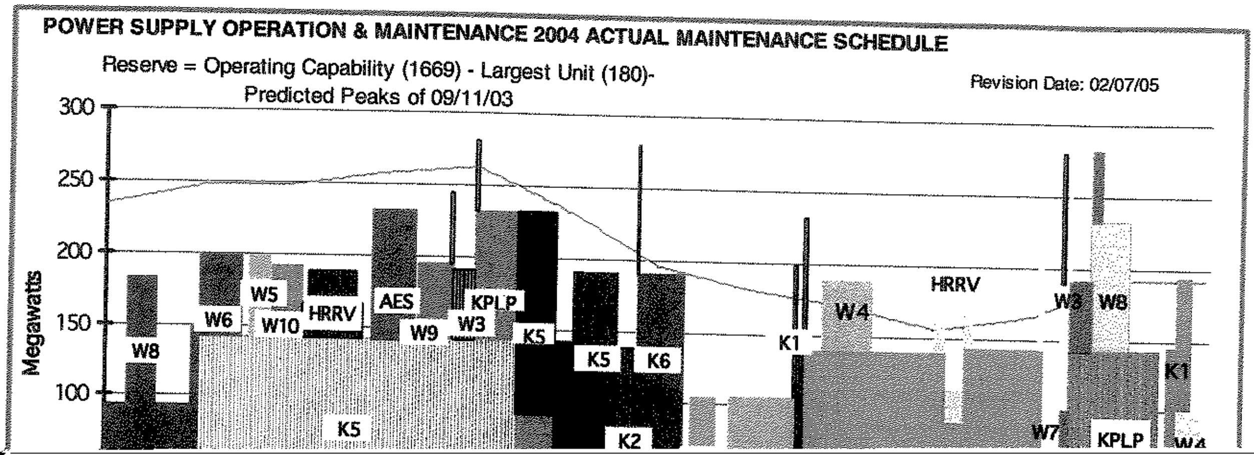




2004 Planned Maintenance Schedule



2004 Actual Maintenance Schedule



Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005

2004 Overhaul Capital Projects	2004 Budgeted	2004 Actual	Variance	Explanation
Kahe 4				Overhaul start moved up to late 2003
P0000083 K4 Blr Wtr Chem Alyz Repl(CCI)	0	55,666	55,666	
P0000242 K4 SH & RH Attemp Spray	2,289	68,838	66,549	
P0000327 K4 Flue Gas O2 Analyzer	30,614	17,653	-12,961	
P0000492 K4 HP Turb Row 9-11 Blades	143,793	146,809	3,016	
P0000601 K4 Generator Protective Relay	57,628	40,602	-17,026	
P0000633 K4 Exciter/Regulator Upgrade	441,432	266,973	-174,459	Expenditures budgeted for 2004 spent in 2003
P0000822 K4 Recorder Replacement	49,675	47,454	-2,221	
P0000863 K4 Generator Rotor Rewind	691,671	416,827	-274,844	Expenditures budgeted for 2004 spent in 2003
	1,417,102	1,060,822	-356,280	
Kahe 5				
P0000078 K5 Boiler Controls Upgrade	1,335,188	1,880,730	545,542	Expenditures budgeted for 2003 spent in 2004
P0000084 K5 Blr Wtr Chem Analyzer Replace(CCI)	228,047	112,554	-115,493	Expenditures budgeted for 2004 spent in 2003
P0000228 K5 SH & RH Attemp Spray Valves	151,718	81,737	-69,981	
P0000267 K5 Data Acquisition & Monitoring	186,045	182,790	-3,255	
P0000328 K5 Flue Gas Oxy Analyzr Upg	48,712	76,150	27,438	
P0000511 K5 BFP Automated Test	43,966	25,653	-18,312	
P0000601 K5 Generator Protective Relay Upgrade	57,628	40,602	-17,026	
P0000651 K5 AEH Limit Switch Upgrd	19,347	54,505	35,158	
P0000750 K5 Reheater Element Replacements	372,112	692,446	320,334	Expenditures budgeted for 2003 spent in 2004
	2,442,763	3,147,167	704,405	
Waiau 3				
P0000208 W3 Cycle Chem Instr.	279,043	293,071	14,028	
P0000254 W3 Stack & Breeching Rpl	224,109	283,379	59,270	
P0000260 W3 Data Acq & Monitoring	45,698	241,606	195,908	Additional monitoring points for Predictive Maintenance and heat rate information
P0000297 W3 Condenser Waterbox	391,264	432,710	41,446	
P0000330 Waiau 3 Ignitor Replacement	173,362	123,685	-49,677	
P0000441 W3 Soot Blower Upgrade	371,313	6,009	-365,304	Project deferred
P0000459 Waiau 3 ERV Replacement	74,915	72,142	-2,773	
P0000510 Circ Water Temperature Monitor	17,545	41,164	23,619	
P0000511 BFP Automated Test	43,966	25,653	-18,313	
P0000601 Generator Protective Relay Upg	57,628	40,602	-17,026	
P0000605 W3 and W4 Stack Drain	99,799	52,142	-47,657	
P0000638 W3 Air Heater Tube Replmnt	439,354	767,855	328,501	Tube material costs higher due to steel shortage
P0000664 W3 UPS (& Battery Charger)	37,796	73,481	35,685	
P0000803 W3 Operator Console Upgrade	232,925	344,969	112,044	Added scope for control board enclosure and AC
P0000832 W3 Main Xfmr Replacement	713,342	869,325	155,983	Added scope for new underground conduit
	3,202,059	3,667,793	465,734	
Waiau 8				
P0000097 Waiau 8 Sootblower Ctls Upg	112,571	279,296	166,725	Additional equipment upgrades increased costs
P0000213 W8 Cycle Chem Instr.	327,150	406,714	79,564	
P0000231 W8 BFP Rec Ctrl Valves Upg	49,374	90,095	40,721	
P0000232 W8 SH & RH Attemp Spray	110,203	126,475	16,272	
P0000303 Waiau FWH #82 Replacement	230,369	283,156	52,787	
P0000313 W8 APH Sootblower Upgrade	243,094	70,328	-172,766	Lower cost due to revised design
P0000463 Waiau 8 ERV Replacement	123,757	99,089	-24,668	
P0000510 Waiau Circ Water Temperature Monitor	17,545	41,164	23,619	
P0000511 W8 BFP Automated Test	43,966	25,653	-18,313	
P0000601 W8 Generator Protective Relay Upgrade	57,628	40,602	-17,026	
P0000936 Waiau Turbine Drains		22,951	22,951	
P0000955 W8 BFP Rotating Elem/Volute	300,729	329,172	28,443	
P0000968 W8 Process Parameter Monitoring		45,886	45,886	
	1,616,386	1,860,581	244,195	

Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005

2004 Overhaul Capital Projects		2004 Budgeted	2004 Actual	Variance	Explanation
Waiau 6					Overhaul moved into 2005
P0000211	W6 Cycle Chem Instr.	294,476	342,189	47,713	
P0000493	W6 HP Turbine Blades	2,368,044	1,131,440	-1,236,604	Costs moved into 2005
P0000511	W6 BFP Automated Test	43,966	25,653	-18,313	
P0000601	W6 Generator Protective Relay	57,628	40,602	-17,026	
P0000675	W6 Control/DC Cables to Swyd	147,450	64,705	-82,745	
P0000682	W6 Annunciator Upgrade	342,036	6,465	-335,571	Costs moved into 2005
P0000804	W6 Operator Console Upgrade	183,471	154,736	-28,735	
P0000968	W6 Process Parameter Monitor		45,866	45,866	
		3,437,071	1,811,656	-1,625,415	
Kahe 2					Overhaul moved into 2005
G0007213	K2 Generator Protective Relay	57,628	40,602	-17,026	
P0000215	K2 Cycle Chem Instr.	165,697	115,313	-50,384	
P0000511	K2 BFP Automated Test	43,966	25,653	-18,313	
P0000609	K2 Blr Access Door Addition	97,339	42,240	-55,099	
P0000647	Kahe 23FWH Replacement	205,886	99,356	-106,530	Costs moved into 2005
P0000659	Kahe 25FWH Replacement	330,263	208,294	-121,969	Costs moved into 2005
P0000676	K2 Opacity Monitor Upgrade	155,066	0	-155,066	Costs moved into 2005
P0000821	K2 Battery Bank Replacement	210,418	0	-210,418	Costs moved into 2005
P0000860	K2 Annunciator Replacement	358,239	6,179	-352,060	Costs moved into 2005
P0000873	Kahe 2 Sootblower Controls	311,600	20,638	-290,962	Costs moved into 2005
P0000934	K2 Turbine Drains	0		0	
P0000968	K2 Process Parameter Monitor	0	45,866	45,866	
		1,571,472	380,333	-1,191,139	
Waiau 9					Projects moved up due to forced outage
P0000658	W9 Exhaust Duct Replacement	5,385	469,210	463,825	
P0000564	W9 DCS Processor Upgrade	77,410	4,197	-73,213	
P0000939	Waiau CT Separation	88,973	235,186	146,213	
		171,768	708,593	536,825	

Hawaiian Electric Company Inc.
2005 TEST YEAR
2004 O&M Overhaul Projects

Project #	Project Description	2004 Budget	2004 Actual	Variance	Var Expl
Operation-					
P0000252	Waiau 5 2002 Overhaul	0	8,476	8,476	
P0000521	Waiau 8 Overhaul (2003)	0	7,529	7,529	
Operation Total		0	16,005	16,005	
Maintenance					
P0000244	Waiau 4 2001 Overhaul	0	18	18	
P0000248	Kahe 3 2001 Overhaul	0	398	398	
P0000249	Waiau 3 2002 Overhaul	3,399,775	3,305,215	(94,560)	
P0000251	Kahe 1 2002 Overhaul	0	3,338	3,338	
P0000252	Waiau 5 2002 Overhaul	0	849	849	
P0000519	Kahe 5 Overhaul (2003)	3,909,857	4,221,755	311,898	A
P0000520	Kahe 4 Overhaul (2003)	0	3,869	3,869	
P0000521	Waiau 8 Overhaul (2003)	2,175,843	3,444,806	1,268,963	B
P0000522	Waiau 7 Overhaul (2003)	0	25,787	25,787	
P0000523	Honolulu 8 Overhaul (2003)	0	29,451	29,451	
P0000650	Kahe 2 Overhaul (2004)	1,900,189	94,743	(1,805,446)	C
P0000654	Waiau 6 Overhaul (2004)	2,185,251	555,314	(1,629,937)	D
P0000655	Kahe 4 Overhaul (2004)	300,000	1,118,289	818,289	E
P0000844	Kahe 6 Overhaul (2005)	0	330	330	
P0000937	W9 Major Inspection	0	981,919	981,919	F
Maintenance Total		13,870,915	13,786,081	(84,834)	
Total		13,870,915	13,802,086	(68,829)	

Explanations-

A K-5 Overhaul actual cost reflects an increase in scope for the turbine repairs and higher boiler chemical clean costs than anticipated.

B W-8 Overhaul actual cost reflects more air pre-heater (APH) repairs than expected, unanticipated waterwall cladding, unanticipated secondary superheater repairs, and an increase in turbine repair scope. Also used more outside services to support concurrent overhauls.

C K-2 overhaul originally scheduled from 11/05/04 to 1/1/05. Overhaul was moved to 2005 due to K-4 overhaul starting in late 2003 and continuing into 2004, additional time on K-5 overhaul, and the forced outage on W-9, which caused its overhaul to start in October, 2004. Actual K2 cost reflects pre-overhaul preparation work.

Explanations -

D W-6 overhaul originally scheduled from 8/20/04 to 10/30/04. Overhaul was moved to 2005 due to K-4 overhaul starting in 2004, additional time on K-5 overhaul, and W9 forced outage which advanced its overhaul. Actuals represent preparation work for overhaul which began 1/26/05.

G K-4 overhaul was moved into 2003 to address the grounded generator field. Overhaul started later in 2003 than anticipated and duration was longer than expected. 2004 budget was only for carried over costs, but actuals represent nearly half of the overhaul costs.

F W-9 overhaul budgeted for 2005 was forced to begin in 2004 due to a forced outage caused by a compressor blade failure.

(REVISED 4-21-05)

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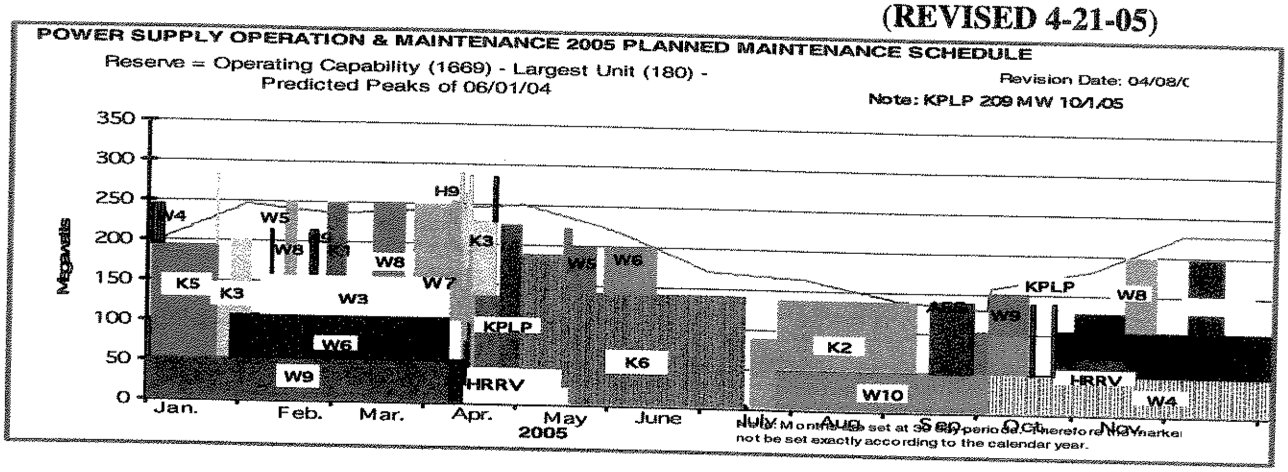
<u>Ref: HECO 627 Production Maintenance Schedule – Test Year.</u>

a. Please provide a color copy of the current Planned 2005 O

(REVISED 4-21-05)



Approved 4/8/05

UNIT	DATE Brk Op	Start	Bkr Cl	Firm	Duration (Wks.Days)	REMARKS
W9	10/12/2004	1/1/2005	4/04/2005	4/8/2005	24.3	Overhaul (Comprssr, HG, Cl), Gen, Exh Duct Repl, Blade damage
W4	1/1/2005	1/1/2005	1/5/2005	1/5/2005	0.5	Hydrogen coolers(act dates)
K5	1/2/2005	1/3/2005	1/22/2005	1/23/2005	3.0	Outage #7 vibration, seal oilfilter, aph bearing cover leak APH wash(act dates)
K3	1/23/2005	1/24/2005	2/2/2005	2/3/2005	1.4	Maintenance Outage, blr inspct, AH baskets replacement(act dates)
W6	1/28/2005	1/29/2005	4/14/2005	4/15/2005	11.0	Overhaul (HP blades, annunciator panel, blr refractory)
W3	2/7/2005	2/7/2005	4/12/2005	4/12/2005	9.2	Boiler tube leak and waterbox repairs
W5	2/10/2005	2/10/2005	2/10/2005	2/10/2005	0.1	ACW Tie in w/ Waiau 6(act dates)
W8	2/15/2005	2/15/2005	2/16/2005	2/17/2005	0.2	Aux transformer (act. Dates)
H9	2/23/2005	2/23/2005	2/24/2005	2/24/2005	0.2	Main steam bypass and sample valve replacement (act. Dates)
K1	2/28/2005	2/28/2005	3/4/2005	3/5/2005	0.5	RH inspection / expansion joint (act. Dates)
W8	3/15/2005	3/15/2005	3/24/2005	3/24/2005	1.3	Maintenance Outage tunnel clean (act dates)
W7	3/28/2005	3/28/2005	4/15/2005	4/16/2005	2.5	Maintenance Outage tunnel clean
H9	4/9/2005	4/9/2005	4/11/2005	4/11/2005	0.3	Remove exciter
K3	4/12/2005	4/13/2005	4/22/2005	4/23/2005	1.4	Maintenance Outage (APH Baskets)
HRRV-	4/14/2005		4/14/2005		0.1	23 MW Loss
HRRV	4/15/2005		5/15/2005		4.3	46 MW Loss
HRRV-	5/16/2005		5/17/2005		0.2	23 MW Loss
KPLP-	4/17/2005		4/24/2005		1.1	CT1 inspection HRSG repairs
H9	4/23/2005	4/23/2005	4/23/2005	4/23/2005	0.1	Reinstall exciter
KPLP	4/25/2005		5/1/2005		1.0	180 MW Loss, CT1 B Inspection, ST Outage, CT2 Outage, Bal of Plant
K6	5/2/2005	5/3/2005	7/12/2005	7/13/2005	10.2	Overhaul (blr, annunciator upgrade, SSH tubes rpl, RSH tubes rpl)
W5	5/16/2005	5/17/2005	5/24/2005	5/25/2005	1.2	Maintenance Outage BFP Check, ERV, Attemp block
W6	5/29/2005	5/30/2005	6/13/2005	6/14/2005	2.2	Maintenance Outage (APH Baskets)
K2	7/16/2005	7/17/2005	9/6/2005	9/7/2005	7.4	Overhaul (HRH bend, MS bend, annunciator upgrade, FWH repl)
W10	7/25/2005	7/25/2005	10/13/2005	10/13/2005	11.4	Overhaul (Comprssr, HG, Cl), Gen, Exh Duct Repl CT sep.
AES-	9/12/2005		9/25/2005		2.0	90 MW Loss, Boiler Inspection
w9	9/26/2005	9/26/2005	10/13/2005	10/13/2005	2.4	CT Separation
W4	10/1/2005	10/2/2005	1/5/2006	1/6/2006	13.6	Overhaul (HP/LP/Gen, exciter upgrade)
KPLP-	10/15/2005		10/15/2005		0.1	104.5 MW Loss, CT2 A Inspection
KPLP-	10/22/2005		10/22/2005		0.1	104.5 MW Loss, CT1 A Inspection
H9	10/23/2005	10/24/2005	1/17/2006	1/18/2006	12.3	Maintenance Outage (Generator Rewind)
HRRV-	10/29/2005		11/4/2005		1.0	23 MW Loss
HRRV-	11/5/2005		11/13/2005		1.2	23 MW Loss
W8	11/14/2005	11/14/2005	11/23/2005	11/23/2005	1.3	Maintenance Outage tunnel clean
W7	12/4/2005	12/4/2005	12/14/2005	12/14/2005	1.4	Maintenance Outage tunnel clean

Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005

(REVISED 4-21-05)

2005 Overhaul Capital Projects
Based on Planned Maintenance Schedule dated 4/8/04

Budgeted			Budget
Waiau 9			
	P0000299	W9 Compressor Blade Coating	336,369
	P0000564	W9 DCS Processor Upgrade	228,150
	P0000658	W9 Exhaust Duct Replacement	411,408
	P0000689	W9 Intake Duct Upgrade	411,408
			1,387,335
Waiau 10			
	P0000300	W10 Compr Blade Coating	338,252
	P0000565	W10 DCS Processor Upgrade	301,854
	P0000657	W10 Exhaust Duct Replacement	413,703
	P0000691	W10 Intake Duct Upgrade	413,703
			1,467,512
Kahe 6			
	P0000454	K6 Fan Enclosure	586,005
	P0000641	K6 AEH Limit Switch Upgrd	86,506
	P0000809	K6 Annunciator Replacement	354,295
	P0000958	K6 SSH Element Replacement	432,313
	P0000968	K6 Process Parameter Monitoring	121,000
			1,580,119
Kahe 4			
	P0000271	K4 Stormwater Drain Impv	216,873
	P0000781	KPP FWH #41 Replacement	20,107
	P0000782	KPP FWH #42 Replacement	21,143
	P0000869	K4 Annunciator Replacement	427,142
	P0000874	Kahe 4 Sootblower Controls	110,707
	P9454000	K4 Boiler Control Upgrade	1,995,570
	P9541000	K4 Data Acq and Monitor	396,982
			3,188,525
Kahe 1			
	P0000610	K1 Blr Access Door Addition	104,092
	P0000681	Kahe1 Condenser Tube Replacement	1,397,620
	P0000800	K1 Operator Console Upgrade	202,108
	P0000820	K1 Main Xfmr Replacement	1,106,029
	P0000830	K1 Aux Xfmr Replacement	199,917
	P0000854	K1 Excitation System	346,309
	P0000861	K1 Annunciator Replacement	370,297
	P0000871	Kahe 1 Sootblower Controls	299,693
	P0000957	K1 MS Replacement	561,944
	P0001009	K1 Battery Bank Replacement	229,516
			4,817,524
Waiau 4			
	P0000209	W4 Cycle Chem Instr.	292,712
	P0000442	W4 Soot Blower Upgrade	367,721
	P0000489	W4 Cond Wtrbx Repl	336,062
	P0000801	W4 Operator Console Upgrade	181,113
	P0000829	W4 Main Xfmr Replacement	673,210
	P8820000	W4 Exciter Upgrade	346,890
			2,197,709

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Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005

2005 Overhaul Capital Projects
Based on Overhaul Schedule dated 1/2004
Projected Based on Overhaul Schedule dated 4/2005

			Budget	Projected	Variance	Explanation
Waiau 9						
	P0000299	W9 Compressor Blade Coating	336,369	120,000	(216,369)	Scope reduction to only cover a waterwash system
	P0000564	W9 DCS Processor Upgrade	228,150	219,380	(8,770)	Updated project forecast
	P0000658	W9 Exhaust Duct Replacement	411,408	847,792	436,384	Additional cost for expedited material delivery and construction due to emergency outage
	P0000689	W9 Intake Duct Upgrade	411,408	0	(411,408)	Project deferred to 2010
	P0000939	Waiau CT Separation	0	392,051	392,051	Project transferred from Energy Delivery Department
			1,387,335	1,187,172	191,888	
Waiau 6						
	P0000211	W6 Cycle Chem Instr.	0	191,786	191,786	Overhaul moved from 2004
	P0000804	W6 Operator Console Upgrade	0	187,293	187,293	Overhaul moved from 2004
	P0000493	W6 HP Turbine Blades	0	589,329	589,329	Overhaul moved from 2004
	P0000675	W6 Control/DC Cables to Swyd	0	22,161	22,161	Overhaul moved from 2004
	P0000682	W6 Annunciator Upgrade	0	499,821	499,821	Overhaul moved from 2004
	P0000968	W6 Process Parameter Monitoring	0	200,000	200,000	Overhaul moved from 2004
			0	1,690,390	1,690,390	
Waiau 10						
	P0000300	W10 Compr Blade Coating	338,252	122,791	(215,461)	Scope reduction to only cover a waterwash system
	P0000565	W10 DCS Processor Upgrade	301,854	440,637	138,783	Updated project forecast
	P0000657	W10 Exhaust Duct Replacement	413,703	563,749	150,046	2004 progress payment moved into 2005
	P0000691	W10 Intake Duct Upgrade	413,703	0	(413,703)	Project deferred to 2010
			1,467,512	1,127,177	(340,335)	
Kahe 6						
	P0000238	K6 BFP Rec Ctrl Valves Upg	0	75,413	75,413	New projected project
	P0000454	K6 Fan Enclosure	586,005	547,250	(38,755)	Updated project forecast
	P0000641	K6 AEH Limit Switch Upgrd	86,506	92,750	6,244	Updated project forecast
	P0000806	K06 CWP MOV Replacement	0	74,229	74,229	Project deferred from 2004
	P0000809	K6 Annunciator Replacement	354,295	656,636	302,341	Updated project forecast
	P0000958	K6 SSH Element Replacement	432,313	1,546,996	1,114,683	2004 progress payment deferred into 2005
	P0000968	K6 Process Parameter Monitoring	121,000	121,000	0	Updated project forecast
	P0001031	K6 Flame Scanner Det Replace	0	169,173	169,173	New projected project
			1,580,119	2,917,861	1,458,742	
Kahe 4						
	P0000271	K4 Stormwater Drain Impv	216,873	0	(216,873)	Overhaul moved to 2006
	P0000781	KPP FWH #41 Replacement	20,107	0	(20,107)	Overhaul moved to 2006
	P0000782	KPP FWH #42 Replacement	21,143	0	(21,143)	Overhaul moved to 2006
	P0000869	K4 Annunciator Replacement	427,142	0	(427,142)	Overhaul moved to 2006
	P0000874	Kahe 4 Sootblower Controls	110,707	0	(110,707)	Overhaul moved to 2006
	P9454000	K4 Boiler Control Upgrade	1,995,570	0	(1,995,570)	Overhaul moved to 2006
	P9541000	K4 Data Acq and Monitor	396,982	0	(396,982)	Overhaul moved to 2006
			3,188,525	0	(3,188,525)	

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Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005

2005 Overhaul Capital Projects
Based on Overhaul Schedule dated 1/2004
Projected Based on Overhaul Schedule dated 4/2005

			Budget	Projected	Variance	Explanation
Kahe 1						
	P0000610	K1 Blr Access Door Addition	104,092	0	(104,092)	Overhaul moved to 2006
	P0000681	Kahe1 Condenser Tube Replacement	1,397,620	0	(1,397,620)	Overhaul moved to 2006
	P0000800	K1 Operator Console Upgrade	202,108	0	(202,108)	Overhaul moved to 2006
	P0000820	K1 Main Xfmr Replacement	1,106,029	0	(1,106,029)	Overhaul moved to 2006
	P0000830	K1 Aux Xfmr Replacement	199,917	0	(199,917)	Overhaul moved to 2006
	P0000854	K1 Excitation System	346,309	0	(346,309)	Overhaul moved to 2006
	P0000861	K1 Annunciator Replacement	370,297	0	(370,297)	Overhaul moved to 2006
	P0000871	Kahe 1 Sootblower Controls	299,693	0	(299,693)	Overhaul moved to 2006
	P0000957	K1 MS Replacement	561,944	0	(561,944)	Overhaul moved to 2006
	P0001009	K1 Battery Bank Replacement	229,516	0	(229,516)	Overhaul moved to 2006
			4,817,524	0	(4,817,524)	
Kahe 2						
	P0000215	K2 Cycle Chem Instr.	0	232,781	232,781	Overhaul moved from 2004
	P0000609	K2 Blr Access Door Addition	0	51,813	51,813	Overhaul moved from 2004
	P0000646	Kahe 24FWH Replacement	0	35,706	35,706	Overhaul moved from 2004
	P0000647	Kahe 23FWH Replacement	0	178,679	178,679	Overhaul moved from 2004
	P0000659	Kahe 25FWH Replacement	0	116,011	116,011	Overhaul moved from 2004
	P0000873	Kahe 2 Sootblower Controls	0	434,094	434,094	Overhaul moved from 2004
	P0000676	K2 Opacity Monitor Upgrade	0	129,675	129,675	Overhaul moved from 2004
	P0000821	K2 Battery Bank Replacement	0	200,649	200,649	Overhaul moved from 2004
	P0000860	K2 Annunciator Replacement	0	666,781	666,781	Overhaul moved from 2004
			0	2,046,189	2,046,189	
Honolulu 9						
	P0000870	H9 Generator Rotor Rewind	0	518,320	518,320	Project advanced from 2007
Waiau 4						
	P0000209	W4 Cycle Chem Instr.	292,712	272,927	(19,785)	Updated project forecast
	P0000442	W4 Soot Blower Upgrade	367,721	338,813	(28,908)	Updated project forecast
	P0000460	Waiau 4 ERV Replacement	0	68,420	68,420	New projected project
	P0000489	W4 Cond Wtrbx Repl	336,062	387,745	51,683	Updated project forecast
	P0000801	W4 Operator Console Upgrade	181,113	280,404	99,291	Updated project forecast
	P0000829	W4 Main Xfmr Replacement	673,210	761,098	87,888	Updated project forecast
	P8820000	W4 Exciter Upgrade	346,890	572,165	225,275	Updated project forecast
			2,197,709	2,681,572	483,863	

Hawaiian Electric Company Inc.
2005 TEST YEAR
2005 O&M Overhaul Project
1/12/04 vs. 2/03/05 vs. 4/05 Planned Maintenance Schedule Comparison

(REVISED 4-21-05)

Project #	Project Description	1/12/04 Schedule 2005 Test Yr	2/03/05 Schedule 2005 Projected		Revised 4/05 Sch 2005 Projected	
P0000650	Kahe 2 Overhaul (2004)	481,500	2,420,200	A	2,420,200	
P0000844	Kahe 6 Overhaul (2005)	2,890,828	2,938,900		2,938,900	
P0000845	Kahe 4 Overhaul (2005)	3,549,686	0	B	0	
P0000846	Kahe 1 Overhaul (2005)	1,908,690	0	C	0	
P0000847	Waiau 4 Overhaul (2005)	3,716,918	3,775,600		3,775,600	
P0000937	W9 Major Inspection	1,002,540	2,637,300	D	3,212,500	H
P0000938	W10 Major Inspection	1,002,540	3,014,900	E	3,664,800	I
P0000521	Waiau 8 Overhaul (2004)		131,500	F	138,700	H
P0000654	Waiau 6 Overhaul		2,219,200	G	2,036,000	H
		14,552,702	17,137,600		18,186,700	

A K-2 Overhaul was originally expected to be completed at the end of 2004. Test year budget included only anticipated carry over costs. Due to extended overhauls in 2004 and the advancement of the W-9 overhaul in 2004, K-2 was moved into 2005.

B K-4 Overhaul to be moved into 2006 due to W-6 and K-2 overhauls shifting from 2004 into 2005

C K-1 Overhaul to be moved into 2006 due to W-6 and K-2 overhauls shifting from 2004 into 2005

D W-9 Overhaul continuation from October, 2004, is expected to be over budget due to more worn and damaged components requiring replacement than anticipated. Note that these costs do not include costs that will be covered by insurance.

E W-10 Overhaul expected to be over budget. Work scope for W-10 is estimated to be similar to W-9, less complete rotor disassembly and less replacement of blades and other rotating and stationary turbine and compressor parts.

F W-8 overhaul was completed in November, 2004. Above is carried over from 2004.

G W-6 Overhaul was to have been completed in 2004. Due to extended overhauls in 2004 and unanticipated W-9 overhaul in 2004, W-6 was moved into 2005.

H Waiau 8 completed 11/02/2004 , Waiau 9 Overhaul completed 4/8/05 and Waiau 6 overhaul proejcted to be complete 4/17/05. Revised 2005 projected to include actuals and remaining commitments.

I Waiau 10 estimated revised based on Waiau 9 actuals.

CA-IR-43

Ref: HECO 627 Production Maintenance Schedule – Test Year.

a. Please provide a color copy of the current Planned 2005 Outage Schedule Exhibit together with copies of all related reports and documentation for the Test Year, including a detailed statement of the budgeted capital and O&M costs by Account and RA for each outage within the plan.

b. If any revisions have been made to the Outage Schedule and related cost estimates since the preparation of the Company's rate filing, please identify and quantify each change and explain whether such revisions are properly recognized in the rate case Docket.

HECO Response:

a. A color copy of the test year 2005 O&M Planned Maintenance Schedule dated 1/12/04 (HECO-627) and related documents are provided on pages 4 to 6 to this response. In addition to the color copy of HECO-627 on page 4, a spreadsheet showing the specific dates of the respective unit outages, durations, and remarks is included. The Capital Project budget and the O&M Project budget are provided on pages 5 and 6 respectively. The RA used for forecasting purposes is PIT (Traveling Maintenance).

b. Since the test year 2005 O&M Planned Maintenance Schedule was developed in HECO-627, a number of events in 2004, including the forced outage and overhaul on W9 which began in October 2004, triggered changes to the 2005 Planned Maintenance Schedule. As discussed in HECO T-6 on pages 11 to 14, managing unit outages is very dynamic and there are many factors that can impact the original schedule. The 2005 O&M Planned Maintenance Schedule was revised as of February 3, 2005. A comparison between the 1/12/04 version of the 2005 test year schedule and the 2/3/05 revision, and the Capital project and O&M project impacts, are provided on pages 7 to 11. Page 7 compares the 1/12/04 version of the 2005 Planned Maintenance Schedule with the 2/3/05 version. A

(Revised 3-18-05)

spreadsheet containing specific dates of the respective unit outages, durations, and remarks of the 2/3/05 version is included on page 8. The changes to the capital project budget between the two 2005 Planned Maintenance Schedules are provided on pages 9 and 10. The changes to the O&M project budget between the two 2005 Planned Maintenance Schedules is provided on page 11.

The increase in O&M project expense on page 10 based on the revised 2/03/05 Planned Maintenance schedule is primarily due to the anticipated increase in work scope on W10 based on the inspection and findings on W9. As shown in CA-IR-41 for 2003, and CA-IR-42 for 2004, changes are driven by a number of factors including predicted reserve margin, unanticipated increases in overhaul scope based on what is found, operating permit inspection dates, aging units, etc.

Since the development of the 2/03/05 revision to the 2005 O&M Planned Maintenance Schedule, additional revisions will be necessary to reflect the extension of the W9 overhaul to March 31st based on delays caused by material deliveries and increases in scope due to the discovery of additional repairs during the outage. Also, other shifts in unit outages are being considered to minimize system spinning reserve risks. Therefore, another revision to the 2005 Planned Maintenance Schedule with Capital and O&M project updates will be forthcoming, and will be provided (with a comparison of the schedule and cost impacts) after it is finalized and approved.

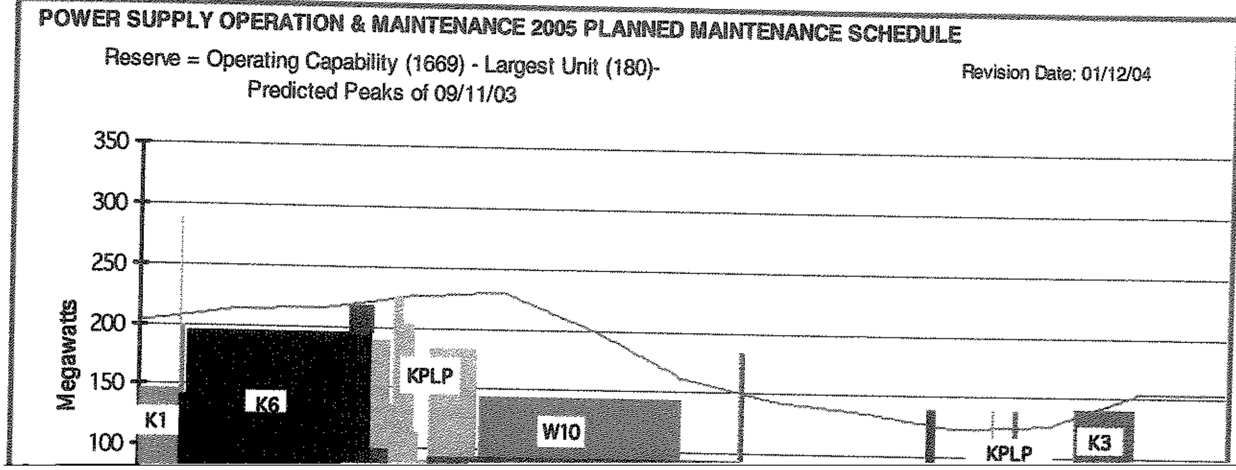
HECO is in the process of making further revisions to the O&M Planned Maintenance Schedule for 2005, but does not yet have another approved schedule. The W9 outage was extended, and the unit will be returned to service at the end of March. The W6 scheduled outage is underway, and will be extended by 7-10 days due to the need to replace additional spreadsheet containing specific dates of the respective unit outages, durations, and remarks of the 2/3/05 version is included on page 8. The changes to the capital project budget between the two 2005 Planned Maintenance Schedules are provided on pages 9 and 10. The changes to the O&M project budget between the two 2005 Planned Maintenance Schedules is provided on page 11.

The increase in O&M project expense on page 10 based on the revised 2/03/05 Planned Maintenance schedule is primarily due to the anticipated increase in work scope on W10 based on the inspection and findings on W9. As shown in CA-IR-41 for 2003, and CA-IR-42 for 2004, changes are driven by a number of factors including predicted reserve margin, unanticipated increases in overhaul scope based on what is found, operating permit inspection dates, aging units, etc.

Since the development of the 2/03/05 revision to the 2005 O&M Planned Maintenance Schedule, additional revisions will be necessary to reflect the extension of the W9 overhaul to March 31st based on delays caused by material deliveries and increases in scope due to the discovery of additional repairs during the outage. Also, other shifts in unit outages are being considered to minimize system spinning reserve risks. Therefore, another revision to the 2005 Planned Maintenance Schedule with Capital and O&M project updates will be forthcoming, and will be provided (with a comparison of the schedule and cost impacts) after it is finalized and approved.

HECO is in the process of making further revisions to the O&M Planned Maintenance Schedule for 2005, but does not yet have another approved schedule. The W10 outage was extended, and the unit will be returned to service at the end of March. The W6 scheduled outage is underway, and will be extended by 7-10 days due to the need to replace additional turbine blades. W8 was taken out of service on March 15th, as scheduled, for its planned [redacted] the end of March for 2-3 days (to do a permanent repair on a fuel line that was temporarily repaired), after W8 returns to service and before W7 is taken out for its tunnel cleaning. Given the extended outage of W9, and the possibility that the W10 outage will also have to be extended, (1) the W10 outage will be rescheduled to follow the K6 outage, (2) the H9 outage will be moved to 2006, and (3) the scope of the K2 outage (which follows the K6 outage and precedes the AES Hawaii outage) will be reduced, by moving the low pressure turbine portion of the work to the 2006 overhaul for the unit. (The revisions will provide flexibility to extend the K6 outage if necessary, given the scope of the planned work, which

HECO 627 - Test Year 2005 Planned Outage Schedule



Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005

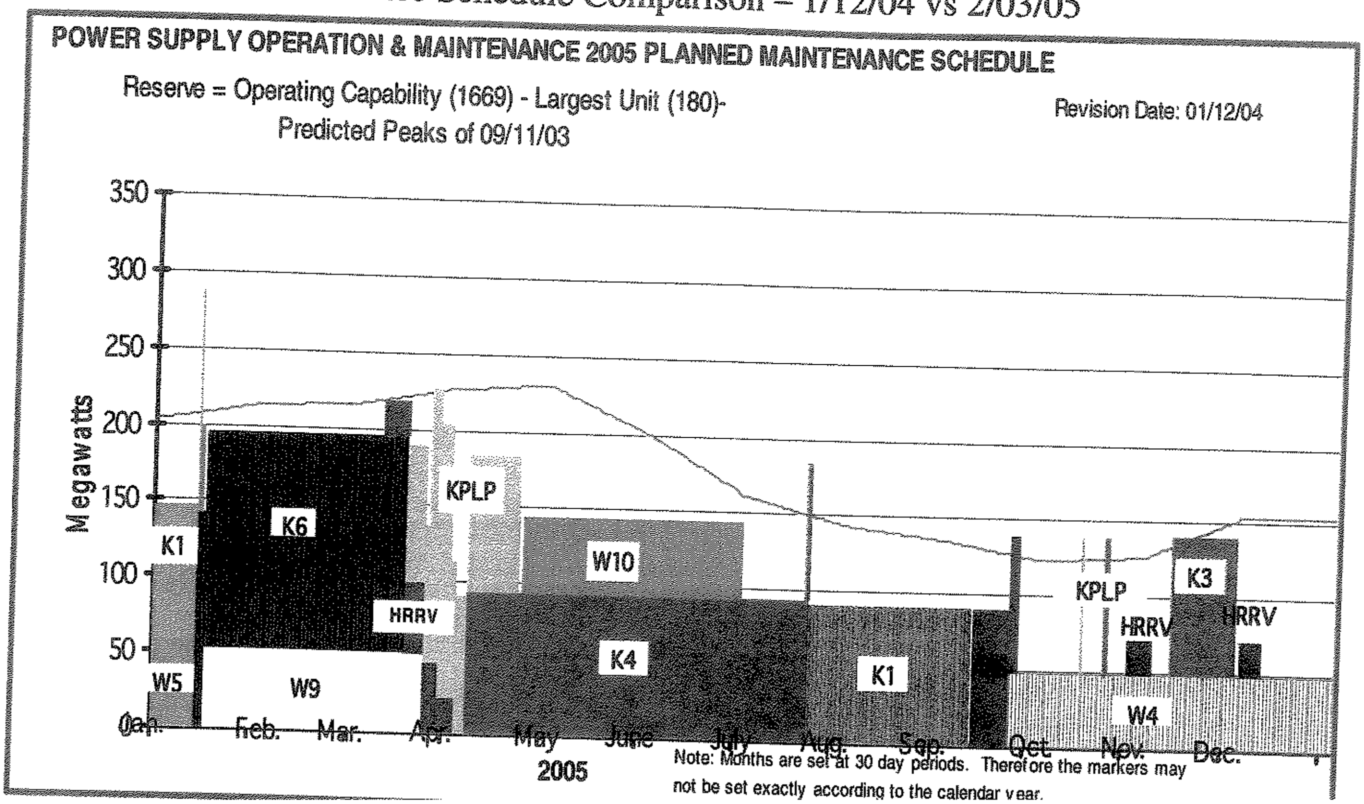
2005 Overhaul Capital Projects
Based on Planned Maintenance Schedule dated 1/12/04

Budgeted			Budget
Waiau 9			
	P0000299	W9 Compressor Blade Coating	336,369
	P0000564	W9 DCS Processor Upgrade	228,150
	P0000658	W9 Exhaust Duct Replacement	411,408
	P0000689	W9 Intake Duct Upgrade	411,408
			1,387,335
Waiau 10			
	P0000300	W10 Compr Blade Coating	338,252
	P0000565	W10 DCS Processor Upgrade	301,854
	P0000657	W10 Exhaust Duct Replacement	413,703
	P0000691	W10 Intake Duct Upgrade	413,703
			1,467,512
Kahe 6			
	P0000454	K6 Fan Enclosure	586,005
	P0000641	K6 AEH Limit Switch Upgrd	86,506
	P0000809	K6 Annunciator Replacement	354,295
	P0000958	K6 SSH Element Replacement	432,313
			1,459,119
Kahe 4			
	P0000271	K4 Stormwater Drain Impv	216,873
	P0000781	KPP FWH #41 Replacement	20,107
	P0000782	KPP FWH #42 Replacement	21,143
	P0000869	K4 Annunciator Replacement	427,142
	P0000874	Kahe 4 Sootblower Controls	110,707
	P9454000	K4 Boiler Control Upgrade	1,995,570
	P9541000	K4 Data Acq and Monitor	396,982
			3,188,525
Kahe 1			
	P0000610	K1 Blr Access Door Addition	104,092
	P0000681	Kahe1 Condenser Tube Replacement	1,397,620
	P0000800	K1 Operator Console Upgrade	202,108
	P0000820	K1 Main Xfmr Replacement	1,106,029
	P0000830	K1 Aux Xfmr Replacement	199,917
	P0000854	K1 Excitation System	346,309
	P0000861	K1 Annunciator Replacement	370,297
	P0000871	Kahe 1 Sootblower Controls	299,693
	P0000957	K1 MS Replacement	561,944
	P0001009	K1 Battery Bank Replacement	229,516
			4,817,524
Waiau 4			
	P0000209	W4 Cycle Chem Instr.	292,712
	P0000442	W4 Soot Blower Upgrade	367,721
	P0000489	W4 Cond Wtrbx Repl	336,062
	P0000801	W4 Operator Console Upgrade	181,113
	P0000829	W4 Main Xfmr Replacement	673,210
	P8820000	W4 Exciter Upgrade	346,890
			2,197,709

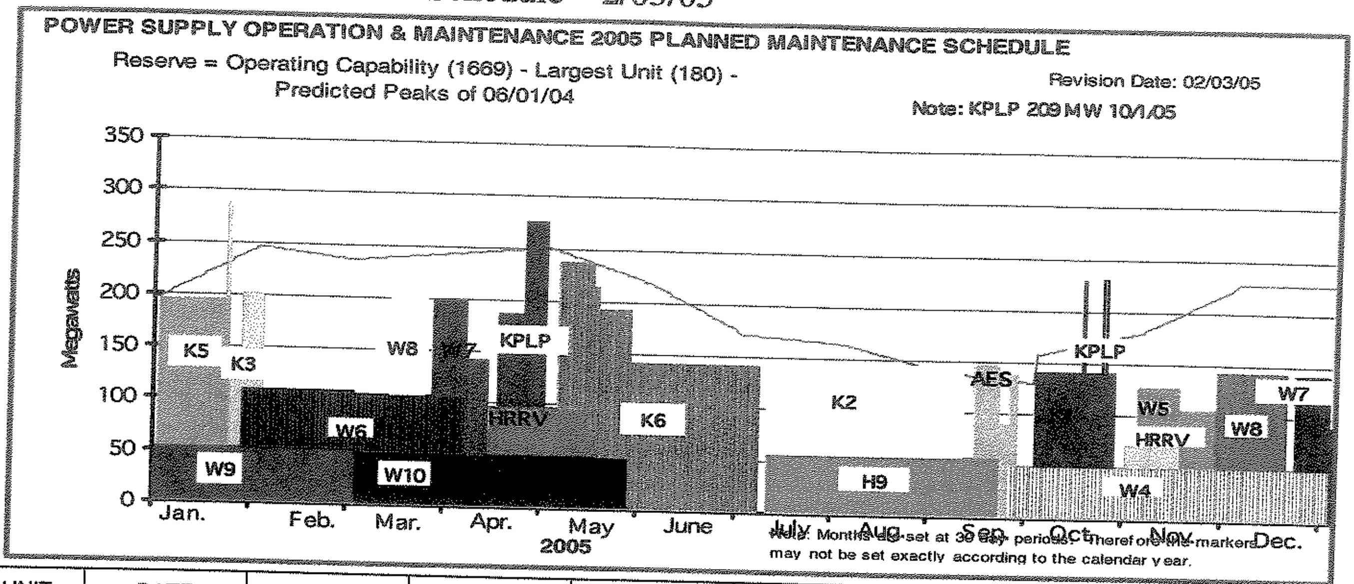
Hawaiian Electric Company Inc.
2005 TEST YEAR
2005 O&M Overhaul Projects Based on Planned Maintenance Schedule dated 1/12/04

Acct	Acct Desc	RA	RA Desc	Project #	Project Description	2005 Test Yr
512030	Maint Blr&FO Plt Kahe	PIT	Traveling Maint	P0000650	Kahe 2 Overhaul (2004)	284,250
512030	Maint Blr&FO Plt Kahe	PIT	Traveling Maint	P0000844	Kahe 6 Overhaul (2005)	1,957,088
512030	Maint Blr&FO Plt Kahe	PIT	Traveling Maint	P0000845	Kahe 4 Overhaul (2005)	2,302,355
512030	Maint Blr&FO Plt Kahe	PIT	Traveling Maint	P0000846	Kahe 1 Overhaul (2005)	1,332,582
512020	Maint Blr&FO Plt Waiau	PIT	Traveling Maint	P0000847	Waiau 4 Overhaul (2005)	2,111,643
513030	Maint Elec Plt Kahe	PIT	Traveling Maint	P0000650	Kahe 2 Overhaul (2004)	197,250
513030	Maint Elec Plt Kahe	PIT	Traveling Maint	P0000844	Kahe 6 Overhaul (2005)	933,740
513030	Maint Elec Plt Kahe	PIT	Traveling Maint	P0000845	Kahe 4 Overhaul (2005)	1,247,331
513030	Maint Elec Plt Kahe	PIT	Traveling Maint	P0000846	Kahe 1 Overhaul (2005)	576,108
513020	Maint Elec Plt Kahe	PIT	Traveling Maint	P0000847	Waiau 4 Overhaul (2005)	1,605,275
553	M Elec Plt Oth Prod	PIT	Traveling Maint	P0000937	W9 Major Inspection	1,002,540
553	M Elec Plt Oth Prod	PIT	Traveling Maint	P0000938	W10 Major Inspection	1,002,540
TOTAL						14,552,702

2005 Planned Maintenance Schedule Comparison – 1/12/04 vs 2/03/05



2005 Planned Maintenance Schedule – 2/03/05



UNIT	DATE				Duration	REMARKS
	Brk Op	Start	Bkr Cl	Firm	(Wks.Days)	
W9	10/12/2004	1/1/2005	3/3/2005	3/3/2005	20.3	Overhaul (Comprssr, HG, Cl), Gen, Exh Duct Repl, Blade damage
K5	1/2/2005	1/3/2005	1/22/2005	1/23/2005	3.0	Outage #7 vibration, seal oilfilter, aph bearing cover leak APH wash
K3	1/23/2005	1/24/2005	2/2/2005	2/3/2005	1.4	Maintenance Outage, blr inspct, AH baskets replacement
W6	1/28/2005	1/29/2005	4/5/2005	4/6/2005	9.5	Overhaul (HP blades, annunciator panel, blr refractory)
W10	3/4/2005	3/4/2005	5/27/2005	5/27/2005	12.1	Overhaul (Comprssr, HG, Cl), Gen, Exh Duct Repl
W8	3/15/2005	3/15/2005	3/25/2005	3/25/2005	1.4	Maintenance Outage tunnel clean
W7	3/28/2005	3/28/2005	4/13/2005	4/13/2005	2.3	Maintenance Outage tunnel clean
HRRV-	4/14/2005		4/14/2005		0.1	23 MW Loss
HRRV	4/15/2005		5/15/2005		4.3	46 MW Loss
HRRV-	5/16/2005		5/17/2005		0.2	23 MW Loss
KPLP-	4/17/2005		4/24/2005		1.1	CT1 inspection HRSG repairs
KPLP	4/25/2005		5/1/2005		1.0	180 MW Loss, CT1 B Inspection, ST Outage, CT2 Outage, Bal of Plant
K6	5/6/2005	5/7/2005	[illegible]	[illegible]		Overhaul (blr, annunciator upgrade, SSH tubes rpl

2005 Overhaul Capital Projects
Based on Overhaul Schedule dated 1/2004
Projected Based on Overhaul Schedule dated 2/2005

			Budget	Projected	Variance	Explanation
Waiau 9						
	P0000299	W9 Compressor Blade Coating	336,369	120,000	(216,369)	Scope reduction to only cover a waterwash system
	P0000564	W9 DCS Processor Upgrade	228,150	309,015	80,865	Updated project forecast
	P0000658	W9 Exhaust Duct Replacement	411,408	841,236	429,828	Additional cost for expedited material delivery and construction due to emergency outage
	P0000689	W9 Intake Duct Upgrade	411,408	0	(411,408)	Project deferred to 2010
	P0000939	Waiau CT Separation	0	388,923	388,923	Project transferred from Energy Delivery Department
			1,387,335	1,270,251	271,838	
Waiau 6						
	P0000211	W6 Cycle Chem Instr.	0	157,957	157,957	Overhaul moved from 2004
	P0000804	W6 Operator Console Upgrade	0	212,204	212,204	Overhaul moved from 2004
	P0000493	W6 HP Turbine Blades	0	286,645	286,645	Overhaul moved from 2004
	P0000675	W6 Control/DC Cables to Swyd	0	74,035	74,035	Overhaul moved from 2004
	P0000682	W6 Annunciator Upgrade	0	499,821	499,821	Overhaul moved from 2004
			0	1,230,662	1,230,662	
Waiau 10						
	P0000300	W10 Compr Blade Coating	338,252	120,000	(218,252)	Scope reduction to only cover a waterwash system
	P0000565	W10 DCS Processor Upgrade	301,854	358,342	56,488	Updated project forecast
	P0000657	W10 Exhaust Duct Replacement	413,703	566,431	152,728	2004 progress payment moved into 2005
	P0000691	W10 Intake Duct Upgrade	413,703	0	(413,703)	Project deferred to 2010
			1,467,512	1,044,773	(422,739)	
Kahe 6						
	P0000238	K6 BFP Rec Ctrl Valves Upg	0	75,098	75,098	New projected project
	P0000454	K6 Fan Enclosure	586,005	654,207	68,201	Updated project forecast
	P0000641	K6 AEH Limit Switch Upgrd	86,506	90,377	3,871	Updated project forecast
	P0000806	K06 CWP MOV Replacement	0	74,329	74,329	Project deferred from 2004
	P0000809	K6 Annunciator Replacement	354,295	655,699	301,404	Updated project forecast
	P0000958	K6 SSH Element Replacement	432,313	1,512,348	1,080,035	2004 progress payment deferred into 2005
	P0001031	K6 Flame Scanner Det Replace	0	167,544	167,544	New projected project
			1,459,119	2,986,960	1,527,841	
Kahe 4						
	P0000271	K4 Stormwater Drain Impv	216,873	0	(216,873)	Overhaul moved to 2006
	P0000781	KPP FWH #41 Replacement	20,107	0	(20,107)	Overhaul moved to 2006
	P0000782	KPP FWH #42 Replacement	21,143	0	(21,143)	Overhaul moved to 2006
	P0000869	K4 Annunciator Replacement	427,142	0	(427,142)	Overhaul moved to 2006
	P0000874	Kahe 4 Sootblower Controls	110,707	0	(110,707)	Overhaul moved to 2006
	P9454000	K4 Boiler Control Upgrade	1,995,570	0	(1,995,570)	Overhaul moved to 2006
	P9541000	K4 Data Acq and Monitor	396,982	0	(396,982)	Overhaul moved to 2006
			3,188,525	0	(3,188,525)	
Kahe 1						
	P0000610	K1 Blr Access Door Addition	104,092	0	(104,092)	Overhaul moved to 2006
	P0000681	Kahe1 Condenser Tube Replacement	1,397,620	0	(1,397,620)	Overhaul moved to 2006
	P0000800	K1 Operator Console Upgrade	202,108	0	(202,108)	Overhaul moved to 2006
	P0000820	K1 Main Xfmr Replacement	1,106,029	0	(1,106,029)	Overhaul moved to 2006
	P0000830	K1 Aux Xfmr Replacement	199,917	0	(199,917)	Overhaul moved to 2006

Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005

2005 Overhaul Capital Projects
Based on Overhaul Schedule dated 1/2004
Projected Based on Overhaul Schedule dated 2/2005

			Budget	Projected	Variance	Explanation
	P0000854	K1 Excitation System	346,309	0	(346,309)	Overhaul moved to 2006
	P0000861	K1 Annunciator Replacement	370,297	0	(370,297)	Overhaul moved to 2006
	P0000871	Kahe 1 Sootblower Controls	299,693	0	(299,693)	Overhaul moved to 2006
	P0000957	K1 MS Replacement	561,944	0	(561,944)	Overhaul moved to 2006
	P0001009	K1 Battery Bank Replacement	229,516	0	(229,516)	Overhaul moved to 2006
			4,817,524	0	(4,817,524)	
Kahe 2						
	P0000215	K2 Cycle Chem Instr.	0	231,277	231,277	Overhaul moved from 2004
	P0000609	K2 Blr Access Door Addition	0	51,817	51,817	Overhaul moved from 2004
	P0000646	Kahe 24FWH Replacement	0	32,137	32,137	Overhaul moved from 2004
	P0000647	Kahe 23FWH Replacement	0	178,132	178,132	Overhaul moved from 2004
	P0000659	Kahe 25FWH Replacement	0	112,236	112,236	Overhaul moved from 2004
	P0000873	Kahe 2 Sootblower Controls	0	353,880	353,880	Overhaul moved from 2004
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	P0000821	K2 Battery Bank Replacement	0	187,845	187,845	Overhaul moved from 2004
	P0000860	K2 Annunciator Replacement	0	742,538	742,538	Overhaul moved from 2004
			0	2,023,012	2,023,012	
Honolulu 9						
	P0000870	H9 Generator Rotor Rewind	0	971,500	971,500	Project advanced from 2007
Waiau 4						
	P0000209	W4 Cycle Chem Instr.	292,712	136,962	(155,750)	Updated project forecast
	P0000442	W4 Soot Blower Upgrade	367,721	337,361	(30,360)	Updated project forecast
	P0000460	Waiau 4 ERV Replacement	0	68,181	68,181	New projected project
	P0000489	W4 Cond Wtrbx Repl	336,062	272,417	(63,646)	Updated project forecast
	P0000801	W4 Operator Console Upgrade	181,113	294,618	113,506	Updated project forecast
	P0000829	W4 Main Xfmr Replacement	673,210	759,684	86,474	Updated project forecast
	P8820000	W4 Exciter Upgrade	346,890	573,646	226,756	Updated project forecast
			2,197,709	2,442,870	245,161	

Hawaiian Electric Company Inc.
2005 TEST YEAR
2005 O&M Overhaul Project
1/12/04 vs. 2/03/05 Planned Maintenance Schedule Comparison

Project #	Project Description	1/12/04 Schedule 2005 Test Yr	2/03/05 Schedule 2005 Projected	
P0000650	Kahe 2 Overhaul (2004)	481,500	2,420,200	A
P0000844	Kahe 6 Overhaul (2005)	2,890,828	2,938,900	
P0000845	Kahe 4 Overhaul (2005)	3,549,686	0	B
P0000846	Kahe 1 Overhaul (2005)	1,908,690	0	C
P0000847	Waiau 4 Overhaul (2005)	3,716,918	3,775,600	
P0000937	W9 Major Inspection	1,002,540	2,637,300	D
P0000938	W10 Major Inspection	1,002,540	3,014,900	E
P0000521	Waiau 8 Overhaul (2004)		131,500	F
P0000654	Waiau 6 Overhaul		2,219,200	G
		14,552,702	17,137,600	

A K-2 Overhaul was originally expected to be completed at the end of 2004. Test year budget included only anticipated carry over costs. Due to extended overhauls in 2004 and the advancement of the W-9 overhaul in 2004, K-2 was moved into 2005.

B K-4 Overhaul to be moved into 2006 due to W-6 and K-2 overhauls shifting from 2004 into 2005

C K-1 Overhaul to be moved into 2006 due to W-6 and K-2 overhauls shifting from 2004 into 2005

D W-9 Overhaul continuation from October, 2004, is expected to be over budget due to more worn and damaged components requiring replacement than anticipated. Note that these costs do not include costs that will be covered by insurance.

E W-10 Overhaul expected to be over budget. Work scope for W-10 is estimated to be similar to W-9, less complete rotor disassembly and less replacement of blades and other rotating and stationary turbine and compressor parts.

F W-8 overhaul was completed in November, 2004. Above is carried over from 2004.

G W-6 Overhaul was to have been completed in 2004. Due to extended overhauls in 2004 and unanticipated W-9 overhaul in 2004, W-6 was moved into 2005.

CA-IR-44

<u>Ref: HECO T-6, Page 13, Line 13.</u>

According to the testimony, "[t]he 2005 test year overhaul schedule shown at the bottom of HECO-627 represents a normal overhaul year, where generating units are selected based on the criteria mentioned above, and are planned and forecasted accordingly." Please provide the following information:

a. Explain how this outage schedule was determined to be "normal."

[redacted]

correspondence and other documentation associated with your response to part (a) of this information request.

c. The Company's response to CA-IR-1, HECO T-6, Attachment 4, shows "Projects – Labor Hours and Direct Labor by RA" totaling 102,363 hours and $3,619,048 for the projected test period. Please provide the comparable actual labor hours and costs for such production O&M "Projects" by RA for each year from 2002 to 2004.

units vary from year to year, the types of work performed are very similar. As shown in HECO-611 and 612, the differences between the planned outages (on which the forecast is based), and the actual mix of units that were overhauled in a given year, may be very different due to the dynamic nature of an island system, aging fleet of generating units, lower reserves resulting in less flexibility, and other factors. Historically, the actual outage time in the course of year exceeds the projected Planned Outage time. Budgets based on projected planned outages are managed accordingly by shifting priorities as the operating year unfolds. Material increases caused by a significant and unexpected event such as a major forced outage that can not be managed with the approved budget are handled on a case-by-case basis.

b. Information used to determine which units are overhauled is provided in Attachments 1 through 4. Attachment 1 includes the 5-year projected IPP overhaul schedules from AES Hawaii, Kalaeloa, and HRRV that were submitted to HECO on 7/27/03, 6/6/03, and 6/30/03 respectively. (As indicated in the response to CA-IR-42, the "C" inspection for Kalaeloa's second CT, CT-2, was moved from April 2005 to November 2004 at Kalaeloa's request to allow the "M Upgrade" for the second CT to be done earlier. Kalaeloa's revised schedule for 2005-2009 is included in Attachment 1A.) Attachment 2, last updated on 2/10/05, is the boiler inspection and certification schedule for HECO boilers units. This information is tracked by HECO's boiler inspector. Attachment 3 contains the inspection schedule for the HECO turbines and generators. Attachment 4 contains the monthly predicted peak information that was used to determine the projected reserve margin. The September, 2003 monthly predicted peak information obtained from HECO's Energy Services Department was used in the development of the 2005 test year overhaul schedule as shown in HECO-

627. (The revised schedule for 2005 is based on the June 2004 short-term update used for the rate case, with adjustments to reflect changes in the estimated peak load impacts from energy-efficiency DSM programs and load management DSM programs, and changes to expected installation dates for CHP systems.)

The information provided in Attachments 1 through 4 was used as a guide for determining the base schedule. The base schedule may change due to a number of factors such as maintenance outages and forced outages that may impact the mix of planned outages. Changes are tracked and added to the year-at-a-glance view to reflect actual conditions. Examples of actual year-at-a-glance schedules are provided in HECO- 612 and HECO-627.

c. As requested, comparable actual labor hours and costs for Production O&M Projects by RA from 2002 to 2004 are provided in Attachment 5. The Project – Direct Labor cost portion of the information in Attachment 5 is also summarized in Attachment 6, and compared with the 2005 test year forecast. Higher labor cost in 2005 TY is attributed to an increase in Travel Crew (PIT) staffing as shown in CA-IR-1, HECO T-6, Attachment 5, pages 3 and 4.

d. As requested, comparable actual non-labor cost incurred for such Production O&M Projects by RA from 2002 to 2004 are provided in Attachment 7. The costs are also totaled and compared to the 2005 test year in Attachment 8. Explanations for the significant increase from 2003 to 2005 test year are provided in HECO T-6, pages 25-27, for Operations Non-Labor, and HECO T-6, pages 31-35, for Maintenance Non-Labor.

AES

AES Hawaii, Inc.
A Subsidiary of The AES Corporation
The Global Power Company

July 27, 2003
File: 13.1000.2

Mrs. Debbie Higashi
Power Purchase Contracts Administrator
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Subject: AES-HI Five-Year Maintenance Schedule

Dear Debbie,

In accordance with Section 3.2C(7) of the Purchase Power Agreement (PPA), we are submitting our sixty-month schedule for timing, duration and scope of scheduled outages for the AES Hawaii Facility.

If there are any further questions, please contact me.

Sincerely,

Jeff Vaughan
Vice President

JV:abs

Enclosure: Five-Year Maintenance Schedule

AES HAWAII
Five Year Maintenance Schedule

Year	Date	Time	MW Outage	Coments
2004	15-Mar	0:00	90	1 Boiler Inspection
	22-Mar	0:00		Return
	22-Mar	0:00	90	1 Boiler Inspection
	29-Mar	0:00		Return
2005	19-Sep	0:00	90	1 Boiler Inspection
	26-Sep	0:00		Return.
	26-Sep	0:00	90	1 Boiler Inspection
	03-Oct	0:00		Return
2007	12-Mar	0:00	90	1 Boiler Inspection
	19-Mar	0:00		Return
	19-Mar	0:00	90	1 Boiler Inspection
	26-Mar	0:00		Return
2008	01-Sep	0:00	180	Turbine Inspection
	30-Sep	0:00		Return

Kalaeloa

KALAELOA
PARTNERS, L.P.
Clean and Efficient Energy

91-111 Kalaeloa Boulevard • Kapolei, Hawai'i 96707 U.S.A.
Tel: (808) 682-5288 • Fax: (808) 682-4996

rec'd 6/26/04
wds

June 24, 2004

Mr. Ward D. Saunders, P.E.
Power Purchase Contracts Administrator
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Subject: Kalaeloa Partners, L.P.
60-Month Outage Schedule 2004 - 2009

Dear Ward:

Pursuant to Section 3.2D(7) of the PPA, attached is the Maintenance Outage Schedule for the period of 2004 – 2009.

Also attached is a copy of the cover letter from Alstom, which outlines changes in the schedule.

Please contact me if there are any questions or comments.

Sincerely,
Kalaeloa Partners, L.P.

H. Tobler

H.R. Tobler
General Manager

wy/rt

Winword/Heco/O&M/60MONT

ALSTOM

Power
Customer Services Division

June 6, 2003

Mr. Ruedi Tobler
General Manager
Kalaeloa Partners, L.P.
91-111 Kalaeloa Boulevard
Kapolei, Hawaii 96707

Dear Ruedi:

SUBJECT: Sixty Month Maintenance Schedule for 2004 ~ 2008

Please find attached the 60-Month Maintenance Schedule for the period January 1, 2004 through December 31, 2008. This is submitted in compliance with the Power Purchase Agreement between HECO and Kalaeloa Partners, section 3.2D (7). This schedule is due to HECO prior to July 1, 2003.

Please note that we have incorporated the changes requested by HECO for 2004. We have also made a change to the start day of all the future outages. In the past, we shut down the C Inspection unit on Friday nights and skipped washing the other unit for that week. By changing the start day of C Inspection to Saturdays, we will be able to wash the B Inspection unit to help keep plant efficiency up without a full plant shutdown.

The Steam Turbine major overhaul is currently planned for 2010 and it does not show up in this submittal.

Please let me know if you need additional information.

Sincerely,

Ziad Khalaf

Ziad Khalaf
Plant Manager

cc: Fred Fernandes (E-mail)
Bruce Robinson (E-mail)

ALSTOM Power Inc.
91-111 Kalaeloa Boulevard
Kapolei, HI 96707 U.S.A.
Tel: 1-808-682-5344
Fax: 1-808-682-0797
Web site: http://www.alstom.com

ALSTOM

Kalaeloa Cogeneration Plant
60 Month Maintenance Schedule
2004 ~2008

Activity	Unit	Start Date	End Date	Duration	Plant Load	Comment
2004						
C Inspection	CT1	Sat 4/17/04 22:00	Sat 5/22/04 22:00	35 days	90	CT1 C Inspection
B Inspection	CT2	Sat 4/24/04 22:00	Sat 5/1/04 22:00	7 days	0	CT2 B Inspection
ST Outage	ST	Sat 4/24/04 22:00	Sat 5/1/04 22:00	7 days	0	Steam Turbine Minor Inspection
A Inspection	CT1	Fri 10/22/04 22:00	Sat 10/23/04 22:00	24 hours	90	CT1 A Inspection
A Inspection	CT2	Fri 10/29/04 22:00	Sat 10/30/04 22:00	24 hours	90	CT2 A Inspection
Emissions	CT1	Wed 7/28/04 07:00	Wed 7/28/04 17:00	10 hours	180	100% Emission Test
Emissions	CT1	Thu 7/29/04 07:00	Thu 7/29/04 17:00	10 hours	165	80% Emission Test
Emissions	CT1	Fri 7/30/04 07:00	Fri 7/30/04 17:00	10 hours	150	60% Emission Test
Emissions	CT1	Sat 7/31/04 07:00	Sat 7/31/04 17:00	10 hours	Later	Emission Retest if needed
Emissions	CT2	Wed 8/4/04 07:00	Wed 8/4/04 17:00	10 hours	180	100% Emission Test
Emissions	CT2	Thu 8/5/04 07:00	Thu 8/5/04 17:00	10 hours	165	80% Emission Test
Emissions	CT2	Fri 8/6/04 07:00	Fri 8/6/04 17:00	10 hours	150	60% Emission Test
Emissions	CT2	Sat 8/7/04 07:00	Sat 8/7/04 17:00	10 hours	Later	Emission Retest if needed

ALSTOM

Kalaeloa Cogeneration Plant
60 Month Maintenance Schedule
2004 ~2008

Activity	Unit	Start Date	End Date	Duration	Plant Load	Comment
2005						
C Inspection	CT2	Sat 3/19/05 22:00	Sat 4/23/05 22:00	35 days	90	CT2 C Inspection
B Inspection	CT1	Sat 3/26/05 22:00	Sat 4/2/05 22:00	7 days	0	CT1 B Inspection
ST Outage	ST	Sat 3/26/05 22:00	Sat 4/2/05 22:00	7 days	0	Steam Turbine Minor Inspection
A Inspection	CT2	Fri 10/14/05 22:00	Sat 10/15/05 22:00	24 hours	90	CT2 A Inspection
A Inspection	CT1	Fri 10/21/05 22:00	Sat 10/22/05 22:00	24 hours	90	CT1 A Inspection
Emissions	CT1	Wed 7/13/05 07:00	Wed 7/13/05 17:00	10 hours	180	100% Emission Test
Emissions	CT1	Thu 7/14/05 07:00	Thu 7/14/05 17:00	10 hours	165	80% Emission Test
Emissions	CT1	Fri 7/15/05 07:00	Fri 7/15/05 17:00	10 hours	150	60% Emission Test
Emissions	CT1	Sat 7/16/05 07:00	Sat 7/16/05 17:00	10 hours	Later	Emission Retest if needed
Emissions	CT2	Wed 7/20/05 07:00	Wed 7/20/05 17:00	10 hours	180	100% Emission Test
Emissions	CT2	Thu 7/21/05 07:00	Thu 7/21/05 17:00	10 hours	165	80% Emission Test
Emissions	CT2	Fri 7/22/05 07:00	Fri 7/22/05 17:00	10 hours	150	60% Emission Test
Emissions	CT2	Sat 7/23/05 07:00	Sat 7/23/05 17:00	10 hours	Later	Emission Retest if needed

Kalaeloa Cogeneration Plant
60 Month Maintenance Schedule
2004 ~2008

	End Date	Duration	Plant Load	Comment
2:00	Sat 5/6/06 22:00	35 days	90	CT1 C Inspection
2:00	Sat 4/15/06 22:00	7 days	0	CT2 B Inspection
2:00	Sat 4/15/06 22:00	7 days	0	Steam Turbine Minor Inspection
22:00	Sat 10/21/06 22:00	24 hours	90	CT1 A Inspection
22:00	Sat 10/28/06 22:00	24 hours	90	CT2 A Inspection
07:00	Wed 7/19/06 17:00	10 hours	180	100% Emission Test
07:00	Thu 7/20/06 17:00	10 hours	165	80% Emission Test
7:00	Fri 7/21/06 17:00	10 hours	150	60% Emission Test
07:00	Sat 7/22/06 17:00	10 hours	Later	Emission Retest if needed
07:00	Wed 7/26/06 17:00	10 hours	180	100% Emission Test
07:00	Thu 7/27/06 17:00	10 hours	165	80% Emission Test
7:00	Fri 7/28/06 17:00	10 hours	150	60% Emission Test
07:00	Sat 7/29/06 17:00	10 hours	Later	Emission Retest if needed

ALSTOM

Kalaeloa Cogeneration Plant
60 Month Maintenance Schedule
2004 ~2008

Activity	Unit	Start Date	End Date	Duration	Plant Load	Comment
2007						
C Inspection	CT2	Sat 3/24/07 22:00	Sat 4/28/07 22:00	35 days	90	CT2 C Inspection
B Inspection	CT1	Sat 3/31/07 22:00	Sat 4/7/07 22:00	7 days	0	CT1 B Inspection
ST Outage	ST	Sat 3/31/07 22:00	Sat 4/7/07 22:00	7 days	0	Steam Turbine Minor Inspection
A Inspection	CT2	Fri 10/19/07 22:00	Sat 10/20/07 22:00	24 hours	90	CT2 A Inspection
A Inspection	CT1	Fri 10/26/07 22:00	Sat 10/27/07 22:00	24 hours	90	CT1 A Inspection
Emissions	CT1	Wed 7/18/07 07:00	Wed 7/18/07 17:00	10 hours	180	100% Emission Test
Emissions	CT1	Thu 7/19/07 07:00	Thu 7/19/07 17:00	10 hours	165	80% Emission Test
Emissions	CT1	Fri 7/20/07 07:00	Fri 7/20/07 17:00	10 hours	150	60% Emission Test
Emissions	CT1	Sat 7/21/07 07:00	Sat 7/21/07 17:00	10 hours	Later	Emission Retest if needed
Emissions	CT2	Wed 7/25/07 07:00	Wed 7/25/07 17:00	10 hours	180	100% Emission Test
Emissions	CT2	Thu 7/26/07 07:00	Thu 7/26/07 17:00	10 hours	165	80% Emission Test
Emissions	CT2	Fri 7/27/07 07:00	Fri 7/27/07 17:00	10 hours	150	60% Emission Test
Emissions	CT2	Sat 7/28/07 07:00	Sat 7/28/07 17:00	10 hours	Later	Emission Retest if needed

					ior Inspection					st			needed	st			needed

HRRV

Covanta Honolulu Resource Recovery Venture
A Covanta Energy Company
91-174 Hanua Street
Kapolei, HI 96707
Tel 808 682 2099
Fax 808 682 5203

COVANTA ENERGY

JUL - 2 2003

June 30, 2003

Ms. Maurene Bishop
Purchase Power Contracts Administrator
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, HI 96840-0001

SUBJECT: HPOWER - CHRRV/HECO MAINTENANCE SCHEDULE
NOTIFICATION OF 5-YEAR PROJECTION

Dear Ms. Bishop:

In accordance with the terms of Appendix B, Paragraph 2 (I) of the Power Purchase Contract between The City and County of Honolulu and Hawaiian Electric Company, Inc., CHRRV submits the following five (5) year maintenance schedule projection:

2004

One Boiler off (Production Cap. 23 mw)
0001 3/6/04

One Boiler off (Production Cap. 0 mw thru 3/23/04)
0001 3/8/04

One Boiler and T-G on (Production Cap. 23 mw)
0600 3/23/04

Two Boilers on and T-G (Production Cap. 46 mw)
0600 3/25/04

The 2004 Outage includes Turbine major overhaul work and boiler tube replacement.

Minor Shutdowns

One Boiler (Production Cap. 23 mw)
0001 10/9/04 to 2359 10/15/04

One Boiler (Production Cap. 23 mw)
0001 12/1/04 to 2359 12/8/04

Ms. Maurene Bishop
June 30, 2003
Page 2

<u>2005</u>

One Boiler (Production Cap. 23 mw)
0001 3/12/05 to 0600 3/29/05

One Boiler (Production Cap. 23 mw)
0001 3/20/05 to 0600 4/4/05

Minor Shutdowns
One Boiler (Production Cap. 23 mw)
0001 10/29/05 to 0600 11/5/05

One Boiler (Production Cap. 23 mw)
0001 12/2/05 to 2359 12/8/05

<u>2006</u>

One Boiler (Production Cap. 23 mw)
0001 3/25/06 to 0600 4/8/06

One Boiler (Production Cap. 23 mw)
0001 4/8/06 to 2359 4/21/06

Minor Shutdowns
One Boiler (Production Cap. 23 mw)
0001 11/4/06 to 2359 11/9/06

One Boiler (Production Cap. 23 mw)
0001 12/1/06 to 2359 12/7/06

<u>2007</u>

One Boiler (Production Cap. 23 mw)
0001 3/31/07 to 0600 4/13/07

One Boiler
0001 4/10/07 to 2359 4/29/07

2007 continued

Minor Shutdowns
One Boiler (Production Cap. 23 mw)
0001 11/10/07 to 2359 11/15/07

One Boiler (Production Cap. 23 mw)
0001 12/1/07 to 2359 12/6/07

2008

One Boiler off (Production Cap. 23 mw)
0001 2/29/08

One Boiler off and T-G off (Production Cap. 0 mw)
0001 3/7/08

One Boiler and T-G on (Production Cap. 23 mw)
0600 3/14/08

Two Boilers and T-G on (Production Cap. 46 mw)
0600 3/21/08

Minor Shutdowns
One Boiler (Production Cap. 23 mw)
0001 10/16/08 to 2359 10/23/08

One Boiler (Production Cap. 23 mw)
0001 12/1/08 to 2359 12/7/08

It should be understood that this schedule reflects our current projection and is subject to revision from time to time. If you have any questions or comments on the above schedule, please contact us at (808) 682-0201.

Very truly yours,

Robert A. Webster
Facility Manager

RAW:iml
0306018raw

cc: T. Kanja
J. Moody
R. Sandry
R. Smith
S. Swanson
A. Wolfe
C. Jones, C&C
G. Miyashita, HECO
D. Ching, HECO
T. Battisto, HECO

KALAELOA
PARTNERS, LP
Clean and Efficient Energy

91-111 Kalaeloa Boulevard • Kapolei, Hawai'i 96707 U.S.A.
Tel: (808) 682-5288 • Fax: (808) 682-4996

rec'd 6/26/04
wds

June 24, 2004

Mr. Ward D. Saunders, P.E.
Power Purchase Contracts Administrator
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Subject: Kalaeloa Partners, L.P.
60-Month Outage Schedule 2004 - 2009

Dear Ward:

Pursuant to Section 3.2D(7) of the PPA, attached is the Maintenance Outage Schedule for the period of 2004 – 2009.

ALSTOM

Power
Customer Services Division

June 24, 2004

Mr. Ruedi Tobler
General Manager
Kalaeloa Partners, L.P.
91-111 Kalaeloa Boulevard
Kapolei, Hawaii 96707

SUBJECT: Sixty Month Maintenance Schedule for 2004 ~ 2009

Dear Ruedi:

Please find attached the 60-Month Maintenance Schedule for the period July 1, 2004 through December 31, 2009. This is submitted in compliance with the Power Purchase Agreement between HECO and Kalaeloa Partners, section 3.2D (7). This schedule is due to HECO prior to July 1, 2004.

Please note that we have incorporated the changes recently agreed to with HECO:

1. CT2 C Inspection and upgrade to NM in October 2004.
2. Plant shutdown in April 2005 for seven days, but no C Inspection that year.
3. Other changes have been made due to the impact of item 1 above.

The Steam Turbine major overhaul is currently planned for 2010 and it does not show up in this submittal.

Please let me know if you need additional information.

Sincerely,

Ziad Khalaf

Ziad Khalaf
Plant Manager

Enclosure

CC: Fred Fernandes (E-mail)
Bruce Robinson (E-mail)

ALSTOM Power Inc.
91-111 Kalaeloa Boulevard
Kapolei, HI 96707 U.S.A.
Tel: 1-808-682-5344
Fax: 1-808-682-0797
Web site: http://www.alstom.com

nment

Kalaeloa Cogeneration Plant
60 Month Maintenance Schedule
2005 ~ 2009 plus 2004 Changes

End Date	Duration	Plant Load	Comment
Sat 4/9/05 22:00	7 days	0	CT1 B Inspection
Sat 4/9/05 22:00	7 days	0	CT2 B Inspection
Sat 4/9/05 22:00	7 days	0	ST Outage
Sat 10/8/05 22:00	24 hours	90	CT1 A Inspection
Sat 10/15/05 22:00	24 hours	90	CT2 A Inspection
Wed 7/13/05 17:00	10 hours	180	100% Emission Test
Thu 7/14/05 17:00	10 hours	165	80% Emission Test
Fri 7/15/05 17:00	10 hours	150	60% Emission Test
Sat 7/16/05 17:00	10 hours	Later	Emission Retest if needed
Wed 7/20/05 17:00	10 hours	180	100% Emission Test
Thu 7/21/05 17:00	10 hours	165	80% Emission Test
Fri 7/22/05 17:00	10 hours	150	60% Emission Test
Sat 7/23/05 17:00	10 hours	Later	Emission Retest if needed

Comment
C Inspection
B Inspection
)utage
A Inspection
A Inspection
; Emission Test
Emission Test
Emission Test
sion Retest if needed
; Emission Test
Emission Test
Emission Test
sion Retest if needed

ALSTOM

Kalaeloa Cogeneration Plant
60 Month Maintenance Schedule
2005 ~ 2009 plus 2004 Changes

Activity	Unit	Start Date	End Date	Duration	Plant Load	Comment
2009						
C Inspection	CT2	Sat 4/4/09 22:00	Sat 5/9/09 22:00	35 days	90	CT2 C Inspection
B Inspection	CT1	Sat 4/11/09 22:00	Sat 4/18/09 22:00	7 days	0	CT1 B Inspection
ST Outage	ST	Sat 4/11/09 22:00	Sat 4/18/09 22:00	7 days	0	ST Outage
A Inspection	CT2	Fri 10/23/09 22:00	Sat 10/24/09 22:00	24 hours	90	CT2 A Inspection
A Inspection	CT1	Fri 10/30/09 22:00	Sat 10/31/09 22:00	24 hours	90	CT1 A Inspection
Emissions	CT1	Wed 7/15/09 07:00	Wed 7/15/09 17:00	10 hours	180	100% Emission Test
Emissions	CT1	Thu 7/16/09 07:00	Thu 7/16/09 17:00	10 hours	165	80% Emission Test
Emissions	CT1	Fri 7/17/09 07:00	Fri 7/17/09 17:00	10 hours	150	60% Emission Test
Emissions	CT1	Sat 7/18/09 07:00	Sat 7/18/09 17:00	10 hours	Later	Emission Retest if needed
Emissions	CT2	Wed 7/22/09 07:00	Wed 7/22/09 17:00	10 hours	180	100% Emission Test
Emissions	CT2	Thu 7/23/09 07:00	Thu 7/23/09 17:00	10 hours	165	80% Emission Test
Emissions	CT2	Fri 7/24/09 07:00	Fri 7/24/09 17:00	10 hours	150	60% Emission Test
Emissions	CT2	Sat 7/25/09 07:00	Sat 7/25/09 17:00	10 hours	Later	Emission Retest if needed

KALAELOA
PARTNERS, LP
Clean and Efficient Energy

91-111 Kalaeloa Boulevard • Kapolei, Hawai'i 96707 U.S.A.
Tel: (808) 682-5288 • Fax: (808) 682-4996

January 6, 2005

Mr. Ward Saunders
HECO Power Purchase Division
Hawaiian Electric Company
P.O. Box 2750
Honolulu, HI 96840-0001

Dear Ward,

As discussed, please find enclosed our request for the 2005 April outage modification.

Please do not hesitate to contact us if you have any questions or comments.

Best Regards,

Hans R. Tobler
General Manager

enclosure

ALSTOM

Power
Customer Services Division
Power Plant Management

January 5, 2005

Mr. Ruedi Tobler
General Manager
Kalaeloa Partners, L.P.
91-111 Kalaeloa Boulevard
Kapolei, Hawaii 96707

Subject: Request for additional time to complete maintenance work in April 2005

Reference: HECO Letter dated November 30, 2004 regarding 60-Month Maintenance Schedule

Dear Ruedi,

The status of our current 60-Month schedule is described in the HECO letter referenced above. In that letter, HECO has approved a seven-day plant outage starting April 24, 2005 at 2200 and ending May 01, 2005 at 2200. We request that outage period to be changed to the following:

Start	End	MW Out	Event
Sun Apr 17, 2005 2200	Sun Apr 24, 2005 22:00	90	CT1 A Inspection, HRSG1 Repairs
Sun Apr 24, 2005 2200	Sun May 01, 2005 22:00	180	Full plant outage, CT2 B Inspection, Steam Turbine maintenance

The additional time is necessary to allow, among other things, replacement of two headers in HRSG1 HP/HT economizer and to replace the supports under the stack heat exchanger. We would like to have CT1 come down first because the initial set-up to get work started on that unit will take up most of our resources.

We will want to shut down CT2 for its weekly wash on April 15th or April 16th just prior to the start of CT1 maintenance.

Thank you for forwarding this request to HECO.

Sincerely,

Ziad Khalaf
Plant Manager

cc: KPLP File

ALSTOM Power Inc.
91-111 Kalaeloa Boulevard
Kapolei, HI 96707
Tel: (808) 682-5344
Fax: (808) 682-0797
Website: www.power.alstom.com

HAWAIIAN ELECTRIC COMPANY, INC.
BOILER INTERNAL INSPECTION RECORD
Last update: 2/10/05

BOILER UNIT	Nat'l Bd No. NB -	State No. HAW-	Date Inspected by HECO	Type of Inspection	Inspector		Op. Permit Rec'd	Permit Expires **(absolute end date)**
KAHE UNITS								
K1	20731	1586-62	8/19/04	Internal	E. Chang		9/20/04	8/19/07
K2	20732	1676-64	6/22/04	Internal	E. Chang		7/16/04	6/22/07
K3	20859	3003-70	1/26/05	Internal	E. Chang		2/8/05	1/26/08
K4	20881	3072-72	12/8/03	Internal	E. Chang		1/8/04	12/8/06
K5	23465	3217-74	4/7/04	Internal	E. Chang		5/10/04	4/7/07
K6	23466	3497-80	5/28/02	Internal	E. Chang		6/28/02	5/28/05
WAIAU UNITS								
W3	14230	372-48	9/7/04	Internal	E. Chang		9/27/04	9/7/07
W4	15982	938-51	3/4/03	Internal	E. Chang		3/28/03	3/4/06
W5	19924	1793-59	8/2/04	Internal	E. Chang		8/16/04	8/2/07
W6	19925	1531-61	1/30/04	Internal	E. Chang		3/22/04	1/30/07
W7	14981	1891-66	10/2/03	Internal	E. Chang		11/10/03	10/2/06
W8	20694	2022-68	10/7/04	Internal	E. Chang		11/9/04	10/7/07
HON UNITS								
H8	18298	1016-54	5/16/03	Internal	E. Chang		7/29/03	5/16/06
H9	19200	1753-57	12/19/02	Internal	E. Chang		1/9/03	12/19/05

Criteria: The State gives you an additional 30-days after the inspection date and NOT 30 days after the permit expires. The Permit Expiration date (shown on the

2020	2021	2022	2023	2024	2025
	Xp			Xp	
	Xp			Xp	
Xp			Xp		
Xp			Xp		
	Xp			Xp	
		Xp			Xp
	Xp			Xp	
		Xp			Xp
HG		FOI	MJ		FOI
FOI	HG		FOI	MJ	
Xp			Xp		
		Xp			Xp
	Xp			Xp	
Xp			Xp		
		Xp			Xp
Xp	bw	bw	Xp	bw	bw
-23 MW -46 MW -23 MW	-23 MW -46 MW -23 MW	-23 MW -46 MW -23 MW	-23 MW -46 MW -23 MW	-23 MW -46 MW -23 MW	-23 MW -46 MW -23 MW
-180 MW (4 wks)	-90 MW -180 MW -90 MW	-90 MW -180 MW -90 MW	-90 MW -180 MW -90 MW	-90 MW -180 MW -90 MW	-90 MW -180 MW -90 MW
-90 MW (2 wks)	-90 MW (2 wks)	-90 MW (2 wks)	-90 MW (2 wks)	-180 MW (4 wks)	-90 MW (2 wks)
CI		HG		CI	

2/

P03PkDsmN rev 9-11-03 sys
2/10/2005

Hawaiian Electric Company, Inc.
MONTHLY SYSTEM PEAK FORECAST [1]
Including Future DSM Program Impact
(Gross MW)

Month	2003 [3]	2004	2005	2006	2007	2008
Jan	1,191	1,255	1,286	1,315	1,343	1,359
Feb	1,161	1,242	1,275	1,302	1,329	1,345
Mar	1,185	1,241	1,274	1,300	1,328	1,344
Apr	1,177	1,232	1,263	1,288	1,316	1,332
May	1,200 *	1,227	1,259 *	1,284 *	1,311	1,327
Jun	1,226 *	1,257 *	1,290 *	1,321 *	1,342 *	1,356 *
Jul	1,276 *	1,294 *	1,328 *	1,360 *	1,382 *	1,396 *
Aug	1,264 *	1,309 *	1,346 *	1,376 *	1,398 *	1,413 *
Sep	1,276	1,319	1,354	1,385	1,409	1,425
Oct	1,288	1,336	1,366	1,399	1,421	1,438
Nov	1,287	1,332	1,363	1,395	1,417	1,434
Dec	1,263	1,305	1,336	1,367	1,389	1,405
Annual	1,288	1,336	1,366	1,399	1,421	1,438

[1] Sep 2003 update. Includes the following MW adjustments:

	2003	2004	2005	2006	2007	2008
THC/PH stdby	20.0	20.0	20.0	20.0	20.0	20.0
Utility CHP loss	0.0	-0.3	-0.7	-1.0	-1.6	-2.1
3rd Pty CHP loss	0.0	-0.4	-0.9	-1.9	-2.4	-3.3
Stdby Exist. 3rd pty	0.0	0.0	0.0	0.0	0.0	0.0
Wal Mart Keaau	0.0	1.3	1.3	1.3	1.3	1.3
UH JABSOM	0.0	3.4	6.0	6.0	6.0	6.0
UH West Oahu	0.0	0.0	0.0	0.0	0.9	1.8
Sand Isl. WWTP	0.0	0.0	7.6	7.6	7.6	7.6
BWS Desalination	0.0	0.0	0.0	5.7	5.7	5.7
Camp Smith	0.0	2.3	2.3	2.3	2.3	2.3
Schofield Info Syst F	0.0	0.0	0.0	1.1	1.1	1.1
Ko Olina Develop.	0.0	0.0	0.0	0.6	3.3	4.2
Acquired DSM	-25.9	-25.9	-25.9	-23.9	-22.7	-22.4
Future DSM	-2.9	-6.6	-10.3	-14.2	-18.1	-22.0
Total	-8.8	-6.2	-0.6	3.6	3.4	0.2

[2] January thru Aug 2003 are recorded peaks, adjusted for estimated DSM, THC and Pearl Harbor.

* System peak is an AM peak.

sys

Hawaiian Electric Company, Inc.
2005 Rate Case Data
Projects - Direct Labor Hours and Amount by RA

YEAR 2002 ACTUAL

RA	Prod Oper Hours	Prod Oper Amount	Prod Maint Hours	Prod Maint Amount	Total Hours	Total Amount
PBT	0	$0	6	$186	6	$186
PDD	0	$0	62	$1,387	62	$1,387
PDF	0	$0	9	$283	9	$283
PDJ	0	$0	6	$197	6	$197
PDL	0	$0	4	$101	4	$101
PHS	0	$0	63	$1,273	63	$1,273
PIB	1	$30	219	$5,996	220	$6,026
PIC	1	$49	0	$0	1	$49
PIE	0	$0	1,975	$61,764	1,975	$61,764
PIH	0	$0	133	$4,489	133	$4,489
PIK	0	$0	811	$27,841	811	$27,841
PIL	0	$0	3,771	$123,755	3,771	$123,755
PIM	0	$0	141	$4,421	141	$4,421
PIN	0	$0	612	$21,051	612	$21,051
PIP	104	$3,562	6,721	$185,573	6,825	$189,135
PIT	4	$147	82,000	$2,730,211	82,004	$2,730,358
PIW	4	$83	698	$23,353	702	$23,436
PIX	7	$207	1,484	$50,174	1,491	$50,381
PJA	2	$69	0	$0	2	$69
PJC	0	$0	59	$1,502	59	$1,502
PJW	67	$1,992	21	$599	88	$2,591
PNL	0	$7,116	0	$0	0	$7,116
PRS	0	$0	74	$2,551	74	$2,551
PRX	0	$0	0	$129	0	$129
PVL	0	$0	5	$153	5	$153
[redacted]						
PYF	0	$0	7	$200	7	$200
PYJ	8	$302	0	$0	8	$302
PYM	0	$0	6	$253	6	$253
Total	201	$13,652	98,887	$3,247,442	99,088	$3,261,094

Hawaiian Electric Company, Inc.
2005 Rate Case Data
Projects - Direct Labor Hours and Amount by RA

YEAR 2003 ACTUAL

RA	Prod Oper Hours	Prod Oper Amount	Prod Maint Hours	Prod Maint Amount	Total Hours	Total Amount
PBT	0	$0	676	$23,114	676	$23,114
PBY	0	$0	1	$32	1	$32
PDD	0	$0	11	$273	11	$273
PDF	0	$0	17	$617	17	$617
PDJ	0	$0	3	$116	3	$116
PHS	0	$0	252	$5,247	252	$5,247
PIB	79	$2,008	0	$0	79	$2,008
PIH	0	$0	1,658	$56,640	1,658	$56,640
PIK	70	$2,682	289	$10,008	359	$12,690
PIL	0	$0	2,323	$82,258	2,323	$82,258
PIM	8	$158	164	$4,868	172	$5,026
PIN	0	$0	1,595	$55,863	1,595	$55,863
PIP	403	$12,129	6,557	$168,103	6,960	$180,232
PIT	0	$0	76,804	$2,620,825	76,804	$2,620,825
PIW	273	$6,299	332	$11,485	605	$17,784
PIX	29	$1,058	3,420	$122,297	3,449	$123,355
PJW	129	$4,146	4	$122	133	$4,268
PRS	0	$0	382	$12,592	382	$12,592
PRX	4	$131	0	$0	4	$131
PVL	0	$0	10	$289	10	$289
PYB	31	$1,072	12	$415	43	$1,487
PYE	0	$0	2,298	$69,318	2,298	$69,318
PYF	0	$0	3	$86	3	$86
PYJ	375	$15,153	0	$0	375	$15,153
PYM	0	$0	7	$281	7	$281
Total	1,401	$44,836	96,818	$3,244,849	98,219	$3,289,685

Hawaiian Electric Company, Inc.
2005 Rate Case Data
Projects - Direct Labor Hours and Amount by RA

YEAR 2004 ACTUAL

RA	Prod Oper Hours	Prod Oper Amount	Prod Maint Hours	Prod Maint Amount	Total Hours	Total Amount
PBT	0	$0	725	$26,185	725	$26,185
PBY	0	$8,943	0	$0	0	$8,943
PDF	0	$0	21	$795	21	$795
PDJ	0	$0	14	$434	14	$434
PDL	0	$0	4	$139	4	$139
PFS	0	$0	7	$188	7	$188
PIB	0	$0	288	$8,701	288	$8,701
PIC	6	$243	0	$0	6	$243
PIH	2	$73	0	$0	2	$73
PIK	0	$0	1,480	$51,742	1,480	$51,742
PIL	0	$0	4,470	$164,702	4,470	$164,702
PIM	0	$0	313	$9,281	313	$9,281
PIN	0	$0	193	$6,820	193	$6,820
PIO	0	$0	4	$137	4	$137
PIP	0	$0	7,388	$197,747	7,388	$197,747
PIT	0	$0	71,633	$2,696,504	71,633	$2,696,504
PIW	0	$0	1,922	$68,156	1,922	$68,156
PIX	0	$0	2,472	$89,363	2,472	$89,363
PJB	26	$1,085	0	$0	26	$1,085
PJC	2	$62	27	$766	29	$828
PJW	14	$441	17	$550	31	$991
PRR	0	$0	22	$715	22	$715
PYB	670	$22,928	0	$0	670	$22,928
PYE	0	$0	2,257	$62,181	2,257	$62,181
PYF	0	$0	22	$730	22	$730
PYG	0	$0	2	$56	2	$56
PYM	0	$4,247	59	$2,229	59	$6,476
Total	720	$38,022	93,340	$3,388,121	94,060	$3,426,143

PROJECTS - DIRECT LABOR$ BY RA

		Data			
*RA #	Resp Area	2002 Actual	2003 Actual	2004 Actual	2005 Test Year
PBA	Admin-ED Engr	$ -	$ -	$ -	$ 677
PBT	Structural	$ 186	$ 23,114	$ 26,185	$ 51,011
PBY	Substn, Protect & Tel	$ -	$ 32	$ 8,943	$ -
PDD	Training Section	$ 1,387	$ 273	$ -	$ -
PDF	Field Operation	$ 283	$ 617	$ 795	$ -
PDJ	West Overhead	$ 197	$ 116	$ 434	$ -
PDL	East Overhead-Ward	$ 101	$ -	$ 139	$ -
PFS	Corporate Safety	$ -	$ -	$ 188	$ -
PHS	Security	$ 1,273	$ 5,247	$ -	$ -
PIB	Admin-PS O&M	$ 6,026	$ 2,008	$ 8,701	$ -
PIC	Power Purchase	$ 49	$ -	$ 243	$ -
PIE	PS Technical Services	$ 61,764	$ -	$ -	$ -
PIH	Honolulu Stn Oper	$ 4,489	$ 56,640	$ 73	$ -
PIK	Kahe Stn Oper	$ 27,841	$ 12,690	$ 51,742	$ -
PIL	Kahe Stn Maint	$ 123,755	$ 82,258	$ 164,702	$ -

Hawaiian Electric Company, Inc.
2005 Rate Case Data
Projects - Direct Non-Labor by RA

YEAR 2002 ACTUAL

RA	Prod Oper	Prod Maint	Total
PAA	(2,781)	0	(2,781)
PEZ	677	983	1,660
PIK	0	11,418	11,418
PIL	0	10,966	10,966
PIN	0	12,036	12,036
PIT	191,587	6,040,373	6,231,960
PIX	0	322,372	322,372
PJW	0	1	1
PNL	50,839	0	50,839
[redacted]			
[redacted]			
Total	240,322	6,404,252	6,644,574

Hawaiian Electric Company, Inc.
2005 Rate Case Data
Projects - Direct Non-Labor by RA

YEAR 2003 ACTUAL

RA	Prod Oper	Prod Maint	Total
PBY	0	255	255
PEZ	5,492	7,969	13,461
PIK	0	3,994	3,994
PIL	0	9,639	9,639
PIN	0	38,748	38,748
PIT	73,783	6,398,743	6,472,526
PIX	0	40,689	40,689
PYM	0	(6,103)	(6,103)
Total	79,275	6,493,934	6,573,209

Hawaiian Electric Company, Inc.
2005 Rate Case Data
Projects - Direct Non-Labor by RA

YEAR 2004 ACTUAL

RA	Prod Oper	Prod Maint	Total
PBY	59	0	59
PIK	0	3,338	3,338
PIL	0	8,301	8,301
PIT	8,108	8,433,892	8,442,000
PIX	7,529	3,528	11,057
PYF	0	2,600	2,600
PYM	110	0	110
Total	15,806	8,451,659	8,467,465

PROJECTS - DIRECT NON-LABOR BY RA

		Data			
*RA #	Resp Area	2002 Actual	2003 Actual	2004 Actual	2005 Test Year
PAA	Admin-Gen Acctg	$ (2,781)	$ -	$ -	$ -
PBY	Substn, Protect & Tel	$ -	$ 255	$ 59	$ -
PEZ	ISD Chargeback	$ 1,660	$ 13,461	$ -	$ -
PHS	Security	$ -	$ -	$ -	$ 64,000
PIK	Kahe Stn Oper	$ 11,418	$ 3,994	$ 3,338	$ -
PIL	Kahe Stn Maint	$ 10,966	$ 9,639	$ 8,301	$ -
PIN	Honolulu Stn Maint	$ 12,036	$ 38,748	$ -	$ -
PIP	Planning	$ -	$ -	$ -	$ 850,000
PIT	Traveling Maintenance	$ 6,231,960	$ 6,472,526	$ 8,442,000	$ 8,342,000
PIX	Waiau Stn Maint	$ 322,372	$ 40,689	$ 11,057	$ -
PJW	Water & Haz Mat	$ 1	$ -	$ -	$ -
PNL	Land & Rights of Way	$ 50,839	$ -	$ -	$ -
PYF	PP Electrical Engr	$ -	$ -	$ 2,600	$ -
PYM	PP Mechanical Engr	$ 6,103	$ (6,103)	$ 110	$ -
Grand Total		$ 6,644,574	$ 6,573,209	$ 8,467,465	$ 9,256,000

2003 vs. 2002 Variance ($71,365)
-1%

2004 vs. 2003 Variance $1,894,256
29%

2005 vs. 2004 Variance $788,535
9%

CA-IR-45

Ref: HECO T-6, Page 12, Lines 18 to 24.

According to the testimony, production department work and costs are managed in categories including outage-related work that is for "Planned Outages," "Maintenance Outages" or "Forced Outages," as well as other types of work considered "Operational" or "Preventive," "Predictive" and "Corrective" maintenance. These categories are explained in greater detail through page 17 of the testimony.

a. Please provide a breakdown of the actual capital and O&M costs incurred for each work category in each year from 2002 through 2004, by Account and RA.

b. Compare the historical costs provided in response to part (a) of this information request to the test year projected costs by category, with an explanation of all variances greater than $100,000 among years or between categories.

HECO Response:

a. For clarification, the reference to HECO T-6, Page 12, Lines 18 to 24, and detailed through page 17, was not intended to be a discussion on categories of cost, but rather a discussion on how HECO manages the effects of aging plant and equipment to maintain reliability, efficiency, safety and compliant operations.

First, the discussion distinguishes between outage maintenance, which is broken down into three outage categories (Planned Outages, Maintenance Outages and Forced Outages discussed from line 25 on page 12 through line 13 on page 14 of HECO T-6), and operation maintenance (discussed from line 14 on page 14 through line 7 on page 15), which includes all types of maintenance that can be performed on generating units and supporting infrastructure without taking a generating unit off line.

Second, the discussion goes on to describe established maintenance practices (Preventive, Predictive and Proactive Maintenance from line 8 on page 15 through line 12 on page 16) used by HECO, and assumes corrective maintenance is self explanatory. The preventive (PM), predictive (PDM), and corrective maintenance (CM) practices apply to both outage (PO, MO, and FO) maintenance and operational maintenance.

Given the above clarification between outage and operational maintenance categories and the various types of maintenance practices, a discussion on how the above relates to the various cost categories may be helpful in understanding the cost break down information provided in this response.

Cost Categories:

The most basic cost categories are Capital and O&M costs.

Capital costs are categorized by Projects and Programs. Some Capital Projects such as controls upgrades require a unit outage to implement and are planned in advance to coincide with scheduled Planned Outages (e.g., controls upgrade). Other Capital Projects such as the installation of a new firewater system do not require a generating unit outage and are thus scheduled independent of generating unit outages. Programs include smaller scope capital items and, as with Projects, may be done during generating unit outages, or not, depending on the nature of the work. In addition to the Project vs Program breakdown of capital expenditures, a few capital items (compared to the total budget) may also be categorized as PM, PDM or CM projects as shown on page 8. Unlike O&M costs, there is no effort to categorize capital projects into PM, PDM or CM categories. Therefore, the is provided on pages 9 and 10. Again, this does not reflect the total Power Supply capital expenditure trends.

Production O&M maintenance costs are categorized by Projects and Non-Projects/Non-Programs (Non-Projects). O&M maintenance Projects include Planned Outages (PO's) and other O&M maintenance like the Pond 1A cleaning (CA-IR-188). O&M maintenance Non-Project costs includes costs for Maintenance Outages (MO's), Forced Outages (FO's), operational maintenance, and facility/infrastructure maintenance. O&M costs in general can be further categorized according to the cost structures provided on page 503 in HECO-WP-101 (E), page 767 in HECO-WP-101 (F), and page 871 in HECO-WP-101 (G). HECO-WP-101 (E) provides a cost structure that captures costs from a Labor and Non-Labor perspective. HECO-WP-101 (F) provides a view of Direct Labor cost that includes activities and RA. HECO-WP-101 (G) provides a view of Direct Non-Labor cost that includes activities and RA. From this information, several views of O&M maintenance costs can be obtained and are provided below.

First, O&M maintenance costs, in terms of PM, PDM and CM activities for 2002 – 2004 and 2005 derived from HECO-WP-101, are provided on pages 11-12 for Direct Labor and pages 13-14 for Direct Non-Labor. The information is similar to the structure in HECO-WP-101 (F) and (G). Note that PM, PDM and CM activity numbers ("Act #") range from 257 – 275, and combine Projects and Non-Projects.

Second, O&M Maintenance cost in terms of Projects and Non-Projects broken down by Direct Labor and Direct Non-Labor, and by RA, for 2002 – 2004 Actual and 2005 derived from HECO-WP-101, are provided on pages 15-22. The information is organized beginning with a total Direct Labor and Non-Labor Summary on page 15. Direct Labor broken down into Projects and Non-Projects is summarized on page 16 followed by RA level details on pages 17-19. Direct Non-Labor is similarly broken down into a Project and Non-Project summary on page 20 followed by RA level details on pages 21-22.

Third, as indicated in response to CA-IR-43, a revised maintenance schedule was approved in February, 2005, and HECO was in the process of making further revisions which were finalized in April. HECO has provided the revised maintenance schedule approved on April 8, 2005, and associated Capital and O&M Project estimate changes based on the new schedule, as a supplement to its response to CA-IR-43. The cost breakdowns for the revised Capital and O&M Projects estimates differ from the various views discussed above because the estimates are made on an informal basis (i.e., outside of Pillar) as part of the Production Department's ongoing efforts to manage the dynamic nature of changes that occur throughout the year. Therefore, the approved April 8, 2005 schedule cost cannot be directly compared to the labor and non-labor costs as summarized on pages 15, 16 and 20. The total O&M Production Maintenance impact of the 4/8/05 schedule in terms of Projects was provided in the supplement to CA-IR-43 on page 6. The Project and Non-Project impacts

based on the approved 4/8/05 Planned Outage Schedule are provided below on page 23.

b. The Power Supply total capital expenditures, without the Waiau Fuel Oil Pipeline costs, are provided on page 8 for 2002 – 2004 Actual and 2005 Revised as of March, 2005. Budget versus Actual comparisons for Capital Projects included in Planned Outages (PO) for 2003 and 2004 were provided in CA-IR-41, Attachment 2, and CA-IR-42, Attachment 2, respectively. Also, a revised breakdown of Capital Projects for Planned Outages in 2005, and a comparison to the original budget were provided in CA-IR-43 (Revised 4-21-05), pages 3-5. Included in the Planned Outage capital projects and total Power Supply Capital Expenditure costs are capital items categorized as PM, PDM and CM.

Referring to the O&M Production Maintenance Direct Labor expenses categorized according to PM, PDM and CM activities on pages 11-12, most of the maintenance Labor resources are forecasted to support Boiler Plant and Equipment PM and CM (Act # 257 and 259 respectively); Steam Turbine Equipment PM, CM (Act # 260 and 262 respectively); and Common Structure CM (Act # 265). The total O&M Production Maintenance Direct Labor on page 12 reflects the increase in staffing due primarily to night shift maintenance and additional trades and craft positions to handle a higher volume of work.

Referring to the O&M Production Maintenance Direct Non-Labor expenses categorized according to PM, PDM and CM activities on pages 13-14, most of the maintenance Non-Labor resources are forecasted to PM, PDM and CM activities (Act # 257 through 275). Total O&M Production Maintenance Direct Non-Labor expenses for the 2005 TY on page 14 show a lower amount for the test year compared to 2004 Actual, and a higher amount compared to 2002 and 2003 Actuals.

Referring to the O&M Production Maintenance expenses categorized according to Projects and Non-Projects, Direct Labor and Non-Labor, and by RA, the information provided starts with a high level summary on page 15, for 2002 – 2004 Actual and 2005 test year. The Direct Labor costs, broken down by Projects and Non-Projects, are provided on page 16. This view compares 2002 – 2004 Actuals with 2005 TY. The significant increase in 2005 TY Direct Labor Non-Project expenses is due to the establishment of the night shift maintenance crews. The RA breakdown on pages 17 and 19 shows the Non-Project increase in the Kahe Maintenance (PIL) and Waiau Maintenance (PIX) RA's.

The Direct Non-Labor costs, broken down by Projects and Non-Projects, are provided on page 20. This view compares 2002 – 2004 Actuals with 2005 TY. The 2005 TY Direct Non-Labor expenses are lower than the 2004 Actual expenses due to lower Non-Project outside service estimates for the Kahe Maintenance (PIL) and Waiau Maintenance (PIX) RA's on page 21. This is due, in part, to the establishment of the night shift maintenance crews at Waiau and Kahe Stations. While 2005 TY estimates are lower than 2004 Actual, unanticipated multiple and concurrent unit outages (combination of PO, MO and FO) beyond what is planned for 2005 could significantly increase Direct Non-Labor expenses as HECO labor resources are spread thin to support unplanned and planned repairs.

Referring back to the total O&M Maintenance Direct Labor and Non-Labor summary on page 15, which compares 2002 – 2004 Actuals with the 2005 TY forecast, O&M Maintenance Direct Labor is higher than the 2004 Actual, and O&M Maintenance Non-Labor is lower than the 2004 Actual, but significantly higher than 2002 and 2003 Actuals. The total Direct Labor and Non-Labor expenses for 2004 Actual and 2005 TY are comparable. However, the addition of on-costs to the 2004 Actual and 2005 TY Direct Labor and Non-Labor expenses increases the 2005 TY amount over the 2004 Actual. Explanations for the higher 2005 TY Other Production Maintenance expenses were provided in HECO T-6, and additional detail was provided in various responses to IR's, including CA-IR-1 with Attachments 1, 3, 3A, 3B, 3D, 3H, 3I, 4, 4A, 4B, 4D, 4E, and 5; CA-IR 2 with Attachments 3, 4, 4B, and 5.

As the generating units continue to age and are operated harder, more maintenance will be required to maintain reliability and thus additional staff will enable more work to be done. As discussed in the referenced IR's, the establishment of night shift maintenance crews for Kahe (PIL) and Waiau (PIX) will not only increase staffing to enable more work to be done, but will also provide additional maintenance capability during off peak hours that is not currently available. Night shift maintenance capability will allow more maintenance to be performed with less impact on generating unit and system reliability, because the work can be performed during a time (off peak) when generation reserves are not a constraint, and maintenance activities (PM, PDM and CM) requiring capacity deratings and risk conditions can be performed with less impact to the system during peak periods. In simple terms, the amount of maintenance work that needs to be done each year has increased, for the reasons stated in HECO T-6, pages 9-11, 28-30 and 34, and related IR responses, but there are constraints on the number of units that can be taken out of service each year to do work during planned overhauls. The addition of the night maintenance crews will allow the additional work to be done.

While O&M Maintenance Direct Non-Labor is forecasted at a lower level than 2004 Actual, there also is a potential for this cost category to increase based on high levels of unanticipated repairs that may impact baseload and cycling unit capability and availability. For example, unanticipated unit maintenance outages, forced outages and unit deratings on top of scheduled PO's and MO's will spread HECO labor resources too thin to be able to repair and restore units in a timely manner unless outside services are brought in to complement the workforce. These types of situations are expected to increase as scheduling flexibility diminishes with increasing load and lower reserve margins.

Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005
Predictive, Preventive, Corrective - (Summary)
Years 2002-2004 Actual and 2005 Budget

TYPE	2002	2003	2004	2005
Capital (Partial)				
Corrective	799,050	1,455,487	895,886	939,153
Predictive	1,084,134	2,192,674	2,971,612	297,661
Preventive	912,268	4,544,696	1,913,227	218,978
Capital (Partial)	2,795,452	8,192,857	5,780,725	1,455,792
PS Total CAPEX (w/o Waiau F.O. Pipeline)	15,189,860	21,178,056	26,624,191	31,516,819

Hawaiian Electric Company, Inc.
Rate Case 2005
Predictive, Preventive, Corrective - CAPITAL (Details)

Acct Grp Descr	Capital

			Data			
TYPE	NARUC Acct Blk Descr	*RA #	2002 Actual	2003 Actual	2004 Actual	2005 Test Year
Corrective	CWIP	PBA	19	32	0	0
		PHF	0	516	0	0
		PIB	2,464	0	0	0
		PIE	1,195	0	0	0
		PIH	0	0	2,680	0
		PIK	3,383	0	11,446	0
		PIL	277,221	106,533	45,440	401,651
		PIM	0	356	811	0
		PIN	26,252	36,289	173,961	155,748
		PIP	1,646	1,051	0	0
		PIT	171,780	280,105	62,816	26,329
		PIW	3,680	71	17,663	0
		PIX	265,516	809,567	478,567	354,848
		PVL	53	0	0	0
		PYE	0	58,432	9,834	0
		PYF	3,519	0	2,927	0
		PYG	499	1,958	470	0
		PYM	0	4,081	29,862	0
	CWIP Total		757,227	1,298,991	836,477	938,576
	Removal	PDF	0	118	0	0
		PIL	10,527	4,595	2,767	0
		PIP	435	0	0	0
		PIT	8,292	85,761	28,847	577
		PIX	17,704	50,417	27,795	0
		PRX	4,865	0	0	0
		PYM	0	15,605	0	0
	Removal Total		41,823	156,496	59,409	577
Corrective Total			799,050	1,455,487	895,886	939,153
Predictive	CWIP	PBA	66	0	0	0
		PBT	59,281	448	39,927	0
		PBY	988	0	1,443	0
		PIA	0	(88,024)	0	0
		PIB	0	0	413	0
		PIL	1,111	36,192	51,349	0
		PIN	307	1,837	827	0
		PIP	989	0	2,578	0
		PIT	23,710	197,754	1,033,084	2,874
		PIX	1,679	879	246,192	0
		PNP	0	519	0	0
		PRR	0	0	11,930	0
		PRS	0	0	19,648	0

Acct Grp Descr	Capital

			Data			
TYPE	NARUC Acct Blk Descr	*RA #	2002 Actual	2003 Actual	2004 Actual	2005 Test Year
Predictive	CWIP	PVL	0	0	168	0
		PYE	0	0	6,934	970

[redacted]

Hawaiian Electric Company, Inc.
Rate Case 2005
PRODUCTION MAINTENACE: Direct O&M - Labor

Acct Blk Descr	Prod Maint

		Data			
*Act #	Activity	2002 Actual	2003 Actual	2004 Actual	2005 Test Year
110	Impl Mktg Pgm-Core	0	0	0	0
210	Plan & Approve Projects	847	113,682	83,862	55,178
211	Engr Design & Mng Proj	0	442	0	7,522
212	Construct Projects	0	0	0	6,161
213	Const Sm Bettermnt Proj	0	0	88	0
245	Mon Plt Perf-Boiler	0	0	0	0
248	Perf Wtr Treat & Anlys	253,731	266,983	302,632	0
255	Dev Outage & Proj Plans	96,855	81,651	60,937	198,594
256	Plan Sch Maint & Const	377,942	474,825	521,904	930,086
257	Maint Boiler Plt Eq-Prev	1,457,073	1,067,426	1,499,455	2,379,966
258	Maint Boiler Plt Eq-Pred	325,610	727,277	894,447	319,290
259	Maint Boiler Plt Eq-Corr	1,791,194	1,613,790	1,559,482	2,794,585
260	Maint Stm Turbo Eq-Prev	641,419	1,144,014	816,451	2,247,602
261	Maint Stm Turbo Eq-Pred	549,238	497,164	498,937	182,068
262	Maint Stm Turbo Eq-Corr	1,109,738	1,311,769	882,333	796,194
263	Maint Com Struc-Prev	98,518	74,531	65,382	187,581
264	Maint Com Struc-Pred	2,735	0	0	0
265	Maint Com Struc-Corr	419,950	316,557	369,269	613,211
266	Maint Com Misc Eq-Prev	59,905	48,166	28,473	66,675
267	Maint Com Misc Eq-Pred	121	186	0	0
268	Maint Com Misc Eq-Corr	280,778	192,516	158,174	269,779
269	Maint Fuel Feed Sys-Prev	10,385	27,841	7,947	19,177
270	Maint Fuel Feed Sys-Pred	5,436	36,053	0	11,458
271	Maint Fuel Feed Sys-Corr	46,845	50,288	103,254	0

Hawaiian Electric Company, Inc.
Rate Case 2005
PRODUCTION MAINTENACE: Direct O&M - Labor

Acct Blk Descr	Prod Maint

		Data			
*Act #	Activity	2002 Actual	2003 Actual	2004 Actual	2005 Test Year
787	Dev Empl Training	37,639	17,385	17,401	18,155
788	Conduct Empl Training	3,710	1,830	739	6,063
795	Mg Safety Pgm & Trng	0	15	0	0
796	Prov & Mg Fire Protect	0	10	0	0
805	Mg BU & Oth Lbr Agrmnt	483	16,649	308	0
806	Adm Labor Grievances	203	0	0	0
807	Co-wide Empl Commun	1,818	0	0	0
816	Perf Fuel Accounting	3,051	0	0	0
841	New Supp/Contr/Consult	1,240	293	1,961	0
842	Order Mat Eq Sup & Svcs	0	0	0	0
850	Process Mat & Txns	0	0	0	0
876	Comply Ongo-Wstewtr	0	1,597	0	0
898	Op & Maint Desktop-Tech	0	0	0	0
899	Maintain Applications	0	0	0	0
931	Care for Bldgs & Grnds	0	0	0	0
932	Repair Bldgs & Grnds	0	0	0	0
933	Prov&Mg Svcs-Security	2,031	0	595	0
942	Maint Vehicles	0	0	0	0
966	Handle & Deliver Mail	0	0	0	0
968	Prov Word Process Svcs	19,093	17,123	22,838	16,726
Grand Total		7,767,409	8,198,141	8,307,393	11,154,807

Hawaiian Electric Company, Inc.
Rate Case 2005
PRODUCTION MAINTENACE: Direct O&M - Non-Labor

Acct Blk Descr	Prod Maint

		Data			
*Act #	Activity	2002 Actual	2003 Actual	2004 Actual	2005 Test Year
110	Impl Mktg Pgm-Core	598	0	0	0
210	Plan & Approve Projects	0	3,380	1,130	27,120
211	Engr Design & Mng Proj	0	1,812	0	0
212	Construct Projects	29,938	26,826	11,810	864,604
213	Const Sm Bettermnt Proj	0	0	92,199	0
248	Perf Wtr Treat & Anlys	7,078	3,140	624	0
255	Dev Outage & Proj Plans	0	0	0	0
256	Plan Sch Maint & Const	308,564	396,812	532,378	448,300
257	Maint Boiler Plt Eq-Prev	1,657,318	1,525,933	1,224,748	1,037,408
258	Maint Boiler Plt Eq-Pred	1,193,822	1,082,342	2,628,594	2,050,540
259	Maint Boiler Plt Eq-Corr	3,161,805	3,687,432	4,629,314	2,993,454
260	Maint Stm Turbo Eq-Prev	1,503,583	1,409,739	1,368,256	1,123,050
261	Maint Stm Turbo Eq-Pred	1,606,438	1,563,393	2,281,002	1,153,264
262	Maint Stm Turbo Eq-Corr	2,263,841	2,241,224	2,657,269	1,816,604
263	Maint Com Struc-Prev	119,003	140,642	170,650	129,300
264	Maint Com Struc-Pred	1,626	8,568	0	0
265	Maint Com Struc-Corr	1,473,211	826,424	2,226,241	1,972,604
266	Maint Com Misc Eq-Prev	282,883	219,410	230,511	16,000
267	Maint Com Misc Eq-Pred	2,000	6,332	0	0
268	Maint Com Misc Eq-Corr	515,189	477,891	391,689	334,608
269	Maint Fuel Feed Sys-Prev	380,646	568,815	8,517	210,000
270	Maint Fuel Feed Sys-Pred	104,022	129,384	73,125	285,000
271	Maint Fuel Feed Sys-Corr	229,174	182,085	505,741	21,000
272	Maint CT & Elec Eq-Prev	39	93	207,568	1,226,000
273	Maint CT & Elec Eq-Pred	5,200	0	269,899	578,000
274	Maint CT & Elec Eq-Corr	17,803	39,737	41,477	169,000
275	Maint Combust Eng Eq-Prev	0	0	0	0
701	Dev & Mg Forecasts	0	0	0	0
720	Improve Bus Processes	0	85	0	60,000
723	Mg Incent & Recog Pgm	1,323	520	939	0
745	Maint Rel-Leg & Govt Ag	0	0	0	0
750	Maint Rel- Cust	0	0	0	0
753	Maint Rel-Community	375	2,300	896	0
765	Empl Pol Prac Proc	0	0	4	0
775	Empl Comp PolPracProc	0	0	0	0
787	Dev Empl Training	723	0	0	0
788	Conduct Empl Training	0	0	0	0
789	Attend Training	0	0	419	0
796	Prov & Mg Fire Protect	0	0	0	0
805	Mg BU & Oth Lbr Agrmnt	0	0	0	0
806	Adm Labor Grievances	0	0	0	0
850	Process Mat & Txns	0	0	0	0

Hawaiian Electric Company, Inc.
Rate Case 2005
PRODUCTION MAINTENACE: Direct O&M - Non-Labor

Acct Blk Descr	Prod Maint

		Data			
*Act #	Activity	2002 Actual	2003 Actual	2004 Actual	2005 Test Year
891	Maint Exist Comp App	1,815	8,330	876	0
898	Op & Maint Desktop-Tech	0	0	0	0
931	Care for Bldgs & Grnds	0	0	0	0
932	Repair Bldgs & Grnds	0	0	0	0
933	Prov&Mg Svcs-Security	23,983	13,328	4,596	0
936	Mg Svcs-Wstenon-haz	28,987	35,526	25,264	0
968	Prov Word Process Svcs	0	0	0	0
Grand Total		14,920,987	14,601,634	19,585,736	16,515,856

Hawaiian Electric Company, Inc.
2005 Rate Case Data
Direct Labor and Non-Labor - Maintenance

	Actual 2002	Actual 2003	Actual 2004	Test Yr 2005
Direct Labor	7,767,419	8,198,129	8,307,399	11,154,798
Direct Non-Labor	14,920,995	14,601,630	19,585,739	16,515,857
Total	22,688,414	22,799,759	27,893,138	27,670,655

Hawaiian Electric Company, Inc.
2005 Rate Case Data
Direct Labor - Maintenance

	Actual 2002	Actual 2003	Actual 2004	Test Yr 2005
Non-Projects	4,519,975	4,953,292	4,919,284	7,574,358
Projects	3,247,444	3,244,837	3,388,115	3,580,440
Total	7,767,419	8,198,129	8,307,399	11,154,798

Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005
Direct Labor Maintenance - By RA

Acct Blk Descr	Prod Maint

		Data			
Proj_or_NonPr	*RA #	FY02 Act	FY03 Act	FY04 Act	FY05 Budget
NonProject	PBA	9	0	28	
	PBO				
	PBT	3553	4018	1647	
	PDA	943	0		
	PDD				
	PDF	322	945	676	
	PDJ	1372	2763	795	
	PDK				
	PDL	276	0	252	
	PDP				
	PDS				
	PDT	140	0		
	PDU	261	0		
	PFS	0	472	2388	
	PHB	163	1312	1818	
	PHF			87	
	PHS	0	262	736	
	PIA	3895	48	245	29334
	PIB	94656	55943	27495	25233
	PIC	399	611	296	
	PIE	197795	0		
	PIF	200	9171		11458
	PIH	84620	95708	90708	
	PIK	132333	135789	157825	61619
	PIL	1365765	1617899	1405588	2378578
	PIM	35293	35087	48171	16726
	PIN	307583	358366	359640	528175
	PIO	193	0	2650	
	PIP	309183	426211	384586	831607
	PIR	610	0		
	PIS				
	PIT	666264	892733	782015	710900
	PIW	61665	67234	69556	61727
	PIX	1115635	892531	1265304	2282448
	PJA	428	70	77	
	PJB	0	971	920	
	PJC	977	1109		
	PJW	2230	2544	1362	
	PNG	75	110734	80848	47971
	PPA				
	PRC	8737	6326	5775	8142

Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005
Direct Labor Maintenance - By RA

Acct Blk Descr	Prod Maint

		Data			
Proj_or_NonPr	*RA #	FY02 Act	FY03 Act	FY04 Act	FY05 Budget
NonProject	PRD	132	0		
	PRE				
	PRI	13796	10956	6370	27426
	PRR	27922	31801	29461	35981
	PRS	13530	6498	3100	
	PRX	50709	1358	4317	32274
	PSN	0	114		
	PVA				
	PVF				
	PVL	6689	1454	2711	
	PYB	0	1899	-810	
	PYE	0	165227	175364	390415
	PYF	348	1559	146	5418
	PYG	0	121	406	
	PYJ	612	0		54187
	PYM	10654	13448	6719	34742
	PZP				
NonProject Total		4519967	4953292	4919272	7574361
Project	PBA				677
	PBT	186	23114	26185	51011
	PBY	0	32		
	PDD	1387	273		
	PDF	283	617	795	
	PDJ	197	116	434	
	PDL	101	0	139	
	PFS			188	
	PHS	1273	5247		
	PIB	5996	0	8701	
	PIE	61764	0		
	PIH	4489	56640	0	
	PIK	27841	10008	51742	
	PIL	123755	82258	164702	
	PIM	4421	4868	9281	
	PIN	21051	55863	6820	
	PIO			137	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005
Direct Labor Maintenance - By RA

Acct Blk Descr	Prod Maint

		Data			
Proj_or_NonPr	*RA #	FY02 Act	FY03 Act	FY04 Act	FY05 Budget
Project	PJA				
	PJB				
	PJC	1502	0	766	
	PJW	599	122	550	
	PQC				
	PRR			715	
	PRS	2551	12592		
	PRX	129	0		
	PVL	153	289		
	PVM				
	PYB	0	415		
	PYC				
	PYE	0	69318	62181	
	PYF	200	86	730	
	PYG			56	
	PYM	253	281	2229	
Project Total		3247442	3244849	3388121	3580438
Grand Total		7767409	8198141	8307393	11154799

Hawaiian Electric Company, Inc.
2005 Rate Case Data
Direct Non-Labor - Maintenance

	Actual 2002	Actual 2003	Actual 2004	Test Yr 2005
Non-Projects	8,516,745	8,107,698	11,134,076	7,323,856
Projects	6,404,250	6,493,932	8,451,663	9,192,001
Total	14,920,995	14,601,630	19,585,739	16,515,857

Hawaiian Electric Company, Inc.
Rate Case - Test Year 2005
Direct Non-Labor Maintenance - By RA

Acct Blk Desc	Prod Maint

		Data			
Proj_or_NonP	*RA #	FY02 Act	FY03 Act	FY04 Act	FY05 Budget
NonProject	P2V				
	P4V	7170	8330	876	
	PBT	15793	1816		
	PBY				
	PDJ				
	PDV				
	PEZ	337585	416976	554234	482488
	PFS				
	PIA				
	PIB	25338	15601	4942	93000
	PIC				
	PIE	2890	0		
	PIH	1546	1935	165	
	PIK	1115	830		
	PIL	3669785	3726515	4814849	2243084
	PIM	67180	72218	71868	47560
	PIN	625503	639906	1196322	1570768
	PIO	600	-7027	54	
	PIP	21340	16765	18842	29080
	PIR	55	0		
	PIT	131392	266096	137952	0
	PIW	6781	870	459	
	PIX	3532871	2865829	4289936	2824636
	PJB			10	
	PJW	0	5		
	PKI	-9534	0		
	PKM	74383	73892	15313	15480
	PNG	0	3380	97	8280
	PNT	117	0		
	PPA	1323	427	939	
	PRC	0	164	1075	
	PRI				600
	PRR	1458	3011	4635	2880
	PRX				6000
	PWP				
	PYA	2054	0		
	PYB				
	PYE	0	161	20486	
	PYF				
	PYJ				
	PYM			1023	
NonProject Total		8516745	8107700	11134077	7323856
Project	P2V				
	PBT				
	PBY	0	255		
	PEZ	983	7969		

Acct Blk Desc	Prod Maint

		Data			
Proj_or_NonP	*RA #	FY02 Act	FY03 Act	FY04 Act	FY05 Budget

Production O&M
costs in $1000s

	Cost Category	Budget 12 mos.	Projected 12 mos.	Projected YE Var
NonProject	LABOR	$17,737	$15,346	-$2,391
	MATERIAL	$4,503	$4,903	$400
	O/S SVCS	$6,224	$7,318	$1,094
	ON-COSTS	$12,384	$10,714	-$1,671
	OTHER	$358	$266	-$91
	TRANSPORT	$176	$224	$49
NonProject	**sub total**	$41,382	$38,771	-$2,611
Project	LABOR	$3,568	$3,555	-$13
	MATERIAL	$3,832	$5,770	$1,938
	O/S SVCS	$5,821	$7,838	$2,016
	ON-COSTS	$2,398	$2,459	$61
	OTHER	$0	-$1,033	-$1,033
	TRANSPORT	$0	$0	$0
Projects	**sub total**	$15,619	$18,589	$2,970
Less non-overhaul other projects		*-$1,066*	*-$402*	$664
Overhauls	subtotal	$14,553	$18,187	$3,634
Totals	LABOR	$21,305	$18,901	-$2,404
	MATERIAL	$8,335	$10,673	$2,338
	O/S SVCS	$12,045	$15,155	$3,110
	ON-COSTS	$14,782	$13,172	-$1,610
	OTHER	$358	-$767	-$1,124
	TRANSPORT	$176	$224	$49
	Total	$57,001	$57,360	$359

CA-IR-46

<u>Ref: HECO T-6, Page 16, Line 16.</u>

According to the testimony, "HECO has been able to manage the total Other Production O&M [illegible]

equipment." Examples are provided on page 17 of certain efforts to improve operational

6 superheater replacement project in 2005, and future superheater and reheater replacement projects on steam units.

3. Various communications and conferencing technologies (voice, data, and video conferencing) to minimize the need for inter-station commuting and to provide for participation of off-island subject matter experts and stakeholders.
4. Maximizing the capabilities of Outlook to enhance emergency notification and response via alpha paging, text messaging, etc., to incident responders and key management personnel.
5. Application of aerial photos overlaid with site drainage flow, tank capacity, etc., information required to meet spill prevention documentation requirements, plant stack information to address air issues, emergency evacuation routes etc.
6. Periodic Vibration Monitoring: Utilizing two CSI 2120 data collectors to collect data on over 300 pieces of equipment per month. These data collectors, along with the analysis software, converts mechanical motion into a vibration spectrum or "picture", which can indicate equipment problems such as imbalance, misalignment, looseness, and gear, bearing and electrical faults. The data is fed into a computer that provides a report of machines requiring attention. The technology also provides the capability to balance machines in-place using a program built into the data collectors.
7. On-line Vibration Monitoring: All of HECO turbines/generators (except H8) are equipped with Bentley Nevada on-line vibration monitoring systems that continuously measure the vibration level on each turbine bearing. The Predictive Maintenance team has been working toward bringing the vibration points into the Distributed Control System where vibration and bearing temperatures can be monitored and trended from

the Engineer's desktop PC using the PI system.

8. Vibration Trainer: PDM specialists are trained to balance rotating equipment on a [redacted] types of faults (e.g. imbalance, misalignment, bearing faults, bent shaft, etc.) to allow the PDM specialists to practice, troubleshoot, and experiment with balancing techniques and solutions.

9. Infra Red thermography: A FLIR PM 695 infra red camera is used to take a thermal image of equipment to enable the thermographer to detect electrical faults, bearing

attention to problem equipment.

12. Electric motor monitoring: This device uses a computer-based tester made by PdMA Corp. (MCE 3000 and MCEmax motor analyzer), and checks for insulation resistance, circuit resistance, capacitance (motor cleanliness), air gap problems, crack rotor bars and stator shorts. In addition, on-line performance data can be obtained to provide a total picture of motor health. Overhaul work package for motors are now mainly based on the results from our motor monitoring program.
13. Transformer Monitoring: Infrared surveys, oil analysis, dissolved gas analysis and electrical testing (Doble, megger) technologies and techniques are used to monitor the condition of our critical transformers. Examples of recent findings include the Waiau 3 and Waiau 8 auxiliary transformers where excessive dissolved gases were detected, thus avoiding the potential for catastrophic failure and serious safety, environmental and risk management issues.
14. Pump Performance Testing: Pump performance testing on critical pumps enable pump performance tracking and trending to focus maintenance resources based on predictive results as opposed to time-based (preventive maintenance) maintenance or responding to breakdown (corrective) maintenance. Instruments and transmitters are being installed on boiler feed pumps to enable on-line monitoring of pump performance to allow timely detection and correction of performance problems.
15. Eddy Current Testing: This technology is used to assess the condition of tubular heat exchangers (feedwater heaters, air ejector condenser, lube oil coolers, chillers, hydrogen coolers). Deteriorated tubes can be proactively plugged to prevent in-service failures. The information obtained through eddy current testing and tube plugging is also used to

plan heat exchanger replacements before tube failures become too problematic and impact operations.

16. Flux Probe Tester: Permanent flux probes are being installed in generator cores to measure the magnetic flux from the generator field. A special laptop tester is used to obtain data, and then calculate and trend the number of shorted turns that are present in the generator field (rotor). Shorted turns can cause a decrease in generator output, increased heat generation and vibration.

b. Reports and other documentation are not generated to specifically measure the effectiveness of the five technology applications described in HECO T-6 on page 17, or the other examples listed above. However, the effectiveness of the examples provided can be described as follows:

<u>Reference items from HECO T-6, page 17:</u>

1. HECO's BRO – Please also refer to response to CA-IR-50 for a detailed description of

with reserve capacity shortfall conditions caused by rapidly growing demand, running aging units harder, and other factors discussed in HECO T-6, by enhancing "temporary versus permanent" repair decision making with appropriate follow-up to manage boiler reliability.

2. State-of-the-art instrumentation and software to track and monitor the operating performance of HECO's steam generating units on a real time basis – This technology provides real time information on selected processes depending on the level of application. Some units are instrumented more than others. The benefit of this system is it provides real-time and trended information on selected operating parameters such as temperatures, pressures, flows and turbine speed, generator output, system frequency, generator breaker status, etc., and enables users to access the information remotely from their desktop computers. The technology provides an effective means of troubleshooting problems on the various systems that are monitored, and for responding

4. Non-destructive testing instrumentation – Additional technologies with examples of findings are provided below.

5. Automatic paging and cell phone applications – This technology was invaluable in responding to the generation-related system conditions summarized for 2002, 2003, and 2004 in CA-IR-1, HECO T-6, Attachment 6, and response to CA-IR-169, part a. Key decision makers were immediately and simultaneously notified of a serious system condition as the problem occurred and were able to take immediate corrective actions to avoid potential escalation of the problem.

<u>Reference to response to part a. above - Other innovations and technology applications:</u>

1. Honolulu 8&9 video stack cameras – Honolulu Units 8&9 are cycled daily. This mode of operation increases the risk of high levels of visible emissions (opacity) which may impact neighbors in close proximity. The real-time visual indication of stack emissions has enabled the operating staff to operate in the cycling mode while complying with stringent emission requirements.

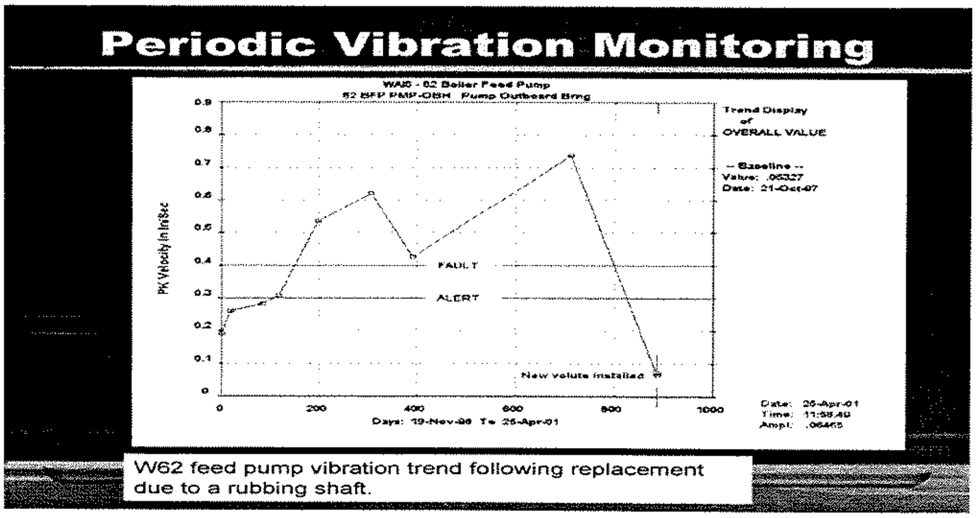
2. Superheater and reheater process improvement – As stated in response to part a. above, shortening an outage by 2-3 weeks and avoiding a steam blow has significant benefits. In addition to the productivity gains by avoiding an extended 2-3 week outage, public safety and inconvenience are maintained as roads and highways do not need to be shutdown for the steam blow process.

3. Communications and conferencing technologies – Effectiveness was adequately explained in response to part a. above.

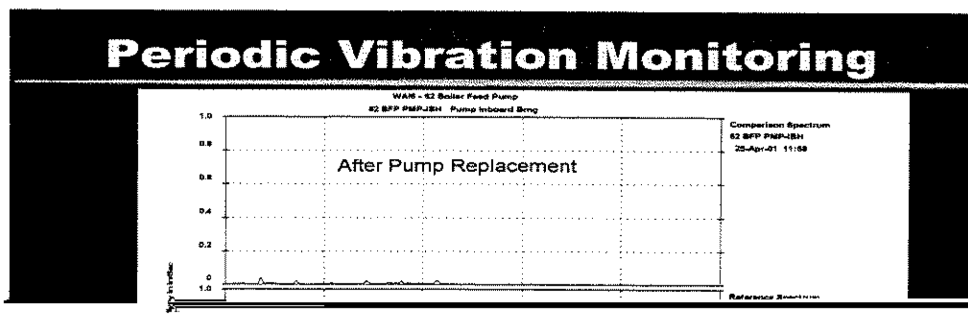
4. Aerial photo overlays – aerial photos are combined with electronic drawing technologies to produce very accurate site-specific information that serves multiple

purposes. As mentioned in response to a. above, the photo accurately depicts drainage flows, storage tanks, emergency evacuation routes, etc. that is used extensively for environmental compliance and emergency response.

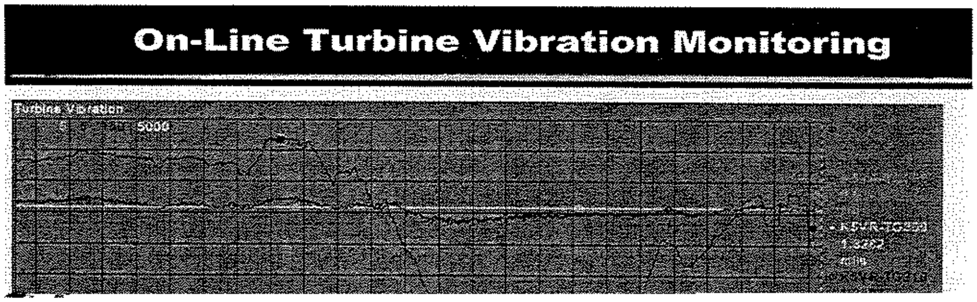
5. Periodic Vibration Monitoring



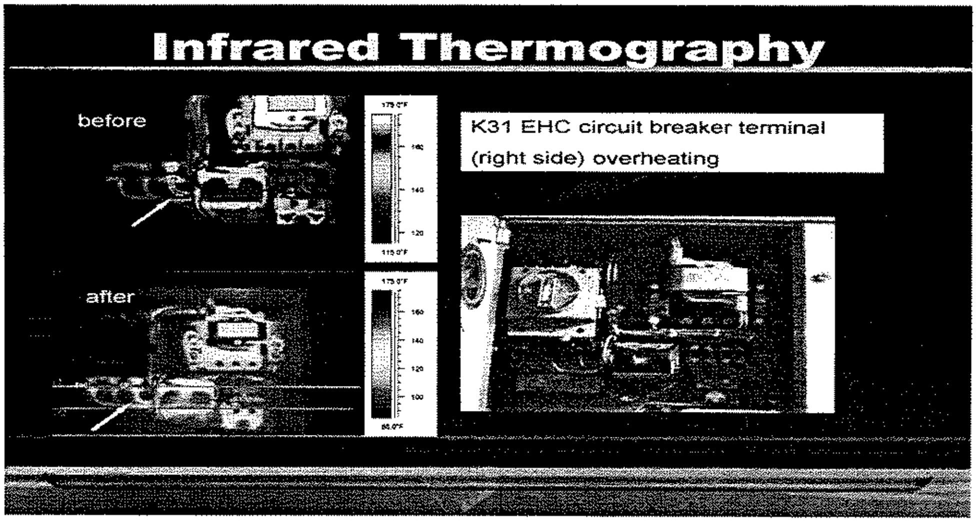
Periodic vibration surveys on the Waiau #62 boiler feed pump indicated a substantial increase in vibration. The root cause was determined to be a rub between the shaft and the case cover.



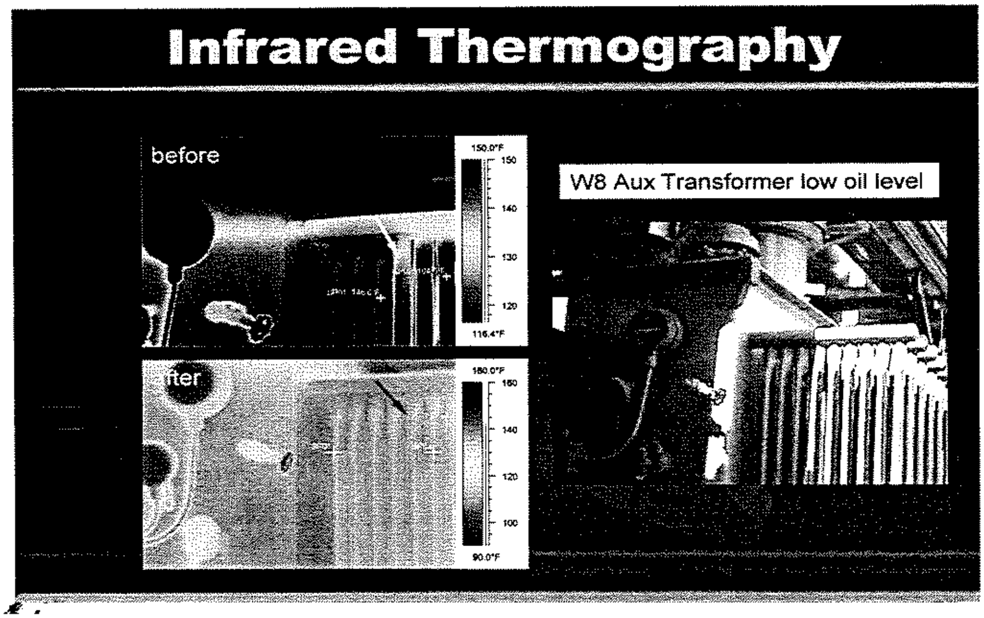
6. On-Line Vibration



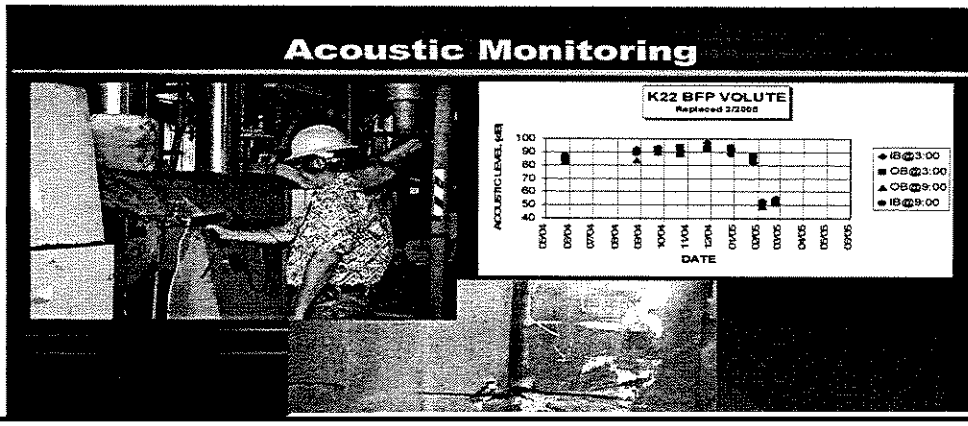
8. Infrared thermography – provides a quick and effective means to survey, detect, and correct problems before they impact reliability.

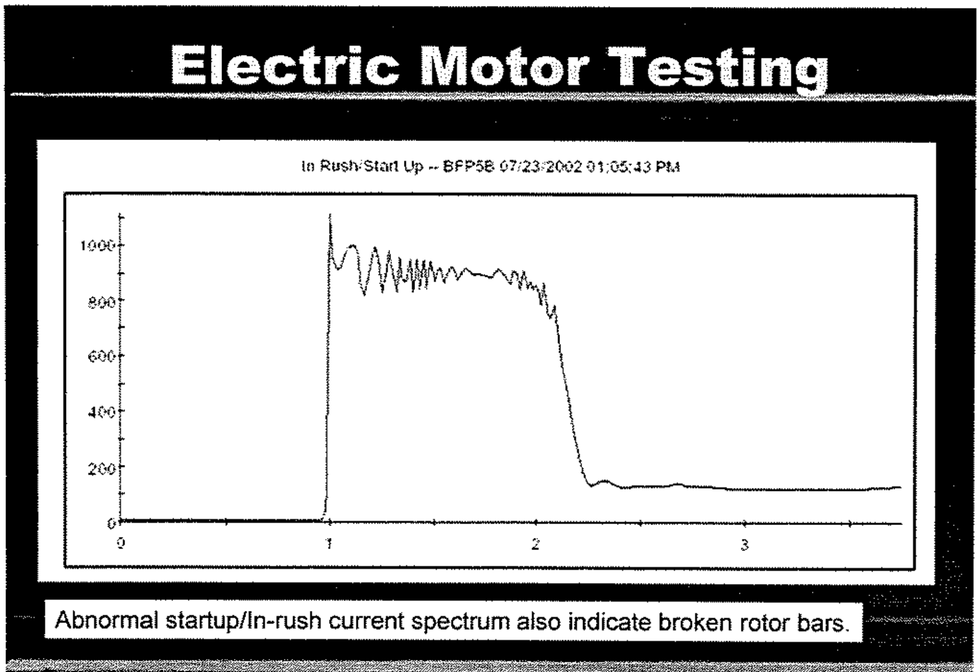


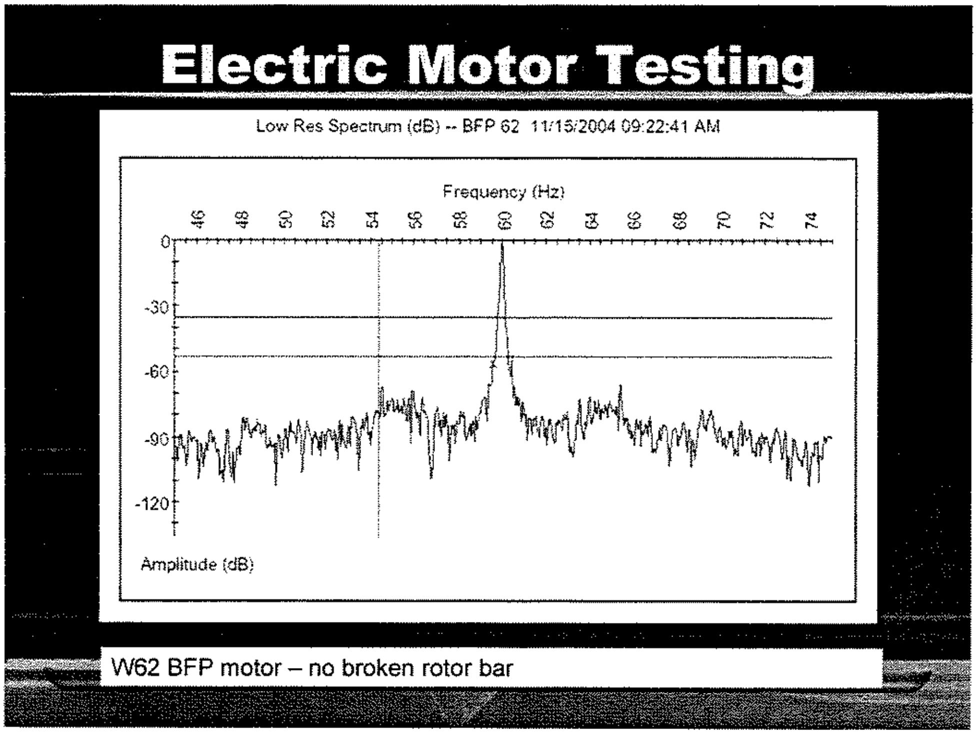
Electrical survey of motor line starter. Circuit breaker terminal was found loose and retightened.


Infrared Thermography
before
after
W8 Aux Transformer low oil level

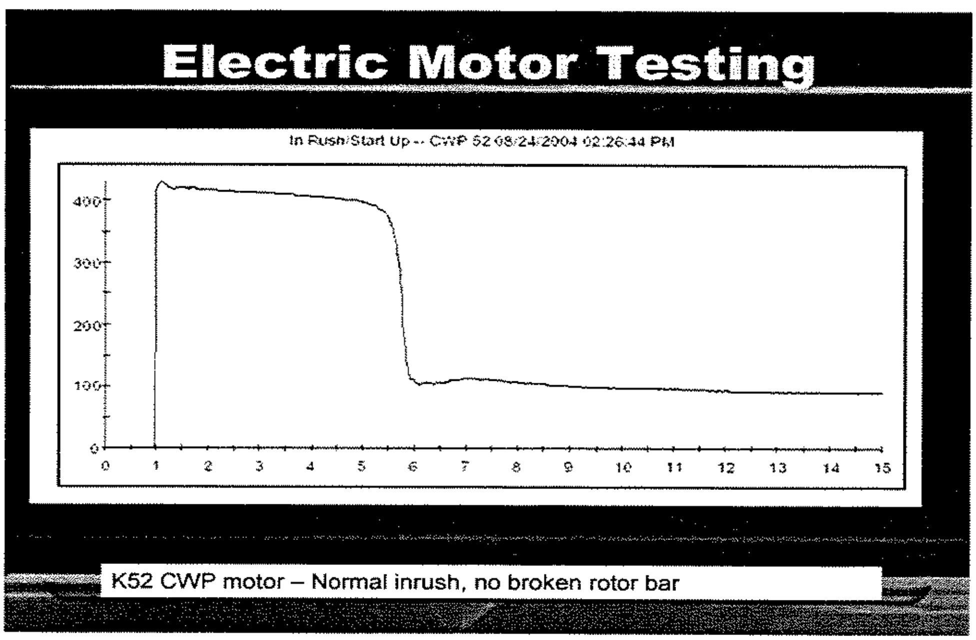
10. Acoustic monitoring




Electric Motor Testing
In Rush/Start Up -- BFP5B 07/23/2002 01:05:43 PM
1000
800
600
400
200
0
0
1
2
3
Abnormal startup/In-rush current spectrum also indicate broken rotor bars.

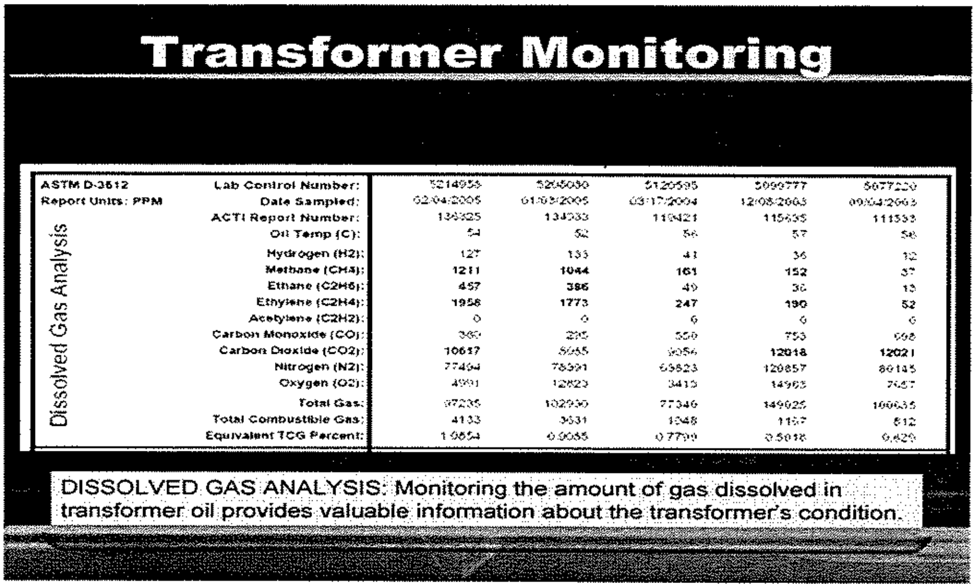


Current spectrum of a normal motor without any broken rotor bars.



12. Transformer monitoring –Increasing amount of Methane, Ethane and Ethylene indicate internal arcing. Early detection prevents a catastrophic fault from developing thus preventing the potential for a transformer explosion within a generating unit that could

result in a serious safety, environmental, and reliability situation. Below are the results of a recent finding on the W8 auxiliary transformer.

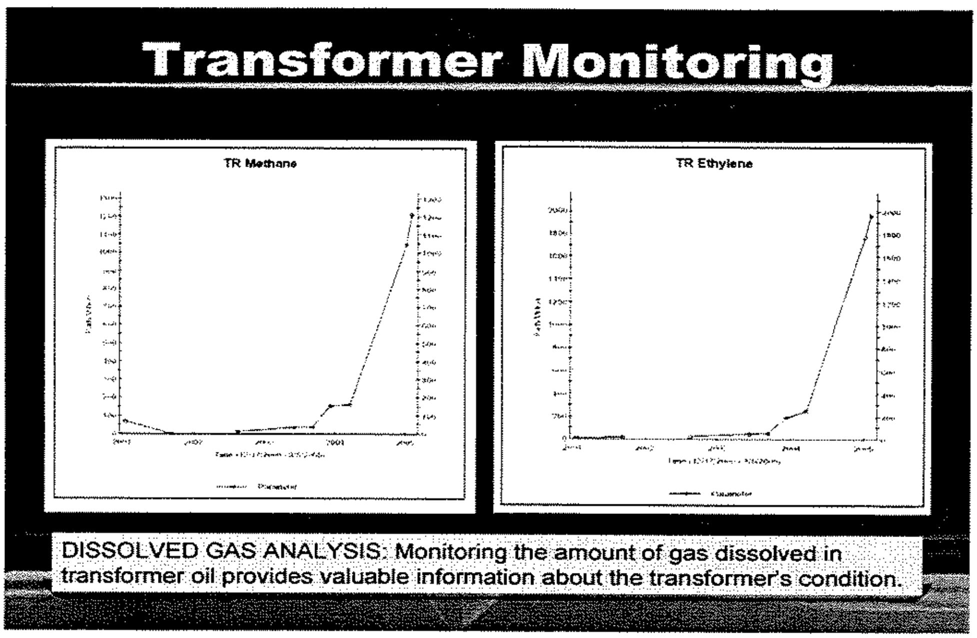


Transformer Monitoring

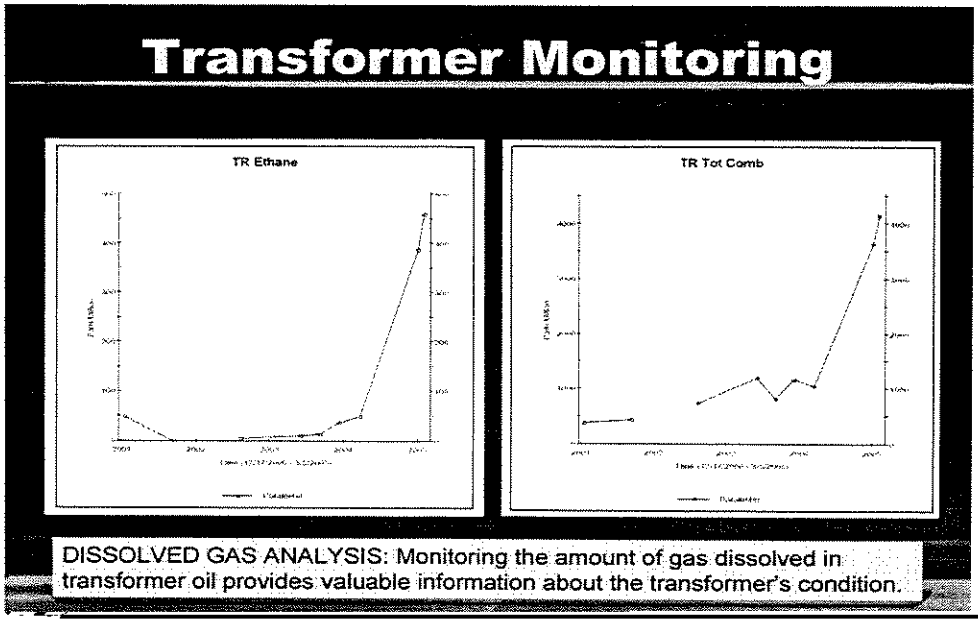
Dissolved Gas Analysis

ASTM D-3612 / Report Units: PPM					
Lab Control Number:	5214955	5205030	5120595	5090777	5077220
Date Sampled:	02/04/2005	01/03/2005	03/17/2004	12/08/2003	09/04/2003
ACTI Report Number:	136325	134333	119421	115635	111533
Oil Temp (C):	54	52	56	57	58
Hydrogen (H2):	127	133	41	36	12
Methane (CH4):	1211	1044	161	152	37
Ethane (C2H6):	457	386	49	36	13
Ethylene (C2H4):	1958	1773	247	190	52
Acetylene (C2H2):	0	0	6	0	0
Carbon Monoxide (CO):	380	295	550	753	698
Carbon Dioxide (CO2):	10617	5055	9056	12018	12021
Nitrogen (N2):	77494	78591	63823	120857	80145
Oxygen (O2):	4991	12823	3415	14963	7657
Total Gas:	97235	102930	77346	149025	100635
Total Combustible Gas:	4133	3631	1048	1157	812
Equivalent TCG Percent:	1.9854	0.9055	0.7799	0.5018	0.829

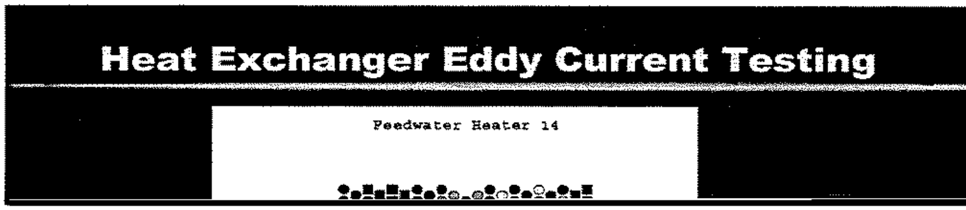
DISSOLVED GAS ANALYSIS: Monitoring the amount of gas dissolved in transformer oil provides valuable information about the transformer's condition.



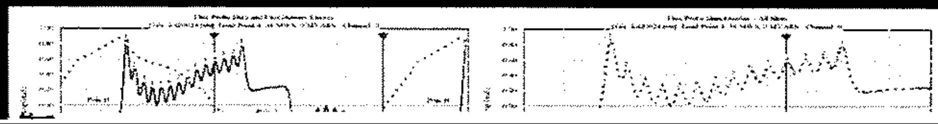
W8 Aux Transformer: graph shows the dissolved methane & Ethylene gas in the transformer oil. Exponential increase indicates temperatures greater than 700C.


Transformer Monitoring
TR Ethane
TR Tot Comb
DISSOLVED GAS ANALYSIS: Monitoring the amount of gas dissolved in transformer oil provides valuable information about the transformer's condition.

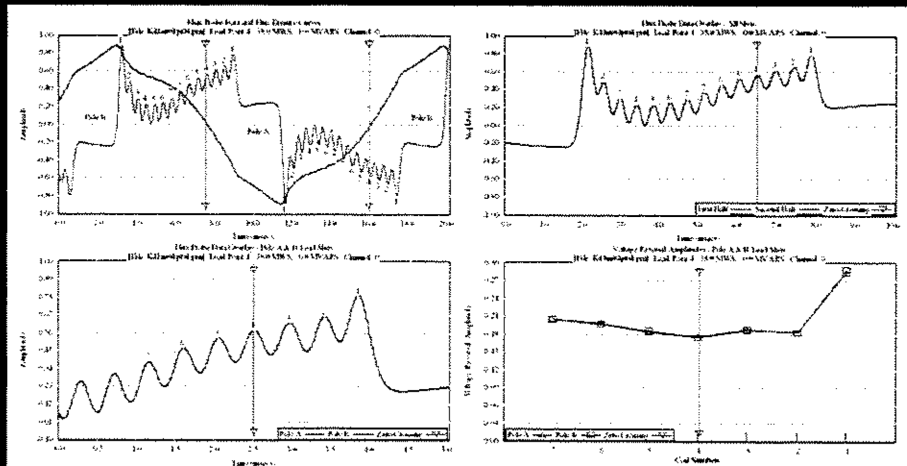
14. Eddy current testing



Flux Probe Testing



Flux Probe Testing



Flux probe data from Kahe 4 generator at load point 4 after rewinding rotor.

Flux Probe Testing

Generatortech Shorted-Turn Data Table

File: K4Jan04pt04.pm Date: January 28, 2004 8:00:29 pm

Path: [illegible]
Company: HAWAIIAN ELECTRIC COMPANY Station: KAHE UNIT 4
Comments: Baseline test - rotor rewound Jan 04
Number of poles= 2 Coils/pole= 7 Max Load MWS= [illegible]
Turns/Coil 1=25, 2=26, 3=26, 4=26, 5=26, 6=26, 7=26

Load Point= 4 MWS= [illegible] MVARs= [illegible] Field Amps=[illegible] Field Volts=[illegible]
Flux Density Zero Crossing= [illegible] Filter=none, Rotor RPM=[illegible] Peak Height=Original

Coil	Pole A Peak Size	Pole B Peak Size	Ratio of Sizes A/B	Ratio of Sizes B/A	Pole A Shorted Turn Indication	Pole B Shorted Turn Indication
1	0.288	0.293	0.982	1.018	...	...
2	0.186	0.186	0.998	1.002	...	...
3	0.191	0.190	1.005	0.995	...	...
4	0.179	0.178	1.005	0.995	...	...
5	0.186	0.188	0.988	1.012	...	...
6	0.200	0.199	1.005	0.995	...	...
7	0.208	0.207	1.005	0.995	...	...

No shorted-turns indicated (post-rewind flux probe test)

CA-IR-47

Ref: HECO-629.

a. Please provide a monthly breakdown, by payee, of actual expenses incurred in 2003 and 2004 for each line item for which there are itemized amounts shown for Power Production Operations outside services in the test year.

b. Is HECO considering adjusting the forecasted costs in each instance where actual expenditures do not support the increases reflected in the test year forecast? Explain why or why not.

c. If contractual commitments have been made for the increased expenses, please provide copies of agreements reflected the contractual commitment.

HECO Response:

a. The information requested is voluminous and therefore one copy each (CA-IR-47, Transmittal 1, pages 1 to 60) will be provided to the Consumer Advocate and the Commission under separate transmittal. The file will also be made available electronically. In this file HECO is providing details of the actual 2003 and 2004 outside service transactions. Page 3 of this response describes the organization of the information being provided in CA-IR-47, Transmittal 1.

b. No, HECO is not considering adjusting the forecasted costs in each instance where actual expenditures do not support the increases reflected in the test year forecast because the distribution of actual expenditures as they occur is different from the estimating process used to develop the budget. Budgeting is performed at a higher level to ensure that sufficient resources are available to accomplish the work that needs to be done to operate and maintain the generating units in a safe, compliant, and reliable manner. Also, historical actual vs test year forecast variance analysis will not account for new expenditures that are expected to be incurred in the test year and future years. For the reasons above HECO recommends a higher level view of historical versus test year expenditures for ratemaking purposes.

c. The outside services for Power Production Operations provided in CA-IR-47, Transmittal 1, reflects the specific vendors used in 2003 and 2004 to perform services. It is not possible to identify specific increases and copies of agreements because the mix of vendors and scope of work in 2005 test year for the similar services may be different due to the dynamic nature of operations and maintenance. There are around 151 service agreements, each 15 to 20 pages long, with vendors that provide services for HECO Production. The information is too voluminous to reproduce. In addition, these service agreements are confidential and not for public dissemination. To release the service agreements to the public would jeopardize the agreements that are negotiated between HECO and its vendor. Please see pages 4 to 8 of this response for the list of service agreements with vendors. If the Consumer Advocate identifies which service agreements they would like to review, arrangements can be made for on-site visits at the Waiau Administration Office. Arrangements can be made by contacting Irene Sekiya at 543-4778 for review.

Explanation of Database file "CA-IR-47_Oper_OS_data.xls"

Transaction records were extracted from Heco Ellipse system for "Outside Services" costs for periods 2003 through 2004. "Outside Services" classification consist of two categories of costs, Outside Services and Other.

Outside Services by Expense Element-
- 501 – Outside Services – General
- 502 – Outside Services – Legal
- 503 – Outside Services – Temporary
- 505 – Ouside Services – Construction
- 506 – Outside Services – Engineering
- 508 – Outside Services – Environmental

Other by Expense Element-
- 451 – Info Sys Production & Development
- 462 – Info Sys PC Software
- 516 – Employee Membership
- 520 – Mainland Travel
- 521 – Meals and Entertainment
- 522 – Interisland Travel
- 570 – Rent
- 600 – Gen Plt Equip Maint
- 640 – Freight, Post & Bulk Main
- 900 – Financial Statement Items
- 901 – Amort of Deferred Db

Summary of 2003 "Outside Services" cost is shown as an exhibit in T-6, Aaron Fujinaka direct testimony HECO-621 (Prod Operations).

File includes various types of transactions, such as service vendor charge, manual entries, transfers, financial statement transactions, etc. This file was primarily prepared to collect vendor (supplier) information.

The useful data shown for each record are:

1) Account Code – Defines RA, Activity, Location, Indicator, 5th Segment/Project, and Expense Element
2) Block – Block B30=Operation

New Contracts Request Log

	Supplier Name	CONTRACT #
1	AGT Services	MSTR-IP-02-005
2	Air & Hydraulic Service	MSTR-IP-04-002
3	AirCare Environmental	MSTR-IP-03-037
4	Akana Trucking Inc	MSTR-IP-03-051
5	Alakona Corp	MSTR-IP-03-015
6	Alii Flooring	MSTR-IP-03-009
7	Allied Security Fence Co.	MSTR-IP-02-021
8	Allstate Steel	MSTR-IP-02-012
9	Aloha Equipment Repair	MSTR-IP-99-36
10	Aloha Painting Company, Inc	MSTR-IP-00-109
11	Amatek Solidstate Controls, Inc	MSTR-IP-99-30
12	American Marine	MSTR-IP-01-004
13	American Piping & Boiler	MSTR-IP-02-002
14	Arakaki Mecanical LLC	MSTR-IP-04-015
15	Armstrong Bldg. Maintenance Inc	MSTR-IP-01-021
16	Associated Steel Workers Ltd.	MSTR-IP-03-044
17	Atlas Sales Co., Inc.	MSTR-IP-04-022
18	ATMOS Inc.	MSTR-IP-03-046
19	B & C Trucking Co. Ltd.	MSTR-IP-00-61
20	B & J Insulation Co. Inc.	MSTR-IP-03-032T
21	Babcock & Wilcox	MSTR-IP-02-007
22	Barry Sibul	MSTR-IP-04-003
23	BEI Hawaii	MSTR-IP-03-050
24	Bering Sea Eccotech	MSTR-IP-02-003T
25	BJ Process & Pipeline Services	MSTR-IP-04-007
26	Bobs Equipment rental	MSTR-IP-03-021
27	BRYCO, Inc	MSTR-IP-00-105
28	C. S. Squared	MSTR-IP-03-048
29	Clean Living Dust-Tex Honolulu Inc.	MSTR-IP-01-017
30	Clean-N-Rooter	MSTR-IP-03-023
31	Clear Visions	MSTR-IP-00-84
32	Conco Systems Inc.	MSTR-IP-02-009
33	Concrete Coring Company	MSTR-IP-03-006
34	Costal Piping & Fabrication	MSTR-IP-03-035T
35	Crane Pro Services	MSTR-IP-03-013
36	D & M Hydraulic Sales & Service	MSTR-IP-00-92

New Contracts Request Log

	Supplier Name	CONTRACT #
37	D & S Commercial Service	MSTR-IP-03-007
38	D.Y. Mikami Construction Inc.	MSTR-IP-03-014
39	DCS2000	MSTR-IP-00-90
40	Diversified Energy Services	MSTR-IP-02-019T
41	Don's Makiki Inc.	MSTR-IP-99-39
42	Earle Matsunaga Painting	MSTR-IP-99-52
43	Electric Power Technologies	MSTR-IP-03-020
44	Engineering & Inspections Hi.	MSTR-IP-03-039
45	Enviroservices & Training	MSTR-IP-03-038
46	EPRI Solutions Inc	MSTR-YA-03-01
47	Erik Builders Inc.	MSTR-IP-03-019
48	F & H Construction	MSTR-IP-02-013
49	Finlay Testing Laboratories	MSTR-IP-03-029
50	Flowserve Inc	MSTR-IP-04-004
51	G.Y. Murashige Contractor Inc.	MSTR-IP-03-011
52	Garlow Petroleum	MSTR-IP-00-74
53	Giordano's Painting Inc.	MSTR-IP-02-014T
54	Global Environmental Services Group	MSTR-IP-00-110
55	GMI Pacific Waste Services	MSTR-VP-00-16
56	Green Magic (dba Diversified Exterminators)	MSTR-IP-01-020
57	Hamon Custodis Inc.	MSTR-IP-04-023
58	Hawaii Duct & Acoustical Ceiling Cleaners	MSTR-IP-01-112
59	Hawaii Vertical Transportation	MSTR-IP-03-031
60	Hawaiian Crane & Rigging Ltd.	MSTR-IP-00-62
61	Hawaiian Crane & Rigging Ltd.	MSTR-IP-03-012
62	Hawaiian Dredging Construction Co.	MSTR-IP-02-015T
63	Hawaiian Steam Inc.	MSTR-IP-02-016T
64	Haztech Environmental Services Inc	MSTR-IP-99-24
65	Heide & Cook Ltd.	MSTR-IP-05-008
66	Hi Tech Roofing Services, Inc	MSTR-IP-04-025
67	Honolulu Painting	MSTR-IP-02-020
68	Honolulu Shipyard Inc.	MSTR-IP-00-103
69	Honomac, Inc.	MSTR-IP-01-007
70	HSI Electric	MSTR-IP-04-019
71	HSI Mechanical	MSTR-IP-03-045
72	Ikaika Masonary	MSTR-IP-03-025

	Supplier Name	CONTRACT #
73	Industrial Parts Hawaii, Inc.	MSTR-IP-00-100
74	Island Demo	MSTR-IP-99-41
75	Island Mechanical Corp	MSTR-IP-99-25
76	Island Top Soil	MSTR-IP-00-79
77	Iwalani Trucking	MSTR-IP-00-85
78	Jani-King of Hawaii	MSTR-IP-01-022
79	K2M Mobile Treatment Services	MSTR-IP-02-001
80	Kan-Seal	MSTR-IP-04-008
81	Kawika's Painting & Waterproofing Inc.	MSTR-IP-03-027
82	Keith Environmental Consultants LLC.	MSTR-IP-04-009
83	Kleen Sweeps Inc.	MSTR-IP-03-034
84	Latigo Construction, Inc.	MSTR-IP-03-049
85	LFR Levine-Fricke	MSTR-IP-00-66
86	Maikai Plumbing	MSTR-IP-00-63
87	Marisco, Ltd.	MSTR-IP-03-017T
88	Maxwell Communications	MSTR-IP-01-003
89	McClean's Air Purification Specialists	MSTR-IP-00-59
90	Medeiros Trucking Service Inc	MSTR-IP-03-004
91	Mega Construction Inc.	MSTR-IP-04-001
92	Menehune Water Co.	MSTR-IP-03-005
93	Merican Industries Inc.	MSTR-IP-00-82
94	Metropolitan Painting & Environmental Sys	MSTR-IP-04-024
95	Mid-Pacific Medical Training Institute	MSTR_IP-03-007
96	Milo Nursery & Landscape, Inc	MSTR-IP-04-006
97	MKD Enterprises	MSTR-IP-99-44
98	Modern Key Shop	MSTR-IP-04-018
99	Muranaka Environmental	MSTR-IP-03-047
100	National Concrete Sawing	MSTR-IP-04-014
101	Oahu Industrial Inc.	MSTR-IP-99-33
102	Oak Park Chimney	MSTR-IP-00-83
103	Oceanic Dive Company, Inc	MSTR-IP-99-31
104	Ohana Environmental Construction Inc	MSTR-IP-01-006
105	Oliver Tile Corporation	MSTR-IP-00-101
106	Pacific Commercial Services LLC	MSTR-IP-03-026
107	Pacific Concrete Resurfacing	MSTR-IP-00-89
108	Pacific Diving Industries	MSTR-IP-03-024

New Contracts Request Log

	Supplier Name	CONTRACT #
109	Pacific Industrial Corp	MSTR-IP-03-042T
110	Pacific Tank & Repair	MSTR-IP-03-002
111	Pacific Testing Services	MSTR-IP-02-022
112	Petrochem Industries	MSTR-IP-99-005
113	Petrochem Insulation, Inc.	MSTR-IP-02-018T
114	PII North America, Inc.	MSTR-IP-04-016
115	Pomaikai Transport Services	MSTR-IP-00-58
116	Powers Engineering & Inspections	MSTR-IP-03-033
117	Process Controls Inc.	MSTR-IP-03-018
118	Progressive Air Conditioning Inc	MSTR-IP-01-002
119	PSC Industrial Outsourcing, Inc	MSTR-IP-03-016
120	R K Oshiro Door Service	MSTR-IP-02-010
121	Reinhart & Associates	MSTR-IP-01-001
122	Richards Painting	MSTR-IP-02-006
123	Rolloffs Hawaii, Inc.	MSTR-VP-03-015
124	Roto-Rooter	MSTR-IP-03-043
125	Safway Services Inc.	MSTR-IP-03-040
126	Sako Electrical Corp	MSTR-IP-01-008
127	SCEC	MSTR-IP-03-020
128	Sea Engineering Inc.	MSTR-IP-03-003
129	Sensormatic	MSTR-IP-01-009
130	Siemens Industrial Services, Inc.	MSTR-IP-04-017
131	SPCC & Consult ting	MSTR-IP-99-29
132	Specialty General	MSTR-IP-00-104
133	Steinke Brothers Inc.	MSTR-IP-03-010
134	Structural Dynamics Inc	MSTR-IP-03-041
135	Structural Integrity Associates	MSTR-IP-04-013
136	Superheat	MSTR-IP-04-010
137	TesTex	MSTR-IP-03-036
138	The Aqua Man Power Washing	MSTR-IP-00-71
139	Thermal Solutions Inc	MSTR-IP-03-030
140	Thielsch Engineering Inc.	MSTR-IP-04-005
141	Thyssen Dover Elevator Corp	MSTR-IP-01-012
142	Trees of Hawaii	MSTR-IP-03-022
143	TURVAC, INC	MSTR-IP-00-102
144	Unitek Insulation Inc.	MSTR-IP-02-008

New Contracts Request Log

	Supplier Name	CONTRACT #
145	Unitek Slovent Services Inc.	MSTR-IP-03-028
146	Universal Associates (Manufacturer)	MSTR-IP-04-012
147	Wesdyne	MSTR-IP-00-87
148	West Coast Cleaning & Preservation	MSTR-IP-99-28
149	Western Process Controls	MSTR-IP-00-88
150	Western Waterproofing	MSTR-IP-00-64
151	Williams & Associates Inc	MSTR-IP-01-005

Due to the voluminous nature of the information, one copy of CA-IR-47, Transmittal 1 (pages 1-60) will be provided to the Consumer Advocate and the Commission under separate transmittal.

CA-IR-48

Ref: HECO T-6, Page 28, line 23 to Page 29, line 13, HECO-623 and HECO 625.

According to the testimony, "[t]he increase between 2003 Actual and test year 2005 is mainly attributed to existing vacancies from retirements at the end of 2003, and an increase in maintenance staffing." Please provide the following information:

a. State whether the Company conducted any studies of the optimal staffing plan for production maintenance personnel and, if affirmative, provide complete copies of all such studies.

b. Provide all calculations, workpapers, analyses, projections and other documents supportive of the cost effectiveness of HECO's decision to increased maintenance employee levels by 40 people (34 percent) relative to 2003 staff levels, with 20 added positions attributed to night maintenance.

c. Explain and quantify the treatment of overtime hours and costs reflected in the test year, relative to historical overtime percentages per HECO-625.

d. Explain and reconcile the increased staffing with the proposed versus historical levels of overtime for production department maintenance personnel, indicating the extent to which "avoided" overtime costs in the test year projections are available to "pay for" increased staffing levels in such projections.

e. Explain and reconcile increased staffing with the proposed versus historical levels of outside services costs incurred by the power production department, indicating the extent to which "avoided" outside service costs in the test year projections are available to "pay for" increased staffing levels in such projections.

f. Provide an update to HECO-623 indicating actual YE 2004 staffing levels and explain plans for and the status of any further hiring in 2005.

g. According to HECO's response to CA-IR-1, T-6, Page 3 of 3, "[b]acklog of work continues to increase as the units and associated infrastructure ages." Please describe how HECO's production department maintenance work requirements are tracked and provide documentation of all measures of work "backlog" as of December 2002, 2003 and 2004 associated with this statement.

HECO Response:

a. The Company did not conduct any formal studies of the optimal staffing plan for production maintenance personnel. The approach used to determine staffing requirements was based on:

1. Replacements of vacancies attributed to retirements, resignations, job transfers and terminations. What's different today versus in the past is that to the extent plans for separations are known in advance positions being vacated are requested and approved as soon as possible to provide as much lead time and/or overlap for transition as possible.
2. Establishment of a night shift maintenance crew. The night shift maintenance crew size of 10 at Waiau and 10 at Kahe was based on the minimum crew size covering all required trades and craft skills necessary to accomplish maintenance on operating and available units. This crew size is too small to provide night shift overhaul support, but can be utilized in a limited capacity for this purpose if the need arises.
3. Increasing key resources to address more work. Additional trades and crafts, resource planners, planning coordinators and engineers identified in CA-IR-1, HECO T-6, are needed to handle the higher levels of work being generated as the units are run harder. The need for more unanticipated maintenance outages (MO), overlapping planned outages (PO) and response to forced outages (FO) requires more capability to plan, schedule and execute work required to maintain reliability.

b. As discussed in HECO T-6 on page 9, in order to mitigate the rapid growth in demand experienced in 2004, and in anticipation of equivalent or higher demand going forward, HECO had to take immediate steps to maximize the availability of its existing fleet of 16 generating units, and to figure out ways to maintain reliability of the aging fleet. Comparing the reserve margins in HECO-611 and HECO-612, in just one year, from 2003 to 2004, HECO system reserves dropped approximately 50 MW across the whole year due to the growth in demand. As experienced in 2004, actual demand outpaced the anticipated demand projections in the 2004 Adequacy of Supply letter to the Commission (HECO-606), and the impacts to the HECO system are expected to continue until permitting and installation of the planned simple-cycle combustion turbine can be expected to be completed.

Maximizing the availability of all generating units meant increasing the staffing levels at Honolulu and Waiau Stations to increase the availability of Honolulu Units 8&9 and Waiau 3&4 from 2 shifts, 5 days per week to 3 shifts, 7 days per week (24x7) as explained in HECO T-6, pages 23 and 24. Maintaining reliability of an aging fleet entailed looking at labor availability as well as available daily periods where meeting Spinning Reserve and Quickload Pickup generation criteria were not an issue with regard to meeting peak demand or responding to forced outages. To this end, off-peak periods shown in HECO-624 [redacted] two for safety and system isolation and tagging. Adding a merit Supervisor to provide supervision and administrative support as well as safety and environmental compliance enforcement brings the crew size up to 10 at Waiau and 10 at Kahe.

In addition to the nightshift maintenance crews at Waiau and Kahe, additional staffing increases reflected in CA-IR-1, HECO T-6, are required to manage a much higher workload during day peak periods in order to keep HECO's fleet of aging generating units on line and to support safety and environmental compliance by adequately maintaining supporting infrastructure and facilities. Regarding unit outages, as shown in HECO-611 and HECO-612, the respective Actual Maintenance outages throughout most of the year involved concurrent unit outages (units are down at the same time). The trend, similar to that experienced in 2004, is expected to continue into the foreseeable future as demand grows and all existing generating units, including IPPs, get older.

Comparing 2003 staffing levels with 2005 test year projections is not a good comparison, but used in the original analysis because 2003 was the most recent actual full-year result when the 2005 test case was being developed in 2004. The system conditions and requirements in 2003 are not same based on what was experienced in 2004, and projected to continue into the foreseeable future. While 2004 actual results are provided it does not factor in HECO's generation shortfall mitigation plans which are included in the 2005 test year budget, and discussed above and in HECO T-6.

c. HECO-625 compares OT percentages for the Maintenance Division comprised of Honolulu Maintenance (PIH), Waiau Maintenance (PIX), Kahe Maintenance (PIL) and Travel Maintenance (PIT) and included a year-to-date percentage as of August, 2004. The attached spreadsheet on pages 8 and 9 provides a breakdown, by RA, of actual overtime hours compared to straight time hours for 2002, 2003 and includes the year-end 2004 result

d. It is not possible to reconcile the increased maintenance staffing forecasted in 2005 because the maintenance staffing levels forecasted were based on the numbers of specific trades and craft personnel required to keep up with anticipated increased workload requirements. Comparing the 2005 test year forecasted OT percentages with actual historical trends indicates a decrease in OT % for each of the Maintenance RA's. Most affected are the Waiau and Kahe Maintenance crews with the establishment of the night shift maintenance crews. It should be noted that actual OT is not only a function of staffing levels, but also a function of work requirements to keep available units operational and in compliance (environmental, safety, permit) on a 24x7 basis. Also, units down for overhaul, maintenance outages or forced outages contribute to OT trends as work is done on weekends, holidays after normal business hours, and on a call out basis. Unit outages are also overlapped, or stacked, to accomplish normal and recurring maintenance. During periods when labor shortfalls occur, such as when unit outages are stacked, man-hour deficits are made up with OT and/or contact services. As mentioned in the response to part b. above, system demand is expected to continue to increase into the foreseeable future and will result in reduced generating reserve margins. This will tend to increase OT as all available time and resources are utilized to keep the lights on. This reality is one of the major differences between an intertied system and an island system that must be self sufficient.

e. The levels of outside services costs is expected to remain high and/or increase due to the need to overlap unit outages to keep up with the maintenance of 16 generating units through the course of a year. As discussed in the response to part d. above, contractors are expected to continue to supplement the workforce as existing HECO labor forces are spread amongst multiple unit outages. While maintenance staffing numbers are significantly higher compared to previous years, as discussed in the response to part b. above, HECO's additional staffing requirements forecasted in 2005 is the minimum staffing level required to keep up with multiple planned outages (PO), maintenance outages (MO) and the occasional forced outage (FO). Night shift maintenance will provide some relief by allowing maintenance to be performed during off peak hours.

f. CA-IR-1, HECO T-6, Attachment 5, has the requested actual YE 2004 staffing levels by RA. The attachment has been updated and attached to this response, on pages 10 to 16, to reflect vacancy and hiring status through March 3, 2005.

g. "Backlog" statistics are not tracked and/or available in a useable format for analysis purposes. As explained in HECO T-6, pages 9 to 16, there are many factors that contribute to the amount of work (maintenance) that is identified, categorized, prioritized and planned. "Backlog" is a general term used to identify work that is held in abeyance until an opportunity arises to perform the work is considered backlog. Examples may include repairs that require a unit shutdown, but not an immediate threat to safety, environmental compliance or unit reliability, repairs awaiting materials and/or parts, labor resource availability, infrastructure repairs not directly impacting unit availability and/or system reliability, etc. The process to integrate backlog into the maintenance practices discussed in HECO T-6, pages 9 to 16, is described below:

- Planned Outages (PO) – Backlog items are added to the scope of PO's in advance of the outage since the outage is predictable many months and years in advance. As the outage approaches, Production Resource Planners generate a list of identified backlog items for the identified generating unit which is reviewed by planners, operations and maintenance supervisors, and engineers. Included with this response on pages 17 to 34 is an example of a work order backlog list for W6 which has been undergoing an outage since 01/27/05. Pre-overhaul meetings are held prior to an outage to define the scope of the outage and estimated duration. Based on available resources, backlog items are added to the overhaul scope along with capital and O&M projects. Priorities are then adjusted if unanticipated problems are identified during the overhaul.

- Maintenance Outages (MO) – The same example of a backlog list provided on pages 17 to 34 is used for a short MO. Based on available resources, backlog items are added to the maintenance outage scope. A pre-outage meeting is held with appropriate stakeholders to coordinate shutdown, repair and startup activities.
- Forced Outage (FO) – The same example of a backlog list provided on pages 17 to 34 is also used to identify items that can be worked on during a forced outage. Since a FO requires immediate attention and restoration, selection of backlog items is limited. For example, if the unit needs to be restored immediately, it may not be possible to accomplish internal boiler repairs on a forced outage as it takes two days to cool the boiler to safely gain entry for the repairs.

In summary, backlog items exist for each unit and are managed depending on unit and resource availability, and type of outage. No statistics or reports are available for analysis at this time.

Hawaiian Electric Company Inc.
Rate Case - Test Year 2005
Labor Overtime

RA	RA Desc	Overtime Hours	Straight Time Hours	Proportion OT/ST Hrs %
2002 Actual				
PIB	Admin-PS O&M	0	11,310	0%
PIH	Honolulu Stn Oper	6,325	29,696	21%
PIK	Kahe Stn Oper	15,072	101,284	15%
PIL	Kahe Stn Maint	8,669	46,533	19%
PIM	Maintenance Admin	0	3,680	0%
PIN	Honolulu Stn Maint	1,610	13,809	12%
PIO	Operations Admin	0	1,720	0%
PIP	Planning	10	20,903	0%
PIT	Traveling Maintenance	27,854	116,978	24%
PIW	Waiau Stn Oper	19,133	90,429	21%
PIX	Waiau Stn Maint	7,467	42,090	18%
TOTAL		86,140	478,432	18%
2003 Actual				
PIB	Admin-PS O&M	15	11,417	0%
PIH	Honolulu Stn Oper	7,233	30,287	24%
PIK	Kahe Stn Oper	12,819	107,094	12%
PIL	Kahe Stn Maint	9,716	48,881	20%
PIM	Maintenance Admin	0	3,762	0%
PIN	Honolulu Stn Maint	1,425	14,004	10%
PIO	Operations Admin	0	837	0%
PIP	Planning	73	25,149	0%
PIT	Traveling Maintenance	26,682	116,257	23%
PIW	Waiau Stn Oper	23,641	92,184	26%
PIX	Waiau Stn Maint	7,397	38,219	19%
TOTAL		89,001	488,091	18%
2004 Actual				
PIB	Admin-PS O&M	5	12,830	0%
PIH	Honolulu Stn Oper	9,489	30,109	32%
PIK	Kahe Stn Oper	16,288	101,372	16%
PIL	Kahe Stn Maint	10,977	44,188	25%
PIM	Maintenance Admin	0	3,699	0%
PIN	Honolulu Stn Maint	1,997	13,714	15%
PIO	Operations Admin	0	1,576	0%
PIP	Planning	0	24,611	0%
PIT	Traveling Maintenance	34,316	108,302	32%
PIW	Waiau Stn Oper	22,760	96,693	24%
PIX	Waiau Stn Maint	11,812	40,713	29%
TOTAL		107,644	477,807	23%

Hawaiian Electric Company Inc.
Rate Case - Test Year 2005
Labor Overtime

RA	RA Desc	Overtime Hours	Straight Time Hours	Proportion OT/ST Hrs %
2005 Budget				
PIB	Admin-PS O&M	1,177	19,353	6%
PIH	Honolulu Stn Oper	4,762	50,593	9%
PIK	Kahe Stn Oper	17,139	118,674	14%
PIL	Kahe Stn Maint	7,944	73,101	11%
PIM	Maintenance Admin	641	4,321	15%
PIN	Honolulu Stn Maint	1,632	17,225	9%
PIO	Operations Admin	183	1,934	9%
PIP	Planning	6,608	43,526	15%
PIT	Traveling Maintenance	34,556	164,190	21%
PIW	Waiau Stn Oper	25,446	133,992	19%
PIX	Waiau Stn Maint	7,099	72,065	10%
TOTAL		107,187	698,974	15%

2005 Budget - Breakdown of Straight Time Hours

		O&M Hrs	*All Oth Hrs*	*Total*
PIB	Admin-PS O&M	12,944	6,409	19,353
PIH	Honolulu Stn Oper	45,649	4,944	50,593
PIK	Kahe Stn Oper	108,885	9,789	118,674
PIL	Kahe Stn Maint	67,618	5,483	73,101
PIM	Maintenance Admin	2,079	2,242	4,321
PIN	Honolulu Stn Maint	15,801	1,424	17,225
PIO	Operations Admin	426	1,508	1,934
PIP	Planning	35,608	7,918	43,526
PIT	Traveling Maintenance	120,284	43,906	164,190
PIW	Waiau Stn Oper	123,649	10,343	133,992
PIX	Waiau Stn Maint	64,666	7,399	72,065
TOTAL		597,609	101,365	698,974

Agrees with labor hours reported in response to CA-IR-1, except for RA PIP which has a difference of 186 hours. Difference represents less than .1% of the total O&M hours.

ar	Actuals 4/30/2004	Actuals 12/31/2004	Actuals 4/30/2004 vs Test Year 2005	Actuals 2/28/2005	Comments
[illegible]	0	1	1	1	Vacancy created due to promotion. Status: Filled in 2004
[illegible]	0	1	1	1	Vacancy created due to promotion. Status: Filled in 2004
[illegible]	1	1	0	1	
[illegible]	1	2	0	2	Administrative Assistant converted to Contracts Admin. Status: Filled in 2004.
[illegible]	0	0	1	0	Vacancy, converted to Contracts Administrator.
[illegible]	1	1	0	1	
[illegible]	1	1	0	1	
[illegible]	0	1	1	1	Vacancy created due to job transfer. Status: Filled in 2004
[illegible]	1	1	1	1	Addition - See Note (1) below. Status: Position to be filled in January, 2005. 3/3/05 Update: Trainer hired and in transition.
[illegible]	1	0	0	0	
[illegible]	1	1	0	1	
[illegible]	2	2	0	2	
[illegible]	0	0	1	0	Addition - See Note (2) below. Status: Awaiting approval to fill.
[illegible]	0	0	0	0	
[illegible]	1	1	0	1	
[illegible]	3	3	0	3	
[illegible]	2	2	0	2	
[illegible]	0	0	0	0	
[illegible]	1	1	0	1	
[illegible]	1	1	0	1	
[illegible]	1	0	0	0	3/3/05 Update: Interviews in progress for "Mr. Pipeline". Note, position transferred from Production to Power Supply Engineering Dept.
[illegible]	1	1	0	1	
[illegible]	0	0	1	0	Addition - See Note (3) below. Status: Interviews in progress. 3/3/05 Correction: Pending approval to fill.

aiian Electric Company, Inc.
uction O&M
ing - Update with Actuals at 2/28/05

Position	RA	Test Year 2005	Actuals 4/30/2004	Actuals 12/31/2004	Actuals 4/30/2004 vs Test Year 2005	Actuals 2/28/2005	Comments
Honolulu Senior Supervisor	IH	1	1	1	0	1	
Honolulu Clerk	IH	1	0	0	1	0	Vacancy created due to job transfer. Status: Considering reassignment to support Technical Trainer. 3/3/05 Update: Pending approval.
Shift Supervisor	IH	5	4	4	1	4	Vacancy created due to retirement. Status: Scheduled to be filled in March, 2005 with a promotion from within. 3/3/05 Update: Promotion accepted. On-the-job training to commence in March 2005, with target transfer date of 6/27/05.
Honolulu Operators	IH	19	12	14	7	14	5 Additions to support 24x7 operation of H8&9; 2 Vacancies due to promotion and job transfer. Status: 5 positions to be filled in February, 2005. 3/3/05 Update: Positions filled. Operators in training. Target 24x7 on 6/5/05.
Kahe Senior Shift Supervisor	IK	1	1	1	0	1	
Kahe Station Aide	IK	1	1	1	0	1	
Shift Supervisor	IK	7	7	7	0	7	
Kahe Operators	IK	49	49	50	0	50	
Kahe Maint Supervisor	IL	3	2	2	1	2	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
Boiler Working Foreman	IL	2	1	1	1	1	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
Elec Working Foreman	IL	2	1	1	1	1	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
Machinist Working Foreman	IL	2	1	1	1	1	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.

Actuals 4/30/2004	Actuals 12/31/2004	Actuals 4/30/2004 vs Test Year 2005	Actuals 2/28/2005	Comments
4	4	1	4	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
3	3	1	3	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
2	3	3	3	Addition - +1 Night Shift, +1higher work demands, +1 Vacancy due to retirement. Status: Awaiting approval to fill. Vacancy due to retirement filled in May 2004 (Internal transfer). 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
3	3	1	3	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
6	6	2	6	Addition - +2 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
2	2	0	2	
1	1	0	1	
1	1	0	1	
1	1	0	1	
0	1	1	1	Vacancy due to retirement. Status:Filled in 2004
1	1	0	0	3/3/05 Update: Vacancy due to retirement. Interviews to be scheduled.
1	1	0	1	
1	1	0	1	
1	1	0	1	
1	1	0	1	
1	1	0	1	
2	1	0	2	1 Position filled in Feb 2005.

Actuals 4/30/2004	Actuals 12/31/2004	Actuals 4/30/2004 vs Test Year 2005	Actuals 2/28/2005	Comments
1	1	0	1	
0	0	0	0	
0	2	0	2	2 Additions to support operations with field engineering support at Kahe and Waiau. Status: Filled in 2004.
1	1	0	1	
1	1	0	1	
0	1	1	1	Vacancy due to promotion. Satus: Filled in 2004.
4	7	4	7	2 Additions to support higher workload, 2 Vacancies due to job transfers. Status: All but 1 position have been filled in 2004. Remaining vacancy awaiting response to job offer. 3/3/05 Update: Job offer accepted; remaining vacancy will be filled in March 2005.
0	0	2	0	1 Addition to support higher workload, 1 Vacancy due to resignation. Status: Job interviews in progress. 3/3/05 Update: No qualified applicants, position to be readvertised.
1	1	2	1	Vacancy due to retirement and job transfer. Status: Job interviews in progress. 3/3/05 Update: Interviews still in progress.
1	1	0	1	
3	3	0	3	
1	1	0	1	
4	4	0	4	
2	2	0	2	
2	2	0	2	
1	2	1	2	Vacancy due to termination. Status: Filled in 2004.
1	1	0	1	
1	1	0	1	
7	8	1	8	Addition - +1 to support higher workload. Status: Filled in 2004. 3/3/05 Update: Will use Helper Position (listed below) to add 1 addt'l Sr Electrician. Plan is to have 9 total Sr Electricians instead of 8.

Year 05	Actuals 4/30/2004	Actuals 12/31/2004	Actuals 4/30/2004 vs Test Year 2005	Actuals 2/28/2005	Comments
9	8	8	1	8	Vacancy due to retirement. Status: Job interviews in progress. 3/3/05 Update: Interviews still in progress.
7	7	7	0	7	
1	1	1	0	1	
7	6	6	1	6	Vacancy due to retirement. Status: Filled in January, 2005. 3/3/05 Update: Candidate declined job offer. Interviews in progress.
7	6	6	1	6	Addition - +1 to support higher workload. Status: Targeting to fill in March, 2005. 3/3/05 Update: Target date to fill moved to July 2005.
4	3	3	1	3	Vacancy due to promotion. Status: Interviews in progress. 3/3/05 Update: Will use Helper Position to add 1 addt'l Sr Electrician (listed above). Plan is to have 3 total Helpers instead of 4.
1	9	11	2	11	+2 Vacancies due to termination and long term disability. Status: Filled in 2004
8	4	4	4	3	+2 Vacancies due to retirement, +2 additions to support higher workload. Status: Interviews in progress. 3/3/05 Update: 4 internal transfers to occur March 2005. 1 new position to be filled in July 2005. Note, there was 1 termination in Feb 2005.
1	1	1	0	1	
1	1	1	0	1	
7	7	7	0	7	
3	46	55	7	55	4 Additions for 24x7 operation of W3&4, 3 Vacancies due to job transfers and retirements. Status: Positions fillled in 2004.
3	2	2	1	2	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.

...ar	Actuals 4/30/2004	Actuals 12/31/2004	Actuals 4/30/2004 vs Test Year 2005	Actuals 2/28/2005	Comments
	1	1	1	1	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
	1	1	1	1	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
	1	1	1	1	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
	3	3	2	3	Addition - +1 Night Shift, +1 Work demands. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
	3	3	1	3	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
	4	4	1	4	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
	3	3	1	3	Addition - +1 Night Shift. See Note (4) below. Status: Awaiting approval to fill. 3/3/05 Update: Received approval in Feb 2005. Job Vacancy Request to be issued in March 2005.
	5	5	3	6	Addition - +2 Night Shift - See Note (4) below; +1 Vacancy due to retirement. Status: Awaiting approval to fill 2 additional positions, interviews in progress to fill vacancy due to retirement. 3/3/05 Update: Received approval in Feb 2005 for 2 additional positions; Job Vacancy Request to be issued in March 2005. Filled 1 vacancy due to retirement in January 2005.

Year 05	Actuals 4/30/2004	Actuals 12/31/2004	Actuals 4/30/2004 vs Test Year 2005	Actuals 2/28/2005	Comments
	1	1	0	1	
	1	1	0	1	
4	285	310	69	310	

ort compliance and competency training requirements, with emphasis on operations.
rements, the need to restore operation of Honolulu 8&9 and Waiau 3&4 to 24x7
ılations, and the continued application of technology have increased the need

heavily on technology to ensure compliant, safe, reliable and efficient operations.
ɒport, security administration, troubleshooting support, user training/certification,
usiness software applications in the PS Process Area.

ed on 1) fuel supplier performance issues including compliance of purchased fuel to
contractor performance to ensure they operate fuel distribution facilities and
nd regulatory complaint manner; 3) resolve any measurement discrepancies
ces accurate information.

necessary at this time as opposed to any other time in the
r demand that is driving the need to operate aging units much harder with
nce. This trend will continue into the foreseeable future. A nightshift maintenance
eak periods (normal business hours) are declining. This means there is less
certain types of maintenance requiring unit deratings and/or short outages.
which provides a consistent opportunity to perform maintenance requiring deratings.
hired on the dayshift in 2005 to provide sufficient time (approximately 6-9 months)
yees to HECO's maintenance practices, safety procedures and
ıift maintenance crew will consist of a mixture of trades and craft skill sets,
s, and electricians, and helpers) to perform mechanical, electrical and technical
schedule will run from 21:30 hrs to 06:00 hrs relative to a typical daily load cycle.

0	575	0
68.85	0	49.31
0	0	0
0	0	0
21.52	0	7473.37
0	0	608.4
0	0	0
72.61	0	647.12
69.97	0	1344
0	211.51	0
0	211.51	0
92.69	39845.82	9885.24
0	0	0
0	16576	3318.77
75.29	0	6358.89
17.21	664	32104.57
2.89	3506.98	5207.67
333.3	936.18	25094.07
0	201466.14	3504.03
0	97934.01	3705.48

	W06CRCISTANA		G0006833		ISLER, R	20011206	0	0	26408.45	472.56
	W06TRBTHPCYL		G0009652	PPWAM	YUEN, MI	20040211	0	0	1084338.94	8789.92
	W06TRBTHPCYL		G0009652	PPWAM	YUEN, MI	20040211	0	0	0	0
	W06TRBTHPCYL		G0009652	PPWAM	YUEN, MI	20040211	0	0	0	0
RING	W06GENISTPRT		G0007217		TIEDE, CI	20040609	0	0	0	0
RING	W06GENISTPRT		G0007217		TIEDE, CI	20040609	6	158.65	0	110.39
LS	W06GENISTPRT		G0007217		TIEDE, CI	20040609	0	0	7546.5	26.85
ENGRG	W06GENISTPRT		G0007217		TIEDE, CI	20040609	62.5	1754.98	0	2056.07
T ENGRG	W06GENISTPRT		G0007217	PELEBBB	TIEDE, CI	20040609	0	0	0	0
EST	W06GENISTPRT		G0007217	PSREL	TIEDE, CI	20040609	0	0	0	0
BOR	W06GENISTPRT		G0007217	PPTREEL	TIEDE, CI	20040609	0	0	0	0
L	W06GENISTPRT		G0007217	PPTREEL	TIEDE, CI	20040609	0	0	0	0
VYD - ENGINEER	W06CRCCTLMISC		G0010254	PPKTY	ROMPASI	20040709	87	2553.85	0	2316.1
VYD - OUTS ENG	W06CRCCTLMISC		G0010254	PPKTY	ROMPASI	20040709	0	0	0	0
VYD - SYST PROT	W06CRCCTLMISC		G0010254	PPKTY	ROMPASI	20040709	0	0	0	0
VYD - MATERIALS	W06CRCCTLMISC		G0010254	PPKTY	ROMPASI	20040709	0	0	20431.32	185.22
VYD - LABOR	W06CRCCTLMISC		G0010254	PPTRE	ROMPASI	20040709	0	0	0	0
VYD - REMOVAL	W06CRCCTLMISC		G0010254	PPTRE	ROMPASI	20040709	0	0	0	0
r	W06CRCDCSOPR		G0010391	PPWAMMT	KABUTAN	20040728	0	0	0	0
	W06CRCDCSOPR		G0010393	PPWAMMT	KABUTAN	20040728	0	0	0	0
	W06GENISTPRT		G0010501	PPWAM	YONAMIN	20040816	0	0	0	0
	W06TRBTHPCYL		G0009652	PPWAM	YUEN, MI	20040903	0	0	0	0
Balance in place.	W06CWSCWP062PUMP		G0000297	PPWAMMT	ONIATE, I	19981222	3	81.77	0	53.18
Acoustic Survey Please OM requirements, rep ort	W06BFWPVCMANVLV	PR000020	G0000297	PPSWOWO	KINOSHIT	19990208	0	0	0	0
Blr Tubes Support I. W6-1998-3. SSH similar. Original castings lle to separate.	W06BLRSSH	PR000045	G0000297	PPTRBBL	MARK, KA	19990715	4	0	0	0
iki side of condenser,	W06TRBTHPCYL		G0000297	PPWAMMT	CHANG, S	19991014	2	56.67	0	33.17
Due for yearly burner	W06FOSBFEBRGUN		G0000289	PPWAM	TAPARRA	20000307	32	900.49	42308.98	415.41
g a copper filtering system minimize copper ostream feedwater heaters. 0 issue, page 22.	W06BFWFWH064PV		G0000120	PPKTY	MARK, KA	20000414	0	444.9	0	186.65
REPLACE WIRES	W06ELETSFLTXFR		G0000297	PPWAM	ISHIHARA	20000619	0	0	0	0
eeded Sato	W06CNDFWH063PV		G0000297	PPWAMMT	TAPARRA	20000628	87.5	2601.5	1237.54	1853.13
AKER - REMOVAL	W06CNDCDP061SWGR		G0000085	PPWAM	ISHIHARA	20000707	0	0	0	4.68

22.89	180.38	654.14	135.72	204.38	643.32	0	999.77	0	999.77	999.77	999.77	999.76	0	225.74	0	1214.39	0
0	0	33.38	0	0	0	0	0	0	0	0	0	0	0	0	930.15	278.01	0
65.38	98.15	03.53	02.53	12.91	05.67	0	0	0	0	0	0	0	0	76.92	0	29.79	0

PR021009	W6:Wet stack pipe under exhaust corrodedTwo of the four support lugs at the 6th floor are gone. consider replacing the piping soon. E Chang	W06BLRABT		G0000297	PPWAMMT	TAPARRA	20010729	1.5	47.81	0	24.12
PR021012	W6: 8" seal air pipe, hole in pipe, 6th floor, Ewa-Makai corner. Repair as needed. E. Chang	W06BDFPVCPIPE		G0000297	PPWAMMT	TAPARRA	20010729	0	0	0	0
PR021105	W6: Blr steam drum Waikiki normal level sightglass top isolation valve packing leaking. Bottom isolation valve also needs repacking.	W06BLRPVCMANVLV		G0000297	PPWAMMT	CHANG, S	20010802	4	122.57	0	44.75
PR021452	W6 #62 CWP Motor - Repair broken spiders	W06CNDCDP062MOTOR		G0000289	PPWAMMT	KAHAWA	20010815	0	0	0	0
PR021461	W6 #61 Boiler Feed Pump-Replace Volute BFP volute ETA is mid-Oct. 2001.	W06BFWBFP061PUMP		G0000289	PPTRMMA	KAHAWA	20010815	0	0	85.69	0
PR021503	W6: relocate FW sample to 3rd floor sample room. Presently located on the 1st floor. B. Choy	W06BFWPVCPIPE		G0000297	PPWAMMT	TAPARRA	20010817	5	205.96	0	134.68
PR021506	W6: Blr, bottom blow drn pipe leak. 1st floor 6 feet before entering blow off tank. See shipping tag Need welder, insulation already removed. Lee is this a shutdown item? Field check required.	W06BLRPVCPIPE		G0000297	PPWAMMT	TAPARRA	20010818	7	201.98	0	77.24
PR021564	W6 TURBINE BLDG ROOF REPAIR REPLACE METAL PLATES.	W06TRBHSE		G0000289	PPWAM	KAHAWA	20010821	0	0	0	0
PR021828	W6:APH INSULATION FALLING OFF	W06BDFPVCDUCT		G0000297	PPWAM	ISHIHARA	20010905	116	3838.49	28234.88	51596.14
PR022287	W6 Econo - Replace Tube Centerline B Refer to BTF Report No.01-W6-02-04 dated 08/-6/01. See Recommendation #1. Remove and replace economizer inlet header #1 (south-west) stub tube on Centerline B. There is a significantly old pad weld repair on the stub tube	W06BLRECO	PR000236	G0010220	PPTRBBL	MCCRAW	20011001	0	0	0	0
PR022288	W6 Econo - Replace Tube on Centerline C Refer to BTF Report No. 01-W6-02-04 dated 8/6/01. See Recommendation 2. Remove and replace eonconmizer inlet header #1 (south-west) stub tube on Centerline C. This tube was pad welded for a temporary repair and the stub tube and	W06BLRECO	PR000236	G0010220	PPTRBBL	MCCRAW	20011001	0	0	0	0
PR022302	Replace bent tube of repaired WW tube Refer to BTF Report No 01-W6-01-01, Recommendation #1. Replace the repaired tube on the lower front wall water wall header. The tube is the 2nd tube from the south-west conmer on the rear water wall header. The	W06BLRTUB			PPTRBBL	MCCRAW	20011002	4	159.7	0	54.17
PR022314	W6 Inspect/NDT lower rear wall tubes Refer to BFT Report No. 01-W6-01-01, Rcommendation #2. During the 2004 Overhaul, remove all the insulation, casing and castable refractory along the lower rear waterwall header and performe visual and NDT testing on	W06BLRTUB	PR000236	G0010220	PPTRBBL	MCCRAW	20011002	0	0	0	0

0	0	0	277.23	300.31	107.64	132.59	0	124.47	0	0	1181.29	321.55	14.43	142.69	12011.56	12.93	483.64	1249.99
0	0	9.07	0	0	0	0	55.48	31.58	0	0	96.28	0	0	0	0	0	6.04	0

[redacted]

PR028062	W6 HELIUM TESTING BY CONCO	W06CNDAEJCOND		G0000297	PPWAMMT	MANESS	20020718	0	0	0	2102.54
PR028180	W6 Gland seal head tank control inlet valve to 6VLC-13 leaking at bonnet and the inlet valve to 6VLC-12 leaking at packing.(Davis)	W06WTRISTVLC13		G0000297	PPWAMMT	QUITORI	20020723	0	0	0	0
PR028546	W06 Boiler drum safety leaks. (E. Chang)	W06BLRPVCRV51		G0000297	PPWAMMT	ADAMS, J	20020809	0	0	0	0
PR028790	W62 Circ Wtr Tunnel-Structural Inspecionof the tunnel is required. Tunnel cleaning on 8-15-02 to 8-17-02 (cleaning out barnacles, marine growth) found two (2) holes the size of a half dollar. First hole found about 150" from pipe cover (heading mauka) at the 2:00	W06CWSFNDTUNNL		G0000297	PPWAMMT	MARK, KA	20020817	0	0	0	0
PR029224	W6: Hydrazine tank drain valve leaks through. dripping in trench	W06CFDHDZ061PUMP		G0000297	PPWAMMT	MARK, KA	20020913	1.5	51.39	0	20.18
PR029418	W6 GEN FLUX PROBE TEST - 2002	W06GENGENROTOR		G0000283		KIYABU, I	20020924	0	0	0	2600
PR029622	W6 Main Fuel Trip VFC5, packing leak. The packing on VFC-5 has begun to leak.	W06FOSISTVFC5		G0000297	PPWAMMT	STURGES	20021003	0	0	0	0
PR029720	W6 MS l.p. alm stop valve. packing leak.The stop valve on the main steam low pressure alarm capillary tube is leaking. It is located by the bleed trip valves about 15 feet off the floor on the Waikiki side of the plant.	W06STMISTPT		G0000297	PPWAMMT	STURGES	20021009	0	0	0	0
PR030645	W6 Aux Chiller. SW strnr. Isolation val W6 Internal isolation valve for SW stariner leaking through. Strainer located at inlet of # 61 Auxiliary cooling water chiller. Tanaka	W06WTRPVCMANVLV		G0000297	PPWAMMT	SATO, DE	20021127	0	0	0	0
PR030646	W6 Aux Chiller SW strnr. Inlet islo val.W6 Inlet isolation valve for service water strainer located at auxiliary cooling water chiller. Local open/close indicator not working. Tanaka.	W06WTRPVCMANVLV		G0000297	PPWAM	SATO, DE	20021127	0	0	0	0
PR030724	W6 "STEAM INTO HEATER LOW TEMP TANK #3" and "FUEL OIL OUT OF HEATER HI-LOW TEMP TANK NO 3" alarms go on and off during the day. FO heater #3 is no longer in service. Please disable alarms or reset them to prevent them from coming on and off constantly.	W06CRCISTANN		G0000297	PPWAMMT	EVANS, V	20021203	4	165.65	0	107.83
PR031277	W6: Inspect and adjust gov. Trb hunting.Please inspect and adjust all ranges to the manufacturers specifications. This work can be done prior to placing the unit on line, work with ops on a schedule.	W06TRBISTGOVVLV		G0000297	PPWAMMT	STURGES	20030110	0	0	0	0
PR031283	W6 AE condenser head leaks on the Waikiki end. Leak stops after we draw vacuum so it is a shell side leak. (P. Roberson)	W06CNDAEJCOND		G0000297	PPWAMMT	EVANS, V	20030110	0	0	0	0
PR031297	W06 turbine #1 bleed trip valve seems tobe leaking air at the hinge point of the valve packing seems to be sucking in air. (Tanaka).	W06TRBPVCCHKVLV		G0000297	PPWAMMT	ADAMS, J	20030111	0	0	0	0
PR031351	W6 When coming on line, shutting OCB 105 causes the "GEN BREAKER SLOW CLOSE" alarm to come on. On 1/14/03 - the timer read 107ms for OCB 105. For comparison, OCB 104 read 54ms. Substation plans to go back and check this breaker out.	W06ELE11K		G0000297	PPWAMMT	EVANS, V	20030114	0	0	0	0
PR031628	W6 65 FWH Instrumentation	W06BFWISTMISC		G0000297	PPWAMMT	KAHAWA	20030124	33.5	1071.53	0	713.24

Screen Wash Pump seal leaking. The mechanical his pump is beginning to leak.	W06CWSSWP061		G0000297	PPWAMMT	STURGES	20030128	0	0	946.15	0
uka throttle did not open till Makai side valve was en (Gomes).	W06TRBISTTHRVLV		G0000297	PPWAMMT	ADAMS, J	20030201	0	0	0	0
MT W06 steam drum N2 blanket 2 bla nketing for W6 steam drum. this is required for it for the bro program.	W06BLRSTD		G0000297	PPWAMMT	ADAMS, J	20030203	5	157.77	0	133.42
dwater heater nitrogen blanketinginstallation for 52-55 install individual 0-15# pre ssure gauges and needle valves with stainless tubi ng to connect al heaters to N2 supply to come from W 5 future N2	W06BFWPVCPIPE		G0000297	PPWAMMT	ADAMS, J	20030203	5	197.08	206.5	136.77
unciator System Replacement Request For ring Attention Replace annunciator system with new d "state of art" annunciation system due to aterials being "obsolete". When performing the required ' lamp/module test required by our insurance carrier, ets	W06CRCISTANN		G0000120	PPDYA	MEYER, F	20030204	0	0	0	0
ect Front/Rear WW Tubes Refer to BTFR No. 02-W5-01-05 Recommendation 1. Expose the front ' waterwall headers and tubes forming the rear, floor t wall in the makai bottom boiler vestibule. Inspect the n of the tubes	W06BLRTUB	PR000236	G0010220	PPTRBBL	MCCRAW	20030205	0	0	0	0
lify Bottom Boiler Vestibule AccessRefer to BTFR No. 02-W5-01-05 Recommendation 2. Modify the boiler vestibule drains and manhole access in the front ' waterwall header area to be the same as was done to ng the 2002 overhaul. Modifications	W06BLRTUB	PR000236	G0010220	PPTRBBL	MCCRAW	20030205	0	0	0	0
62 CWP's. When CWP's are on the city water for lube water, there is no or low lube water flow to the gland. When the by-pass valve around the trip valve is lube water pressure to 62 CWP is ok, but still low on '. Indications point to a	W06CWSISTPT		G0000297	PPWAMMT	QUITORI/	20030227	0	0	0	0
INSPECT/REPAIR COLD/PRESS LINES Refer to W6 essurized Line Inspection List which can be found on drive at: arSupplyOperations&Maintenance\PDM\BRO\Boiler ressurized Line Inspections 2002-2003\W6 Cold-Press	W06BLRPVCPIPE			PPWAMMT	MCCRAW	20030310	21.5	850.06	0	2480.77
VP UNBALANCE W61 CWP ANCE VIBRATION DATA SHOW RAPID INCREASE RUNNING SPEED INDICATING UNBALANCE ILY DUE TO OBSTRUCTION IN PUMP PLEASE ULE DIVERS TO INSPECT/REMOVE/CLEAN AS RED PROVIDE REPORT TO D.MARTIN X4333	W06CWSCWP061PUMP		G0000297	PPWAMMT	MARTIN,	20030404	1	39.91	0	1723.7
2.3 kV Motor Testing (MCE)	W06ELE23VMISC		G0000297	PPSWOWM	EROLIN,	20030410	16	642.21	0	337.87
480 V SWGR Motor Testing (MCE)	W06ELE480MISC		G0000297	PPSWOWM	EROLIN,	20030410	23	900.12	0	481.6

(MCE)	W06ELEMCCMISC		G0000297	PPSWOWM	EROLIN, {	20030410	19	762.52	0	394.92
ave fallen off into the	W06BDFFDFLOSWGR		G0000297	PPWAMMT	EVANS, V	20030412	8	300.34	3119.3	217.58
cked. located 3rd floor,	W06FOSPVCPIPE		G0000297	PPWAMMT	TAPARRA	20030424	0	0	0	0
ock and root valves are	W06BLRPVCMANVLV		G0000297	PPWAMMT	EVANS, V	20030426	0	0	0	0
tions	W06BDFISTMISC		G0000297	PPWAMMT	MEYER, F	20030429	0	0	3995.86	0
/8 rusted.The cross over line : header connection at the blistering through the pipe in o seep from the hole.	W06WTRPVCPIPE		G0000297	PPWAMMT	STURGES	20030616	0	0	0	0
cking lk.The poppet pressure ng is leaking excessively.	W06BLRSOT		G0000297	PPWAMMT	STURGES	20030810	0	0	0	0
oken. The gage reads zero	W06BLRSOT		G0000297	PPWAMMT	STURGES	20030810	0	0	0	0
ream" isolation valve leaks	W06BFWPVCMANVLV		G0000297	PPWAMMT	QUITORIA	20030903	0	0	0	0
holes inthe casing.	W06BLRBLRIRB		G0000297	PPWAMMT	EVANS, V	20030907	0	0	0	0
ports on the 9th floor need e missing. Condition of ne next overhaul.	W06STMPVCPIPE		G0000297	PPWAMMT	EVANS, V	20030907	0	0	0	0
d drips onstructural framing. ips need to be redirected.	W06STMPVCRV	PR000236	G0010227	PPWAMMT	EVANS, V	20030907	0	0	663.39	0
cage. W6 # 61 Service protective cage around gging of pump by litter. alling an isolation valve and of	W06WTRSWP061PUMP		G0000297	PPWAMMT	SATO, DE	20030909	2.5	98	0	58.27
eed toall be in working order s or overhaul per our	W06BLRISTLT		G0000297	PPWAMMT	EVANS, V	20030915	15	697.92	0	408.81
p pipingW6 # 63 FWH. g, unable to confirm exact leak. approx location in	W06CNDPVCPIPE		G0000297	PPWAMMT	SATO, DE	20030918	0	0	0	0
AE W 6 Steam supply ion valves leaking through. ured for repair of root valve.	W06CNDPVCPIPE		G0000297	PPWAMMT	SATO, DE	20030919	0	0	0	0

PR036115	W6 Main Aux Oil Pump Breaker smoking W 6 During start up of unit aux oil pump started smoke being emitted from breaker cubicle, unable to trip breaker from remote location. Breaker tripped manually at cubicle. Bartels Oshiro Fujiwara	W06TRBLUBAOILSW		G0000297	PPWAMMT	SATO, DE	20031006	40.5	1485.9	6905.8	5935.97
PR036181	W6 Sootblower steam low press sensing line isolation valve has a packing leak. Valve is on 7th floor between SB #2 & #3, 11 feet up from the grating, 3 feet from the furnace casing. Shipping tag hanging on valve. .	W06BLRPVCMANVLV		G0000297	PPWAMMT	EVANS, V	20031006	2	69.64	0	45.93
PR036249	W6 Cooperheats - zones 3 & 4 GFIs keep tripping when unit is shutdown. Zone 6 & 7 reads 1010 when unit is on line.	W06TRBTHPWARM		G0000297	PPWAMMT	EVANS, V	20031009	15	589.55	0	356.64
PR036576	W6: #61 screen wash pump strainer cover needs repair, need to replace cover or weld leak and repair or replace the vent valves. Estrada	W06CWSPVCSTR		G0000297	PPWAMMT	TAPARRA	20031027	0	0	0	0
PR036622	61 TRAVELING SCREEN - INSTALL	W06CWSTVS061SCREE		G0000085	PPWAMMT	MEYER, F	20031030	108	5502.79	95422.34	18297.99
PR036675	W6: Turbine Makai (left) throttle valve,hard to close the last 1 1/2 turns. Binding? Also...may be leaking thru slightly. (Roberson)	W06TRBISTTHRVLV		G0000297	PPWAMMT	CHANG, S	20031103	0	0	0	0
PR036726	W6 Blowoff tank exhaust pipe at the top and the exhaust head drain line are badly corroded and need to be replaced. Insulation must be removed to determine extent of replacement needed. Support brackets are missing and/or deteriorated. Need scaffolding.	W06BLRABT		G0000297	PPWAMMT	EVANS, V	20031104	0	0	0	0
PR036778	W6 Economizer Outlet Hdr - Repair Gouge	W06BLRECO	PR000236	G0010220	PPTRBBL	MCCRAW	20031105	0	0	0	0
PR036879	W6: Sodium chlorite day tank at W6 coveris cracked and needs to be repaired or replaced Akana	W06CWSPVCPIPE		G0000297	PPWAMMT	TAPARRA	20031114	0	0	0	0
PR036958	W6 Sootblowing pressure gage has a leaking fitting located even with the 4th floor grating, above the ewa end of the reboiler 3' waikiki.	W06BDFPVCPIPE		G0000297	PPWAMMT	EVANS, V	20031119	0	0	0	0
PR037178	W6: IK6, steam leak on lance flange connection. see shipping tag. Kumano	W06BLRSOT		G0000287	PPWAMMT	TAPARRA	20031201	0	0	0	0
PR037525	W6 Insp Econ Outlet Hdr Stubs/Tubes W06 Inspect Stubs and Tubes at Econ Outlet Header Reference BTF Report No. 03-W6-01-04 Perform Visual and UTT inpections of the stub tubes and the 1st 3-4 inches of the economizer tubes for thinning and X-ray the circumferential butt-weld to detect any	W06BLRECO	PR000236	G0010220	PPTRBBL	MCCRAW	20031222	0	0	0	0
PR037815	W6: Clear Stack test due to outage	W06IASISTMISC		G0000297	PPWAMMT	CHINCIO	20040107	6	218.43	0	159.16
PR037816	W6 'DC System Trouble' alarm energizes when MOS 116 is closed. Alarm clears when MOS 116 is opened.. (Bartels)	W06CRCISTANN		G0000297	PPWAMMT	QUITORIA	20040107	3	135.27	0	81.8
PR037838	W6 Condensate make up to the gland seal head tank isolation valve prior to the make up control valve is leaking at the bonnet area. Valve is located on the 7th floor, mauka waikiki corner, directly adjacent to the gland seal head tank. (Fujiwara)	W06CNDPVCMANVLV		G0000297	PPWAMMT	QUITORIA	20040107	0	0	0	0

in pipe,	W06BLRPVCPIPE		G0000297	PPWAMMT	TAPARRA	20040108	0	0	0	0
@ 26 mils.	W06WTRSWP061PUMP		G0000297	PPWAMMT	MARTIN,	20040115	90.5	2997.56	1333.6	3412.68
alve leaks ill not be risk vailable	W06WTRPVCCHKVLV		G0000297	PPWAMMT	EVANS, V	20040115	0	0	0	0
indicates Change the	W06BDFAPHROTOR		G0000297	PPWAMMT	ITAI, JOH	20040120	14.5	479.84	0	321.85
g leak.	W06CNDCDP061PUMP		G0000297	PPWAMMT	CHANG, S	20040120	0	0	0	0
Traveling ated in rear of needed.	W06CWSISTMISC		G0000297	PPWAMMT	SATO, DE	20040122	4	166.93	0	107.93
aveling innel al cleaning.	W06CWSTVS062SCREEN		G0000297	PPWAMMT	TAPARRA	20040130	0	0	0	0
ended down	W06STMPVCPIPE		G0000297	PPWAMMT	EVANS, V	20040131	0	0	0	0
ff exposing nd failing to ct beginning Lum.	W06BLRBLRIRB		G0000297	PPWAMMT	PERBERA	20040205	0	0	0	0
node	W06TRBISTSUPPRO		G0000297	PPWAMMT	CHANG, S	20040205	0	0	0	0
	W06WTRSWP061PUMP		G0000297	PPWAMMT	PERBERA	20040206	21.5	760.61	0	481.39
lack plant CRT	W06CRCDCSTUR		G0000297	PPWAMMT	SATO, DE	20040217	6	229.96	0	135.85
casing	W06BFWBFP061LUBEAU		G0000297	PPWAMMT	EVANS, V	20040217	12.5	426.5	378.24	278.53
oiler water	W06CRCISTANN		G0000297	PPWAMMT	QUITORIA	20040217	9	310.12	0	200.8
justment.	W06BLRPVCMANVLV		G0000297	PPWAMMT	STURGES	20040218	0	0	0	0
inimum water g disc press in press or ots of flow.	W06CWSSWP061		G0000297	PPWAMMT	SATO, DE	20040301	26.5	867.75	0	587.42
WATERBOX RIOR	W06CWSPVCPIPE			PPWAM	YOKOI, R	20040309	0	0	0	0

t shut. K. Wong & G. Greenleaf ed.	W06ELE23VMASWGR		G0000297	PPWAMMT	EVANS, V	20040325	0	0	0	0
jage range is 0 to 60#. Normal eater than 60# or very close. Need ed (approximately 0 - 120#).	W06FOSISTPT		G0000297	PPWAMMT	EVANS, V	20040327	7.5	216.44	0	135.9
ve the boiler vent valves on together. Pipe is the boiler vent	W06BLRPVCPIPE			PPWAM	EVANS, V	20040330	0	0	0	0
valve into the condenser has a aikiki side of condenser, right next	W06CNDPVCMANVLV			PPWAM	EVANS, V	20040417	0	0	0	0
eturn isolation valve has a	W06FOSPVCMANVLV			PPWAM	EVANS, V	20040422	0	0	0	0
eturn isolation valve has a	W06FOSPVCMANVLV			PPWAM	EVANS, V	20040422	0	0	0	0
rn isolation valve has a packing	W06FOSPVCMANVLV			PPWAM	EVANS, V	20040422	0	0	0	0
rroded on 6thfloor, waikiki side of to it's isolation valve just before	W06WTRPVCPIPE			PPWAM	EVANS, V	20040425	0	0	0	0
king	W06BFWBFP061PUMP		G0000297	PPWAMMT	ITAI, JOH	20040429	32.5	1107.43	3192.95	602.43
Modify Gland W63 HDP concrete Redo the base/grouting. Modify gland to accept a	W06CNDHDP063	PR000236	G0010220	PPTRBBL	ITAI, JOH	20040504	0	0	0	0
earing Fault ACOUSTIC 'ATED SOUND LEVELS AND BOTH BEARINGS. E BEARINGS NEXT	W06WTRSWP061MOTOR		G0000297	PPWAM	MARTIN,	20040528	10.5	345.45	0	232.88
ance Performance test ance. Replace volute next	W06BFWBFP061PUMP	PR000238	G0010220	PPTRMMA	MARTIN,	20040602	0	0	0	0
o operation.(Kimo)	W06BLRSOT			PPWAM	CHANG, S	20040603	16.5	572.3	138.99	368.47
drip tk lekover flow sight glass for ight glass located next to # 62 el. Yamane/Keahi No outage	W06FOSRBRCDTNK			PPWAM	SATO, DE	20040607	0	0	0	0
in control roomNo remote level room, digital reading is E01. Local	W06CRCISTREC			PPWAM	TAPARRA	20040614	0	0	0	0
orking. The tube side steam Operators are compensating by ep condensate from backing up.	W06FOSRBRCDTNK			PPWAM	STURGES	20040615	0	0	0	0

40616	0	0	0	0
40625	0	0	0	0
40630	0	0	0	0
40701	0	0	0	0
40708	0	0	0	0
40708	0	0	0	0
40708	0	0	0	0
40709	0	0	0	0
40709	0	0	0	0
40709	0	0	0	0
40709	0	0	0	0
40709	0	0	0	0
40709	0	0	0	0
40709	0	0	0	0
40709	0	0	0	0
40709	0	0	0	0
40709	0	0	0	0
40712	0	0	0	0
40712	0	0	0	0
40714	0	0	0	0
40714	0	0	0	0
40714	0	0	0	0
40714	0	0	0	0
40714	0	0	0	0
40714	0	0	0	0
40714	0	0	0	0
40719	0	0	0	0
40719	0	0	0	0
40719	0	0	0	0
40719	0	0	0	0
40719	0	0	0	0
40719	0	0	0	0
40722	0	0	0	0
40722	0	0	0	0
40722	0	0	0	0
40722	0	0	0	0
40722	0	0	0	0

TRBBL	PEDRO J	20040722	0	0	0	0
TRBBL	PEDRO J	20040722	0	0	0	0
TRBBL	PEDRO J	20040722	0	0	0	0
TRBBL	PEDRO J	20040722	0	0	0	0
TRBBL	PEDRO J	20040722	0	0	0	0
TRBBL	PEDRO J	20040722	0	0	0	0
TRBBL	PEDRO J	20040723	0	0	0	0
TRBBL	PEDRO J	20040723	0	0	0	0
WAM	TAPARRA	20040728	0	0	0	0
WAM	TAPARRA	20040804	0	0	0	0
TRBBL	PEDRO J	20040805	0	0	0	839.98
TRBBL	PEDRO J	20040805	0	0	0	839.98
TRBBL	PEDRO J	20040805	0	0	0	839.98
TRBBL	PEDRO J	20040805	0	0	0	839.99
WAMMT	STURGES	20040805	2	86.72	0	38.55
WAM	ADAMS, J	20040807	0	0	0	0
WAM	EVANS, V	20040809	0	0	0	0
TREEL	PEDRO J	20040810	0	0	0	0
TREEL	PEDRO J	20040810	0	0	0	0
WAM	STURGES	20040811	7	269.12	0	132.22
WAM	EVANS, V	20040811	0	0	0	0
WAM	PEDRO J	20040813	0	0	938.34	0
WAM	PEDRO J	20040813	0	0	0	955.62
WAM	PEDRO J	20040813	0	0	2444.13	0
WAM	PEDRO J	20040813	0	0	0	0
WAM	CHANG, S	20040815	0	0	0	0
WAM	SATO, DE	20040816	17	542.58	2094.25	312.16

PR042301	ITE\W61 BFP Motor Recondition On-line results indicate possible broken rotor bars HiRes spectrum, In-rush current profile, indicate possible broken rotor bar. Send motor out for reconditioning and repair as required.	W06BFWBFP061MOTOR		G0000297	PPTRE	EROLIN, $	20040817	2	63.4	0	36.69
PR042344	W6 INSULATION;REFRAC;BLR CASE REPAIR W6 INSULATION;REFRAC;BLR CASE REPAIR W6B013 covers insulation done on overhaul and projects. This includes insulating pipe,valves,vessels,tanks,duct, expansions,boiler casing and boiler refractory.	W06BLRBLRIRB	PR000236	G0010227	PPTRBBL	PEDRO J	20040819	0	0	0	0
PR042345	W6 MAIN 480V SWGR SERVICE	W06ELE480BKR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042346	W6 480V SWITCHGEAR BUS SERVICE	W06ELE480BUS	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042347	W6 480V MCC BUS SERVICE	W06ELEMCCBUS	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042348	W6 MISC 480V SWITCHGEAR SERVICE	W06ELE480MISC	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042349	W6 2.3KV BUS SERVICE	W06ELE23VBUS	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042350	W6 STATION SVC XFMR SWGR SERVICE	W06ELE23VSSSWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042351	W6 MAIN AUX FEEDER SWITCHGEAR SERVICE	W06ELE23VMASWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042352	SVC SPARE 2.3KV SWGR BREAKER	W06ELE23VSPBKR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042353	W6 START UP XFMR SWGR SERVICE	W06ELE23VSUSWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042354	W6 STATION SERVICE TRANSFORMER SERVICE	W06ELETSFSSXFR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042355	SERVICE GENERATOR NEUTRAL GROUND XFMR	W06ELETSFGNXFR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042356	W6 LIGHTING/AUTO TRANSFER SW SERVICE	W06ELELTG	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042357	W6 SERVICE MISC 480V MCC BREAKERS	W06ELEMCCMISC	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042358	W61 CIRC WATER PUMP SWITCHGEAR SERVICE	W06CWSCWP061SWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042359	W62 CIRC WATER PUMP SWITCHGEAR SERVICE	W06CWSCWP062SWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042360	W61 CONDENSATE PUMP SWITCHGEAR SERVICE	W06CNDCDP061SWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042361	W62 CONDENSATE PUMP SWITCHGEAR SERVICE	W06CNDCDP062SWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042362	W6 HI SPEED FD FAN SWITCHGEAR SERVICE	W06BDFFDFHISWGR	PR000237	G0010219	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042363	W6 LO SPEED FD FAN SWITCHGEAR SERVICE	W06BDFFDFLOSWGR	PR000237	G0010219	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042364	W61 BOILER FEED PUMP SWITCHGEAR SERVICE	W06BFWBFP061SWGR	PR000237	G0010219	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042365	W62 BOILER FEED PUMP SWITCHGEAR SERVICE	W06BFWBFP062SWGR	PR000237	G0010219	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042366	W6 GENERATOR MAIN FIELD BRKR SERVICE	W06GENEXCMASWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042367	W6 GENERATOR SPARE FIELD BREAKER SERVICE	W06GENEXCSSWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042368	W61 SECONDARY F.O. PUMP SWITCHGEAR SVC	W06FOSSFO061SWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042369	W62 SECONDARY F.O. PUMP SWITCHGEAR SVC	W06FOSSFO062SWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042370	W6 INSTR AIR COMPRESSOR SWITCHGEAR SVC	W06IASIAC061SWGR	PR000237	G0010232	PPTREEL	PEDRO J	20040819	0	0	0	0
PR042466	W6 LOOP SEAL VAPOR EXTR MTR/LINESTR SVC	W06GENSEAVAEXT	PR000237	G0010232	PPTREEL	PEDRO J	20040825	0	0	0	0
PR042467	W6 GEN SEAL OIL (AC) PP MTR/LNESTR - SVC	W06GENSEASOPMP	PR000237	G0010232	PPTREEL	PEDRO J	20040825	0	0	0	0
PR042468	W6 SEAL OIL VACUUM PP MTR/LINESTR SVC	W06GENSEASOVAPP	PR000237	G0010232	PPTREEL	PEDRO J	20040825	0	0	0	0
PR042469	W61 TRAVEL SCREEN LINESTR/MTR SERVICE	W06CWSTVS061SCREE	PR000237	G0010232	PPTREEL	PEDRO J	20040825	0	0	0	0
PR042470	W62 TRAVEL SCREEN LINESTR/MTR SERVICE	W06CWSTVS062SCREE	PR000237	G0010232	PPTREEL	PEDRO J	20040825	0	0	0	0
PR042471	W6 O2 AND COMBUS ANALYZER LINESTR SVC	W06BDFSAMO21	PR000237	G0010232	PPTREEL	PEDRO J	20040825	0	0	0	0

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PR042555	W6 VOLTAGE REGULATOR CUBICLE SERVICE	W06GENVORVOREG	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042556	W6 MAIN EXCITER SERVICE	W06GENEXCEXCITE	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042557	W6 STATION SVC WTR SWITCHGEAR SERVICE	W06WTRSWP061SWGR	PR000237	G0010219	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042558	W6 STATION SVC WTR MOTOR SERVICE	W06WTRSWP061MOTOR	PR000237	G0010219	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042562	W61 AUX COOLING WTR PP SWGR SERVICE	W06WTRACP061SWGR	PR000237	G0010219	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042563	W61 AUX COOLING WTR PP MOTOR SERVICE	W06WTRACP061MOTOR	PR000237	G0010219	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042564	W6 480V MCC FEEDER SWGR SERVICE	W06ELE480MCBKR	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042565	W6 TRB AUX OIL PP SWGR SERVICE	W06TRBLUBAOILSW	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042566	W6 TRB AUX OIL PP MOTOR SERVICE	W06TRBLUBAOILMT	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042567	W6 EMERG SEAL OIL (DC) PP MTR/LINESTR	W06GENSEAASOPP	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042568	W6 EMERG LUBE OIL (DC) PP MTR/LINESTR	W06TRBLUBCDLOPP	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042569	W61 CWP CATHODIC PROTECTION SERVICE	W06CWSCWP061CATH	PR000237	G0010232	PPTREEL	PEDRO J	20040826	-0	0	0	0
PR042570	W62 CWP CATHODIC PROTECTION SERVICE	W06CWSCWP062CATH	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042571	W6 CONDENSER CATHODIC PROTECTION SVC	W06CNDCONCATH	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042572	W61 TRAVL SCREEN CATHODIC SERVICE	W06CWSTVS061CATH	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042573	W62 TRAVL SCREEN CATHODIC SERVICE	W06CWSTVS062CATH	PR000237	G0010232	PPTREEL	PEDRO J	20040826	0	0	0	0
PR042576	W6: 62 SFOP, suction side casing seal leaking, Akana	W06FOSSFO062PUMP			PPWAM	TAPARRA	20040827	0	0	0	0
PR042582	W6 LUBE OIL VAPOR EXTRACTOR - SERVICE	W06TRBLUBVAPEXT	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042584	W6 LOOP SEAL VAPOR EXTRACTOR - Service	W06GENSEAVAEXT	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042585	W6 LUBE OIL RESERVOIR / BOWSER / FILTERS	W06TRBLUBRESV	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042586	W6 TURNING GEAR OIL PUMP - SERVICE	W06TRBLUBTGOILP	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042587	W6 TURBINE AUXILIARY OIL PUMP - SERVICE	W06TRBLUBAOILPP	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042588	W6 TURBINE EMERGENCY OIL PUMP - Service	W06TRBLUBCDLOPP	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042589	W6 GEN SEAL OIL VACUUM PUMP - Service	W06GENSEASOVAPP	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042590	W6 GENERATOR SEAL OIL PUMP - SERVICE	W06GENSEASOPMP	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042591	W6 SEAL OIL RESERVOIR SERVICE	W06GENSEATANK	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042592	W6 GEN SEAL OIL EMERGENCY PUMP - SERVICE	W06GENSEAASOPP	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042593	W6 GENERATOR H2 COOLERS - Service	W06GENHYGCLRS	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042594	W61 TRAVEL SCREEN - Service	W06CWSTVS061SCREE	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042595	W62 TRAVELLING SCREEN - SERVICE	W06CWSTVS062SCREE	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042596	W62 BOILER FEED PUMP - Service	W06BFWBFP062PUMP	PR000238	G0010219	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042597	W6 FORCED DRAFT FAN SERVICE	W06BDFFDFROTOR	PR000238	G0010219	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042598	W63 HEATER DRIP PUMP - SERVICE	W06CNDHDP063	PR000238	G0010219	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042599	W61 CONDENSATE PUMP - Service	W06CNDCDP061PUMP	PR000238	G0010219	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042600	W62 CONDENSATE PUMP - Service	W06CNDCDP062PUMP	PR000238	G0010219	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042601	W61 CIRCULATING WATER PUMP - Service	W06CWSCWP061PUMP	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042602	W62 CIRCULATING WATER PUMP - Service	W06CWSCWP062PUMP	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042603	W61 AUX COOLING WATER PUMP - Service	W06WTRACP061PUMP	PR000238	G0010232	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042604	W62 FWH EXTRACTION VLV BTV-4 - Service	W06TRBISTBTV4	PR000238	G0010219	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042605	W63 FWH EXTRACTION VLV BTV-3 - Service	W06TRBISTBTV3	PR000238	G0010219	PPTRMMA	PEDRO J	20040827	0	0	0	0

PR042606	W64 FWH EXTRACTION VLV BTV-2 - Service	W06TRBISTBTV2	PR000238	G0010219	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042607	W65 FWH EXTRACTION VLV BTV-1 - Service	W06TRBISTBTV1	PR000238	G0010219	PPTRMMA	PEDRO J	20040827	0	0	0	0
PR042608	W6 SA Chain wheel fell off, SA Xover valW6 Chain Wheel fell off the chain whell valve, unable to open or close valve w/o assistence from wrench. Located Waikiki of W6 lube oil coolers. Torres	W06SVAPVCMANVLV			PPWAM	SATO, DE	20040827	0	0	0	0
PR042609	W6 BOILER IGNITORS - SERVICE	W06FOSBFEIGGUN	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042610	W6 PROTECTION RELAYS (PRODUCTION)	W06CRCCTLREL	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042611	W6 PROTECTION RELAYS (RELAY DIVISION)	W06CRCCTLREL	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042612	W6 BOILER O2 ANALYZER - SERVICE	W06BDFSAMO21	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042613	W6 FD FAN INLET PO-1 VANE CTRLS Service	W06BDFISTPO1	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042614	W6 FD FAN DAMPER PO-2 CTRLS Service	W06BDFISTPO2	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042615	W6 RECIRC AIR DMPR PO-7 CTRLS SERVICE	W06BDFISTPO7	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042616	W6 BLR DRAFT LINES	W06BDFISTDPT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042617	W6 BLR COLD AIR TEST	W06CRCDCSBLR	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042619	W6 GAS/DEGAS (HYDROGEN) GENERATOR	W06GENGENSTATOR	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042620	W6 BLR TUBE THERMOCOUPLES	W06BLRISTTT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042621	W61 HOTWELL COND ANALYZR CR-1 Service	W06CNDSAMCR1	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042622	W62 HOTWELL COND ANALYZR CR-2 Service	W06CNDSAMCR2	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042623	W6 INSTRUMENT AIR SYSTEM SERVICE	W06IASPVCPRRED	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042624	W6 OPACITY METER - SERVICE	W06BDFSAMOPAC	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042625	W6 GEN INSTRUMENTATION CALIBRATION	W06CRCISTAMM	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042626	W6 VOLTAGE REGULATOR SERVICING	W06GENVORVOREG	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042627	W6 SPEED CHANGER MTR - SERVICE	W06TRBISTSPCGR	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042633	W6 FO SYSTEM PRESS INSTRUMENTS SERVICE	W06FOSISTTT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042634	W6 FO SYSTEM FLOW INSTRUMENTS SERVICE	W06FOSISTFT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042635	W6 DCS MODULE FAN(S) SERVICE	W06CRCDCSMISC	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042636	W6 BLR FW FLOW INSTRUMENTS SERVICE	W06BFWISTFT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042637	W6 BLR LEVEL INSTRUMENTS SERVICE	W06BFWISTLT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042638	W6 BLR DRAFT FLOW INSTRUMENTS SERVICE	W06BDFISTFT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042639	W6 BLR PRESSURE INSTRUMENTS SERVICE	W06BLRISTTT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042640	W6 CND SYSTEM LEVEL INSTRUMENTS SERVICE	W06BLRISTLT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042641	W6 TURBINE TEMPERATURE INSTRUMENTS SERVI	W06TRBISTTT	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042642	W6 CND SYSTEM FLOW INSTRUMENTS SERVICE	W06CNDISTFT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042643	W6 TURBINE PROTECTION DEVICES	W06TRBISTSUPPRO	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042644	W6 TURBINE PRESS INSTRUMENTS SERVICE	W06TRBISTPT	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042645	W6 HYDROGEN ANALYZER SERVICE	W06GENHYGBLOWER	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042646	W6 HYDROGEN TEMP TRANSMITTER SERVICE	W06GENISTTT	PR000239	G0010232	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042647	W6 TURB GOV PRESS INSTRUMENTS SERVICE	W06STMISTTT	PR000239	G0010219	PPTRTTE	PEDRO J	20040827	0	0	0	0
PR042670	W6: #61 TS gear box leaking oil. Think the Waikiki seal is bad on the gear box for #61 TS. Oil is dripping down the side of the TS POTENTIAL ENVIRONMENTAL! Please replace seal.	W06CWSTVS061SCREE		G0000297	PPWAMMT	STURGES	20040830	0	0	0	0

PR042721	W6 SILENCER - PREV	W06BLRPVCSILC	PR000236	G0010219	PPTRBBL	PEDRO J	20040831	0	0	0	0
PR042735	W6 CONDENSER - PRED MAINT	W06CNDCONCOND	PR000236	G0010233	PPTRBBL	PEDRO J	20040831	0	0	0	0
PR042737	W61 CHILLER - PRED MAINT	W06WTRACP061CHLER	PR000236	G0010233	PPTRBBL	PEDRO J	20040831	0	0	0	0
PR042738	W61 CHILLER STRAINER - PREV	W06WTRACP061CHLER	PR000236	G0010232	PPTRBBL	PEDRO J	20040831	0	0	0	0
PR042740	W62 FEED WATER HTR - PRED	W06CNDFWH062PV	PR000236	G0010233	PPTRBBL	PEDRO J	20040831	0	0	0	0
PR042744	W64 FEED WATER HTR - PRED	W06BFWFWH064PV	PR000236	G0010233	PPTRBBL	PEDRO J	20040831	0	0	0	0
PR042745	W65 FEED WATER HTR - PRED	W06BFWFWH065PV	PR000236	G0010233	PPTRBBL	PEDRO J	20040831	0	0	0	0
PR042746	W6 AIR EJECTOR CONDENSER - PRED	W06CNDAEJCOND	PR000236	G0010233	PPTRBBL	PEDRO J	20040831	0	0	0	0
PR042747	W6 LUBE OIL COOLERS - PRED	W06TRBLUBCLRS	PR000236	G0010233	PPTRBBL	PEDRO J	20040831	0	0	0	0
PR042832	W61 FEED WATER HTR - PREV	W06CNDFWH061PV	PR000236	G0010219	PPTRBBL	PEDRO J	20040903	0	0	0	0
PR042833	W63 FEED WATER HTR - PREV	W06CNDFWH063PV	PR000236	G0010219	PPTRBBL	PEDRO J	20040903	0	0	0	0
PR042834	W6 HP Turbine Rotor Ovhl	W06TRBTHPROTOR	PR000238	G0010233	PPTRMMA	PEDRO J	20040903	0	0	0	0
PR042850	W6 Sample Root Valve packing leak Packing leak on Root Valve for Drum Steam Conductivity sample line. Valve located on Waikiki side of drum next to Drum vents. Tighten packing as needed, if packing needs to be added unit outage coming up 10/17/04. Gomes	W06BLRSAMCA4			PPWAM	SATO, DE	20040903	0	0	0	0
PR042871	W5/6 chlorine system city water solenoidvalve spraying water from top cover. System out of service, see shipping tag Akana 1st floor at condenser area	W06CWSPVCMANVLV			PPWAM	TAPARRA	20040905	0	0	0	0
PR042885	W6: #62BFP recirc control vlv leaking. The cage gasket has failed.	W06BFWISTVFC9			PPWAM	STURGES	20040906	0	0	0	0
PR042897	W6 Sootblowing steam stop valve has a packing leak. Shipping tag hanging. 10th floor. (J. Sturges)	W06BLRPVCMANVLV			PPWAM	EVANS, V	20040907	0	0	0	0
PR042899	W6 #62 condensate pump has a bad packing leak. (R. Chong)	W06CNDCDP062PUMP			PPWAM	EVANS, V	20040907	0	0	0	0
PR042911	XT/XB - W61 BFP Recirc CV (6VFC-8) leak W61 BFP Recirc CV - leaking IR thermograph image show valve leaking. Cycle/stroke valve. Check for proper seal. Replace internals as required.	W06BFWISTVFC8		G0000297	PPWAM	EROLIN, S	20040908	0	0	0	0
PR042912	XT/XB W62 BFP Recirc CV (6VFC-9) leak W62 BFP Recirc CV leaking IR thermograph image show leaking valve. Cycle/stroke valve. Check for proper seal. Replace internals as required.	W06BFWISTVFC9		G0000297	PPWAM	EROLIN, S	20040908	0	0	0	0
PR042913	W62BFP O/B bearing leaking oil also oil leaking from top of bearing oil sight glass and mauka pump oil return sightglass various nipples. Lee	W06BFWBFP062PUMP	PR000238	G0010227	PPTRMMA	PEDRO J	20040908	0	0	0	0
PR042914	W61 CWP UNBALANCE - PUMP W61 CWP UNBALANCE VIBRATION DATA SHOW RAPID INCREASE AT 1X RUNNING SPEED INDICATING UNBALANCE POSSIBLY DUE TO OBSTRUCTION IN PUMP PLEASE SCHEDULE DIVERS TO INSPECT/REMOVE/CLEAN AS REQUIRED PROVIDE REPORT TO D.MARTIN X4333	W06CWSCWP061PUMP	PR000238	G0010233	PPTRMMA	PEDRO J	20040908	0	0	0	0
PR042930	W6: #62 BFP recirc valve "upstream" isolation valve leaks thru (closer to pump). (Taparra/Akana)	W06BFWPVCMANVLV		G0000297	PPWAMMT	CHANG, S	20040909	0	0	0	0

CA-IR-49

[redacted]

a. Please provide a detailed breakdown, comparable to HECO-629 that is associated with Production Operations Outside Services, indicating the projected test year outside services Production Maintenance expenses by category and payee.

b. In addition, please provide a monthly breakdown, by payee, of the actual expenses incurred in 2003 and 2004 in the same categories.

c. Is HECO considering adjusting the forecasted costs for the 2005 test year in each instance where the actual expenditures through December 2004 do not provide evidence of the anticipated increases reflected in the test year forecast? Explain why or why not.

d. If contractual commitments have been made for the increased expenses, please provide copies of agreements reflecting the contractual commitment.

HECO Response:

a. Attachment 1 is comparable to HECO-629 for Production Maintenance Outside Services, and compares 2003 actual with test year 2005. Explanations for the variances are also provided. The expense information is categorized into two groups – Non-Projects and providing the requested details of the actual 2003 and 2004 outside services transactions

[redacted]

Attachment 3 describes the structure of the database file.

[redacted]

Hawaiian Electric Company, Inc.
2005 Test Year
Maintenance Outside Services - Increase Explanations

(In Thousands)

	Actual 2003	Test Year 2005	Change	Comments
Non-Project				
	220	1,009	789	Primarily for 2005 for Waiau common structure work for corrosion control and building repairs. Please refer to HECO-WP-601, page 1of 7 and CA-IR-2, Attachment 3A, page 27 of 29.
Subtotal	220	1,009	789	
Projects				
P0000138-Hono 9 Overhaul	723	0	(723)	See Note 1) below
P00000252-Waiau 5 Overhaul	81	0	(81)	See Note 1) below
P0000522-Waiau 7 Overhaul	528	0	(528)	See Note 1) below
P0000523-Hono 8 Overhaul	1,670	0	(1,670)	See Note 1) below
P0000655-Kahe 4 Overhaul	242	0	(242)	See Note 1) below
P0000650-Kahe 2 Overhaul	0	482	482	See Note 1) below
P0000844-Kahe 6 Overhaul	0	507	507	See Note 1) below
P0000845-Kahe 4 Overhaul	0	665	665	See Note 1) below
P0000846-Kahe 1 Overhaul	0	351	351	See Note 1) below
P0000847-Waiau 4 Overhaul	0	1,278	1,278	See Note 1) below
P0000937-W9 Major Insp	0	798	798	See Note 1) below
P0000938-W10 Major Insp	0	798	798	See Note 1) below
Subtotal	3,244	4,879	1,635	
Total	3,464	5,888	2,424	
Other O/S Services Cost not shown in above	4,074	4,477	403	
Grand Total - O/S	7,538	10,365	2,827	

Note: 1) The specific units subject to overhauls vary every year based on the cyclical approach to unit overhauls. Therefore, the mix of unit overhauls vary every year.

Hawaiian Electric Company, Inc.
2005 Test Year
Maintenance Outside Services - Comparison 2003-2005

(In Thousands)

	Actual 2003	Actual 2004	Test Year 2005	Comments
Non-Project				
	220	1,195	1,009	In 2004 increased cost primarily for Kahe common structure corrosion control work. In 2005 increase primarily for Waiau common structure work for corrosion control and building repairs. Please refer to HECO-WP-601, page 1of 7 and CA-IR-2, Attachment 3A, page 27 of 29.
Subtotal	220	1,195	1,009	
Projects				
P0000138-Hono 9 Overhaul	723	0	0	See Note 1) below
P0000249-Waiau 3 Overhaul	0	1,371	0	See Note 1) below
P00000252-Waiau 5 Overhaul	157	0	0	See Note 1) below
P0000519-Kahe 5 Overhaul	0	1,691	0	See Note 1) below
P0000521-Waiau 8 Overhaul	0	1,528	0	See Note 1) below
P0000522-Waiau 7 Overhaul	528	10	0	See Note 1) below
P0000523-Hono 8 Overhaul	1,670	18	0	See Note 1) below
P0000655-Kahe 4 Overhaul	242	351	0	See Note 1) below
P0000650-Kahe 2 Overhaul	0	21	482	See Note 1) below
P0000654-Waiau 6 Overhaul	0	30	0	See Note 1) below
P0000844-Kahe 6 Overhaul	0	0	507	See Note 1) below
P0000845-Kahe 4 Overhaul	0	0	665	See Note 1) below
P0000846-Kahe 1 Overhaul	0	0	351	See Note 1) below
P0000847-Waiau 4 Overhaul	0	0	1,278	See Note 1) below
P0000937-W9 Major Insp	0	326	798	See Note 1) below
P0000938-W10 Major Insp	0	0	798	See Note 1) below
Subtotal	3,320	5,346	4,879	
Total	3,540	6,541	5,888	
Other O/S Services Cost not shown in above	3,998	4,203	4,477	
Grand Total - O/S	7,538	10,744	10,365	

Note: 1) The specific units subject to overhauls vary every year based on the cyclical approach to unit overhauls. Therefore, the mix of unit overhauls vary every year.

Explanation of Database file "CA-IR-49_Maint_OS_data.xls"

Transaction records were extracted from Heco Ellipse system for "Outside Services" costs for periods 2003 through 2004. "Outside Services" classification consist of two categories of costs, Outside Services and Other.

Outside Services by Expense Element-
- 501 – Outside Services – General
- 502 – Outside Services – Legal
- 503 – Outside Services – Temporary
- 505 – Ouside Services – Construction
- 506 – Outside Services – Engineering
- 508 – Outside Services – Environmental

Other by Expense Element-
- 451 – Info Sys Production & Development
- 462 – Info Sys PC Software
- 516 – Employee Membership
- 520 – Mainland Travel
- 521 – Meals and Entertainment
- 522 – Interisland Travel
- 570 – Rent
- 600 – Gen Plt Equip Maint
- 640 – Freight, Post & Bulk Main
- 900 – Financial Statement Items
- 901 – Amort of Deferred Db

Summary of 2003 "Outside Services" cost is shown as an exhibit in T-6, Aaron Fujinaka direct testimony HECO-626 (Prod Maintenance).

File includes various types of transactions, such as service vendor charge, manual entries, transfers, financial statement transactions, etc. This file was primarily prepared to collect vendor (supplier) information.

The useful data shown for each record are:

1) Account Code – Defines RA, Activity, Location, Indicator, 5th Segment/Project, and Expense Element
2) Block – Block B31=Maintenance
3) Full_Period – Year and Month of transaction
4) Tran_Amount – Transaction Amount
5) Account_Loc – Account Location
6) Inter_NARUC – NARUC Account
7) Work_Order – Work Order
8) Work_Order_Desc – Work Order Description
9) Supplier_Name

File: Expl_datafile_OS_Other.doc

Due to the voluminous nature of the information, one copy (pages 1-97) will be provided to the Consumer Advocate and the Public Utilities Commission under separate transmittal.

CA-IR-50

Ref: BRO Program.

Please provide complete copies of the:

a. Studies/reports addressing the need for, feasibility of, and success of such program; and

b. Studies, reports, documents, etc. from EPRI leading to the conclusion that the program "has elevated HECO's industry ranking to "world class" status.

HECO Response:

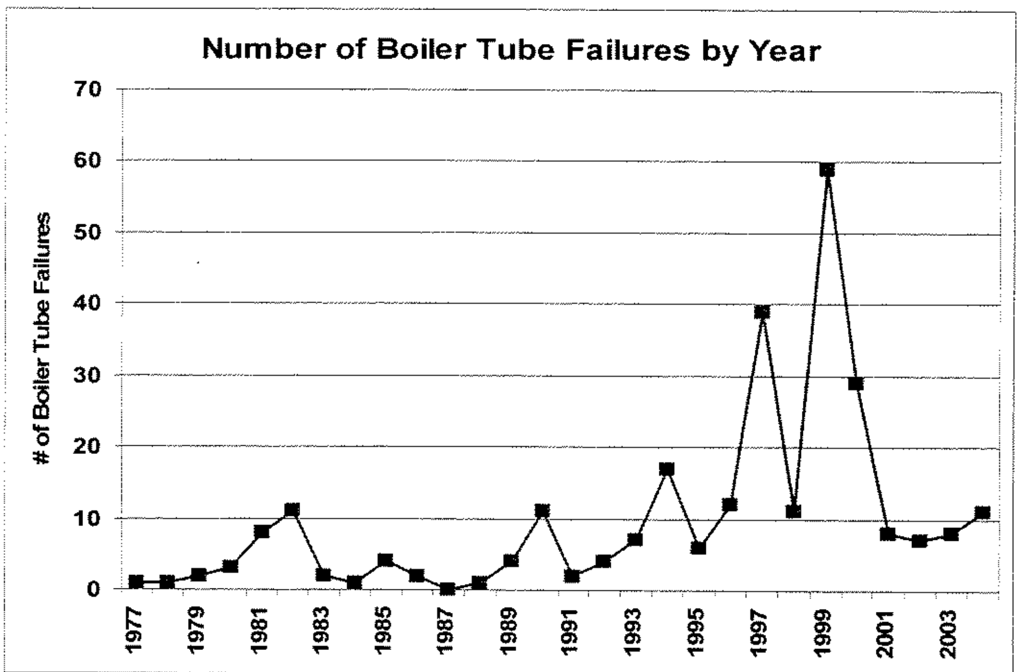
a. The design of HECO's Boiler Reliability Optimization (BRO) program started in late 1998

and was finalized in November 2001 in the Boiler Reliability Optimization Procedures Manual. This manual is included with this response on pages 4 through 32. Section 1.0 through Section 3.0 of the Procedures Manual describes the purpose and background behind the BRO program.

With reference to the data in Table 3.0-1 of Section 3.0, beginning in the early 1990's, HECO's units began experiencing an increasing trend in the number of boiler tube failures per year. It was this increasing trend that prompted HECO to seek the advice of EPRI to recommend a solution. The program that evolved from EPRI's recommendations

Year	Number
2001	8
2002	7
2003	8
2004	11

The increasing trend, followed by a decrease from 2001, is readily apparent when the data is displayed in graphical form:



b. EPRI conducted an assessment of HECO at the beginning of the program to establish a baseline. Based on their criteria, EPRI rated HECO as "19", or at the high end of "Average". In June 2002, EPRI conducted a follow up assessment. At this assessment, HECO's rating improved to "13", or "Good". At a subsequent assessment in December 2002, EPRI rated HECO at "5", or "World Class/Excellent". The November 2003 assessment rated Kahe Station at "3" and Waiau Station at "5". Results for 2004 are not available. A summary of the EPRI assessments from 1999 to 2003 is included on page 33 to this response. Copies of the EPRI assessments for June 2002, December 2002, and November 2003, which summarizes the scoring for that assessment, are also included with this response on page 34. A copy of the 1999 initial rating by EPRI was not provided to HECO.

Boiler Reliability Optimization Procedures Manual

Hawaiian Electric Company, Inc.
Power Supply Operations & Maintenance Department

November 2001

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Hawaiian Electric Company, Inc.
Boiler Reliability Optimization
Procedures Manual

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APPENDICES

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APPROVAL OF PROCEDURES MANUAL

Prepared by: William E. McCraw (signature) — 12/12/01 Date

William E. McCraw
O&M Engineer (BRO Engineer)
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Approved: (signature) — 12/13/01 Date

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Project Manager, Project Management Division
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Jose Dizon
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(signature) — 1/10/02 Date

Larry Ornellas
Superintendent, Maintenance Division
Power Supply Operations & Maintenance Department.

Glenn Miyashita (signature) — 01/10/02 Date

Glenn Miyashita
Superintendent, Technical Services Division
Power Supply Services Department.

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REVISION RECORD

Rev No.	Date	Description	Approvals
0		Original issue.	Noted on previous page..

1.0 Purpose

The purposes of this manual are to define a focused condition monitoring approach that:

a. applies and integrates certain proven technologies and methodologies to boiler systems; and,

b. provides an action plan to reduce short and long term boiler maintenance costs, while maintaining or improving overall boiler reliability.

2.0 Background

In its continuous effort to "Price It Right" and "Keep The Lights On," the Power Supply process area has been looking into various means to increase productivity, contain costs, and maintain or improve reliability. One area of focus has been on Boiler Reliability Optimization (BRO). The objective of the BRO program is to find the optimal balance between boiler O&M costs, capital improvements and plant reliability.

The BRO program at HECO currently consists of the following programs:

a. Boiler Tube Failure Reduction (BTFR)/ Cycle Chemistry Improvement (CCI). The objective of this program is to reduce the number of boiler tube failures by implementing practices that have been developed by the Electric Power Research Institute (EPRI) and shown to successfully achieve this objective. The program uses Root Cause Failure Analysis and can use Streamlined Reliability-Centered Maintenance techniques. The program also requires careful control including on-line parameter monitoring of the chemistry of the water/steam cycle through the condensate, feedwater, boiler and turbine systems. The following are subsets of the BTFR/CCI Program:

   1) **Condensate System Monitoring:** The objective of this program is to use non-destructive examinations and monitoring of air-inleakage and salt intrusion to maximize the utilization of the components or replace weak performing equipment within the condensate systems. Components include condensers, air ejector condensers and low-pressure condensate heaters.

2) **Feedwater System Monitoring:** The objective of this program is to use non-destructive examinations to maximize the utilization of the components within the feedwater systems. Components include high-pressure feedwater heaters and piping.

3) **Boiler System Monitoring:** The objective of this program is to use all means of visual, destructive and non-destructive examinations to determine the condition of components of the boiler. Components include waterwalls, superheaters, reheaters, economizers, headers, drums, flue gas and air systems

b. Boiler Remaining Useful Life (BRUL)/High Energy Lines (HiEL) Inspections. The objective of this program is to use both destructive and non-destructive techniques to determine a condition and remaining useful life assessment of boiler components and associated high-energy lines to enhance safety and reliability.

c. Flow Accelerated Corrosion Inspections. The objective of this program is to use visual and non-destructive inspections on condensate lines, boiler feedwater lines, drips and extraction lines to determine if flow accelerated corrosion is present and to monitor it further to prevent catastrophic failure.

3.0 Baseline - Current Situation

Table 3.0-1 shows the actual number of boiler tube failures[1] experienced as of the end of 2000.

Table 3.0-1

Number of Boiler Tube Failures on HECO Units

Boiler Tube Failures														
YEAR	K1	K2	K3	K4	K5	K6	W3	W4	W5	W6	W7	W8	H8	H9
1958													2	
1977			1											
1978									1					
1979		1											1	
1980		2								1				
1981		2	3	1	1	1								
1982	1				7					2				1
1983		2												
1984		1												
1985	2								1					1
1986	1		1											
1987														
1988					1									
1989					2								1	1
1990	1			1	2	2					1	4		

Table 3.0-2 shows the reduction in Equivalent Availability Factor (EAF)[2] attributable to boiler tube failures over the years 1994 to 2000.

Table 3.0-2

Equivalent Availability Factor Loss Attributable to Boiler Tube Failures

1994 to 2000

Year	Composite HECO System EAF		EAF Loss Attributable to Boiler Tube Failures
	Including All Outages	Excluding Outage Durations Attributable to Boiler Tube Failures	
1994	91.6%	94.6%	3.0%
1995	89.3%	93.4%	4.1%
1996	90.4%	93.5%	3.1%
1997	89.6%	93.5%	3.9%
1998	91.2%	92.5%	1.3%
1999	89.8%	94.2%	4.4%
2000	91.6%	95.2%	3.6%
1994-2000	90.5%	93.8%	3.3%

Source document: BTFR EAF Loss.xls

4.0 BTFR/CCI Program

To be successful, a BTFR/CCI program must include three primary elements. These are:

a. a Management Mandate (See Reference A);

[2] EAF is defined as (Period MWh - Planned Outage MWh - Unplanned MWh) / (Period MWh), where Period MWh total capacity in MW x total period hours. The total period hours is 8,760 for one year; 8,784 hours for a leap year. Planned Outages include planned maintenance outages and planned deratings. Unplanned Outages include forced outages and forced deratings.

b. a multi-disciplinary team with representation from cross-functional departments including the following areas:
   - Power Supply Operations & Maintenance Department
   - Power Supply Services Department
   - Power Supply Planning and Engineering Department, and
c. mechanisms for comprehensive reporting, trending, analysis (including Root Cause Analysis) and archiving boiler tube and cycle chemistry information

The Management Mandate:

a. conveys senior management's commitment to reduce the frequency of boiler tube failures;
b. establishes the requirements which, when satisfied, will result in reduced frequency of boiler tube failures and improved unit availability; and
c. sets goals for the BTFR/CCI program.

5.0 BTFR/CCI Program Goals

HECO has established the following major goals for its BTFR/CCI program:

a. HECO shall incur no more than one boiler tube failure per year per unit;
b. By December 2002, achieve a reduction in availability loss attributable to boiler tube failures that is at least 10% below the average availability loss attributable to boiler tube failures over the period 1994 to 1998. The average availability loss attributable to boiler tube failures over the period 1994 to 1998 was 3.1%. Based on this, the target maximum availability loss for the year 2002 is 2.8%.
c. The ultimate program goal is to achieve a reduction in availability loss attributable to boiler tube failures that at least 25% below the average availability loss attributable to

A complete listing of all program goals is given in the Mandate.

6.0 BRO and BTFR/CCI Program Teams

6.1 Purpose

The purposes of this section are to:

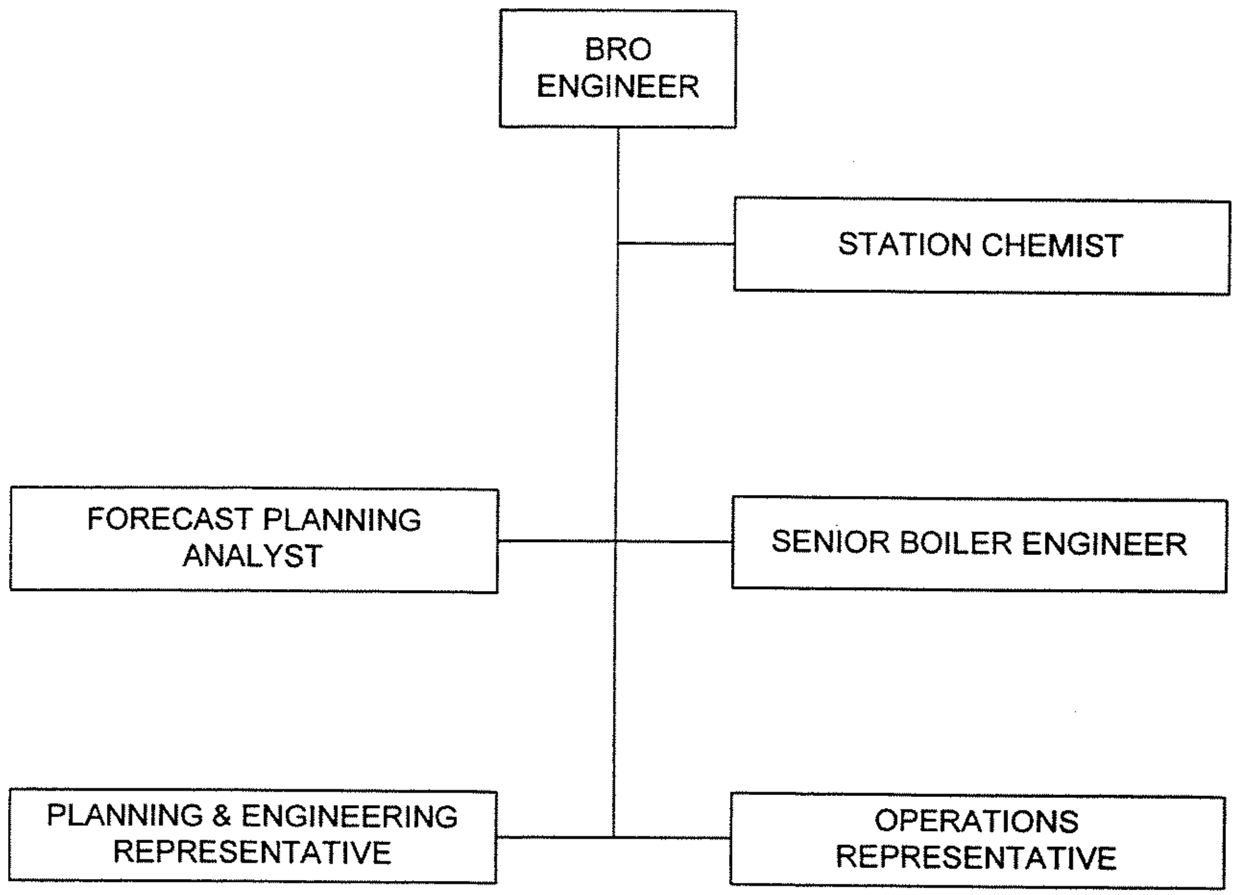
a. define a multi-disciplinary teams that will be responsible for ensuring compliance with the Management Mandate for HECO's Boiler Tube Failure Reduction / Cycle Chemistry Improvement (BTFR/CCI) Program ("Mandate");
b. define the duties and responsibilities of the multi-disciplinary team;
c. describe the tasks that must be performed by, or delegated and directed by, the multi-disciplinary team; and
d. outline general procedures to comply with the BTFR/CCI Mandate.

6.2 Boiler Reliability Optimization Team

As part of the Boiler Reliability Optimization effort described in Section 2.0, a multi-disciplinary or cross-functional team was formed. This team's mission is to organize, develop and implement the BRO program. Figure 6.2-1 shows the organization of the BRO team. The BRO Team forms the governing body of the BRO Program. The primary responsibilities of the BRO Team are to:

a. make the major decisions for the direction of the program;
b. review reports generated under the program;
c. make operational recommendations; and,
d. assist in the development and implementation of the program
e. promote buy in and support for the program
f. look for opportunities for

BOILER RELIABILITY OPTIMIZATION TEAM
Fig. 6.2 -1



6.3 BTFR/CCI Response Team

The BTFR/CCI Response Team, while it has members that are also on the BRO team, has responsibilities that are different from that of the BRO team. The BTFR/CCI Response Team's primary mission is to achieve reductions in the number and the impact of boiler [redacted]

7.0 BTFR - General Requirements and Procedures Following Boiler Tube Failures[3]

7.1 Notification in the Event of Boiler Tube Failures

When a boiler tube failure is discovered at a particular plant and unit, the following persons on the BTFR/CCI Response Team shall be immediately notified:

a. Senior Boiler Engineer

b. Station Chemist for the particular plant

c. BRO Engineer

d. Operations and Maintenance representatives for the particular plant

The Senior Supervisor/Shift Supervisor at the affected station is tasked with initial notification of the BTFR/CCI Team since he/she will normally be the first member of the team aware of the incident. Initial notification shall be mainly by e-mail for all members and additionally by pager or telephone for those required to perform the pre-repair inspection.

7.2 Pre-Repair Inspection

7.2.1 Senior Boiler Engineer's Tasks

The Senior Boiler Engineer, or a person acting under the direction of the Senior Boiler Engineer, shall perform the following pre-repair inspection work:

a. determine the failure mechanism;

b. determine the extent of damage to:

   1) the failed tube;

   2) tubes adjacent to or in the proximity of the failed tube; and

   3) tubes in other locations subject to the same failure mechanism and root cause;

c. obtain sample specimens, as necessary[4], for root cause failure analysis;

---

[3] All work described in this section is not intended to supersede work descriptions or procedures now in effect. Rather, this section is intended only to provide a supplemental description and emphasize the team aspect of the work.

d. document the "as-found" conditions on the Standardized Form for Boiler Tube Failure Reporting;

e. work with the maintenance representative on the team to:

   1) determine the appropriate repairs necessary;

   2) coordinate the procurement of materials needed for the repair; and

   3) schedule the repair work; and

f. recommend corrective actions to address the root cause of the failure.

7.2.2 Station Chemists' Tasks

The station chemist at the station affected shall perform the following work during the pre-repair inspection phase:

a. accompany the Senior Boiler Engineer during the pre-repair inspection to evaluate the tube failure;

b. work closely with the Senior Boiler Engineer in determining the failure mechanism; and

c. work closely with the Senior Boiler Engineer to determine whether or not deviations outside of cycle chemistry limits were a root cause of the failure.

7.2.3 BRO Engineer's Tasks

The BRO Engineer shall perform the following work during the pre-repair inspection phase:

a. accompany the Senior Boiler Engineer during the pre-repair inspection;

b. stay informed of the pre-repair inspection activities;

c. assist Senior Boiler Engineer in coordinating field repair activities;

d. provide engineering support in the field as needed;

e. monitor compliance with the Mandate;

---

[4] Obtaining sample specimens are necessary when one of the following conditions exist:

- The BTFR Team is unable to determine the failure mechanism/root cause without a tube sample
- Removal of the tube sample is necessary to perform appropriate repairs
- The BTFR Team deems a tube sample is necessary for additional

7.2.4 Maintenance Representative's Tasks

The Maintenance Representative on the BTFR/CCI Response Team shall perform the following work during the pre-repair inspection phase:

a. accompany the Senior Boiler Engineer during the pre-repair inspection and provide maintenance assistance as needed;
b. keep the Maintenance Division Superintendent and Senior Supervisor apprised of the situation;
c. work closely with the Senior Boiler Engineer to:
   1) determine the appropriate repairs necessary;
   2) coordinate the procurement of materials needed for the repair; and
   3) schedule the repair work; and
d. where the inspection indicates that the boiler tube failure may have been due to "maintenance controllable activities," the maintenance representative shall work closely with the Senior Boiler Engineer to develop a corrective action plan.

7.2.5 Operating Representative's Tasks

The Operating Representative on the BTFR/CCI Response Team shall perform the following work during the pre-repair inspection phase:

a. accompany the Senior Boiler Engineer during the pre-repair inspection and provide operating assistance as needed;
b. keep the Superintendent of the Operating Division apprised of the situation; and
c. where the inspection indicates that the boiler tube failure may have been due to "operator controllable activities," the operating representative shall work closely with the Senior Boiler Engineer to develop a corrective action plan.

7.2.6 Forecast Planning Analyst's Tasks

The Forecast Planning Analyst on the BTFR/CCI Response Team shall perform the following work:

a. stay informed of the work being performed in order to quantify the impact of the boiler failure in terms of dollars and EAF loss attributable to the boiler tube failure as accurately as possible;

7.2.7 Planning & Engineering Department Support Tasks

The Planning & Engineering support personnel shall perform the following work during the pre-repair inspection phase:

a. accompany the Senior Boiler Engineer during the pre-repair inspection, if possible; and

b. provide engineering assistance as needed.

7.3 Failure Investigation

7.3.1 Senior Boiler Engineer's & BRO Engineer's Tasks

In addition to the work currently performed with each boiler tube failure investigation, the Senior Boiler Engineer and the BRO Engineer shall work together to ensure that the following requirements are met:

a. each boiler tube failure investigation shall determine:
   1) the failure mechanism;
   2) the most probable root cause; and
   3) the appropriate corrective or preventive action.

b. boiler tube failure mechanisms shall be identified by the EPRI standard cause codes to the greatest extent possible[5];

c. where outside metallurgical consultants or failure analysts are utilized, their determinations of boiler tube failure mechanisms shall be identified by the EPRI standard cause codes to the greatest extent possible.

[5] Refer to the 33 possible boiler tube failure mechanisms described in the EPRI books "Boiler Tube Failure: Theory and Practice," Volumes 1-3, TR-105261.

7.4 Boiler Tube Wall Thickness Measurement

7.4.1 Senior Boiler Engineer's Tasks

The Senior Boiler Engineer shall be responsible for performing, or for directing the work to perform, boiler tube wall thickness measurements as deemed necessary to establish the extent of repair required and support the BTF analysis.

7.5 Boiler Tube Repairs

7.5.1 General Conditions

a. Use of temporary fireside erosion/corrosion tube protection methods, i.e., shields, plasma or metal spraying, is allowed but is generally discouraged under EPRI guidelines. Reduction of erosion/corrosion rates through correction of root-causes(s) or replacement with more resistant tube material (if necessary) is generally preferred. Consideration shall be given to the particular circumstances in each instance in determining the appropriate course of action.

b. Use of pad welding or window weld repairs are permitted only as temporary repairs. These temporarily repaired sections should be replaced at the next scheduled boiler maintenance overhaul outage or when practical. This type of repair must follow HECO Pad Welding Procedures available from the Senior Boiler Engineer.

7.5.2 Senior Boiler Engineer's Tasks

The Senior Boiler Engineer shall:

a. ensure that the following quality assurance provisions of the HECO National Board "R" Symbol Stamp program are met:

   1) welder and inspector qualifications;
   2) welding materials;
   3) welding procedures; and
   4) selection of tube material

b. ensure that the State of Hawaii administrative requirements for Boiler and Pressure Vessel repairs are met.

c. witness or delegate tube pressure integrity tests;

d. certify the boiler as ready for service following the completion of repairs;

e. arrange for temporarily repaired sections to be replaced at the next scheduled boiler maintenance overhaul outage or when practical;

7.5.3 Maintenance Representative's Tasks

The maintenance representative shall:

a. provide qualified welders to perform repairs;

b. assist in determination of repair methods used.

7.5.4 BRO Engineer's Tasks

The BRO Engineer shall:

a. ensure that accurate accounts of the repairs made are recorded in the Boiler Maintenance Workstation software.

7.6 Future Preventive or Control Actions

a. Each corrective or preventive action recommended in accordance with Section 7.3.1a.3) to address the root cause of boiler tube failures shall be approved by the BTFR/CCI Response Team representatives from the engineering, operations and maintenance areas.

b. Each corrective or preventive action recommendation approved by the BTFR/CCI Response Team representatives shall be issued, as a minimum, to:

1) the Manager, Power Supply Operations & Maintenance Department; and

2) the Manager, Power Supply Services Department

for review and approval.

c. The BRO Engineer shall ensure compliance with Sections 7.6a and 7.6b.

d. Following approval of the recommendation, the recommended actions shall be implemented by the appropriate department.

e. The BRO Engineer shall have the responsibility of monitoring the progress and status of each recommendation.

7.7 BTFR Documentation

7.7.1 Data Quality Assurance

a. To ensure uniformity of the data on each boiler tube failure incident, data for each incident shall be recorded on the standardized form shown in Appendix A.

b. To ensure the accuracy of the data on each boiler tube failure incident, data for each incident shall be recorded by the Senior Boiler Engineer.

c. The BRO Engineer is responsible to ensure data is entered into the Boiler Maintenance Workstation software.

7.7.2 Data on Boiler Tube Failures

The BRO Engineer shall submit a Boiler Tube Failure Report for each boiler tube failure. As a minimum, the following data on each boiler tube failure shall be included in the report:

a. plant and unit in which the tube failed;

b. date of failure;

c. identification of specific tubes that failed in terms of section (waterwall, economizer, primary or secondary superheaters or reheater) and tube number;

d. location of failure on the tube;

e. description of the failure (size, appearance, etc.)

f. failure mechanism using EPRI standard cause codes to the greatest extent possible;

g. apparent root cause of failure;

h. type of repair made;

i. name of repairer; and

j. type and extent of pre-repair inspection and name of inspector(s).

k. cost to repair

l. EAF impacts

m. Short and long term recommendations

7.7.3 Centralizing, Processing and Archiving of Data

a. All boiler tube failure data shall be kept and processed in a central location in the Company. The Power Supply Technical Services Department shall be the office of record. The Senior Boiler Engineer shall be responsible for keeping the records current.

b. To facilitate trending and statistical analyses of boiler tube failure data, all data recorded in accordance with Section 7.7.2 shall be input to the Boiler Maintenance Workstation software.

c. All data on the Boiler Maintenance Workstation shall be backed up on periodic bases.

d. Processed data, which is suitable for internal dissemination, shall be made available on the intranet or on a shared drive.

7.7.4 Quantification of Impacts of Boiler Tube Failures

As a minimum, the Forecast Planning Analyst shall record the following data to enable the calculation of boiler tube failure impacts:

a. start and end time and date for boiler tube repairs;

b. start and end time and date for all planned and unplanned outages; and

c. unit operating statistics (e.g., operating hours and heat rates).

The Forecast Planning Analyst shall support the effort in compiling the BTF Report as described in Section 7.7.2 by supplying data as deemed necessary.

8.0 Scheduled Major Boiler Maintenance Overhauls

8.1 Senior Boiler Engineer's and BRO Engineer's Tasks

During scheduled boiler maintenance overhauls, the Senior Boiler Engineer and the BRO Engineer shall work together to ensure that the work identified by the BRO program is planned, scheduled and performed with the scheduled boiler maintenance work.

9.0 General Requirements and Procedures - Cycle Chemistry Improvement

9.1 Cycle Chemistry Objectives

HECO has established the following objectives for the Cycle Chemistry Improvement Program:

a. develop a management supported cycle chemistry program

b. develop unit-specific limits, action levels and operating procedures

c. establish optimum sampling points, specify and install "core" level instrumentation on each unit

[redacted]

9.3 Core Cycle Chemistry Parameters

a. The following cycle chemistry parameters shall be considered core and shall be monitored at the locations indicated in Table 9.3-1:

Table 9.3-1

Core Cycle Chemistry Parameters and Monitoring Locations

Parameter	Measurement Locations
Cation Conductivity	• Condensate pump discharge • Feedwater • Boiler drum steam • Main steam
Specific Conductivity	• Condenser hotwell • Feedwater • Boiler drum water
Silica	• Feedwater • Boiler drum water • Main steam
Dissolved Oxygen	• Condensate pump discharge • Feedwater • Boiler drum water
Sodium	• Condensate pump discharge • Feedwater • Boiler drum water • Boiler drum steam • Main steam
Chloride	• Boiler drum water
Phosphate	• Boiler drum water
Hydrazine	• Feedwater

PH	• Condensate pump discharge • Feedwater • Boiler drum water
ORP	• Feedwater

b. The critical cycle chemistry parameters identified in Section 9.3a above:
   1) shall be maintained within established limits;
   2) shall be continuously monitored;
   3) shall be have audible alarms when the limits are exceeded; and
   4) shall be tied into the DCS.

9.3.1 Cycle Chemistry Monitoring Protocols

The following information shall be established for each of the cycle chemistry monitoring parameters:

a. allowable ranges;
b. manual sampling frequency, if required;
c. set points for action levels; and
d. specific actions to be taken at each action level.

9.4 Cycle Chemistry Responsibilities

9.4.1 BRO Engineer's Tasks

The primary responsibilities of the BRO Engineer will be to:

a. assist the Station Chemists in accomplishing their CCI Tasks;
b. stay informed of the CCI activities;
c. provide engineering support as needed; and

9.4.2 Station Chemist's Tasks

The primary responsibilities of the Station Chemists will be to:

a. establish limits on feedwater chemistry for all modes of boiler operation, including start-up load changes, planned or immediate shutdowns, and short and long term lay-up;

b. establish action-oriented procedures with respect to cycle chemistry to minimize boiler tube damaging conditions;

c. establish unit-specific cycle chemistry monitoring requirements and protocols;

d. monitor on a daily basis cycle chemistry parameters in relation to the established cycle chemistry limits and shall recommend corrective actions when the limits are exceeded;

e. train operating personnel on the operation of the cycle chemistry instrumentation;

f. review on a monthly basis cycle chemistry technical and performance indices specific to their operating mode, i.e., cycling or baseload, such that unit availability and/or performance parameters influenced by cycle chemistry contaminant ingress, corrosion or corrosion product transport and/or deposition can be monitored, reported and controlled; and

g. be active participants in determining the root cause of boiler tube failures, boiler tube corrosion damage, excessive deposit buildup on boiler tubes, or other cycle chemistry-related problems concerning boiler tubes.

9.4.3 Maintenance Representative Tasks

The primary responsibilities of the Maintenance Representative will be to:

a. ensure adequate resources are available to fulfill supporting maintenance on all cycle chemistry instrumentation;

b. work closely with the Station Chemists to;
   1) determine the appropriate repairs necessary
   2) coordinate the procurement of materials needed for the repair
   3) execute the repair work; and

c. where an inspection indicates that an instrument failure may have been due to closely with the Station Chemist to develop a corrective action plan.

9.4.4 Operating Representatives Tasks

The primary responsibilities of the Operating Representative will be to:

a. ensure operating personnel are adequately trained by the Station Chemist to operate the cycle chemistry instrumentation;
b. report all operating discrepancies to the Station Chemist;
c. where an inspection indicated that an instrument malfunction may have been due due to "operator controllable activities", the operating representative shall work closely with the Station Chemist to develop a corrective action plan; and
d. take corrective action in accordance with established procedures when action levels are reached.

9.5 Cycle Chemistry Documentation

9.5.1 Quantifiable Loss

Whenever there is a quantifiable loss in availability in terms of EAF or performance in terms of boiler efficiency as a result of corrosion or deposition on boiler tubes, the impact shall be quantified in terms of:

a. magnitude (surface area affected, thickness, loss of wall thickness, etc);
b. historical trend (rate of change of size, thickness, loss of wall thickness, etc.);
c. EAF impacts;
d. cost;
e. root cause; and
f. corrective actions

9.5.2 Reporting and Archiving

The BRO Engineer is responsible to ensure that data referenced in 9.5.1 is archived in a written report and made available on a network-shared drive.

HECO BOILER TUBE FAILURE REPORT

1. Outage Name: ______________________________

2. BTF ID #: ______________ 3. Unit: ______ 4. Date/Time of Failure: ______________

5. Leak Discovery Method ☐ Visual ☐ Change in Drum Level
☐ High Make-up ☐ Other ______________

6. Was HECO Boiler Inspector Called? (Y/N) ______ 7. Was BTF Team Leader Called? (Y/N) ______

8. Operating conditions at failure: ______________________________

9. BTF inspected by:

FAILURE LOCATION

WATERWALL
- ☐ Front Wall
- ☐ Rear Wall
- ☐ Right Side Wall
- ☐ Left Side Wall
- ☐ Roof Tube
- ☐ Floor Tube
- ☐ Arch Tube
- ☐ Other: __________

SUPERHEATER
- ☐ Primary Inlet
- ☐ Primary Outlet
- ☐ Secondary Inlet
- ☐ Secondary Outlet
- ☐ Other: __________
- ☐ Row No.: __________

ELEMENT NUMBER
- ☐ From Left ______
- ☐ From Right ______

WW TUBE NUMBER
- ☐ From Top ______
- ☐ From Bottom ______
- ☐ From Front ______
- ☐ From Rear ______
- ☐ From Right Side ______
- ☐ From Left Side ______

ECONOMIZER
- ☐ Inlet
- ☐ Outlet
- ☐ Other: __________

REHEATER
- ☐ Inlet
- ☐ Outlet
- ☐ Other: __________
- ☐ Row No.: __________

LOCATION REFERENCE
- ☐ ______ feet from __________
- ☐ Other: __________

Additional Info. ______________________________

FAILURE OCCURRED AT:

WELD
- ☐ Header-Nipple
- ☐ Dissimilar Metal

ATTACHMENT
- ☐ Seal Plate
- ☐ Support

TUBING
- ☐ Vertical Straight Run
- ☐ Horizontal Straight Run

HECO BOILER TUBE FAILURE REPORT

PROBABLE PRIMARY FAILURE MECHANISM

- ☐ Short-term Overheat
- ☐ Long Term Overheat/Creep
- ☐ Dissimilar Weld
- ☐ Caustic Gouging
- ☐ Hydrogen Damage
- ☐ Pitting
- ☐ Acid Phosphate Corrosion
- ☐ Stress Corrosion
- ☐ Lo-temp Creep
- ☐ Acid Dewpoint Corrosion
- ☐ Fireside Corrosion
- ☐ Rubbing/Fretting
- ☐ Sootblower Erosion
- ☐ Chemical Cleaning Damage
- ☐ Thermal Fatigue
- ☐ Corrosion Fatigue
- ☐ Maintenance Damage
- ☐ Material Flaws
- ☐ Weld Flaws
- ☐ Graphitization
- ☐ Erosion-Corrosion
- ☐ Other: ____________

BTF REPAIR ACTIVITIES

Repair Date: ____________ **Work Order No:** ____________

Weld Repair Checklist No: ____________

Weld Procedure Specification No: ____________

Repair Type
- ☐ Permanent
- ☐ Temporary

Repair Method
- ☐ Circuit Replaced
- ☐ Crack Ground & Welded
- ☐ Dutchman Installed
- ☐ Buildup Weld
- ☐ Other: ____________

Additional Comments: ____________

Tube Material: ____________ **Header Material:** ____________

Tube OD: ____________ **Tube Wall Thickness:** ____________ **Replacement Tube Length:** ____________

Inspection Date: ____________ **Inspection Procedure No:** ____________

NDE Method
- ☐ None
- ☐ Mag Particle
- ☐ Dye Penetrant
- ☐ Ultrasonic
- ☐ Visual

NDE Results: ____________

Welder: ____________ **Presiding Inspector:** ____________

OUTAGE/COST INFORMATION

Outage Type: ☐ Forced ☐ Planned ☐ Overhaul

Repeat Failure? ☐ Yes ☐ No

Outage End Date/Time: ____________
Unit Capacity: ____________
Hours of Unit Unavailability: ____________
EAF Loss (MWHRs): ____________
EAF Loss (% of System): ____________
EFOR (%): ____________

REPAIR COSTS

Labor: ____________
Materials: ____________
Overheads: ____________
Other: ____________
Total Repair Costs: ____________

FUEL COSTS

Heatrate: ____________
Startup: ____________
Total Fuel Costs: ____________

Additional Comments: ____________

HECO BOILER TUBE FAILURE REPORT

POST REPAIR ANALYSIS

Tube Sample Taken? ☐ Yes ☐ No **Sample Sent To:** ______________________

Analysis Performed:

- ☐ Alloy Analysis
- ☐ Deposit Chemical Analysis
- ☐ Deposit Weight Analysis
- ☐ Failure Analysis
- ☐ Remaining Life Analysis
- ☐ Multiple Analysis
- ☐ Other: ____________

Analysis Date: ____________ **Analysis Report No:** ____________

Analysis Comments: ______________________

Verification of Failure Mechanism after the BTF Outage: ______________________

Verification of Root Cause after the BTF Outage: ______________________

Actions taken to correct Root Cause after the BTF Outage: ______________________

Recommendations for future outages:

1. ______________________
2. ______________________
3. ______________________
4. ______________________

FORM PREPARED BY: ______________________ Date: ____________
William E. McCraw

O&M MANAGER: ______________________ Date: ____________
Harold Kageura

POWER SUPPLY SERVICES MANAGER: ______________________ Date: ____________
Tom Simmons

Additional Comments: ______________________

Benchmarking BTFR Programs

Hawaiian Electric Rating

World Class/Excellent	≤ 5
Very Good	6 – 10
Good	11 – 15
Average	16 – 20
Below Average	>20

Dec 99.	Whole System 19	
June 02.	K 13	W 13
Dec 02.	K 5	W 5
Nov 03.	K 3	W 5

EPRI

June 2002 by John Dimmer & Barry Dooley - Kahe

Benchmarking a Utility's Boiler Tube Failure Reduction Program

Introduction

EPRI's Boiler Tube Failure Reduction Program/Cycle Chemistry Improvement Program (BTFRP/CCIP) has been designed to assist an organization to reduce the availability loss due to BTF and the costs associated with cycle chemistry influenced problems. Alternatively it can be used to maintain excellence in these areas. Most utilities do not need an organization such as EPRI to indicate to them that their availability loss (AL) percentage (or equivalent) for BTF are good or bad. As the average in the US is currently around 3%, utilities know that if AL is around 6% then this is extremely poor; alternatively as the AL approaches 0.5% then this is very good. The financial penalties in the current competitive market can be enormous.

Also utilities frequently ask how good or bad they are in terms of their cycle chemistry operation and organization, and where do they rank with other utilities for a utility of their size. To answer these questions, EPRI developed a Cycle Chemistry Benchmarking Process, which has now been used with over 30 organizations. This process has also now been linked with a new approach to determine the value of Cycle Chemistry and for assisting in justifying new cycle chemistry equipment or improvements. No similar Benchmarking Process has existed to date for BTF.

For BTF, insufficient quantitative data exist to benchmark/rank utilities simply in terms of internally collected data or national statistics such as the NERC/GADS.

Much thought has been given to this topic and the current assessment methodology, which has been developed over the last year, will provide an assessment for an organization of its approach to BTFR. It is anticipated that this process can also be used by individual utilities to monitor their improvement through participation in EPRI's BTFRP/CCIP.

Assessing a Utility's BTFRP

The attached form is a self-assessment. It consists of a series of eight "results and process oriented" boiler tube failure reduction factors. Each of the "non-subjective" factors is capable of being addressed definitively, and, as a whole, they represent the key performance and availability indicators, which should judge the organization. Each factor relates to one of the items within the BTFRP/CCIP Corporate Mandate or Philosophy. It is suggested that a utility makes the initial assessment with data from the last two years. Improvements/changes could then be assessed on an annual basis or during the review process, once the BTFRP/CCIP has started. The methodology will work for a single unit/plant, but will provide the best indicator when applied across a utility system.

All of the factors except C need no further description. Information to determine Factor C is provided below and in the attachment.

Factor C. Chemically Influenced Boiler Tube Failures (BTF)

All of the factors except C need no further description. Information to determine Factor C is provided below and in the attachment.

Factor C. Chemically Influenced Boiler Tube Failures (BTF)

In the Cycle Chemistry Benchmarking, this question relates to the percentage of the total numbers of BTF over the period, that have resulted in forced outage or unit unavailability and that have been influenced by the cycle chemistry. In this BTFR Benchmarking the question only relates to whether there have been any cycle chemistry influenced BTF. A supplementary listing of those BTF influenced by the chemistry is provided for water-touched and steam-touched tubing. For further information on BTF Mechanisms, see "Boiler Tube Failures: Theory and Practice". B. Dooley and W. McNaughton. TR-105261.

Assessment of a Utility's Boiler Tube Failure Reduction Program
Kahe Power Plant

Weighting		Factor	Points	Total
3	A.	Do you know the Availability Loss (%) Due to BTF		Kahe
		❑ < 0.5%	0	0.061 (12 mo)
		❑ 0.5-1%	1	
		❑ 1-2%	2	
		❑ 2-3%	3	
		❑ >3 %	4	
		❑ No	4	
		Sub-total (Points x Weighting)		0
2	B.	Do you have a ranking (priority) for BTF Mechanisms in Plant/System (could be in terms of MWhrs, AL %, or on a cost basis)		
		❑ Yes	0	Yes
		❑ No	1	
		Sub-total (Points x Weighting)		0
2	C.	Do you have any cycle chemistry related BTF Mechanisms (See attached for relevant BTF)		
		❑ Yes	1	Yes
		❑ No	0	
		Sub-total (Points x Weighting)		2
2	D.	What percentage of superheater and reheater circuits in your system/plant do you know the remaining life (using oxide scale technique)		
		❑ All	0	
		❑ >50%	1	
		❑ <50%	2	<50%
		Sub-total (Points x Weighting)		4

Weighting		Factor	Points	Total
2	E.	Do you have a BTF forced outage plan other than "fix it quick" ?		
		❑ Yes	0	
		❑ No	1	No
		Sub-total (Points x Weighting)		2
2	F.	Do you have Action Plans for repeat BTF that address:		
		a) Damaged tubing		
		❑ Yes	0	Yes
		❑ No	1	
		Sub-total (Points x Weighting)		02
		b) Root Cause (to kill the BTF mechanism)		
		❑ Yes	0	
		❑ No	1	No
		Sub-total (Points x Weighting)		2
2	G.	Do you normally continue running with known tube leaks (except in a system emergency)		
		❑ Yes	1	Yes
		❑ No	0	
		Sub-total (Points x Weighting)		2
1	H.	Do you normally use pad welding (except in a system emergency)		
		❑ Yes	1	Yes
		❑ No	0	
		Sub-total (Points x Weighting)		1

1 I. Do you have a set of BTF goals/objectives

❑	Yes	0	Yes
❑	No	1	

Sub-total (Points x Weighting) 0

Total **13**

Rating System

World Class	0-5
Very good BTFR Program	6-10
Good Program	11 –15
Average Program	16-20
Below Average Program	>20

Supplementary Information for Factor A

BTF Mechanisms in Water-touched Tubes that are Influenced by Cycle Chemistry	
Mechanism	Nature of Chemistry Influence
Hydrogen damage	Excessive feedwater corrosion products form excessive deposits and combine with a source of acidic contamination.
Caustic gouging	Excessive feedwater corrosion products form deposits and combine with a source of caustic.
Acid phosphate corrosion	Excessive feedwater corrosion products form deposits and combine with a source of phosphate
Chemical cleaning damage	Excessive deposits in waterwalls lead to chemical cleaning; process errors lead to tube damage.
Corrosion fatigue	Poor water chemistry, shutdown or layup practices, and improper chemical cleaning worsen contribution of the environment to causing damage.
Supercritical waterwall cracking and overheating	Excessive internal deposits lead to increased tube metal temperatures; exacerbates mechanism.
Fireside corrosion	Excessive internal deposits lead to increased tube metal temperatures; exacerbates mechanism.
Short-term overheating	Plugging of waterwall orifices by feedwater corrosion products.
Erosion/corrosion of economizer inlet headers	Attack by reducing feedwater conditions.
Pitting (economizer)	Stagnant, oxygenated water formed during shutdown.
BTF Mechanisms in Steam-Touched Tubes that are Influenced by Cycle Chemistry	
Long-term overheating (creep)	If caused by restricted steam flow as a result of contaminant deposits, debris, etc.
Short-term overheating	Blockage from improper chemical cleaning (of SH/RH or waterwalls).
Stress corrosion cracking	Variety of bad environment influences, most directly related to chemistry control and practices.
Pitting (RH loops)	Carryover of Na_2SO_4 or poor shutdown practices allowing for oxygenated, stagnant condensate.
Chemical cleaning damage	Poor chemical cleaning practice.

For further information on BTF Mechanisms, see “Boiler Tube Failures: Theory and Practice”. B. Dooley and W. McNaughton. TR-105261

Benchmarking Clarifications

A. % EAL

- This item is expected to include all outage time attributed to BTF except for major planned boiler overhauls.
  - It should be separated from a total boiler random outage rate (ROR)
  - Best if a rolling 2 year average is used unless an element with damaged tubing, such as a SH or RH, has been completely replaced.

B. Ranking by BTF mechanisms in terms of Mwhrs, EAL or $

- The total number of BTF, or potential BTF, due to each mechanism should be included. This should include BTF that resulted in a forced outage as well as those leaking or damaged tubes by the same mechanism that were found by an inspection or hydro that didn't cost any Mwhrs but were potential future forced outages.

C. Cycle chemistry influenced BTF

- These BTF should be tracked over a rolling 2 year period. <u>If none have occurred over the last 24 months</u>, and the root cause has been addressed, a zero score can be given.

D. What % SH and RH condition assessment

- Self explanatory

E. Do you have a "forced outage plan" other than fix it quick

- To get a zero, this must be a plant-specific outage plan <u>on paper</u>, and must include all the critical "pre-repair inspection" activities for minimizing the probability of a repeat BTF. It's a plus if system status is considered in actually what activities will be done.

F. Action plans for "damaged tubing" and for addressing the root cause to "kill " the mechanism

- Self explanatory.

G. Running with known tube leaks

- To get a zero, a plant-specific operating procedure must exist that clearly indicates that for the majority of all boiler tube leaks, when a "serious system condition" doesn't exist, the standard is to remove the unit from service in a controlled manner.

H. Normally use pad welds

- To get a zero, a plant-specific maintenance procedure must exist that clearly indicates that for the majority of all boiler tube repairs, when a "serious system condition" doesn't exist, a new piece of tubing rather than a pad or window weld is the standard method of repair.

I. Setting of plant- and/or unit-specific BTF goals

- Self explanatory.

June 2002 by John Dimmer & Barry Dooley - Waiau

Benchmarking a Utility's Boiler Tube Failure Reduction Program

Introduction

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The attached form is a self-assessment. It consists of a series of eight "results and process oriented" boiler tube failure reduction factors. Each of the "non-subjective" factors is capable of being addressed definitively, and, as a whole, they represent the key performance and availability indicators, which should judge the organization. Each factor relates to one of the items within the BTFRP/CCIP Corporate Mandate or Philosophy. It is suggested that a utility makes the initial assessment with data from the last two years. Improvements/changes could then be assessed on an annual basis or during the review process, once the BTFRP/CCIP has started. The methodology will work for a single unit/plant, but will provide the best indicator when applied across a utility system.

All of the factors except C need no further description. Information to determine Factor C is provided below and in the attachment.

Factor C. Chemically Influenced Boiler Tube Failures (BTF)

In the Cycle Chemistry Benchmarking, this question relates to the percentage of the total numbers of BTF over the period, that have resulted in forced outage or unit unavailability and that have been influenced by the cycle chemistry. In this BTFR Benchmarking the question only relates to whether there have been any cycle chemistry influenced BTF. A supplementary listing of those BTF influenced by the chemistry is provided for water-touched and steam-touched tubing. For further information on BTF Mechanisms, see "Boiler Tube Failures: Theory and Practice". B. Dooley and W. McNaughton. TR-105261.

Assessment of a Utility's Boiler Tube Failure Reduction Program
Waiau Power Plant

Weighting		Factor	Points	Total
3	A.	Do you know the Availability Loss (%) Due to BTF		Waiau
		❑ < 0.5%	0	0.0348 (12 mo)
		❑ 0.5-1%	1	
		❑ 1-2%	2	
		❑ 2-3%	3	
		❑ >3 %	4	
		❑ No	4	
		Sub-total (Points x Weighting)		0
2	B.	Do you have a ranking (priority) for BTF Mechanisms in Plant/System (could be in terms of MWhrs, AL %, or on a cost basis)		
		❑ Yes	0	Yes
		❑ No	1	
		Sub-total (Points x Weighting)		0
2	C.	Do you have any cycle chemistry related BTF Mechanisms (See attached for relevant BTF)		
		❑ Yes	1	Yes
		❑ No	0	
		Sub-total (Points x Weighting)		2
2	D.	What percentage of superheater and reheater circuits in your system/plant do you know the remaining life (using oxide scale technique)		
		❑ All	0	
		❑ >50%	1	
		❑ <50%	2	<50%
		Sub-total (Points x Weighting)		4

Weighting		Factor	Points	Total
2	E.	Do you have a BTF forced outage plan other than "fix it quick" ?		
		❑ Yes	0	
		❑ No	1	No
		Sub-total (Points x Weighting)		2
2	F.	Do you have Action Plans for repeat BTF that address:		
		a) Damaged tubing		
		❑ Yes	0	Yes
		❑ No	1	
		Sub-total (Points x Weighting)		0
		b) Root Cause (to kill the BTF mechanism)		
		❑ Yes	0	
		❑ No	1	No
		Sub-total (Points x Weighting)		2
2	G.	Do you normally continue running with known tube leaks (except in a system emergency)		
		❑ Yes	1	Yes
		❑ No	0	
		Sub-total (Points x Weighting)		2
1	H.	Do you normally use pad welding (except in a system emergency)		
		❑ Yes	1	Yes
		❑ No	0	
		Sub-total (Points x Weighting)		1

1 I. Do you have a set of BTF goals/objectives

❑	Yes	0	Yes
❑	No	1	

Sub-total (Points x Weighting) 0

Total **13**

Rating System

World Class	0-5
Very good BTFR Program	6-10
Good Program	11 –15
Average Program	16-20
Below Average Program	>20

Supplementary Information for Factor A

BTF Mechanisms in Water-touched Tubes that are Influenced by Cycle Chemistry	
Mechanism	Nature of Chemistry Influence
Hydrogen damage	Excessive feedwater corrosion products form excessive deposits and combine with a source of acidic contamination.
Caustic gouging	Excessive feedwater corrosion products form deposits and combine with a source of caustic.
Acid phosphate corrosion	Excessive feedwater corrosion products form deposits and combine with a source of phosphate
Chemical cleaning damage	Excessive deposits in waterwalls lead to chemical cleaning; process errors lead to tube damage.
Corrosion fatigue	Poor water chemistry, shutdown or layup practices, and improper chemical cleaning worsen contribution of the environment to causing damage.
Supercritical waterwall cracking and overheating	Excessive internal deposits lead to increased tube metal temperatures; exacerbates mechanism.
Fireside corrosion	Excessive internal deposits lead to increased tube metal temperatures; exacerbates mechanism.
Short-term overheating	Plugging of waterwall orifices by feedwater corrosion products.
Erosion/corrosion of economizer inlet headers	Attack by reducing feedwater conditions.
Pitting (economizer)	Stagnant, oxygenated water formed during shutdown.
BTF Mechanisms in Steam-Touched Tubes that are Influenced by Cycle Chemistry	
Long-term overheating (creep)	If caused by restricted steam flow as a result of contaminant deposits, debris, etc.
Short-term overheating	Blockage from improper chemical cleaning (of SH/RH or waterwalls).
Stress corrosion cracking	Variety of bad environment influences, most directly related to chemistry control and practices.
Pitting (RH loops)	Carryover of Na_2SO_4 or poor shutdown practices allowing for oxygenated, stagnant condensate.
Chemical cleaning damage	Poor chemical cleaning practice.

For further information on BTF Mechanisms, see “Boiler Tube Failures: Theory and Practice”. B. Dooley and W. McNaughton. TR-105261

Benchmarking Clarifications

A. % EAL

- This item is expected to include all outage time attributed to BTF except for major planned boiler overhauls.
  - It should be separated from a total boiler random outage rate (ROR)
  - Best if a rolling 2 year average is used unless an element with damaged tubing, such as a SH or RH, has been completely replaced.

B. Ranking by BTF mechanisms in terms of Mwhrs, EAL or $

- The total number of BTF, or potential BTF, due to each mechanism should be included. This should include BTF that resulted in a forced outage as well as those leaking or damaged tubes by the same mechanism that were found by an inspection or hydro that didn't cost any Mwhrs but were potential future forced outages.

C. Cycle chemistry influenced BTF

- These BTF should be tracked over a rolling 2 year period. If none have occurred over the last 24 months, and the root cause has been addressed, a zero score can be given.

D. What % SH and RH condition assessment

- Self explanatory

E. Do you have a "forced outage plan" other than fix it quick

- To get a zero, this must be a plant-specific outage plan on paper, and must include all the critical "pre-repair inspection" activities for minimizing the probability of a repeat BTF. It's a plus if system status is considered in actually what activities will be done.

F. Action plans for "damaged tubing" and for addressing the root cause to "kill " the mechanism

- Self explanatory.

G. Running with known tube leaks

- To get a zero, a plant-specific operating procedure must exist that clearly indicates that for the majority of all boiler tube leaks, when a "serious system condition" doesn't exist, the standard is to remove the unit from service in a controlled manner.

H. Normally use pad welds

- To get a zero, a plant-specific maintenance procedure must exist that clearly

December 2002 by John Dimmer & Barry Dooley

Benchmarking a Utility's Boiler Tube Failure Reduction Program

Introduction

EPRI's Boiler Tube Failure Reduction Program/Cycle Chemistry Improvement Program (BTFRP/CCIP) has been designed to assist an organization to reduce the availability loss due to BTF and the costs associated with cycle chemistry influenced problems. Alternatively it can be used to maintain excellence in these areas. Most utilities do not need an organization such as EPRI to indicate to them that their availability loss (AL) percentage (or equivalent) for BTF are good or bad. As the average in the US is currently around 3%, utilities know that if AL is around 6% then this is extremely poor; alternatively as the AL approaches 0.5% then this is very good. The financial penalties in the current competitive market can be enormous.

Also utilities frequently ask how good or bad they are in terms of their cycle chemistry operation and organization, and where do they rank with other utilities for a utility of their size. To answer these questions, EPRI developed a Cycle Chemistry Benchmarking Process, which has now been used with over 30 organizations. This process has also now been linked with a new approach to determine the value of Cycle Chemistry and for assisting in justifying new cycle chemistry equipment or improvements. No similar Benchmarking Process has existed to date for BTF.

For BTF, insufficient quantitative data exist to benchmark/rank utilities simply in terms of internally collected data or national statistics such as the NERC/GADS.

Much thought has been given to this topic and the current assessment methodology, which has been developed over the last year, will provide an assessment for an organization of its approach to BTFR. It is anticipated that this process can also be used by individual utilities to monitor their improvement through participation in EPRI's BTFRP/CCIP.

Assessing a Utility's BTFRP

The attached form is a self-assessment. It consists of a series of eight "results and process oriented" boiler tube failure reduction factors. Each of the "non-subjective" factors is capable of being addressed definitively, and, as a whole, they represent the key performance and availability indicators, which should judge the organization. Each factor relates to one of the items within the BTFRP/CCIP Corporate Mandate or Philosophy. It is suggested that a utility makes the initial assessment with data from the last two years. Improvements/changes could then be assessed on an annual basis or during the review process, once the BTFRP/CCIP has started. The methodology will work for a single unit/plant, but will provide the best indicator when applied across a utility system.

All of the factors except C need no further description. Information to determine Factor C is provided below and in the attachment.

Factor C. Chemically Influenced Boiler Tube Failures (BTF)

In the Cycle Chemistry Benchmarking, this question relates to the percentage of the total numbers of BTF over the period, that have resulted in forced outage or unit unavailability and that have been influenced by the cycle chemistry. In this BTFR Benchmarking the question only relates to whether there have been any cycle chemistry influenced BTF. A supplementary listing of those BTF influenced by the chemistry is provided for water-touched and steam-touched tubing. For further information on BTF Mechanisms, see "Boiler Tube Failures: Theory and Practice". B. Dooley and W. McNaughton. TR-105261.

Assessment of a Utility's Boiler Tube Failure Reduction Program

Weighting		Factor	Points	Kahe	Waiau	Hnl
3	A.	Do you know the Availability Loss (%) Due to BTF		Kahe	Waiau	Hnl
		❑ < 0.5%	0	0.37	0.37	0.37
		❑ 0.5-1%	1			
		❑ 1-2%	2			
		❑ 2-3%	3			
		❑ >3 %	4			
		❑ No	4			
		Sub-total (Points x Weighting)		0	0	0
2	B.	Do you have a ranking (priority) for BTF Mechanisms in Plant/System (could be in terms of MWhrs, AL %, or on a cost basis)		Kahe	Waiau	Hnl
		❑ Yes	0	Yes	Yes	Yes
		❑ No	1			
		Sub-total (Points x Weighting)		0	0	0
2	C.	Do you have any cycle chemistry related BTF Mechanisms (See attached for relevant BTF)		Kahe	Waiau	Hnl
		❑ Yes	1	Yes	Yes	Yes
		❑ No	0			
		Sub-total (Points x Weighting)		2	2	2
2	D.	What percentage of superheater and reheater circuits in your system/plant do you know the remaining life (using oxide scale technique)		Kahe	Waiau	Hnl
		❑ All	0	All	All	All
		❑ >50%	1			
		❑ <50%	2			
		Sub-total (Points x Weighting)		0	0	0

Weighting		Factor	Points	Kahe	Waiau	Hnl
2	E.	Do you have a BTF forced outage plan other than "fix it quick" ?		Kahe	Waiau	Hnl
		❑ Yes	0	Yes	Yes	Yes
		❑ No	1			
		Sub-total (Points x Weighting)		0	0	0
2	F.	Do you have Action Plans for repeat BTF that address:		Kahe	Waiau	Hnl
		a) Damaged tubing				
		❑ Yes	0	Yes	Yes	Yes
		❑ No	1			
		Sub-total (Points x Weighting)		0	0	0
		b) Root Cause (to kill the BTF mechanism)				
		❑ Yes	0	Yes	Yes	Yes
		❑ No	1			
		Sub-total (Points x Weighting)		0	0	0
2	G.	Do you normally continue running with known tube leaks (except in a system emergency)		Kahe	Waiau	Hnl
		❑ Yes	1	Yes	Yes	Yes
		❑ No	0			
		Sub-total (Points x Weighting)		2	2	2
1	H.	Do you normally use pad welding (except in a system emergency)		Kahe	Waiau	Hnl
		❑ Yes	1	Yes	Yes	Yes
		❑ No	0			
		Sub-total (Points x Weighting)		1	1	1

				Kahe	Waiau	Hnl
1	I.	Do you have a set of BTF goals/objectives				
		❑ Yes	0	Yes	Yes	Yes
		❑ No	1			
		Sub-total (Points x Weighting)		0	0	0
		Total		**5**	**5**	**5**

Rating System

World Class	0-5
Very good BTFR Program	6-10
Good Program	11 –15
Average Program	16-20
Below Average Program	>20

Supplementary Information for Factor A

BTF Mechanisms in Water-touched Tubes that are Influenced by Cycle Chemistry	
Mechanism	Nature of Chemistry Influence
Hydrogen damage	Excessive feedwater corrosion products form excessive deposits and combine with a source of acidic contamination.
Caustic gouging	Excessive feedwater corrosion products form deposits and combine with a source of caustic.
Acid phosphate corrosion	Excessive feedwater corrosion products form deposits and combine with a source of phosphate
Chemical cleaning damage	Excessive deposits in waterwalls lead to chemical cleaning; process errors lead to tube damage.
Corrosion fatigue	Poor water chemistry, shutdown or layup practices, and improper chemical cleaning worsen contribution of the environment to causing damage.
Supercritical waterwall cracking and overheating	Excessive internal deposits lead to increased tube metal temperatures; exacerbates mechanism.
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Short-term overheating	Plugging of waterwall orifices by feedwater corrosion products.
Erosion/corrosion of economizer inlet headers	Attack by reducing feedwater conditions.
Pitting (economizer)	Stagnant, oxygenated water formed during shutdown.
BTF Mechanisms in Steam-Touched Tubes that are Influenced by Cycle Chemistry	
Long-term overheating (creep)	If caused by restricted steam flow as a result of contaminant deposits, debris, etc.
Short-term overheating	Blockage from improper chemical cleaning (of SH/RH or waterwalls).
Stress corrosion cracking	Variety of bad environment influences, most directly related to chemistry control and practices.
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For further information on BTF Mechanisms, see "Boiler Tube Failures: Theory and Practice". B. Dooley and W. McNaughton. TR-105261

Benchmarking Clarifications

A. % EAL

- This item is expected to include all outage time attributed to BTF except for major planned boiler overhauls.
  - It should be separated from a total boiler random outage rate (ROR)
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B. Ranking by BTF mechanisms in terms of Mwhrs, EAL or $

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C. Cycle chemistry influenced BTF

- These BTF should be tracked over a rolling 2 year period. If none have occurred over the last 24 months, and the root cause has been addressed, a zero score can be given.

D. What % SH and RH condition assessment

- Self explanatory

E. Do you have a "forced outage plan" other than fix it quick

- To get a zero, this must be a plant-specific outage plan on paper, and must include all the critical "pre-repair inspection" activities for minimizing the probability of a repeat BTF. It's a plus if system status is considered in actually what activities will be done.

F. Action plans for "damaged tubing" and for addressing the root cause to "kill " the mechanism

- Self explanatory.

G. Running with known tube leaks

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H. Normally use pad welds

- To get a zero, a plant-specific maintenance procedure must exist that clearly indicates that for the majority of all boiler tube repairs, when a "serious system condition" doesn't exist, a new piece of tubing rather than a pad or window weld is the standard method of repair.

I. Setting of plant- and/or unit-specific BTF goals

- Self explanatory.

2003 by John Dimmer

Benchmarking a Utility's Boiler Tube Failure Reduction Program

Introduction

EPRI's Boiler Tube Failure Reduction Program/Cycle Chemistry Improvement Program (BTFRP/CCIP) has been designed to assist an organization to reduce the availability loss due to BTF and the costs associated with cycle chemistry influenced problems. Alternatively it can be used to maintain excellence in these areas. Most utilities do not need an organization such as EPRI to indicate to them that their availability loss (AL) percentage (or equivalent) for BTF are good or bad. As the average in the US is currently around 3%, utilities know that if AL is around 6% then this is extremely poor; alternatively as the AL approaches 0.5% then this is very good. The financial penalties in the current competitive market can be enormous.

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All of the factors except C need no further description. Information to determine Factor C is provided below and in the attachment.

Factor C. Chemically Influenced Boiler Tube Failures (BTF)

In the Cycle Chemistry Benchmarking, this question relates to the percentage of the total numbers of BTF over the period, that have resulted in forced outage or unit unavailability and that have been influenced by the cycle chemistry. In this BTFR Benchmarking the question only relates to whether there have been any cycle chemistry influenced BTF. A supplementary listing of those BTF influenced by the chemistry is provided for water-touched and steam-touched tubing. For further information on BTF Mechanisms, see "Boiler Tube Failures: Theory and Practice". B. Dooley and W. McNaughton. TR-105261.

Assessment of a Utility's Boiler Tube Failure Reduction Program

Weighting		Factor	Points	Total	
3	A.	Do you know the Availability Loss (%) Due to BTF		Kahe	Waiau/Hnl
		❑ < 0.5%	0	.066	.066
		❑ 0.5-1%	1		
		❑ 1-2%	2		
		❑ 2-3%	3		
		❑ >3 %	4		
		❑ No	4		
		Sub-total (Points x Weighting)		0	0
2 Waiau/Hnl	B.	Do you have a ranking (priority) for BTF Mechanisms in Plant/System (could be in terms of MWhrs, AL %, or on a cost basis)		Kahe	
		❑ Yes	0	Yes	Yes
		❑ No	1		
		Sub-total (Points x Weighting)		0	0
2	C.	Do you have any cycle chemistry related BTF Mechanisms (See attached for relevant BTF)		Kahe	Waiau/Hnl
		❑ Yes	1	No	Yes
		❑ No	0		
		Sub-total (Points x Weighting)		0	2
2	D.	What percentage of superheater and reheater circuits in your system/plant do you know the remaining life (using oxide scale technique)		Kahe	Waiau/Hnl
		❑ All	0	All	All
		❑ >50%	1		
		❑ <50%	2		
		Sub-total (Points x Weighting)		0	0

Weighting		Factor	Points	Total	
2	E.	Do you have a BTF forced outage plan other than "fix it quick" ?		Kahe	Waiau/Hnl
		❑ Yes	0	Yes	Yes
		❑ No	1		
		Sub-total (Points x Weighting)		0	0
2	F.	Do you have Action Plans for repeat BTF that address:		Kahe	Waiau/Hnl
		a) Damaged tubing			
		❑ Yes	0	Yes	Yes
		❑ No	1		
		Sub-total (Points x Weighting)		0	0
		b) Root Cause (to kill the BTF mechanism)			
		❑ Yes	0	Yes	Yes
		❑ No	1		
		Sub-total (Points x Weighting)		0	0
2	G.	Do you normally continue running with known tube leaks (except in a system emergency)		Kahe	Waiau/Hnl
		❑ Yes	1	No Doc	No Doc
		❑ No	0		
		Sub-total (Points x Weighting)		2	2
1	H.	Do you normally use pad welding (except in a system emergency)		Kahe	Waiau/Hnl
		❑ Yes	1	No Doc	No Doc
		❑ No	0		
		Sub-total (Points x Weighting)		1	1

				Kahe	Waiau/Hnl
1 I.	Do you have a set of BTF goals/objectives				
	❑ Yes		0	Yes	Yes
	❑ No		1		
		Sub-total (Points x Weighting)		0	0
		Total		**3**	**5**

Rating System

World Class	0-5
Very good BTFR Program	6-10
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A. % EAL

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D. What % SH and RH condition assessment

- Self explanatory

E. Do you have a "forced outage plan" other than fix it quick

- To get a zero, this must be a plant-specific outage plan on paper, and must include all the critical "pre-repair inspection" activities for minimizing the probability of a repeat BTF. It's a plus if system status is considered in actually what activities will be done.

F. Action plans for "damaged tubing" and for addressing the root cause to "kill " the mechanism

- Self explanatory.

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- To get a zero, a plant-specific operating procedure must exist that clearly indicates that for the majority of all boiler tube leaks, when a "serious system condition" doesn't exist, the standard is to remove the unit from service in a controlled manner.

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- To get a zero, a plant-specific maintenance procedure must exist that clearly indicates that for the majority of all boiler tube repairs, when a "serious system condition" doesn't exist, a new piece of tubing rather than a pad or window weld is the standard method of repair.

I. Setting of plant- and/or unit-specific BTF goals

- Self explanatory.

CA-IR-51

Ref: State-of-the-art instrumentation and software to track and monitor the operating performance of HECO's steam generating units on a real time basis.

If different from the EMS system that is the subject of Docket No. 03-0360, and not already provided in that docket, please provide:

a. A copy of the feasibility studies addressing the acquisition and implementation of each hardware application and each software program.

b. The in-service date of each hardware application and each software program

c. The capitalized costs by NARUC account for each hardware application and each software program

HECO Response:

a. The data acquisition instrumentation and software being referred to is different from the EMS system that is the subject in Docket No. 03-0360. In this case, the components making up the Data Acquisition projects have been engineered to work in conjunction with the Boiler Distributed Control System upgrades. Signals from the field instruments are sent to either the updated boiler control system or to the data acquisition system. The signals are analyzed either in the Boiler Distributed Control System or by the Plant Information/Process Book software in the data acquisition system. In combination, both provide for the real-time monitoring of the operation of the HECO generating units. There are no feasibility studies addressing the acquisition and implementation of these data acquisition projects.

b. The table on page 3 of this response summarizes the different Data Acquisition projects with each date in service. The same information is provided in the response to CA-IR-52 for the Boiler Control Systems upgrade projects. The table also identifies the capitalization costs and NARUC account number for each of these projects.

The software expense to support the data acquisition projects is an O&M expense and varies with the licensing fees and annual maintenance fees. The amounts paid in past years are as follows:

Date	Amount	NARUC
May 2001	$30,593	512
May 2002	$30,593	512
May 2003	$30,593	512
May 2004	$100,930	502

The expense for May 2004 is for a 3-year software licensing and maintenance agreement.

c. The NARUC accounts for the capitalized costs are also outlined in page 3 of this response. The NARUC accounts for the software O&M expenses are shown in the response to part b. above.

Data Acquisition Projects -- Capital Expense

Unit	Project #	Cap Amt (In Thous)	In Service Date	NARUC Account	NARUC Description
K1	P4010000	$ 275	June-99	312	Boiler Plant Eq
K2	P8980000	$ 230	February-02	312	Boiler Plant Eq
K3	P9542000	$ 491	December-01	312	Boiler Plant Eq
K4	P9541000		CWIP		
K5	P0000267	$ 446	May-04	312	Boiler Plant Eq
K6	P0000266	$ 492	August-02	316	Misc Pwr Plant Eq
K1	PE000785	$ 30	October-03	312	Misc Pwr Plant Eq
W3	P0000260	$ 244	October-04	368	Line Transformers
W4	P0000261	$ 118	November-01	316	Misc Pwr Plant Eq
W5	P0000262	$ 186	December-02	316	Misc Pwr Plant Eq
W6	P0000263	$ 227	March-01	316 &369	Misc Pwr Plt & Dist Srvc
W7	P0000058	$ 464	December-00	312	Boiler Plant Eq
W8	P0000059	$ 448	July-00	316	Misc Pwr Plant Eq
W8	PE000829	$ 4	December-03	312	Misc Pwr Plant Eq
H8	P0000264	$ 246	April-03	316	Misc Pwr Plant Eq
H9	P0000265	$ 56	July-04	311	Struct & Impr

CA-IR-52

Ref: Boiler Control upgrade.

Please provide:

a. A copy of the feasibility studies addressing the acquisition and implementation of each Boiler Control upgrade.

b. The in-service date of each Boiler Control upgrade.

c. The capitalized costs by NARUC account for each Boiler Control upgrade.

HECO Response:

a. While no feasibility studies were conducted to address the acquisition and implementation of each Boiler Control upgrade, beginning with the Waiau 4 project which went in service in 1993, justification for each project is described in the Decision and Order from the Public Utilities Commission. Please refer to the respective Decision and Order documents which are listed on pages 2 and 3 of this response.

b. The in-service dates for each upgrade are listed on pages 2 and 3 of this response.

c. The capitalized costs by NARUC account are listed on pages 2 and 3 of this response.

Boiler Controls Upgrade Projects

Docket No.	Date Filed	In Service Date	Description	D&O No.	Date Approval Received	NARUC Account	Capitalization Cost
NA	NA	1992	K1 Combustion Control Modifications	NA	NA	312	$367K
NA	NA	1992	K4 Combustion Control Modifications	NA	NA	312	$409K
NA	NA	1992	K6 Steam Temperature Control Modifications	NA	NA	312	$221K
NA	NA	1992	K6 Combustion Control Modifications	NA	NA	312	$347K
NA	NA	1992	W7 Steam Temperature Control Modifications	NA	NA	312	$257K
NA	NA	1992	W7 Combustion Control Modifications	NA	NA	312	$427K
NA	NA	1993	W8 Combustion Control Modifications	NA	NA	312	$413K
NA	NA	1993	W8 Steam Temperature Control Modifications	NA	NA	312	$240K
NA	NA	1993	K2 Combustion Control Modifications	NA	NA	312	$409K
NA	NA	1993	K2 Steam Temperature Control Modifications	NA	NA	312	$214K
NA	NA	1993	K3 Combustion Controls Modifications	NA	NA	312	$398K
NA	NA	1993	K3 Steam Temperature Control Modifications	NA	NA	312	$201K
NA	NA	1993	K5 Combustion Controls Modifications	NA	NA	312	$420K
NA	NA	1993	K5 Steam Temperature Control Modifications	NA	NA	312	$240K
7323	06/02/92	1993	Item PP-430, Purchase and Installation of Waiau 4 Controls	11923	10/21/92	312	$2,204K
7745	06/23/93	1994	Item PP-481, Purchase and Installation of Waiau 5 Controls	12554	08/05/93	312	$2,270K
94-0042	03/01/94	11/26/94	For approval to commit funds in excess of $500,000 for Item PP-482, Purchase and Installation of Waiau 6 Controls.	13275	05/27/94	312	$2,116K

Boiler Controls Upgrade Projects

Docket No.	Date Filed	In Service Date	Description	D&O No.	Date Approval Received	NARUC Account	Capitalization Cost
94-0066	03/18/94	04/15/95	For approval to commit funds in excess of $500,000 for Item PP-475, Purchase and Installation of Controls Upgrades for Kahe 2 Control System.	13303	06/14/94	312	$2,902K
95-0093	04/21/95	09/16/96	For approval to commit funds in excess of $500,000 for Item PP-474, Purchase and Installation of Controls Upgrades for Kahe 1 Boiler Control System.	13997	07/18/95	312	$2,575K
01-0072	03/08/01	08/20/02	For approval to commit funds in excess of $500,000 for Item P0000079, the Kahe 6 Boiler Control System Upgrade Project.	18703	07/30/01	312	$2,976K
01-0272	08/14/01	05/15/04	For approval to commit funds in excess of $500,000 for Item P0000078, the Kahe 5 Boiler Control System Upgrade Project.	19142	01/11/02	312	$3,300K
02-0206	08/02/02	11/18/06	For approval to commit funds in excess of $500,000 for Item P9539000, the Kahe 3 Boiler Control System Upgrade Project.	19774	11/15/02	CWIP	$2,656K (est.)
02-0207	08/02/02	04/03/06	For approval to commit funds in excess of $500,000 for Item P9454000, the Kahe 4 Boiler Control System Upgrade Project.	19775	11/15/02	CWIP	$3,006K (est.)

CA-IR-53

Ref: Non-destructive diagnostic instruments.

Please provide:

a. A copy of the feasibility studies addressing the acquisition and implementation of each non-destructive diagnostic instrument.

b. The in-service date of each non-destructive diagnostic instruments.

c. The capitalized costs by NARUC account for each non-destructive diagnostic instrument.

HECO Response:

a. There are no feasibility studies addressing the acquisition and implementation of the non-destructive diagnostic instruments.

b. Please refer to page 2 to this response for the description and in-service date for each non-destructive diagnostic instrument.

c. Please refer to page 2 to this response for the capitalized cost by NARUC account for each non-destructive diagnostic instrument.

Non-Destructive Diagnostic Instruments

Instrument Description	Company	Model No.	Date In Svc	Cost	Comments	NARUC
Vibration Data Collector	CSI	2120	12/01/95	$13,495	Capital Tool	394
Vibration Data Collector	CSI	2120	12/01/95	$13,495	Capital Tool	394
Off-Line Motor Tester	PdMA	MCE 3000	11/01/98	$27,340	Capital Tool	394
Off-Line Motor Tester	PdMA	MCE 3000	04/01/00	$27,340	Capital Tool	394
Ultrasonic Flowmeter	Controlotron	1010WP1	05/01/00	$6,360	Capital Tool	394
Helium Detector	Varian	Helitest Gen	09/01/00	$18,616	Capital Tool	394
Infrared Camera	Flir	PM 695	04/01/01	$50,000	Paid through EPRI project funds	
Upgrade of On-Line Motor Tester	PdMA	MCEmax	12/31/01	$30,605	Capital Tool	394
Partial Discharge Analyzer	Iris Power Engineering, Inc	TGA-B	12/01/02	$99,501	K1 only; Capital Proj. P0000593	312
Ultrasonic Gun	UE Systems	UP 9000	06/01/03	$6,429	Capital Tool	394
Flux Probe Analyzer	Generator Tech, Inc	9610	12/08/03	$17,000	Capital Tool	394
Videoscope System	Olympus	IPLEX SA	02/10/04	$49,163	Capital Tool	394
Ultrasonic Thickness Gage	Panametrics	37DLP	11/23/04	$3,800	Capital Tool	394

CA-IR-54

<u>Ref: Automatic paging and cell phone system.</u>

If different from the EMS system that is the subject of Docket No. 03-0360, and not already provided in that docket, please provide:

a. A copy of the feasibility studies addressing the acquisition and implementation of the automatic paging and cell phone system.

b. The In-service date of each Capitalized costs by NARUC account of the automatic paging and cell phone system.

c. The capitalized costs by NARUC account of the automatic paging and cell phone system.

<u>HECO Response:</u>

This item is not related to the EMS system, Docket No. 03-0360.

a. A feasibility study doesn't exist for this capability. The auto paging and cell phone system utilizes existing capabilities with cell phone text messaging, Outlook, and the existing Process Book software discussed in CA-IR-51.

b. Not applicable.

c. Not applicable.

CA-IR-55

Ref: Production Materials Inventory.

Please provide the following:

a. Actual calculations deriving the 2005 test year average balance as discussed at pages 37 and 38; and

b. Actual production materials inventory balance for each month beginning January 2003 to 2005 to-date.

HECO Response:

a. Actual calculations deriving the 2005 test year average balance using the 5-step process in HECO T-6 at pages 37 and 38 are shown below. Each step in HECO T-6 at pages 37 and 38 is replicated below, followed by the actual calculation used to derive the inventory amount for the 2005 test year.

1) Assume no change from April 2004 inventory value (current at time of calculation) to 2004 year-end inventory value.

   - April 2004 inventory value: **$5,362,679**

2) A forecasted 2004 year-end turn ratio of 0.70 was derived based on the actual April 2004 turn ratio of 0.72 and a projected 3% increase to the 12-month average inventory value by year-end 2004.

   - 2003 year-end average inventory value **$4,899,829** X 1.03 = 2004 projected year-end average inventory value **$5,040,371**

3) The 2004 forecasted inventory value and the 2004 year-end forecasted turn ratio are used as a starting point, entering the 2005 calendar year. An assumption was made that turn ratio in 2005 would stay constant at 0.70 (the 2004 year-end turn ratio result).

4) Using the forecasted 2005 starting inventory value and the projected 2005 year-end turn ratio, the 2005 year-end average inventory value is projected to increase by 4%.

   - 2004 projected year-end average inventory value **$5,040,371** X 1.04 = 2005 projected year-end average inventory value **$5,241,986**

5) The 2005 year-ending inventory value is expected to be 1% higher than the 2005 12-month average inventory value, based on the average five-year trend of this comparison.

	avg value	yr-end value	% change
2000	$3,933,852	$4,005,542	1.82%
2001	$4,067,891	$4,010,686	-1.41%
2002	$4,395,752	$4,439,987	1.01%
2003	$4,899,829	$4,797,614	-2.09%
2004	$5,040,371	$5,362,679	6.39%
		AVERAGE:	**1.15%**

- 2005 projected year-end average inventory **$5,241,986** PLUS 1% (X 1.01) = 2005 projected year-end value **$5,294,406**

b. The actual production materials inventory balance for each month beginning January 2003 to December 2004 is provided in Attachment 1.

Hawaiian Electric Company, Inc.
2005 Test Year
Production Material Inventory Monthly Balance

ENDING INVENTORY $

MONTH END		MONTH END	
Jan-03	$4,627,312	**Jan-04**	$4,953,411
Feb-03	$4,758,315	**Feb-04**	$4,988,501
[illegible]	[illegible]	[illegible]	[illegible]

CA-IR-56

Ref: EPRI-based T&D Maintenance Optimization Program.

Please provide the following regarding the noted program:

a. Copies of all studies addressing the feasibility of the program and identify any and all expectations from the program.

b. The costs incurred to-date by month, by NARUC account related to the program.

c. The budgeted 2005 expenditures by month, by NARUC account related to the program.

d. A listing of each change to the 2005 rate case budget that was reflected, as a result of implementation of the Program along the annual dollar impact of each change noted.

HECO Response:

a. In 2002, we contracted with EPRI Solutions to assist us in performing a self- assessment of the current maintenance organization and practices in the Construction and Maintenance (C&M) and System Operation Departments. As a result of the assessment, EPRI Solutions working with a team of HECO Superintendents, Principal Engineers and other management personnel developed a list of recommendations. These recommendations are shown on Attachment A, titled, "Recommended Initiatives for Optimizing Maintenance". After a review, it was determined that the recommended initiatives needed to be prioritized in light of the current [illegible]

Implementation of a PdM organization in Substation

Maintenance Basis Training

o Helicopter Borne – Airborne Inspection System (AIS), Infrared (IR), and Corona Inspections

The SERP pilot was completed in 2003. Please refer to Attachment B titled, "Maintenance Optimization Support for Phase II Pilot Project at HECO", Task 1, dated 5/5/03. In this pilot, EPRI Solutions provided training on a methodology to prioritize individual pieces of equipment based on the criticality of the equipment to the system. As a result of this pilot the System Criticality Rankings (SCR) for all Substations and Circuits were developed. Please refer to Attachment C for an example showing the first few pages of a listing of Substation Transformers by SCR and Attachment D for an example showing the first few pages of a listing of Circuits by SCR.

The Substation PdM pilot was completed in 2004. Please refer to the Attachment B, Task 3, for a description of this effort. In this pilot, EPRI Solutions demonstrated the application of predictive maintenance technologies such as Infrared and Corona imaging, vibration and ultrasound analysis. Attachment E, titled, "Condition Status Report for HECO" dated May/June 2004 was prepared under this pilot.

After a review of the results of the Substation PdM pilot, it was decided to proceed with the implementation of a Predictive Maintenance organization in Substation, planned for

Predictive Maintenance Engineer, which is listed in CA-IR-1, HECO T-8, Attachment K, page 3, as a Substation PDM Engineer. Please refer to the Attachment F, titled, "HECO C&M Phase III Maintenance Optimization Proposed Scope of Work", Task 2 & 3, for more information on this item.

Maintenance Basis training by EPRI Solutions was completed in January 2005. Personnel at HECO were provided training in the development and documentation of the maintenance programs for major pieces of equipment. The Maintenance Basis documents the predictive and preventive maintenance tasks, as well as, schedules for these tasks. Please refer to Attachment F, Task 1, for more information on this item.

The "Helicopter Borne – (Airborne Inspection System) High Resolution Digital Camera survey, Infrared (IR) inspection, and Corona inspection" is focused on our Transmission System and the effort is explained in Attachment F, Task 4. We are planning to contract with EPRI Solutions, in 2005, to perform the Airborne Inspection using a high resolution camera. This involves the mounting of a high resolution camera on a helicopter and taking images of each transmission structure. The images are then visually inspected to detect any problems or defects on the structures. The Infrared (IR) survey is done with our own staff using an infrared camera from the ground or via helicopter for inaccessible areas. The camera will detect any "hot spots" on the system which would indicate a problem. The Corona survey is performed by a contractor using a corona camera from the ground or via helicopter for inaccessible areas. The camera will detect ionized air near the conductors indicating possible problems due to arcing. The IR and Corona work was initially done in 2004 and is scheduled to be performed annually.

We are in the initial stages of the Maintenance Optimization effort. As noted we have completed pilot projects and initial training and much more work is required to fully develop the Maintenance Bases for all major equipment, implement the support processes and organizations and gain the necessary knowledge and experience.

We have not quantified the benefits of these programs. Our expectation as we move forward is to use technology and process improvements to make more effective use of our maintenance funds. As our system ages and more facilities are added these initiatives are expected to help us manage the increasing maintenance costs. The Maintenance Optimization program is seen as an ongoing effort of continuous improvement.

b. The costs to date, by NARUC, are shown on Attachment G.

c. The budgeted 2005 expenditures by month, by NARUC, are shown on Attachment H.

d. The one significant change to the 2005 test year forecast is the inclusion of a Substation PDM Engineer in the System Operation Department. The amount forecasted for this position is approximately $164,000, which consists of labor and related on-cost charges.

CA-IR-56
DOCKET NO. 04-0113
ATTACHMENT A
PAGE 1 of 1

s for Optimizing Maintenance

dM process across EDP

ources to inspection and Condition Monitoring

step)

echniques to Prioritize Assets

ng and Maintenance Priority Index

asis Optimization

M) Templates for critical assets

e Maintenance (PAM) Program

to allow for learning from history
ting CM-U's

Scheduling Process across EDP

lning and scheduling across C&M, Substation, &

laintenance Metrics - Performance Monitoring
ne bottom-line"
ct focus & results
nittee for project milestones, results,
ts

EPRI SOLUTIONS

Draft Proposal to provide:

Maintenance Optimization Support for

Phase II Pilot Project at HECO

System & Equipment Reliability Prioritization (SERP), Maintenance Basis Optimization (MBO) and Predictive Maintenance(PdM)

(Proposal# P#####)

Submitted to:
Hawaiian Electric Company

05/05/03

EPRIsolutions Point of Contact: Pat Abbott

Telephone: 407-321-3586
Email: pabbott@eprisolutions.com

TABLE OF CONTENTS

1 INTRODUCTION / PROPOSAL SUMMARY

[redacted]

2 SCOPE / STATEMENT OF WORK / DELIVERABLES

Task 1: System and Equipment Reliability Prioritization (SERP)

EPRIsolutions will provide coaching and support for performing the SERP process that will generate a quantitative ranking for all major systems in the HECO (Oahu) Network and subsequently each major component in a Pilot System as selected by HECO EDP.

These methods and techniques and industry experience will be covered in a two-day training session. At the conclusion of the second day, an interactive session with the HECO EDP Maintenance Management team will be conducted to review and determine the recommended specific approach for implementing MBO for the Pilot Circuit.

MBO Implementation

Based on the recommended approach for optimizing the maintenance basis, EPRIsolutions Senior Maintenance Consultants will coach HECO through guided exercises to create and capture an optimized maintenance basis for various pilot systems and/or components. An MBO review including recommended PM task additions, deletions and frequency modifications will be developed. The basis for the resulting PM tasks will be documented and the impact of the changes will be captured.

Upon completion of this pilot MBO application, results and impact on equipment reliability and O&M cost will be captured and presented to the HECO Leadership team.

Task 3: Predictive Maintenance (PdM) Pilot Application

PdM Classroom Training

EPRIsolutions will provide one day of classroom training to educate HECO EDP personnel on the condition monitoring techniques to be applied and the process of developing equipment condition status reports. Severity/action level criteria will be presented and discussed in the training. Specific equipment anomalies detected using the techniques will be presented. The process and objectives for the fieldwork will be covered.

PdM Field Training and Technology Demonstration

EPRIsolutions predictive maintenance experts will perform a PDM survey on all major/critical equipment in various Substations as selected by HECO EDP. Various new [redacted] new techniques. The objective of the pilot PdM surveys will be to raise the level of awareness of HECO predictive maintenance personnel of new condition monitoring technologies and new application techniques of existing technologies.

EPRIsolutions will provide all testing equipment necessary for the surveys.

Prior to the on-site training and demonstration survey activities a list of the critical Components to be included in the Pilot Predictive Maintenance Surveys will be generated

with the support of HECO EDP personnel from single line diagrams and master equipment lists. HECO will be required to collect a full set of transformer & tap changer oil samples and provide the laboratory analysis results to EPRIsolutions prior to the performance of the PDM surveys. Additional oil samples may be requested for collection and analysis based on the findings of the PDM surveys.

Two EPRIsolutions PdM experts will be on-site for two weeks to perform the one-day training and then perform as many SPdM surveys at the HECO selected substations.

Upon completion of the field survey, an exit meeting with the HECO EDP Maintenance management team will be conducted to discuss findings and remaining actions to develop the formal equipment condition report.

Equipment Condition Status Report

Immediately following the predictive maintenance surveys, EPRIsolutions experts will review and analyze all data collected with HECO personnel.

- Schedule
- Budget

Upon completion the plan will presented to the HECO EDP oversight committee for review and approval.

3 SCHEDULE

A detailed schedule will be prepared with upon acceptance of this proposal.

4 COSTS

The cost for three EPRIsolutions representatives to conduct the tasks outlined above is $158,821.

These costs include all labor, and travel expenses for EPRI solutions personnel. The price for this proposal is based on a cost plus fee contract in accordance with the terms of a standard EPRIsolutions TC Agreement.

5 TERMS AND CONDITIONS

This proposal is good for a period of 45 days.

System Criticality Ranl - Substation Transformers

HECo	Honolulu						
SCR	System Name	SystemID	Type	Text40	Redundancy Factor	Environmental (EN)	Availability (AV)
19.52	KAHE TRANS	138KV	TRANS	10	10	10	9
17.58	KOOLAU TRANS	138KV	TRANS	10	9	8	8
17.47	WAIAU TRANS	12KV	TRANS	7.5	10	10	7
15.17	HALAWA TRANS	138KV	TRANS	8	7	9	6
14.63	MAKALAPA TRANS	138KV	TRANS	10	7	4	7
14.59	PUKELE TRANS	138KV	TRANS	8	8	6	7
13.96	ARCHER TRANS	46Kv	TRANS	8	9	1	7
13.94	EWA NUI TRANS	138KV	TRANS	7.5	7	8	5
13.34	IWILEI TRANS	138KV	TRANS	8	7	4	7
12.70	AIRPORT 1-12KV	12KV	DIST	7.5	10	1	2
12.70	AIRPORT 2-12KV	12KV	DIST	7.5	10	1	2
12.57	SCHOOL ST. TRANS	138KV	TRANS	8	6	3	7
11.87	KEWALO TRANS	138KV	TRANS	6	10	1	2
11.75	WAHIAWA TRANS	138KV	TRANS	8	4	3	7
10.54	KUAHUA 1-12KV	12KV	DIST	10	1	1	3
10.54	KUAHUA 2-12KV	12KV	DIST	10	1	1	3
10.54	PUULOA 1-12KV	12KV	DIST	10	1	1	3
10.54	PUULOA 2-12KV	12KV	DIST	10	1	1	3
10.30	MOKAPU 1-12KV	12KV	DIST	10	1	1	2
10.30	MOKAPU 2-12KV	12KV	DIST	10	1	1	2

System Criticality Rank · Substation Transformers

IECo	Honolulu						
CR	System Name	SystemID	Type	Text40	Redundancy Factor	Environmental (EN)	Availability (AV)
.15	HICKAM 1-12KV	12KV	DIST	10	1	1	1
.15	HICKAM 2-12KV	12KV	DIST	10	1	1	1
.15	HICKAM 3-12KV	12KV	DIST	10	1	1	1
27	CEIP TRANS	138KV	TRANS	6	4	3	5
23	AIRPORT TRANS	138KV	TRANS	7.5	4	3	2
17	CAMP SMITH 1-12KV	12KV	DIST	9	1	1	1
17	CAMP SMITH 2-12KV	12KV	DIST	9	1	1	1
)7	ARCHER DIST	46Kv	DIST	7.5	4	1	3
38	ARCHER 1-12KV	12KV	DIST	7.5	3	1	2
38	ARCHER 2-12KV	12KV	DIST	7.5	3	1	2
38	EWA NUI 1-12KV	12KV	DIST	7.5	3	1	2
38	HALA 2-12KV	12KV	DIST	7.5	3	1	2
38	HILA 1-12KV	12KV	DIST	7.5	3	1	2
38	HILA 2-12KV	12KV	DIST	7.5	3	1	2
38	HOAEAE 2-12KV	12KV	DIST	7.5	3	1	2
38	KAILUA 1-12KV	12KV	DIST	7.5	3	1	2
38	KAONOHI 1-12KV	12Kv	DIST	7.5	3	1	2
38	KAONOHI 2-12KV	12Kv	DIST	7.5	3	1	2
38	KAPALAMA 1-12KV	12KV	DIST	7.5	3	1	2
38	KAPALAMA 3-12KV	12KV	DIST	7.5	3	1	2

System Criticality Rank Substation Transformers

HECo	Honolulu						
SCR	System Name	SystemID	Type	Text40	Redundancy Factor	Environmental (EN)	Availability (AV)
8.38	KAPIOLANI 1-12KV	12KV	DIST	7.5	3	1	2
8.38	KEEHI 1-12KV	12KV	DIST	7.5	3	1	2
8.38	KEEHI 4-12KV	12KV	DIST	7.5	3	1	2
8.38	MCCULLY 2-12KV	12KV	DIST	7.5	3	1	2
8.38	SCHOOL ST 1-12KV	12KV	DIST	7.5	3	1	2
8.38	SCHOOL ST 2-12KV	12KV	DIST	7.5	3	1	2
8.38	SCHOOL ST 3-12KV	12KV	DIST	7.5	3	1	2
8.38	WAHIAWA 1-12KV	12KV	DIST	7.5	3	1	2
8.38	WAHIAWA 2-12KV	12KV	DIST	7.5	3	1	2
8.37	AES TRANS	138Kv	TRANS	4	3	3	6
8.20	FORT STREET 1-12KV	12KV	DIST	7.5	3	1	1
8.20	KAHALA 2-4KV	4KV	DIST	7.5	3	1	1
8.20	KAIMUKI 1	4KV	DIST	7.5	3	1	1
8.20	POHAKUPU 2-12KV	12KV	DIST	7.5	3	1	1
8.08	BARBERS PT. SW. STA	46Kv	DIST	7.5	2	1	2
8.08	KAHUKU 1-12KV	12KV	DIST	7.5	2	1	2
7.94	KAKAAKO 3-12KV	12KV	DIST	7	3	1	2
7.94	KAKAAKO 4-12KV	12KV	DIST	7	3	1	2
7.94	KANEOHE 3-12KV	12KV	DIST	7	3	1	2
7.94	KEWALO 1-12KV	12KV	DIST	7	3	1	2

System Critica ankings - Circuits

SCR	System Name	SystemID	Type	Reliability	Redundancy Factor	Load	Maintenance Access	Load Type
22.55	WAIAU - KOOLAU 1	138KV	CKT-T	7.5	1	7	10	5
22.55	WAIAU - KOOLAU 2	138KV	CKT-T	7.5	1	7	10	5
22.51	HALAWA - KOOLAU	138KV	CKT-T	8	1	6	10	5
21.20	KAHE - HALAWA 1	138KV	CKT-T	8	1	7	7	5
21.20	KAHE - HALAWA 2	138KV	CKT-T	8	1	7	7	5
20.52	KOOLAU - AIKAHI	46KV	CKT-ST	7.5	4	4	5	10
20.18	WAIAU - WAHIAWA	138KV	CKT-T	7.5	1	2	10	5
20.07	KOOLAU - LAELAE - KAHUKU	46KV	CKT-ST	8	4	4	6	7
19.80	WAHIAWA - MIKILUA	46KV	CKT-ST	6	4	4	8	9
19.51	KOOLAU - PUKELE 1	138KV	CKT-T	5	3	6	10	5
19.51	KOOLAU - PUKELE 2	138KV	CKT-T	5	3	6	10	5
19.20	KAHE - WAIAU	138KV	CKT-T	8	1	7	1	5
18.90	KOOLAU - KAHUKU	46KV	CKT-ST	7.5	4	4	5	7
18.33	KOOLAU - POHAKUPU	46KV	CKT-ST	6	4	4	7	7.5

System Critica ankings - Circuits

SCR	System Name	SystemID	Type	Reliability	Redundancy Factor	Load	Maintenance Access	Load Type
18.26	PUKELE 7	46KV	CKT-ST	6	3	5	8	5
18.08	PUKELE 6	46KV	CKT-ST	6	3	4	8	6
17.99	KAHE - WAHIAWA	138KV	CKT-T	5	3	7	7	5
17.76	KALAELOA - EWA NUI	138KV	CKT-T	1	1	7	10	5
17.70	MAUKA	12 Kv	CKT-D	9	4	2	0	0
17.55	HALAWA 4	46KV	CKT-ST	5	4	5	5	9
17.39	KOOLAU - NUUANU - LAELAE	46KV	CKT-ST	7.5	3.5	1	5	6
17.17	KOOLAU - WAILUPE 2	46KV	CKT-ST	5	3	5	8	5
16.92	EWA NUI 42	46KV	CKT-ST	6	4	4	5	7
16.90	WAIALAE NUI	12 Kv	CKT-D	9	0	1	0	0
16.78	WAIALUA - KAHUKU	46KV	CKT-ST	5	4	3	7	7.5
16.57	KOOLAU - WAILUPE 1	46KV	CKT-ST	5	3	4	8	5
16.49	KAHE - PERMANENTE	46KV	CKT-ST	6	3	3	7	5
16.37	HALAWA 1	46KV	CKT-ST	5	3	5	5	7.5

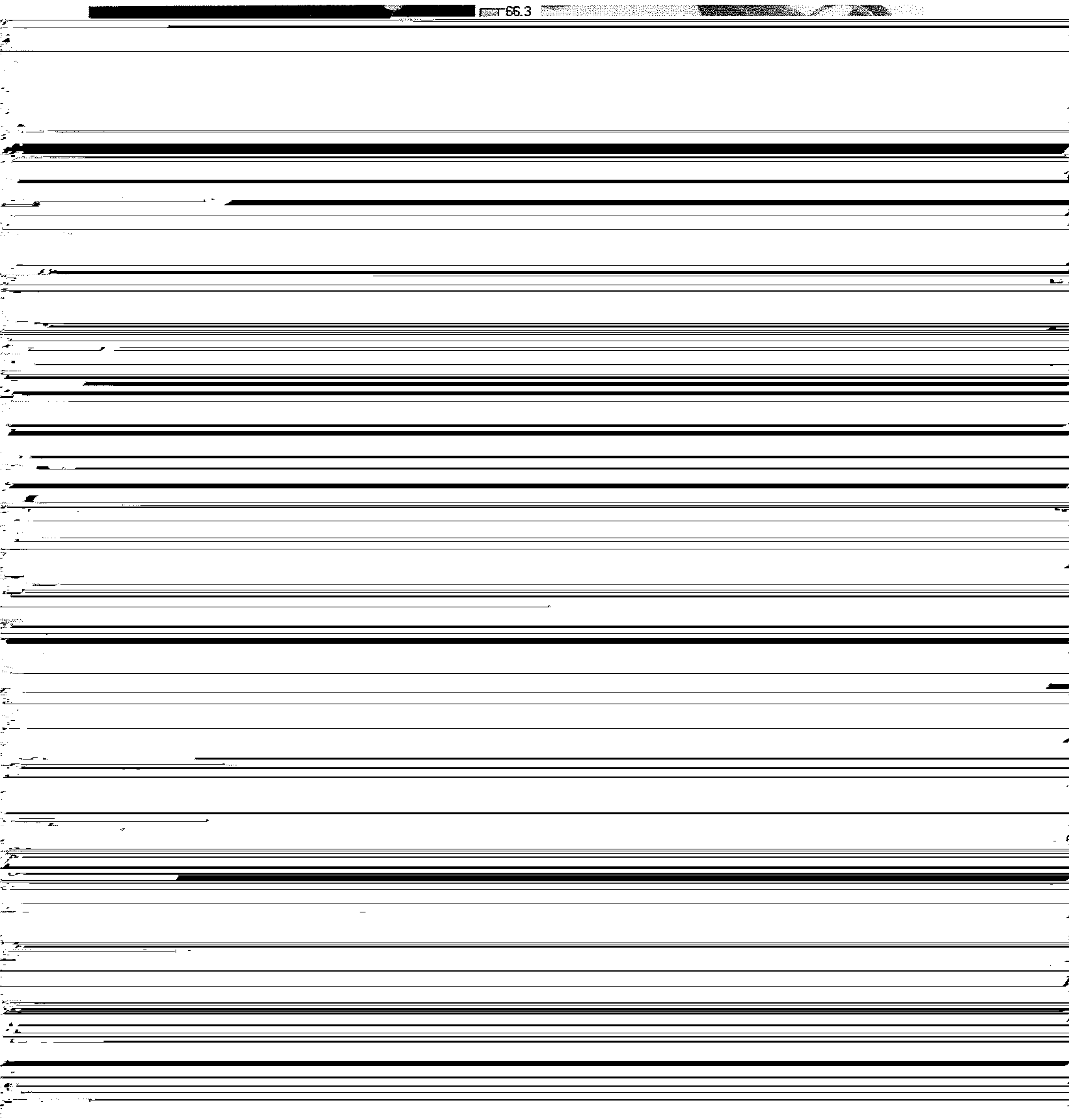
System Critica ankings - Circuits

ystemID	Type	Reliability	Redundancy Factor	Load	Maintenance Access	Load Type
6KV	CKT-ST	5	4	4	5	7.5
2 Kv	CKT-D	8	4	2	0	0
6KV	CKT-ST	4	3	5	7	6
6KV	CKT-ST	5	3	3	7	6
2 Kv	CKT-D	8	4	1	0	0
38KV	CKT-T	5	3	7	1	5
6KV	CKT-ST	7	3	3	2	5
6KV	CKT-ST	4	4	5	6	6
6KV	CKT-ST	3	3	5	6	7.5
2 Kv	CKT-D	8	0	1	0	0
2 Kv	CKT-D	8	0	1	0	0
2 Kv	CKT-D	8	0	1	0	0
2 Kv	CKT-D	8	0	1	0	0
2 Kv	CKT-D	8	0	1	0	0

EPRI SOLUTIONS

Condition Status Report for

Distribution Line Scan
A 110C rise was detected during a trial scan of the Campbell Industrial Park.
This problem was turned into maintenance for repair.



EPRIsolutions /Hawaiian Electric Company
SPdM Project Report
Jon L. Giesecke, Senior Project Manager

Background:
The Substation Predictive Maintenance Group consisting of George Spencer and Jon Giesecke, completed the data collection and 'Condition Assessment' at HECO during the weeks of May 24th thru June 5th, 2004.

Scope:
The equipment included in this survey are listed as important components for the operation of the HECO system. (See the Condition Status Report (CSR) for equipment list details)

Technologies:
The CSR page lists the <u>tests performed</u>, the <u>technologies used</u> and the <u>overall condition</u> of each piece of equipment surveyed. (Note: when viewing the CSR page notice the amount of good conditions detected.)

Results:
Many conditions detected are considered in the serious category and several are critical. The overall condition of the listed substations and components reveals the necessity for a change in the way maintenance is being done.

The list below is made up of observations and recommendations derived from our SPdM process.

General Observations (O) and Recommendations (R):
O> No consistent DGA or Oil Quality history exists.
R> Institute & Maintain Oil monitoring program. This is paramount for maintenance decisions on transformers and LTC's.
O> No power factor program or history exists.
R> Institute & maintain a power factor program. Trending the condition of the electrical infrastructure is necessary to make an educated decision.
O> The Circuit Breaker preventive maintenance program is less than adequate. The overhaul schedule is not up the date. Control cabinets are in poor condition, many rusted through, heaters INOP or missing, wiring exposed, mechanism lubrication is in question. In the condition, the probability of catastrophic failures in the future is likely.
R> Institute an aggressive breaker PM program, including trip testing & oil sampling.
O> The substation yards are overgrown with vegetation and weeds. The stones have settled & earth is exposed. This is a safety concern due to the ground (earth) contact of personnel. Also during a fault the vegetation may become fuel for the spread of the fire.
R> Remove and control the vegetation then re-stone the yards.
O> Many flexible gate grounds were found broken or missing. This is an OSHA requirement to prevent injury from circulating current.
R> Inspect & repair existing flexible gate grounds, install grounds where missing, inspect all equipment and fence grounds.
O> A partial Infrared (IR) scan of the distribution system detected a critical hot spot. IR scans are not being done in a consistent manor.
R> Institute an IR & visual inspection of entire distribution system.
R> Recommend the setup of an SPdM process, including training of in-house personnel in the use of the condition monitoring technologies that were used during the EPRIsolutions' inspection.
R> Recommend building preventative maintenance (PM) basis templates.

Legend:

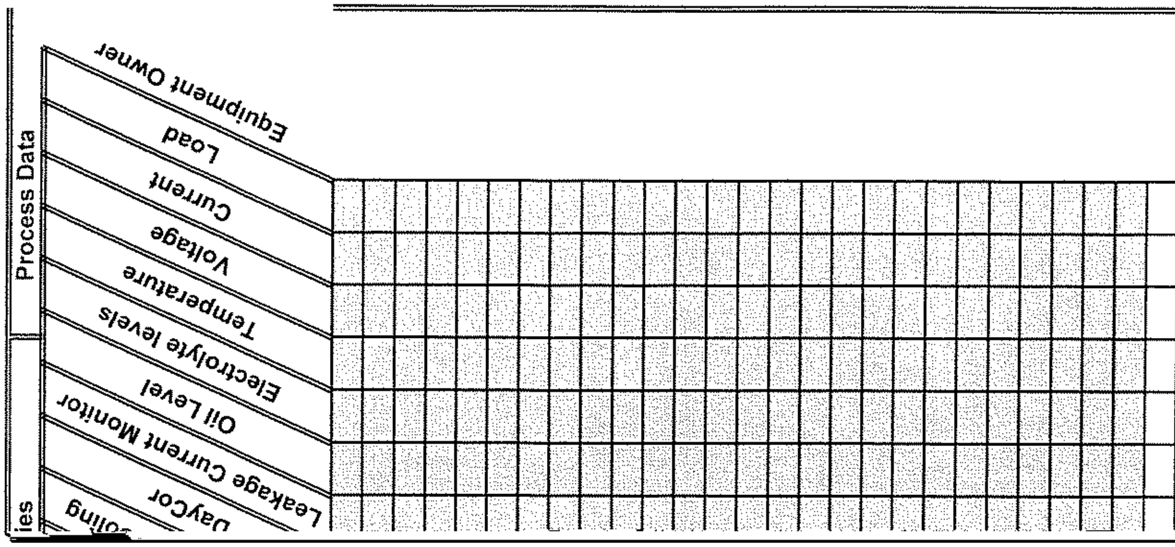
Acceptable	**Green** = Acceptable (no significant deviations from normal operating conditions; continue normal operations and monitoring; no maintenance action required)
Monitor	**Blue** = The detected condition needs to be monitored, tracked or trended. No maintenance action is required at this time. NOTE: Action initiated for tracking, trending and monitoring.
Marginal	**Yellow** = Minor deviations from normal operating conditions with little probability of damage or failure; normal or modified operations and monitoring may be applied. NOTE: Action initiated for corrective maintenance
	Red = Serious deviations from normal operating conditions with high probability for damage or failure; modified operations or removal from service may be required; Action initiated for corrective maintenance.

Equipment Owner	Load	Current	Voltage	Temperature	Electrolyte levels	Oil Level	Leakage Current Monitor
HECO	X					A	
	X					A	
	X					A	
	X					A	
	X					A	
						A	
						A	
						A	
						A	
						A	
						A	
						A	
						A	
						A	
						A	
						A	
						A	
						A	

Process Data ... logies

DayCor ... al test Cooling

Equipment Inspected	General Condition	Visual Inspection	Ultrasonic Noise Analysis	Infrared Thermography	Oil Analysis (DGA)	Oil Quality	Vibration Analysis	Air Flow	Functional test LTC	Functional test Cooling	DayCor	Leakage Current Monitor	Oil Level	Electrolyte levels	Temperature	Voltage	Current	Load	Equipment Owner
		SPDM Technologies													Process Data				
GCB 5303 HE 991		A	A	A							A								
PT, Bus B			A	A							A								
#1 Line PT			A	A							A								
SW 146A		A	A	A							A								
SW 146L		A	A	A							A								
SW 147A		A	A	A							A								
SW 147B		A	A	M							A								
SW 148B		A	A	A							A								
SW 148C		A	A	A							A								
SW 149C		A	A	A							A								
SW 149D		A	A	A							A								
SW 150D		A	A	A							A								
SW 150L		A	A	A							A								
Cap Bank 4488		A	A								A								
Cap Bank 4745		M	A								A								
BUS B UNIT 1 SW 151		A	A	A							A								
BUS C UNIT 2 SW 152		A	A	A							A								
BUS A UNIT 3 SW 153		A	A	A							A								
BUS D UNIT 4 SW 154			A	A							A								
SW 4743		A	A	A							A								
SW 4801		A	A	A							A								
SW 4802		A	A	A							A								
SW 4803		A	A	A							A								
SW 4804		A	A	A							A								
SW 4805		A	A	A							A								
SW 4806		A	A	A							A								
SW 4807		A	A	A							A								

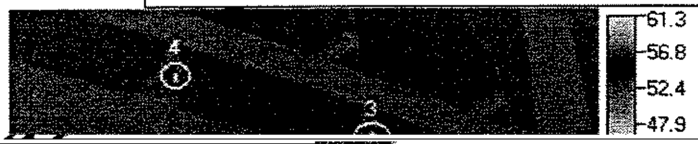

Process Data
Equipment Owner
Load
Current
Voltage
Temperature
Electrolyte levels
Oil Level
Leakage Current Monitor
DayCor
ies

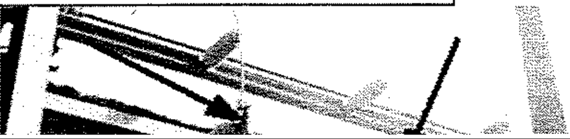
Equipment Inspected	General Condition	SPDM Technologies												Process Data					
		Visual Inspection	Ultrasonic Noise Analysis	Infrared Thermography	Oil Analysis (DGA)	Oil Quality	Vibration Analysis	Air Flow	Functional test LTC	Functional test Cooling	DayCor	Leakage Current Monitor	Oil Level	Electrolyte levels	Temperature	Voltage	Current	Load	Equipment Owner
	KEY																		
	Reading Taken		X																
	Acceptable		A																
	Monitor/Watch		W																
	Problem Detected		M																
	Unacceptable																		

Station	Equipment	Description of Occurrence or Comment	Severity	Recommendation	Link to Image Page
Pukele	Transformer #1	Fans failed to run. Note: Found short in fan circuit.	****	Inspect and repair - This was repaired.	
	Transformer #2	A 200C + temperature rise was detected on the four hole pad connector on A Phase low side bushing. (Note, repairs were made)	****	Inspect and repair - This was repaired.	
	OCB 147	Control Cabinet rusted through, animal intrusion evident, relay cover damaged, fuse jumpered	****	Inspect and repair	
	Cap Bank 4488	B phase terminals hot - 200C	****	Inspect and repair - This was repaired.	
	Transformer #4	Flow gauge is erratic, usually indicates a pump problem. Both pumps are very noisy. Pump #1 = .574 in/sec; Pump #2 = .32 in/sec. Note: .1 ips is considered the trigger point for pump repair.	****	Inspect and repair pumps	
	OCB 147	B phase drain pipe has a large rusted spot which appears to be more than half way thru the pipe.	****	Inspect and repair	
	Bus B Potential Trans	The switch box on the low side of the PT is rusted away. Large pieces of rust laying inside box near energized terminals.	****	Replace Box	
	Disconnect 154	The Arc runner is missing from A Ø	****	Inspect & Repair	
	#1 Line PT	Low side electrical boxes rusted through.	****	Replace Box	
	Transformer #2	Oil shut off valves have parts missing that hold the valves in the open position. Valves are impacting as they are being moved by the oil flow.	****	Repairs were made.	
	Gate Grounds	Missing from main gates and personnel gate. One broken from the east side gate.	****	Inspect & Repair	
	All Transformers	DGA and Oil quality testing is not up to date. No history exists only random records found. No power factor test records are available.	****	Initiate Oil & Power Factor Program	
	Cap Bank 4745	Fuse blown on B phase. B phase terminals hot, one right side and one left side.	***	Inspect and repair	
	Transformer #4	A 57.3 C rise was detected on the bottom left terminal of the motor control contactor.	***	Inspect and repair	
	Transformer #4	SCT coil Bottom left terminal hot, insulation is burnt off the wire 1.5 in from termination.	***	Inspect and repair	
	Transformer #3	Top Oil gauge is frozen in place @ 60C. Pump #2 gauge is broken. One high side bushing is pegged HI. Lower drag and on the LTC does not reset. The gear box on the LTC is very noisy.	**	Inspect and repair	
	Transformer #2	Selector compartment oil level indication is pegged on HI.	**	Inspect & Repair	
	Disc. 4818	Line side hot terminals	**	Inspect and repair	
	OCB 149	Control Cabinet heater is INOP	**	Inspect and repair	
	Transformer #3	Three hot terminals were detected on the 8/3 brkr terminal	**	Inspect and repair	
	Disconnect 4813	An 18C and 13C rise was detected on the line side disconnect B Ø hinge.	**	Inspect and repair	

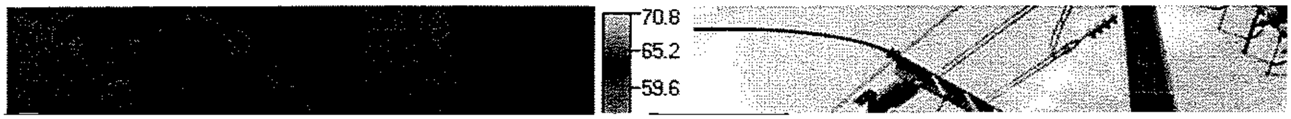
	Disconnect 147B	A 35C rise was detected on the C Ø hinge.	**	Inspect and repair	
	OCB 4820	A 17C and 16C rise were detected on bushing terminals	**	Inspect and repair	
	GCB 4745	Air leak detected on exhaust valve. Heater is INOP, rusted interior.	**	Inspect and repair	
	Substation Yard	Weeds are overtaking the yard, the stones are settling into the earth.	**	Kill weeds, clean up yard, re-stone	
	Transformer #2	The A phase high side bushing oil level is pegged HI	*	Inspect and repair	
	Transformer #4	Active oil leak next to Pump 2, (epoxy repair is leaking)	*	Inspect and repair	
Return to CSR					
	Severity Key	* **Minor**			
		** **Intermediate**			
		*** **Serious**			
		**** **Critical**			

Pulele Station
Disconnect 4818
Three hot spots were detected, 2 on BØ and 1 on AØ.
See Temperatures below.





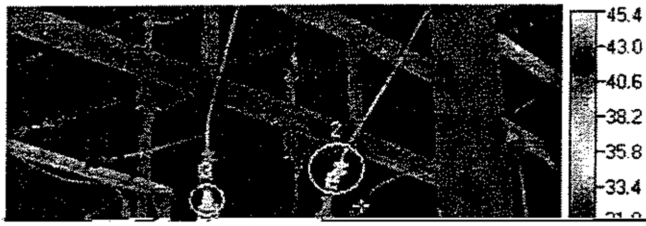
Pulele Station
Capacitor Bank 4488
A 132C Rise was detected on the capacitor terminal. This is on BØ.



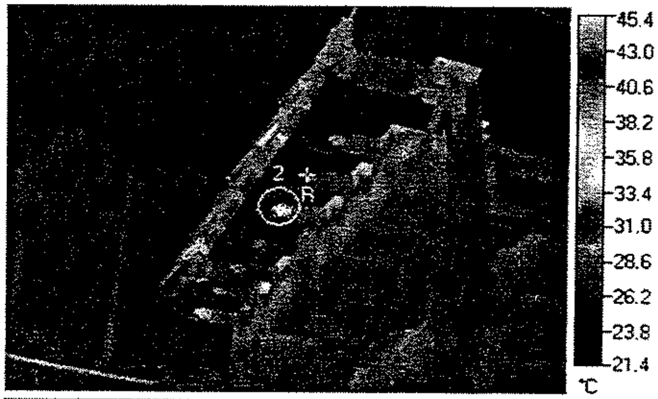
4 Transformer Control

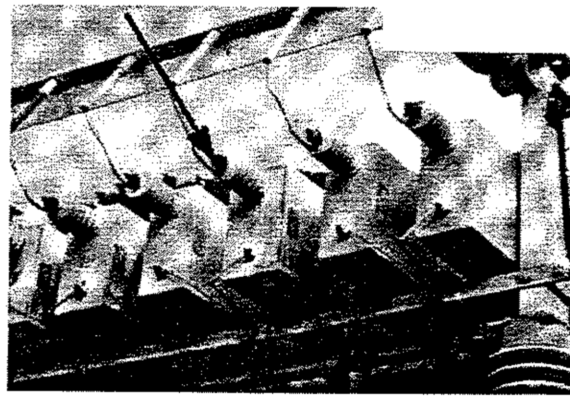
A 14.7C Rise was detected on the bottom left terminal of the SCT coil. Also noticed was the insulation burned off the wire and the discoloration of the

An 18C and a 16C Rise hot spots were detected on 2 connections.



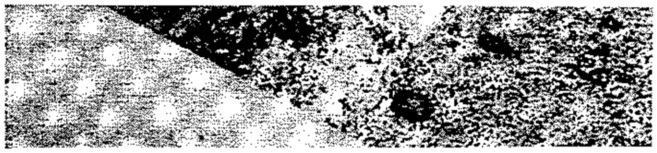
this rack as well.

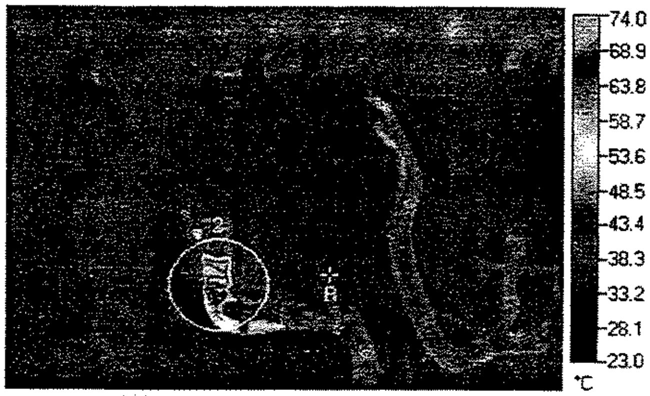


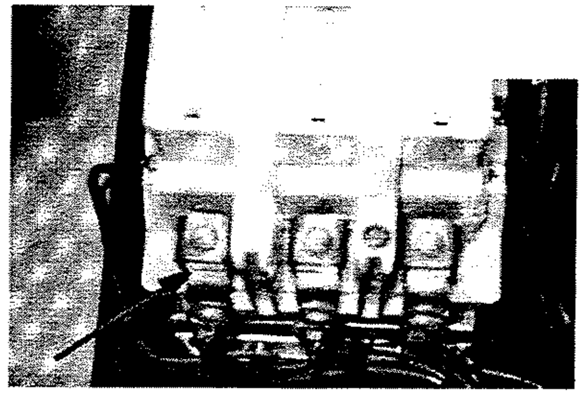


	Ref.	Circle 2
Emissivity	0.70	0.70
Avg Temp °C		36
Min Temp °C		30
Max Temp °C	39.3	68.3
Delta Ref. °C		29

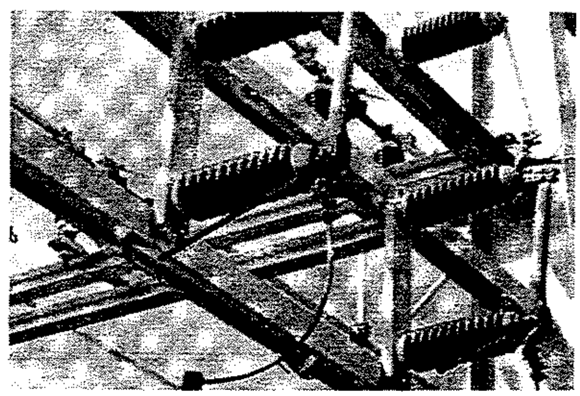
Pulele Station
OCB 147
Control Cabinet is rusted through allowing water and animals to enter the cabinet.





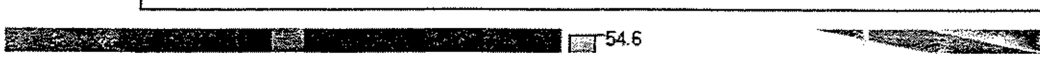


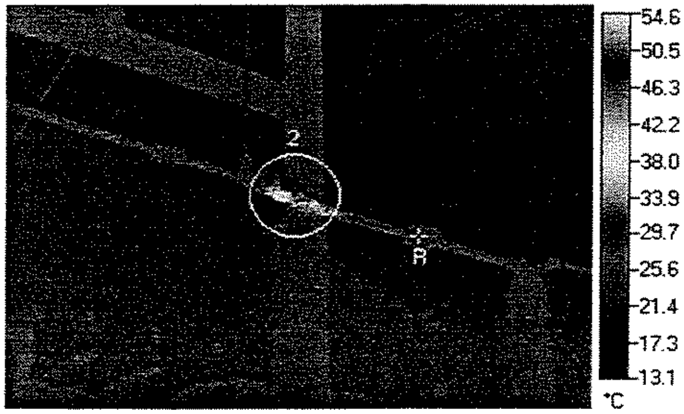
	Ref.	Circle 2
Emissivity	0.70	0.70
Avg Temp °C		55.7
Min Temp °C		37.2
Max Temp °C	39.4	96.7
Delta Ref. °C		**57.3**

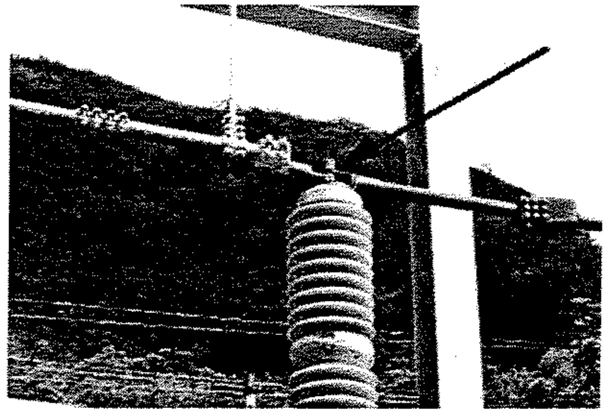


	Ref.	Circle 2	Circle 3
Emissivity	0.70	0.70	0.70
Avg Temp °C		38.8	34
Min Temp °C		9.5	-14.7
Max Temp °C	37.5	55.5	50.7
Delta Ref. °C		**18**	**13.2**

Pulele Station
Disconnect # 147B
A 35C temperature rise was detected on the C phase hinge.

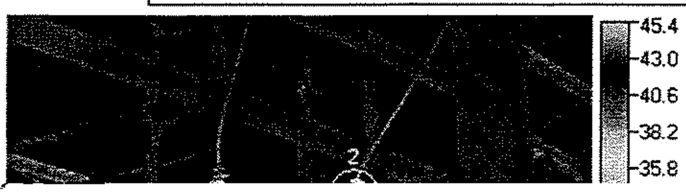


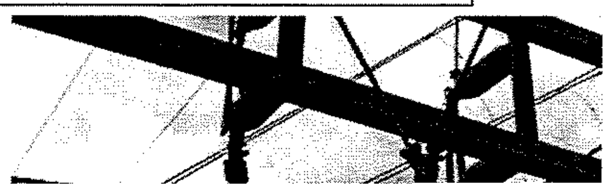




	Ref.	Circle 2
Emissivity	0.70	0.70
Avg Temp °C		34.3
Min Temp °C		18
Max Temp °C	36.7	71.6
Delta Ref. °C		**34.9**

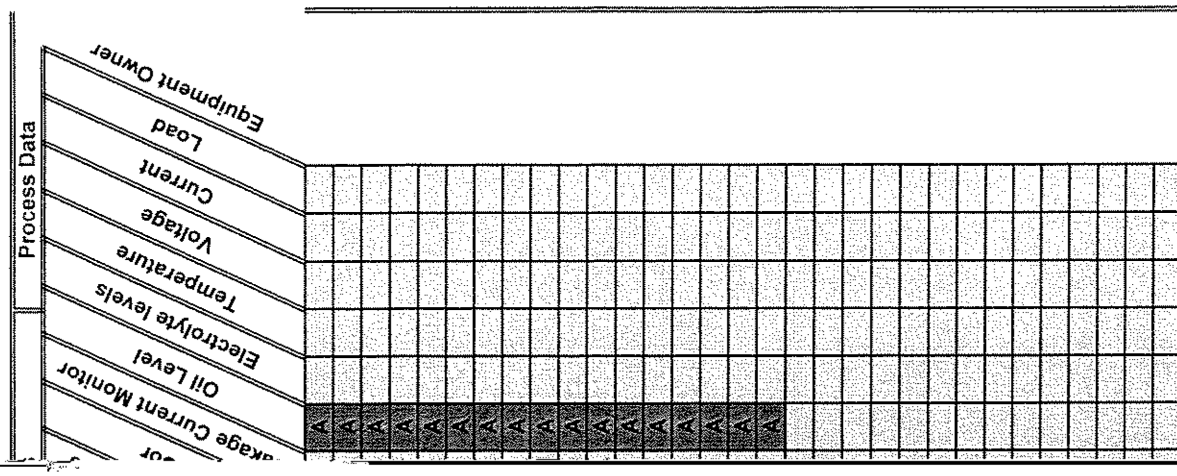
Pulele Station
OCB 4820
Two hot terminals were detected. The terminal on the left is hot in the adapter threads.





Equipment Owner

HECO


Process Data
Equipment Owner
Load
Current
Voltage
Temperature
Electrolyte levels
Oil Level
A

Process Data

SPDM Technologies

Equipment Owner																															
Load																															
Current																															
Voltage																															
Temperature																															
Electrolyte levels																															
Oil Level																															
Leakage Current Monitor																															
DayCor																															
Functional test Cooling	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Functional test LTC																															
Air Flow																															
Vibration Analysis																															
Oil Quality																															
Oil Analysis (DGA)																															
Infrared Thermography																															

ds

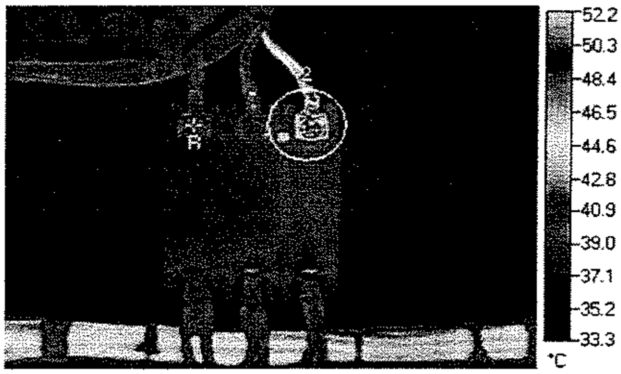
SPDM Technologies											Process Data			
Infrared Thermography	Oil Analysis (DGA)	Oil Quality	Vibration Analysis	Air Flow	Functional test LTC	Functional test Cooling	DayCor	Leakage Current Monitor	Oil Level	Electrolyte levels	Temperature	Voltage	Current	Load
A							A							
[redacted]							A							
A							A							
A							A							
A							A							
A							A							
A							A							
A							A							
M							A							
M							A							
A							A							

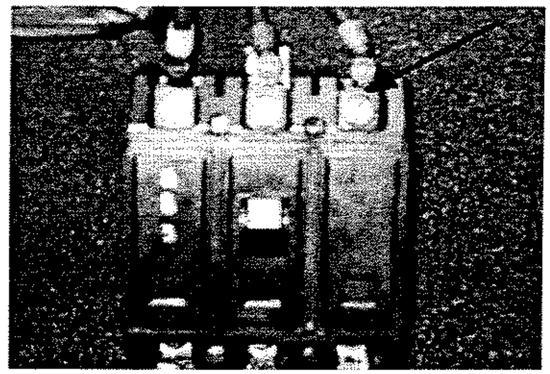
Additional column headings printed without grid columns: ...ection; Ultrasonic Noise Analysis; Equipment Owner

Description of Occurrence or Comment	Severity	Recommendation	Link to Image Page
ɦections were detected on the hinge end of all three phases, ranging from 25C to 75C (see image for details)	****	Inspect & Repair	
ɐt is rusted through.	****	Inspect and repair	
ɐt was found open to the weather.	****	Inspect and repair - This was repaired.	
re detected in a large splice box where water and animals get in.	****	Inspect and repair - This was repaired.	
ɩor relay was stuck and the compressor was running continously	****	Inspect and repair - This was repaired.	
ɡged low on oil	****	Inspect & Repair - Level was confirmed OK using clear tubing.	
r missing, possible low oil	****	Inspect & Repair - Level was confirmed OK using clear tubing.	
s detected on the left side PToff of OCB 4655	***	Inspect & Repair	
s detected on the two right side PT's off of ocb 4656	***	Inspect & Repair	
in reverse, these fans are mounted in the top position (critical Winding temperature gauges are out of calibration.	***	Inspect & Repair	
erature gauges are out of calibration	***	Inspect & Repair	
ɩing, one was hot (locked rotor)	***	Inspect and repair	
ɪn boxes under control cabinets are missing covers, wiring is ɐather and animals.	***	Inspect and repair	
s detected on the breaker AB5 in the control cabinet.	**	Inspect and repair	
ɦ valve is leaking, a temperary fix is in place.	**	Inspect and repair	
ɩild up of dirt in the silicon	**	Inspect and repair	

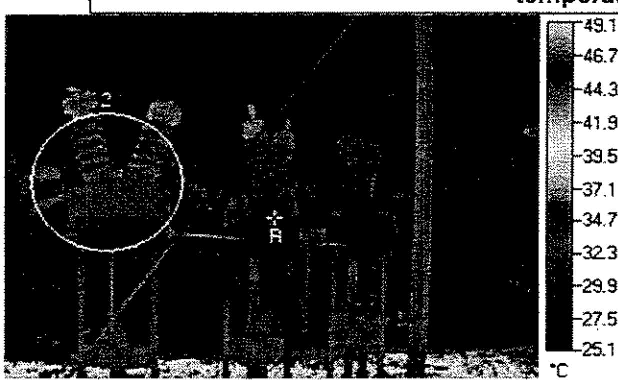
	Severity Key	* Minor			
		** Intermediate			
		*** Serious			
		**** Critical			

Waiau Station
Transformer A
Cooling system breaker AB5
A 20C rise was detected on the top right terminal.

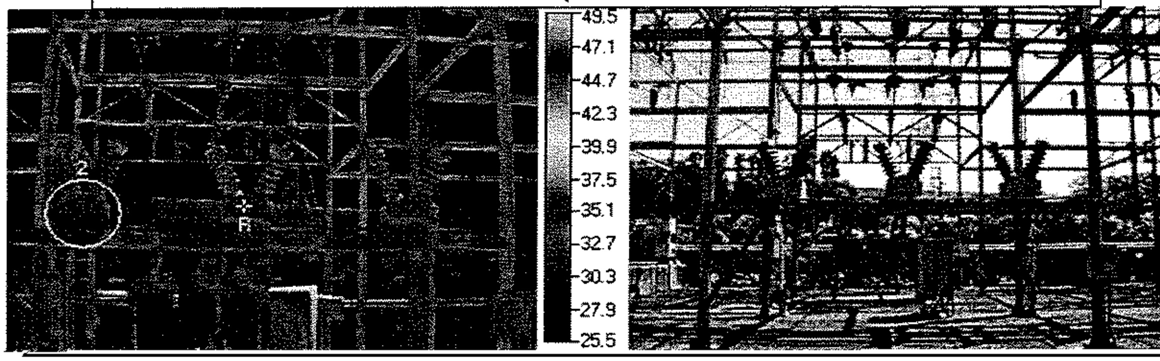




Waiau Station
Bus B PT's
The left side PT is warmer than the other two. Normally they are equal in temperature.



Waiau Station
Bus A PT's
The left side PT is cooler than the other two. Normally they are equal in temperature.



Page 1

cess Data					
Load					
Current	X	X	X	X	
...ge					

Process Data	
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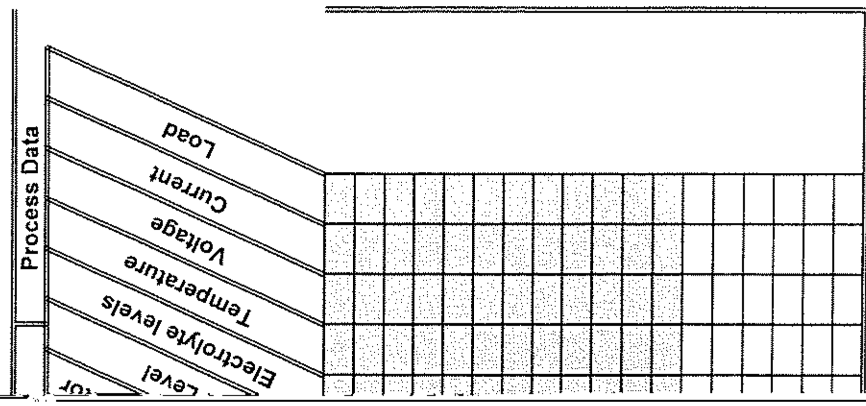
	Voltage
	Temperature
	Electrolyte levels
	Oil Level
	...ent Monitor

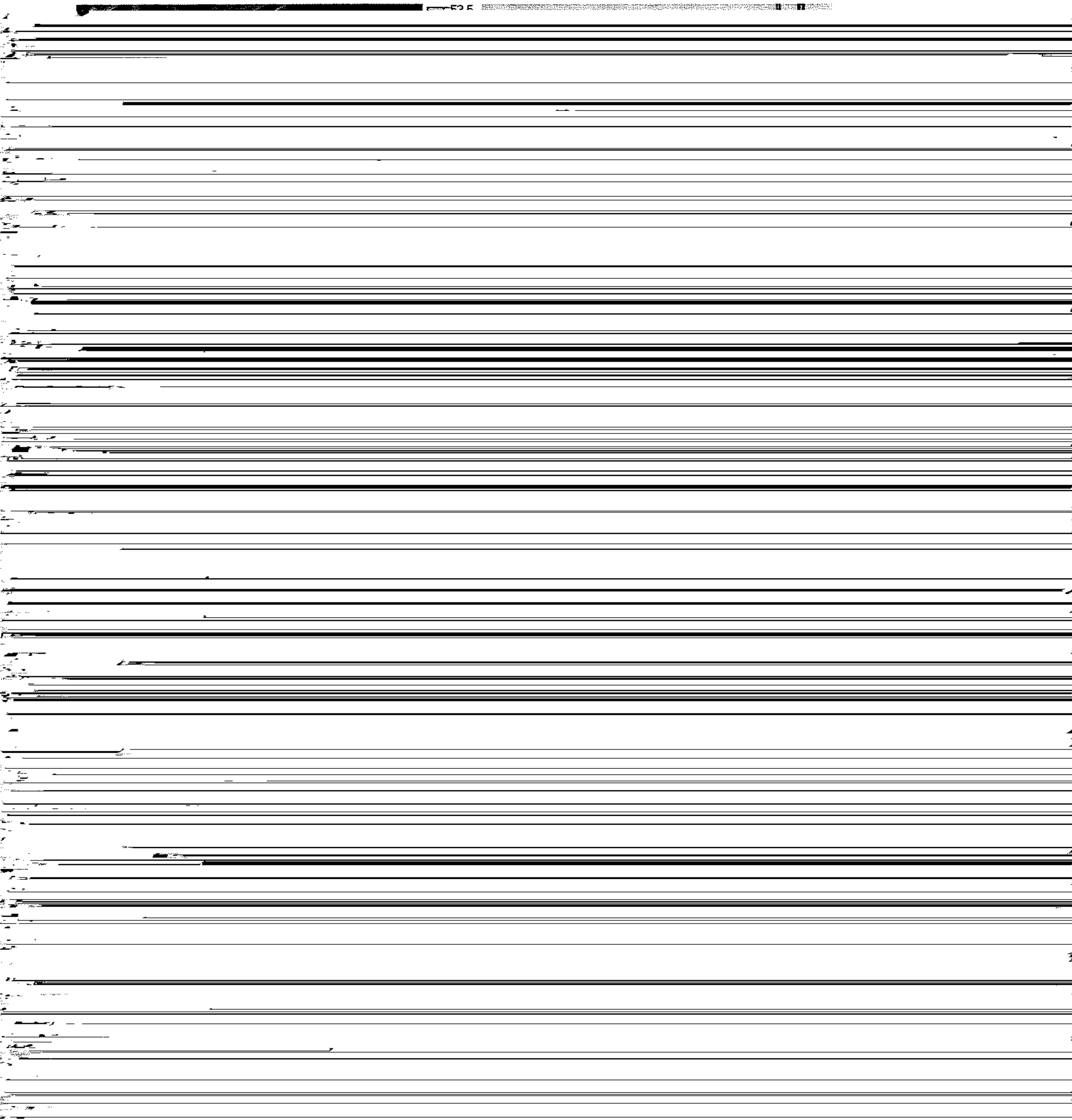
Process Data	Load																													
	Current																													
	Voltage																													
	Temperature																													
SPDM Technologies	Electrolyte levels																													
	Oil Level																													
	Leakage Current Monitor																													
	DayCor	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		
	Functional test Cooling																													
	Functional test LTC																													
	Air Flow																													
	Vibration Analysis																													
	Oil Quality																													
	Oil Analysis (DGA)																													
	Infrared Thermography Analysis	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		A	A	A	A	A	A	A	M	M
	Ultrasonic Noise	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	Visual Inspection																													


Process Data
Load
Current
Voltage
Temperature
Electrolyte levels

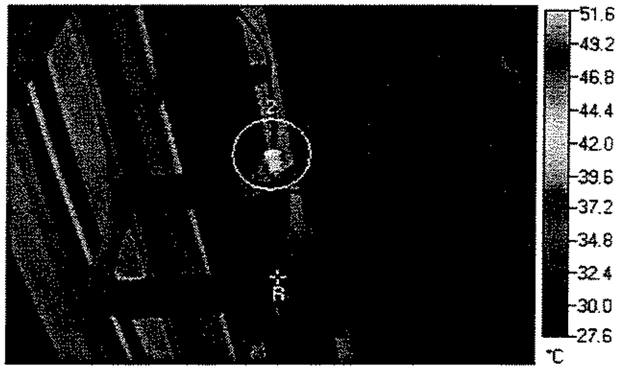
ıdation	Link to Image Page
Repair	
Repair	
Repair	
oottle	
in tighter control	
Repair	
Repair	
oil, monitor	
Repair	
with brass.	
Repair	
Repair	
Repair	
Repair	
Repair	
ak and repair	
e leads	
gauge	

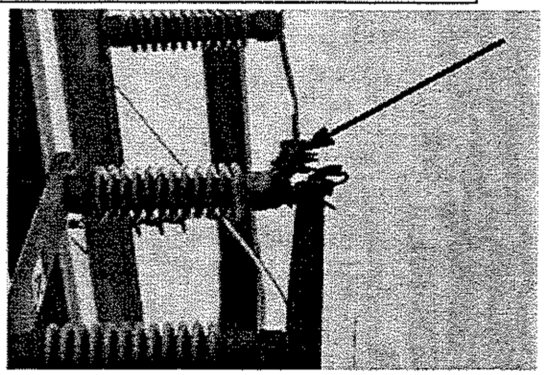
	Severity Key	* Minor			
		** Intermediate			
		*** Serious			
		**** Critical			

Kahe Station
OCB 132
A 30C rise was detected on #2 bushing connection.

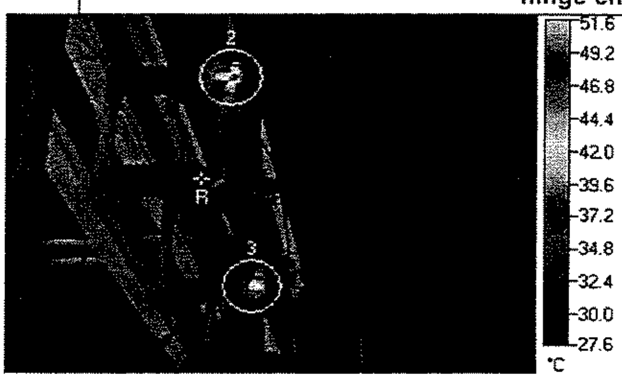


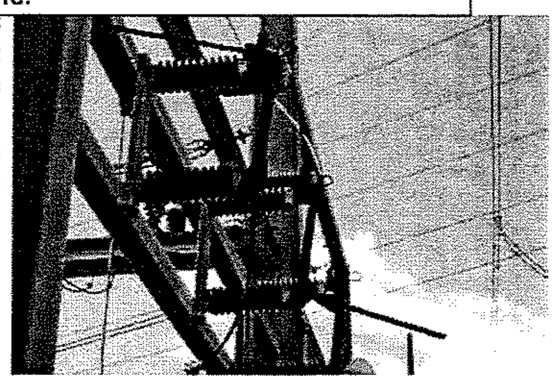
Kahe Station
Disconnect 4716
A 22C rise was detected on the West phase clip end cable to clamp connection.



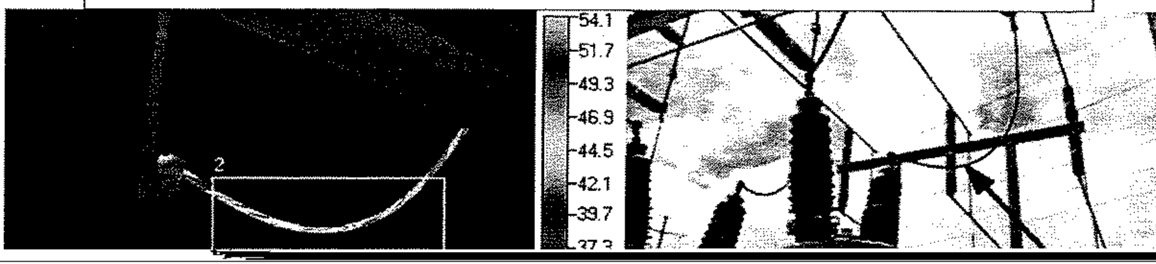


Kahe Station
Disconnect 4717
A 25C and a 20C rise was detected on the West and Center phase clip end and hinge end.



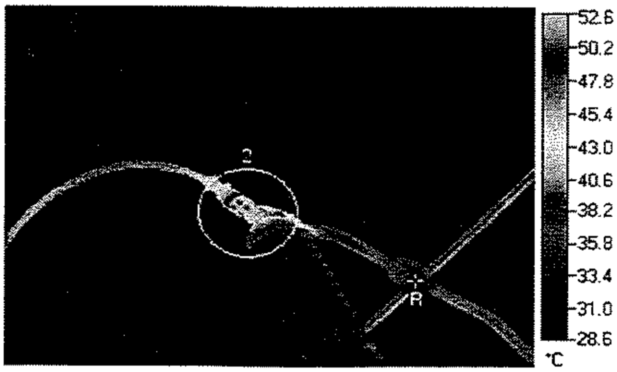


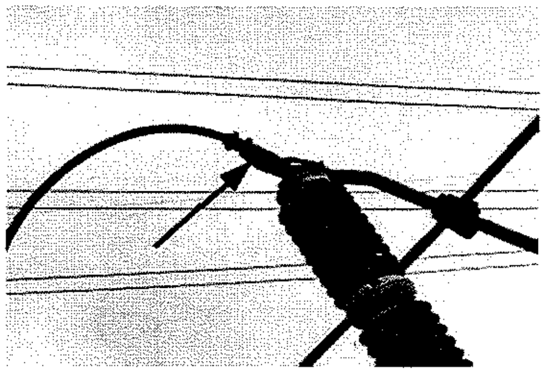
Kahe Station
OCB 246
A 25C rise was detected on the #6 bushing lead. Note the barber pole effect. A poor connection to all strands are the reason.
A 75C rise was also detected on the #2 bushing connection. (below)



Kahe Station
Disconnect 248C

A 56C rise was detected on the East phase 4 hole pad on the gas CB side.

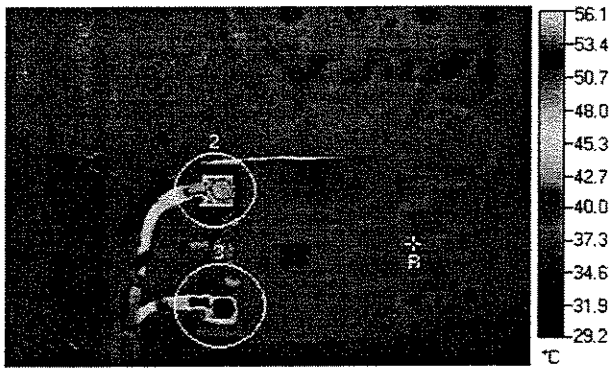


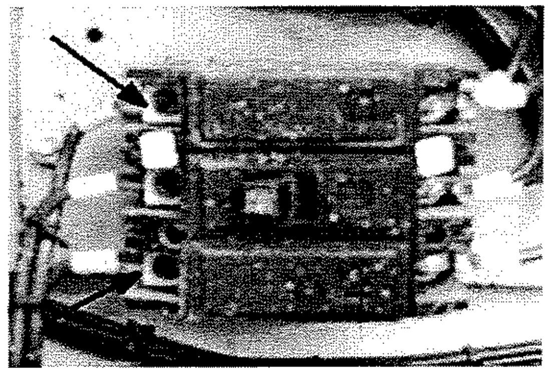


Kahe Station
OCB 242
Three hot connections were detected on this breaker. The problems appears to be in the bushing adapter threaded connection to the bushing stud.
#2 bushing = 70C rise
#3 bushing = 95C rise
#5 bushing = 30C rise

Kahe Station
Start Up Transformer 33952

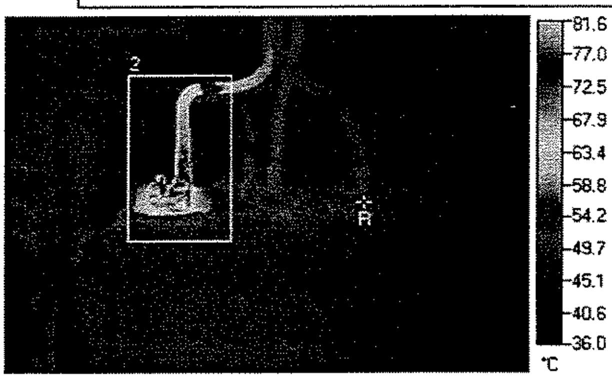
A 25C & 30C rise were detected on the main fan control breaker terminals

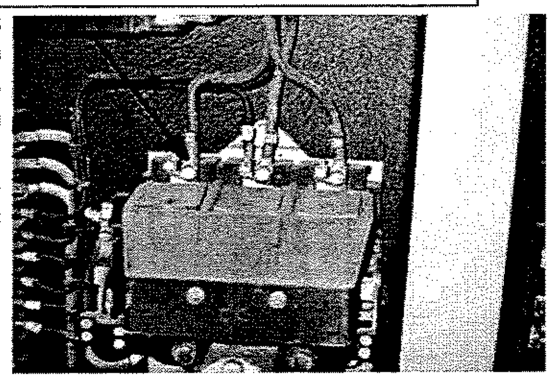




Kahe Station
Unit #1 Main Transformer

A 50C rise was detected on the top left terminal of the main cooling contactor.





HECO C&M Phase III Maintenance Optimization Proposed Scope of Work

Task 1: Maintenance Basis Optimization

MBO Training: EPRIsolutions Senior Maintenance Consultants will perform initial maintenance basis optimization training in order to inform HECO EDP personnel of the latest methods that could be applied to optimize and capture the basis for creating preventive maintenance tasks as applied to substation & distribution systems and equipment. Techniques that will be included in the training are:

- Reliability Centered Maintenance (RCM) Analysis
- Streamlined Reliability Centered Maintenance (Streamlined RCM) Analysis
- Preventive Maintenance Templates
- [redacted]

These methods and techniques and indust

responsibilities, the equipment, and condition indicator matrix, performance indicators, condition status reporting, etc. Periodically, a PDM coach will visit to support the HECO PDM Program coordinator with all aspects of the implementation plan. Substation PDM surveys/condition monitoring technology training is also included at the inception and then every 3-6 months. This support is provided over an 18 month to 24-month period.

Task 2 recommended prerequisites: In order to be fully successful with the implementation of SPDM, EPRI Solutions recommends that HECO dedicate 2 full time SPDM technicians to perform substation PDM surveys (all technologies) and visual inspections. Also, it is strongly recommended that a HECO consider assigning a PDM program coordinator dedicated to the initiative. Once the program is mature, the coordinator will be capable of also coordinating other maintenance optimization initiatives.

Task 3: Plant View Implementation

EPRIsolutions will support the configuration of the Plant View Software to allow for the utilization of the Condition Status Reporting Software for all equipment to be included in the SPdM Program.

This proposal is not inclusive of any applicable PlantView software license costs due to the rules concerning use of TC funding. All necessary training for the PlantView equipment condition status reporting features will be provided to the appropriate HECO Substation PdM personnel.

Task 4: Helicopter Borne – High Res. Digital Camera, IR, & Corona Inspections

EPRI solutions will perform a helicopter borne aerial inspection of over 213 miles of overhead transmission circuits situated on the island of Oahu. Approximately 60% (+/-10%) of these transmission lines will need to be inspected by helicopter from the air while the remainder will have to be inspected from a vehicle since the FAA will not permit flying over the City of Honolulu and/or other residential areas. The scope of the inspection will include:

- Perform an infrared inspection of HECo's high voltage line system as well as acquire infrared imagery (digital still and video imagery) for all lines;
- Perform a corona inspection of HECo's high voltage line system as well as acquire corona imagery (digital still and video imagery) for all lines;
- Perform a visual spectrum inspection of HECo's high voltage line system as well as acquire visual spectrum imagery (digital still and video imagery) for all lines;
- Provide all of the equipment required to acquire the infrared, corona, and visual imagery of HECo's lines for the aerial as well as ground based patrol;

- Utilize the helicopter provided by HECo's service provider for the aerial patrols [redacted] helicopter services to be paid for by HECo)

Data Processing & Analysis

EPRIsolutions will process and analyze all infrared, corona, and visual imagery for delivery to HECo. All video will be delivered in MPG 2 format and all still images will be delivered in JPG format. Imagery will be delivered either via CD ROM or FireWire The inspection report will be delivered in MS Word and Adobe PDF format. An example of a page out of a typical inspection report is enclosed.

Component Location: Bowen-Big Shanty Black	**Survey Date:** May 14, 2001 **Time:** 3:59 P.M.	**Inspector:** Luther G. Hill, Jr.
Customer: Georgia Power **City:** Norcross, **State:** GA	**Inspection Equipment:** FLIR 595 IR Camera	

the issue. Reports will address exceptions only; all other digital media collected will be reported in electronic format as either a JPG or an MPG file in a directory structure as provided by HECo.

Equipment conditions most frequently identified in a survey include but are not limited to the following:

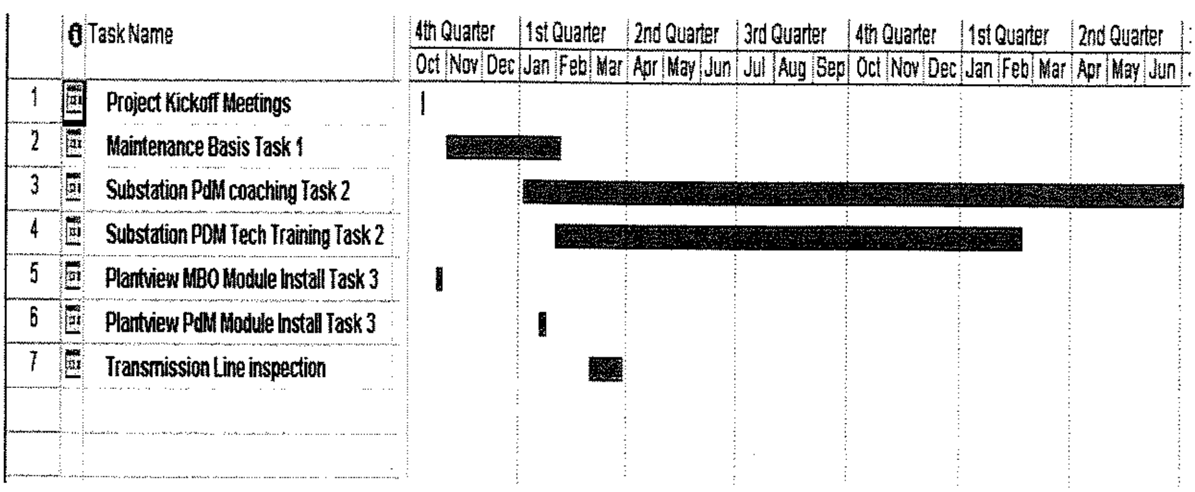
- Compression Fittings (Thermal Problems, IR);
- Broken Insulators (Insulation Problem, UV & IR);
- Broken Strands (Fatigue Problem & Gunshots, UV);
- Jumpers (Thermal Problems, IR)
- Grounding Systems (Incorrect Installation & Severed Grounds, IR & UV)
- Etc.

Reporting & Software

An executive summary will be developed to summarize the results of the corona and infrared inspection. The executive summary will document the scope of the effort, provide a report of the anomalies identified, and provide a summary listing of all digital JPG and MPG format imagery collected in the effort. The report will also provide recommendations on the optimum use of IR and Corona inspections as part of the routine inspection process as well as on the optimum frequency of activity.
A cross reference to all data will be delivered in the format of an ESRI shape file that can be used in EPRI's Airborne Inspection System (AIS) software. The AIS system permits the user to review, analyze, and interpret digital imagery effectively and accurately. HECo already holds a license for the AIS software and is therefore not restricted from the internal use of the software at HECo.

Project Schedule

The following schedule is a rough draft of the EPRIsolutions recommended approach to this project phase taking in to consideration the limited HECO TC funding availability in 2004.



Project Price

The total, fixed price for this project are as follows:

Task 1-3	$255,000
Task 4	$74,000
Total	$329,000

HECO Tailored Collaboration Funding	$164,500
EPRI Tailored Collaboration Matching Funds	$164,500
Project Total	$329,000

This project is proposed according to the standard terms of an EPRIsolutions fixed price TC agreement.

The PlantView Software license agreements are not eligible for TC funding and must be contracted for via a separate agreement.

Note 1. This proposal does not include the purchase of any Condition Monitoring Technologies; this will be the responsibility of HECo.

Actual Costs Incurred for Maintenance Optimization

NARUC	Item Description	Activity	2002 ($)						
			June	July	Aug	Sept	Oct	Nov	Dec
184060	EPRI Solutions - Maintenance SERP Pilot Program	720							
184060	EPRI Solutions - Maintenance Optimization Assessment	720							
184060	EPRI Solutions - Maintenance Optimization System Operation Work Sheet / EDP Assessment	720						16,595	114,413
184060	Asset Management	720	3,908	1,178	1,104	474	265	139	521
184060	Plant Maintenance Optimization - Transmission	325							
184060	Plant Maintenance Optimization - Distribution	455							
	C&M WORK SHOP	N/A	24,302						
			28,210	1,178	1,104	474	265	16,735	114,934

ance Optimization

	Activity	2003 ($) Jan	Feb	Mar	Apr	May	June	July
Pilot Program	720							
ization Assessment	720				38,198			
ization System ment	720		544					
	720	2,016	2,201	1,523	3,085	126	463	4,209
ansmission	325							161
stribution	455							198
	N/A							
		2,016	2,745	1,523	41,283	126	463	4,567

Actual Costs Incurred for Maintenance Optimization

NARUC	Item Description	Activity	Aug	Sept	Oct	Nov	Dec	Jan	Feb
184060	EPRI Solutions - Maintenance SERP Pilot Program	720		41,117		80,600			
184060	EPRI Solutions - Maintenance Optimization Assessment	720							
184060	EPRI Solutions - Maintenance Optimization System Operation Work Sheet / EDP Assessment	720							
184060	Asset Management	720	2,654	1,394	2,527	2,641	5,086	8,737	8,311
184060	Plant Maintenance Optimization - Transmission	325	195	366	176				
184060	Plant Maintenance Optimization - Distribution	455		550	176				
	C&M WORK SHOP	N/A							
			2,849	43,427	2,879	83,241	5,086	8,737	8,311

Actual Costs Incurred for Maintenance Optimization

NARUC	Item Description	Activity	2004 ($) Mar	Apr	May	June	July	Aug	Sept
184060	EPRI Solutions - Maintenance SERP Pilot Program	720			793	1,427			
184060	EPRI Solutions - Maintenance Optimization Assessment	720							
184060	EPRI Solutions - Maintenance Optimization System Operation Work Sheet / EDP Assessment	720							
184060	Asset Management	720	12,828	23,043	4,450	5,646	3,841	1,877	1,980
184060	Plant Maintenance Optimization - Transmission	325							
184060	Plant Maintenance Optimization - Distribution	455							
	C&M WORK SHOP	N/A							
			12,828	23,043	5,243	7,073	3,841	1,877	1,980

Actual Costs Incurred for Maintenance Optimization

NARUC	Item Description	Activity	Oct	Nov	Dec	Jan	Feb	Total
					2005 ($)			
184060	EPRI Solutions - Maintenance SERP Pilot Program	720						123,937
184060	EPRI Solutions - Maintenance Optimization Assessment	720						38,198
184060	EPRI Solutions - Maintenance Optimization System Operation Work Sheet / EDP Assessment	720						131,553
184060	Asset Management	720	2,257	7,806	1,657	490	187	118,623
184060	Plant Maintenance Optimization - Transmission	325			380	3,947	427	5,652
184060	Plant Maintenance Optimization - Distribution	455			380	3,284	495	5,084
	C&M WORK SHOP	N/A						24,302
			2,257	7,806	2,418	7,721	1,109	447,348

Forecasted 2005 Test Year Expenses - Maintenance Optimization Program

	NARUC	FY05	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
EPRI Tailored Collaboration - Maintenance Optimization	598	150,000	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500

REVISED 4-19-05

CA-IR-57

Ref: Direct burial Cable Replacement Projects and Programs.

Please provide copies of all feasibility studies addressing each project or program budgeted to occur in 2005.

HECO Response:

Descriptions of the following direct buried cable replacement projects and programs currently in the 2005 test year forecast are included in Attachment A:

1. Project P0000917, Village Park
2. Project P0001016, Lurline Mariposa
3. Program P1810000, Preventive Cable Replacement
4. Program P0000122, Corrective Cable Replacement

The following is general discussion on the history and current initiatives related to Direct Buried (DB) cable.

In 1998, the company initiated the Cable Cure program. This program was designed to prolong the life of our direct buried (DB) primary cables and in turn reduce failures. Installation of these DB cables began in residential subdivisions in the 1940's and was the standard for residential underground installation at that time. As these cables are buried directly in the soil, replacement is difficult. The current standard is to place cables in concrete encased PVC conduits which allows for ease of future cable replacement.

Cable curing (sometimes referred to as Reconditioning), is a life extension process that consists of injecting a silicone based fluid into the cable to restore the insulating properties of the cable jacket. Unfortunately, not all primary cables are "curable" and all secondary cables are not

CA-IR-57

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Cable curing (sometimes referred to as Reconditioning) is a life extension process that consists of injecting a silicone based fluid into the cable to restore the insulating properties of the cable jacket. Unfortunately, not all primary cables are "curable" and all secondary cables are not "curable". Part of the program was to identify these sections of primary cable for future replacement. The Cable Cure Program was completed in 2004.

In 2001, the Technical Services Division of the Energy Delivery Engineering Department issued a Memorandum dated September 7, 2001, Attachment B, which provides the results of an analysis of secondary cable faults on our system. The analysis confirms a high rate of secondary cable failures and recommends a program of replacements.

The current Cable Replacement Program consists of several initiatives:

- The Vault to Vault Program is designed to replace these "uncurable" primary cables identified in the Cable Cure Program. Secondary cables are also replaced at the same time since they run in the same trenches. Attachment C, titled "Vault-to-Vault", is a listing of the work that has been currently identified. This vault-to-vault work will be done under the Preventive Cable Replacement program - P1810000, as resources become available.
- In late 2003, the Company initiated work to reduce the number of overhead jumpers. Overhead jumpers are temporary installations of overhead cables to bypass the failed underground secondary cable to provide continued service to individual residences. As shown on Attachment D, titled "Tracking of Jumper Repair Orders", we had a substantial number of 213 overhead jumpers at the beginning of the program. As these direct buried secondary cables age we expect failures to continue. This work is budgeted under the Corrective Cable Replacement program - P0000122.
- The final effort is the large scale replacement of primary and secondary cable in

Engineering in 2005 on other projects that will be scheduled for construction in future years.

Description of Direct Buried Cable Projects/Programs

Projects

P0000917 – Village Park Direct Buried Cable Replacement. The purpose of this project is to replace direct buried cable in the Village Park subdivision that have reached their design life expectancy. This includes the design, construction and installation of primary and secondary underground conduits and cables. This also includes the restoration of sidewalks and driveways, as well as, repaving roadways in a manner consistent with the new requirements set forth by the City & County.

P0001016 – Lurline/Mariposa Cable Replacement. The purpose of this project is to replace primary and secondary feeders that have been in service since the 1940's. Due to the age and deterioration of the direct buried cables, the area is experiencing a high rate of cable failures. The scope of the project includes the design, construction and installation of primary and secondary underground conduits and cables. This also includes the restoration of sidewalks and driveways, as well as, repaving roadways in a manner consistent with the new requirements set forth by the City & County.

Programs

P0000122 – Corrective miscellaneous cable failures. The purpose of the program is the corrective repair or replacement of underground primary, secondary, service and transmission cables, including damages due to a dig-in by outside parties. The replacement cable may be of greater capacity and/or higher voltage rating to accommodate future conditions

P181000 – Preventive miscellaneous cable failure replacement. The purpose of the program is the planned replacement of underground cables that have been identified as needing replacement due to excessive faulting.

MEMORANDUM

September 7, 2001

SUBJECT: Underground Secondary Cable Failures

BACKGROUND: Hawaiian Electric has long been concerned with the reliability of the service it provides to its customers. Our outage records over the past few years have indicated that underground (UG) cable failures are the largest (40+%) cause of outages on our system. Consequently, the Company has implemented, for the past few years, a comprehensive program of underground cable replacement and reconditioning. Although this program has been in operation in only the past few years, the improvements have been significant. Areas and circuits where the UG cables have been replaced or reconditioned have shown substantial improvement in service.

The replacement and reconditioning program has concentrated on primary distribution cables. There is no program in place to monitor the performance of our UG secondary and service cables. In recent months we have become aware of two areas where the UG secondary system in a neighborhood was suffering an unusually large amount of failures. The Distribution Reliability Team (DRT) investigated the Kahala Kua and Pearl City Vault #1404 areas and confirmed that the secondary systems in these areas were indeed failing at alarming rates. The residents at the Kahala Kua Subdivision have been complaining for several years about the poor quality of service they have been receiving. In Pearl City, at Vault #1404, the UG secondary cables were failing so often that the C&M crews had suspended cables from the street light poles in the neighborhood to maintain service to the customers. The existing UG cables were abandoned in place. The DRT proposed replacement projects for both areas. The work in Pearl City has been completed; the engineering for the Kahala Kua area is in progress.

The Kahala Kua and Pearl City incidents appeared to the DRT to be indicative of a possibly serious problem that may be emerging. The DRT felt that if the primary cables in UG areas were failing to such a degree that we had to initiate replacement and reconditioning programs, the secondary cables, which were installed at the same time as the primaries, might also be failing with increasing frequency. Our discussions with personnel in C&M, who respond to customer outages, confirmed that they also were concerned that the UG secondary cables in our system were starting to fail at an alarming rate.

As a result, the Area Reliability Improvement Subcommittee of the Distribution Reliability Team initiated a study of the failures of the underground secondary cables on our system.

ANALYSIS: We reviewed the data in C&M's Cable Failure Database. The Database showed that during the period from 1981 through the present there were 7,332 outages in the UG secondary system. There were relatively few failures in the Database prior to 1985. Therefore, we concluded that any meaningful information in the Database was probably from 1985 to the present. In addition, our review of the information showed that the majority of the failures (86.8%) were due to cable faults. As a result, we decided to focus our attention on Secondary Cable Failures from 1985 through 2000.

The results of this initial review is summarized in Table A, UG Secondary Cable Failures, 1985 Thru 2000, dated April 19, 2000. This shows that there were 6,248 secondary cable failures during the sixteen-year period from 1985 through 2000. Most (76.8%) were on direct buried cables. This indicates that older cables (current standards require cables to be placed in conduits/ducts) were deteriorating and starting to show high failure rates. Additionally, the data review showed that 68.7% of the failures were due to failure modes found most often in direct buried cable cases. This suggested that our study should next focus on areas where the UG system was older – in service twenty years or more.

We then focused on areas – neighborhoods – where we knew the UG system has been service for several years. We subdivided these areas by streets and investigated the number of secondary cable failures experienced on each of these streets for the 1985 through 2000 period. The street-by-street analysis was summarized in Summary Tables for each area. These Summary Tables, an example is shown as Table B attached, showed the total number of secondary cable failures experienced each year on each street in the area.

In Table C we listed the annual and total (for the study period) secondary cable failures for all of the areas studied. Note that this area review shows a total of 3,907 secondary cable failures, 62.5% of the 6,248 total secondary cable failures experienced on the system during this period. Note also that our analysis focused on older areas and not the entire system, as the mode of failures indicated that older cables were experiencing the high failure rate. The ten areas that experienced the most secondary cable failures during the 1985 through 2000 study period were:

1. Aina Haina........................258 Failures
2. Waipahu..........................205
3. Lunalilo Home Road 197
4. Waialae Iki.......................187
5. Village Park......................175
6. Newtown..........................165
7. Mililani............................164
8. Makakilo 162
9. Momilani 155
10. Waipio 155

Note that most of these Areas experienced more than ten secondary cable failures per year for the sixteen-year study period.

Our analysis broadened to attempt to determine which areas were experiencing worse problems than others. Table D shows the results of this effort. We focused on those streets that had experienced five or more failures during the study period. We developed three ratios to analyze. These were Faults Per Year, FaultsPer 100 Feet (of street), and Faults Per 100 Feet Per Year. In reviewing the data we used the following criteria to decide if a street had experienced a particularly high incidence of secondary cable failures:

a) Faults per Year : Exceeded 1.00
b) Faults per 100 Feet of Street Length: Exceeded 0.900
c) Faults per 100 Feet of Street Length per Year: Exceeded 0.0900

We next focused on those Areas where multiple streets exceeded one or more of these criteria. Nine Areas had at least half of its Five-Failure Streets exceeding one or more of the criteria. These Areas were:

1. Kalama Valley
2. Aina Haina
3. Hahaione Valley
4. Waialae Nui
5. Niumalu Loop
6. Kamiloiki
7. Makakilo

From the above listing, we note that six of the seven areas are in East Honolulu (Kalama Valley, Aina Haina, Hahaione Valley, Waialae Nui, Niumalu Loop, and Kamiloiki) and four of the seven areas are in Hawaii Kai , in particular.

CONCLUSION

The above analysis confirms that we are experiencing a high rate of secondary cable failures in certain sections of our system. It further shows that the more serious areas are in East Honolulu, Hawaii Kai in particular. A program of replacement is recommended.

TABLE A
UG SECONDARY CABLE FAILURES
1985 Thru 2000

April 19, 2001

Year	Total Cble. Failures	Type of Cable Burial				Cable Failure Cause				
		C-D-C	D.B.	Duct	Unknown	Backfill	Dig In	Deterioration	Termites	Other
1985	230		172	58		76	14	36	86	18
1986	429		323	106		59	67	122	164	17
1987	568		448	119	1	123	92	147	171	35
1988	613		475	138		122	98	208	148	37
1989	569		421	146	2	119	76	143	179	52
1990	469		338	131		89	78	133	138	31
1991	498	1	365	132		58	58	155	185	42
1992	352	2	247	103		34	48	161	35	74
1993	305	1	233	71		22	43	155	48	37
1994	404	1	326	76	1	31	43	248	35	47
1995	307		259	48		15	41	208	15	28
1996	526	2	432	92		35	51	359	25	56
1997	358	1	281	76		17	41	217	17	66
1998	184		138	46		16	28	101	7	32
1999	211		164	46	1	8	21	118	7	57
2000	225		179	44	2	20	29	112	4	60
	6,248	**8**	**4,801**	**1,432**	**7**	**844**	**828**	**2,623**	**1,264**	**689**

TABLE B
SECONDARY & SERVICE CABLE FILURES
1985 Thru 2000
Alea Heights

Street	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Alea Hts			2	3	3	2	1	1				1	1	2			16
Akaaka	2									1	1	1					5
Analio			1				1										2
Hapuu		1	1														2
Hoapono				1													1
Holo	1	1	1				1	1									5
Hoklo				1													1
Holo		1			1				1								3
Iliee			1		1	1				1		1	1				6
Kaamilo			1		1	1			2		5		1	1			12
Kahilinai		1		1	1	1	1	2				3					10
Kaulainahee						1											1
Kaupili														1			1
Kealakaha			2											1			3
Kihewa				1				1				1				2	5
Kuawa				1							1						2
Kulawai						1							1				2
Lauhulu					1	1											2
Lauole							1										1
Lohea												1					1
Mahipua				1													1
Manako									1								1
Neki				1	1				1		1	1					5
Pakalana										1						1	2
Pooholua	1			1						1		3	2		1		9
Waipao		4		3							1	1	1				10
																	0
																	0
																	0
																	0
	4	8	9	14	9	8	5	5	5	4	9	13	7	5	1	3	109

July 30, 2001

TABLE C
HECO SECONDARY CABLE FAILURES
1985 Through 2000
Listing of Areas Experiencing Secondary Cable Failures

Area	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Ahuimanu	1	5	5	0	6	7	8	5	1	3	3	2	3	1	1	4	55
Aiea Heights	1	2	2	0	4	4	0	0	1	0	0	0	2	0	1	0	17
Aikahi Park	2	2	7	3	4	1	4	5	2	1	6	2	2	2	2	2	47
Aina Haina	4	15	30	14	25	32	36	18	10	14	14	14	13	4	12	3	258
Crown Terrace	3	3	4	9	[illegible]	1	2	4	2	2	0	1	3	0	1	1	39
Enchanted Lakes	3	0	3	3	3	1	4	6	3	6	4	3	8	0	0	3	50
Hahaione Valley	7	8	10	14	8	9	7	5	7	17	8	12	7	5	5	6	135
Haiku	0	6	8	12	3	2	4	7	2	5	2	4	3	1	0	0	59
Halawa Heights	4	8	9	14	9	8	5	5	5	4	9	13	7	5	1	3	109
Kailua Beach	2	4	10	10	5	11	13	10	4	11	7	5	3	2	4	4	105
Kalama Valley	5	10	9	5	7	9	5	9	5	5	5	14	8	6	9	14	126
Kamehame	1	0	3	1	0	0	0	1	0	4	1	0	1	0	1	0	13
Kamiloiki	1	9	6	10	9	11	10	3	5	3	1	3	6	5	4	6	92
Kapahulu	3	3	8	4	5	8	8	2	0	2	1	6	2	1	3	1	55
Kapunahala	0	0	0	2	1	1	1	0	1	0	0	0	0	0	0	0	6
Keapuka	0	2	3	4	3	1	1	1	2	0	0	1	2	1	1	2	24
Keolu Hills	3	1	7	6	11	4	7	4	4	9	6	6	4	1	1	2	76
Kuliouou	1	3	3	4	2	3	5	1	3	2	3	3	0	1	1	0	35
Lunalilo Home Road	1	12	24	21	10	12	17	8	7	16	6	30	14	4	8	7	197
Makakilo	4	8	12	13	17	13	14	7	7	10	11	20	12	4	5	5	162
Manoa	4	6	10	15	10	7	7	8	6	7	4	6	7	4	1	3	105
Mariner's Ridge	3	9	11	9	10	6	4	8	3	2	6	4	4	2	2	2	85
Maunalani Heights	5	9	9	13	11	9	11	10	6	11	4	13	8	5	5	3	132
Mililani	3	10	11	22	16	15	11	5	8	12	11	11	13	4	7	5	164
Momilani	4	15	17	14	19	10	16	7	4	12	9	8	7	3	3	7	155
Newtown	8	20	15	26	13	5	12	5	11	10	8	14	4	2	9	3	165
Niu	1	4	2	3	3	1	7	4	4	2	1	1	1	0	2	0	35
Niumalu Loop	3	4	7	5	17	5	6	3	5	7	4	13	6	2	4	10	101
Pacific Palisades	3	1	1	5	3	3	5	2	0	1	2	2	1	1	3	3	35
Pearl City Uplands	0	4	7	5	8	3	3	2	1	0	1	4	7	1	0	1	47
Pearlridge	2	1	3	2	1	3	2	0	1	5	1	1	0	1	1	1	25
Queen's Gate	0	2	5	3	7	3	0	1	1	2	1	1	0	0	2	6	34
Salt Lake	6	8	10	7	5	11	10	13	8	7	7	6	7	4	2	3	114
Village Park	2	12	16	19	13	8	16	6	6	11	14	17	12	8	6	3	175
Waialae	1	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	5
Waialae Golf Course	1	1	2	2	4	2	1	0	3	1	0	1	0	1	2	0	21
Waialae Iki	7	7	15	23	16	11	14	16	8	13	7	20	18	8	2	4	187
Waialae Kahala	7	11	12	6	12	14	15	7	2	6	7	10	3	4	2	2	120
Waialae Nui	2	5	4	7	5	5	4	3	2	3	7	1	2	3	1	1	55
Wailupe Circle	0	1	2	1	2	6	7	2	3	2	0	7	1	2	1	0	37
Waipahu	10	17	25	15	27	9	6	10	13	14	12	22	10	3	5	7	205
Waipio	5	9	15	20	15	6	7	6	9	6	3	14	14	9	10	5	153
Waipio Acres	3	6	3	10	13	4	5	1	4	6	4	20	5	2	3	2	91
	126	263	363	382	371	284	321	220	180	254	200	336	230	110	13[illegible]	134	3,907

TABLE D
HECO UNDERGROUND SECONDARY CABLE FAILURES
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Area	Street	No. Of Cable Failures	Approx. St. Length	Flts./Yr.	Flts.per 100 ft.	Flts./ 100 Ft. per Yr.
Pearl City Uplands	Paailuna	18	196	1.13	9.184	0.57398
Village Park	Makou	7	133	0.44	5.263	0.32895
Queen's Gate	Kapunapuna	7	150	0.44	4.667	0.29167
Aina Haina	Olapa	15	350	0.94	4.286	0.26786
Kalama Valley	Eaea	6	143	0.38	4.196	0.26224
Village Park	Kumau	6	145	0.38	4.138	0.25862
Waipio Acres	Lealea	5	135	0.31	3.704	0.23148
Village Park	Kaaoki	16	458	1.00	3.493	0.21834
Waipahu	Hapanui	8	295	0.50	2.712	0.16949
Waialae Nui	Lihipali	5	185	0.31	2.703	0.16892
Waialae Iki	Kunihi	6	238	0.38	2.521	0.15756
Kamehame	Ainanani	20	814	1.25	2.457	0.15356
Kalama Valley	Papalalo	19	857	1.19	2.217	0.13856
Waialae Golf Course	Hanahanai	10	462	0.63	2.165	0.13528
Waialae Kahala	Kala	10	505	0.63	1.980	0.12376
Village Park	Kamalo	23	1,183	1.44	1.944	0.12151
Aina Haina	Papai	22	1,139	1.38	1.932	0.12072
Kalama Valley	Inuwai	12	628	0.75	1.911	0.11943
Aina Haina	Opihi	24	1,258	1.50	1.908	0.11924
Village Park	Kaapuna	8	421	0.50	1.900	0.11876
Waipahu	Hapalima	5	264	0.31	1.894	0.11837
Waialae Kahala	Black Point	10	545	0.63	1.835	0.11468
Kamehame	Oilipuu	9	495	0.56	1.818	0.11364
Salt Lake	Luapele	25	1,381	1.56	1.810	0.11314
Kamiloiki	Ninini	12	685	0.75	1.752	0.10949
Kalama Valley	Napoko	6	348	0.38	1.724	0.10776
Aiea Heights	Waipao	10	611	0.63	1.637	0.10229
Makakilo	Nohopaa	16	993	1.00	1.611	0.10070
Waipio Acres	Pililua	5	313	0.31	1.597	0.09984
Aina Haina	Makalena	13	859	0.81	1.513	0.09459
Aina Haina	East Hind	37	2,495	2.31	1.483	0.09269
Village Park	Kaiewa	9	619	0.56	1.454	0.09087
Maunalani Heights	Matsonia	20	1,400	1.25	1.429	0.08929
Village Park	Kaiao	18	1,271	1.13	1.416	0.08851
Maunalani Heights	Mariposa	19	1,390	1.19	1.367	0.08543
Manoa	Malama	8	599	0.50	1.336	0.08347
Waipahu	Ulieo	10	754	0.63	1.326	0.08289
Maunalani Heights	Lanipili	6	461	0.38	1.302	0.08134
Hahaione Valley	Kumukahi	5	407	0.31	1.229	0.07678
Makakilo	Ahikoe	7	572	0.44	1.224	0.07649
Waipio	Lumialani	11	907	0.69	1.213	0.07580

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Wailupe Circle	Niuhi	10	830	0.63	1.205	0.07530
Kamiloiki	Kipu	8	667	0.50	1.199	0.07496
Makakilo	Lihau	6	515	0.38	1.165	0.07282
Keolu Hills	Auwaiku	25	2,214	1.56	1.129	0.07057
Kamiloiki	Wainiha	24	2,210	1.50	1.086	0.06787
Newtown	Lanikuakaa	10	940	0.63	1.064	0.06649
Niumalu Loop	Kukii	12	1,134	0.75	1.058	0.06614
Keolu Hills	Aulepe	17	1,625	1.06	1.046	0.06538
Waipahu	Kumuao	6	586	0.38	1.024	0.06399
Aina Haina	Oio	23	2,381	1.44	0.966	0.06037
Makakilo	Wainohia	21	2,187	1.31	0.960	0.06001
Waipio	Leko	6	636	0.38	0.943	0.05896
Salt Lake	Kahikolu	6	644	0.38	0.932	0.05823
Waipio	Lumiloke	8	863	0.50	0.927	0.05794
Aina Haina	Waihou	10	1,092	0.63	0.916	0.05723
Aiea Heights	Kihewa	5	549	0.31	0.911	0.05692
Makakilo	Nohopono	10	1,103	0.63	0.907	0.05666
Waipio Acres	Hokuloa	11	1,215	0.69	0.905	0.05658
Village Park	Maaniani	5	564	0.31	0.887	0.05541
Lunalilo Home Rd.	Kaleimamaha	7	791	0.44	0.885	0.05531
Lunalilo Home Rd.	Ahukini	32	3,635	2.00	0.880	0.05502
Waipahu	Apii	8	909	0.50	0.880	0.05501
Waipahu	Puloku	11	1,266	0.69	0.869	0.05430
Waialae Iki	Ihi Loa	30	3,498	1.88	0.858	0.05360
Maunalani Heights	Monterey	12	1,439	0.75	0.834	0.05212
Waialae Iki	Nalulu	5	605	0.31	0.826	0.05165
Waipahu	Hiahia	25	3,029	1.56	0.825	0.05158
Momilani	Hookahua	5	611	0.31	0.818	0.05115
Waialae Kahala	Waiohinu	5	616	0.31	0.812	0.05073
Waialae Iki	Hoaaina	14	1,727	0.88	0.811	0.05067
Momilani	Hoohonua	18	2,251	1.13	0.800	0.04998
Kalama Valley	Olowalu	9	1,131	0.56	0.796	0.04973
Mililani	Lauaki	7	882	0.44	0.794	0.04960
Manoa	Komaia	6	759	0.38	0.791	0.04941
Maunalani Heights	Mana	5	640	0.31	0.781	0.04883
Niumalu Loop	Niumalu	42	5,576	2.63	0.753	0.04708
Kamiloiki	Waioli	16	2,140	1.00	0.748	0.04673
Niumalu Loop	Kamilo	21	2,853	1.31	0.736	0.04600
Waipio Acres	Hakupokano	10	1,360	0.63	0.735	0.04596
Makakilo	Moaka	5	681	0.31	0.734	0.04589
Mililani	Ulukoa	5	689	0.31	0.726	0.04536

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Waipio	Kahuli	6	850	0.38	0.706	0.04412
Momilani	**Hoomaike**	16	2,306	**1.00**	0.694	0.04337
Kalama Valley	**Kaeleku**	15	2,169	**0.94**	0.692	0.04322
Kailua Beach	Kuumele	7	1,017	0.44	0.688	0.04302
Village Park	Kehela	5	728	0.31	0.687	0.04293
Village Park	Nolupe	7	1,020	0.44	0.686	[illegible]
Ahuimanu	Hui Alala	8	1,184	0.50	0.676	0.04223
Makakilo	Nohona	14	2,090	0.88	0.670	0.04187
Makakilo	Uhiuala	7	1,063	0.44	0.659	0.04116
Salt Lake	Ala Hinalo	7	1,063	0.44	0.659	0.04116
Newtown	Apelekoka	6	945	0.38	0.635	0.03968
Mariner's Ridge	Kaoopulu	5	797	0.31	0.627	0.03921
Wailupe Circle	**Wailupe**	24	3,883	**1.50**	0.618	0.03863
Hahaione Valley	**Ainapo**	25	4,085	**1.56**	0.612	0.03825
Aiea Heights	Kahilinai	10	1,646	0.63	0.608	0.03797
Makakilo	Akaawa	7	1,166	0.44	0.600	0.03752
Mililani	Kuaie	10	1,679	0.63	0.596	0.03722
Newtown	Puailima	8	1,344	0.50	0.595	0.03720
Niumalu Loop	Naakea	7	1,176	0.44	0.595	0.03720
Newtown	Lania	9	1,515	0.56	0.594	0.03713
Waipahu	Hiapaiole	12	2,029	0.75	0.591	0.03696
Makakilo	**Palailai**	37	6,264	**2.31**	0.591	0.03692
Waipio	Manino	5	852	0.31	0.587	0.03668
Kuliouou	Paiko	7	1,196	0.44	0.585	0.03658
Aiea Heights	Pooholua	9	1,559	0.56	0.577	0.03608
Waialae Golf Course	Ehupua	7	1,216	0.44	0.576	0.03598
Village Park	**Kaaka**	15	2,633	**0.94**	0.570	0.03561
Aiea Heights	Neki	5	883	0.31	0.566	0.03539
Lunalilo Home Rd.	**Kalanipuu**	22	3,921	**1.38**	0.561	0.03507
Waipio Acres	Alaalaa	9	1,630	0.56	0.552	0.03451
Momilani	Hoono	6	1,104	0.38	0.543	0.03397
Momilani	**Hoohiki**	21	3,882	**1.31**	0.541	0.03381
Aina Haina	Nenue	11	2,043	0.69	0.538	0.03365
Newtown	**Puaalii**	26	4,880	**1.63**	0.533	0.03330
Waipio	Lumipolu	12	2,267	0.75	0.529	0.03308
Haiku	**Ka Hanahou**	20	3,809	**1.25**	0.525	0.03282
Maunalani Heights	Lurline	12	2,297	0.75	0.522	0.03265
Lunalilo Home Rd.	Kekauluohi	7	1,351	0.44	0.518	0.03238
Waipahu	Kuakahi	6	1,169	0.38	0.513	0.03208
Maunalani Heights	Maunalani	13	2,567	0.81	0.506	0.03165
Waipio	Meahale	8	1,585	0.50	0.505	0.03155

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Aikahi Park	Kaimalino	11	2,192	0.69	0.502	0.03136
Waialae Iki	Kihi	8	1,601	0.50	0.500	0.03123
Hahaione Valley	**Opihikao**	25	5,051	**1.56**	0.495	0.03093
Kamiloiki	Kuahono	5	1,019	0.31	0.491	0.03067
Pearl City Uplands	Paaaina	6	1,252	0.38	0.479	0.02995
Aina Haina	Kiholo	8	1,676	0.50	0.477	0.02983
Waipio	**Lumihoahu**	19	4,012	**1.19**	0.474	0.02960
Mariner's Ridge	**Makaa**	20	4,281	**1.25**	0.467	0.02920
Waialae Iki	Kahalakua	5	1,071	0.31	0.467	0.02918
Waipio Acres	Kawau	5	1,071	0.31	0.467	0.02918
Kalama Valley	Kekaa	7	1,514	0.44	0.462	0.02890
Kamehame	Kekaa	7	1,514	0.44	0.462	0.02890
Waipahu	Halelehua	14	3,033	0.88	0.462	0.02885
Pearl City Uplands	Lanikeha	7	1,580	0.44	0.443	0.02769
Waipio	Pulai	5	1,143	0.31	0.437	0.02734
Waialae Iki	Nuna	5	1,146	0.31	0.436	0.02727
Waipio Acres	Nawenewene	6	1,386	0.38	0.433	0.02706
Mililani	Poloahilani	6	1,393	0.38	0.431	0.02692
Kailua Beach	Kuukama	10	2,335	0.63	0.428	0.02677
Waipahu	Hapapa	6	1,413	0.38	0.425	0.02654
Pearlridge	Palula	7	1,674	0.44	0.418	0.02614
Hahaione Valley	**Hahaione**	28	6,704	**1.75**	0.418	0.02610
Salt Lake	**Ala Napunani**	27	6,475	**1.69**	0.417	0.02606
Hahaione Valley	Ainahou	10	2,427	0.63	0.412	0.02575
Mariner's Ridge	Kaahue	11	2,706	0.69	0.407	0.02541
Lunalilo Home Rd.	Nuulolo	7	1,744	0.44	0.401	0.02509
Waipio	**Lumikula**	19	4,865	**1.19**	0.391	0.02441
Aina Haina	**Lawelawe**	16	4,120	**1.00**	0.388	0.02427
Salt Lake	Ala Aloalo	8	2,087	0.50	0.383	0.02396
Newtown	Kupukupu	9	2,377	0.56	0.379	0.02366
Aina Haina	Ailuna	9	2,378	0.56	0.378	0.02365
Waialae Iki	Kumakani	6	1,619	0.38	0.371	0.02316
Waialae Nui	Alaeloa	9	2,437	0.56	0.369	0.02308
Kapahulu	Esther	7	1,950	0.44	0.359	0.02244
Waipahu	Hoomakoa	7	1,950	0.44	0.359	0.02244
Kalama Valley	**Honokahua**	18	5,131	**1.13**	0.351	0.02193
Mililani	Maiaku	9	2,589	0.56	0.348	0.02173
Waialae Golf Course	Alaweo	6	1,732	0.38	0.346	0.02165
Waipahu	Kuhaulua	13	3,842	0.81	0.338	0.02115
Kamiloiki	Kalapaki	7	2,085	0.44	0.336	0.02098
Lunalilo Home Rd.	**Aipo**	15	4,476	**0.94**	0.335	0.02095

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Village Park	Alapine	6	1,840	0.38	0.326	0.02038
Maunalani Heights	Paula	12	3,682	0.75	0.326	0.02037
Waialae Golf Course	Analii	7	2,192	0.44	0.319	0.01996
Kamiloiki	Maniniholo	9	2,832	0.56	0.318	0.01986
Keolu Hills	Aupupu	8	2,535	0.50	0.316	0.01972
Waialae Kahala	Makaiwa	9	2,919	0.56	0.308	0.01927
Kapahulu	Duval	6	1,948	0.38	0.308	0.01925
Waipahu	Hinaea	7	2,284	0.44	0.306	0.01915
Waipahu	**Kipou**	17	5,718	**1.06**	0.297	0.01858
Newtown	Ainanui	7	2,372	0.44	0.295	0.01844
Lunalilo Home Rd.	Kalalea	9	3,084	0.56	0.292	0.01824
Mariner's Ridge	Kaumoku	5	1,724	0.31	0.290	0.01813
Village Park	Kime	7	2,468	0.44	0.284	0.01773
Manoa	Keahi	6	2,145	0.38	0.280	0.01748
Kailua Beach	**Kailua Rd.**	16	5,790	**1.00**	0.276	0.01727
Manoa	Huelani	7	2,542	0.44	0.275	0.01721
Aina Haina	**Hao**	19	6,920	**1.19**	0.275	0.01716
Waialae Iki	Kamole	9	3,292	0.56	0.273	0.01709
Pacific Palisades	Akepa	8	3,028	0.50	0.264	0.01651
Kamehame	Kahului	8	3,168	0.50	0.253	0.01578
Ahuimanu	Hui Ulili	7	2,821	0.44	0.248	0.01551
Kapahulu	Hayden	6	2,443	0.38	0.246	0.01535
Manoa	Woodlawn	11	4,560	0.69	0.241	0.01508
Kalama Valley	Mokuhano	10	4,165	0.63	0.240	0.01501
Waialae Nui	**Halekoa**	30	12,584	**1.88**	0.238	0.01490
Niu	Anolani	6	2,526	0.38	0.238	0.01485
Kuliouou	Summer	5	2,122	0.31	0.236	0.01473
Waialae Golf Course	Waiholo	9	3,824	0.56	0.235	0.01471
Momilani	**Hoomalu**	17	7,467	**1.06**	0.228	0.01423
Lunalilo Home Rd.	**Lunalilo Home Rd.**	44	19,345	**2.75**	0.227	0.01422
Queen's Gate	Makaaoa	6	2,708	0.38	0.222	0.01385
Kalama Valley	Kahului	7	3,168	0.44	0.221	0.01381
Waialae Iki	**Laukahi**	25	11,424	**1.56**	0.219	0.01368
Hahaione Valley	Kawaihae	10	4,661	0.63	0.215	0.01341
Miiiiani	Kaholo	6	2,838	0.38	0.211	0.01321
Lunalilo Home Rd.	**Kaumakami**	15	7,177	**0.94**	0.209	0.01306
Mariner's Ridge	**Kaluanui**	16	7,698	**1.00**	0.208	0.01299
Aikahi Park	Aikahi	12	5,819	0.75	0.206	0.01289
Waialae Iki	**Poola**	19	9,225	**1.19**	0.206	0.01287
Newtown	Piki	9	4,416	0.56	0.204	0.01274
Niu	Haleola	12	5,898	0.75	0.203	0.01272

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Kuliouou	Kuliouou	12	6,067	0.75	0.198	0.01236
Waialae Kahala	Aukai	12	6,161	0.75	0.195	0.01217
Aiea Heights	Hoio	5	2,688	0.31	0.186	0.01163
Maunalani Heights	**Sierra**	22	11,992	**1.38**	0.183	0.01147
Aina Haina	Hind Iuka	11	6,058	0.69	0.182	0.01135
Ahuimanu	Alawiki	5	2,807	0.31	0.178	0.01113
Kamehame	Kamehame	9	5,147	0.56	0.175	0.01093
Village Park	Kaaholo	14	8,166	0.88	0.171	0.01072
Lunalilo Home Rd.	Anapalau	5	2,998	0.31	0.167	0.01042
Manoa	**Oahu**	17	10,471	**1.06**	0.162	0.01015
Aiea Heights	Akaaka	5	3,162	0.31	0.158	0.00988
Lunalilo Home Rd.	Kekupua	5	3,219	0.31	0.155	0.00971
Kapahulu	Campbell	6	3,988	0.38	0.150	0.00940
Aiea Heights	Kaamilo	12	8,246	0.75	0.146	0.00910
Mililani	Paikauhale	5	3,437	0.31	0.145	0.00909
Waialae Kahala	Kahala	11	7,799	0.69	0.141	0.00882
Momilani	Hoohai	10	7,217	0.63	0.139	0.00866
Haiku	Haiku	9	6,501	0.56	0.138	0.00865
Queen's Gate	Kealahou	14	10,113	0.88	0.138	0.00865
Aiea Heights	Iliee	6	4,369	0.38	0.137	0.00858
Waipio	Lumiauau	14	10,440	0.88	0.134	0.00838
Enchanted Lake	Akumu	7	5,311	0.44	0.132	0.00824
Waipahu	Hiapo	8	6,226	0.50	0.128	0.00803
Aikahi Park	Mokapu	10	7,814	0.63	0.128	0.00800
Aiea Heights	**Aiea Hts**	16	12,537	**1.00**	0.128	0.00798
Crown Terrace	Heeia	6	4,702	0.38	0.128	0.00798
Momilani	Hoohulu	8	6,713	0.50	0.119	0.00745
Waialae Kahala	Kolohala	6	5,039	0.38	0.119	0.00744
Niu	Halemaumau	5	4,343	0.31	0.115	0.00720
Manoa	**Manoa**	15	13,115	**0.94**	0.114	0.00715
Kailua Beach	Kaha	6	5,299	0.38	0.113	0.00708
Waialae Kahala	Kilauea	13	11,873	0.81	0.109	0.00684
Kailua Beach	Kailuana	5	4,642	0.31	0.108	0.00673
Newtown	Kilinoe	5	4,846	0.31	0.103	0.00645
Momilani	Hoomoana	6	5,829	0.38	0.103	0.00643
Newtown	Hapaki	7	6,841	0.44	0.102	0.00640
Kapahulu	Winam	5	5,101	0.31	0.098	0.00613
Waialae Kahala	Hunakai	7	7,653	0.44	0.091	0.00572
Mililani	Kuahelani	14	15,388	0.88	0.091	0.00569
Pearlridge	Kaonohi	13	14,797	0.81	0.088	0.00549
Kailua Beach	Kainalu	8	9,260	0.50	0.086	0.00540

TABLE D
HECO UNDERGROUND SECONDARY CABLE FAILURES
1985 Through 2000
Listing of Streets Suffering More Than Five Failures

July 30, 2001

Area	Street	No. Of Cable Failures	Approx. St. Length	Flts./Yr.	Flts.per 100 ft.	Flts./ 100 Ft. per Yr.
Haiku	Kahuhipa	5	6,118	0.31	0.082	0.00511
Haiku	Lilipuna	10	12,579	0.63	0.079	0.00497
Enchanted Lake	Keolu	14	17,964	0.88	0.078	0.00487
Keolu Hills	Keolu	14	17,964	0.88	0.078	0.00487
Kailua Beach	Kalaheo	9	12,316	0.56	0.073	0.00457
Mililani	Anania	5	7,161	0.31	0.070	0.00436
Momilani	Hoolaulea	7	10,924	0.44	0.064	0.00400
Newtown	Kaahele	6	9,500	0.38	0.063	0.00395
Makakilo	Makakilo	8	13,344	0.50	0.060	0.00375
Salt Lake	Likini	10	17,613	0.63	0.057	0.00355
Niumalu Loop	Hawaii Kai Dr.	13	23,516	0.81	0.055	0.00346
Waialae Kahala	Kalanianaole	10	19,880	0.63	0.050	0.00314
Village Park	Kupuna	5	10,181	0.31	0.049	0.00307
Newtown	Komo Mai	12	24,529	0.75	0.049	0.00306

Comp dt	ACT_LAB_HRS	ACT_LAB_COST	ACT_MAT_COST	ACT_OTHER_COS	Total $
1999	12,620	422,856	150,973	647,996	1,221,825
2000	14,954	548,772	187,705	836,678	1,573,155
2001	10,684	404,114	77,538	437,901	919,552
2002	3,974	152,783	51,866	157,201	361,850

)02 up to 03/31

VAULT TO VAULT

RITY	SUBDIVISION	FROM	STREET	TO	STREET	NEW DUCT LENGTH
	MOMILANI	V1931	HOONA PL	V1932	HOONA ST	490
	MOMILANI	V1932	HOONA ST	V1933	HOOLAULEA ST	323
	MANANA	V2087	NOELANI ST	V2088	PAAAINA ST	250
	MANANA	V2104	PALAMOI ST	V2105	PALAMOI ST	515
	MOMILANI	V3415	HOOHULU ST	V3416	HOOHULU ST	310
	MOMILANI	V3409	KOMO MAI DR	V2329	HOOIA ST	217
	MOMILANI	JP29	HOOMALU ST	V2176	HOOMALU ST	142
	WAIALAE NUI	V1530	KILAUEA PL	P1/7X/8	KILAUEA AVE	184
	MAKAKILO	V4576B	LEIOLE ST	4576A	LEIOLE ST	814
	MAKAKILO	V4532B	KAIAULU PL	4576A	UHIULA ST	100
	MAKAKILO	V2912	WAINOHIA ST	V2645	WAINOHIA WAY	150
	MAKAKILO	V2642	NOHONA PL	V2907	MOAKA ST	250
	MAKAKILO	V2910	MOAKA ST	V2907	MOAKA ST	305
	MAKAKILO	V2908	KOHUPONO ST	P7	AAHUALII ST	300
	HAWAII LOA RIDGE	V4995N	MAONO LP	V4995O	MAONO LP	225
	WAIMANALO RES LOTS	P8	HULI ST	V2896	KAAIAI ST	250
	WAIMANALO RES LOTS	V3461	HULI ST	V5611C	MANAWAIOLA ST	805
	WAIMANALO RES LOTS	V3460	HULI ST	V2900	HULI ST	391
	INOAOLE	P33	KAL HWY	V3915F	INOA ST	404
	INOAOLE	V3915E	INOA ST	V3915F	INOA ST	381
	MAKAKILO	V4757E	KALEO PL	V4757F	KALEO PL	307
	MAKAKILO	V4757D	HOOKOMO ST	V4757C	HOIKE WAY	150
	MAKAKILO	SW'A' V4642	MAKAKILO DR	V4782A	KIKAHA ST	504

VAULT TO VAULT

SITE NO.	PRIORITY	SUBDIVISION	FROM	STREET	TO	STREET	NEW DUCT LENGTH
24	3	WAIALAE IKI	V4008G	ALAWEO ST	V4008H	ALAWEO ST	181
25	3	WAIALAE IKI	V4008H	ALAWEO ST	V4008I	HAWANE PL	365
26	3	WAIALAE IKI	V4008C	KIHI ST	V4008D	KIHI ST	338
27	3	WAIALAE IKI	V1760	POOLA ST	V1761	POOLA ST	590
28	3	WAIALAE IKI	V1763	POOLA ST	V1764	PALAOLE PL	460
29	3	WAIALAE IKI	SW'A' V4009	KIHI ST	V6381	LAUKAHI ST	461
30	3	WAIALAE IKI	SW'A' V4009	KIHI ST	V450N	LAUKAHI PL	805
31	3	WAIALAE IKI	SW'A' V4009	KIHI ST	V450M	NALULU PL	450
32	3	WAIALAE IKI	V450Y	LAUKAHI ST	V450Z	LAUKAHI ST	326
33	3	WAIALAE IKI	V450T	LAUKAHI ST	P2/50		600
34	3	WAIALAE IKI	V450F	HOAAINA ST	V6430	HOAAINA ST	110
35	3	WAIANAE KAI	V3853L	HOKUUKALI ST	V3853K	HOKUUKALI ST	363
36	3	WAIANAE KAI	V3853A	HOKUPAA ST	V3853B	HOKUPAA ST	322
37	3	POKAI BAY EST	V3595J	INIKI PL	V3595I	KAWILI ST	120
38	3	POKAI BAY EST	V3595J	INIKI PL	V3595K	HALE EKAHI DR	350
39	3	SURF AND SAND	V2571	KIPAIPAI PL	V2572	KIPAHELE PL	310
40	3	SURF AND SAND	V2572	KIPAHELE PL	P13	MOHIHI ST	645
41	3	SEAVIEW	V2238	LUMIAUAU ST	P9	LUMIAINA ST	389
42	3	SEAVIEW	V2238	LUMIAUAU ST	V2239	LUMIAUAU ST	406
43	3	SEAVIEW	V2245	LUMIPOLU ST	V2246	LUMIKULA ST	240
44	4	DOLE ESTATES	V4981B	KILEA PL	P23	EAMES ST	214
45	4	HOLIDAY CITY	V1619	HOOLI PL	V1617	HOOLI CIRCLE	250
46	4	HOLIDAY CITY	V1606	HOOLI CIRCLE	V1607	HOOLI CIRCLE	396
47	4	NIU VALLEY	V5089E	HOIHI PL	V5089G	HALEOLA ST	970

VAULT TO VAULT

27,484 LF Total

[illegible]EET	NEW DUCT LENGTH
[illegible]A ST	288
[illegible]A ST	370
[illegible]HI ST	511
[illegible] PL	700
[illegible] PL	940
[illegible]E ST	330
[illegible]A ST	163
[illegible]KU ST	250
[illegible]ANI PL	340
[illegible]HE ST	350
[illegible]U ST	375
[illegible] ST	345
[illegible]U PL	350
[illegible]U ST	400
[illegible]HE ST	520
[illegible]VAI ST	425
[illegible]LA PL	300
[illegible]LA PL	395
[illegible]AE ST	362
[illegible]AE ST	544
[illegible]AE ST	307
[illegible]WA PL	394
[illegible]WA PL	295
[illegible]JLU ST	395
[illegible]A ST	408

Tracking of Jumper Repair Orders

Reporting Period Ending	RO's Received	RO's Cleared	RO's Outstanding
9/19/2003	37	44	213
9/26/2003	9	10	215
10/17/2003	7	14	209
10/31/2003	7	18	198
11/17/2003	4	17	185
11/21/2003	11	7	189
12/6/2003	39	12	216
12/15/2003	41	7	250
1/8/2004	172	37	385
1/19/2004	15	28	407
1/31/2004	28	29	400
2/6/2004	27	13	418
2/13/2004	16	20	414
2/20/2004	17	24	410
2/27/2004	3	36	377
3/5/2004	47	31	393
3/12/2004	32	16	409
3/19/2004	34	31	412
3/26/2004	3	17	398
4/2/2004	22	28	392
4/9/2004	2	19	378
4/16/2004	0	28	350
4/23/2004	3	24	329
4/30/2004	0	10	319
5/7/2004	0	24	295
5/14/2004	0	22	273
5/21/2004	0	20	253
5/28/2004	0	15	238
6/4/2004	0	30	209

Updated: 2/4/2005

Tracking of Jumper Repair Orders

Reporting Period Ending	RO's Received	RO's Cleared	RO's Outstanding
6/11/2004	0	19	190
6/18/2004	86	44	232
6/25/2004	14	27	219
7/2/2004	0	15	214
7/9/2004	14	33	195
7/16/2004	2	29	168
7/23/2004	4	32	140
7/30/2004	4	22	122
8/6/2004	21	15	128
8/13/2004	6	12	122
8/20/2004	5	16	111
8/27/2004	7	16	102
9/3/2004	8	37	73
9/10/2004	6	16	63
9/17/2004	7	12	58
9/24/2004	5	13	50
10/1/2004	0	8	42
10/8/2004	4	5	41
10/15/2004	5	6	40
10/22/2004	4	9	35
10/29/2004	9	4	40
11/5/2004	11	4	47
11/12/2004	37	3	81
11/19/2004	13	7	87
11/26/2004	15	2	100
12/3/2004	22	9	113
12/10/2004	11	33	91
12/17/2004	10	7	94
12/24/2004	13	1	106

Updated: 2/4/2005

Tracking of Jumper Repair Orders

Reporting Period Ending	RO's Received	RO's Cleared	RO's Outstanding
12/31/2004	22	5	123
1/7/2005	18	1	140
1/14/2005	21	23	138
1/21/2005	10	22	126
1/28/2005	14	7	133
2/4/2005	13	4	142

Total	**1,017**	**1,149**	

Updated: 2/4/2005

CA-IR-58

Ref: T&D Inventory.

Please provide the following regarding T&D inventory:

a. The actual calculations supporting the 2005 T&D materials inventory level as discussed at page 21.

b. The actual T&D materials inventory balance for each month beginning January 2003 to 2005 to-date.

HECO Response:

a. 2005 projected total inventory issues were calculated using a six-year average of annual total issues PLUS 5.4% in anticipation of higher material costs and increased issue volume.

	Total Issues
1999	$6,172,459
2000	$6,755,658
2001	$5,921,076
2002	$6,065,816
2003	$6,584,028
2004	$6,913,671

Six-year average = $6,402,118 (*PLUS 5.4%* increase) = $6,748,850 projected 2005 total inventory issues

The following turn ratio goal was set as a target, to reflect inventory management efficiency:
2005 turn ratio goal: 1.30

HECO uses the following formula to calculate a 12-month turn ratio:
12-months' total issues (/) 12-month average inventory value = turn ratio

Therefore:
12-months' total issues (/) turn ratio = 12-month average inventory value

2005 projected total issues (/) 2005 turn ratio goal = 2005 projected 12-month average inventory value

$6,748,850 (projected 2005 issues) / 1.30 goal = $5,191,423 projected 2005 average inventory value

b. The following chart documents the T&D materials inventory balance from January 2003 through March 2005.

T&D Material			
MONTH END	**ENDING INVENTORY $**	**MONTH END**	**ENDING INVENTORY $**
Jan-03	$4,676,917	**Jan-04**	$5,632,235
Feb-03	$4,651,684	**Feb-04**	$5,513,756
Mar-03	$4,754,914	**Mar-04**	$5,461,141
Apr-03	$4,795,430	**Apr-04**	$5,351,595
May-03	$5,063,388	**May-04**	$5,525,919
Jun-03	$5,019,248	**Jun-04**	$5,088,368
Jul-03	$5,060,691	**Jul-04**	$4,983,557
Aug-03	$5,169,724	**Aug-04**	$4,963,956
Sep-03	$5,477,796	**Sep-04**	$4,864,686
Oct-03	$5,598,981	**Oct-04**	$4,903,388
Nov-03	$5,614,869	**Nov-04**	$4,980,887
Dec-03	$5,728,651	**Dec-04**	$5,554,439
		Jan-05	$5,627,891
		Feb-05	$5,789,384
		Mar-05	$5,769,308

CA-IR-59

Ref. T-8, page 4, lines 16-17 (T&D Expense).

The referenced testimony attributes the decrease in T&D expense from 2000 to 2003 as being "primarily due to a reduction in spending and hiring constraints that occurred following the events of September 11, 2001." Please provide the following:

a. With regard to T&D O&M, when did the spending reduction and hiring constraints end? Please explain.

b. Did the spending reduction and hiring constraints result in the deferral of needed T&D **operating** costs to future periods?

   1. If so, please identify any material operational needs that were deferred.

   2. Provide an estimate of the expenses associated with the deferral and indicate when HECO incurred, or plans to incur such costs.

c. Did the spending reduction and hiring constraints result in the deferral of needed T&D **maintenance** costs to future periods?

   1. If so, please identify any material maintenance needs that were deferred.

   2. Provide an estimate of the expenses associated with such deferral and indicate

actual costs versus 2004 budget costs. For the test year 2005, an increase in inspections is forecasted primarily due to our aging facilities and need for early identification of problems

In the System Operation Department, there was a backlog of work in the Operating Engineering division relating to the maintenance and updating of system maps, circuit drawings and switching diagrams. Also, there was an impact on the monitoring of discrepancies and field inspections to verify changes being made to maps and/or drawings. In the Instrument and Control division there was a backlog relating to meter calibration work, regulator maintenance, and equipment upgrades. Much of this backlog was addressed in 2004, as a result of the additional staff available after the filling of vacancies, and partially through contract services. This level of staffing is necessary to support on-going work. For example, as the system grows, the mappers will need to continually update electrical facilities data of new circuits, installations and equipment. This data is relied on by all areas of operations (dispatch, PTM's, etc.) to be accurate and up to date. Also, the mapping section migrated to a new G-tech technology tool which required training to ensure a smooth transition. The Instrument and Control division also needs to maintain their level of staffing to support their on-going work as well. For example, in efforts to address HECO's aging facilities and equipment, the I&C technicians and engineers are focusing their efforts on installing additional testing and monitoring equipment (Remote Terminal Units, BMI's, MOSCAD's, etc.) and upgrading from electromagnetic to digital technologies. They also service the EMS system UPS, EMS/DSS hardware.

The estimated costs associated with filling these vacancies in 2004 was approximately $364,000 (based on labor costs associated with the hiring of an Instrument & Control (I&C) Technician in January; Mapping Supervisor and I&C Engineer in June; Electric Facilities Management System Technician and another I&C Technician in November; and outside contractor for mapping services during June – December. The portion of this cost attributable to only addressing the backlog cannot be quantified.

c. Yes, these spending and hiring constraints did create work backlog in several areas. In the C&M Department, there was a backlog of overhead jumpers, which are installed to temporarily restore power to customers with underground services. In late 2003, the Company initiated work to address failures of secondary cables to reduce the number of overhead jumpers, with the majority of the backlog of overhead jumpers being addressed in 2004, primarily through the use of capital dollars. Please refer to CA-IR-64, Attachment A, program P0000122 – Corrective miscellaneous cable failures, for a comparison of 2004 actual costs versus 2004 budget costs.

In the System Operation Department, due to a lack of staffing in the Instrument and Control and Substation Divisions, baseline maintenance schedules were modified as work was handled on a more reactive versus proactive basis. For the Instrument and Control Division this affected maintenance on fault detection equipment and other power quality monitoring. In the Substation Division the work affected was transformer and breaker maintenance and repair. For both areas there was a greater lag in the timeliness of equipment upgrades and repair work. Simultaneously with additional plant being added, there is now more plant and equipment to maintain going forward. Some of the backlog was addressed in 2004 with the staff added by the filling of vacancies. This level of staffing is necessary to support on-going work. For example, in efforts to address

HECO's aging facilities and equipment, the I&C technicians and engineers are focusing their efforts on installing additional testing and monitoring equipment (Remote Terminal Units, BMI's, MOSCAD's, etc.) and upgrading from electromagnetic to digital technologies. They also service the EMS system UPS, EMS/DSS hardware. The substation electricians are required not only to provide baseline maintenance work for our aging and new equipment, but also to fulfill ongoing capital work, much of which involves customer driven projects and other reliability related capital projects.

The estimated costs of filling the vacancies in 2004 was approximately $400,000 (based on labor costs associated with the hiring of 8 Substation Electricians (2 in June; 1 each in July, August, September and October; and 2 in November). The portion of this cost attributable to only addressing the backlog cannot be quantified. Please refer to response b above for the statement regarding costs associated with Instrument and