FUEL CELL SECOND YEAR END OPERATING REPORT

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Second Year End Report (6-11-2001)

The fuel Cell was placed (dedicated) in serviced on July 19, 1999 with the following initial parameters.

✍✍Cumulative operating hours as of: 1093 hours

✍✍Cumulative Mega-Watt Hours delivered; 150 mWh (Mega-Watt Hours)

✍✍Cumulative fuel consumed: 2558643 SCF (Standard Cubic Feet)

On 6-11-2001 annual maintenance shutdown commenced.
The following parameters were recorded.

✍✍Cumulative operating time: 14116 hours

?? Total actual operating hours 14116-1093 = **13,023**

?? Year 1 actual operating hours = 6166 hours = 70% operating uptime

?? **Year 2 actual operating hours =6858**

(8-21-00 to 6-11-01[avail hrs 7080]) operating uptime = **96.9%**

✍✍Cumulative MWh delivered 1922.6

?? total actual Grid MWh 1922.6-150 = **1772.6**

?? year 1 actual Grid MWh = 901

?? **year 2 actual Grid MWh =871.6**

?? year 1 worth @ $65.00/mWh = **$58,565**

?? **year 2 worth @ $65.00/MWh = $56,654**

✍✍Cumulative fuel consumed to date 34916710

?? Total actual SCF consumed 34916710 - 2558643 = **32,358,067**

?? year 1 actual SCF consumed 16,209,173

?? **year 2 actual SCF consumed = 16,148,894**

Second Year Operating History

Abnormal Annual Maintenance issues

1. 6-29-00 discovered FCV-140 brake not operating properly--replace the electric brake
2. 7-6-00 discovered the controller Air Conditioning unit not working--replaced AC unit
3. 8-14-00 discovered a loose copper tubing union on the Ancillary coolant loop.--tightened same
4. 8-16-00 attempted Fuel Cell startup. The new FCV-140 brake not operating properly replaced the brake
5. 2-28-01 discovered Hex 400 and/or Hex 431 is leaking.

8-21-00 restarted Fuel Cell

The following shutdown have occurred since 8-21-00

1. 10-17-00 to 10-19-00 changing digester valve arrangement appears to have introduced air in the fuel train causing TE002 high temp for longer than 10 minutes.
2. 10-26-00 to 10-27-01 TE002 high temp for longer than 10 minutes again air in fuel train. Took this time to flush the make up water carbon bottle because of pump 450's extended run time.
3. 11-16-00 Faulty H2S sensor--replace it. Having several problems getting the MSA H2S monitor to read correctly at low levels of H2S (2-10 ppm)
4. 4-27-01 to 5-01-01 TE002 high temp shutdown reason unknown possible air in fuel again. Discovered Water treatment system resin bottle was leaking at fitting and ACC 840 was overflowing due to a leaking heat exchanger(s). Obtained new fitting for the resin bottle. The leaking heat exchanger repair differed until annual maintenance shutdown.

NOTES

1. Back flushing the make up water carbon bed is needed to prevent Pump 450 extended run times.
2. Problems continue to occur with the MSA H2S monitor requiring above normal maintenance. At this time it is the only monitor meeting the operational specifications.
3. Gas Processing Unit Carbon beds, one of two, is being changed about every 5-6 months. The original estimate was one every 3-4 months.
4. Water treatment system resin bottles and carbon bottle require changing about every 8-9 months.
5. Because of the heat exchanger (s) leak, weekly maintenance was higher than normal and the Fuel Cell power output was reduced to 125 kW causing less grid delivered power than the first year.
6. On recommendation from the manufacture (United Fuel Technology) we changed both heat exchangers HEX 400 and 431 from the flat shell type to the new tube in shell type which required significant piping modification to accommodate the new heat exchangers.

Fuel Cell Maintenance time and material since 8-21-2000

1,	Material			$16,284.75
2.	Man-hours			
	A.	Electrical	377 hours for a cost of	$10,464.02
	B.	Instrument	128 hours for a cost of	$ 3,190.52
	C.	Mechanical	220 hours for a cost of	$ 4,636.46
		SUB-TOTAL	**725 hours for a cost of**	**$18,291.00**
		TOTAL Material and Labor		**$34,575.75**

Heat Exchanger HEX 400 and HEX 431 Replacement costs

1.	Material			$6165.00
2.	Labor Man-hours			
	A.	Electrical	19 hours for a cost of	$547.47
	B.	Instrument	0 hours for a cost of	$0.00
	C.	Mechanical	95 hours for a cost of	$2013.05
	SUB-TOTAL		**114 hours for a cost of**	**$2,560.97**
		TOTAL Material and Labor		**$8,725.52**

GRAND TOTAL **$43,301.27**

First Year Operating History

The following shutdowns occurred between July 19, 1999 and June 26, 2000

1. 8-23-1999 to 8-24 1999 due to high pump 451 on time (cleaned resin bed inlet screen)
2. 8-24-1999 to 9-2-1999 due to high temp TE431(blown fuse on cooling tower fans, replaced resin bed TMS 440).
3. 9-2-199 to 9-9-1999 due to Gas processing Unit GPU (not sure why)
4. 9-14-1999 to 9-20-1999 due to burned out cooling tower fan motor. ONSI sent replacement motor.
5. 9-29-1999 to 10-6-1999 due to possible software problem.
6. 10-6-1999 to 10-14 1999 due to possible software problem. Installed updated software program.
7. 10-28-1999 to 11-3-1999 due to GPU (not sure what item caused the shutdown. Installed lights on possible fault items to help indicate faulty item)
8. 11-3-1999 to 11-19-1999 reduced power to 50 kW while waiting for replacement motor for second burned out cooling tower fan motor.
9. 11-29-1999 to 12-1-1999 due to possible high GPU compressor discharge pressure.
10. 12-27 to 1-14-00 due to GPU airflow switch; possibly due to faulty air pump Changed flow SW and added constant bleed off valve on air pump discharge.
11. 1-21-00 reduced power to 125 kw due because of GPU heat exch. High delta T (readjusted cooling control valve).

12. 2-4-00 to 2-10-00 shut down due to hit TE002 temp for 10 minutes. Possible cause excess air in fuel. Check all connections tight.
    - ?? Tues. 2-8-00 ACC 840 empty, Investigated for possible leak and found nothing.
    - ?? Wed. 2-9-00 Looked for glycol leak and found nothing, Tightened gas flanges and filled ACC 840 with Propylene-glycol.
    - ?? Thurs. 2-10-00 Loaded new software version 4.2 and started power plant.
13. 2-25-00 to 3-1-00 replace first GPU carbon bed (on 2-25-00). Did not purge carbon bed adequately causing fuel cell to shut down due to high TE002 temp from excess air in fuel train. Purged GPU also flushed resin bed inlet screen because of high run time on pump (6 Minutes) PMP 451 (feed water makeup)
14. 3-27-00 received a high conductivity alarm (CE450) indicating that three resin bed and the carbon be are depleted. Changed resin and carbon bed on 3-30-2000. FCV140 not responding as well as ONSI would like. Therefore holding power to 150 kw after resin replacement while ONSI reviews FCV 140's operation.
15. 5-5-00 Maintenance inadvertently shut off the methane fuel supply causing a shutdown.
16. 6-26-00 received a high temp shutdown from TS-250 (GPU compressor discharge temperature). Rather than restart at this time decided to commence the annual shutdown maintenance and repair air blower 101, fcu-140 brake and the controller's AC unit.

Fuel Cell maintenance time and material between July 19, 1999 and June 26, 2000

1	Material				**$8,768.36**
2	Man-hours				
	A. Electrical	171.5	hours for a cost of	=	$4769.16
	B. Instrument	22.75	hours for a cost of	=	$ 578.38
	C. Mechanical	*194.5*	*hours for a cost of*	=	*$3953.74*
Man Hours MAINTANCE COST		**388.75**	**Hours**	**=**	**$9,301.28**
Total Cost (Man Hours + Material)					**$18,069.64**

Fuel Cell first year start up and modification costs.

1.	Material				**$3,533.1**
	Man-hours				
	A. Electrical	232	hours for a cost of:	=	$6,308.66
	B. Instrument	28.75	hours for a cost of :	=	$ 723.95
	C. Mechanical	37.5	hours for a cost of :	=	$ 784.00
Man Hours STARTUP COST		**298.25**	**Hours**		**$7,816.61**
Total Cost (Man Hours + Material)					**$11,349.91**

GRAND TOTAL **$29,419.55**