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1978 PARAHO OPERATIONS FINAL REPORT VOLUME II APPENDIX

1978 PARAHO OPERATIONS

FINAL REPORT

VOLUME II

APPENDIX

development engineering incorporated
GRAND JUNCTION, COLORADO

1978 PARAHO OPERATIONS

FINAL REPORT

VOLUME II

APPENDIX

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APPENDIX 1.0

QUARTERLY OPERATING SUMMARIES

OPERATIONS SUMMARY

DATA FOR 10173 TO 40178

MINING OPERATIONS

	ON-STREAM HRS	DOWNTIME HRS
DRILLING	61.2	277.0
ROOF BOLTING	81.5	345.7
SCALING	223.0	111.2
ROAD GRADING	463.2	12.5
DUST CONTROL	185.2	20.0
OVERSIZE CRUSHING	198.2	82.0
AIR COMPRESSOR	209.2	
VENTILATION FAN	504.0	0.0
ELECTRICAL	511.2	8.0

HOLES DRILLED 128 HOLES LOADED 138
TONS BLASTED 13250 USING 11849 LBS EXPLOSIVES
BOLTS USED 134

HAULING OPERATIONS

SERVICE FACTOR 71.3 %

	ON-STREAM HRS	DOWNTIME HRS
LOADER	488.2	38.0
TRUCKS	621.0	409.2

(39.5 TONS/LOAD) TONS

MINE TO CRUSHER	12557
MINE TO STOCKPILE	3728
STOCKPILE TO CRUSHER	3486

TOTAL TONS HAULED= 19771.0
TOTAL TRUCK LOADS= 530.0

(15 TONS/LOAD)
CRUSHER TO STOCKPILE 0

SEMI-WORKS OPERATIONS SUMMARY
DATA FOR 10178 TO 40178

CRUSHING OPERATIONS

(63.7 TPH CRUSHING RATE)

SERVICE FACTOR 52.3 %

	ON-STREAM HRS	DOWNTIME HRS
CRUSHERS	193.4	
PRIMARY		6.5
SECONDARY		11.0
TERTIARY		35.0
LOADER		31.5
CONVEYORS		16.7
ELECTRICAL		8.0
MISCELLANEOUS		67.7
OVERSIZE ROCK		39.0
TURN-AROUND		0.0

CRUSHED SHALE PRODUCED (TONS) 12328

PRODUCTION FIGURES AND INVENTORIES

DRY SHALE USED (TONS)	5500
AVERAGE F.A. GPT	29.3
WET OIL PRODUCED (BBL)	3187
MINED SHALE IN MINE (TONS)	9674
MINED SHALE AT CRUSHER (TONS)	3511
MINED SHALE STOCKPILES (TONS)	10381
CRUSHED SHALE IN BINS (TONS)	1802
CRUSHED SHALE IN STOCKPILE (TONS)	5670
DRY OIL TRANSFERRED TO STORAGE (BBL)	
FOR THIS PERIOD	2901
CUMULATIVE SINCE JAN 1, 1978	2901

SEMI-WORKS OPERATIONS SUMMARY
DATA FOR 10178 TO 40178

RETORT OPERATIONS

SERVICE FACTOR 33.4 %

	ON-STREAM HRS	DOWNTIME HRS
RETORT	378.8	72.0
RAW SHALE CONVEYOR		0.0
RAW SHALE SEAL		0.0
GRATE		0.0
RET SHALE SEAL		0.0
RET SHALE CONVEYOR		0.0
COALESCER		0.0
ESP		0.0
OIL LINES		0.0
RECYCLE GAS BLOWER		0.0
AIR BLOWER		0.0
INSTUMENT		0.0
ELECTRICAL		1.2
MISCELLANEOUS		2.0
TURN-AROUND		1706.2

PRODUCTION FIGURES AND INVENTORIES

DRY SHALE USED (TONS)	3930
AVERAGE F.A. GPT	28.8
WET OIL PRODUCED (BBL)	2203

PILOT PLANT OPERATIONS SUMMARY
DATA FOR 10178 TO 40178

RETORT OPERATIONS

SERVICE FACTOR 90.8 %

	ON-STREAM HRS	DOWNTIME HRS
RETORT	1286.2	0.0
RAW SHALE CONVEYOR		0.0
RAW SHALE SEAL		0.0
GRATE		0.0
RET SHALE SEAL		0.0
RET SHALE CONVEYOR		0.0
COALESCER		0.0
ESP		3.0
OIL LINES		0.0
RECYCLE GAS BLOWER		0.0
AIR BLOWER		0.0
INSTUMENT		0.0
ELECTRICAL		128.0
MISCELLANEOUS		0.0
TURN-AROUND		742.8

PRODUCTION FIGURES AND INVENTORIES

DRY SHALE USED (TONS) ---------- 1650
AVERAGE F.A. GPT ---------- 29.9
WET OIL PRODUCED (BBL) ---------- 984

OPERATIONS SUMMARY

DATA FOR 40173 TO 70178

MINING OPERATIONS

	ON-STREAM HRS	DOWNTIME HRS
DRILLING	149.5	194.5
ROOF BOLTING	131.0	348.0
SCALING	189.0	128.0
ROAD GRADING	259.0	38.0
DUST CONTROL	298.5	14.0
OVERSIZE CRUSHING	85.0	12.0
AIR COMPRESSOR	310.0	8.0
VENTILATION FAN	524.0	16.0
ELECTRICAL	536.0	8.0

HOLES DRILLED 279 HOLES LOADED 255
TONS BLASTED 26275 USING 22500 LBS EXPLOSIVES
BOLTS USED 251

HAULING OPERATIONS

SERVICE FACTOR 77.5 %

	ON-STREAM HRS	DOWNTIME HRS
LOADER	551.0	16.0
TRUCKS	928.0	413.0

(39.9 TONS/LOAD) TONS

MINE TO CRUSHER	26950
MINE TO STOCKPILE	4862
STOCKPILE TO CRUSHER	4788

TOTAL TONS HAULED= 35600.0
TOTAL TRUCK LOADS= 917.0

(15 TONS/LOAD)
CRUSHER TO STOCKPILE 0

OPERATIONS SUMMARY

MINING OPERATIONS

	ON-STREAM HRS	DOWNTIME HRS
DRILLING	149.5	194.5
ROOF BOLTING	131.0	348.0
SCALING	189.0	128.0
ROAD GRADING	259.0	38.0
DUST CONTROL	298.5	14.0
OVERSIZE CRUSHING	85.0	12.0
AIR COMPRESSOR	310.0	8.0
VENTILATION FAN	524.0	16.0
ELECTRICAL	536.0	8.0

HOLES DRILLED 279 HOLES LOADED 255
TONS BLASTED 26275 USING 22500 LBS EXPLOSIVES
BOLTS USED 251

HAULING OPERATIONS

SERVICE FACTOR 77.5 %

	ON-STREAM HRS	DOWNTIME HRS
LOADER	551.0	16.0
TRUCKS	928.0	413.0

(39.9 TONS/LOAD) TONS

MINE TO CRUSHER	26950
MINE TO STOCKPILE	4862
STOCKPILE TO CRUSHER	4788

TOTAL TONS HAULED= 35600.0
TOTAL TRUCK LOADS= 917.0

(15 TONS/LOAD)
CRUSHER TO STOCKPILE 0

CRUSHING OPERATIONS

(65.0 TPH CRUSHING RATE)

SERVICE FACTOR 54.3 %

	ON-STREAM HRS	DOWNTIME HRS
CRUSHERS	356.5	
PRIMARY		31.2
SECONDARY		12.0
TERTIARY		97.3
LOADER		18.0
CONVEYORS		16.0
ELECTRICAL		0.5
MISCELLANEOUS		124.5
OVERSIZE ROCK		89.0
TURN-AROUND		0.0

CRUSHED SHALE PRODUCED (TONS) 23173

PRODUCTION FIGURES AND INVENTORIES

DRY SHALE USED (TONS)	22910
AVERAGE F.A. GPT	27.5
WET OIL PRODUCED (BBL)	12916
MINED SHALE IN MINE (TONS)	8164
MINED SHALE AT CRUSHER (TONS)	4745
MINED SHALE STOCKPILES (TONS)	9396
CRUSHED SHALE IN BINS (TONS)	920
CRUSHED SHALE IN STOCKPILE (TONS)	2494
DRY OIL TRANSFERRED TO STORAGE (BBL)	
FOR THIS PERIOD	11912
CUMULATIVE SINCE JAN 1, 1978	14813

SEMI-WORKS OPERATIONS SUMMARY
DATA FOR 40178 TO 70178

RETORT OPERATIONS

SERVICE FACTOR 90.1 %

	ON-STREAM HRS	DOWNTIME HRS
RETORT	1970.5	77.1
RAW SHALE CONVEYOR		0.0
RAW SHALE SEAL		0.0
GRATE		4.0
RET SHALE SEAL		0.0
RET SHALE CONVEYOR		32.5
COALESCER		102.3
ESP		0.0
OIL LINES		0.0
RECYCLE GAS BLOWER		0.0
AIR BLOWER		0.0
INSTUMENT		0.0
ELECTRICAL		1.6
MISCELLANEOUS		0.0
TURN-AROUND		0.0

PRODUCTION FIGURES AND INVENTORIES

DRY SHALE USED (TONS)	21826
AVERAGE F.A. GPT	27.5
WET OIL PRODUCED (BBL)	12372

PILOT PLANT OPERATIONS SUMMARY
DATA FOR 40178 TO 70178

RETORT OPERATIONS

SERVICE FACTOR 61.2 %

	ON-STREAM HRS	DOWNTIME HRS
RETORT	969.1	70.2
RAW SHALE CONVEYOR		0.0
RAW SHALE SEAL		0.0
GRATE		70.2
RET SHALE SEAL		0.0
RET SHALE CONVEYOR		123.0
COALESCER		0.0
ESP		64.3
OIL LINES		0.0
RECYCLE GAS BLOWER		233.1
AIR BLOWER		0.0
INSTUMENT		0.0
ELECTRICAL		54.6
MISCELLANEOUS		0.0
TURN-AROUND		599.5

PRODUCTION FIGURES AND INVENTORIES

DRY SHALE USED (TONS) ---------- 1083
AVERAGE F.A. GPT ---------- 27.6
WET OIL PRODUCED (BBL) ---------- 542

DATA FROM 70178 THROUGH 93078

MINING OPERATIONS

	ON-STREAM HRS	DOWNTIME HRS
DRILLING	139.0	8.0
ROOF BOLTING	212.0	28.0
SCALING	123.0	96.0
ROAD GRADING	200.0	16.0
DUST CONTROL	280.0	12.0
OVERSIZE CRUSHING	60.0	0.0
AIR COMPRESSOR	332.0	16.0
VENTILATION FAN	408.0	24.0
ELECTRICAL	432.0	0.0

HOLES DRILLED 308 HOLES LOADED 238
TONS BLASTED 27900 USING 22650 LBS EXPLOSIVES
BOLTS USED 562

HAULING OPERATIONS

	ON-STREAM HRS	DOWNTIME HRS
LOADER	443.0	4.0
TRUCKS	808.0	399.0

	LOADS
MINE TO CRUSHER	505
MINE TO STOCKPILE	5
STOCKPILE TO CRUSHER	160

TOTAL TONS HAULED FROM MINE= 19114
TOTAL TRUCK LOADS= 670

CRUSHING OPERATIONS

	ON-STREAM HRS	DOWNTIME HRS
CRUSHERS	314.0	
PRIMARY		12.3
SECONDARY		14.5
TERTIARY		69.5
LOADER		21.3
CONVEYORS		6.0
ELECTRICAL		5.5
MISCELLANEOUS		79.0
OVERSIZE ROCK		59.5
TURN-AROUND		216.0

CRUSHED SHALE PRODUCED (TONS) 21498

SEMI-WORKS OPERATIONS

SERVICE FACTOR 93.6 %

	ON-STREAM HRS	DOWNTIME HRS
RETORT	1537.5	0.0
RAW SHALE CONVEYOR		0.0
RAW SHALE SEAL		0.0
GRATE		0.0
RET SHALE SEAL		0.0
RET SHALE CONVEYOR		0.0
COALESCER		0.0
ESP		0.0
OIL LINES		0.0
RECYCLE GAS BLOWER		0.0
AIR BLOWER		101.5
INSTUMENT		0.0
ELECTRICAL		4.0
MISCELLANEOUS		0.0
TURN-AROUND		565.0

DRY SHALE USED (TONS) ---------- 17295.7
SHALE GRADE (FA GPT) ---------- 27.4
OIL PRODUCED (BBLS) ---------- 9719.9

PILOT PLANT OPERATIONS

SERVICE FACTOR 83.1 %

	ON-STREAM HRS	DOWNTIME HRS
RETORT	1396.5	0.0
RAW SHALE CONVEYOR		0.0
RAW SHALE SEAL		0.0
GRATE		6.0
RET SHALE SEAL		0.0
RET SHALE CONVEYOR		1.0
COALESCER		0.0
ESP		271.0
OIL LINES		0.0
RECYCLE GAS BLOWER		0.0
AIR BLOWER		0.0
INSTUMENT		0.0
ELECTRICAL		5.5
MISCELLANEOUS		0.0
TURN-AROUND		528.0

DRY SHALE USED (TONS) ---------- 1666.5
SHALE GRADE (FA GPT) ---------- 27.3
OIL PRODUCED (BBLS) ---------- 839.5

INVENTORY DATA

MINED SHALE STOCKPILES

FULL FACE (TONS)	3800
FLOOR (TONS)	3700
LEAN (TONS)	5300
RICH (TONS)	3150

MINE ROAD STOCKPILES

OVERSIZE (TONS)	800
FULL FACE (TONS)	4000
FLOOR (TONS)	2530
LEAN (TONS)	200
MINED SHALE AT CRUSHER (TONS)	1000
CRUSHED SHALE IN STOCKPILE (TONS)	5000
CRUSHED SHALE IN BINS (TONS)	950
SHALE LOSSES (TONS)	4227

DRY OIL TRANSFERRED TO PERMANENT STORAGE

FOR THIS PERIOD (BBL)	11514
CUMULATIVE SINCE JAN. 1, 1978 (BBL)	26328
TOTAL OIL ON SITE (BBL)	14562

DRY OIL SHIPPED

FOR THIS PERIOD (BBL)	79815
CUMULATIVE SINCE JULY 5, 1978 (BBL)	79815

APPENDIX 2.0

SEMI-WORKS RETORTING RESEARCH

(MATERIAL AND ELEMENTAL BALANCES AND DATA SUMMARIES)

APPENDIX 2.1

SEMI-WORKS RETORTING RESEARCH - MULTICLONE

***SEMI-WORKS ***
STARTING DATE 21178 TO 21278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	693.65	630.28	90.9
ASH	#/MIN	247.54	247.54	100.0
OXYGEN	SCFM	184.39	184.39	100.0
			83.95 TO H2O	
			100.19 TO CO&CO2	
			0.25 GAS	
WATER	#/MIN	20.57	14.54	70.7
		12.60 SHALE	1.22 LIQ	
		7.97 COMB	13.32 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	52.25	50.31	96.3
			7.46 SHALE	
			32.63 OIL	
			10.11 GAS	
			0.10 WATER	
ORGANIC CARBON	#/MIN	45.00	42.52	94.5
			6.92 SHALE	
			27.64 OIL	
			7.90 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	61.91	59.45	96.0
			19.61 SHALE	
			27.64 OIL	
			12.12 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	5.69	6.24	109.7
			0.54 SHALE	
			3.65 OIL	
			2.02 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.00	1.49	74.6
SULFUR	#/MIN	2.33	3.14	134.6
			2.63 SHALE	
			0.20 OIL	
			0.27 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	441.59	431.87	97.8

3.499 #/MIN C 0.886 #/MIN H 3.949 C/H COMB RATIO
86.44 VOL%FA 87.60WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 21178 TO 21278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	693.65	693.65	100.0
ASH	#/MIN	247.54	247.54	100.0
OXYGEN	SCFM	184.39	184.39	100.0
			57.92 TO H2O	
			126.19 TO CO&CO2	
			0.28 GAS	
WATER	#/MIN	18.10	15.88	87.8
		12.60 SHALE	1.22 LIQ	
		5.50 COMB	14.66 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	52.25	51.39	98.3
			7.46 SHALE	
			32.63 OIL	
			11.19 GAS	
			0.10 WATER	
ORGANIC CARBON	#/MIN	45.00	43.74	97.2
			6.92 SHALE	
			27.64 OIL	
			9.12 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	61.91	60.67	98.0
			19.61 SHALE	
			27.64 OIL	
			13.34 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	5.69	6.08	106.8
			0.54 SHALE	
			3.65 OIL	
			1.86 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.00	1.52	76.0
SULFUR	#/MIN	2.33	3.17	135.8
			2.63 SHALE	
			0.20 OIL	
			0.30 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	441.59	441.53	100.0

4.362 #/MIN C 0.611 #/MIN H 7.136 C/H COMB RATIO
86.44 VOL%FA 87.60WT.%FA

DATA SUMMARY

STARTING DATE 21178 TO 21278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.06	H2O FA	WT%	2.29
OIL FA	GPT	26.40			
MIN CO2	WT%	16.75	ASH	WT%	66.85
CARBON	WT%	16.72	HYDROGEN	WT%	1.79
NITROGEN	WT%	0.54	SULFUR	WT%	0.63

RAW SHALE MOISTURE WT% (UNGROUND) 1.10

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	4.1
VIS	SUS-130	91.4	SEDIMENT	ML/100G	0.4
VIS	SUS-210	46.7	POUR	DEG F	85.0
CARBON	WT%	84.72	HYDROGEN	WT%	11.20
NITROGEN	WT%	1.53	SULFUR	WT%	0.61

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	4.1

PRODUCT WATER PROPERTIES

CARBON	WT%	5.48	HYDROGEN	WT%	10.83
NITROGEN	WT%	2.96	SULFUR	WT%	3.88
CO2	WT%	3.48			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.80	C2H4	VOL%	0.73
N2+AR	VOL%	62.51	C2H6	VOL%	0.56
O2	VOL%	0.03	C3'S	VOL%	0.56
CO	VOL%	2.48	C4'S	VOL%	0.43
CH4	VOL%	1.98	C5+	VOL%	0.43
CO2	VOL%	24.41	H2S	VOL%	0.32
			NH3	VOL%	0.77

GROSS HEAT STU/SCF 124.66

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	15.43	ASH	WT%	82.04
CARBON	WT%	6.50	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.22	SULFUR	WT%	0.87

TEMPERATURES DEG F

RAW SHALE IN	36	RET SHALE OUT	405
AIR TD IN	156	AIR MD IN	125
GAS BD IN	243	GAS MD IN	212
GAS TD IN	209	GAS PROD OUT	239
COOLING WATER IN	76	COOLING WATER OUT	85
PRODUCT OIL OUT	129		
AMBIENT AIR	35	OFF GAS	138

RATES AND QUANTITIES

RAW SHALE	TPH	11.11	THROUGHPUT PHF2		451.1
RET SHALE	TPH	9.05	RET/RAW	WT%	81.5

AIR TOP	SCFM	713.9	SCF/T	3855.9
AIR MID	SCFM	164.2	SCF/T	886.6
AIR BTM	SCFM	0.0	SCF/T	0.0
TOTAL AIR	SCFM	378.0	SCF/T	4742.5

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 21.760
SP GR 0.975

GAS TOP	SCFM	261.0	SCF/T	1409.7
GAS MID	SCFM	248.2	SCF/T	1340.3
GAS BTM	SCFM	2149.8	SCF/T	11611.3
TOTAL GAS	SCFM	2658.9	SCF/T	14361.4

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	1288.8	SCF/T	6960.8

COOLING WATER	GPM	100.0	BARO PRESS IN HG	23.5
AMB AIR REL HUM	%	90.0	BED PD IN H2O/FT	1.1

OIL YIELD WT% FA= 87.5
OIL YIELD VOL% FA= 86.4

***SEMI-WORKS ***
STARTING DATE 21278 TO 21378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	697.27	642.87	92.2
ASH	#/MIN	246.34	246.34	100.0
OXYGEN	SCFM	185.35	185.35	100.0
			35.08 TO H2O	
			150.27 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	15.56	14.07	90.4
		12.23 SHALE	2.01 LIQ	
		3.33 COMB	12.06 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	55.23	51.10	92.5
			7.09 SHALE	
			32.60 OIL	
			11.23 GAS	
			0.17 WATER	
ORGANIC CARBON	#/MIN	45.44	43.73	96.2
			6.58 SHALE	
			27.57 OIL	
			9.48 GAS	
			0.10 WATER	
TOTAL CARBON	#/MIN	62.04	60.35	97.3
			19.65 SHALE	
			27.57 OIL	
			13.00 GAS	
			0.13 WATER	
ORG. HYDROGEN	#/MIN	5.94	5.69	95.9
			0.51 SHALE	
			3.64 OIL	
			1.51 GAS	
			0.03 WATER	
ORG. NITROGEN	#/MIN	2.07	1.36	65.6
SULFUR	#/MIN	2.77	3.24	116.9
			2.65 SHALE	
			0.21 OIL	
			0.31 GAS	
			0.08 WATER	
O'ALL WEIGHT	#/MIN	442.19	434.90	98.4

5.050 #/MIN C 0.370 #/MIN H 13.640 C/H COMB RATIO
86.45 VOL%FA 87.43WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 21278 TO 21378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	697.27	697.26	100.0
ASH	#/MIN	246.34	246.34	100.0
OXYGEN	SCFM	185.35	185.35	100.0
			10.83 TO H2O	
			174.52 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	13.26	15.09	113.8
		12.23 SHALE	2.01 LIQ	
		1.03 COMB	13.08 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	55.23	52.06	94.3
			7.09 SHALE	
			32.60 OIL	
			12.19 GAS	
			0.17 WATER	
ORGANIC CARBON	#/MIN	45.44	44.83	98.7
			6.58 SHALE	
			27.57 OIL	
			10.58 GAS	
			0.10 WATER	
TOTAL CARBON	#/MIN	62.04	61.45	99.1
			19.65 SHALE	
			27.57 OIL	
			14.10 GAS	
			0.13 WATER	
ORG. HYDROGEN	#/MIN	5.94	5.54	93.3
			0.51 SHALE	
			3.64 OIL	
			1.36 GAS	
			0.03 WATER	
ORG. NITROGEN	#/MIN	2.07	1.38	66.6
SULFUR	#/MIN	2.77	3.27	117.8
			2.65 SHALE	
			0.21 OIL	
			0.33 GAS	
			0.08 WATER	
O'ALL WEIGHT	#/MIN	442.19	443.28	100.2

5.849 #/MIN C 0.114 #/MIN H 51.176 C/H COMB RATIO
86.45 VOL%FA 87.43WT.%FA

DATA SUMMARY

STARTING DATE 21278 TO 21378

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.08	H2O FA	WT%	2.03
OIL FA	GPT	26.40			
MIN CO2	WT%	16.45	ASH	WT%	66.59
CARBON	WT%	16.77	HYDROGEN	WT%	1.83
NITROGEN	WT%	0.56	SULFUR	WT%	0.75

RAW SHALE MOISTURE WT% (UNGROUND) 1.26

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	6.6
VIS	SUS-130	90.1	SEDIMENT	ML/100G	0.4
VIS	SUS-210	47.9	POUR	DEG F	85.0
CARBON	WT%	84.57	HYDROGEN	WT%	11.16
NITROGEN	WT%	1.54	SULFUR	WT%	0.65

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	6.6

PRODUCT WATER PROPERTIES

CARBON	WT%	5.48	HYDROGEN	WT%	10.83
NITROGEN	WT%	2.96	SULFUR	WT%	3.88
CO2	WT%	3.48			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.66	C2H4	VOL%	0.74
N2+AR	VOL%	61.25	C2H6	VOL%	0.57
O2	VOL%	0.00	C3'S	VOL%	0.49
CO	VOL%	2.18	C4'S	VOL%	0.39
CH4	VOL%	2.10	C5+	VOL%	0.42
CO2	VOL%	26.22	H2S	VOL%	0.34
			NH3	VOL%	0.64

GROSS HEAT BTU/SCF 120.18

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	15.93	ASH	WT%	81.85
CARBON	WT%	6.53	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.18	SULFUR	WT%	0.88

TEMPERATURES DEG F

RAW SHALE IN	32	RET SHALE OUT	407
AIR TD IN	152	AIR MD IN	123
GAS BD IN	244	GAS MD IN	211
GAS TD IN	209	GAS PROD OUT	238
COOLING WATER IN	63	COOLING WATER OUT	73
PRODUCT OIL OUT	128		
AMBIENT AIR	33	OFF GAS	136

RATES AND QUANTITIES

RAW SHALE	TPH	11.10	THROUGHPUT PHF2		450.7
RET SHALE	TPH	9.03	RET/RAW	WT%	81.4
AIR TOP	SCFM	720.5		SCF/T	3895.4
AIR MID	SCFM	162.1		SCF/T	876.3
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	882.6		SCF/T	4771.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.480			
SP GR		0.993			
GAS TOP	SCFM	262.3		SCF/T	1417.9
GAS MID	SCFM	251.3		SCF/T	1358.5
GAS BTM	SCFM	2158.7		SCF/T	11670.9
TOTAL GAS	SCFM	2672.2		SCF/T	14447.3
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1303.6		SCF/T	7047.7
COOLING WATER	GPM	100.0	BARO PRESS IN HG		23.7
AMB AIR REL HUM	%	78.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 87.3
OIL YIELD VOL% FA= 85.4

***SEMI-WORKS ***
STARTING DATE 21578 TO 21678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	696.25	630.40	90.5
ASH	#/MIN	246.55	246.55	100.0
OXYGEN	SCFM	185.08	185.08	100.0
			124.44 TO H2O	
			60.64 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	25.54	16.66	65.2
		13.72 SHALE	1.60 LIQ	
		11.82 COMB	15.06 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	51.26	49.05	95.7
			7.79 SHALE	
			33.20 OIL	
			7.92 GAS	
			0.14 WATER	
ORGANIC CARBON	#/MIN	43.59	41.09	94.3
			7.31 SHALE	
			28.19 OIL	
			5.51 GAS	
			0.08 WATER	
TOTAL CARBON	#/MIN	61.22	58.75	96.0
			20.08 SHALE	
			28.19 OIL	
			10.37 GAS	
			0.10 WATER	
ORG. HYDROGEN	#/MIN	5.49	6.44	117.3
			0.48 SHALE	
			3.74 OIL	
			2.19 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.07	1.58	76.0
SULFUR	#/MIN	2.81	3.19	113.2
			2.62 SHALE	
			0.22 OIL	
			0.28 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	443.63	436.37	97.1

2.236 #/MIN C 1.313 #/MIN H 1.703 C/H COMB RATIO
81.79 VOL%FA 82.70WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 21578 TO 21678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	696.25	696.24	100.0
ASH	#/MIN	246.55	246.55	100.0
OXYGEN	SCFM	185.08	185.08	100.0
			99.23 TO H2O	
			85.85 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	23.14	18.24	78.8
		13.72 SHALE	1.60 LIQ	
		9.43 COMB	16.64 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	51.26	49.98	97.5
			7.79 SHALE	
			33.20 OIL	
			8.85 GAS	
			0.14 WATER	
ORGANIC CARBON	#/MIN	43.59	42.18	96.8
			7.31 SHALE	
			28.19 OIL	
			6.59 GAS	
			0.08 WATER	
TOTAL CARBON	#/MIN	61.22	59.83	97.7
			20.08 SHALE	
			28.19 OIL	
			11.45 GAS	
			0.10 WATER	
ORG. HYDROGEN	#/MIN	5.49	6.27	114.1
			0.48 SHALE	
			3.74 OIL	
			2.02 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.07	1.60	77.1
SULFUR	#/MIN	2.81	3.22	114.3
			2.62 SHALE	
			0.22 OIL	
			0.31 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	443.63	440.72	99.3

3.075 #/MIN C 1.047 #/MIN H 2.937 C/H COMB RATIO
81.79 VOL%FA 82.70WT.%FA

DATA SUMMARY

STARTING DATE 21578 TO 21678
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.84	H2O FA	WT%	2.13
OIL FA	GPT	28.40			
MIN CO2	WT%	17.46	ASH	WT%	66.57
CARBON	WT%	16.53	HYDROGEN	WT%	1.72
NITROGEN	WT%	0.56	SULFUR	WT%	0.76

RAW SHALE MOISTURE WT% (UNGROUND) 1.55

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	5.2
VIS	SUS-130	92.0	SEDIMENT	ML/100G	0.2
VIS	SUS-210	75.0	POUR	DEG F	85.0
CARBON	WT%	84.92	HYDROGEN	WT%	11.28
NITROGEN	WT%	2.08	SULFUR	WT%	0.66

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	5.2

PRODUCT WATER PROPERTIES

CARBON	WT%	5.48	HYDROGEN	WT%	10.83
NITROGEN	WT%	2.96	SULFUR	WT%	3.88
CO2	WT%	3.48			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.85	C2H4	VOL%	0.73
N2+AR	VOL%	64.26	C2H6	VOL%	0.54
O2	VOL%	0.00	C3'S	VOL%	0.43
CO	VOL%	2.52	C4'S	VOL%	0.23
CH4	VOL%	2.03	C5+	VOL%	0.10
CO2	VOL%	23.35	H2S	VOL%	0.34
			NH3	VOL%	0.63

GROSS HEAT BTU/SCF 96.14

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	15.53	ASH	WT%	91.77
CARBON	WT%	5.66	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.20	SULFUR	WT%	0.87

TEMPERATURES DEG F

RAW SHALE IN	32	RET SHALE OUT	402
AIR TD IN	154	AIR MD IN	124
GAS BD IN	235	GAS MD IN	205
GAS TD IN	232	GAS PROD OUT	231
COOLING WATER IN	53	COOLING WATER OUT	72
PRODUCT OIL OUT	128		
AMBIENT AIR	32	OFF GAS	136

RATES AND QUANTITIES

RAW SHALE	TPH	11.11	THROUGHPUT	PHF2	451.2
RET SHALE	TPH	9.05	RET/RAW	WT%	81.4
AIR TOP	SCFM	719.4		SCF/T	3884.6
AIR MID	SCFM	162.0		SCF/T	874.6
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	881.3		SCF/T	4759.2

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		24.430			
SP GR		0.950			
GAS TOP	SCFM	262.8		SCF/T	1419.1
GAS MID	SCFM	251.6		SCF/T	1358.7
GAS BTM	SCFM	2165.6		SCF/T	11694.1
TOTAL GAS	SCFM	2579.9		SCF/T	14471.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1298.3		SCF/T	7010.6
COOLING WATER	GPM	100.0	BARO PRESS IN HG		23.8
AMB AIR REL HUM	%	66.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 82.6
OIL YIELD VOL% FA= 81.8

***SEMI-WORKS ***

STARTING DATE 21678 TO 21778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	699.30		651.61		93.2
ASH	#/MIN	244.42		244.42		100.0
OXYGEN	SCFM	185.89		185.89		100.0
				103.32	TO H2O	
				82.57	TO CO&CO2	
				0.00	GAS	
WATER	#/MIN	21.74		14.57		67.0
		11.93	SHALE	1.32	LIQ	
		9.81	COMB	13.25	VAP	
				0.00	SHALE	
KEROGEN	#/MIN	52.56		55.06		104.8
				8.75	SHALE	
				37.84	OIL	
				8.35	GAS	
				0.11	WATER	
ORGANIC CARBON	#/MIN	47.77		46.61		97.6
				8.31	SHALE	
				32.09	OIL	
				6.15	GAS	
				0.07	WATER	
TOTAL CARBON	#/MIN	65.34		64.19		98.2
				20.83	SHALE	
				32.09	OIL	
				11.20	GAS	
				0.08	WATER	
ORG. HYDROGEN	#/MIN	5.88		6.74		114.6
				0.45	SHALE	
				4.29	OIL	
				1.98	GAS	
				0.02	WATER	
ORG. NITROGEN	#/MIN	2.03		1.65		81.4
SULFUR	#/MIN	2.84		3.24		114.0
				2.64	SHALE	
				0.25	OIL	
				0.29	GAS	
				0.05	WATER	
O'ALL WEIGHT	#/MIN	441.06		433.81		98.4

2.979 #/MIN C 1.090 #/MIN H 2.732 C/H COMB RATIO

90.85 VOL%FA 91.77WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 21678 TO 21778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	699.30	699.30	100.0
ASH	#/MIN	244.42	244.42	100.0
OXYGEN	SCFM	185.89	185.89	100.0
			83.57 TO H2O	
			102.32 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	19.87	15.54	78.2
		11.93 SHALE	1.32 LIQ	
		7.94 COMB	14.22 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	52.56	55.75	106.1
			8.75 SHALE	
			37.84 OIL	
			9.05 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	47.77	47.43	99.3
			8.31 SHALE	
			32.09 OIL	
			6.97 GAS	
			0.07 WATER	
TOTAL CARBON	#/MIN	65.34	65.01	99.5
			20.83 SHALE	
			32.09 OIL	
			12.02 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	5.88	6.59	112.2
			0.45 SHALE	
			4.29 OIL	
			1.84 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.03	1.67	82.3
SULFUR	#/MIN	2.84	3.26	114.8
			2.64 SHALE	
			0.25 OIL	
			0.31 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	441.06	440.94	100.0

3.636 #/MIN C 0.882 #/MIN H 4.123 C/H COMB RATIO
90.85 VOL%FA 91.77WT.%FA

DATA SUMMARY

STARTING DATE 21678 TO 21778
OPERATING TIME (HRS) 24
OPERATING FACTOR 95.33 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.19	H2O FA	WT%	1.94
OIL FA	GPT	29.30			
MIN CO2	WT%	17.48	ASH	WT%	66.32
CARBON	WT%	17.73	HYDROGEN	WT%	1.81
NITROGEN	WT%	0.55	SULFUR	WT%	0.77

RAW SHALE MOISTURE WT% (UNGROUND) 1.28

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.5	WATER	WT%	3.9
VIS	SUS-130	93.1	SEDIMENT	ML/100G	0.2
VIS	SUS-210	45.3	POUR	DEG F	85.0
CARBON	WT%	84.80	HYDROGEN	WT%	11.33
NITROGEN	WT%	2.14	SULFUR	WT%	0.67

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.5	WATER	WT%	3.9

PRODUCT WATER PROPERTIES

CARBON	WT%	5.48	HYDROGEN	WT%	10.83
NITROGEN	WT%	2.96	SULFUR	WT%	3.88
CO2	WT%	3.48			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.08	C2H4	VOL%	0.69
N2+AR	VOL%	62.70	C2H6	VOL%	0.54
O2	VOL%	0.00	C3'S	VOL%	0.48
CO	VOL%	2.68	C4'S	VOL%	0.12
CH4	VOL%	2.11	C5+	VOL%	0.03
CO2	VOL%	24.64	H2S	VOL%	0.33
			NH3	VOL%	0.60

GROSS HEAT BTU/SCF 91.06

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	15.45	ASH	WT%	82.27
CARBON	WT%	7.01	HYDROGEN	WT%	0.15
NITROGEN	WT%	0.19	SULFUR	WT%	0.89

TEMPERATURES DEG F

RAW SHALE IN	29	RET SHALE OUT	402
AIR TD IN	152	AIR MD IN	123
GAS BD IN	238	GAS MD IN	206
GAS TD IN	202	GAS PROD OUT	232
COOLING WATER IN	64	COOLING WATER OUT	74
PRODUCT OIL OUT	128		
AMBIENT AIR	29	OFF GAS	136

RATES AND QUANTITIES

RAW SHALE	TPH	11.06	THROUGHPUT PHF2		449.0
RET SHALE	TPH	8.91	RET/RAW	WT%	80.6

AIR TOP	SCFM	722.6	SCF/T	3921.4
AIR MID	SCFM	162.6	SCF/T	882.1
AIR BTM	SCFM	0.0	SCF/T	0.0
TOTAL AIR	SCFM	885.2	SCF/T	4803.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 21.160
SP GR 0.965

GAS TOP	SCFM	262.4	SCF/T	1423.9
GAS MID	SCFM	251.0	SCF/T	1362.2
GAS BTM	SCFM	2161.0	SCF/T	11726.9
TOTAL GAS	SCFM	2674.4	SCF/T	14513.0
GAS SEAL LOSS NOT INCLUDED				
GAS PRODUCT	SCFM	1318.1	SCF/T	7153.0

COOLING WATER	GPM	100.0	BARO PRESS IN HG		23.8
AMB AIR REL HUM	%	66.0	BED PD IN H2O/FT		1.2

OIL YIELD WT% FA= 91.7
OIL YIELD VOL% FA= 90.9

APPENDIX 2.2

SEMI-WORKS RETORTING RESEARCH - SHALE RATES

***SEMI WORKS *** ROTO CHMMODY

STARTING DATE 40478 TO 40578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	689.12	653.93	94.9
ASH	#/MIN	252.46	252.46	100.0
OXYGEN	SCFM	183.18	183.18	100.0
			101.41 TO H2O	
			81.51 TO CO&CO2	
			0.26 GAS	
WATER	#/MIN	21.77	14.60	67.1
		12.13 SHALE	1.60 LIQ	
		9.63 COMB	13.00 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	49.29	50.71	102.9
			7.78 SHALE	
			33.51 OIL	
			9.29 GAS	
			0.12 WATER	
ORGANIC CARBON	#/MIN	43.56	42.92	98.5
			7.31 SHALE	
			28.60 OIL	
			6.94 GAS	
			0.07 WATER	
TOTAL CARBON	#/MIN	61.54	60.90	99.0
			20.37 SHALE	
			28.60 OIL	
			11.87 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	5.68	6.57	115.7
			0.47 SHALE	
			3.88 OIL	
			2.20 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.80	1.57	87.6
SULFUR	#/MIN	2.88	3.13	108.4
			2.62 SHALE	
			0.19 OIL	
			0.26 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	446.56	444.40	99.5

2.991 #/MIN C 1.070 #/MIN H 2.794 C/H COMB RATIO

93.93 VOL%FA 95.37WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 40478 TO 40578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	689.12	689.12	100.0
ASH	#/MIN	252.46	252.46	100.0
OXYGEN	SCFM	183.18	183.18	100.0
			87.37 TO H2O	
			95.54 TO CO&CO2	
			0.27 GAS	
WATER	#/MIN	20.43	15.30	74.9
		12.13 SHALE	1.60 LIQ	
		8.30 COMB	13.70 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	49.29	51.27	104.0
			7.78 SHALE	
			33.51 OIL	
			9.85 GAS	
			0.12 WATER	
ORGANIC CARBON	#/MIN	43.56	43.56	100.0
			7.31 SHALE	
			28.60 OIL	
			7.58 GAS	
			0.07 WATER	
TOTAL CARBON	#/MIN	61.54	61.54	100.0
			20.37 SHALE	
			28.60 OIL	
			12.51 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	5.68	6.48	114.1
			0.47 SHALE	
			3.88 OIL	
			2.11 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.80	1.60	89.0
SULFUR	#/MIN	2.88	3.14	108.9
			2.62 SHALE	
			0.19 OIL	
			0.28 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	446.56	449.65	100.7

3.461 #/MIN C 0.922 #/MIN H 3.753 C/H COMB RATIO
93.93 VOL%FA 95.37WT.%FA

DATA SUMMARY

STARTING DATE 40478 TO 40578
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.38	H2O FA	WT%	1.84
OIL FA	GPT	24.60			
MIN CO2	WT%	17.60	ASH	WT%	67.40
CARBON	WT%	16.43	HYDROGEN	WT%	1.72
NITROGEN	WT%	0.48	SULFUR	WT%	0.77

RAW SHALE MOISTURE WT% (UNGROUND) 1.38

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	5.1
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	85.34	HYDROGEN	WT%	11.57
NITROGEN	WT%	2.22	SULFUR	WT%	0.57

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	5.1

PRODUCT WATER PROPERTIES

CARBON	WT%	3.98	HYDROGEN	WT%	10.64
NITROGEN	WT%	2.99	SULFUR	WT%	3.58
CO2	WT%	0.38			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.28	C2H4	VOL%	0.57
N2+AR	VOL%	62.60	C2H6	VOL%	0.47
O2	VOL%	0.02	C3'S	VOL%	0.47
CO	VOL%	2.87	C4'S	VOL%	0.36
CH4	VOL%	1.95	C5+	VOL%	0.36
CO2	VOL%	23.53	H2S	VOL%	0.30
			NH3	VOL%	1.21

GROSS HEAT BTU/SCF 116.36

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	15.37	ASH	WT%	81.06
CARBON	WT%	6.54	HYDROGEN	WT%	0.15
NITROGEN	WT%	0.10	SULFUR	WT%	0.84

TEMPERATURES DEG F

RAW SHALE IN	56	RET SHALE OUT	404
AIR TD IN	175	AIR MD IN	146
GAS BD IN	245	GAS MD IN	214
GAS TD IN	212	GAS PROD OUT	240
COOLING WATER IN	81	COOLING WATER OUT	91
PRODUCT OIL OUT	130		
AMBIENT AIR	48	OFF GAS	138

RATES AND QUANTITIES

RAW SHALE	TPH	11.24	THROUGHPUT PHF2		456.3
RET SHALE	TPH	9.34	RET/RAW	WT%	83.1
AIR TOP	SCFM	712.2		SCF/T	3802.9
AIR MID	SCFM	160.1		SCF/T	854.7
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	872.3		SCF/T	4657.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 20.760
SP GR 0.968

GAS TOP	SCFM	235.9	SCF/T	1259.5
GAS MID	SCFM	248.2	SCF/T	1325.2
GAS BTM	SCFM	2135.3	SCF/T	11401.4
TOTAL GAS	SCFM	2619.4	SCF/T	13986.1

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	1318.4	SCF/T	7039.3

COOLING WATER	GPM	100.0	BARO PRESS IN HG	24.0
AMB AIR REL HUM	%	59.0	BED PD IN H2O/FT	1.4

OIL YIELD WT% FA= 95.3
OIL YIELD VOL% FA= 93.9

***SEMI-WORKS ***
STARTING DATE 40578 TO 40678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	694.87	672.08	96.7
ASH	#/MIN	247.17	247.17	100.0
OXYGEN	SCFM	184.71	184.71	100.0
			167.20 TO H2O	
			17.25 TO CO&CO2	
			0.26 GAS	
WATER	#/MIN	27.42	12.64	46.1
		11.54 SHALE	0.96 LIQ	
		15.88 COMB	11.68 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	49.32	49.14	99.6
			9.38 SHALE	
			32.13 OIL	
			7.56 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	42.44	40.96	96.5
			8.93 SHALE	
			27.40 OIL	
			4.59 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	59.73	58.26	97.5
			18.35 SHALE	
			27.40 OIL	
			12.46 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	5.59	6.89	123.3
			0.45 SHALE	
			3.68 OIL	
			2.76 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.76	1.68	95.2
SULFUR	#/MIN	2.53	3.06	120.9
			2.54 SHALE	
			0.19 OIL	
			0.30 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	438.72	432.15	98.5

0.964 #/MIN C 1.765 #/MIN H 0.546 C/H COMB RATIO
86.98 VOL%FA 88.15WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 40578 TO 40678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	694.87	694.87	100.0
ASH	#/MIN	247.17	247.17	100.0
OXYGEN	SCFM	184.71	184.71	100.0
			157.34 TO H2O	
			27.10 TO CO&CO2	
			0.27 GAS	
WATER	#/MIN	26.48	13.04	49.2
		11.54 SHALE	0.96 LIQ	
		14.95 COMB	12.08 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	49.32	49.50	100.4
			9.38 SHALE	
			32.13 OIL	
			7.92 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	42.44	41.39	97.5
			8.93 SHALE	
			27.40 OIL	
			5.01 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	59.73	58.68	98.2
			18.35 SHALE	
			27.40 OIL	
			12.88 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	5.59	6.82	122.0
			0.45 SHALE	
			3.68 OIL	
			2.69 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.76	1.69	95.9
SULFUR	#/MIN	2.53	3.07	121.3
			2.54 SHALE	
			0.19 OIL	
			0.31 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	438.72	435.56	99.3

1.292 #/MIN C 1.661 #/MIN H 0.778 C/H COMB RATIO
86.98 VOL%FA 88.15WT.%FA

DATA SUMMARY

STARTING DATE 40578 TO 40678
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.94	H2O FA	WT%	1.85
OIL FA	GPT	26.00			
MIN CO2	WT%	17.29	ASH.	WT%	67.41
CARBON	WT%	16.29	HYDROGEN	WT%	1.73
NITROGEN	WT%	0.48	SULFUR	WT%	0.69

RAW SHALE MOISTURE WT% (UNGROUND) 1.28

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	1.48
1.500	27.04
1.050	27.59
0.742	19.44
0.525	11.11
0.371	8.33
0.263	1.67
0.185	0.37
0.131	0.37
PAN	2.59

FACTORS

DA (IN.)=	0.93
DV (IN.)=	1.20
DV/DA =	1.28

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	3.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.1
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	35.29	HYDROGEN	WT%	11.44
NITROGEN	WT%	2.19	SULFUR	WT%	0.59

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	3.3

PRODUCT WATER PROPERTIES

CARBON	WT%	3.98	HYDROGEN	WT%	10.64
NITROGEN	WT%	2.99	SULFUR	WT%	3.58
CO2	WT%	3.38			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.66	C2H4	VOL%	0.51
N2+AR	VOL%	62.28	C2H6	VOL%	0.39
O2	VOL%	0.02	C3'S	VOL%	0.35
CO	VOL%	2.84	C4'S	VOL%	0.26
CH4	VOL%	1.63	C5+	VOL%	0.37
CO2	VOL%	25.50	H2S	VOL%	0.33
			NH3	VOL%	0.86

GROSS HEAT BTU/SCF 100.88

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	11.57	ASH	WT%	82.84
CARBON	WT%	5.15	HYDROGEN	WT%	0.15
NITROGEN	WT%	0.20	SULFUR	WT%	0.85

TEMPERATURES DEG F

RAW SHALE IN	49	RET SHALE OUT	392
AIR TD IN	163	AIR MD IN	133
GAS BD IN	239	GAS MD IN	206
GAS TD IN	201	GAS PROD OUT	233
COOLING WATER IN	81	COOLING WATER OUT	90
PRODUCT OIL OUT	129		
AMBIENT AIR	44	OFF GAS	136

RATES AND QUANTITIES

RAW SHALE	TPH	11.00	THROUGHPUT	PHF2	446.7
RET SHALE	TPH	8.95	RET/RAW	WT%	81.4

AIR TOP	SCFM	718.0	SCF/T	3916.4
AIR MID	SCFM	161.6	SCF/T	881.3
AIR BTM	SCFM	0.0	SCF/T	0.0
TOTAL AIR	SCFM	879.6	SCF/T	4797.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 18.560
SP GR 0.992

GAS TOP	SCFM	232.9	SCF/T	1270.2
GAS MID	SCFM	249.7	SCF/T	1362.0
GAS BTM	SCFM	2162.8	SCF/T	11797.1
TOTAL GAS	SCFM	2645.4	SCF/T	14429.2

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	1325.1	SCF/T	7227.7

COOLING WATER	GPM	100.0	BARO PRESS IN HG	23.9
AMB AIR REL HUM	%	63.0	BED PD IN H2O/FT	1.4

OIL YIELD WT% FA= 88.0
OIL YIELD VOL% FA= 87.0

***SEMI-WORKS ***
STARTING DATE 41378 TO 41478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	689.75	683.86	99.1
ASH	#/MIN	246.38	246.38	100.0
OXYGEN	SCFM	183.35	183.35	100.0
			121.85 TO H2O	
			61.24 TO CO&CO2	
			0.26 GAS	
WATER	#/MIN	21.45	14.50	67.6
		9.88 SHALE	1.02 LIQ	
		11.57 COMB	11.44 VAP	
			2.05 SHALE	
KEROGEN	#/MIN	50.72	49.85	98.3
			7.23 SHALE	
			33.57 OIL	
			8.98 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	41.09	41.87	101.9
			6.92 SHALE	
			28.49 OIL	
			6.42 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	59.66	60.44	101.3
			19.49 SHALE	
			28.49 OIL	
			12.42 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	5.57	6.41	114.9
			0.31 SHALE	
			3.76 OIL	
			2.31 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.88	1.49	79.2
SULFUR	#/MIN	3.17	3.31	104.3
			2.77 SHALE	
			0.22 OIL	
			0.28 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	441.86	435.50	98.6

2.341 #/MIN C 1.286 #/MIN H 1.820 C/H COMB RATIO
91.98 VOL%FA 92.78WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 41378 TO 41478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	689.75	689.75	100.0
ASH	#/MIN	246.38	246.38	100.0
OXYGEN	SCFM	183.35	183.35	100.0
			119.47 TO H2O	
			63.61 TO CO&CO2	
			0.26 GAS	
WATER	#/MIN	21.22	14.60	68.8
		9.88 SHALE	1.02 LIQ	
		11.35 COMB	11.54 VAP	
			2.05 SHALE	
KEROGEN	#/MIN	50.72	49.95	98.5
			7.23 SHALE	
			33.57 OIL	
			9.07 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	41.09	41.98	102.2
			6.92 SHALE	
			28.49 OIL	
			6.53 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	59.66	60.55	101.5
			19.49 SHALE	
			28.49 OIL	
			12.53 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	5.57	6.39	114.6
			0.31 SHALE	
			3.76 OIL	
			2.30 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.88	1.49	79.3
SULFUR	#/MIN	3.17	3.31	104.4
			2.77 SHALE	
			0.22 OIL	
			0.28 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	441.86	436.35	98.8

2.420 #/MIN C 1.261 #/MIN H 1.919 C/H COMB RATIO
91.98 VOL%FA 92.78WT.%FA

DATA SUMMARY

STARTING DATE 41378 TO 41478

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.80	H2O FA	WT%	1.08
OIL FA	GPT	25.60			
MIN CO2	WT%	18.44	ASH.	WT%	66.74
CARBON	WT%	16.16	HYDROGEN	WT%	1.63
NITROGEN	WT%	0.51	SULFUR	WT%	0.86

RAW SHALE MOISTURE WT% (UNGROUND) 1.57

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	3.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.2
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.87	HYDROGEN	WT%	11.21
NITROGEN	WT%	2.18	SULFUR	WT%	0.67

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	3.3

PRODUCT WATER PROPERTIES

CARBON	WT%	4.05	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.74	SULFUR	WT%	4.05
CO2	WT%	0.94			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.64	C2H4	VOL%	0.49
N2+AR	VOL%	63.88	C2H6	VOL%	0.40
O2	VOL%	0.02	C3'S	VOL%	0.39
CO	VOL%	2.77	C4'S	VOL%	0.33
CH4	VOL%	1.71	C5+	VOL%	0.51
CO2	VOL%	24.31	H2S	VOL%	0.30
			NH3	VOL%	0.24

GROSS HEAT BTU/SCF 109.34

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.02			
OIL FA	GPT	0.06			
MIN CO2	WT%	15.30	ASH	WT%	81.81
CARBON	WT%	6.47	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.21	SULFUR	WT%	0.92

TEMPERATURES DEG F

RAW SHALE IN	51	RET SHALE OUT	406
AIR TD IN	172	AIR MD IN	142
GAS BD IN	243	GAS MD IN	211
GAS TD IN	210	GAS PROD OUT	237
COOLING WATER IN	89	COOLING WATER OUT	99
PRODUCT OIL OUT	127		
AMBIENT AIR	44	OFF GAS	134

RATES AND QUANTITIES

RAW SHALE	TPH	11.08	THROUGHPUT PHF2		449.7
RET SHALE	TPH	9.03	RET/RAW	WT%	81.6
AIR TOP	SCFM	712.8		SCF/T	3861.4
AIR MID	SCFM	160.3		SCF/T	868.7
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	873.1		SCF/T	4730.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.370			
SP GR		0.993			
GAS TOP	SCFM	245.4		SCF/T	1329.2
GAS MID	SCFM	248.3		SCF/T	1345.3
GAS BTM	SCFM	2134.6		SCF/T	11564.3
TOTAL GAS	SCFM	2528.2		SCF/T	14238.8
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1311.5		SCF/T	7104.9
COOLING WATER	GPM	100.0	BARO PRESS IN HG		23.9
AMB AIR REL HUM	%	53.0	BED PD IN H2O/FT		1.4

OIL YIELD WT% FA= 92.7
OIL YIELD VOL% FA= 92.0

DATA SUMMARY

***SEMI-WORKS ***
STARTING DATE 41478 TO 41578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	688.31		652.45		94.8
ASH	#/MIN	243.29		243.29		100.0
OXYGEN	SCFM	182.97		182.97		100.0
				112.48	TO H2O	
				70.35	TO CO&CO2	
				0.13	GAS	
WATER	#/MIN	19.47		15.84		81.3
		8.78	SHALE	0.74	LIQ	
		10.68	COMB	14.35	VAP	
				0.74	SHALE	
KEROGEN	#/MIN	51.28		48.83		95.2
				6.13	SHALE	
				34.01	OIL	
				8.64	GAS	
				0.05	WATER	
ORGANIC CARBON	#/MIN	42.03		41.05		97.7
				5.74	SHALE	
				29.00	OIL	
				6.27	GAS	
				0.03	WATER	
TOTAL CARBON	#/MIN	60.55		59.57		98.4
				18.38	SHALE	
				29.00	OIL	
				12.16	GAS	
				0.03	WATER	
ORG. HYDROGEN	#/MIN	5.66		6.42		113.5
				0.39	SHALE	
				3.87	OIL	
				2.15	GAS	
				0.01	WATER	
ORG. NITROGEN	#/MIN	1.79		1.61		89.5
SULFUR	#/MIN	2.71		2.88		106.1
				2.37	SHALE	
				0.21	OIL	
				0.27	GAS	
				0.03	WATER	
O'ALL WEIGHT	#/MIN	437.94		431.15		98.4

2.615 #/MIN C 1.187 #/MIN H 2.203 C/H COMB RATIO
92.64 VOL%FA 93.77WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 41478 TO 41578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	688.31	688.31	100.0
ASH	#/MIN	243.29	243.29	100.0
OXYGEN	SCFM	182.97	182.97	100.0
			97.05 TO H2O	
			85.78 TO CO&CO2	
			0.14 GAS	
WATER	#/MIN	18.00	16.62	92.3
		8.78 SHALE	0.74 LIQ	
		9.22 COMB	15.14 VAP	
			0.74 SHALE	
KEROGEN	#/MIN	51.28	49.46	96.3
			6.13 SHALE	
			34.01 OIL	
			9.21 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	42.03	41.72	99.3
			5.74 SHALE	
			29.00 OIL	
			6.94 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	60.55	60.24	99.5
			18.38 SHALE	
			29.00 OIL	
			12.83 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	5.66	6.31	111.6
			0.39 SHALE	
			3.87 OIL	
			2.04 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.79	1.62	90.0
SULFUR	#/MIN	2.71	2.89	106.6
			2.37 SHALE	
			0.21 OIL	
			0.29 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	437.94	436.67	99.7

3.128 #/MIN C 1.024 #/MIN H 3.054 C/H COMB RATIO
92.64 VOL%FA 93.77WT.%FA

DATA SUMMARY

STARTING DATE 41478 TO 41578
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.90	H20 FA	WT%	1.04
OIL FA	GPT	25.90			
MIN CO2	WT%	18.54	ASH	WT%	66.42
CARBON	WT%	16.53	HYDROGEN	WT%	1.66
NITROGEN	WT%	0.49	SULFUR	WT%	0.74

RAW SHALE MOISTURE WT% (UNGROUND) 1.34

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	2.4
VIS	SUS-130	0.0	SEDIMENT	ML/100C	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	85.29	HYDROGEN	WT%	11.39
NITROGEN	WT%	2.32	SULFUR	WT%	0.61

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	2.4

PRODUCT WATER PROPERTIES

CARBON	WT%	4.05	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.74	SULFUR	WT%	4.05
CO2	WT%	0.94			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.59	C2H4	VOL%	0.51
N2+AR	VOL%	62.53	C2H6	VOL%	0.46
O2	VOL%	0.01	C3'S	VOL%	0.40
CO	VOL%	2.75	C4'S	VOL%	0.24
CH4	VOL%	1.88	C5+	VOL%	0.35
CO2	VOL%	25.52	H2S	VOL%	0.31
			NH3	VOL%	0.45

GROSS HEAT BTU/SCF 102.31

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.02			
MIN CO2	WT%	15.66	ASH	WT%	82.22
CARBON	WT%	6.21	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.21	SULFUR	WT%	0.80

TEMPERATURES DEG F

RAW SHALE IN	52	RET SHALE OUT	400
AIR TD IN	176	AIR MD IN	144
GAS BD IN	244	GAS MD IN	213
GAS TD IN	213	GAS PROD OUT	239
COOLING WATER IN	91	COOLING WATER OUT	101
PRODUCT OIL OUT	129		
AMBIENT AIR	53	OFF GAS	135

RATES AND QUANTITIES

RAW SHALE	TPH	10.99	THROUGHPUT	PHF2	446.2
RET SHALE	TPH	8.88	RET/RAW	WT%	80.8

AIR TOP	SCFM	711.9	SCF/T	3887.2
AIR MID	SCFM	159.3	SCF/T	870.1
AIR BTM	SCFM	0.0	SCF/T	0.0
TOTAL AIR	SCFM	871.3	SCF/T	4757.3

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 22.460
SP GR 0.975

GAS TOP	SCFM	244.7	SCF/T	1336.3
GAS MID	SCFM	247.9	SCF/T	1353.4
GAS BTM	SCFM	2132.4	SCF/T	11643.1
TOTAL GAS	SCFM	2625.0	SCF/T	14332.8

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	1345.7	SCF/T	7347.5

COOLING WATER	GPM	100.0	BARO PRESS IN HG	23.8
AMB AIR REL HUM	%	50.0	BED PD IN H2O/FT	1.4

OIL YIELD WT% FA= 93.7
OIL YIELD VOL% FA= 93.6

***SEMI-WORKS ***
STARTING DATE 42078 TO 42178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	714.44	677.32	94.8
ASH	#/MIN	258.99	258.99	100.0
OXYGEN	SCFM	189.92	189.91	100.0
			92.32 TO H2O	
			97.33 TO CO&CO2	
			0.27 GAS	
WATER	#/MIN	18.14	15.50	85.4
		9.37 SHALE	0.67 LIQ	
		8.77 COMB	13.08 VAP	
			1.75 SHALE	
KEROGEN	#/MIN	59.89	54.70	91.3
			8.58 SHALE	
			35.37 OIL	
			10.72 GAS	
			0.03 WATER	
ORGANIC CARBON	#/MIN	49.58	46.14	93.1
			8.01 SHALE	
			29.77 OIL	
			8.33 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	68.57	65.13	95.0
			21.69 SHALE	
			29.77 OIL	
			13.65 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.64	6.82	102.7
			0.57 SHALE	
			4.01 OIL	
			2.24 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	2.08	1.79	86.2
SULFUR	#/MIN	3.14	2.99	95.2
			2.51 SHALE	
			0.21 OIL	
			0.24 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	467.07	457.65	98.0

3.442 #/MIN C 0.974 #/MIN H 3.533 C/H COMB RATIO
83.46 VOL%FR 84.97WT.%FR

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 42078 TO 42178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	714.44	714.44	100.0
ASH	#/MIN	258.99	258.99	100.0
OXYGEN	SCFM	189.92	189.91	100.0
			76.22 TO H2O	
			113.40 TO CO&CO2	
			0.29 GAS	
WATER	#/MIN	16.61	16.22	97.6
		9.37 SHALE	0.67 LIQ	
		7.24 COMB	13.80 VAP	
			1.75 SHALE	
KEROGEN	#/MIN	59.89	55.36	92.4
			8.58 SHALE	
			35.37 OIL	
			11.38 GAS	
			0.03 WATER	
ORGANIC CARBON	#/MIN	49.58	46.89	94.6
			8.01 SHALE	
			29.77 OIL	
			9.08 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	68.57	65.88	96.1
			21.69 SHALE	
			29.77 OIL	
			14.40 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.64	6.72	101.2
			0.57 SHALE	
			4.01 OIL	
			2.14 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	2.08	1.81	87.2
SULFUR	#/MIN	3.14	3.00	95.6
			2.51 SHALE	
			0.21 OIL	
			0.25 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	467.07	463.36	99.2

3.975 #/MIN C 0.804 #/MIN H 4.941 C/H COMB RATIO
83.46 VOL%FA 84.97WT.%FA

DATA SUMMARY

STARTING DATE 42078 TO 42178
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.60	H2O FA	WT%	1.07
OIL FA	GPT	27.80			
MIN CO2	WT%	17.73	ASH	WT%	65.95
CARBON	WT%	17.46	HYDROGEN	WT%	1.81
NITROGEN	WT%	0.53	SULFUR	WT%	0.80

RAW SHALE MOISTURE WT% (UNGROUND) 1.30

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.5	WATER	WT%	2.1
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.5
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.16	HYDROGEN	WT%	11.33
NITROGEN	WT%	2.05	SULFUR	WT%	0.60

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.5	WATER	WT%	2.1

PRODUCT WATER PROPERTIES

CARBON	WT%	3.98	HYDROGEN	WT%	10.54
NITROGEN	WT%	3.53	SULFUR	WT%	4.13
CO2	WT%	3.94			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.89	C2H4	VOL%	0.64
N2+AR	VOL%	61.39	C2H6	VOL%	0.56
O2	VOL%	0.02	C3'S	VOL%	0.48
CO	VOL%	2.51	C4'S	VOL%	0.41
CH4	VOL%	2.09	C5+	VOL%	0.51
CO2	VOL%	25.34	H2S	VOL%	0.26
			NH3	VOL%	0.90

GROSS HEAT BTU/SCF 126.53

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.20			
OIL FA	GPT	0.51			
MIN CO2	WT%	15.79	ASH	WT%	81.57
CARBON	WT%	6.83	HYDROGEN	WT%	0.24
NITROGEN	WT%	0.22	SULFUR	WT%	0.79

TEMPERATURES DEG F

RAW SHALE IN	52	RET SHALE OUT	413
AIR TD IN	176	AIR MD IN	146
GAS BD IN	236	GAS MD IN	207
GAS TD IN	207	GAS PROD OUT	231
COOLING WATER IN	88	COOLING WATER OUT	98
PRODUCT OIL OUT	130		
AMBIENT AIR	54	OFF GAS	137

RATES AND QUANTITIES

RAW SHALE	TPH	11.78	THROUGHPUT	PHF2	478.4
RET SHALE	TPH	9.53	RET/RAW	WT%	80.9

AIR TOP	SCFM	738.9	SCF/T	3763.3
AIR MID	SCFM	165.4	SCF/T	842.5
AIR BTM	SCFM	0.0	SCF/T	0.0
TOTAL AIR	SCFM	904.4	SCF/T	4605.9

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 19.980
SP GR 0.986

GAS TOP	SCFM	254.4	SCF/T	1295.9
GAS MID	SCFM	258.5	SCF/T	1316.6
GAS BTM	SCFM	2242.6	SCF/T	11421.4
TOTAL GAS	SCFM	2755.6	SCF/T	14033.9

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	1378.8	SCF/T	7022.1

COOLING WATER	GPM	100.0	BARO PRESS IN HG	23.8
AMB AIR REL HUM	%	28.0	BED PD IN H2O/FT	1.5

OIL YIELD WT% FA= 84.9
OIL YIELD VOL% FA= 83.5

MATH SUMMARY

***SEMI-WORKS ***
STARTING DATE 42178 TO 42278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	721.08	705.28	97.8
ASH	#/MIN	265.46	263.58	99.3
OXYGEN	SCFM	191.68	191.68	100.0
			113.43 TO H2O	
			76.09 TO CO&CO2	
			2.16 GAS	
WATER	#/MIN	18.92	12.62	66.7
		8.15 SHALE	0.81 LIQ	
		10.77 COMB	11.65 VAP	
			0.16 SHALE	
KEROGEN	#/MIN	53.99	54.86	101.6
			8.27 SHALE	
			36.17 OIL	
			10.39 GAS	
			0.04 WATER	
ORGANIC CARBON	#/MIN	44.70	45.96	102.8
			7.61 SHALE	
			30.58 OIL	
			7.73 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	63.99	65.26	102.0
			21.22 SHALE	
			30.58 OIL	
			13.42 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.17	7.25	117.5
			0.66 SHALE	
			4.09 OIL	
			2.50 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.90	1.90	100.3
SULFUR	#/MIN	3.05	2.97	97.4
			2.49 SHALE	
			0.18 OIL	
			0.26 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	465.39	464.40	99.8

2.781 #/MIN C 1.197 #/MIN H 2.323 C/H COMB RATIO
87.39 VOL%FA 88.28WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 42178 TO 42278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	721.08	721.08	100.0
ASH	#/MIN	265.46	263.58	99.3
OXYGEN	SCFM	191.68	191.68	100.0
			107.04 TO H2O	
			82.43 TO CO&CO2	
			2.21 GAS	
WATER	#/MIN	18.32	12.88	70.3
		8.15 SHALE	0.81 LIQ	
		10.17 COMB	11.91 VAP	
			0.16 SHALE	
KEROGEN	#/MIN	53.99	55.13	102.1
			8.27 SHALE	
			36.17 OIL	
			10.65 GAS	
			0.04 WATER	
ORGANIC CARBON	#/MIN	44.70	46.26	103.5
			7.61 SHALE	
			30.58 OIL	
			8.03 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	63.99	65.56	102.4
			21.22 SHALE	
			30.58 OIL	
			13.72 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.17	7.21	116.8
			0.66 SHALE	
			4.09 OIL	
			2.46 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.90	1.91	100.8
SULFUR	#/MIN	3.05	2.97	97.6
			2.49 SHALE	
			0.18 OIL	
			0.27 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	465.39	466.73	100.3

2.991 #/MIN C 1.130 #/MIN H 2.648 C/H COMB RATIO
87.39 VOL%FA 88.28WT.%FA

DATA SUMMARY

STARTING DATE 42178 TO 42278

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.36	H2O FA	WT%	1.34
OIL FA	GPT	27.10			
MIN CO2	WT%	17.89	ASH	WT%	67.12
CARBON	WT%	16.18	HYDROGEN	WT%	1.71
NITROGEN	WT%	0.48	SULFUR	WT%	0.77

RAW SHALE MOISTURE WT% (UNGROUND) 1.42

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	2.4
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.3
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.55	HYDROGEN	WT%	11.30
NITROGEN	WT%	2.04	SULFUR	WT%	0.50

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	2.4

PRODUCT WATER PROPERTIES

CARBON	WT%	3.98	HYDROGEN	WT%	10.54
NITROGEN	WT%	0.53	SULFUR	WT%	4.13
CO2	WT%	0.94			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.83	C2H4	VOL%	0.64
N2+AR	VOL%	62.63	C2H6	VOL%	0.55
O2	VOL%	0.19	C3'S	VOL%	0.43
CO	VOL%	2.51	C4'S	VOL%	0.38
CH4	VOL%	2.00	C5+	VOL%	0.58
CO2	VOL%	23.90	H2S	VOL%	0.28
			NH3	VOL%	1.08

GROSS HEAT BTU/SCF 126.92

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.25			
OIL FA	GPT	0.64			
MIN CO2	WT%	15.43	ASH	WT%	81.49
CARBON	WT%	6.56	HYDROGEN	WT%	0.21
NITROGEN	WT%	0.22	SULFUR	WT%	0.77

TEMPERATURES DEG F

RAW SHALE IN	48	RET SHALE OUT	409
AIR TD IN	157	AIR MD IN	134
GAS BD IN	233	GAS MD IN	202
GAS TD IN	281	GAS PROD OUT	228
COOLING WATER IN	80	COOLING WATER OUT	90
PRODUCT OIL OUT	127		
AMBIENT AIR	38	OFF GAS	136

RATES AND QUANTITIES

RAW SHALE	TPH	11.78	THROUGHPUT PHF2		478.4
RET SHALE	TPH	9.70	RET/RAW	WT%	82.4
AIR TOP	SCFM	745.8		SCF/T	3798.4
AIR MID	SCFM	166.9		SCF/T	850.2
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	912.8		SCF/T	4648.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		17.880			
SP GR		0.990			
GAS TOP	SCFM	255.0		SCF/T	1298.5
GAS MID	SCFM	257.2		SCF/T	1309.8
GAS BTM	SCFM	2241.9		SCF/T	11418.0
TOTAL GAS	SCFM	2754.1		SCF/T	14026.3
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1371.3		SCF/T	6984.1
COOLING WATER	GPM	100.0	BARO PRESS IN HG		23.6
AMB AIR REL HUM	%	31.0	BED PD IN H2O/FT		1.5

OIL YIELD WT% FA= 88.2
OIL YIELD VOL% FA= 87.4

***SEMI-WORKS ***
STARTING DATE 42478 TO 42578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	714.59	706.17	98.8
ASH	#/MIN	273.64	273.64	100.0
OXYGEN	SCFM	189.95	189.95	100.0
			112.57 TO H2O	
			77.11 TO CO&CO2	
			0.27 GAS	
WATER	#/MIN	20.58	14.74	71.6
		9.89 SHALE	0.87 LIQ	
		10.69 COMB	13.37 VAP	
			0.50 SHALE	
KEROGEN	#/MIN	48.99	50.62	103.3
			7.81 SHALE	
			33.16 OIL	
			9.61 GAS	
			0.04 WATER	
ORGANIC CARBON	#/MIN	45.77	42.23	92.3
			7.29 SHALE	
			27.78 OIL	
			7.12 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	65.41	61.86	94.6
			21.74 SHALE	
			27.78 OIL	
			12.31 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.23	6.59	105.8
			0.51 SHALE	
			3.75 OIL	
			2.32 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.04	1.97	96.9
SULFUR	#/MIN	2.87	3.54	123.3
			3.05 SHALE	
			0.18 OIL	
			0.27 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	473.73	472.41	99.7

2.795 #/MIN C 1.188 #/MIN H 2.352 C/H COMB RATIO
84.51 VOL%FA 85.62WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 42478 TO 42578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	714.59	714.59	100.0
ASH	#/MIN	273.64	273.64	100.0
OXYGEN	SCFM	189.95	189.95	100.0
			109.39 TO H2O	
			80.29 TO CO&CO2	
			0.27 GAS	
WATER	#/MIN	20.28	14.90	73.5
		9.89 SHALE	0.87 LIQ	
		10.39 COMB	13.52 VAP	
			0.50 SHALE	
KEROGEN	#/MIN	48.99	50.75	103.6
			7.81 SHALE	
			33.16 OIL	
			9.74 GAS	
			0.04 WATER	
ORGANIC CARBON	#/MIN	45.77	42.37	92.6
			7.29 SHALE	
			27.78 OIL	
			7.27 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	65.41	62.01	94.8
			21.74 SHALE	
			27.78 OIL	
			12.46 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.23	6.57	105.5
			0.51 SHALE	
			3.75 OIL	
			2.30 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.04	1.98	97.1
SULFUR	#/MIN	2.87	3.55	123.4
			3.05 SHALE	
			0.18 OIL	
			0.28 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	473.73	473.64	100.0

2.901 #/MIN C 1.154 #/MIN H 2.513 C/H COMB RATIO
84.51 VOL%FA 85.62WT.%FA

DATA SUMMARY

STARTING DATE 42478 TO 42578

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.70	H2O FA	WT%	1.17
OIL FA	GPT	25.40			
MIN CO2	WT%	18.03	ASH	WT%	68.53
CARBON	WT%	16.38	HYDROGEN	WT%	1.69
NITROGEN	WT%	0.51	SULFUR	WT%	0.72

RAW SHALE MOISTURE WT% (UNGROUND) 1.29

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	2.7
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.1
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	83.76	HYDROGEN	WT%	11.31
NITROGEN	WT%	1.98	SULFUR	WT%	0.55

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	2.7

PRODUCT WATER PROPERTIES

CARBON	WT%	3.90	HYDROGEN	WT%	10.58
NITROGEN	WT%	0.36	SULFUR	WT%	3.95
CO2	WT%	1.01			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.18	C2H4	VOL%	0.63
N2+AR	VOL%	64.55	C2H6	VOL%	0.52
O2	VOL%	0.02	C3'S	VOL%	0.41
CO	VOL%	2.45	C4'S	VOL%	0.32
CH4	VOL%	1.88	C5+	VOL%	0.45
CO2	VOL%	23.19	H2S	VOL%	0.30
			NH3	VOL%	1.09

GROSS HEAT BTU/SCF 113.72

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.03			
MIN CO2	WT%	15.79	ASH	WT%	81.58
CARBON	WT%	5.48	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.26	SULFUR	WT%	0.91

TEMPERATURES DEG F

RAW SHALE IN	55	RET SHALE OUT	420
AIR TD IN	131	AIR MD IN	156
GAS BD IN	238	GAS MD IN	210
GAS TD IN	210	GAS PROD OUT	233
COOLING WATER IN	85	COOLING WATER OUT	95
PRODUCT OIL OUT	129		
AMBIENT AIR	54	OFF GAS	136

RATES AND QUANTITIES

RAW SHALE	TPH	11.98	THROUGHPUT PHF2		486.4
RET SHALE	TPH	10.06	RET/RAW	WT%	84.0
AIR TOP	SCFM	740.1		SCF/T	3706.7
AIR MID	SCFM	164.5		SCF/T	823.9
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	904.5		SCF/T	4530.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.460			
SP GR		0.977			
GAS TOP	SCFM	254.9		SCF/T	1276.9
GAS MID	SCFM	259.0		SCF/T	1297.4
GAS BTM	SCFM	2303.9		SCF/T	11539.7
TOTAL GAS	SCFM	2817.8		SCF/T	14113.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1375.5		SCF/T	6889.4
COOLING WATER	GPM	100.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	32.0	BED PD IN H2O/FT		1.5

OIL YIELD WT% FA= 85.5

***SEMI-WORKS ***
STARTING DATE 50178 TO 50278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	694.42	650.28	93.6
ASH	#/MIN	251.41	251.41	100.0
OXYGEN	SCFM	184.59	184.59	100.0
			109.13 TO H2O	
			75.20 TO CO&CO2	
			0.26 GAS	
WATER	#/MIN	18.57	15.93	85.8
		8.20 SHALE	1.05 LIQ	
		10.37 COMB	13.81 VAP	
			1.07 SHALE	
KEROGEN	#/MIN	52.09	50.06	96.1
			7.01 SHALE	
			32.96 OIL	
			9.95 GAS	
			0.14 WATER	
ORGANIC CARBON	#/MIN	43.86	41.89	95.5
			6.64 SHALE	
			27.79 OIL	
			7.36 GAS	
			0.10 WATER	
TOTAL CARBON	#/MIN	61.57	59.61	96.8
			18.91 SHALE	
			27.79 OIL	
			12.80 GAS	
			0.11 WATER	
ORG. HYDROGEN	#/MIN	5.80	6.39	110.1
			0.37 SHALE	
			3.71 OIL	
			2.29 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.90	1.23	64.7
SULFUR	#/MIN	2.68	2.88	107.3
			2.31 SHALE	
			0.18 OIL	
			0.35 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	443.89	438.59	98.8

2.742 #/MIN C 1.152 #/MIN H 2.380 C/H COMB RATIO
86.20 VOL%FA 87.25WT.%FA

DATA SUMMARY

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 50178 TO 50278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	694.42	694.42	100.0
ASH	#/MIN	251.41	251.41	100.0
OXYGEN	SCFM	184.59	184.59	100.0
			90.62 TO H2O	
			93.69 TO CO&CO2	
			0.28 GAS	
WATER	#/MIN	16.81	16.87	100.3
		8.20 SHALE	1.05 LIQ	
		8.61 COMB	14.75 VAP	
			1.07 SHALE	
KEROGEN	#/MIN	52.09	50.83	97.6
			7.01 SHALE	
			32.96 OIL	
			10.73 GAS	
			0.14 WATER	
ORGANIC CARBON	#/MIN	43.86	42.76	97.5
			6.64 SHALE	
			27.79 OIL	
			8.23 GAS	
			0.10 WATER	
TOTAL CARBON	#/MIN	61.57	60.47	98.2
			18.91 SHALE	
			27.79 OIL	
			13.66 GAS	
			0.11 WATER	
ORG. HYDROGEN	#/MIN	5.80	6.27	108.0
			0.37 SHALE	
			3.71 OIL	
			2.17 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.90	1.24	65.2
SULFUR	#/MIN	2.68	2.90	108.2
			2.31 SHALE	
			0.18 OIL	
			0.37 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	443.89	445.36	100.3

3.356 #/MIN C 0.956 #/MIN H 3.509 C/H COMB RATIO
86.20 VOL%FA 87.25WT.%FA

DATA SUMMARY

STARTING DATE 50178 TO 50278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.13	H2O FA	WT%	1.20
OIL FA	GPT	26.50			
MIN CO2	WT%	17.41	ASH	WT%	67.42
CARBON	WT%	16.51	HYDROGEN	WT%	1.69
NITROGEN	WT%	0.51	SULFUR	WT%	0.72

RAW SHALE MOISTURE WT% (UNGROUND) 0.99

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	0.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.32	HYDROGEN	WT%	11.25
NITROGEN	WT%	1.40	SULFUR	WT%	0.54

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	3.2

PRODUCT WATER PROPERTIES

CARBON	WT%	3.71	HYDROGEN	WT%	10.22
NITROGEN	WT%	3.09	SULFUR	WT%	4.10
CO2	WT%	3.00			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.71	C2H4	VOL%	0.64
N2+AR	VOL%	62.57	C2H6	VOL%	0.51
O2	VOL%	0.03	C3'S	VOL%	0.46
CO	VOL%	2.62	C4'S	VOL%	0.49
CH4	VOL%	1.83	C5+	VOL%	0.54
CO2	VOL%	24.91	H2S	VOL%	0.39
			NH3	VOL%	0.32

GROSS HEAT BTU/SCF 124.95

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	14.77	ASH	WT%	82.56
CARBON	WT%	5.21	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.20	SULFUR	WT%	0.76

TEMPERATURES DEG F

RAW SHALE IN	52	RET SHALE OUT	412
AIR TD IN	178	AIR MD IN	149
GAS BD IN	234	GAS MD IN	204
GAS TD IN	234	GAS PROD OUT	229
COOLING WATER IN	82	COOLING WATER OUT	91
PRODUCT OIL OUT	128		
AMBIENT AIR	44	OFF GAS	138

RATES AND QUANTITIES

RAW SHALE	TPH	11.19	THROUGHPUT PHF2		454.3
RET SHALE	TPH	9.14	RET/RAW	WT%	81.7
AIR TOP	SCFM	718.6		SCF/T	3854.1
AIR MID	SCFM	160.4		SCF/T	860.3
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	879.0		SCF/T	4714.4

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		21.860			
SP GR		0.981			
GAS TOP	SCFM	259.4		SCF/T	1391.4
GAS MID	SCFM	248.9		SCF/T	1335.0
GAS BTM	SCFM	2178.4		SCF/T	11683.7
TOTAL GAS	SCFM	2686.8		SCF/T	14410.1
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1330.1		SCF/T	7133.7
COOLING WATER	GPM	100.0	BARO PRESS IN HG		23.8
AMB AIR REL HUM	%	78.0	BED PD IN H2O/FT		1.3

OIL YIELD WT% FA= 97.1
OIL YIELD VOL% FA= 85.2

***SEMI-WORKS ***
STARTING DATE 50278 TO 50378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	694.50	666.39	96.0
ASH	#/MIN	255.02	255.02	100.0
OXYGEN	SCFM	184.61	184.61	100.0
			104.14 TO H2O	
			80.20 TO CO&CO2	
			0.27 GAS	
WATER	#/MIN	19.08	15.50	81.2
		9.19 SHALE	1.00 LIQ	
		9.89 COMB	13.32 VAP	
			1.18 SHALE	
KEROGEN	#/MIN	56.69	51.96	91.6
			7.47 SHALE	
			34.23 OIL	
			10.13 GAS	
			0.13 WATER	
ORGANIC CARBON	#/MIN	45.76	43.54	95.1
			7.04 SHALE	
			28.87 OIL	
			7.55 GAS	
			0.08 WATER	
TOTAL CARBON	#/MIN	63.74	61.53	96.5
			19.85 SHALE	
			28.87 OIL	
			12.71 GAS	
			0.09 WATER	
ORG. HYDROGEN	#/MIN	6.32	6.56	103.8
			0.43 SHALE	
			3.85 OIL	
			2.25 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.99	1.30	65.1
SULFUR	#/MIN	2.56	2.77	107.8
			2.18 SHALE	
			0.18 OIL	
			0.35 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	454.09	447.40	98.5

2.875 #/MIN C 1.099 #/MIN H 2.615 C/H COMB RATIO
83.06 VOL%FA 83.90WT.%FA

*** ATM. N2 BALANCE ***

STARTING DATE 50278 TO 50378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	694.50	694.50	100.0
ASH	#/MIN	255.02	255.02	100.0
OXYGEN	SCFM	184.61	184.61	100.0
			92.72 TO H2O	
			91.62 TO CO&CO2	
			0.28 GAS	
WATER	#/MIN	18.00	16.07	89.3
		9.19 SHALE	1.00 LIQ	
		8.81 COMB	13.89 VAP	
			1.18 SHALE	
KEROGEN	#/MIN	56.69	52.44	92.5
			7.47 SHALE	
			34.23 OIL	
			10.61 GAS	
			0.13 WATER	
ORGANIC CARBON	#/MIN	45.76	44.07	96.3
			7.04 SHALE	
			28.87 OIL	
			8.09 GAS	
			0.08 WATER	
TOTAL CARBON	#/MIN	63.74	62.06	97.4
			19.85 SHALE	
			28.87 OIL	
			13.25 GAS	
			0.09 WATER	
ORG. HYDROGEN	#/MIN	6.32	6.48	102.7
			0.43 SHALE	
			3.85 OIL	
			2.18 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.99	1.30	65.3
SULFUR	#/MIN	2.56	2.78	108.4
			2.18 SHALE	
			0.18 OIL	
			0.36 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	454.09	451.63	99.5

3.253 #/MIN C 0.979 #/MIN H 3.325 C/H COMB RATIO

83.06 VOL%FA 83.90WT.%FA

DATA SUMMARY

STARTING DATE 50278 TO 50378

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.66	H2O FA	WT%	1.35
OIL FA	GPT	27.90			
MIN CO2	WT%	17.22	ASH	WT%	66.62
CARBON	WT%	16.65	HYDROGEN	WT%	1.80
NITROGEN	WT%	0.52	SULFUR	WT%	0.67

RAW SHALE MOISTURE WT% (UNGROUND) 1.04

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	0.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.32	HYDROGEN	WT%	11.25
NITROGEN	WT%	1.40	SULFUR	WT%	0.54

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	3.4

PRODUCT WATER PROPERTIES

CARBON	WT%	7.51	HYDROGEN	WT%	9.80
NITROGEN	WT%	3.90	SULFUR	WT%	3.12
CO2	WT%	2.73			

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PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.93	C2H4	VOL%	0.65
N2+AR	VOL%	63.03	C2H6	VOL%	0.55
O2	VOL%	0.03	C3'S	VOL%	0.48
CO	VOL%	2.45	C4'S	VOL%	0.45
CH4	VOL%	2.04	C5+	VOL%	0.48
CO2	VOL%	24.37	H2S	VOL%	0.39
			NH3	VOL%	0.14

GROSS HEAT BTU/SCF 123.31

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.02			
MIN CO2	WT%	15.08	ASH	WT%	81.82
CARBON	WT%	6.37	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.23	SULFUR	WT%	0.70

TEMPERATURES DEG F

RAW SHALE IN	54	RET SHALE OUT	413
AIR TD IN	180	AIR MD IN	151
GAS BD IN	232	GAS MD IN	204
GAS TD IN	204	GAS PROD OUT	227
COOLING WATER IN	87	COOLING WATER OUT	97
PRODUCT OIL OUT	130		
AMBIENT AIR	49	OFF GAS	139

RATES AND QUANTITIES

RAW SHALE	TPH	11.48	THROUGHPUT PHF2		466.3
RET SHALE	TPH	9.35	RET/RAW	WT%	81.4
AIR TOP	SCFM	719.1		SCF/T	3757.2
AIR MID	SCFM	160.0		SCF/T	835.9
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	879.1		SCF/T	4593.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.970			
SP GR		0.980			
GAS TOP	SCFM	259.1		SCF/T	1353.9
GAS MID	SCFM	248.6		SCF/T	1299.0
GAS BTM	SCFM	2196.9		SCF/T	11478.2
TOTAL GAS	SCFM	2704.7		SCF/T	14131.1
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1337.8		SCF/T	6989.6
COOLING WATER	GPM	100.0	BARO PRESS IN HG		23.8
AMB AIR REL HUM	%	65.0	BED PD IN H2O/FT		1.4

OIL YIELD WT% FA= 83.8
OIL YIELD VOL% FA= 83.1

APPENDIX 2.3

SEMI-WORKS RETORTING RESEARCH - ENGINEERING STUDY

***SEMI-WORKS ***
STARTING DATE 53078 TO 53178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	652.33	597.85	91.6
ASH	#/MIN	251.74	251.74	100.0
OXYGEN	SCFM	173.40	173.40	100.0
			81.11 TO H2O	
			91.93 TO CO&CO2	
			0.36 GAS	
WATER	#/MIN	16.97	13.72	80.8
		9.27 SHALE	0.80 LIQ	
		7.70 COMB	12.22 VAP	
			0.69 SHALE	
KEROGEN	#/MIN	51.93	49.68	95.7
			6.96 SHALE	
			33.08 OIL	
			9.56 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	45.21	42.13	93.2
			6.47 SHALE	
			28.11 OIL	
			7.52 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	64.07	61.01	95.2
			21.35 SHALE	
			28.11 OIL	
			11.50 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.30	6.19	98.4
			0.49 SHALE	
			3.78 OIL	
			1.91 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.92	1.53	79.8
SULFUR	#/MIN	2.90	2.79	96.1
			2.35 SHALE	
			0.22 OIL	
			0.15 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	445.28	438.33	98.4

3.248 #/MIN C 0.856 #/MIN H 3.794 C/H COMB RATIO
85.42 VOL%FA 86.14WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 53078 TO 53178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	652.33	652.33	100.0
ASH	#/MIN	251.74	251.74	100.0
OXYGEN	SCFM	173.40	173.40	100.0
			58.89 TO H20	
			114.12 TO CO&CO2	
			0.40 GAS	
WATER	#/MIN	14.86	14.83	99.8
		9.27 SHALE	0.80 LIQ	
		5.59 COMB	13.34 VAP	
			0.69 SHALE	
KEROGEN	#/MIN	51.93	50.60	97.4
			6.96 SHALE	
			33.08 OIL	
			10.48 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	45.21	43.18	95.5
			6.47 SHALE	
			28.11 OIL	
			8.57 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	64.07	62.06	96.9
			21.35 SHALE	
			28.11 OIL	
			12.55 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.30	6.06	96.2
			0.49 SHALE	
			3.78 OIL	
			1.78 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.92	1.54	80.2
SULFUR	#/MIN	2.90	2.80	96.6
			2.35 SHALE	
			0.22 OIL	
			0.17 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	445.28	446.56	100.3

3.988 #/MIN C 0.621 #/MIN H 6.416 C/H COMB RATIO
85.42 VOL%FA 86.14WT.%FA

***SEMI-WORKS ***

DATA SUMMARY

STARTING DATE 53078 TO 53178
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.19	H2O FA	WT%	1.07
OIL FA	GPT	26.68			
MIN CO2	WT%	18.35	ASH	WT%	66.80
CARBON	WT%	17.00	HYDROGEN	WT%	1.79
NITROGEN	WT%	0.51	SULFUR	WT%	0.77

RAW SHALE MOISTURE WT% (UNGROUND) 1.37

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)	FACTORS	
2.120	7.89	DA (IN.)=	1.23
1.500	51.74	DV (IN.)=	1.53
1.050	15.78	DV/DA =	1.24
0.742	11.93		
0.525	7.71		
0.371	2.02		
0.263	1.28		
0.185	0.18		
0.131	0.18		
PAN	1.28		

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.7	WATER	WT%	2.9
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.8
VIS	SUS-210	0.0	POUR	DEG F	0.0
CARBON	WT%	84.96	HYDROGEN	WT%	11.42
NITROGEN	WT%	2.09	SULFUR	WT%	0.66

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.7	WATER	WT%	2.9

PRODUCT WATER PROPERTIES

CARBON	WT%	5.73	HYDROGEN	WT%	10.01
NITROGEN	WT%	4.49	SULFUR	WT%	7.80
CO2	WT%	7.81			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.09	C2H4	VOL%	0.63
N2+AR	VOL%	62.72	C2H6	VOL%	0.55
O2	VOL%	0.04	C3'S	VOL%	0.48
CO	VOL%	2.70	C4'S	VOL%	0.41
CH4	VOL%	2.30	C5+	VOL%	0.48
CO2	VOL%	24.19	H2S	VOL%	0.19
			NH3	VOL%	0.22

GROSS HEAT BTU/SCF 124.69

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.02			
OIL FA	GPT	0.05			
MIN CO2	WT%	17.38	ASH	WT%	80.18
CARBON	WT%	6.80	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.23	SULFUR	WT%	0.75

TEMPERATURES DEG F

RAW SHALE IN	64	RET SHALE OUT	445
AIR TD IN	132	AIR MD IN	150
GAS BD IN	252	GAS MD IN	220
GAS TD IN	221	GAS PROD OUT	246
COOLING WATER IN	97	COOLING WATER OUT	107
PRODUCT OIL OUT	129		
AMBIENT AIR	52	OFF GAS	137

RATES AND QUANTITIES

RAW SHALE	TPH	11.31	THROUGHPUT PHF2		459.1
RET SHALE	TPH	9.42	RET/RAW	WT%	83.3
AIR TOP	SCFM	674.1		SCF/T	3577.5
AIR MID	SCFM	151.6		SCF/T	804.7
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	825.7		SCF/T	4382.2

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 21.260
SP GR 0.975

GAS TOP	SCFM	243.3	SCF/T	1291.0
GAS MID	SCFM	236.1	SCF/T	1252.8
GAS BTM	SCFM	2065.1	SCF/T	10959.3
TOTAL GAS	SCFM	2544.4	SCF/T	13503.1

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	1210.6	SCF/T	6424.8

COOLING WATER	GPM	100.0	BARO PRESS IN HG	23.8
AMB AIR REL HUM	%	26.7	BED PD IN H2O/FT	1.0

OIL YIELD WT% FA= 86.0
OIL YIELD VOL% FA= 85.4

***SEMI-WORKS ***
STARTING DATE 53178 TO 60178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	658.86	603.15	91.5
ASH	#/MIN	248.31	248.31	100.0
OXYGEN	SCFM	175.14	175.14	100.0
			86.60 TO H2O	
			88.53 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	14.34	13.16	91.7
		6.12 SHALE	0.78 LIQ	
		8.23 COMB	11.46 VAP	
			0.92 SHALE	
KEROGEN	#/MIN	56.25	50.31	89.4
			6.95 SHALE	
			32.29 OIL	
			11.00 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	46.33	42.11	90.9
			6.47 SHALE	
			27.03 OIL	
			8.58 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	65.00	60.80	93.5
			20.72 SHALE	
			27.03 OIL	
			12.99 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.63	6.45	97.2
			0.48 SHALE	
			3.69 OIL	
			2.26 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.99	1.55	77.9
SULFUR	#/MIN	2.85	2.76	96.6
			2.27 SHALE	
			0.21 OIL	
			0.22 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	442.94	432.43	97.6

3.149 #/MIN C 0.914 #/MIN H 3.446 C/H COMB RATIO
82.41 VOL%FA 83.17WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 53178 TO 60178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	658.86	658.86	100.0
ASH	#/MIN	248.31	248.31	100.0
OXYGEN	SCFM	175.14	175.14	100.0
			63.12 TO H2O	
			112.02 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	12.11	14.22	117.4
		6.12 SHALE	0.78 LIQ	
		6.00 COMB	12.52 VAP	
			0.92 SHALE	
KEROGEN	#/MIN	56.25	51.40	91.4
			6.95 SHALE	
			32.29 OIL	
			12.09 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	46.33	43.31	93.5
			6.47 SHALE	
			27.03 OIL	
			9.78 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	65.00	62.00	95.4
			20.72 SHALE	
			27.03 OIL	
			14.20 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.63	6.32	95.3
			0.48 SHALE	
			3.69 OIL	
			2.13 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.99	1.56	78.6
SULFUR	#/MIN	2.85	2.78	97.3
			2.27 SHALE	
			0.21 OIL	
			0.24 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	442.94	441.00	99.6

3.932 #/MIN C 0.666 #/MIN H 5.902 C/H COMB RATIO
82.41 VOL%FA 83.17WT.%FA

DATA SUMMARY

STARTING DATE 53178 TO 60178
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.34	H2O FA	WT%	0.66
OIL FA	GPT	27.06			
MIN CO2	WT%	18.23	ASH	WT%	66.13
CARBON	WT%	17.31	HYDROGEN	WT%	1.84
NITROGEN	WT%	0.53	SULFUR	WT%	0.76

RAW SHALE MOISTURE WT% (UNGROUND) 0.96

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)	FACTORS	
2.120	3.07	DA (IN.)=	1.05
1.500	32.85	DV (IN.)=	1.30
1.050	26.90	DV/DA =	1.23
0.742	20.04		
0.525	11.91		
0.371	2.53		
0.263	1.62		
0.185	0.18		
0.131	0.18		
PAN	0.72		

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.5	WATER	WT%	2.9
VIS	SUS-130	0.0	SEDIMENT ML/100G		1.2
VIS	SUS-210	0.0	POUR	DEG F	0.0
CARBON	WT%	33.72	HYDROGEN	WT%	11.44
NITROGEN	WT%	2.02	SULFUR	WT%	0.65

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.5	WATER	WT%	2.9

PRODUCT WATER PROPERTIES

CARBON	WT%	5.83	HYDROGEN	WT%	9.88
NITROGEN	WT%	4.52	SULFUR	WT%	7.89
CO2	WT%	8.22			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.25	C2H4	VOL%	0.71
N2+AR	VOL%	51.10	C2H6	VOL%	0.65
O2	VOL%	0.00	C3'S	VOL%	0.76
CO	VOL%	2.68	C4'S	VOL%	0.62
CH4	VOL%	2.50	C5+	VOL%	0.63
CO2	VOL%	24.42	H2S	VOL%	0.26
			NH3	VOL%	0.41

GROSS HEAT BTU/SCF 153.61

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.13			
OIL FA	GPT	0.33			
MIN CO2	WT%	17.05	ASH	WT%	81.03
CARBON	WT%	5.76	HYDROGEN	WT%	0.19
NITROGEN	WT%	0.23	SULFUR	WT%	0.74

TEMPERATURES DEG F

RAW SHALE IN	56	RET SHALE OUT	438
AIR TD IN	177	AIR MD IN	147
GAS BD IN	254	GAS MD IN	221
GAS TD IN	222	GAS PROD OUT	247
COOLING WATER IN	90	COOLING WATER OUT	100
PRODUCT OIL OUT	129		
AMBIENT AIR	52	OFF GAS	137

RATES AND QUANTITIES

RAW SHALE	TPH	11.26	THROUGHPUT PHF2		457.4
RET SHALE	TPH	9.19	RET/RAW	WT%	81.6
AIR TOP	SCFM	681.0		SCF/T	3627.5
AIR MID	SCFM	153.0		SCF/T	814.7
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	834.0		SCF/T	4442.2

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.640			
SP GR		0.987			
GAS TOP	SCFM	243.6		SCF/T	1297.7
GAS MID	SCFM	238.2		SCF/T	1268.7
GAS BTM	SCFM	2066.8		SCF/T	11008.9
TOTAL GAS	SCFM	2548.7		SCF/T	13575.3
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1228.3		SCF/T	6542.5
COOLING WATER	GPM	100.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	40.3	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 83.1
OIL YIELD VOL% FA= 82.4

***SEMI-WORKS ***
STARTING DATE 60178 TO 60278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	655.40	616.29	94.0
ASH	#/MIN	251.98	251.98	100.0
OXYGEN	SCFM	174.22	174.22	100.0
			93.61 TO H2O	
			80.61 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	15.07	12.89	85.6
		6.18 SHALE	0.64 LIQ	
		8.89 COMB	11.38 VAP	
			0.87 SHALE	
KEROGEN	#/MIN	56.71	51.45	90.7
			6.83 SHALE	
			33.93 OIL	
			10.62 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	46.08	43.07	93.5
			6.36 SHALE	
			28.50 OIL	
			8.17 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	64.60	61.60	95.4
			20.34 SHALE	
			28.50 OIL	
			12.72 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.33	6.66	105.1
			0.46 SHALE	
			3.91 OIL	
			2.28 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.12	1.58	74.3
SULFUR	#/MIN	2.88	2.82	97.7
			2.33 SHALE	
			0.23 OIL	
			0.21 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	446.23	438.17	98.2

2.907 #/MIN C 0.988 #/MIN H 2.943 C/H COMB RATIO
83.15 VOL%FA 84.16WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 60178 TO 60278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	655.40	655.40	100.0
ASH	#/MIN	251.98	251.98	100.0
OXYGEN	SCFM	174.22	174.22	100.0
			77.66 TO H2O	
			96.56 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	13.55	13.61	100.5
		6.18 SHALE	0.64 LIQ	
		7.38 COMB	12.11 VAP	
			0.87 SHALE	
KEROGEN	#/MIN	56.71	52.18	92.0
			6.83 SHALE	
			33.93 OIL	
			11.35 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	46.08	43.88	95.2
			6.36 SHALE	
			28.50 OIL	
			8.98 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	64.60	62.41	96.6
			20.34 SHALE	
			28.50 OIL	
			13.52 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.33	6.57	103.7
			0.46 SHALE	
			3.91 OIL	
			2.19 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.12	1.58	74.5
SULFUR	#/MIN	2.88	2.83	98.1
			2.33 SHALE	
			0.23 OIL	
			0.22 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	446.23	444.07	99.5

3.440 #/MIN C 0.820 #/MIN H 4.197 C/H COMB RATIO
83.15 VOL%FA 84.16WT.%FA

DATA SUMMARY

STARTING DATE 60178 TO 60278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.63	H2O FA	WT%	0.72
OIL FA	GPT	27.86			
MIN CO2	WT%	17.90	ASH	WT%	66.43
CARBON	WT%	17.03	HYDROGEN	WT%	1.75
NITROGEN	WT%	0.56	SULFUR	WT%	0.76

RAW SHALE MOISTURE WT% (UNGROUND) 0.90

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	2.68
1.500	33.52
1.050	27.20
0.742	18.39
0.525	12.45
0.371	2.87
0.263	1.92
0.185	0.19
0.131	0.19
PAN	0.57

FACTORS

DA (IN.)	=	1.04
DV (IN.)	=	1.29
DV/DA	=	1.24

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	2.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	1.0
VIS	SUS-210	0.0	POUR	DEG F	0.0
CARBON	WT%	34.00	HYDROGEN	WT%	11.51
NITROGEN	WT%	2.03	SULFUR	WT%	0.67

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	2.3

PRODUCT WATER PROPERTIES

CARBON	WT%	5.52	HYDROGEN	WT%	10.02
NITROGEN	WT%	4.59	SULFUR	WT%	8.07
CO2	WT%	5.35			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.34	C2H4	VOL%	0.69
N2+AR	VOL%	61.96	C2H6	VOL%	0.63
O2	VOL%	0.00	C3'S	VOL%	0.62
CO	VOL%	2.73	C4'S	VOL%	0.54
CH4	VOL%	2.46	C5+	VOL%	0.65
CO2	VOL%	23.91	H2S	VOL%	0.25
			NH3	VOL%	0.21

GROSS HEAT BTU/SCF 146.87

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.02			
MIN CO2	WT%	16.50	ASH	WT%	81.16
CARBON	WT%	5.55	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.25	SULFUR	WT%	0.75

TEMPERATURES DEG F

RAW SHALE IN	52	RET SHALE OUT	442
AIR TD IN	187	AIR MD IN	157
GAS BD IN	255	GAS MD IN	224
GAS TD IN	224	GAS PROD OUT	248
COOLING WATER IN	97	COOLING WATER OUT	107
PRODUCT OIL OUT	130		
AMBIENT AIR	58	OFF GAS	139

RATES AND QUANTITIES

RAW SHALE	TPH	11.38	THROUGHPUT PHF2		462.1
RET SHALE	TPH	9.31	RET/RAW	WT%	81.9
AIR TOP	SCFM	581.2		SCF/T	3592.0
AIR MID	SCFM	148.4		SCF/T	782.4
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	329.6		SCF/T	4374.4

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.420			
SP GR		0.985			
GAS TOP	SCFM	243.1		SCF/T	1281.7
GAS MID	SCFM	237.5		SCF/T	1252.3
GAS BTM	SCFM	2063.8		SCF/T	10881.8
TOTAL GAS	SCFM	2544.4		SCF/T	13415.8
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1234.3		SCF/T	6508.2
COOLING WATER	GPM	100.0	BARO PRESS IN HG		23.9
AMB AIR REL HUM	%	33.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 84.1
OIL YIELD VOL% FA= 83.2

APPENDIX 2.4

SEMI-WORKS RETORTING RESEARCH - BOTTOM AIR

***SEMI-WORKS ***
STARTING DATE 61378 TO 61478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	690.90	691.30	100.1
ASH	#/MIN	267.24	267.24	100.0
OXYGEN	SCFM	183.66	183.66	100.0
			128.37 TO H2O	
			55.29 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	18.86	15.77	83.6
		6.67 SHALE	0.71 LIQ	
		12.19 COMB	13.31 VAP	
			1.76 SHALE	
KEROGEN	#/MIN	63.16	54.65	86.5
			7.40 SHALE	
			37.13 OIL	
			10.04 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	47.97	45.49	94.8
			7.05 SHALE	
			31.30 OIL	
			7.09 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	66.04	63.57	96.3
			20.89 SHALE	
			31.30 OIL	
			11.33 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.55	7.24	110.6
			0.35 SHALE	
			4.18 OIL	
			2.70 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.80	1.58	87.8
SULFUR	#/MIN	2.68	2.99	111.7
			2.40 SHALE	
			0.25 OIL	
			0.30 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	470.23	453.80	96.5

2.137 #/MIN C 1.355 #/MIN H 1.578 C/H COMB RATIO
88.55 VOL%FA 89.25WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 61378 TO 61478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	690.90	690.90	100.0
ASH	#/MIN	267.24	267.24	100.0
OXYGEN	SCFM	183.66	183.66	100.0
			128.49 TO H2O	
			55.17 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	18.87	15.77	83.5
		6.67 SHALE	0.71 LIQ	
		12.20 COMB	13.30 VAP	
			1.76 SHALE	
KEROGEN	#/MIN	63.16	54.65	86.5
			7.40 SHALE	
			37.13 OIL	
			10.03 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	47.97	45.49	94.8
			7.05 SHALE	
			31.30 OIL	
			7.09 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	66.04	63.57	96.3
			20.89 SHALE	
			31.30 OIL	
			11.32 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.55	7.24	110.7
			0.35 SHALE	
			4.18 OIL	
			2.70 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.80	1.58	87.8
SULFUR	#/MIN	2.68	2.99	111.7
			2.40 SHALE	
			0.25 OIL	
			0.30 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	470.23	453.75	96.5

2.133 #/MIN C 1.356 #/MIN H 1.573 C/H COMB RATIO
88.55 VOL%FA 89.25WT.%FA

DATA SUMMARY

STARTING DATE 61378 TO 61478
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.40	H2O FA	WT%	0.84
OIL FA	GPT	27.20			
MIN CO2	WT%	16.56	ASH	WT%	66.81
CARBON	WT%	16.51	HYDROGEN	WT%	1.73
NITROGEN	WT%	0.45	SULFUR	WT%	0.67

RAW SHALE MOISTURE WT% (UNGROUND) 0.82

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.7	WATER	WT%	0.2
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.31	HYDROGEN	WT%	11.26
NITROGEN	WT%	1.79	SULFUR	WT%	0.66

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.6	WATER	WT%	2.3

PRODUCT WATER PROPERTIES

CARBON	WT%	5.34	HYDROGEN	WT%	9.55
NITROGEN	WT%	5.11	SULFUR	WT%	7.21
CO2	WT%	5.46			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	6.31	C2H4	VOL%	0.74
N2+AR	VOL%	65.41	C2H6	VOL%	0.66
O2	VOL%	0.00	C3'S	VOL%	0.58
CO	VOL%	2.77	C4'S	VOL%	0.47
CH4	VOL%	2.66	C5+	VOL%	0.40
CO2	VOL%	19.15	H2S	VOL%	0.34
			NH3	VOL%	0.51

GROSS HEAT BTU/SCF 138.41

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.07			
OIL FA	GPT	0.18			
MIN CO2	WT%	15.88	ASH	WT%	83.68
CARBON	WT%	5.54	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.21	SULFUR	WT%	0.75

TEMPERATURES DEG F

RAW SHALE IN	73	RET SHALE OUT	453
AIR TD IN	203	AIR MD IN	165
GAS BD IN	256	GAS MD IN	227
GAS TD IN	228	GAS PROD OUT	250
COOLING WATER IN	107	COOLING WATER OUT	119
PRODUCT OIL OUT	133		
AMBIENT AIR	71	OFF GAS	140

RATES AND QUANTITIES

RAW SHALE	TPH	12.00	THROUGHPUT PHF2		487.3
RET SHALE	TPH	9.58	RET/RAW	WT%	79.8
AIR TOP	SCFM	715.4		SCF/T	3577.2
AIR MID	SCFM	159.1		SCF/T	795.6
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	374.6		SCF/T	4372.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.960			
SP GR		0.943			
GAS TOP	SCFM	260.2		SCF/T	1301.2
GAS MID	SCFM	247.4		SCF/T	1237.0
GAS BTM	SCFM	2171.0		SCF/T	10855.2
TOTAL GAS	SCFM	2678.7		SCF/T	13393.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1337.2		SCF/T	6685.9
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	20.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 89.1
OIL YIELD VOL% FA= 83.5

***SEMI-WORKS ***
STARTING DATE 61578 TO 61678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	694.94		664.00		95.5
ASH	#/MIN	261.82		261.82		100.0
OXYGEN	SCFM	184.73		184.73		100.0
				119.46	TO H2O	
				65.27	TO CO&CO2	
				0.00	GAS	
WATER	#/MIN	17.59		13.31		75.6
		6.25	SHALE	0.39	LIQ	
		11.35	COMB	12.33	VAP	
				0.59	SHALE	
KEROGEN	#/MIN	57.68		53.96		93.6
				8.25	SHALE	
				34.85	OIL	
				10.80	GAS	
				0.05	WATER	
ORGANIC CARBON	#/MIN	47.33		45.17		95.4
				7.67	SHALE	
				29.57	OIL	
				7.91	GAS	
				0.02	WATER	
TOTAL CARBON	#/MIN	67.40		65.25		96.8
				22.32	SHALE	
				29.57	OIL	
				13.33	GAS	
				0.03	WATER	
ORG. HYDROGEN	#/MIN	6.62		7.27		109.7
				0.59	SHALE	
				4.00	OIL	
				2.67	GAS	
				0.01	WATER	
ORG. NITROGEN	#/MIN	2.18		2.03		93.1
SULFUR	#/MIN	2.94		3.07		104.6
				2.54	SHALE	
				0.23	OIL	
				0.29	GAS	
				0.01	WATER	
O'ALL WEIGHT	#/MIN	466.64		460.32		98.6

2.497 #/MIN C 1.261 #/MIN H 1.981 C/H COMB RATIO
79.96 VOL%FA 80.90WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 61578 TO 61678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	694.94	694.94	100.0
ASH	#/MIN	261.82	261.82	100.0
OXYGEN	SCFM	184.73	184.73	100.0
			107.09 TO H2O	
			77.65 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	16.42	13.88	84.6
		6.25 SHALE	0.39 LIQ	
		10.17 COMB	12.91 VAP	
			0.59 SHALE	
KEROGEN	#/MIN	57.68	54.53	94.5
			8.25 SHALE	
			34.85 OIL	
			11.37 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	47.33	45.79	96.8
			7.67 SHALE	
			29.57 OIL	
			8.53 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	67.40	65.87	97.7
			22.32 SHALE	
			29.57 OIL	
			13.96 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.62	7.20	108.8
			0.59 SHALE	
			4.00 OIL	
			2.61 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.18	2.04	93.6
SULFUR	#/MIN	2.94	3.08	105.0
			2.54 SHALE	
			0.23 OIL	
			0.30 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	466.64	464.97	99.6

2.913 #/MIN C 1.130 #/MIN H 2.577 C/H COMB RATIO
79.96 VOL%FA 80.90WT.%FA

DATA SUMMARY

STARTING DATE 61578 TO 61678
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.86	H2O FA	WT%	0.91
OIL FA	GPT	28.40			
MIN CO2	WT%	18.55	ASH	WT%	66.00
CARBON	WT%	16.99	HYDROGEN	WT%	1.77
NITROGEN	WT%	0.55	SULFUR	WT%	0.74

RAW SHALE MOISTURE WT% (UNGROUND) 0.66

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	0.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.83	HYDROGEN	WT%	11.47
NITROGEN	WT%	2.02	SULFUR	WT%	0.66

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	1.3

PRODUCT WATER PROPERTIES

CARBON	WT%	5.37	HYDROGEN	WT%	9.60
NITROGEN	WT%	5.84	SULFUR	WT%	3.25
CO2	WT%	5.51			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.94	C2H4	VOL%	0.75
N2+AR	VOL%	61.58	C2H6	VOL%	0.59
O2	VOL%	0.00	C3'S	VOL%	0.61
CO	VOL%	2.99	C4'S	VOL%	0.58
CH4	VOL%	2.34	C5+	VOL%	0.53
CO2	VOL%	23.13	H2S	VOL%	0.32
			NH3	VOL%	0.65

GROSS HEAT BTU/SCF 145.56

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.06			
OIL FA	GPT	0.16			
MIN CO2	WT%	16.51	ASH	WT%	80.48
CARBON	WT%	6.86	HYDROGEN	WT%	0.20
NITROGEN	WT%	0.32	SULFUR	WT%	0.78

TEMPERATURES DEG F

RAW SHALE IN	74	RET SHALE OUT	457
AIR TD IN	237	AIR MD IN	167
GAS BD IN	256	GAS MD IN	227
GAS TD IN	228	GAS PROD OUT	251
COOLING WATER IN	109	COOLING WATER OUT	120
PRODUCT OIL OUT	134		
AMBIENT AIR	73	OFF GAS	141

RATES AND QUANTITIES

RAW SHALE	TPH	11.90	THROUGHPUT PHF2		483.3
RET SHALE	TPH	9.76	RET/RAW	WT%	82.0
AIR TOP	SCFM	720.7		SCF/T	3633.5
AIR MID	SCFM	159.0		SCF/T	801.5
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	879.7		SCF/T	4435.0

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.410			
SP GR		0.974			
GAS TOP	SCFM	259.2		SCF/T	1306.9
GAS MID	SCFM	248.1		SCF/T	1250.9
GAS BTM	SCFM	2148.3		SCF/T	10830.7
TOTAL GAS	SCFM	2655.6		SCF/T	13388.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1338.0		SCF/T	6745.9
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	24.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 80.8

***SEMI-WORKS ***

STARTING DATE 61878 TO 61978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	734.34	690.95	94.1
ASH	#/MIN	257.04	257.04	100.0
OXYGEN	SCFM	195.20	195.20	100.0
			106.65 TO H2O	
			88.28 TO CO&CO2	
			0.27 GAS	
WATER	#/MIN	23.51	15.42	65.6
		13.38 SHALE	0.40 LIQ	
		10.13 COMB	12.71 VAP	
			2.31 SHALE	
KEROGEN	#/MIN	62.67	53.28	85.0
			8.04 SHALE	
			33.90 OIL	
			11.28 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	47.11	45.03	95.6
			7.76 SHALE	
			28.71 OIL	
			8.54 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	65.36	63.29	96.8
			21.57 SHALE	
			28.71 OIL	
			12.98 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.60	6.82	103.3
			0.29 SHALE	
			4.01 OIL	
			2.51 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.71	2.14	125.3
SULFUR	#/MIN	2.22	3.31	149.2
			2.79 SHALE	
			0.21 OIL	
			0.28 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	471.13	456.22	96.8

3.175 #/MIN C 1.126 #/MIN H 2.821 C/H COMB RATIO

81.52 VOL%FA 82.42WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 61878 TO 61978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	734.34	734.34	100.0
ASH	#/MIN	257.04	257.04	100.0
OXYGEN	SCFM	195.20	195.20	100.0
			90.55 TO H2O	
			104.37 TO CO&CO2	
			0.29 GAS	
WATER	#/MIN	21.98	16.22	73.8
		13.38 SHALE	0.40 LIQ	
		8.60 COMB	13.51 VAP	
			2.31 SHALE	
KEROGEN	#/MIN	62.67	54.02	86.2
			8.04 SHALE	
			33.90 OIL	
			12.02 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	47.11	45.84	97.3
			7.76 SHALE	
			28.71 OIL	
			9.36 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	65.36	64.10	98.1
			21.57 SHALE	
			28.71 OIL	
			13.79 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.60	6.74	102.0
			0.29 SHALE	
			4.01 OIL	
			2.43 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.71	2.16	126.0
SULFUR	#/MIN	2.22	3.32	150.0
			2.79 SHALE	
			0.21 OIL	
			0.30 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	471.13	462.55	98.2

3.713 #/MIN C 0.956 #/MIN H 3.885 C/H COMB RATIO
81.52 VOL%FA 82.42WT.%FA

DATA SUMMARY

STARTING DATE 61878 TO 61978
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.58	H2O FA	WT%	0.56
OIL FA	GPT	27.70			
MIN CO2	WT%	17.21	ASH	WT%	66.11
CARBON	WT%	16.81	HYDROGEN	WT%	1.76
NITROGEN	WT%	0.44	SULFUR	WT%	0.57

RAW SHALE MOISTURE WT% (UNGROUND) 2.80

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	0.4
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.68	HYDROGEN	WT%	11.82
NITROGEN	WT%	2.34	SULFUR	WT%	0.62

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	1.4

PRODUCT WATER PROPERTIES

CARBON	WT%	6.67	HYDROGEN	WT%	9.57
NITROGEN	WT%	5.76	SULFUR	WT%	4.79
CO2	WT%	7.93			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.53	C2H4	VOL%	0.69
N2+AR	VOL%	63.38	C2H6	VOL%	0.64
O2	VOL%	0.02	C3'S	VOL%	0.62
CO	VOL%	2.64	C4'S	VOL%	0.53
CH4	VOL%	2.45	C5+	VOL%	0.52
CO2	VOL%	22.17	H2S	VOL%	0.31
			NH3	VOL%	0.49

GROSS HEAT BTU/SCF 141.32

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.03			
MIN CO2	WT%	15.78	ASH	WT%	80.08
CARBON	WT%	6.72	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.35	SULFUR	WT%	0.87

TEMPERATURES DEG F

RAW SHALE IN	72	RET SHALE OUT	508
AIR TD IN	198	AIR MD IN	167
GAS BD IN	257	GAS MD IN	229
GAS TD IN	239	GAS PROD OUT	253
COOLING WATER IN	133	COOLING WATER OUT	114
PRODUCT OIL OUT	133		
AMBIENT AIR	58	OFF GAS	141

RATES AND QUANTITIES

RAW SHALE	TPH	11.66	THROUGHPUT PHF2		473.7
RET SHALE	TPH	9.63	RET/RAW	WT%	82.6
AIR TOP	SCFM	718.4		SCF/T	3695.4
AIR MID	SCFM	161.2		SCF/T	829.0
AIR BTM	SCFM	50.0		SCF/T	257.2
TOTAL AIR	SCFM	929.5		SCF/T	4781.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.710			
SP GR		0.971			
GAS TOP	SCFM	259.0		SCF/T	1332.2
GAS MID	SCFM	247.9		SCF/T	1275.1
GAS BTM	SCFM	2112.1		SCF/T	10864.8
TOTAL GAS	SCFM	2519.0		SCF/T	13472.0
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1357.9		SCF/T	6984.9
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	19.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 82.3
OIL YIELD VOL% FA= 81.5

***SEMI-WORKS ***
STARTING DATE 61978 TO 62078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	730.82	691.02	94.6
ASH	#/MIN	254.04	254.04	100.0
OXYGEN	SCFM	194.27	194.27	100.0
			170.03 TO H2O	
			23.43 TO CO&CO2	
			0.80 GAS	
WATER	#/MIN	28.46	14.27	50.2
		12.31 SHALE	0.47 LIQ	
		16.15 COMB	11.92 VAP	
			1.88 SHALE	
KEROGEN	#/MIN	58.49	53.13	90.8
			7.58 SHALE	
			35.74 OIL	
			9.75 GAS	
			0.06 WATER	
ORGANIC CARBON	#/MIN	45.05	43.85	97.3
			7.22 SHALE	
			30.22 OIL	
			6.38 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	65.36	64.18	98.2
			20.63 SHALE	
			30.22 OIL	
			13.28 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.55	7.45	113.7
			0.36 SHALE	
			3.92 OIL	
			3.16 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.79	1.84	103.0
SULFUR	#/MIN	3.22	3.36	104.3
			2.76 SHALE	
			0.28 OIL	
			0.27 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	470.12	451.34	96.0

1.091 #/MIN C 1.795 #/MIN H 0.608 C/H COMB RATIO
89.34 VOL%FA 90.62WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 61978 TO 62078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	730.82	730.82	100.0
ASH	#/MIN	254.04	254.04	100.0
OXYGEN	SCFM	194.27	194.27	100.0
			154.54 TO H2O	
			38.87 TO CO&CO2	
			0.85 GAS	
WATER	#/MIN	26.99	14.96	55.4
		12.31 SHALE	0.47 LIQ	
		14.68 COMB	12.61 VAP	
			1.88 SHALE	
KEROGEN	#/MIN	58.49	53.82	92.0
			7.58 SHALE	
			35.74 OIL	
			10.45 GAS	
			0.06 WATER	
ORGANIC CARBON	#/MIN	45.05	44.61	99.0
			7.22 SHALE	
			30.22 OIL	
			7.14 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	65.36	64.94	99.4
			20.63 SHALE	
			30.22 OIL	
			14.05 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.55	7.36	112.4
			0.36 SHALE	
			3.92 OIL	
			3.08 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.79	1.85	103.6
SULFUR	#/MIN	3.22	3.38	104.8
			2.76 SHALE	
			0.28 OIL	
			0.29 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	470.12	457.18	97.2

1.604 #/MIN C 1.631 #/MIN H 0.983 C/H COMB RATIO
89.34 VOL%FA 90.62WT.%FA

DATA SUMMARY

STARTING DATE 61978 TO 62078

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.16	H2O FA	WT%	0.29
OIL FA	GPT	26.60			
MIN CO2	WT%	19.19	ASH	WT%	65.45
CARBON	WT%	16.84	HYDROGEN	WT%	1.72
NITROGEN	WT%	0.46	SULFUR	WT%	0.83

RAW SHALE MOISTURE WT% (UNGROUND) 2.80

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	0.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.57	HYDROGEN	WT%	10.96
NITROGEN	WT%	1.94	SULFUR	WT%	0.79

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	1.7

PRODUCT WATER PROPERTIES

CARBON	WT%	5.14	HYDROGEN	WT%	9.45
NITROGEN	WT%	5.44	SULFUR	WT%	9.99
CO2	WT%	3.08			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.45	C2H4	VOL%	0.65
N2+AR	VOL%	62.87	C2H6	VOL%	0.57
O2	VOL%	0.07	C3'S	VOL%	0.55
CO	VOL%	2.43	C4'S	VOL%	0.57
CH4	VOL%	2.33	C5+	VOL%	0.55
CO2	VOL%	23.18	H2S	VOL%	0.29
			NH3	VOL%	0.50

GROSS HEAT BTU/SCF 138.04

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.02			
MIN CO2	WT%	15.68	ASH	WT%	81.01
CARBON	WT%	5.58	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.29	SULFUR	WT%	0.88

TEMPERATURES DEG F

RAW SHALE IN	74	RET SHALE OUT	501
AIR TD IN	198	AIR MD IN	166
GAS BD IN	256	GAS MD IN	227
GAS TD IN	228	GAS PROD OUT	251
COOLING WATER IN	136	COOLING WATER OUT	116
PRODUCT OIL OUT	131		
AMBIENT AIR	70	OFF GAS	139

RATES AND QUANTITIES

RAW SHALE	TPH	11.64	THROUGHPUT PHF2		472.9
RET SHALE	TPH	9.41	RET/RAW	WT%	80.8
AIR TOP	SCFM	715.1		SCF/T	3684.5
AIR MID	SCFM	160.6		SCF/T	827.3
AIR BTM	SCFM	49.5		SCF/T	254.8
TOTAL AIR	SCFM	925.1		SCF/T	4766.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.590			
SP GR		0.982			
GAS TOP	SCFM	258.3		SCF/T	1333.7
GAS MID	SCFM	247.7		SCF/T	1276.6
GAS BTM	SCFM	2109.5		SCF/T	10869.6
TOTAL GAS	SCFM	2516.1		SCF/T	13479.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1350.1		SCF/T	6956.8
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	18.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 90.5
OIL YIELD VOL% FA= 83.3

***SEMI-WORKS ***
STARTING DATE 62078 TO 62178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	735.79	729.95	99.2
ASH	#/MIN	256.60	256.60	100.0
OXYGEN	SCFM	195.59	195.59	100.0
			166.46 TO H2O	
			29.13 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	20.69	13.07	63.2
		4.88 SHALE	0.36 LIQ	
		15.81 COMB	11.18 VAP	
			1.53 SHALE	
KEROGEN	#/MIN	63.97	54.31	84.9
			8.30 SHALE	
			36.05 OIL	
			9.90 GAS	
			0.06 WATER	
ORGANIC CARBON	#/MIN	48.88	45.06	92.2
			7.87 SHALE	
			30.67 OIL	
			6.50 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	67.78	63.97	94.4
			20.13 SHALE	
			30.67 OIL	
			13.14 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.94	7.59	109.3
			0.42 SHALE	
			4.01 OIL	
			3.14 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.12	1.72	81.3
SULFUR	#/MIN	3.37	3.40	100.9
			2.79 SHALE	
			0.27 OIL	
			0.31 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	466.03	453.08	97.2

1.322 #/MIN C 1.757 #/MIN H 0.753 C/H COMB RATIO
81.92 VOL%FA 83.16WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 62078 TO 62178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	735.79		735.79		100.0
ASH	#/MIN	256.60		256.60		100.0
OXYGEN	SCFM	195.59		195.59		100.0
				164.31	TO H2O	
				31.28	TO CO&CO2	
				0.00	GAS	
WATER	#/MIN	20.49		13.16		64.2
		4.88	SHALE	0.36	LIQ	
		15.61	COMB	11.27	VAP	
				1.53	SHALE	
KEROGEN	#/MIN	63.97		54.40		85.0
				8.30	SHALE	
				36.05	OIL	
				9.99	GAS	
				0.06	WATER	
ORGANIC CARBON	#/MIN	48.88		45.16		92.4
				7.87	SHALE	
				30.67	OIL	
				6.61	GAS	
				0.02	WATER	
TOTAL CARBON	#/MIN	67.78		64.08		94.5
				20.13	SHALE	
				30.67	OIL	
				13.25	GAS	
				0.03	WATER	
ORG. HYDROGEN	#/MIN	6.94		7.58		109.2
				0.42	SHALE	
				4.01	OIL	
				3.13	GAS	
				0.01	WATER	
ORG. NITROGEN	#/MIN	2.12		1.72		81.4
SULFUR	#/MIN	3.37		3.40		101.0
				2.79	SHALE	
				0.27	OIL	
				0.32	GAS	
				0.03	WATER	
O'ALL WEIGHT	#/MIN	466.03		453.90		97.4

1.394 #/MIN C 1.734 #/MIN H 0.804 C/H COMB RATIO
81.92 VOL%FA 83.16WT.%FA

DATA SUMMARY

STARTING DATE 62078 TO 62178
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.06	H2O FA	WT%	0.54
OIL FA	GPT	29.00			
MIN CO2	WT%	17.68	ASH	WT%	65.46
CARBON	WT%	17.29	HYDROGEN	WT%	1.83
NITROGEN	WT%	0.54	SULFUR	WT%	0.86

RAW SHALE MOISTURE WT% (UNGROUND) 0.70

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	0.5
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	85.06	HYDROGEN	WT%	11.11
NITROGEN	WT%	2.05	SULFUR	WT%	0.75

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	1.3

PRODUCT WATER PROPERTIES

CARBON	WT%	5.88	HYDROGEN	WT%	5.82
NITROGEN	WT%	9.26	SULFUR	WT%	9.01
CO2	WT%	3.18			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.73	C2H4	VOL%	0.68
N2+AR	VOL%	63.51	C2H6	VOL%	0.63
O2	VOL%	0.00	C3'S	VOL%	0.60
CO	VOL%	2.64	C4'S	VOL%	0.43
CH4	VOL%	2.52	C5+	VOL%	0.41
CO2	VOL%	22.01	H2S	VOL%	0.32
			NH3	VOL%	0.51

GROSS HEAT BTU/SCF 131.87

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.02			
MIN CO2	WT%	14.36	ASH	WT%	81.95
CARBON	WT%	6.43	HYDROGEN	WT%	0.19
NITROGEN	WT%	0.23	SULFUR	WT%	0.89

TEMPERATURES DEG F

RAW SHALE IN	72	RET SHALE OUT	499
AIR TD IN	198	AIR MD IN	168
GAS BD IN	257	GAS MD IN	229
GAS TD IN	229	GAS PROD OUT	253
COOLING WATER IN	107	COOLING WATER OUT	117
PRODUCT OIL OUT	134		
AMBIENT AIR	68	OFF GAS	141

RATES AND QUANTITIES

RAW SHALE	TPH	11.76	THROUGHPUT PHF2		477.6
RET SHALE	TPH	9.39	RET/RAW	WT%	79.9
AIR TOP	SCFM	718.3		SCF/T	3664.7
AIR MID	SCFM	163.7		SCF/T	835.0
AIR BTM	SCFM	49.4		SCF/T	252.3
TOTAL AIR	SCFM	931.4		SCF/T	4751.9

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		17.000			
SP GR		0.976			
GAS TOP	SCFM	254.7		SCF/T	1299.6
GAS MID	SCFM	247.8		SCF/T	1264.1
GAS BTM	SCFM	2093.0		SCF/T	10678.8
TOTAL GAS	SCFM	2595.5		SCF/T	13242.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1384.7		SCF/T	7064.8
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	20.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 83.1
OIL YIELD VOL% FA= 81.9

***SEMI-WORKS ***
STARTING DATE 62178 TO 62278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT		% REC.
ATM. NITROGEN	SCFM	735.34	693.14		94.3
ASH	#/MIN	261.34	261.34		100.0
OXYGEN	SCFM	195.47	195.47		100.0
			175.09	TO H2O	
			20.11	TO CO&CO2	
			0.27	GAS	
WATER	#/MIN	27.76	15.26		55.0
		11.13 SHALE	0.60	LIQ	
		16.63 COMB	13.10	VAP	
			1.56	SHALE	
KEROGEN	#/MIN	66.09	61.14		92.5
			8.45	SHALE	
			42.48	OIL	
			10.13	GAS	
			0.08	WATER	
ORGANIC CARBON	#/MIN	50.49	50.62		100.3
			8.02	SHALE	
			36.07	OIL	
			6.50	GAS	
			0.03	WATER	
TOTAL CARBON	#/MIN	68.74	68.88		100.2
			20.51	SHALE	
			36.07	OIL	
			12.27	GAS	
			0.04	WATER	
ORG. HYDROGEN	#/MIN	6.27	8.62		137.5
			0.43	SHALE	
			4.82	OIL	
			3.35	GAS	
			0.01	WATER	
ORG. NITROGEN	#/MIN	2.05	1.47		71.8
SULFUR	#/MIN	3.34	3.55		106.5
			2.84	SHALE	
			0.32	OIL	
			0.32	GAS	
			0.07	WATER	
O'ALL WEIGHT	#/MIN	476.71	461.01		96.7

0.998 #/MIN C 1.848 #/MIN H 0.540 C/H COMB RATIO
90.67 VOL%FA 91.10WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 62178 TO 62278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	735.34	735.34	100.0
ASH	#/MIN	261.34	261.34	100.0
OXYGEN	SCFM	195.47	195.47	100.0
			160.85 TO H2O	
			34.33 TO CO&CO2	
			0.29 GAS	
WATER	#/MIN	26.40	16.06	60.8
		11.13 SHALE	0.60 LIQ	
		15.28 COMB	13.90 VAP	
			1.56 SHALE	
KEROGEN	#/MIN	66.09	61.84	93.6
			8.45 SHALE	
			42.48 OIL	
			10.83 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	50.49	51.36	101.7
			8.02 SHALE	
			36.07 OIL	
			7.25 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	68.74	69.63	101.3
			20.51 SHALE	
			36.07 OIL	
			13.01 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.27	8.56	136.6
			0.43 SHALE	
			4.82 OIL	
			3.29 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.05	1.48	72.2
SULFUR	#/MIN	3.34	3.57	107.1
			2.84 SHALE	
			0.32 OIL	
			0.34 GAS	
			0.07 WATER	
O'ALL WEIGHT	#/MIN	476.71	467.03	98.0

1.476 #/MIN C 1.698 #/MIN H 0.869 C/H COMB RATIO
90.67 VOL%FA 91.10WT.%FA

DATA SUMMARY

STARTING DATE 62178 TO 62278
OPERATING TIME (HRS) 24
OPERATING FACTOR 95.33 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.60	H2O FA	WT%	1.90
OIL FA	GPT	30.30			
MIN CO2	WT%	16.65	ASH	WT%	65.01
CARBON	WT%	17.10	HYDROGEN	WT%	1.77
NITROGEN	WT%	0.51	SULFUR	WT%	0.83

RAW SHALE MOISTURE WT% (UNGROUND) 0.86

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)	FACTORS	
2.120	2.88	DA (IN.)=	1.01
1.500	36.92	DV (IN.)=	1.31
1.050	22.50	DV/DA =	1.29
0.742	18.27		
0.525	10.77		
0.371	3.46		
0.263	2.31		
0.185	0.96		
0.131	0.19		
PAN	1.73		

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.9	WATER	WT%	1.8
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.90	HYDROGEN	WT%	11.35
NITROGEN	WT%	1.36	SULFUR	WT%	0.76

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.9	WATER	WT%	1.8

PRODUCT WATER PROPERTIES

CARBON	WT%	5.67	HYDROGEN	WT%	9.35
NITROGEN	WT%	5.88	SULFUR	WT%	11.85
CO2	WT%	5.08			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	7.47	C2H4	VOL%	0.75
N2+AR	VOL%	63.43	C2H6	VOL%	0.72
O2	VOL%	0.02	C3'S	VOL%	0.67
CO	VOL%	2.59	C4'S	VOL%	0.54
CH4	VOL%	2.68	C5+	VOL%	0.42
CO2	VOL%	20.08	H2S	VOL%	0.35
			NH3	VOL%	0.29

GROSS HEAT BTU/SCF 148.09

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.02			
MIN CO2	WT%	14.36	ASH	WT%	81.95
CARBON	WT%	6.43	HYDROGEN	WT%	0.19
NITROGEN	WT%	0.23	SULFUR	WT%	0.89

TEMPERATURES DEG F

RAW SHALE IN	75	RET SHALE OUT	502
AIR TD IN	200	AIR MD IN	169
GAS BD IN	256	GAS MD IN	229
GAS TD IN	229	GAS PROD OUT	252
COOLING WATER IN	111	COOLING WATER OUT	122
PRODUCT OIL OUT	132		
AMBIENT AIR	73	OFF GAS	140

RATES AND QUANTITIES

RAW SHALE	TPH	12.06	THROUGHPUT PHF2		489.7
RET SHALE	TPH	9.57	RET/RAW	WT%	79.3
AIR TOP	SCFM	717.7		SCF/T	3570.8
AIR MID	SCFM	163.7		SCF/T	814.2
AIR BTM	SCFM	49.4		SCF/T	246.0
TOTAL AIR	SCFM	930.8		SCF/T	4630.9

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.160			
SP GR		0.944			
GAS TOP	SCFM	258.4		SCF/T	1285.7
GAS MID	SCFM	247.2		SCF/T	1229.7
GAS BTM	SCFM	2107.5		SCF/T	10485.1
TOTAL GAS	SCFM	2513.1		SCF/T	13000.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1368.7		SCF/T	6809.3
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	19.2	BED PD IN H2O/FT		1.2

OIL YIELD WT% FA= 91.0
OIL YIELD VOL% FA= 93.7

***SEMI-WORKS ***
STARTING DATE 62778 TO 62878

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	734.21	670.42	91.3
ASH	#/MIN	264.66	264.66	100.0
OXYGEN	SCFM	195.17	195.17	100.0
			120.11 TO H2O	
			74.78 TO CO&CO2	
			0.27 GAS	
WATER	#/MIN	19.74	15.72	79.7
		8.33 SHALE	0.44 LIQ	
		11.41 COMB	14.15 VAP	
			1.13 SHALE	
KEROGEN	#/MIN	62.11	54.48	87.7
			8.60 SHALE	
			34.92 OIL	
			10.91 GAS	
			0.06 WATER	
ORGANIC CARBON	#/MIN	48.14	45.60	94.7
			7.98 SHALE	
			29.45 OIL	
			8.15 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	66.38	63.86	96.2
			21.06 SHALE	
			29.45 OIL	
			13.31 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.37	7.24	113.7
			0.62 SHALE	
			3.94 OIL	
			2.67 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.92	1.83	95.4
SULFUR	#/MIN	3.04	3.08	101.6
			2.69 SHALE	
			0.21 OIL	
			0.17 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	473.11	461.02	97.4

2.810 #/MIN C 1.268 #/MIN H 2.217 C/H COMB RATIO
80.93 VOL%FA 82.03WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 62778 TO 62878

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	734.21	734.21	100.0
ASH	#/MIN	264.66	264.66	100.0
OXYGEN	SCFM	195.17	195.17	100.0
			94.73 TO H2O	
			100.14 TO CO&CO2	
			0.30 GAS	
WATER	#/MIN	17.32	17.07	98.5
		8.33 SHALE	0.44 LIQ	
		9.00 COMB	15.50 VAP	
			1.13 SHALE	
KEROGEN	#/MIN	62.11	55.62	89.5
			8.60 SHALE	
			34.92 OIL	
			12.05 GAS	
			0.06 WATER	
ORGANIC CARBON	#/MIN	48.14	46.87	97.4
			7.98 SHALE	
			29.45 OIL	
			9.42 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	66.38	65.12	98.1
			21.06 SHALE	
			29.45 OIL	
			14.58 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.37	7.11	111.6
			0.62 SHALE	
			3.94 OIL	
			2.54 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.92	1.86	97.1
SULFUR	#/MIN	3.04	3.10	102.1
			2.69 SHALE	
			0.21 OIL	
			0.19 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	473.11	470.73	99.5

3.663 #/MIN C 1.000 #/MIN H 3.664 C/H COMB RATIO
80.93 VOL%FA 82.03WT.%FA

DATA SUMMARY

STARTING DATE 62778 TO 62878
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.65	H2O FA	WT%	1.50
OIL FA	GPT	27.90			
MIN CO2	WT%	16.74	ASH	WT%	66.22
CARBON	WT%	16.61	HYDROGEN	WT%	1.76
NITROGEN	WT%	0.48	SULFUR	WT%	0.76

RAW SHALE MOISTURE WT% (UNGROUND) 0.58

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	1.5
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.35	HYDROGEN	WT%	11.28
NITROGEN	WT%	1.98	SULFUR	WT%	0.61

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	1.5

PRODUCT WATER PROPERTIES

CARBON	WT%	5.36	HYDROGEN	WT%	9.03
NITROGEN	WT%	7.71	SULFUR	WT%	3.00
CO2	WT%	5.66			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.89	C2H4	VOL%	0.62
N2+AR	VOL%	61.83	C2H6	VOL%	0.48
O2	VOL%	0.03	C3'S	VOL%	0.53
CO	VOL%	3.04	C4'S	VOL%	0.60
CH4	VOL%	2.27	C5+	VOL%	0.58
CO2	VOL%	23.06	H2S	VOL%	0.19
			NH3	VOL%	0.88

GROSS HEAT BTU/SCF 143.17

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.14			
OIL FA	GPT	0.38			
MIN CO2	WT%	14.83	ASH	WT%	81.80
CARBON	WT%	6.51	HYDROGEN	WT%	0.23
NITROGEN	WT%	0.23	SULFUR	WT%	0.83

TEMPERATURES DEG F

RAW SHALE IN	76	RET SHALE OUT	463
AIR TD IN	230	AIR MD IN	179
GAS BD IN	249	GAS MD IN	222
GAS TD IN	223	GAS PROD OUT	245
COOLING WATER IN	112	COOLING WATER OUT	124
PRODUCT OIL OUT	134		
AMBIENT AIR	73	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	11.99	THROUGHPUT PHF2		486.9
RET SHALE	TPH	9.71	RET/RAW	WT%	81.0

AIR TOP	SCFM	718.9	SCF/T	3597.7
AIR MID	SCFM	210.4	SCF/T	1053.1
AIR BTM	SCFM	0.0	SCF/T	0.0
TOTAL AIR	SCFM	929.4	SCF/T	4650.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 21.560
SP GR 0.965

GAS TOP	SCFM	262.5	SCF/T	1313.6
GAS MID	SCFM	252.1	SCF/T	1261.8
GAS BTM	SCFM	2125.3	SCF/T	10635.4
TOTAL GAS	SCFM	2639.9	SCF/T	13210.7

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	1382.3	SCF/T	6917.0

COOLING WATER	GPM	94.0	BARO PRESS IN HG	24.0
AMB AIR REL HUM	%	22.7	BED PD IN H2O/FT	1.1

OIL YIELD WT% FA= 81.9
OIL YIELD VOL% FA= 83.9

***SEMI-WORKS ***
STARTING DATE 62878 TO 62978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	735.85	703.22	95.6
ASH	#/MIN	264.53	264.53	100.0
OXYGEN	SCFM	195.61	195.61	100.0
			137.93 TO H2O	
			56.58 TO CO&CO2	
			1.10 GAS	
WATER	#/MIN	18.18	15.30	84.2
		5.08 SHALE	0.37 LIQ	
		13.10 COMB	13.69 VAP	
			1.24 SHALE	
KEROGEN	#/MIN	59.52	53.52	89.9
			9.14 SHALE	
			33.38 OIL	
			10.96 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	45.02	44.49	98.8
			8.46 SHALE	
			28.15 OIL	
			7.86 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	63.80	63.28	99.2
			22.31 SHALE	
			28.15 OIL	
			12.79 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.49	7.44	114.6
			0.68 SHALE	
			3.81 OIL	
			2.94 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.90	1.79	94.3
SULFUR	#/MIN	3.13	3.17	101.4
			2.68 SHALE	
			0.22 OIL	
			0.25 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	469.27	462.46	98.5

2.185 #/MIN C 1.456 #/MIN H 1.501 C/H COMB RATIO
76.80 VOL%FA 77.73WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 62878 TO 62978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	735.85	735.85	100.0
ASH	#/MIN	264.53	264.53	100.0
OXYGEN	SCFM	195.61	195.61	100.0
			126.67 TO H2O	
			67.79 TO CO&CO2	
			1.15 GAS	
WATER	#/MIN	17.11	15.93	93.1
		5.08 SHALE	0.37 LIQ	
		12.03 COMB	14.32 VAP	
			1.24 SHALE	
KEROGEN	#/MIN	59.52	54.07	90.8
			9.14 SHALE	
			33.38 OIL	
			11.51 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	45.02	45.08	100.1
			8.46 SHALE	
			28.15 OIL	
			8.45 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	63.80	63.87	100.1
			22.31 SHALE	
			28.15 OIL	
			13.39 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.49	7.39	113.8
			0.68 SHALE	
			3.81 OIL	
			2.89 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.90	1.81	95.1
SULFUR	#/MIN	3.13	3.18	101.8
			2.68 SHALE	
			0.22 OIL	
			0.27 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	469.27	467.17	99.6

2.561 #/MIN C 1.337 #/MIN H 1.916 C/H COMB RATIO
76.80 VOL%FA 77.73WT.%FA

DATA SUMMARY

STARTING DATE 62878 TO 62978
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.85	H2O FA	WT%	0.72
OIL FA	GPT	28.40			
MIN CO2	WT%	17.40	ASH	WT%	66.84
CARBON	WT%	16.12	HYDROGEN	WT%	1.72
NITROGEN	WT%	0.48	SULFUR	WT%	0.79

RAW SHALE MOISTURE WT% (UNGROUND) 0.56

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	1.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.34	HYDROGEN	WT%	11.42
NITROGEN	WT%	1.81	SULFUR	WT%	0.67

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	1.3

PRODUCT WATER PROPERTIES

CARBON	WT%	5.06	HYDROGEN	WT%	9.21
NITROGEN	WT%	5.79	SULFUR	WT%	2.94
CO2	WT%	3.82			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.76	C2H4	VOL%	0.69
N2+AR	VOL%	64.12	C2H6	VOL%	0.60
O2	VOL%	0.10	C3'S	VOL%	0.59
CO	VOL%	2.72	C4'S	VOL%	0.59
CH4	VOL%	2.47	C5+	VOL%	0.60
CO2	VOL%	20.66	H2S	VOL%	0.27
			NH3	VOL%	0.84

GROSS HEAT BTU/SCF 149.03

RETORTED SHALE PROPERTIES

OIL FA	WT%	3.03			
OIL FA	GPT	0.08			
MIN CO2	WT%	15.52	ASH	WT%	80.88
CARBON	WT%	6.82	HYDROGEN	WT%	0.25
NITROGEN	WT%	0.25	SULFUR	WT%	0.82

TEMPERATURES DEG F

RAW SHALE IN	73	RET SHALE OUT	461
AIR TD IN	198	AIR MD IN	177
GAS BD IN	249	GAS MD IN	222
GAS TD IN	223	GAS PROD OUT	245
COOLING WATER IN	138	COOLING WATER OUT	120
PRODUCT OIL OUT	133		
AMBIENT AIR	70	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	11.87	THROUGHPUT PHF2		482.1
RET SHALE	TPH	9.81	RET/RAW	WT%	82.6
AIR TOP	SCFM	720.0		SCF/T	3638.7
AIR MID	SCFM	211.4		SCF/T	1068.4
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	931.5		SCF/T	4707.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.810			
SP GR		0.959			
GAS TOP	SCFM	263.0		SCF/T	1329.1
GAS MID	SCFM	252.6		SCF/T	1276.7
GAS BTM	SCFM	2129.4		SCF/T	10760.9
TOTAL GAS	SCFM	2545.1		SCF/T	13366.7
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1385.0		SCF/T	6998.8
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	36.7	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 77.6
OIL YIELD VOL% FA= 72.8

***SEMI-WORKS ***
STARTING DATE 63078 TO 70178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	739.38		675.26		91.3
ASH	#/MIN	258.05		258.05		100.0
OXYGEN	SCFM	196.55		196.54		100.0
				142.02	TO H2O	
				54.26	TO CO&CO2	
				0.27	GAS	
WATER	#/MIN	19.23		17.39		90.4
		5.74	SHALE	0.56	LIQ	
		13.49	COMB	14.21	VAP	
				2.62	SHALE	
KEROGEN	#/MIN	63.40		54.81		86.5
				8.19	SHALE	
				36.34	OIL	
				10.22	GAS	
				0.06	WATER	
ORGANIC CARBON	#/MIN	49.56		46.00		94.7
				7.96	SHALE	
				30.78	OIL	
				7.23	GAS	
				0.03	WATER	
TOTAL CARBON	#/MIN	67.55		64.98		96.2
				22.18	SHALE	
				30.78	OIL	
				11.99	GAS	
				0.03	WATER	
ORG. HYDROGEN	#/MIN	6.63		7.17		108.1
				0.23	SHALE	
				4.12	OIL	
				2.81	GAS	
				0.01	WATER	
ORG. NITROGEN	#/MIN	2.09		1.80		86.0
SULFUR	#/MIN	2.77		3.00		108.7
				2.49	SHALE	
				0.22	OIL	
				0.27	GAS	
				0.02	WATER	
O'ALL WEIGHT	#/MIN	468.40		460.63		98.3

2.097 #/MIN C 1.499 #/MIN H 1.399 C/H COMB RATIO
81.65 VOL%FA 82.45WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 63078 TO 70178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	739.38	739.38	100.0
ASH	#/MIN	258.05	258.05	100.0
OXYGEN	SCFM	196.55	196.54	100.0
			119.74 TO H2O	
			76.52 TO CO&CO2	
			0.29 GAS	
WATER	#/MIN	17.11	18.74	109.5
		5.74 SHALE	0.56 LIQ	
		11.37 COMB	15.56 VAP	
			2.62 SHALE	
KEROGEN	#/MIN	63.40	55.86	88.1
			8.19 SHALE	
			36.34 OIL	
			11.27 GAS	
			0.06 WATER	
ORGANIC CARBON	#/MIN	48.56	47.14	97.1
			7.96 SHALE	
			30.78 OIL	
			8.37 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	67.55	66.12	97.9
			22.18 SHALE	
			30.78 OIL	
			13.13 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.63	7.06	106.4
			0.23 SHALE	
			4.12 OIL	
			2.70 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.09	1.83	87.6
SULFUR	#/MIN	2.77	3.03	109.6
			2.49 SHALE	
			0.22 OIL	
			0.29 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	468.40	470.11	100.4

2.846 #/MIN C 1.264 #/MIN H 2.252 C/H COMB RATIO
81.65 VOL%FA 82.45WT.%FA

DATA SUMMARY

STARTING DATE 63078 TO 70178
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.16	+20 FA	WT%	1.00
OIL FA	GPT	29.20			
MIN CO2	WT%	17.62	ASH	WT%	65.33
CARBON	WT%	17.10	HYDROGEN	WT%	1.79
NITROGEN	WT%	0.53	SULFUR	WT%	0.70

RAW SHALE MOISTURE WT% (UNGROUND) 0.45

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	1.8
VIS	SUS-130	0.0	SEDIMENT	ML/100G	1.4
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.69	HYDROGEN	WT%	11.33
NITROGEN	WT%	2.01	SULFUR	WT%	0.61

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	1.8

PRODUCT WATER PROPERTIES

CARBON	WT%	4.75	HYDROGEN	WT%	9.57
NITROGEN	WT%	4.83	SULFUR	WT%	3.56
CO2	WT%	3.05			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.27	C2H4	VOL%	0.65
N2+AR	VOL%	64.57	C2H6	VOL%	0.56
O2	VOL%	0.03	C3'S	VOL%	0.53
CO	VOL%	2.78	C4'S	VOL%	0.58
CH4	VOL%	2.25	C5+	VOL%	0.52
CO2	VOL%	21.02	H2S	VOL%	0.31
			NH3	VOL%	0.93

GROSS HEAT BTU/SCF 139.11

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.02			
OIL FA	GPT	0.05			
MIN CO2	WT%	15.10	ASH	WT%	79.69
CARBON	WT%	5.85	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.21	SULFUR	WT%	0.77

TEMPERATURES DEG F

RAW SHALE IN	70	RET SHALE OUT	474
AIR TD IN	199	AIR MD IN	169
GAS BD IN	247	GAS MD IN	219
GAS TD IN	221	GAS PROD OUT	242
COOLING WATER IN	109	COOLING WATER OUT	119
PRODUCT OIL OUT	132		
AMBIENT AIR	55	OFF GAS	141

RATES AND QUANTITIES

RAW SHALE	TPH	11.85	THROUGHPUT PHF2		481.2
RET SHALE	TPH	9.71	RET/RAW	WT%	82.0
AIR TOP	SCFM	718.9		SCF/T	3639.9
AIR MID	SCFM	157.4		SCF/T	797.1
AIR BTM	SCFM	59.6		SCF/T	301.9
TOTAL AIR	SCFM	935.9		SCF/T	4738.9

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		22.240			
SP GR		0.970			
GAS TOP	SCFM	263.1		SCF/T	1332.3
GAS MID	SCFM	246.3		SCF/T	1247.0
GAS BTM	SCFM	2112.4		SCF/T	10695.5
TOTAL GAS	SCFM	2521.8		SCF/T	13274.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1345.0		SCF/T	6810.0
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	56.5	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 82.3
OIL YIELD VOL% FA= 81.2

***SEMI-WORKS ***
STARTING DATE 70278 TO 70378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	749.58	688.38	91.8
ASH	#/MIN	264.51	264.51	100.0
OXYGEN	SCFM	199.26	199.25	100.0
			114.30 TO H2O	
			84.16 TO CO&CO2	
			0.80 GAS	
WATER	#/MIN	15.22	14.42	94.7
		4.37 SHALE	0.60 LIQ	
		10.86 COMB	12.26 VAP	
			1.56 SHALE	
KEROGEN	#/MIN	61.19	54.44	89.0
			7.52 SHALE	
			35.57 OIL	
			11.29 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	46.40	45.65	98.4
			7.07 SHALE	
			30.08 OIL	
			8.47 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	64.92	64.17	98.9
			21.41 SHALE	
			30.08 OIL	
			12.64 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.75	7.04	104.2
			0.44 SHALE	
			3.97 OIL	
			2.61 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.78	1.59	89.4
SULFUR	#/MIN	2.93	3.16	107.7
			2.60 SHALE	
			0.26 OIL	
			0.27 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	470.57	460.73	97.9

3.072 #/MIN C 1.206 #/MIN H 2.546 C/H COMB RATIO
79.91 VOL%FA 80.70WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 70278 TO 70378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	749.58	749.58	100.0
ASH	#/MIN	264.51	264.51	100.0
OXYGEN	SCFM	199.26	199.25	100.0
			92.38 TO H2O	
			106.00 TO CO&CO2	
			0.87 GAS	
WATER	#/MIN	13.14	15.51	118.0
		4.37 SHALE	0.60 LIQ	
		8.78 COMB	13.35 VAP	
			1.56 SHALE	
KEROGEN	#/MIN	61.19	55.48	90.7
			7.52 SHALE	
			35.57 OIL	
			12.33 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	46.40	46.78	100.8
			7.07 SHALE	
			30.08 OIL	
			9.60 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	64.92	65.30	100.6
			21.41 SHALE	
			30.08 OIL	
			13.77 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.75	6.93	102.7
			0.44 SHALE	
			3.97 OIL	
			2.50 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.78	1.61	90.4
SULFUR	#/MIN	2.93	3.18	108.5
			2.60 SHALE	
			0.26 OIL	
			0.29 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	470.57	469.53	99.8

3.807 #/MIN C 0.975 #/MIN H 3.904 C/H COMB RATIO
79.91 VOL%FA 80.70WT.%FA

DATA SUMMARY

STARTING DATE 70278 TO 70378
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.12	H2O FA	WT%	0.69
OIL FA	GPT	29.10			
MIN CO2	WT%	17.13	ASH	WT%	66.74
CARBON	WT%	16.38	HYDROGEN	WT%	1.78
NITROGEN	WT%	0.45	SULFUR	WT%	0.74

RAW SHALE MOISTURE WT% (UNGROUND) 0.41

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	1.9
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.1
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.56	HYDROGEN	WT%	11.16
NITROGEN	WT%	1.81	SULFUR	WT%	0.74

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	1.9

PRODUCT WATER PROPERTIES

CARBON	WT%	5.52	HYDROGEN	WT%	9.86
NITROGEN	WT%	4.73	SULFUR	WT%	3.64
CO2	WT%	2.91			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.98	C2H4	VOL%	0.72
N2+AR	VOL%	63.55	C2H6	VOL%	0.60
O2	VOL%	0.07	C3'S	VOL%	0.59
CO	VOL%	2.85	C4'S	VOL%	0.51
CH4	VOL%	2.53	C5+	VOL%	0.53
CO2	VOL%	21.26	H2S	VOL%	0.29
			NH3	VOL%	0.50

GROSS HEAT BTU/SCF 143.43

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.03			
OIL FA	GPT	0.06			
MIN CO2	WT%	16.16	ASH	WT%	81.28
CARBON	WT%	6.58	HYDROGEN	WT%	0.19
NITROGEN	WT%	0.22	SULFUR	WT%	0.80

TEMPERATURES DEG F

RAW SHALE IN	78	RET SHALE OUT	474
AIR TD IN	203	AIR MD IN	169
GAS BD IN	246	GAS MD IN	213
GAS TD IN	220	GAS PROD OUT	241
COOLING WATER IN	113	COOLING WATER OUT	124
PRODUCT OIL OUT	129		
AMBIENT AIR	75	OFF GAS	139

RATES AND QUANTITIES

RAW SHALE	TPH	11.89	THROUGHPUT PHF2		482.8
RET SHALE	TPH	9.76	RET/RAW	WT%	82.1
AIR TOP	SCFM	716.9		SCF/T	3617.4
AIR MID	SCFM	143.8		SCF/T	725.9
AIR BTM	SCFM	88.1		SCF/T	444.8
TOTAL AIR	SCFM	948.8		SCF/T	4788.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.240			
SP GR		0.965			
GAS TOP	SCFM	263.8		SCF/T	1331.1
GAS MID	SCFM	193.7		SCF/T	977.7
GAS BTM	SCFM	2144.5		SCF/T	10821.5
TOTAL GAS	SCFM	2602.0		SCF/T	13130.3
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1341.2		SCF/T	6768.2
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	24.5	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 80.6

OIL YIELD VOL% FA= 77.9

***SEMI-WORKS ***
STARTING DATE 70378 TO 70478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	744.72	655.20	88.0
ASH	#/MIN	265.18	265.18	100.0
OXYGEN	SCFM	197.96	197.96	100.0
			129.96 TO H2O	
			67.36 TO CO&CO2	
			0.64 GAS	
WATER	#/MIN	17.26	14.05	81.4
		4.91 SHALE	0.85 LIQ	
		12.34 COMB	11.64 VAP	
			1.57 SHALE	
KEROGEN	#/MIN	57.21	56.64	99.0
			8.02 SHALE	
			38.30 OIL	
			10.23 GAS	
			0.09 WATER	
ORGANIC CARBON	#/MIN	45.63	47.41	103.9
			7.61 SHALE	
			32.35 OIL	
			7.40 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	64.73	66.51	102.8
			21.71 SHALE	
			32.35 OIL	
			12.40 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	6.52	7.40	113.4
			0.41 SHALE	
			4.32 OIL	
			2.65 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.86	1.84	99.0
SULFUR	#/MIN	3.01	3.15	104.8
			2.64 SHALE	
			0.24 OIL	
			0.24 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	469.47	461.98	98.4

2.540 #/MIN C 1.372 #/MIN H 1.852 C/H COMB RATIO
90.55 VOL%FA 91.48WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 70378 TO 70478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	744.72		744.72		100.0
ASH	#/MIN	265.18		265.18		100.0
OXYGEN	SCFM	197.96		197.96		100.0
				95.27	TO H2O	
				101.97	TO CO&CO2	
				0.73	GAS	
WATER	#/MIN	13.96		15.64		112.0
		4.91	SHALE	0.85	LIQ	
		9.05	COMB	13.23	VAP	
				1.57	SHALE	
KEROGEN	#/MIN	57.21		58.16		101.7
				8.02	SHALE	
				38.30	OIL	
				11.76	GAS	
				0.09	WATER	
ORGANIC CARBON	#/MIN	45.63		49.10		107.6
				7.61	SHALE	
				32.35	OIL	
				9.10	GAS	
				0.04	WATER	
TOTAL CARBON	#/MIN	64.73		68.21		105.4
				21.71	SHALE	
				32.35	OIL	
				14.09	GAS	
				0.05	WATER	
ORG. HYDROGEN	#/MIN	6.52		7.20		110.4
				0.41	SHALE	
				4.32	OIL	
				2.46	GAS	
				0.02	WATER	
ORG. NITROGEN	#/MIN	1.86		1.87		100.6
SULFUR	#/MIN	3.01		3.18		105.9
				2.64	SHALE	
				0.24	OIL	
				0.27	GAS	
				0.03	WATER	
O'ALL WEIGHT	#/MIN	469.47		475.12		101.2

3.702 #/MIN C 1.005 #/MIN H 3.682 C/H COMB RATIO
90.55 VOL%FA 91.48WT.%FA

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DATA SUMMARY

STARTING DATE 70378 TO 70478

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.58	H2O FA	WT%	0.82
OIL FA	GPT	27.70			
MIN CO2	WT%	17.70	ASH	WT%	67.02
CARBON	WT%	16.36	HYDROGEN	WT%	1.74
NITROGEN	WT%	0.47	SULFUR	WT%	0.76

RAW SHALE MOISTURE WT% (UNGROUND) 0.42

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	2.5
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.2
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.47	HYDROGEN	WT%	11.28
NITROGEN	WT%	2.27	SULFUR	WT%	0.62

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	2.5

PRODUCT WATER PROPERTIES

CARBON	WT%	5.06	HYDROGEN	WT%	10.07
NITROGEN	WT%	4.20	SULFUR	WT%	3.78
CO2	WT%	1.64			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.78	C2H4	VOL%	0.66
N2+AR	VOL%	62.56	C2H6	VOL%	0.58
O2	VOL%	0.06	C3'S	VOL%	0.50
CO	VOL%	2.92	C4'S	VOL%	0.44
CH4	VOL%	2.46	C5+	VOL%	0.50
CO2	VOL%	22.72	H2S	VOL%	0.27
			NH3	VOL%	0.55

GROSS HEAT BTU/SCF 134.48

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.04			
OIL FA	GPT	0.10			
MIN CO2	WT%	15.84	ASH	WT%	81.21
CARBON	WT%	5.65	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.22	SULFUR	WT%	0.81

TEMPERATURES DEG F

RAW SHALE IN	77	RET SHALE OUT	462
AIR TD IN	201	AIR MD IN	165
GAS BD IN	244	GAS MD IN	206
GAS TD IN	217	GAS PROD OUT	239
COOLING WATER IN	113	COOLING WATER OUT	124
PRODUCT OIL OUT	126		
AMBIENT AIR	74	OFF GAS	136

RATES AND QUANTITIES

RAW SHALE	TPH	11.87	THROUGHPUT PHF2		482.0
RET SHALE	TPH	9.80	RET/RAW	WT%	82.5
AIR TOP	SCFM	710.7		SCF/T	3592.6
AIR MID	SCFM	135.6		SCF/T	685.5
AIR BTM	SCFM	96.3		SCF/T	486.9
TOTAL AIR	SCFM	942.7		SCF/T	4765.0

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.960			
SP GR		0.973			
GAS TOP	SCFM	261.4		SCF/T	1321.4
GAS MID	SCFM	159.9		SCF/T	808.4
GAS BTM	SCFM	2201.3		SCF/T	11127.1
TOTAL GAS	SCFM	2522.7		SCF/T	13257.0
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1292.5		SCF/T	6533.0
COOLING WATER	GPM	94.0	BARO PRESS IN HG		23.3
AMB AIR REL HUM	%	16.3	BED PD IN H2O/FT		1.2

OIL YIELD WT% FA= 91.4
OIL YIELD VOL% FA= 93.5

***SEMI-WORKS ***
STARTING DATE 70578 TO 70678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	751.69	666.51	88.7
ASH	#/MIN	264.16	264.16	100.0
OXYGEN	SCFM	199.82	199.82	100.0
			105.13 TO H2O	
			94.43 TO CO&CO2	
			0.26 GAS	
WATER	#/MIN	13.39	14.27	106.6
		3.40 SHALE	0.99 LIQ	
		9.99 COMB	11.21 VAP	
			2.06 SHALE	
KEROGEN	#/MIN	58.87	58.69	99.7
			9.18 SHALE	
			38.26 OIL	
			11.18 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	47.41	49.74	104.9
			8.62 SHALE	
			32.52 OIL	
			8.56 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	66.45	68.80	103.5
			23.16 SHALE	
			32.52 OIL	
			13.06 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.38	7.36	115.3
			0.56 SHALE	
			4.35 OIL	
			2.43 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.17	1.87	86.2
SULFUR	#/MIN	2.84	3.03	106.6
			2.49 SHALE	
			0.24 OIL	
			0.25 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	469.84	465.34	99.2

3.457 #/MIN C 1.110 #/MIN N 3.116 C/H COMB RATIO
88.47 VOL%FA 89.51WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 70578 TO 70678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	751.69	751.69	100.0
ASH	#/MIN	264.16	264.16	100.0
OXYGEN	SCFM	199.82	199.82	100.0
			71.18 TO H2O	
			128.35 TO CO&CO2	
			0.29 GAS	
WATER	#/MIN	10.16	15.70	154.5
		3.40 SHALE	0.99 LIQ	
		6.76 COMB	12.64 VAP	
			2.06 SHALE	
KEROGEN	#/MIN	58.87	60.20	102.2
			9.18 SHALE	
			38.26 OIL	
			12.68 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	47.41	51.41	108.4
			8.62 SHALE	
			32.52 OIL	
			10.23 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	66.45	70.47	106.1
			23.16 SHALE	
			32.52 OIL	
			14.73 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.38	7.17	112.4
			0.56 SHALE	
			4.35 OIL	
			2.24 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.17	1.90	87.7
SULFUR	#/MIN	2.84	3.06	107.7
			2.49 SHALE	
			0.24 OIL	
			0.28 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	469.04	477.91	101.9

4.601 #/MIN C 0.751 #/MIN H 6.124 C/H COMB RATIO
88.47 VOL%FA 89.51WT.%FA

DATA SUMMARY

STARTING DATE 70578 TO 70678
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.84	H2O FA	WT%	0.38
OIL FA	GPT	28.40			
MIN CO2	WT%	17.70	ASH	WT%	66.99
CARBON	WT%	16.85	HYDROGEN	WT%	1.66
NITROGEN	WT%	0.55	SULFUR	WT%	0.72

RAW SHALE MOISTURE WT% (UNGROUND) 0.48

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	2.9
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.99	HYDROGEN	WT%	11.38
NITROGEN	WT%	1.98	SULFUR	WT%	0.63

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	2.9

PRODUCT WATER PROPERTIES

CARBON	WT%	5.11	HYDROGEN	WT%	10.24
NITROGEN	WT%	3.00	SULFUR	WT%	4.40
CO2	WT%	5.04			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.70	C2H4	VOL%	0.63
N2+AR	VOL%	62.08	C2H6	VOL%	0.52
O2	VOL%	0.02	C3'S	VOL%	0.53
CO	VOL%	3.21	C4'S	VOL%	0.47
CH4	VOL%	2.20	C5+	VOL%	0.59
CO2	VOL%	23.11	H2S	VOL%	0.28
			NH3	VOL%	0.65

GROSS HEAT BTU/SCF 137.85

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.20			
OIL FA	GPT	0.51			
MIN CO2	WT%	16.27	ASH	WT%	80.64
CARBON	WT%	7.07	HYDROGEN	WT%	0.24
NITROGEN	WT%	0.25	SULFUR	WT%	0.76

TEMPERATURES DEG F

RAW SHALE IN	74	RET SHALE OUT	454
AIR TD IN	230	AIR MD IN	165
GAS BD IN	243	GAS MD IN	189
GAS TD IN	215	GAS PROD OUT	238
COOLING WATER IN	116	COOLING WATER OUT	129
PRODUCT OIL OUT	125		
AMBIENT AIR	71	OFF GAS	133

RATES AND QUANTITIES

RAW SHALE	TPH	11.83	THROUGHPUT PHF2		480.4
RET SHALE	TPH	9.83	RET/RAW	WT%	83.1

AIR TOP	SCFM	717.0	SCF/T	3636.6
AIR MID	SCFM	137.1	SCF/T	695.4
AIR BTM	SCFM	97.4	SCF/T	494.0
TOTAL AIR	SCFM	951.5	SCF/T	4825.9

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 18.020
SP GR 0.981

GAS TOP	SCFM	265.1	SCF/T	1344.4
GAS MID	SCFM	99.9	SCF/T	506.8
GAS BTM	SCFM	2244.1	SCF/T	11381.9
TOTAL GAS	SCFM	2609.1	SCF/T	13233.1

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	1309.7	SCF/T	6642.7

COOLING WATER	GPM	94.0	BARO PRESS IN HG	24.0
AMB AIR REL HUM	%	15.2	BED PD IN H2O/FT	1.1

OIL YIELD WT% FA= 89.4
OIL YIELD VOL% FA= 83.5

***SEMI-WORKS ***
STARTING DATE 70678 TO 70778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	753.37	675.55	89.7
ASH	#/MIN	264.83	264.83	100.0
OXYGEN	SCFM	200.26	200.26	100.0
			109.48 TO H2O	
			89.87 TO CO&CO2	
			0.91 GAS	
WATER	#/MIN	16.23	13.83	85.2
		5.83 SHALE	0.58 LIQ	
		10.40 COMB	11.41 VAP	
			1.83 SHALE	
KEROGEN	#/MIN	55.11	53.93	97.9
			8.16 SHALE	
			34.53 OIL	
			11.20 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	45.11	45.45	100.8
			7.58 SHALE	
			29.36 OIL	
			8.50 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	63.92	64.27	100.6
			22.01 SHALE	
			29.36 OIL	
			12.86 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.23	6.93	111.1
			C.58 SHALE	
			3.82 OIL	
			2.51 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.12	1.63	76.9
SULFUR	#/MIN	2.79	3.27	117.1
			2.78 SHALE	
			0.20 OIL	
			0.25 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	467.68	461.06	96.6

3.290 #/MIN C 1.155 #/MIN H 2.847 C/H COMB RATIO
83.17 VOL%FA 84.33WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 70678 TO 70778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	753.37	753.37	100.0
ASH	#/MIN	264.83	264.83	100.0
OXYGEN	SCFM	200.26	200.26	100.0
			79.95 TO H2O	
			119.30 TO CO&CO2	
			1.02 GAS	
WATER	#/MIN	13.42	15.14	112.8
		5.83 SHALE	0.58 LIQ	
		7.59 COMB	12.73 VAP	
			1.83 SHALE	
KEROGEN	#/MIN	55.11	55.28	100.3
			8.16 SHALE	
			34.53 OIL	
			12.54 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	45.11	46.94	104.0
			7.58 SHALE	
			29.36 OIL	
			9.98 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	63.92	65.75	102.9
			22.01 SHALE	
			29.36 OIL	
			14.35 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.23	6.77	108.6
			0.58 SHALE	
			3.82 OIL	
			2.36 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.12	1.66	78.2
SULFUR	#/MIN	2.79	3.30	118.2
			2.78 SHALE	
			0.20 OIL	
			0.28 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	467.68	472.38	101.0

4.281 #/MIN C 0.844 #/MIN H 5.074 C/H COMB RATIO
83.17 VOL%FA 84.33WT.%FA

DATA SUMMARY

STARTING DATE 70678 TO 70778

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.41	H2O FA	WT%	1.13
OIL FA	GPT	27.30			
MIN CO2	WT%	17.53	ASH	WT%	67.33
CARBON	WT%	16.25	HYDROGEN	WT%	1.71
NITROGEN	WT%	0.54	SULFUR	WT%	0.71

RAW SHALE MOISTURE WT% (UNGROUND) 0.35

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	0.4
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	35.02	HYDROGEN	WT%	11.07
NITROGEN	WT%	1.97	SULFUR	WT%	0.59

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	1.9

PRODUCT WATER PROPERTIES

CARBON	WT%	4.85	HYDROGEN	WT%	10.03
NITROGEN	WT%	3.58	SULFUR	WT%	5.03
CO2	WT%	5.37			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.69	C2H4	VOL%	0.64
N2+AR	VOL%	62.85	C2H6	VOL%	0.55
O2	VOL%	0.08	C3'S	VOL%	0.56
CO	VOL%	3.06	C4'S	VOL%	0.51
CH4	VOL%	2.35	C5+	VOL%	0.58
CO2	VOL%	22.24	H2S	VOL%	0.28
			NH3	VOL%	0.61

GROSS HEAT BTU/SCF 140.81

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.17			
OIL FA	GPT	0.44			
MIN CO2	WT%	16.16	ASH	WT%	80.84
CARBON	WT%	5.72	HYDROGEN	WT%	0.24
NITROGEN	WT%	0.21	SULFUR	WT%	0.85

TEMPERATURES DEG F

RAW SHALE IN	73	RET SHALE OUT	453
AIR TD IN	199	AIR MD IN	165
GAS BD IN	243	GAS MD IN	178
GAS TD IN	215	GAS PROD OUT	239
COOLING WATER IN	115	COOLING WATER OUT	128
PRODUCT OIL OUT	127		
AMBIENT AIR	71	OFF GAS	135

RATES AND QUANTITIES

RAW SHALE	TPH	11.80	THROUGHPUT PHF2		479.2
RET SHALE	TPH	9.83	RET/RAW	WT%	83.3
AIR TOP	SCFM	719.3		SCF/T	3657.4
AIR MID	SCFM	137.0		SCF/T	696.7
AIR BTM	SCFM	97.3		SCF/T	494.9
TOTAL AIR	SCFM	953.6		SCF/T	4849.0

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.270			
SP GR		0.977			
GAS TOP	SCFM	264.9		SCF/T	1346.7
GAS MID	SCFM	80.6		SCF/T	409.7
GAS BTM	SCFM	2262.9		SCF/T	11506.5
TOTAL GAS	SCFM	2608.4		SCF/T	13263.0
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1315.0		SCF/T	6686.6
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	18.3	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 84.2
OIL YIELD VOL% FA= 83.2

APPENDIX 2.5

SEMI-WORKS RETORTING RESEARCH - TOP GAS RATIOS

***SEMI-WORKS ***
STARTING DATE 71778 TO 71878

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	769.32	670.80	87.2
ASH	#/MIN	269.85	269.85	100.0
OXYGEN	SCFM	204.50	204.50	100.0
			142.17 TO H2O	
			61.42 TO CO&CO2	
			0.92 GAS	
WATER	#/MIN	20.61	18.26	88.6
		7.11 SHALE	0.94 LIQ	
		13.50 COMB	13.44 VAP	
			3.87 SHALE	
KEROGEN	#/MIN	54.98	56.62	103.0
			8.27 SHALE	
			35.70 OIL	
			12.55 GAS	
			0.10 WATER	
ORGANIC CARBON	#/MIN	43.06	47.24	109.7
			8.03 SHALE	
			29.98 OIL	
			9.18 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	62.53	66.71	106.7
			23.05 SHALE	
			29.98 OIL	
			13.64 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	6.11	7.37	120.5
			0.24 SHALE	
			3.97 OIL	
			3.14 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.96	1.80	92.1
SULFUR	#/MIN	3.23	3.36	103.8
			2.81 SHALE	
			0.23 OIL	
			0.28 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	477.84	469.62	98.3

2.224 #/MIN C 1.500 #/MIN H 1.483 C/H COMB RATIO
82.92 VOL%FA 83.62WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 71778 TO 71872

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	769.32	769.32	100.0
ASH	#/MIN	269.85	269.85	100.0
OXYGEN	SCFM	204.50	204.50	100.0
			108.11 TO H2O	
			95.33 TO CO&CO2	
			1.06 GAS	
WATER	#/MIN	17.38	20.23	116.4
		7.11 SHALE	0.94 LIQ	
		10.27 COMB	15.41 VAP	
			3.87 SHALE	
KEROGEN	#/MIN	54.98	58.54	106.5
			8.27 SHALE	
			35.70 OIL	
			14.47 GAS	
			0.10 WATER	
ORGANIC CARBON	#/MIN	43.06	49.24	114.4
			8.03 SHALE	
			29.98 OIL	
			11.18 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	62.53	68.72	109.9
			23.05 SHALE	
			29.98 OIL	
			15.64 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	6.11	7.25	118.5
			0.24 SHALE	
			3.97 OIL	
			3.02 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.96	1.81	92.6
SULFUR	#/MIN	3.23	3.40	105.1
			2.81 SHALE	
			0.23 OIL	
			0.32 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	477.84	484.13	101.3

3.351 #/MIN C 1.141 #/MIN H 2.937 C/H COMB RATIO
82.92 VOL.%FA 83.62WT.%FA

DATA SUMMARY

STARTING DATE 71778 TO 71878
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.70	H2O FA	WT%	0.70
OIL FA	GPT	28.00			
MIN CO2	WT%	17.89	ASH	WT%	67.63
CARBON	WT%	15.67	HYDROGEN	WT%	1.61
NITROGEN	WT%	0.49	SULFUR	WT%	0.81

RAW SHALE MOISTURE WT% (UNGROUND) 1.07

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.6	WATER	WT%	3.0
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	83.96	HYDROGEN	WT%	11.12
NITROGEN	WT%	2.16	SULFUR	WT%	0.64

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.6	WATER	WT%	3.0

PRODUCT WATER PROPERTIES

CARBON	WT%	4.86	HYDROGEN	WT%	9.92
NITROGEN	WT%	4.47	SULFUR	WT%	4.62
CO2	WT%	1.38			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.97	C2H4	VOL%	0.63
N2+AR	VOL%	64.39	C2H6	VOL%	0.63
O2	VOL%	0.09	C3'S	VOL%	1.27
CO	VOL%	2.18	C4'S	VOL%	1.41
CH4	VOL%	2.32	C5+	VOL%	0.53
CO2	VOL%	21.08	H2S	VOL%	0.32
			NH3	VOL%	0.20

GROSS HEAT BTU/SCF 180.05

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.09			
OIL FA	GPT	0.23			
MIN CO2	WT%	16.48	ASH	WT%	80.79
CARBON	WT%	5.90	HYDROGEN	WT%	0.20
NITROGEN	WT%	0.27	SULFUR	WT%	0.84

TEMPERATURES DEG F

RAW SHALE IN	75	RET SHALE OUT	503
AIR TD IN	195	AIR MD IN	163
GAS BD IN	242	GAS MD IN	214
GAS TD IN	218	GAS PROD OUT	238
COOLING WATER IN	118	COOLING WATER OUT	128
PRODUCT OIL OUT	133		
AMBIENT AIR	72	OFF GAS	141

RATES AND QUANTITIES

RAW SHALE	TPH	11.97	THROUGHPUT PHF2		486.1
RET SHALE	TPH	10.02	RET/RAW	WT%	83.7
AIR TOP	SCFM	716.6		SCF/T	3591.8
AIR MID	SCFM	159.2		SCF/T	797.9
AIR BTM	SCFM	98.1		SCF/T	491.5
TOTAL AIR	SCFM	973.8		SCF/T	4881.2

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		21.360			
SP GR		0.975			
GAS TOP	SCFM	257.4		SCF/T	1290.3
GAS MID	SCFM	247.7		SCF/T	1241.5
GAS BTM	SCFM	2061.2		SCF/T	10331.7
TOTAL GAS	SCFM	2566.3		SCF/T	12863.5
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1324.9		SCF/T	6640.6

COOLING WATER	GPM	1.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	55.8	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 83.5
OIL YIELD VOL% FA= 82.9

***SEMI-WORKS ***
STARTING DATE 71878 TO 71978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	767.21	663.59	86.5
ASH	#/MIN	262.02	262.02	100.0
OXYGEN	SCFM	203.94	203.94	100.0
			125.12 TO H2O	
			77.90 TO CO&CO2	
			0.92 GAS	
WATER	#/MIN	20.24	18.34	90.6
		8.35 SHALE	1.12 LIQ	
		11.88 COMB	14.03 VAP	
			3.20 SHALE	
KEROGEN	#/MIN	59.59	55.42	93.0
			6.84 SHALE	
			35.82 OIL	
			12.66 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	45.28	46.25	102.1
			6.58 SHALE	
			30.10 OIL	
			9.52 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	63.83	64.81	101.5
			21.33 SHALE	
			30.10 OIL	
			13.32 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.20	7.16	115.5
			0.26 SHALE	
			3.94 OIL	
			2.94 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.08	1.78	85.6
SULFUR	#/MIN	3.34	3.36	100.5
			2.81 SHALE	
			0.23 OIL	
			0.27 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	472.31	458.54	97.1

2.722 #/MIN C 1.321 #/MIN H 2.061 C/H COMB RATIO
84.23 VOL%FA 85.28WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 71878 TO 71978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	767.21	767.21	100.0
ASH	#/MIN	262.02	262.02	100.0
OXYGEN	SCFM	203.94	203.94	100.0
			89.64 TO H2O	
			113.23 TO CO&CO2	
			1.06 GAS	
WATER	#/MIN	16.87	20.53	121.7
		8.35 SHALE	1.12 LIQ	
		8.52 COMB	16.22 VAP	
			3.20 SHALE	
KEROGEN	#/MIN	59.59	57.41	96.4
			6.84 SHALE	
			35.82 OIL	
			14.65 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	45.28	48.33	106.7
			6.58 SHALE	
			30.10 OIL	
			11.60 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	63.83	66.89	104.8
			21.33 SHALE	
			30.10 OIL	
			15.40 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	6.20	7.04	113.5
			0.26 SHALE	
			3.94 OIL	
			2.82 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.08	1.81	86.8
SULFUR	#/MIN	3.34	3.40	101.8
			2.81 SHALE	
			0.23 OIL	
			0.31 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	472.31	473.87	100.3

3.892 #/MIN C 0.946 #/MIN H 4.114 C/H COMB RATIO
84.23 VOL%FA 85.28WT.%FA

DATA SUMMARY

STARTING DATE 71878 TO 71978
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.68	H2O FA	WT%	0.93
OIL FA	GPT	28.00			
MIN CO2	WT%	17.30	ASH	WT%	66.62
CARBON	WT%	16.23	HYDROGEN	WT%	1.68
NITROGEN	WT%	0.53	SULFUR	WT%	0.85

RAW SHALE MOISTURE WT% (UNGROUND) 1.18

PRODUCT OIL PROPERTIFS

GRAVITY	DEG API	21.3	WATER	WT%	3.5
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.02	HYDROGEN	WT%	10.99
NITROGEN	WT%	2.21	SULFUR	WT%	0.64

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	3.5

PRODUCT WATER PROPERTIES

CARBON	WT%	4.80	HYDROGEN	WT%	10.02
NITROGEN	WT%	4.02	SULFUR	WT%	4.71
CO2	WT%	3.72			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.89	C2H4	VOL%	0.60
N2+AR	VOL%	64.48	C2H6	VOL%	0.64
O2	VOL%	0.09	C3'S	VOL%	1.28
CO	VOL%	2.04	C4'S	VOL%	1.38
CH4	VOL%	2.39	C5+	VOL%	0.50
CO2	VOL%	20.97	H2S	VOL%	0.31
			NH3	VOL%	0.43

GROSS HEAT BTU/SCF 178.64

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.11			
OIL FA	GPT	0.28			
MIN CO2	WT%	16.74	ASH	WT%	81.06
CARBON	WT%	6.60	HYDROGEN	WT%	0.19
NITROGEN	WT%	0.24	SULFUR	WT%	0.87

TEMPERATURES DEG F

RAW SHALE IN	79	RET SHALE OUT	509
AIR TD IN	138	AIR MD IN	166
GAS BD IN	245	GAS MD IN	218
GAS TD IN	219	GAS PROD OUT	240
COOLING WATER IN	122	COOLING WATER OUT	132
PRODUCT OIL OUT	131		
AMBIENT AIR	72	OFF GAS	140

RATES AND QUANTITIES

RAW SHALE	TPH	11.80	THROUGHPUT PHF2		479.1
RET SHALE	TPH	9.70	RET/RAW	WT%	82.2
AIR TOP	SCFM	716.4		SCF/T	3643.1
AIR MID	SCFM	157.6		SCF/T	801.6
AIR BTM	SCFM	97.1		SCF/T	493.8
TOTAL AIR	SCFM	971.2		SCF/T	4938.5

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		22.300			
SP GR		0.969			
GAS TOP	SCFM	253.1		SCF/T	1286.9
GAS MID	SCFM	249.0		SCF/T	1266.0
GAS BTM	SCFM	2359.2		SCF/T	10471.5
TOTAL GAS	SCFM	2561.3		SCF/T	13024.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1324.5		SCF/T	6735.1

COOLING WATER	GPM	93.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	47.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 85.2
OIL YIELD VOL% FA= 84.2

***SEMI-WORKS ***
STARTING DATE 72078 TO 72178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	783.22		693.66		88.6
ASH	#/MIN	259.59		259.59		100.0
OXYGEN	SCFM	208.20		208.20		100.0
				158.39	TO H2O	
				49.54	TO CO&CO2	
				0.27	GAS	
WATER	#/MIN	21.65		16.52		76.3
		6.61	SHALE	1.23	LIQ	
		15.04	COMB	12.98	VAP	
				2.32	SHALE	
KEROGEN	#/MIN	58.47		55.31		94.6
				7.37	SHALE	
				36.69	OIL	
				11.12	GAS	
				0.13	WATER	
ORGANIC CARBON	#/MIN	46.63		45.89		98.4
				7.11	SHALE	
				30.91	OIL	
				7.80	GAS	
				0.07	WATER	
TOTAL CARBON	#/MIN	65.81		65.07		98.9
				21.08	SHALE	
				30.91	OIL	
				13.00	GAS	
				0.07	WATER	
ORG. HYDROGEN	#/MIN	6.50		7.53		115.9
				0.26	SHALE	
				4.13	OIL	
				3.12	GAS	
				0.02	WATER	
ORG. NITROGEN	#/MIN	1.88		1.70		90.3
SULFUR	#/MIN	2.47		3.03		122.7
				2.48	SHALE	
				0.22	OIL	
				0.28	GAS	
				0.05	WATER	
O'ALL WEIGHT	#/MIN	470.85		460.21		97.7

1.890 #/MIN C 1.672 #/MIN H 1.130 C/H COMB RATIO
86.30 VOL%FA 87.46WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 72078 TO 72178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	783.22		783.22		100.0
ASH	#/MIN	259.59		259.59		100.0
OXYGEN	SCFM	208.20		208.20		100.0
				127.08	TO H2O	
				80.81	TO CO&CO2	
				0.30	GAS	
WATER	#/MIN	18.68		18.20		97.4
		6.61	SHALE	1.23	LIQ	
		12.07	COMB	14.65	VAP	
				2.32	SHALE	
KEROGEN	#/MIN	58.47		56.87		97.3
				7.37	SHALE	
				36.69	OIL	
				12.69	GAS	
				0.13	WATER	
ORGANIC CARBON	#/MIN	46.63		47.57		102.0
				7.11	SHALE	
				30.91	OIL	
				9.48	GAS	
				0.07	WATER	
TOTAL CARBON	#/MIN	65.81		66.75		101.4
				21.08	SHALE	
				30.91	OIL	
				14.68	GAS	
				0.07	WATER	
ORG. HYDROGEN	#/MIN	6.50		7.39		113.7
				0.26	SHALE	
				4.13	OIL	
				2.97	GAS	
				0.02	WATER	
ORG. NITROGEN	#/MIN	1.88		1.73		91.7
SULFUR	#/MIN	2.47		3.07		124.2
				2.48	SHALE	
				0.22	OIL	
				0.32	GAS	
				0.05	WATER	
O'ALL WEIGHT	#/MIN	470.85		473.15		100.5

2.931 #/MIN C 1.341 #/MIN H 2.185 C/H COMB RATIO
86.30 VOL%FA 87.46WT.%FA

DATA SUMMARY

STARTING DATE 72078 TO 72178
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.69	H2O FA	WT%	1.03
OIL FA	GPT	28.00			
MIN CO2	WT%	17.92	ASH	WT%	66.15
CARBON	WT%	16.77	HYDROGEN	WT%	1.77
NITROGEN	WT%	0.48	SULFUR	WT%	0.63

RAW SHALE MOISTURE WT% (UNGROUND) 0.65

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	3.8
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.5
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.25	HYDROGEN	WT%	11.26
NITROGEN	WT%	1.92	SULFUR	WT%	0.60

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.0	WATER	WT%	3.8

PRODUCT WATER PROPERTIES

CARBON	WT%	5.26	HYDROGEN	WT%	10.18
NITROGEN	WT%	3.87	SULFUR	WT%	4.41
CO2	WT%	0.28			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.67	C2H4	VOL%	0.61
N2+AR	VOL%	64.79	C2H6	VOL%	0.56
O2	VOL%	0.02	C3'S	VOL%	1.12
CO	VOL%	2.35	C4'S	VOL%	1.38
CH4	VOL%	2.23	C5+	VOL%	0.35
CO2	VOL%	21.45	H2S	VOL%	0.31
			NH3	VOL%	0.51

GROSS HEAT BTU/SCF 150.85

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.03			
MIN CO2	WT%	15.92	ASH	WT%	80.65
CARBON	WT%	5.55	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.23	SULFUR	WT%	0.77

TEMPERATURES DEG F

RAW SHALE IN	84	RET SHALE OUT	507
AIR TD IN	203	AIR MD IN	171
GAS BD IN	245	GAS MD IN	218
GAS TD IN	219	GAS PROD OUT	240
COOLING WATER IN	118	COOLING WATER OUT	128
PRODUCT OIL OUT	132		
AMBIENT AIR	76	OFF GAS	140

RATES AND QUANTITIES

RAW SHALE	TPH	11.77	THROUGHPUT	PHF2	478.1
RET SHALE	TPH	9.66	RET/RAW	WT%	82.0

AIR TOP	SCFM	732.5	SCF/T	3733.0
AIR MID	SCFM	160.9	SCF/T	820.0
AIR BTM	SCFM	98.1	SCF/T	499.7
TOTAL AIR	SCFM	991.4	SCF/T	5052.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.330		
SP GR		0.975		
GAS TOP	SCFM	243.5	SCF/T	1241.2
GAS MID	SCFM	251.9	SCF/T	1283.8
GAS BTM	SCFM	2055.7	SCF/T	10476.6
TOTAL GAS	SCFM	2551.1	SCF/T	13001.6
GAS SEAL LOSS NOT INCLUDED				
GAS PRODUCT	SCFM	1343.9	SCF/T	6849.1

COOLING WATER	GPM	88.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	36.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 87.4
OIL YIELD VOL% FA= 85.3

***SEMI-WORKS ***
STARTING DATE 72178 TO 72278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	787.57	674.39	85.6
ASH	#/MIN	261.67	261.67	100.0
OXYGEN	SCFM	209.35	209.35	100.0
			135.77 TO H2O	
			73.05 TO CO&CO2	
			0.54 GAS	
WATER	#/MIN	18.06	16.44	91.1
		5.16 SHALE	1.17 LIQ	
		12.90 COMB	13.95 VAP	
			1.32 SHALE	
KEROGEN	#/MIN	65.72	55.57	84.6
			7.47 SHALE	
			36.12 OIL	
			11.86 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	49.02	46.71	95.3
			7.07 SHALE	
			30.83 OIL	
			8.75 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	67.60	65.29	96.6
			21.26 SHALE	
			30.83 OIL	
			13.15 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	7.46	7.42	99.5
			0.40 SHALE	
			4.07 OIL	
			2.94 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.36	1.77	74.8
SULFUR	#/MIN	2.92	2.93	100.4
			2.38 SHALE	
			0.23 OIL	
			0.27 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	476.94	459.03	96.2

2.668 #/MIN C 1.433 #/MIN H 1.862 C/H COMB RATIO
80:86 VOL%FA 82.03WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 72178 TO 72278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	787.57	787.57	100.0
ASH	#/MIN	261.67	261.67	100.0
OXYGEN	SCFM	209.35	209.35	100.0
			95.13 TO H2O	
			113.59 TO CO&CO2	
			0.63 GAS	
WATER	#/MIN	14.20	18.79	132.3
		5.16 SHALE	1.17 LIQ	
		9.04 COMB	16.30 VAP	
			1.32 SHALE	
KEROGEN	#/MIN	65.72	57.63	87.7
			7.47 SHALE	
			36.12 OIL	
			13.92 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	49.02	48.92	99.8
			7.07 SHALE	
			30.83 OIL	
			10.96 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	67.60	67.50	99.9
			21.26 SHALE	
			30.83 OIL	
			15.35 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	7.46	7.25	97.1
			0.40 SHALE	
			4.07 OIL	
			2.76 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.36	1.81	76.5
SULFUR	#/MIN	2.92	2.98	102.0
			2.38 SHALE	
			0.23 OIL	
			0.32 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	476.94	475.81	99.8

4.026 #/MIN C 1.004 #/MIN H 4.009 C/H COMB RATIO
80.8% VOL%FA 82.03WT.%FA

DATA SUMMARY

STARTING DATE 72170 TO 72278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.01	H2O FA	WT%	1.12
OIL FA	GPT	28.83			
MIN CO2	WT%	17.03	ASH	WT%	65.42
CARBON	WT%	16.90	HYDROGEN	WT%	1.99
NITROGEN	WT%	0.59	SULFUR	WT%	0.73

RAW SHALE MOISTURE WT% (UNGROUND) 0.17

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	3.6
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.2
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	85.34	HYDROGEN	WT%	11.26
NITROGEN	WT%	1.96	SULFUR	WT%	0.63

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	3.6

PRODUCT WATER PROPERTIES

CARBON	WT%	4.48	HYDROGEN	WT%	10.27
NITROGEN	WT%	3.64	SULFUR	WT%	4.50
CO2	WT%	0.15			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.13	C2H4	VOL%	0.63
N2+AR	VOL%	63.69	C2H6	VOL%	0.62
O2	VOL%	0.05	C3'S	VOL%	1.49
CO	VOL%	2.61	C4'S	VOL%	1.16
CH4	VOL%	2.19	C5+	VOL%	0.38
CO2	VOL%	21.51	H2S	VOL%	0.30
			NH3	VOL%	0.61

GROSS HEAT BTU/SCF 158.08

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.29			
OIL FA	GPT	0.51			
MIN CO2	WT%	15.17	ASH	WT%	81.37
CARBON	WT%	6.61	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.24	SULFUR	WT%	0.74

TEMPERATURES DEG F

RAW SHALE IN	82	RET SHALE OUT	510
AIR TD IN	292	AIR MD IN	170
GAS BD IN	243	GAS MD IN	217
GAS TD IN	216	GAS PROD OUT	238
COOLING WATER IN	115	COOLING WATER OUT	126
PRODUCT OIL OUT	130		
AMBIENT AIR	74	OFF GAS	141

RATES AND QUANTITIES

RAW SHALE	TPH	12.00	THROUGHPUT PHF2		487.3
RET SHALE	TPH	9.65	RET/RAW	WT%	80.4
AIR TOP	SCFM	738.4		SCF/T	3692.1
AIR MID	SCFM	161.2		SCF/T	806.1
AIR BTM	SCFM	97.3		SCF/T	486.6
TOTAL AIR	SCFM	996.9		SCF/T	4984.9

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		21.720			
SP GR		0.966			
GAS TOP	SCFM	244.0		SCF/T	1220.2
GAS MID	SCFM	248.7		SCF/T	1243.4
GAS BTM	SCFM	2380.2		SCF/T	10401.7
TOTAL GAS	SCFM	2572.9		SCF/T	12865.3
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1352.7		SCF/T	6763.9
COOLING WATER	GPM	87.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	28.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 81.9
OIL YIELD VOL% FA= 83.9

***SEMI-WORKS ***
STARTING DATE 72478 TO 72578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	789.41	690.51	87.5
ASH	#/MIN	262.05	262.05	100.0
OXYGEN	SCFM	209.84	209.84	100.0
			119.16 TO H2O	
			90.41 TO CO&CO2	
			0.27 GAS	
WATER	#/MIN	16.88	14.53	86.1
		5.56 SHALE	1.29 LIQ	
		11.32 COMB	11.99 VAP	
			1.24 SHALE	
KEROGEN	#/MIN	60.18	56.39	93.7
			8.31 SHALE	
			34.98 OIL	
			12.99 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	49.17	47.15	95.9
			7.81 SHALE	
			29.40 OIL	
			9.87 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	67.77	65.76	97.0
			21.50 SHALE	
			29.40 OIL	
			14.79 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	6.77	7.29	107.6
			0.50 SHALE	
			3.91 OIL	
			2.85 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.16	1.63	75.2
SULFUR	#/MIN	2.83	3.34	117.7
			2.74 SHALE	
			0.21 OIL	
			0.33 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	472.46	459.10	97.2

3.226 #/MIN C 1.258 #/MIN H 2.565 C/H COMB RATIO
81.28 VOL%FA 82.22WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 72478 TO 72578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	789.41	789.41	100.0
ASH	#/MIN	262.05	262.05	100.0
OXYGEN	SCFM	209.84	209.84	100.0
			79.81 TO H2O	
			129.73 TO CO&CO2	
			0.31 GAS	
WATER	#/MIN	13.15	16.25	123.6
		5.56 SHALE	1.29 LIQ	
		7.58 COMB	13.71 VAP	
			1.24 SHALE	
KEROGEN	#/MIN	60.18	58.36	97.0
			8.31 SHALE	
			34.98 OIL	
			14.95 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	49.17	49.27	100.2
			7.81 SHALE	
			29.40 OIL	
			11.99 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	67.77	67.88	100.2
			21.50 SHALE	
			29.40 OIL	
			16.91 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	6.77	7.10	104.8
			0.50 SHALE	
			3.91 OIL	
			2.66 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.16	1.65	76.2
SULFUR	#/MIN	2.83	3.38	119.4
			2.74 SHALE	
			0.21 OIL	
			0.38 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	472.46	473.95	100.3

4.535 #/MIN C 0.842 #/MIN H 5.383 C/H COMB RATIO
81.28 VOL%FA 82.22WT.%FA

DATA SUMMARY

STARTING DATE 72478 TO 72573
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.81	H2O FA	WT%	0.80
OIL FA	GPT	28.30			
MIN CO2	WT%	17.33	ASH	WT%	66.58
CARBON	WT%	17.22	HYDROGEN	WT%	1.81
NITROGEN	WT%	0.55	SULFUR	WT%	0.72

RAW SHALE MOISTURE WT% (UNGROUND) 0.61

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.2	WATER	WT%	4.1
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.3
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.05	HYDROGEN	WT%	11.19
NITROGEN	WT%	2.16	SULFUR	WT%	0.60

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.2	WATER	WT%	4.1

PRODUCT WATER PROPERTIES

CARBON	WT%	4.98	HYDROGEN	WT%	10.41
NITROGEN	WT%	3.55	SULFUR	WT%	3.98
CO2	WT%	3.58			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.72	C2H4	VOL%	0.68
N2+AR	VOL%	62.32	C2H6	VOL%	0.57
O2	VOL%	0.02	C3'S	VOL%	1.27
CO	VOL%	2.52	C4'S	VOL%	0.85
CH4	VOL%	2.22	C5+	VOL%	0.60
CO2	VOL%	23.51	H2S	VOL%	0.35
			NH3	VOL%	0.37

GROSS HEAT BTU/SCF 163.65

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.07			
OIL FA	GPT	0.18			
MIN CO2	WT%	15.73	ASH	WT%	82.16
CARBON	WT%	5.74	HYDROGEN	WT%	0.20
NITROGEN	WT%	0.21	SULFUR	WT%	0.86

TEMPERATURES DEG F

RAW SHALE IN	85	RET SHALE OUT	501
AIR TD IN	207	AIR MD IN	175
GAS BD IN	246	GAS MD IN	221
GAS TD IN	218	GAS PROD OUT	242
COOLING WATER IN	116	COOLING WATER OUT	127
PRODUCT OIL OUT	129		
AMBIENT AIR	0	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	11.81	THROUGHPUT PHF2		479.5
RET SHALE	TPH	9.57	RET/RAW	WT%	81.0
AIR TOP	SCFM	740.2		SCF/T	3761.2
AIR MID	SCFM	160.6		SCF/T	816.2
AIR BTM	SCFM	98.5		SCF/T	500.4
TOTAL AIR	SCFM	999.3		SCF/T	5077.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.560			
SP GR		0.996			
GAS TOP	SCFM	230.1		SCF/T	1169.2
GAS MID	SCFM	250.5		SCF/T	1272.8
GAS BTM	SCFM	2360.8		SCF/T	10471.7
TOTAL GAS	SCFM	2541.3		SCF/T	12913.7
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1360.6		SCF/T	6914.0
COOLING WATER	GPM	89.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	0.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 82.1
OIL YIELD VOL% FA= 81.3

***SEMI-WORKS ***
STARTING DATE 72578 TO 72678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	788.54	695.29	88.2
ASH	#/MIN	260.34	260.34	100.0
OXYGEN	SCFM	209.61	209.61	100.0
			134.41 TO H2O	
			74.53 TO CO&CO2	
			0.67 GAS	
WATER	#/MIN	19.69	17.45	88.6
		6.93 SHALE	1.47 LIQ	
		12.77 COMB	12.51 VAP	
			3.47 SHALE	
KEROGEN	#/MIN	57.09	53.83	94.3
			7.08 SHALE	
			34.49 OIL	
			12.13 GAS	
			0.13 WATER	
ORGANIC CARBON	#/MIN	48.75	44.97	92.3
			6.96 SHALE	
			28.99 OIL	
			8.94 GAS	
			0.08 WATER	
TOTAL CARBON	#/MIN	67.46	63.69	94.4
			20.99 SHALE	
			28.99 OIL	
			13.63 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	6.78	7.12	105.0
			0.12 SHALE	
			3.99 OIL	
			2.99 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.14	1.70	79.0
SULFUR	#/MIN	2.96	3.35	113.1
			2.80 SHALE	
			0.20 OIL	
			0.28 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	469.37	456.12	97.2

2.696 #/MIN C 1.419 #/MIN H 1.900 C/H COMB RATIO
81.19 VOL%FA 82.05WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 72578 TO 72678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	788.54	788.54	100.0
ASH	#/MIN	260.34	260.34	100.0
OXYGEN	SCFM	209.61	209.61	100.0
			100.65 TO H2O	
			108.20 TO CO&CO2	
			0.76 GAS	
WATER	#/MIN	16.49	19.13	116.1
		6.93 SHALE	1.47 LIQ	
		9.56 COMB	14.19 VAP	
			3.47 SHALE	
KEROGEN	#/MIN	57.09	55.54	97.3
			7.08 SHALE	
			34.49 OIL	
			13.84 GAS	
			0.13 WATER	
ORGANIC CARBON	#/MIN	48.75	46.80	96.0
			6.96 SHALE	
			28.99 OIL	
			10.77 GAS	
			0.08 WATER	
TOTAL CARBON	#/MIN	67.46	65.52	97.1
			20.99 SHALE	
			28.99 OIL	
			15.46 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	6.78	6.98	102.9
			0.12 SHALE	
			3.99 OIL	
			2.84 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.14	1.72	80.4
SULFUR	#/MIN	2.96	3.39	114.4
			2.80 SHALE	
			0.20 OIL	
			0.32 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	469.37	469.73	100.1

3.817 #/MIN C 1.062 #/MIN H 3.594 C/H COMB RATIO
81.19 VOL%FA 82.05WT.%FA

DATA SUMMARY

STARTING DATE 72578 TO 72678

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.78	H2O FA	WT%	1.00
OIL FA	GPT	28.23			
MIN CO2	WT%	17.60	ASH	WT%	66.76
CARBON	WT%	17.30	HYDROGEN	WT%	1.85
NITROGEN	WT%	0.55	SULFUR	WT%	0.76

RAW SHALE MOISTURE WT% (UNGROUND) 0.77

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	4.7
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.06	HYDROGEN	WT%	11.56
NITROGEN	WT%	2.10	SULFUR	WT%	0.59

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	4.7

PRODUCT WATER PROPERTIES

CARBON	WT%	4.77	HYDROGEN	WT%	10.31
NITROGEN	WT%	3.07	SULFUR	WT%	4.14
CO2	WT%	3.62			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.15	C2H4	VOL%	0.68
N2+AR	VOL%	63.46	C2H6	VOL%	0.69
O2	VOL%	0.06	C3'S	VOL%	1.30
CO	VOL%	2.39	C4'S	VOL%	1.23
CH4	VOL%	2.53	C5+	VOL%	0.39
CO2	VOL%	21.72	H2S	VOL%	0.31
			NH3	VOL%	0.54

GROSS HEAT BTU/SCF 158.50

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.18			
OIL FA	GPT	0.47			
MIN CO2	WT%	15.15	ASH	WT%	81.74
CARBON	WT%	5.59	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.22	SULFUR	WT%	0.88

TEMPERATURES DEG F

RAW SHALE IN	32	RET SHALE OUT	513
AIR TD IN	235	AIR MD IN	173
GAS BD IN	245	GAS MD IN	219
GAS TD IN	216	GAS PROD OUT	240
COOLING WATER IN	116	COOLING WATER OUT	126
PRODUCT OIL OUT	129		
AMBIENT AIR	73	OFF GAS	142

RATES AND QUANTITIES

RAW SHALE	TPH	11.70	THROUGHPUT PHF2		475.1
RET SHALE	TPH	9.56	RET/RAW	WT%	81.7
AIR TOP	SCFM	741.5		SCF/T	3802.7
AIR MID	SCFM	157.7		SCF/T	808.7
AIR BTM	SCFM	99.0		SCF/T	507.7
TOTAL AIR	SCFM	998.1		SCF/T	5119.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.380			
SP GR		0.976			
GAS TOP	SCFM	229.8		SCF/T	1178.6
GAS MID	SCFM	250.2		SCF/T	1283.1
GAS BTM	SCFM	2038.0		SCF/T	10451.8
TOTAL GAS	SCFM	2518.0		SCF/T	12913.6
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1359.0		SCF/T	6969.8
COOLING WATER	GPM	89.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	26.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 82.0
OIL YIELD VOL% FA= 81.2

***SEMI-WORKS ***
STARTING DATE 72678 TO 72778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	787.15	707.49	89.9
ASH	#/MIN	257.43	257.43	100.0
OXYGEN	SCFM	209.24	209.24	100.0
			123.21 TO H2O	
			85.49 TO CO&CO2	
			0.54 GAS	
WATER	#/MIN	18.16	15.38	84.7
		6.45 SHALE	1.54 LIQ	
		11.70 COMB	12.64 VAP	
			1.20 SHALE	
KEROGEN	#/MIN	52.67	50.39	95.7
			6.72 SHALE	
			32.41 OIL	
			11.17 GAS	
			0.09 WATER	
ORGANIC CARBON	#/MIN	43.15	41.98	97.3
			6.29 SHALE	
			27.23 OIL	
			8.41 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	61.32	60.16	98.1
			19.87 SHALE	
			27.23 OIL	
			12.99 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	6.14	6.86	111.6
			0.43 SHALE	
			3.75 OIL	
			2.66 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.17	1.64	75.4
SULFUR	#/MIN	2.52	2.82	112.1
			2.37 SHALE	
			0.19 OIL	
			0.22 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	459.40	451.46	98.3

3.037 #/MIN C 1.300 #/MIN H 2.335 C/H COMB RATIO
87.38 VOL%FA 88.39WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 72578 TO 72778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	787.15	787.15	100.0
ASH	#/MIN	257.43	257.43	100.0
OXYGEN	SCFM	209.24	209.24	100.0
			94.43 TO H2O	
			114.21 TO CO&CO2	
			0.60 GAS	
WATER	#/MIN	15.42	16.80	108.9
		6.45 SHALE	1.54 LIQ	
		8.97 COMB	14.06 VAP	
			1.20 SHALE	
KEROGEN	#/MIN	52.67	51.71	98.2
			6.72 SHALE	
			32.41 OIL	
			12.50 GAS	
			0.09 WATER	
ORGANIC CARBON	#/MIN	43.15	43.44	100.7
			6.29 SHALE	
			27.23 OIL	
			9.87 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	61.32	61.63	100.5
			19.87 SHALE	
			27.23 OIL	
			14.46 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	6.14	6.70	109.1
			0.43 SHALE	
			3.75 OIL	
			2.50 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.17	1.67	77.0
SULFUR	#/MIN	2.52	2.84	113.1
			2.37 SHALE	
			0.19 OIL	
			0.24 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	459.40	462.95	100.8

3.991 #/MIN C 0.997 #/MIN H 4.005 C/H COMB RATIO
87.38 VOL%FA 88.39WT.%FA

DATA SUMMARY

STARTING DATE 72678 TO 72778

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.62	H2O FA	WT%	1.15
OIL FA	GPT	25.20			
MIN CO2	WT%	17.48	ASH	WT%	67.55
CARBON	WT%	16.09	HYDROGEN	WT%	1.74
NITROGEN	WT%	0.57	SULFUR	WT%	0.66

RAW SHALE MOISTURE WT% (UNGROUND) 0.54

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	5.0
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.1
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.04	HYDROGEN	WT%	11.57
NITROGEN	WT%	2.02	SULFUR	WT%	0.58

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	5.0

PRODUCT WATER PROPERTIES

CARBON	WT%	3.98	HYDROGEN	WT%	10.58
NITROGEN	WT%	2.33	SULFUR	WT%	3.36
CO2	WT%	3.77			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.37	C2H4	VOL%	0.59
N2+AR	VOL%	64.78	C2H6	VOL%	0.48
O2	VOL%	0.05	C3'S	VOL%	1.29
CO	VOL%	2.30	C4'S	VOL%	1.14
CH4	VOL%	1.77	C5+	VOL%	0.23
CO2	VOL%	22.21	H2S	VOL%	0.23
			NH3	VOL%	0.78

GROSS HEAT BTU/SCF 137.58

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.11			
OIL FA	GPT	0.30			
MIN CO2	WT%	15.79	ASH	WT%	81.63
CARBON	WT%	6.30	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.20	SULFUR	WT%	0.75

TEMPERATURES DEG F

RAW SHALE IN	80	RET SHALE OUT	516
AIR TD IN	238	AIR MD IN	177
GAS BD IN	247	GAS MD IN	221
GAS TD IN	218	GAS PROD OUT	242
COOLING WATER IN	118	COOLING WATER OUT	128
PRODUCT OIL OUT	130		
AMBIENT AIR	79	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	11.43	THROUGHPUT	PHF2	464.3
RET SHALE	TPH	9.46	RET/RAW	WT%	82.8

AIR TOP	SCFM	742.8	SCF/T	3898.4
AIR MID	SCFM	156.9	SCF/T	823.5
AIR BTM	SCFM	96.7	SCF/T	507.3
TOTAL AIR	SCFM	996.4	SCF/T	5229.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 19.590
SP GR 0.981

GAS TOP	SCFM	229.7	SCF/T	1205.4
GAS MID	SCFM	250.0	SCF/T	1312.2
GAS BTM	SCFM	2359.0	SCF/T	10805.9
TOTAL GAS	SCFM	2538.7	SCF/T	13323.5

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	1358.2	SCF/T	7128.1

COOLING WATER	GPM	90.0	BARO PRESS IN HG	24.1
AMB AIR REL HUM	%	22.0	BED PD IN H2O/FT	1.0

OIL YIELD WT% FA= 88.3
OIL YIELD VOL% FA= 87.4

APPENDIX 2.6

SEMI-WORKS RETORTING RESEARCH - INCREMENTAL BOTTOM AIR

***SEMI-WORKS ***
STARTING DATE 73178 TO 8178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	799.39	687.20	86.0
ASH	#/MIN	261.00	261.00	100.0
OXYGEN	SCFM	212.50	212.50	100.0
			133.01 TO H2O	
			79.21 TO CO&CO2	
			0.28 GAS	
WATER	#/MIN	18.28	16.73	91.5
		5.65 SHALE	0.30 LIQ	
		12.63 COMB	15.18 VAP	
			1.25 SHALE	
KEROGEN	#/MIN	51.19	48.83	95.4
			4.50 SHALE	
			32.70 OIL	
			11.61 GAS	
			0.03 WATER	
ORGANIC CARBON	#/MIN	43.20	40.31	93.3
			4.06 SHALE	
			27.69 OIL	
			8.55 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	62.43	59.54	95.4
			18.30 SHALE	
			27.69 OIL	
			13.54 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	6.09	6.93	113.9
			0.44 SHALE	
			3.65 OIL	
			2.84 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	1.93	1.65	85.4
SULFUR	#/MIN	2.67	2.82	105.7
			2.27 SHALE	
			0.21 OIL	
			0.32 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	465.77	457.41	98.2

2.831 #/MIN C 1.434 #/MIN H 2.017 C/H COMB RATIO
82.76 VOL%FA 83.63WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 73178 TO 8178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	799.39		799.39		100.0
ASH	#/MIN	261.00		261.00		100.0
OXYGEN	SCFM	212.50		212.50		100.0
				90.01	TO H2O	
				122.17	TO CO&CO2	
				0.32	GAS	
WATER	#/MIN	14.20		19.20		135.2
		5.65	SHALE	0.30	LIQ	
		8.55	COMB	17.66	VAP	
				1.25	SHALE	
KEROGEN	#/MIN	51.19		50.86		99.4
				4.50	SHALE	
				32.70	OIL	
				13.64	GAS	
				0.03	WATER	
ORGANIC CARBON	#/MIN	43.20		42.52		98.4
				4.06	SHALE	
				27.69	OIL	
				10.76	GAS	
				0.01	WATER	
TOTAL CARBON	#/MIN	62.43		61.75		98.9
				18.30	SHALE	
				27.69	OIL	
				15.75	GAS	
				0.01	WATER	
ORG. HYDROGEN	#/MIN	6.09		6.71		110.3
				0.44	SHALE	
				3.65	OIL	
				2.62	GAS	
				0.00	WATER	
ORG. NITROGEN	#/MIN	1.93		1.70		88.0
SULFUR	#/MIN	2.67		2.87		107.6
				2.27	SHALE	
				0.21	OIL	
				0.37	GAS	
				0.02	WATER	
O'ALL WEIGHT	#/MIN	465.77		474.46		101.9

4.256 #/MIN C 0.950 #/MIN H 4.480 C/H COMB RATIO
82.76 VOL%FA 83.63WT.%FA

DATA SUMMARY

STARTING DATE 73178 TO 8178

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.12	H2O FA	WT%	0.94
OIL FA	GPT	26.50			
MIN CO2	WT%	18.25	ASH	WT%	67.56
CARBON	WT%	16.16	HYDROGEN	WT%	1.68
NITROGEN	WT%	0.50	SULFUR	WT%	0.69

RAW SHALE MOISTURE WT% (UNGROUND) 0.52

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	1.1
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.4
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.68	HYDROGEN	WT%	11.16
NITROGEN	WT%	1.98	SULFUR	WT%	0.65

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	1.1

PRODUCT WATER PROPERTIES

CARBON	WT%	4.11	HYDROGEN	WT%	10.62
NITROGEN	WT%	3.27	SULFUR	WT%	5.41
CO2	WT%	3.47			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.59	C2H4	VOL%	0.63
N2+AR	VOL%	63.29	C2H6	VOL%	0.54
O2	VOL%	0.03	C3'S	VOL%	0.91
CO	VOL%	2.30	C4'S	VOL%	0.85
CH4	VOL%	2.19	C5+	VOL%	0.46
CO2	VOL%	23.08	H2S	VOL%	0.35
			NH3	VOL%	0.79

GROSS HEAT BTU/SCF 147.97

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.12			
OIL FA	GPT	0.31			
MIN CO2	WT%	15.32	ASH	WT%	81.57
CARBON	WT%	5.72	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.21	SULFUR	WT%	0.71

TEMPERATURES DEG F

RAW SHALE IN	77	RET SHALE OUT	520
AIR TD IN	200	AIR MD IN	168
GAS BD IN	245	GAS MD IN	219
GAS TD IN	215	GAS PROD OUT	241
COOLING WATER IN	123	COOLING WATER OUT	127
PRODUCT OIL OUT	132		
AMBIENT AIR	74	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	11.59	THROUGHPUT PHF2		470.6
RET SHALE	TPH	9.60	RET/RAW	WT%	82.8
AIR TOP	SCFM	750.2		SCF/T	3884.0
AIR MID	SCFM	161.4		SCF/T	835.7
AIR BTM	SCFM	100.2		SCF/T	518.9
TOTAL AIR	SCFM	1011.9		SCF/T	5238.5

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		22.740			
SP GR		0.971			
GAS TOP	SCFM	229.7		SCF/T	1189.4
GAS MID	SCFM	249.9		SCF/T	1293.8
GAS BTM	SCFM	2076.7		SCF/T	10751.0
TOTAL GAS	SCFM	2556.4		SCF/T	13234.2
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1405.3		SCF/T	7275.2
COOLING WATER	GPM	96.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	29.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 83.5

OIL YIELD VOL% FA= 93.0

***SEMI-WORKS ***
STARTING DATE 80178 TO 80278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	797.14	724.84	90.9
ASH	#/MIN	253.22	253.22	100.0
OXYGEN	SCFM	211.90	211.90	100.0
			98.86 TO H2O	
			112.34 TO CO&CO2	
			0.69 GAS	
WATER	#/MIN	15.45	14.72	95.2
		6.06 SHALE	0.66 LIQ	
		9.39 COMB	12.73 VAP	
			1.32 SHALE	
KEROGEN	#/MIN	47.95	47.82	99.7
			5.78 SHALE	
			29.93 OIL	
			12.06 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	39.39	40.09	101.8
			5.37 SHALE	
			25.28 OIL	
			9.40 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	57.41	58.12	101.2
			18.72 SHALE	
			25.28 OIL	
			14.08 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	5.69	6.18	108.6
			0.41 SHALE	
			3.35 OIL	
			2.41 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.86	1.50	80.7
SULFUR	#/MIN	2.56	2.70	105.4
			2.16 SHALE	
			0.19 OIL	
			0.33 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	450.54	445.69	98.9

3.900 #/MIN C 1.043 #/MIN H 3.737 C/H COMB RATIO
82.01 VOL%FA 83.06WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 80178 TO 80278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	797.14	797.14	100.0
ASH	#/MIN	253.22	253.22	100.0
OXYGEN	SCFM	211.90	211.90	100.0
			70.44 TO H2O	
			140.69 TO CO&CO2	
			0.76 GAS	
WATER	#/MIN	12.75	15.99	125.3
		6.06 SHALE	0.66 LIQ	
		6.69 COMB	14.00 VAP	
			1.32 SHALE	
KEROGEN	#/MIN	47.95	49.08	102.4
			5.78 SHALE	
			29.93 OIL	
			13.32 GAS	
			0.05 WATER	
ORGANIC CARBON	#/MIN	39.39	41.49	105.3
			5.37 SHALE	
			25.28 OIL	
			10.81 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	57.41	59.52	103.7
			18.72 SHALE	
			25.28 OIL	
			15.48 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	5.69	6.02	105.7
			0.41 SHALE	
			3.35 OIL	
			2.25 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.86	1.53	82.3
SULFUR	#/MIN	2.56	2.73	106.7
			2.16 SHALE	
			0.19 OIL	
			0.36 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	450.54	456.37	101.3

4.838 #/MIN C 0.743 #/MIN H 6.508 C/H COMB RATIO
82.01 VOL%FA 83.06WT.%FA

DATA SUMMARY

STARTING DATE 80178 TO 80278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.71	H2O FA	WT%	1.04
OIL FA	GPT	25.40			
MIN CO2	WT%	17.81	ASH	WT%	68.23
CARBON	WT%	15.47	HYDROGEN	WT%	1.65
NITROGEN	WT%	0.50	SULFUR	WT%	0.69

RAW SHALE MOISTURE WT% (UNGROUND) 0.59

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	2.5
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.4
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.47	HYDROGEN	WT%	11.20
NITROGEN	WT%	1.94	SULFUR	WT%	0.62

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	2.5

PRODUCT WATER PROPERTIES

CARBON	WT%	3.98	HYDROGEN	WT%	10.58
NITROGEN	WT%	3.05	SULFUR	WT%	4.58
CO2	WT%	8.17			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.10	C2H4	VOL%	0.55
N2+AR	VOL%	63.76	C2H6	VOL%	0.45
O2	VOL%	0.06	C3'S	VOL%	0.79
CO	VOL%	2.27	C4'S	VOL%	0.91
CH4	VOL%	1.70	C5+	VOL%	0.46
CO2	VOL%	23.87	H2S	VOL%	0.34
			NH3	VOL%	0.73

GROSS HEAT BTU/SCF 136.46

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.09			
OIL FA	GPT	0.23			
MIN CO2	WT%	15.90	ASH	WT%	82.23
CARBON	WT%	5.08	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.19	SULFUR	WT%	0.70

TEMPERATURES DEG F

RAW SHALE IN	73	RET SHALE OUT	513
AIR TD IN	199	AIR MD IN	166
GAS BD IN	246	GAS MD IN	217
GAS TD IN	214	GAS PROD OUT	241
COOLING WATER IN	120	COOLING WATER OUT	129
PRODUCT OIL OUT	130		
AMBIENT AIR	72	OFF GAS	141

RATES AND QUANTITIES

RAW SHALE	TPH	11.13	THROUGHPUT PHF2		452.1
RET SHALE	TPH	9.24	RET/RAW	WT%	83.0
AIR TOP	SCFM	749.5		SCF/T	4038.9
AIR MID	SCFM	161.9		SCF/T	872.2
AIR BTM	SCFM	97.7		SCF/T	526.5
TOTAL AIR	SCFM	1009.0		SCF/T	5437.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.080			
SP GR		0.996			
GAS TOP	SCFM	229.8		SCF/T	1238.6
GAS MID	SCFM	248.5		SCF/T	1339.2
GAS BTM	SCFM	2055.9		SCF/T	11079.1
TOTAL GAS	SCFM	2534.2		SCF/T	13656.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1404.9		SCF/T	7570.7
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	37.0	BED PD IN H2O/FT		0.9

OIL YIELD WT% FA= 83.0
OIL YIELD VOL% FA= 82.0

***SEMI-WORKS ***
STARTING DATE 80278 TO 80378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	801.35	704.56	87.9
ASH	#/MIN	258.68	258.68	100.0
OXYGEN	SCFM	213.02	213.02	100.0
			123.64 TO H2O	
			88.96 TO CO&CO2	
			0.42 GAS	
WATER	#/MIN	17.63	15.08	85.6
		5.88 SHALE	0.75 LIQ	
		11.74 COMB	13.73 VAP	
			0.60 SHALE	
KEROGEN	#/MIN	54.99	51.14	93.0
			6.66 SHALE	
			32.50 OIL	
			11.87 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	43.73	42.59	97.4
			6.19 SHALE	
			27.39 OIL	
			8.95 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	62.49	61.35	98.2
			19.95 SHALE	
			27.39 OIL	
			13.95 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	5.90	7.07	119.9
			0.47 SHALE	
			3.80 OIL	
			2.78 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.93	1.81	93.5
SULFUR	#/MIN	2.71	2.62	97.0
			2.12 SHALE	
			0.21 OIL	
			0.26 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	465.95	454.78	97.6

3.133 #/MIN C 1.305 #/MIN H 2.401 C/H COMB RATIO
82.50 VOL%FA 83.36WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 80278 TO 80378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	801.35	801.35	100.0
ASH	#/MIN	258.68	258.68	100.0
OXYGEN	SCFM	213.02	213.02	100.0
			86.06 TO H2O	
			126.49 TO CO&CO2	
			0.47 GAS	
WATER	#/MIN	14.06	16.97	120.7
		5.88 SHALE	0.75 LIQ	
		8.17 COMB	15.61 VAP	
			0.60 SHALE	
KEROGEN	#/MIN	54.99	52.88	96.2
			6.66 SHALE	
			32.50 OIL	
			13.61 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	43.73	44.51	101.8
			6.19 SHALE	
			27.39 OIL	
			10.87 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	62.49	63.27	101.3
			19.95 SHALE	
			27.39 OIL	
			15.87 GAS	
			0.06 WATER	
ORG. HYDROGEN	#/MIN	5.90	6.87	116.6
			0.47 SHALE	
			3.80 OIL	
			2.58 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.93	1.87	96.7
SULFUR	#/MIN	2.71	2.66	98.3
			2.12 SHALE	
			0.21 OIL	
			0.29 GAS	
			0.04 WATER	
O'ALL WEIGHT	#/MIN	465.95	469.29	100.7

4.375 #/MIN C 0.908 #/MIN H 4.817 C/H COMB RATIO
82.50 VOL%FA 83.36WT.%FA

DATA SUMMARY

STARTING DATE 80278 TO 80378
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.09	H2O FA	WT%	1.03
OIL FA	GPT	26.40			
MIN CO2	WT%	17.80	ASH	WT%	66.94
CARBON	WT%	16.17	HYDROGEN	WT%	1.64
NITROGEN	WT%	0.50	SULFUR	WT%	0.70

RAW SHALE MOISTURE WT% (UNGROUND) 0.49

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	2.7
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.5
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.26	HYDROGEN	WT%	11.70
NITROGEN	WT%	2.00	SULFUR	WT%	0.65

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.3	WATER	WT%	2.7

PRODUCT WATER PROPERTIES

CARBON	WT%	5.61	HYDROGEN	WT%	10.34
NITROGEN	WT%	5.32	SULFUR	WT%	5.16
CO2	WT%	1.23			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.45	C2H4	VOL%	0.71
N2+AR	VOL%	63.13	C2H6	VOL%	0.43
O2	VOL%	0.04	C3'S	VOL%	0.96
CO	VOL%	2.20	C4'S	VOL%	0.69
CH4	VOL%	2.13	C5+	VOL%	0.54
CO2	VOL%	23.38	H2S	VOL%	0.27
			NH3	VOL%	1.08

GROSS HEAT BTU/SCF 145.73

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.06			
OIL FA	GPT	0.15			
MIN CO2	WT%	15.98	ASH	WT%	81.93
CARBON	WT%	5.32	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.21	SULFUR	WT%	0.67

TEMPERATURES DEG F

RAW SHALE IN	76	RET SHALE OUT	521
AIR TD IN	202	AIR MD IN	170
GAS BD IN	245	GAS MD IN	219
GAS TD IN	215	GAS PROD OUT	241
COOLING WATER IN	116	COOLING WATER OUT	127
PRODUCT OIL OUT	131		
AMBIENT AIR	74	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	11.59	THROUGHPUT PHF2		470.8
RET SHALE	TPH	9.47	RET/RAW	WT%	81.7
AIR TOP	SCFM	750.1		SCF/T	3882.2
AIR MID	SCFM	161.4		SCF/T	835.2
AIR BTM	SCFM	102.9		SCF/T	532.5
TOTAL AIR	SCFM	1314.4		SCF/T	5250.0

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.570			
SP GR		0.983			
GAS TOP	SCFM	224.7		SCF/T	1163.0
GAS MID	SCFM	249.9		SCF/T	1293.3
GAS BTM	SCFM	2391.6		SCF/T	10825.3
TOTAL GAS	SCFM	2566.2		SCF/T	13281.6
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1405.1		SCF/T	7272.1
COOLING WATER	GPM	95.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	35.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 83.3
OIL YIELD VOL% FA= 82.5

***SEMI-WORKS ***
STARTING DATE 80378 TO 80478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	801.48	726.86	90.7
ASH	#/MIN	267.90	267.90	100.0
OXYGEN	SCFM	213.05	213.05	100.0
			84.53 TO H2O	
			128.25 TO CO&CO2	
			0.28 GAS	
WATER	#/MIN	13.72	13.21	96.3
		5.69 SHALE	0.60 LIQ	
		8.03 COMB	11.85 VAP	
			0.76 SHALE	
KEROGEN	#/MIN	59.63	58.47	98.1
			7.90 SHALE	
			37.34 OIL	
			13.14 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	48.18	49.49	102.7
			7.39 SHALE	
			31.46 OIL	
			10.60 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	66.94	68.25	102.0
			22.49 SHALE	
			31.46 OIL	
			14.26 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	6.79	7.34	108.1
			0.51 SHALE	
			4.33 OIL	
			2.48 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.08	2.02	97.3
SULFUR	#/MIN	3.03	2.95	97.3
			2.52 SHALE	
			0.20 OIL	
			0.20 GAS	
			0.03 WATER	
OVERALL WEIGHT	#/MIN	479.63	475.41	99.1

4.390 #/MIN C 0.892 #/MIN H 4.921 C/H COMB RATIO
89.57 VOL%FA 90.39WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 80378 TO 80478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	801.48	801.48	100.0
ASH	#/MIN	267.90	267.90	100.0
OXYGEN	SCFM	213.05	213.05	100.0
			56.60 TO H2O	
			156.14 TO CO&CO2	
			0.30 GAS	
WATER	#/MIN	11.06	14.42	130.4
		5.69 SHALE	0.60 LIQ	
		5.38 COMB	13.07 VAP	
			0.76 SHALE	
KEROGEN	#/MIN	59.63	59.81	100.3
			7.90 SHALE	
			37.34 OIL	
			14.48 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	48.18	50.96	105.8
			7.39 SHALE	
			31.46 OIL	
			12.06 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	66.94	69.72	104.2
			22.49 SHALE	
			31.46 OIL	
			15.72 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	6.79	7.21	106.1
			0.51 SHALE	
			4.33 OIL	
			2.35 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.08	2.07	99.7
SULFUR	#/MIN	3.03	2.97	98.0
			2.52 SHALE	
			0.20 OIL	
			0.22 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	479.63	486.26	101.4

5.315 #/MIN C 0.597 #/MIN H 8.897 C/H COMB RATIO
89.57 VOL%FA 90.39WT.%FA

DATA SUMMARY

STARTING DATE 80372 TO 80478
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.35	H2O FA	WT%	0.71
OIL FA	GPT	27.10			
MIN CO2	WT%	17.23	ASH	WT%	67.12
CARBON	WT%	16.77	HYDROGEN	WT%	1.78
NITROGEN	WT%	0.52	SULFUR	WT%	0.76

RAW SHALE MOISTURE WT% (UNGROUND) 0.71

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.6	WATER	WT%	1.9
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.5
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.25	HYDROGEN	WT%	11.60
NITROGEN	WT%	2.11	SULFUR	WT%	0.54

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.6	WATER	WT%	1.9

PRODUCT WATER PROPERTIES

CARBON	WT%	5.56	HYDROGEN	WT%	10.02
NITROGEN	WT%	5.60	SULFUR	WT%	5.34
CO2	WT%	1.47			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.64	C2H4	VOL%	0.67
N2+AR	VOL%	63.35	C2H6	VOL%	0.59
O2	VOL%	0.02	C3'S	VOL%	0.92
CO	VOL%	2.23	C4'S	VOL%	0.85
CH4	VOL%	2.29	C5+	VOL%	0.50
CO2	VOL%	22.57	H2S	VOL%	0.20
			NH3	VOL%	1.16

GROSS HEAT BTU/SCF 151.44

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.04			
OIL FA	GPT	0.10			
MIN CO2	WT%	16.69	ASH	WT%	80.78
CARBON	WT%	5.78	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.21	SULFUR	WT%	0.76

TEMPERATURES DEG F

RAW SHALE IN	78	RET SHALE OUT	521
AIR TD IN	202	AIR MD IN	170
GAS BD IN	246	GAS MD IN	220
GAS TD IN	217	GAS PROD OUT	241
COOLING WATER IN	118	COOLING WATER OUT	133
PRODUCT OIL OUT	134		
AMBIENT AIR	72	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	11.97	THROUGHPUT PHF2		486.3
RET SHALE	TPH	9.95	RET/RAW	WT%	83.1

AIR TOP	SCFM	748.3	SCF/T	3749.8
AIR MID	SCFM	161.5	SCF/T	809.0
AIR BTM	SCFM	104.7	SCF/T	524.7
TOTAL AIR	SCFM	1314.5	SCF/T	5083.5

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		17.860		
SP GR		0.989		
GAS TOP	SCFM	229.2	SCF/T	1148.3
GAS MID	SCFM	249.5	SCF/T	1250.0
GAS BTM	SCFM	2146.2	SCF/T	10753.9
TOTAL GAS	SCFM	2524.8	SCF/T	13152.2
GAS SEAL LOSS NOT INCLUDED				
GAS PRODUCT	SCFM	1396.9	SCF/T	6999.4

COOLING WATER	GPM	95.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	28.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 90.3
OIL YIELD VOL% FA= 89.6

***SEMI-WORKS ***
STARTING DATE 80478 TO 80578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	800.52	721.46	90.1
ASH	#/MIN	269.14	269.14	100.0
OXYGEN	SCFM	212.80	212.80	100.0
			130.98 TO H2O	
			81.12 TO CO&CO2	
			0.70 GAS	
WATER	#/MIN	17.66	14.51	82.1
		5.22 SHALE	0.38 LIQ	
		12.44 COMB	13.52 VAP	
			0.60 SHALE	
KEROGEN	#/MIN	55.58	54.77	98.6
			7.29 SHALE	
			35.15 OIL	
			12.28 GAS	
			0.06 WATER	
ORGANIC CARBON	#/MIN	44.18	45.66	103.3
			6.82 SHALE	
			29.59 OIL	
			9.21 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	64.02	65.49	102.3
			21.88 SHALE	
			29.59 OIL	
			13.98 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.33	7.52	118.7
			0.47 SHALE	
			4.06 OIL	
			2.98 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.84	1.87	101.4
SULFUR	#/MIN	2.88	3.05	105.8
			2.60 SHALE	
			0.22 OIL	
			0.21 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	480.20	474.30	98.8

2.874 #/MIN C 1.382 #/MIN H 2.079 C/H COMB RATIO
87.68 VOL%FA 88.71WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 80478 TO 80578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	800.52	800.52	100.0
ASH	#/MIN	269.14	269.14	100.0
OXYGEN	SCFM	212.80	212.80	100.0
			102.56 TO H2O	
			109.47 TO CO&CO2	
			0.77 GAS	
WATER	#/MIN	14.96	15.99	106.9
		5.22 SHALE	0.38 LIQ	
		9.74 COMB	15.00 VAP	
			0.60 SHALE	
KEROGEN	#/MIN	55.58	56.19	101.1
			7.29 SHALE	
			35.15 OIL	
			13.69 GAS	
			0.06 WATER	
ORGANIC CARBON	#/MIN	44.18	47.19	106.8
			6.82 SHALE	
			29.59 OIL	
			10.74 GAS	
			0.03 WATER	
TOTAL CARBON	#/MIN	64.02	67.02	104.7
			21.88 SHALE	
			29.59 OIL	
			15.52 GAS	
			0.03 WATER	
ORG. HYDROGEN	#/MIN	6.33	7.39	116.8
			0.47 SHALE	
			4.06 OIL	
			2.86 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.84	1.91	104.0
SULFUR	#/MIN	2.88	3.07	106.6
			2.60 SHALE	
			0.22 OIL	
			0.24 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	480.20	485.87	101.2

3.814 #/MIN C 1.002 #/MIN H 3.523 C/H COMB RATIO
87.68 VOL%FA 88.71WT.%FA

DATA SUMMARY

STARTING DATE 80478 TO 80578
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.91	H2O FA	WT%	0.60
OIL FA	GPT	26.00			
MIN CO2	WT%	18.19	ASH	WT%	67.31
CARBON	WT%	16.01	HYDROGEN	WT%	1.65
NITROGEN	WT%	0.46	SULFUR	WT%	0.72

RAW SHALE MOISTURE WT% (UNGROUND) 0.70

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.5	WATER	WT%	1.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.3
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.19	HYDROGEN	WT%	11.54
NITROGEN	WT%	2.09	SULFUR	WT%	0.62

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.5	WATER	WT%	1.3

PRODUCT WATER PROPERTIES

CARBON	WT%	5.61	HYDROGEN	WT%	10.24
NITROGEN	WT%	5.84	SULFUR	WT%	4.59
CO2	WT%	1.02			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.61	C2H4	VOL%	0.67
N2+AR	VOL%	64.02	C2H6	VOL%	0.62
O2	VOL%	0.06	C3'S	VOL%	1.11
CO	VOL%	2.13	C4'S	VOL%	0.84
CH4	VOL%	2.26	C5+	VOL%	0.51
CO2	VOL%	21.89	H2S	VOL%	0.22
			NH3	VOL%	1.05

GROSS HEAT BTU/SCF 156.56

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.03			
OIL FA	GPT	0.07			
MIN CO2	WT%	15.58	ASH	WT%	80.80
CARBON	WT%	5.57	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.20	SULFUR	WT%	0.78

TEMPERATURES DEG F

RAW SHALE IN	78	RET SHALE OUT	530
AIR TD IN	202	AIR MD IN	170
GAS BD IN	246	GAS MD IN	219
GAS TD IN	216	GAS PROD OUT	241
COOLING WATER IN	123	COOLING WATER OUT	133
PRODUCT OIL OUT	131		
AMBIENT AIR	74	OFF GAS	142

RATES AND QUANTITIES

RAW SHALE	TPH	12.00	THROUGHPUT PHF2		487.1
RET SHALE	TPH	9.99	RET/RAW	WT%	83.3
AIR TOP	SCFM	751.1		SCF/T	3756.8
AIR MID	SCFM	158.3		SCF/T	792.0
AIR BTM	SCFM	103.9		SCF/T	519.8
TOTAL AIR	SCFM	1313.3		SCF/T	5068.5

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.170			
SP GR		0.978			
GAS TOP	SCFM	229.5		SCF/T	1148.0
GAS MID	SCFM	251.5		SCF/T	1258.1
GAS BTM	SCFM	2129.8		SCF/T	10653.1
TOTAL GAS	SCFM	2510.8		SCF/T	13059.2
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1411.7		SCF/T	7061.1
COOLING WATER	GPM	95.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	27.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 89.6

OIL YIELD VOL% FA= 87.7

***SEMI-WORKS ***
STARTING DATE 81078 TO 81178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	802.86	748.86	93.3
ASH	#/MIN	264.51	264.51	100.0
OXYGEN	SCFM	213.42	213.42	100.0
			122.78 TO H2O	
			89.96 TO CO&CO2	
			0.68 GAS	
WATER	#/MIN	16.53	12.79	77.4
		4.87 SHALE	1.30 LIQ	
		11.66 COMB	10.34 VAP	
			1.15 SHALE	
KEROGEN	#/MIN	61.75	58.41	94.6
			7.92 SHALE	
			37.35 OIL	
			13.02 GAS	
			0.12 WATER	
ORGANIC CARBON	#/MIN	50.57	49.10	97.1
			7.43 SHALE	
			31.67 OIL	
			9.93 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	69.35	67.90	97.9
			22.14 SHALE	
			31.67 OIL	
			14.01 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	6.93	7.70	111.1
			0.48 SHALE	
			4.21 OIL	
			2.99 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.15	1.96	91.2
SULFUR	#/MIN	2.95	3.13	106.2
			2.71 SHALE	
			0.18 OIL	
			0.19 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	477.76	481.02	100.7

3.207 #/MIN C 1.296 #/MIN H 2.475 C/H COMB RATIO
83.00 VOL%FA 84.47WT.%FA

*** U-WORKS FORCED ATM. N2 BALANCE ***
STA. ING DATE 81078 TO 81178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	802.86	802.86	100.0
ASH	#/MIN	264.51	264.51	100.0
OXYGEN	SCFM	213.42	213.42	100.0
			104.81 TO H2O	
			107.88 TO CO&CO2	
			0.73 GAS	
WATER	#/MIN	14.82	13.54	91.3
		4.87 SHALE	1.30 LIQ	
		9.96 COMB	11.09 VAP	
			1.15 SHALE	
KEROGEN	#/MIN	61.75	59.36	96.1
			7.92 SHALE	
			37.35 OIL	
			13.96 GAS	
			0.12 WATER	
ORGANIC CARBON	#/MIN	50.57	50.11	99.1
			7.43 SHALE	
			31.67 OIL	
			10.94 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	69.35	68.91	99.4
			22.14 SHALE	
			31.67 OIL	
			15.02 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	6.93	7.63	110.1
			0.48 SHALE	
			4.21 OIL	
			2.92 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.15	1.99	92.4
SULFUR	#/MIN	2.95	3.15	106.7
			2.71 SHALE	
			0.18 OIL	
			0.21 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	477.76	488.49	102.2

3.806 #/MIN C 1.106 #/MIN H 3.441 C/H COMB RATIO
83.00 VOL%FA 84.47WT.%FA

DATA SUMMARY

STARTING DATE 81078 TO 81178
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.10	H2O FA	WT%	0.81
OIL FA	GPT	29.10			
MIN CO2	WT%	17.29	ASH	WT%	66.40
CARBON	WT%	17.41	HYDROGEN	WT%	1.83
NITROGEN	WT%	0.54	SULFUR	WT%	0.74

RAW SHALE MOISTURE WT% (UNGROUND) 0.41

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.5	WATER	WT%	3.9
VIS	SUS-130	0.0	SEDIMENT	ML/100G	1.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.79	HYDROGEN	WT%	11.27
NITROGEN	WT%	1.87	SULFUR	WT%	0.47

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.5	WATER	WT%	3.9

PRODUCT WATER PROPERTIES

CARBON	WT%	5.29	HYDROGEN	WT%	9.66
NITROGEN	WT%	4.40	SULFUR	WT%	3.98
CO2	WT%	5.19			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.30	C2H4	VOL%	0.66
N2+AR	VOL%	64.84	C2H6	VOL%	0.59
O2	VOL%	0.06	C3'S	VOL%	0.80
CO	VOL%	2.41	C4'S	VOL%	0.86
CH4	VOL%	2.45	C5+	VOL%	0.70
CO2	VOL%	20.31	H2S	VOL%	0.20
			NH3	VOL%	0.82

GROSS HEAT BTU/SCF 161.78

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.09			
OIL FA	GPT	0.25			
MIN CO2	WT%	15.93	ASH	WT%	78.12
CARBON	WT%	6.54	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.25	SULFUR	WT%	0.80

TEMPERATURES DEG F

RAW SHALE IN	77	RET SHALE OUT	520
AIR TD IN	233	AIR MD IN	170
GAS BD IN	251	GAS MD IN	223
GAS TD IN	220	GAS PROD OUT	246
COOLING WATER IN	110	COOLING WATER OUT	121
PRODUCT OIL OUT	129		
AMBIENT AIR	74	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	11.95	THROUGHPUT PHF2		485.3
RET SHALE	TPH	10.16	RET/RAW	WT%	85.0
AIR TOP	SCFM	748.2		SCF/T	3756.5
AIR MID	SCFM	161.6		SCF/T	811.1
AIR BTM	SCFM	106.5		SCF/T	534.7
TOTAL AIR	SCFM	1316.3		SCF/T	5102.3

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		15.860			
SP GR		0.986			
GAS TOP	SCFM	230.3		SCF/T	1156.5
GAS MID	SCFM	248.8		SCF/T	1249.0
GAS BTM	SCFM	2161.6		SCF/T	10852.6
TOTAL GAS	SCFM	2540.8		SCF/T	13258.1
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1372.7		SCF/T	6891.9
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	31.0	BED PD IN H2O/FT		1.2

OIL YIELD WT% FA= 84.4
OIL YIELD VOL% FA= 83.0

***SEMI-WORKS ***
STARTING DATE 81178 TO 81278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	799.83		744.12		93.0
ASH	#/MIN	258.49		258.49		100.0
OXYGEN	SCFM	212.61		212.61		100.0
				139.59	TO H2O	
				72.07	TO CO&CO2	
				0.96	GAS	
WATER	#/MIN	17.25		16.11		93.4
		3.99	SHALE	1.40	LIQ	
		13.26	COMB	12.35	VAP	
				2.36	SHALE	
KEROGEN	#/MIN	62.48		56.97		91.2
				8.14	SHALE	
				36.33	OIL	
				12.40	GAS	
				0.11	WATER	
ORGANIC CARBON	#/MIN	47.35		47.86		101.1
				7.71	SHALE	
				30.89	OIL	
				9.21	GAS	
				0.06	WATER	
TOTAL CARBON	#/MIN	65.73		66.26		100.8
				22.12	SHALE	
				30.89	OIL	
				13.17	GAS	
				0.08	WATER	
ORG. HYDROGEN	#/MIN	6.76		7.64		113.0
				0.44	SHALE	
				4.07	OIL	
				3.12	GAS	
				0.02	WATER	
ORG. NITROGEN	#/MIN	2.11		2.06		97.4
SULFUR	#/MIN	3.01		3.24		107.7
				2.79	SHALE	
				0.20	OIL	
				0.18	GAS	
				0.06	WATER	
O'ALL WEIGHT	#/MIN	469.80		473.13		100.7

2.641 #/MIN C 1.473 #/MIN H 1.793 C/H COMB RATIO
80.79 VOL%FA 81.97WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 81178 TO 81278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	799.83	799.83	100.0
ASH	#/MIN	258.49	258.49	100.0
OXYGEN	SCFM	212.61	212.61	100.0
			122.52 TO H2O	
			89.06 TO CO&CO2	
			1.03 GAS	
WATER	#/MIN	15.63	17.04	109.0
		3.99 SHALE	1.40 LIQ	
		11.64 COMB	13.28 VAP	
			2.36 SHALE	
KEROGEN	#/MIN	62.48	57.90	92.7
			8.14 SHALE	
			36.33 OIL	
			13.33 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	47.35	48.85	103.2
			7.71 SHALE	
			30.89 OIL	
			10.19 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	65.73	67.24	102.3
			22.12 SHALE	
			30.89 OIL	
			14.15 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	6.76	7.59	112.1
			0.44 SHALE	
			4.07 OIL	
			3.06 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.11	2.09	98.8
SULFUR	#/MIN	3.01	3.26	108.2
			2.79 SHALE	
			0.20 OIL	
			0.20 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	469.80	480.81	102.3

3.212 #/MIN C 1.293 #/MIN H 2.484 C/H COMB RATIO
80.79 VOL%FA 81.97WT.%FA

DATA SUMMARY

STARTING DATE 81178 TO 81278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.34	H2O FA	WT%	0.62
OIL FA	GPT	29.70			
MIN CO2	WT%	17.24	ASH	WT%	66.15
CARBON	WT%	16.82	HYDROGEN	WT%	1.80
NITROGEN	WT%	0.54	SULFUR	WT%	0.77

RAW SHALE MOISTURE WT% (UNGROUND) 0.40

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	4.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.4
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	35.04	HYDROGEN	WT%	11.21
NITROGEN	WT%	1.94	SULFUR	WT%	0.55

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	4.3

PRODUCT WATER PROPERTIES

CARBON	WT%	5.00	HYDROGEN	WT%	9.97
NITROGEN	WT%	3.03	SULFUR	WT%	4.52
CO2	WT%	4.92			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.13	C2H4	VOL%	0.53
N2+AR	VOL%	66.20	C2H6	VOL%	0.58
O2	VOL%	0.09	C3'S	VOL%	0.84
CO	VOL%	2.48	C4'S	VOL%	0.89
CH4	VOL%	2.36	C5+	VOL%	0.67
CO2	VOL%	18.95	H2S	VOL%	0.19
			NH3	VOL%	0.97

GROSS HEAT BTU/SCF 161.71

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.05			
OIL FA	GPT	0.13			
MIN CO2	WT%	15.89	ASH	WT%	77.71
CARBON	WT%	5.65	HYDROGEN	WT%	0.21
NITROGEN	WT%	0.27	SULFUR	WT%	0.84

TEMPERATURES DEG F

RAW SHALE IN	78	RET SHALE OUT	511
AIR TD IN	213	AIR MD IN	174
GAS BD IN	252	GAS MD IN	224
GAS TD IN	222	GAS PROD OUT	247
COOLING WATER IN.	116	COOLING WATER OUT	123
PRODUCT OIL OUT	129		
AMBIENT AIR	76	OFF GAS	142

RATES AND QUANTITIES

RAW SHALE	TPH	11.72	THROUGHPUT PHF2		476.0
RET SHALE	TPH	9.98	RET/RAW	WT%	85.1
AIR TOP	SCFM	742.2		SCF/T	3798.9
AIR MID	SCFM	160.9		SCF/T	823.7
AIR BTM	SCFM	109.3		SCF/T	559.3
TOTAL AIR	SCFM	1012.4		SCF/T	5181.9

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.790			
SP GR		0.969			
GAS TOP	SCFM	234.5		SCF/T	1200.3
GAS MID	SCFM	248.4		SCF/T	1271.4
GAS BTM	SCFM	2158.4		SCF/T	11046.9
TOTAL GAS	SCFM	2641.3		SCF/T	13518.6
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1384.0		SCF/T	7083.7
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.9
AMB AIR REL HUM	%	30.0	BED PD IN H2O/FT		1.2

OIL YIELD WT% FA= 81.9
OIL YIELD VOL% FA= 83.0

***SEMI-WORKS ***
STARTING DATE 81578 TO 81678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	808.55	754.01	93.3
ASH	#/MIN	250.94	258.94	100.0
OXYGEN	SCFM	214.93	214.93	100.0
			145.95 TO H2O	
			68 56 TO CO&CO2	
			0.43 GAS	
WATER	#/MIN	18.46	16.40	88.9
		4.59 SHALE	1.25 LIQ	
		13.86 COMB	13.22 VAP	
			1.93 SHALE	
KEROGEN	#/MIN	63.68	60.97	95.7
			7.31 SHALE	
			40.84 OIL	
			12.72 GAS	
			0.09 WATER	
ORGANIC CARBON	#/MIN	53.00	51.38	96.9
			7.02 SHALE	
			34.97 OIL	
			9.34 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	71.13	69.53	97.8
			20.53 SHALE	
			34.97 OIL	
			13.95 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	7.39	8.07	109.2
			0.29 SHALE	
			4.48 OIL	
			3.28 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.16	2.10	97.3
SULFUR	#/MIN	2.94	3.30	112.1
			2.76 SHALE	
			0.24 OIL	
			0.24 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	471.98	465.80	98.7

2.509 #/MIN C 1.540 #/MIN H 1.629 C/H COMB RATIO
89.56 VOL%FA 90 3SWT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 81578 TO 81678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	808.55	808.55	100.0
ASH	#/MIN	258.94	258.94	100.0
OXYGEN	SCFM	214.93	214.93	100.0
			128.22 TO H2O	
			86.26 TO CO&CO2	
			0.46 GAS	
WATER	#/MIN	16.77	17.36	103.5
		4.59 SHALE	1.25 LIQ	
		12.18 COMB	14.17 VAP	
			1.93 SHALE	
KEROGEN	#/MIN	63.68	61.92	97.2
			7.31 SHALE	
			40.84 OIL	
			13.68 GAS	
			0.09 WATER	
ORGANIC CARBON	#/MIN	53.00	52.39	98.9
			7.02 SHALE	
			34.97 OIL	
			10.35 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	71.13	70.54	99.2
			20.53 SHALE	
			34.97 OIL	
			14.96 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	7.39	8.01	108.4
			0.29 SHALE	
			4.48 OIL	
			3.21 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.16	2.13	99.0
SULFUR	#/MIN	2.94	3.31	112.7
			2.76 SHALE	
			0.24 OIL	
			0.26 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	471.98	473.52	100.3

3.100 #/MIN C 1.353 #/MIN H 2.291 C/H COMB RATIO
89.56 VOL%FA 90.35WT.%FA

DATA SUMMARY

STARTING DATE 81578 TO 81678
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.53	H2O FA	WT%	0.77
OIL FA	GPT	30.20			
MIN CO2	WT%	16.95	ASH	WT%	66.04
CARBON	WT%	18.14	HYDROGEN	WT%	1.97
NITROGEN	WT%	0.55	SULFUR	WT%	0.75

RAW SHALE MOISTURE WT% (UNGROUND) 0.40

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.7	WATER	WT%	3.4
VIS	SUS-130	0.0	SEDIMENT	ML/100G	4.2
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	35.63	HYDROGEN	WT%	10.98
NITROGEN	WT%	1.93	SULFUR	WT%	0.59

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.7	WATER	WT%	3.4

PRODUCT WATER PROPERTIES

CARBON	WT%	4.79	HYDROGEN	WT%	10.15
NITROGEN	WT%	2.85	SULFUR	WT%	4.82
CO2	WT%	5.04			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.16	C2H4	VOL%	0.68
N2+AR	VOL%	65.01	C2H6	VOL%	0.59
O2	VOL%	0.04	C3'S	VOL%	0.84
CO	VOL%	2.30	C4'S	VOL%	1.02
CH4	VOL%	2.40	C5+	VOL%	0.59
CO2	VOL%	19.95	H2S	VOL%	0.24
			NH3	VOL%	1.19

GROSS HEAT BTU/SCF 164.16

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.02			
OIL FA	GPT	0.05			
MIN CO2	WT%	15.64	ASH	WT%	81.72
CARBON	WT%	5.48	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.24	SULFUR	WT%	0.87

TEMPERATURES DEG F

RAW SHALE IN	52	RET SHALE OUT	530
AIR TD IN	188	AIR MD IN	155
GAS BD IN	241	GAS MD IN	212
GAS TD IN	210	GAS PROD OUT	236
COOLING WATER IN	119	COOLING WATER OUT	129
PRODUCT OIL OUT	129		
AMBIENT AIR	58	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	11.76	THROUGHPUT PHF2		477.7
RET SHALE	TPH	9.51	RET/RAW	WT%	80.8
AIR TOP	SCFM	748.6		SCF/T	3818.5
AIR MID	SCFM	160.8		SCF/T	820.4
AIR BTM	SCFM	114.0		SCF/T	581.7
TOTAL AIR	SCFM	1023.5		SCF/T	5220.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.350			
SP GR		0.969			
GAS TOP	SCFM	233.5		SCF/T	1190.9
GAS MID	SCFM	249.0		SCF/T	1270.2
GAS BTM	SCFM	2190.5		SCF/T	11173.3
TOTAL GAS	SCFM	2673.0		SCF/T	13634.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1438.1		SCF/T	7335.8
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	48.0	BED PD IN H2O/FT		1.3

OIL YIELD WT% FA= 90.2
OIL YIELD VOL% FA= 83.6

***SEMI-WORKS ***
STARTING DATE 81678 TO 81778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	799.70	734.63	91.9
ASH	#/MIN	275.95	275.95	100.0
OXYGEN	SCFM	212.58	212.58	100.0
			140.48 TO H2O	
			68.50 TO CO&CO2	
			3.60 GAS	
WATER	#/MIN	17.54	15.10	86.0
		4.20 SHALE	1.19 LIQ	
		13.34 COMB	13.22 VAP	
			0.68 SHALE	
KEROGEN	#/MIN	62.31	61.11	98.1
			9.04 SHALE	
			39.05 OIL	
			12.91 GAS	
			0.10 WATER	
ORGANIC CARBON	#/MIN	51.43	51.19	99.5
			8.47 SHALE	
			33.11 OIL	
			9.55 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	70.57	70.36	99.7
			23.48 SHALE	
			33.11 OIL	
			13.69 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	7.40	8.32	112.4
			0.57 SHALE	
			4.47 OIL	
			3.26 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.18	2.19	100.7
SULFUR	#/MIN	3.21	3.30	102.9
			2.76 SHALE	
			0.25 OIL	
			0.23 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	490.12	484.63	98.9

2.406 #/MIN C 1.483 #/MIN H 1.676 C/H COMB RATIO
86.53 VOL%FA 87.74WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 81678 TO 81778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	799.70	799.70	100.0
ASH	#/MIN	275.95	275.95	100.0
OXYGEN	SCFM	212.58	212.58	100.0
			119.84 TO H2O	
			88.81 TO CO&CO2	
			3.92 GAS	
WATER	#/MIN	15.58	16.27	104.4
		4.20 SHALE	1.19 LIQ	
		11.38 COMB	14.39 VAP	
			0.68 SHALE	
KEROGEN	#/MIN	62.31	62.27	99.9
			9.04 SHALE	
			39.05 OIL	
			14.07 GAS	
			0.10 WATER	
ORGANIC CARBON	#/MIN	51.43	52.40	101.9
			8.47 SHALE	
			33.11 OIL	
			10.76 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	70.57	71.57	101.4
			23.48 SHALE	
			33.11 OIL	
			14.90 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	7.40	8.26	111.6
			0.57 SHALE	
			4.47 OIL	
			3.20 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	2.18	2.24	102.7
SULFUR	#/MIN	3.21	3.32	103.5
			2.76 SHALE	
			0.25 OIL	
			0.25 GAS	
			0.06 WATER	
O'ALL WEIGHT	#/MIN	490.12	493.83	100.8

3.164 #/MIN C 1.265 #/MIN H 2.502 C/H COMB RATIO
86.53 VOL%FA 87.74WT.%FA

DATA SUMMARY

STARTING DATE 81678 TO 81778
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.83	H2O FA	WT%	0.62
OIL FA	GPT	28.40			
MIN CO2	WT%	17.08	ASH	WT%	67.14
CARBON	WT%	17.17	HYDROGEN	WT%	1.87
NITROGEN	WT%	0.53	SULFUR	WT%	0.78

RAW SHALE MOISTURE WT% (UNGROUND) 0.40

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	3.4
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.7
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.79	HYDROGEN	WT%	11.45
NITROGEN	WT%	1.81	SULFUR	WT%	0.64

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	3.4

PRODUCT WATER PROPERTIES

CARBON	WT%	5.42	HYDROGEN	WT%	10.27
NITROGEN	WT%	3.45	SULFUR	WT%	4.84
CO2	WT%	5.33			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.16	C2H4	VOL%	0.68
N2+AR	VOL%	65.15	C2H6	VOL%	0.65
O2	VOL%	0.32	C3'S	VOL%	1.08
CO	VOL%	2.24	C4'S	VOL%	1.06
CH4	VOL%	2.41	C5+	VOL%	0.61
CO2	VOL%	19.23	H2S	VOL%	0.25
			NH3	VOL%	1.17

GROSS HEAT BTU/SCF 173.48

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.09			
OIL FA	GPT	0.24			
MIN CO2	WT%	15.17	ASH	WT%	81.11
CARBON	WT%	5.90	HYDROGEN	WT%	0.19
NITROGEN	WT%	0.28	SULFUR	WT%	0.81

TEMPERATURES DEG F

RAW SHALE IN	71	RET SHALE OUT	536
AIR TD IN	194	AIR MD IN	161
GAS BD IN	241	GAS MD IN	213
GAS TD IN	211	GAS PROD OUT	236
COOLING WATER IN	122	COOLING WATER OUT	132
PRODUCT OIL OUT	130		
AMBIENT AIR	67	OFF GAS	143

RATES AND QUANTITIES

RAW SHALE	TPH	12.33	THROUGHPUT PHF2		500.7
RET SHALE	TPH	10.21	RET/RAW	WT%	82.8
AIR TOP	SCFM	740.6		SCF/T	3603.7
AIR MID	SCFM	159.1		SCF/T	774.2
AIR BTM	SCFM	112.6		SCF/T	547.9
TOTAL AIR	SCFM	1012.3		SCF/T	4925.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.800			
SP GR		0.966			
GAS TOP	SCFM	232.4		SCF/T	1130.9
GAS MID	SCFM	249.5		SCF/T	1214.3
GAS BTM	SCFM	2178.4		SCF/T	10600.0
TOTAL GAS	SCFM	2660.3		SCF/T	12945.2
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1406.0		SCF/T	6841.5
COOLING WATER	GPM	94.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	29.0	BED PD IN H2O/FT		1.2

OIL YIELD WT% FA= 87.6
OIL YIELD VOL% FA= 85.5

APPENDIX 2.7

SEMI-WORKS RETORTING RESEARCH - REDUCED BOTTOM GAS

***SEMI-WORKS ***
STARTING DATE 82278 TO 82378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	828.80	783.76	94.6
ASH	#/MIN	254.14	254.14	100.0
OXYGEN	SCFM	220.31	220.31	100.0
			114.49 TO H2O	
			105.53 TO CO&CO2	
			0.30 GAS	
WATER	#/MIN	17.20	18.23	106.0
		6.32 SHALE	1.97 LIQ	
		10.88 COMB	13.27 VAP	
			2.99 SHALE	
KEROGEN	#/MIN	56.34	48.80	86.6
			5.71 SHALE	
			30.73 OIL	
			12.14 GAS	
			0.21 WATER	
ORGANIC CARBON	#/MIN	41.96	40.77	97.1
			5.48 SHALE	
			25.88 OIL	
			9.32 GAS	
			0.08 WATER	
TOTAL CARBON	#/MIN	59.83	58.67	98.1
			18.17 SHALE	
			25.88 OIL	
			14.51 GAS	
			0.11 WATER	
ORG. HYDROGEN	#/MIN	6.01	6.31	104.9
			0.23 SHALE	
			3.35 OIL	
			2.69 GAS	
			0.04 WATER	
ORG. NITROGEN	#/MIN	2.05	1.85	90.1
SULFUR	#/MIN	2.70	2.61	96.9
			2.05 SHALE	
			0.22 OIL	
			0.26 GAS	
			0.07 WATER	
O'ALL WEIGHT	#/MIN	462.61	457.48	98.9

3.714 #/MIN C 1.208 #/MIN H 3.074 C/H COMB RATIO
85.44 VOL%FA 86.48WT.%FA

*** FORCED ATM. N2 BALANCE ***
STARTING DATE 82278 TO 82378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	828.80	828.80	100.0
ASH	#/MIN	254.14	254.14	100.0
OXYGEN	SCFM	220.31	220.31	100.0
			97.62 TO H2O	
			122.38 TO CO&CO2	
			0.31 GAS	
WATER	#/MIN	15.59	18.99	121.8
		6.32 SHALE	1.97 LIQ	
		9.27 COMB	14.03 VAP	
			2.99 SHALE	
KEROGEN	#/MIN	56.34	49.55	87.9
			5.71 SHALE	
			30.73 OIL	
			12.89 GAS	
			0.21 WATER	
ORGANIC CARBON	#/MIN	41.96	41.60	99.1
			5.48 SHALE	
			25.88 OIL	
			10.15 GAS	
			0.08 WATER	
TOTAL CARBON	#/MIN	59.83	59.50	99.4
			18.17 SHALE	
			25.88 OIL	
			15.34 GAS	
			0.11 WATER	
ORG. HYDROGEN	#/MIN	6.01	6.21	103.4
			0.23 SHALE	
			3.35 OIL	
			2.59 GAS	
			0.04 WATER	
ORG. NITROGEN	#/MIN	2.05	1.87	91.4
SULFUR	#/MIN	2.70	2.63	97.4
			2.05 SHALE	
			0.22 OIL	
			0.28 GAS	
			0.07 WATER	
O'ALL WEIGHT	#/MIN	462.61	464.00	100.3

4.273 #/MIN C 1.030 #/MIN H 4.147 C/H COMB RATIO
85.44 VOL%FA 86.49WT.%FA

DATA SUMMARY

STARTING DATE 82278 TO 82378

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.36	H2O FA	WT%	0.96
OIL FA	GPT	24.50			
MIN CO2	WT%	17.26	ASH	WT%	66.94
CARBON	WT%	15.76	HYDROGEN	WT%	1.69
NITROGEN	WT%	0.54	SULFUR	WT%	0.71

RAW SHALE MOISTURE WT% (UNGROUND) 0.70

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	7.0
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.4
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.22	HYDROGEN	WT%	10.90
NITROGEN	WT%	1.99	SULFUR	WT%	0.72

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	7.0

PRODUCT WATER PROPERTIES

CARBON	WT%	4.74	HYDROGEN	WT%	10.23
NITROGEN	WT%	5.81	SULFUR	WT%	3.77
CO2	WT%	4.75			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.41	C2H4	VOL%	0.55
N2+AR	VOL%	64.18	C2H6	VOL%	0.36
O2	VOL%	0.02	C3'S	VOL%	1.06
CO	VOL%	2.27	C4'S	VOL%	0.58
CH4	VOL%	1.99	C5+	VOL%	0.44
CO2	VOL%	22.89	H2S	VOL%	0.25
			NH3	VOL%	0.99

GROSS HEAT BTU/SCF 132.77

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.05			
OIL FA	GPT	0.13			
MIN CO2	WT%	14.95	ASH	WT%	81.69
CARBON	WT%	5.84	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.21	SULFUR	WT%	0.66

TEMPERATURES DEG F

RAW SHALE IN	73	RET SHALE OUT	546
AIR TD IN	234	AIR MD IN	176
GAS BD IN	246	GAS MD IN	222
GAS TD IN	215	GAS PROD OUT	242
COOLING WATER IN	116	COOLING WATER OUT	127
PRODUCT OIL OUT	128		
AMBIENT AIR	56	OFF GAS	144

RATES AND QUANTITIES

RAW SHALE	TPH	11.39	THROUGHPUT PHF2		462.5
RET SHALE	TPH	9.33	RET/RAW	WT%	81.9
AIR TOP	SCFM	769.4		SCF/T	4053.0
AIR MID	SCFM	201.6		SCF/T	1061.9
AIR BTM	SCFM	78.2		SCF/T	411.7
TOTAL AIR	SCFM	1349.1		SCF/T	5526.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.620			
SP GR		0.987			
GAS TOP	SCFM	237.1		SCF/T	1248.9
GAS MID	SCFM	295.2		SCF/T	1554.9
GAS BTM	SCFM	2054.7		SCF/T	10824.1
TOTAL GAS	SCFM	2587.0		SCF/T	13627.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1500.5		SCF/T	7904.6
COOLING WATER	GPM	86.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	54.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 86.4
OIL YIELD VOL% FA= 83.4

***SEMI-WORKS ***
STARTING DATE 82378 TO 82478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	826.43	784.96	95.0
ASH	#/MIN	252.52	252.52	100.0
OXYGEN	SCFM	219.68	219.68	100.0
			135.81 TO H2O	
			83.58 TO CO&CO2	
			0.30 GAS	
WATER	#/MIN	18.34	15.50	84.5
		5.44 SHALE	1.08 LIQ	
		12.90 COMB	13.69 VAP	
			0.73 SHALE	
KEROGEN	#/MIN	53.43	51.44	96.3
			5.30 SHALE	
			33.95 OIL	
			12.08 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	42.71	42.69	100.0
			4.93 SHALE	
			28.73 OIL	
			8.97 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	60.51	60.51	100.0
			16.89 SHALE	
			28.73 OIL	
			14.82 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	5.93	7.23	121.9
			0.37 SHALE	
			3.84 OIL	
			3.00 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.91	1.85	96.7
SULFUR	#/MIN	2.77	2.85	102.7
			2.27 SHALE	
			0.27 OIL	
			0.25 GAS	
			0.05 WATER	
O'ALL WEIGHT	#/MIN	456.71	452.69	99.1

3.056 #/MIN C 1.433 #/MIN H 2.132 C/H COMB RATIO
98.25 VOL%FA 91.59WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 82378 TO 82478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	826.43	826.43	100.0
ASH	#/MIN	252.52	252.52	100.0
OXYGEN	SCFM	219.68	219.68	100.0
			120.30 TO H2O	
			99.07 TO CO&CO2	
			0.31 GAS	
WATER	#/MIN	16.87	16.22	96.2
		5.44 SHALE	1.08 LIQ	
		11.43 COMB	14.41 VAP	
			0.73 SHALE	
KEROGEN	#/MIN	53.43	52.15	97.6
			5.30 SHALE	
			33.95 OIL	
			12.78 GAS	
			0.11 WATER	
ORGANIC CARBON	#/MIN	42.71	43.48	101.8
			4.93 SHALE	
			28.73 OIL	
			9.76 GAS	
			0.06 WATER	
TOTAL CARBON	#/MIN	60.51	61.29	101.3
			16.89 SHALE	
			28.73 OIL	
			15.60 GAS	
			0.08 WATER	
ORG. HYDROGEN	#/MIN	5.93	7.15	120.5
			0.37 SHALE	
			3.84 OIL	
			2.92 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.91	1.88	98.3
SULFUR	#/MIN	2.77	2.86	103.2
			2.27 SHALE	
			0.27 OIL	
			0.27 GAS	
			0.05 WATER	
OVALL WEIGHT	#/MIN	456.71	458.73	100.4

3.572 #/MIN C 1.270 #/MIN H 2.813 C/H COMB RATIO
98.25 VOL%FA 91.59WT.%FA

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DATA SUMMARY

STARTING DATE 82378 TO 82478

OPERATING TIME (HRS) 24
OPERATING FACTOR 100 00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.90	H2O FA	WT%	0.86
OIL FA	GPT	25.90			
MIN CO2	WT%	17.43	ASH	WT%	67.44
CARBON	WT%	16.16	HYDROGEN	WT%	1.68
NITROGEN	WT%	0.51	SULFUR	WT%	0.74

RAW SHALE MOISTURE WT% (UNGROUND) 0.59

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.6	WATER	WT%	3.6
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.4
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.61	HYDROGEN	WT%	11.31
NITROGEN	WT%	1.91	SULFUR	WT%	0.79

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.6	WATER	WT%	3.6

PRODUCT WATER PROPERTIES

CARBON	WT%	5.16	HYDROGEN	WT%	10.18
NITROGEN	WT%	3.61	SULFUR	WT%	4.80
CO2	WT%	4.68			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.71	C2H4	VOL%	0.55
H2+AR	VOL%	63.83	C2H6	VOL%	0.46
O2	VOL%	0.02	C3'S	VOL%	1.00
CO	VOL%	2.46	C4'S	VOL%	1.18
CH4	VOL%	1.74	C5+	VOL%	0.50
CO2	VOL%	22.61	H2S	VOL%	0.24
			NH3	VOL%	1.20

GROSS HEAT BTU/SCF 139.72

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.12			
OIL FA	GPT	0.31			
MIN CO2	WT%	14.46	ASH	WT%	83.30
CARBON	WT%	5.57	HYDROGEN	WT%	0.15
NITROGEN	WT%	0.20	SULFUR	WT%	0.75

TEMPERATURES DEG F

RAW SHALE IN	75	RET SHALE OUT	543
AIR TD IN	205	AIR MD IN	178
GAS BD IN	246	GAS MD IN	223
GAS TD IN	217	GAS PROD OUT	242
COOLING WATER IN	117	COOLING WATER OUT	127
PRODUCT OIL OUT	129		
AMBIENT AIR	68	OFF GAS	142

RATES AND QUANTITIES

RAW SHALE	TPH	11.23	THROUGHPUT PHF2		456.2
RET SHALE	TPH	9.09	RET/RAW	WT%	81.0
AIR TOP	SCFM	767.3		SCF/T	4098.3
AIR MID	SCFM	200.9		SCF/T	1073.0
AIR BTM	SCFM	77.9		SCF/T	416.3
TOTAL AIR	SCFM	1346.1		SCF/T	5587.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.990			
SP GR		0.984			
GAS TOP	SCFM	231.9		SCF/T	1238.4
GAS MID	SCFM	293.4		SCF/T	1567.0
GAS BTM	SCFM	2334.9		SCF/T	10868.8
TOTAL GAS	SCFM	2560.1		SCF/T	13674.2
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1518.1		SCF/T	8108.5
COOLING WATER	GPM	91.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	46.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 91.5
OIL YIELD VOL% FA= 93.2

***SEMI-WORKS ***
STARTING DATE 82678 TO 82778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	827.67		808.05		97.6
ASH	#/MIN	252.61		252.61		100.0
OXYGEN	SCFM	220.01		220.01		100.0
				111.40	TO H2O	
				108.32	TO CO&CO2	
				0.30	GAS	
WATER	#/MIN	16.29		15.27		93.8
		5.71	SHALE	0.65	LIQ	
		10.58	COMB	13.70	VAP	
				0.92	SHALE	
KEROGEN	#/MIN	60.78		53.39		87.9
				7.03	SHALE	
				34.76	OIL	
				11.53	GAS	
				0.07	WATER	
ORGANIC CARBON	#/MIN	46.32		44.60		96.3
				6.15	SHALE	
				29.55	OIL	
				8.86	GAS	
				0.04	WATER	
TOTAL CARBON	#/MIN	63.47		61.76		97.3
				18.73	SHALE	
				29.55	OIL	
				13.42	GAS	
				0.04	WATER	
ORG. HYDROGEN	#/MIN	6.36		7.30		114.7
				0.83	SHALE	
				3.86	OIL	
				2.55	GAS	
				0.01	WATER	
ORG. NITROGEN	#/MIN	2.05		1.94		94.6
SULFUR	#/MIN	2.92		2.89		98.7
				2.40	SHALE	
				0.23	OIL	
				0.24	GAS	
				0.02	WATER	
O'ALL WEIGHT	#/MIN	462.17		455.85		98.6

3.860 #/MIN C 1.176 #/MIN H 3.283 C/H COMB RATIO
86.07 VOL%FA 87.08WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 82678 TO 82778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	827.67	827.67	100.0
ASH	#/MIN	252.61	252.61	100.0
OXYGEN	SCFM	220.01	220.01	100.0
			104.60 TO H2O	
			115.10 TO CO&CO2	
			0.31 GAS	
WATER	#/MIN	15.65	15.61	99.7
		5.71 SHALE	0.65 LIQ	
		9.94 COMB	14.03 VAP	
			0.92 SHALE	
KEROGEN	#/MIN	60.78	53.68	88.3
			7.03 SHALE	
			34.76 OIL	
			11.82 GAS	
			0.07 WATER	
ORGANIC CARBON	#/MIN	46.32	44.92	97.0
			6.15 SHALE	
			29.55 OIL	
			9.18 GAS	
			0.04 WATER	
TOTAL CARBON	#/MIN	63.47	62.08	97.8
			18.73 SHALE	
			29.55 OIL	
			13.75 GAS	
			0.04 WATER	
ORG. HYDROGEN	#/MIN	6.36	7.26	114.1
			0.88 SHALE	
			3.86 OIL	
			2.51 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	2.05	1.95	95.2
SULFUR	#/MIN	2.92	2.89	98.9
			2.40 SHALE	
			0.23 OIL	
			0.25 GAS	
			0.02 WATER	
G'ALL WEIGHT	#/MIN	462.17	458.60	99.2

4.087 #/MIN C 1.104 #/MIN H 3.702 C/H COMB RATIO
86.07 VOL%FA 87.08WT.%FA

DATA SUMMARY

STARTING DATE 82678 TO 82778

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.51	H2O FA	WT%	0.94
OIL FA	GPT	27.50			
MIN CO2	WT%	16.56	ASH	WT%	66.50
CARBON	WT%	16.71	HYDROGEN	WT%	1.78
NITROGEN	WT%	0.54	SULFUR	WT%	0.77

RAW SHALE MOISTURE WT% (UNGROUND) 0.56

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	2.1
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.3
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	35.01	HYDROGEN	WT%	11.10
NITROGEN	WT%	2.11	SULFUR	WT%	0.66

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.1	WATER	WT%	2.1

PRODUCT WATER PROPERTIES

CARBON	WT%	5.94	HYDROGEN	WT%	10.23
NITROGEN	WT%	4.24	SULFUR	WT%	3.23
CO2	WT%	1.21			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.04	C2H4	VOL%	0.54
N2+AR	VOL%	65.41	C2H6	VOL%	0.41
O2	VOL%	0.02	C3'S	VOL%	0.33
CO	VOL%	2.58	C4'S	VOL%	0.57
CH4	VOL%	1.98	C5+	VOL%	0.46
CO2	VOL%	21.33	H2S	VOL%	0.23
			NH3	VOL%	1.10

GROSS HEAT BTU/SCF 119.52

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.03			
OIL FA	GPT	0.08			
MIN CO2	WT%	15.03	ASH	WT%	82.25
CARBON	WT%	5.10	HYDROGEN	WT%	0.32
NITROGEN	WT%	0.22	SULFUR	WT%	0.78

TEMPERATURES DEG F

RAW SHALE IN	77	RET SHALE OUT	553
AIR TD IN	236	AIR MD IN	180
GAS BD IN	245	GAS MD IN	222
GAS TD IN	217	GAS PROD OUT	242
COOLING WATER IN	118	COOLING WATER OUT	128
PRODUCT OIL OUT	130		
AMBIENT AIR	73	OFF GAS	142

RATES AND QUANTITIES

RAW SHALE	TPH	11.40	THROUGHPUT PHF2		462.8
RET SHALE	TPH	9.21	RET/RAW	WT%	80.9
AIR TOP	SCFM	769.8		SCF/T	4053.0
AIR MID	SCFM	200.3		SCF/T	1054.5
AIR BTM	SCFM	77.6		SCF/T	408.7
TOTAL AIR	SCFM	1047.7		SCF/T	5516.2

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.930			
SP GR		0.971			
GAS TOP	SCFM	236.5		SCF/T	1245.4
GAS MID	SCFM	294.9		SCF/T	1552.8
GAS BTM	SCFM	1937.2		SCF/T	10199.8
TOTAL GAS	SCFM	2468.7		SCF/T	12998.0
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1523.9		SCF/T	8023.7
COOLING WATER	GPM	98.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	28.0	BED PD IN H2O/FT		1.1

OIL YIELD WT% FA= 87.0
OIL YIELD VOL% FA= 86.1

***SEMI-WORKS ***
STARTING DATE 82778 TO 82878

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	829.00	835.82	100.7
ASH	#/MIN	252.93	252.93	100.0
OXYGEN	SCFM	220.58	220.58	100.0
			147.34 TO H2O	
			72.48 TO CO&CO2	
			0.76 GAS	
WATER	#/MIN	19.49	15.26	78.3
		5.50 SHALE	0.54 LIQ	
		14.00 COMB	13.76 VAP	
			0.95 SHALE	
KEROGEN	#/MIN	57.86	53.87	93.1
			6.26 SHALE	
			36.70 OIL	
			10.83 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	45.53	44.71	98.2
			5.97 SHALE	
			30.96 OIL	
			7.74 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	63.00	62.18	98.7
			18.44 SHALE	
			30.96 OIL	
			12.73 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	6.58	7.45	113.2
			0.29 SHALE	
			4.17 OIL	
			2.97 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.93	1.90	98.7
SULFUR	#/MIN	2.91	2.89	99.3
			2.43 SHALE	
			0.21 OIL	
			0.23 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	468.70	457.45	99.3

2.761 #/MIN C 1.555 #/MIN H 1.776 C/H COMB RATIO
91.45 VOL%FA 93.20WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 82778 TO 82878

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	829.80	829.80	100.0
ASH	#/MIN	252.93	252.93	100.0
OXYGEN	SCFM	220.58	220.58	100.0
			149.19 TO H2O	
			70.63 TO CO&CO2	
			0.75 GAS	
WATER	#/MIN	19.67	15.16	77.1
		5.50 SHALE	0.54 LIQ	
		14.17 COMB	13.66 VAP	
			0.95 SHALE	
KEROGEN	#/MIN	57.86	53.78	93.0
			6.26 SHALE	
			36.70 OIL	
			10.74 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	45.53	44.62	98.0
			5.97 SHALE	
			30.96 OIL	
			7.64 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	63.00	62.09	98.6
			18.44 SHALE	
			30.96 OIL	
			12.64 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	6.58	7.46	113.4
			0.29 SHALE	
			4.17 OIL	
			2.98 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.93	1.90	98.6
SULFUR	#/MIN	2.91	2.89	99.3
			2.43 SHALE	
			0.21 OIL	
			0.23 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	468.70	456.63	99.1

2.699 #/MIN C 1.575 #/MIN H 1.714 C/H COMB RATIO
91.45 VOL.%FA 93.28WT.%FA

DATA SUMMARY

STARTING DATE 82778 TO 82878
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.42	H2O FA	WT%	0.81
OIL FA	GPT	27.30			
MIN CO2	WT%	16.95	ASH	WT%	66.93
CARBON	WT%	16.67	HYDROGEN	WT%	1.83
NITROGEN	WT%	0.51	SULFUR	WT%	0.77

RAW SHALE MOISTURE WT% (UNGROUND) 0.64

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.2	WATER	WT%	1.7
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.5
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.36	HYDROGEN	WT%	11.37
NITROGEN	WT%	2.10	SULFUR	WT%	0.57

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.2	WATER	WT%	1.7

PRODUCT WATER PROPERTIES

CARBON	WT%	7.70	HYDROGEN	WT%	9.66
NITROGEN	WT%	4.87	SULFUR	WT%	4.00
CO2	WT%	1.43			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.69	C2H4	VOL%	0.52
N2+AR	VOL%	66.86	C2H6	VOL%	0.39
O2	VOL%	0.06	C3'S	VOL%	0.32
CO	VOL%	2.73	C4'S	VOL%	0.57
CH4	VOL%	2.02	C5+	VOL%	0.45
CO2	VOL%	19.18	H2S	VOL%	0.22
			NH3	VOL%	0.99

GROSS HEAT BTU/SCF 120.40

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.09			
OIL FA	GPT	0.24			
MIN CO2	WT%	14.88	ASH	WT%	82.29
CARBON	WT%	5.00	HYDROGEN	WT%	0.13
NITROGEN	WT%	0.21	SULFUR	WT%	0.79

TEMPERATURES DEG F

RAW SHALE IN	74	RET SHALE OUT	552
AIR TD IN	204	AIR MD IN	176
GAS BD IN	245	GAS MD IN	222
GAS TD IN	216	GAS PROD OUT	242
COOLING WATER IN	114	COOLING WATER OUT	119
PRODUCT OIL OUT	130		
AMBIENT AIR	70	OFF GAS	141

RATES AND QUANTITIES

RAW SHALE	TPH	11.34	THROUGHPUT PHF2		460.4
RET SHALE	TPH	9.22	RET/RAW	WT%	81.3
AIR TOP	SCFM	772.1		SCF/T	4086.4
AIR MID	SCFM	201.2		SCF/T	1064.8
AIR BTM	SCFM	77.1		SCF/T	407.8
TOTAL AIR	SCFM	1350.4		SCF/T	5559.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.820			
SP GR		0.957			
GAS TOP	SCFM	236.4		SCF/T	1251.0
GAS MID	SCFM	295.9		SCF/T	1565.8
GAS BTM	SCFM	1937.6		SCF/T	10254.4
TOTAL GAS	SCFM	2469.8		SCF/T	13071.2
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1539.9		SCF/T	8149.7
COOLING WATER	GPM	98.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	23.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 93.1
OIL YIELD VOL% FA= 91.5

***SEMI-WORKS ***
STARTING DATE 83178 TO 90178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	832.17	769.45	92.5
ASH	#/MIN	243.53	243.53	100.0
OXYGEN	SCFM	221.21	221.21	100.0
			141.85 TO H2O	
			79.36 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	19.56	18.18	93.0
		6.09 SHALE	0.85 LIQ	
		13.47 COMB	16.13 VAP	
			1.21 SHALE	
KEROGEN	#/MIN	54.27	49.55	91.3
			5.43 SHALE	
			33.81 OIL	
			10.19 GAS	
			0.12 WATER	
ORGANIC CARBON	#/MIN	42.57	41.15	96.7
			5.18 SHALE	
			28.53 OIL	
			7.37 GAS	
			0.07 WATER	
TOTAL CARBON	#/MIN	60.50	59.10	97.7
			16.53 SHALE	
			28.53 OIL	
			13.96 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	5.66	6.72	118.7
			0.25 SHALE	
			3.77 OIL	
			2.68 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.92	1.81	94.5
SULFUR	#/MIN	2.40	2.62	109.5
			2.12 SHALE	
			0.22 OIL	
			0.26 GAS	
			0.03 WATER	
OVERALL WEIGHT	#/MIN	450.27	444.90	98.8

2.925 #/MIN C 1.497 #/MIN H 1.954 C/H COMB RATIO
89.37 VOL%FA 90.70WT.%FA

***SEMI-WORKS FORCED ATM. N2 BALANCE ***
STARTING DATE 83178 TO 90178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	832.17	832.17	100.0
ASH	#/MIN	243.53	243.53	100.0
OXYGEN	SCFM	221.21	221.21	100.0
			116.37 TO H2O	
			104.84 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	17.14	19.50	113.8
		6.09 SHALE	0.85 LIQ	
		11.05 COMB	17.45 VAP	
			1.21 SHALE	
KEROGEN	#/MIN	54.27	50.53	93.1
			5.43 SHALE	
			33.81 OIL	
			11.17 GAS	
			0.12 WATER	
ORGANIC CARBON	#/MIN	42.57	42.29	99.4
			5.18 SHALE	
			28.53 OIL	
			8.51 GAS	
			0.07 WATER	
TOTAL CARBON	#/MIN	60.50	60.24	99.6
			16.53 SHALE	
			28.53 OIL	
			15.10 GAS	
			0.07 WATER	
ORG. HYDROGEN	#/MIN	5.65	6.55	115.6
			0.25 SHALE	
			3.77 OIL	
			2.51 GAS	
			0.02 WATER	
ORG. NITROGEN	#/MIN	1.92	1.85	96.5
SULFUR	#/MIN	2.40	2.64	110.3
			2.12 SHALE	
			0.22 OIL	
			0.28 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	450.27	454.35	100.9

3.771 #/MIN C 1.228 #/MIN H 3.070 C/H COMB RATIO
89.37 VOL%FA 90.70WT.%FA

DATA SUMMARY

STARTING DATE 83178 TO 90178
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.11	H2O FA	WT%	1.39
OIL FA	GPT	26.50			
MIN CO2	WT%	17.84	ASH	WT%	66.05
CARBON	WT%	16.41	HYDROGEN	WT%	1.69
NITROGEN	WT%	0.52	SULFUR	WT%	0.65

RAW SHALE MOISTURE WT% (UNGROUND) 0.26

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	2.9
VIS	SUS-130	0.0	SEDIMENT ML/100C		0.1
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.39	HYDROGEN	WT%	11.14
NITROGEN	WT%	2.03	SULFUR	WT%	0.65

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	2.9

PRODUCT WATER PROPERTIES

CARBON	WT%	7.46	HYDROGEN	WT%	8.94
NITROGEN	WT%	5.12	SULFUR	WT%	3.24
CO2	WT%	2.44			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.27	C2H4	VOL%	0.59
N2+AR	VOL%	63.63	C2H6	VOL%	0.48
O2	VOL%	0.00	C3'S	VOL%	0.51
CO	VOL%	2.51	C4'S	VOL%	0.42
CH4	VOL%	1.28	C5+	VOL%	0.37
CO2	VOL%	24.59	H2S	VOL%	0.25
			NH3	VOL%	1.09

GROSS HEAT BTU/SCF 107.30

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.05			
OIL FA	GPT	0.13			
MIN CO2	WT%	14.15	ASH	WT%	82.79
CARBON	WT%	5.62	HYDROGEN	WT%	0.13
NITROGEN	WT%	0.20	SULFUR	WT%	0.72

TEMPERATURES DEG F

RAW SHALE IN	72	RET SHALE OUT	536
AIR TD IN	232	AIR MD IN	178
GAS BD IN	247	GAS MD IN	223
GAS TD IN	218	GAS PROD OUT	244
COOLING WATER IN	115	COOLING WATER OUT	125
PRODUCT OIL OUT	131		
AMBIENT AIR	70	OFF GAS	140

RATES AND QUANTITIES

RAW SHALE	TPH	11.96	THROUGHPUT PHF2		449.2
RET SHALE	TPH	8.82	RET/RAW	WT%	79.8
AIR TOP	SCFM	772.9		SCF/T	4192.7
AIR MID	SCFM	227.1		SCF/T	1231.8
AIR BTM	SCFM	53.4		SCF/T	289.5
TOTAL AIR	SCFM	1353.4		SCF/T	5714.0

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		21.930			
SP GR		0.978			
GAS TOP	SCFM	235.9		SCF/T	1279.7
GAS MID	SCFM	292.8		SCF/T	1588.0
GAS BTM	SCFM	1354.1		SCF/T	10097.5
TOTAL GAS	SCFM	2382.8		SCF/T	12925.2
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	1549.0		SCF/T	8402.2
COOLING WATER	GPM	97.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	26.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 90.6
OIL YIELD VOL% FA= 94.4

SEMI-WORKS
STARTING DATE 90178 TO 90278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	830.15	748.98	90.2
ASH	#/MIN	244.77	244.77	100.0
OXYGEN	SCFM	220.67	220.67	100.0
			102.28 TO H2O	
			118.39 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	15.86	16.56	104.4
		6.14 SHALE	0.48 LIQ	
		9.72 COMB	14.87 VAP	
			1.21 SHALE	
KEROGEN	#/MIN	53.50	48.37	90.4
			5.46 SHALE	
			31.34 OIL	
			11.50 GAS	
			0.08 WATER	
ORGANIC CARBON	#/MIN	42.27	40.78	96.5
			5.21 SHALE	
			26.50 OIL	
			9.02 GAS	
			0.05 WATER	
TOTAL CARBON	#/MIN	60.34	58.85	97.5
			16.62 SHALE	
			26.50 OIL	
			15.68 GAS	
			0.05 WATER	
ORG. HYDROGEN	#/MIN	5.74	6.12	106.6
			0.25 SHALE	
			3.54 OIL	
			2.33 GAS	
			0.01 WATER	
ORG. NITROGEN	#/MIN	1.96	1.74	89.0
SULFUR	#/MIN	2.51	2.64	104.9
			2.13 SHALE	
			0.21 OIL	
			0.27 GAS	
			0.03 WATER	
O'ALL WEIGHT	#/MIN	451.07	446.08	98.9

4.101 #/MIN C 1.079 #/MIN H 3.799 C/H COMB RATIO
81.53 VOL%FA 82.86WT.%FA

SEMI-WORKS FORCED ATM. N2 BALANCE
STARTING DATE 90172 TO 90278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN		OUT		% REC.
ATM. NITROGEN	SCFM	830.15		830.15		100.0
ASH	#/MIN	244.77		244.77		100.0
OXYGEN	SCFM	220.67		220.67		100.0
				63.89	TO H2O	
				156.79	TO CO&CO2	
				0.00	GAS	
WATER	#/MIN	12.21		18.17		148.8
		6.14	SHALE	0.48	LIQ	
		6.07	COMB	16.48	VAP	
				1.21	SHALE	
KEROGEN	#/MIN	53.50		49.82		93.1
				5.46	SHALE	
				31.34	OIL	
				12.94	GAS	
				0.08	WATER	
ORGANIC CARBON	#/MIN	42.27		42.47		100.5
				5.21	SHALE	
				26.50	OIL	
				10.72	GAS	
				0.05	WATER	
TOTAL CARBON	#/MIN	60.34		60.55		100.3
				16.62	SHALE	
				26.50	OIL	
				17.38	GAS	
				0.05	WATER	
ORG. HYDROGEN	#/MIN	5.74		5.85		101.9
				0.25	SHALE	
				3.54	OIL	
				2.06	GAS	
				0.01	WATER	
ORG. NITROGEN	#/MIN	1.96		1.79		91.6
SULFUR	#/MIN	2.51		2.67		106.0
				2.13	SHALE	
				0.21	OIL	
				0.30	GAS	
				0.03	WATER	
O'ALL WEIGHT	#/MIN	451.07		458.92		101.7

5.362 #/MIN C 0.674 #/MIN H 7.952 C/H COMB RATIO
81.53 VOL%FR 82.86WT.%FR

DATA SUMMARY

STARTING DATE 90178 TO 90278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.23	H2O FA	WT%	1.41
OIL FA	GPT	26.80			
MIN CO2	WT%	17.92	ASH	WT%	66.20
CARBON	WT%	16.32	HYDROGEN	WT%	1.71
NITROGEN	WT%	0.53	SULFUR	WT%	0.68

RAW SHALE MOISTURE WT% (UNGROUND) 0.25

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	1.9
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.3
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.57	HYDROGEN	WT%	11.28
NITROGEN	WT%	2.06	SULFUR	WT%	0.66

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.6	WATER	WT%	1.9

PRODUCT WATER PROPERTIES

CARBON	WT%	3.06	HYDROGEN	WT%	6.66
NITROGEN	WT%	5.64	SULFUR	WT%	6.49
CO2	WT%	1.00			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	3.96	C2H4	VOL%	0.94
N2+AR	VOL%	60.87	C2H6	VOL%	0.54
O2	VOL%	0.00	C3'S	VOL%	0.53
CO	VOL%	2.17	C4'S	VOL%	0.43
CH4	VOL%	1.13	C5+	VOL%	0.41
CO2	VOL%	27.71	H2S	VOL%	0.26
			NH3	VOL%	1.04

GROSS HEAT BTU/SCF 112.95

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.05			
OIL FA	GPT	0.13			
MIN CO2	WT%	14.15	ASH	WT%	82.79
CARBON	WT%	5.62	HYDROGEN	WT%	0.13
NITROGEN	WT%	0.20	SULFUR	WT%	0.72

TEMPERATURES DEG F

RAW SHALE IN	75	RET SHALE OUT	542
AIR TD IN	234	AIR MD IN	177
GAS BD IN	248	GAS MD IN	225
GAS TD IN	220	GAS PROD OUT	245
COOLING WATER IN	111	COOLING WATER OUT	122
PRODUCT OIL OUT	132		
AMBIENT AIR	71	OFF GAS	141

RATES AND QUANTITIES

RAW SHALE	TPH	11.09	THROUGHPUT PHF2		450.4
RET SHALE	TPH	8.87	RET/RAW	WT%	80.0

AIR TOP	SCFM	769.2	SCF/T	4160.9
AIR MID	SCFM	224.9	SCF/T	1216.4
AIR BTM	SCFM	56.7	SCF/T	306.8
TOTAL AIR	SCFM	1050.8	SCF/T	5684.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 20.200
SP GR 1.003

GAS TOP	SCFM	240.4	SCF/T	1300.6
GAS MID	SCFM	294.0	SCF/T	1590.3
GAS BTM	SCFM	1354.6	SCF/T	10032.1
TOTAL GAS	SCFM	2389.1	SCF/T	12923.0
GAS SEAL LOSS NOT INCLUDED				
GAS PRODUCT	SCFM	1543.4	SCF/T	8348.8

COOLING WATER	GPM	98.0	BARO PRESS IN HG	24.0
AMB AIR REL HUM	%	28.0	BED PD IN H2O/FT	1.0

OIL YIELD WT% FA= 82.8
OIL YIELD VOL% FA= 81.5

APPENDIX 3.0

PILOT PLANT RETORTING RESEARCH

(MATERIAL AND ELEMENTAL BALANCES AND DATA SUMMARIES)

APPENDIX 3.1

PILOT PLANT RETORTING RESEARCH - SHALE GRADE

***PILOT PLANT ***
STARTING DATE 10978 TO 11078

MATERIAL AND ELENENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.94	45.22	65.6
ASH	#/MIN	20.92	20.92	100.0
OXYGEN	SCFM	18.33	18.33	100.0
			24.27 TO H2O	
			-5.95 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	3.42	0.92	26.8
		1.11 SHALE	0.21 LIQ	
		2.31 COMB	0.66 VAP	
			0.05 SHALE	
KEROGEN	#/MIN	4.08	3.72	91.2
			0.54 SHALE	
			2.80 OIL	
			0.37 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	3.50	2.93	83.8
			0.51 SHALE	
			2.36 OIL	
			0.05 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	5.07	4.51	88.9
			1.37 SHALE	
			2.36 OIL	
			0.77 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.48	0.65	136.3
			0.03 SHALE	
			0.32 OIL	
			0.30 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.16	0.11	68.2
SULFUR	#/MIN	0.23	0.22	96.7
			0.19 SHALE	
			0.01 OIL	
			0.01 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	38.56	33.87	87.8

-0.163 #/MIN C 0.256 #/MIN H -0.638 C/H COMB RATIO
86.58 VOL%FA 88.54WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 10978 TO 11078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.94	68.94	100.0
ASH	#/MIN	20.92	20.92	100.0
OXYGEN	SCFM	18.33	18.33	100.0
			14.39 TO H2O	
			3.94 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.48	1.26	50.9
		1.11 SHALE	0.21 LIQ	
		1.37 COMB	1.00 VAP	
			0.05 SHALE	
KEROGEN	#/MIN	4.08	4.05	99.3
			0.54 SHALE	
			2.80 OIL	
			0.69 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	3.50	3.33	95.3
			0.51 SHALE	
			2.36 OIL	
			0.45 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	5.07	4.91	96.8
			1.37 SHALE	
			2.36 OIL	
			1.17 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.48	0.57	119.6
			0.03 SHALE	
			0.32 OIL	
			0.22 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.16	0.12	73.0
SULFUR	#/MIN	0.23	0.23	99.9
			0.19 SHALE	
			0.01 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	38.56	37.27	96.7

0.166 #/MIN C 0.152 #/MIN H 1.091 C/H COMB RATIO
86.58 VOL%FA 88.54WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 10978 TO 11078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.94	68.94	100.0
ASH	#/MIN	20.01	20.01	100.0
OXYGEN	SCFM	18.33	18.33	100.0
			13.31 TO H2O	
			5.02 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.33	1.26	54.1
		1.07 SHALE	0.21 LIQ	
		1.26 COMB	1.00 VAP	
			0.05 SHALE	
KEROGEN	#/MIN	3.90	4.05	103.7
			0.52 SHALE	
			2.80 OIL	
			0.71 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	3.34	3.34	99.9
			0.49 SHALE	
			2.36 OIL	
			0.49 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	4.85	4.85	100.0
			1.31 SHALE	
			2.36 OIL	
			1.17 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.46	0.56	122.3
			0.03 SHALE	
			0.32 OIL	
			0.21 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.16	0.12	75.3
SULFUR	#/MIN	0.22	0.22	100.7
			0.18 SHALE	
			0.01 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	37.17	36.21	97.4

0.200 #/MIN C 0.140 #/MIN H 1.425 C/H COMB RATIO
90.52 VOL%FA 92.56WT.%FA

DATA SUMMARY

STARTING DATE 10978 TO 11078

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.03	H2O FA	WT%	2.43
OIL FA	GPT	26.30			
MIN CO2	WT%	18.30	ASH	WT%	66.34
CARBON	WT%	16.08	HYDROGEN	WT%	1.78
NITROGEN	WT%	0.52	SULFUR	WT%	0.73

RAW SHALE MOISTURE WT% (UNGROUND) 1.09

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	6.50
1.500	31.45
1.050	25.30
0.742	16.58
0.525	13.50
0.371	3.42
0.263	1.88
0.185	0.17
0.131	0.17
PAN	1.03

FACTORS

DA (IN.)	=	1.04
DV (IN.)	=	1.33
DV/DA	=	1.27

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	7.9
VIS	SUS-130	94.7	SEDIMENT	ML/100G	0.5
VIS	SUS-210	50.6	POUR	DEG F	85.0
CARBON	WT%	84.17	HYDROGEN	WT%	11.29
NITROGEN	WT%	2.01	SULFUR	WT%	0.45

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	7.9

PRODUCT WATER PROPERTIES

CARBON	WT%	4.71	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.70	SULFUR	WT%	4.02
CO2	WT%	3.56			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	2.97	C2H4	VOL%	0.42
N2+AR	VOL%	64.90	C2H6	VOL%	0.36
O2	VOL%	0.00	C3'S	VOL%	0.30
CO	VOL%	2.79	C4'S	VOL%	0.20
CH4	VOL%	1.30	C5+	VOL%	0.26
CO2	VOL%	25.66	H2S	VOL%	0.24
			NH3	VOL%	0.58

GROSS HEAT BTU/SCF 78.53

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.04			
OIL FA	GPT	0.10			
MIN CO2	WT%	12.89	ASH	WT%	85.88
CARBON	WT%	5.62	HYDROGEN	WT%	0.13
NITROGEN	WT%	0.14	SULFUR	WT%	0.77

TEMPERATURES DEG F

RAW SHALE IN	34	RET SHALE OUT	393
AIR TD IN	193	AIR MD IN	193
GAS BD IN	306	GAS MD IN	306
GAS TD IN	306	GAS PROD OUT	306
COOLING WATER IN	75	COOLING WATER OUT	76
PRODUCT OIL OUT	133		
AMBIENT AIR	34	OFF GAS	134

RATES AND QUANTITIES

RAW SHALE	TPH	0.95	THROUGHPUT PHF2		384.2
RET SHALE	TPH	0.73	RET/RAW	WT%	77.2
AIR TOP	SCFM	71.0		SCF/T	4501.7
AIR MID	SCFM	16.3		SCF/T	1032.9
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	87.3		SCF/T	5534.5

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		16.577			
SP GR		1.013			
GAS TOP	SCFM	24.1		SCF/T	1529.5
GAS MID	SCFM	24.1		SCF/T	1527.7
GAS BTM	SCFM	222.2		SCF/T	14089.4
TOTAL GAS	SCFM	270.4		SCF/T	17146.7
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	83.5		SCF/T	5297.6
COOLING WATER	GPM	66.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	62.0	BED PD IN H2O/FT		0.4

OIL YIELD WT% FA= 88.4
OIL YIELD VOL% FA= 85.6

***PILOT PLANT ***
STARTING DATE 11078 TO 11178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.88	41.92	60.9
ASH	#/MIN	20.94	20.94	100.0
OXYGEN	SCFM	18.31	18.31	100.0
			23.62 TO H2O	
			-5.31 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	3.32	0.71	21.4
		1.07 SHALE	0.21 LIQ	
		2.24 COMB	0.42 VAP	
			0.08 SHALE	
KEROGEN	#/MIN	3.39	3.39	99.9
			0.24 SHALE	
			2.79 OIL	
			0.35 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	3.22	2.64	81.9
			0.22 SHALE	
			2.37 OIL	
			0.05 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	4.93	4.36	88.3
			1.23 SHALE	
			2.37 OIL	
			0.75 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.45	0.64	141.2
			0.02 SHALE	
			0.32 OIL	
			0.29 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.16	0.12	73.4
SULFUR	#/MIN	0.24	0.24	101.5
			0.20 SHALE	
			0.02 OIL	
			0.01 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	38.37	33.36	86.9

-0.143 #/MIN C 0.249 #/MIN H -0.575 C/H COMB RATIO
89.68 VOL%FA 90.98WT.%FA

PILOT PLANT FORCED ATM. N2 BALANCE
STARTING DATE 11078 TO 11178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.88	68.88	100.0
ASH	#/MIN	20.94	20.94	100.0
OXYGEN	SCFM	18.31	18.31	100.0
			11.48 TO H2O	
			6.83 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.16	0.98	45.2
		1.07 SHALE	0.21 LIQ	
		1.09 COMB	0.69 VAP	
			0.08 SHALE	
KEROGEN	#/MIN	3.39	3.77	111.3
			0.24 SHALE	
			2.79 OIL	
			0.73 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	3.22	3.12	96.9
			0.22 SHALE	
			2.37 OIL	
			0.53 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	4.93	4.84	98.0
			1.23 SHALE	
			2.37 OIL	
			1.23 GAS	
			0 01 WATER	
ORG. HYDROGEN	#/MIN	0.45	0.54	119.0
			0.02 SHALE	
			0.32 OIL	
			0.19 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.16	0.13	78.8
SULFUR	#/MIN	0.24	0.25	105.0
			0.20 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	38.37	37.19	96.9

0.261 #/MIN C 0.121 #/MIN H 2.151 C/H COMB RATIO
89.68 VOL%FA 90.98WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 11078 TO 11178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.88	68.88	100.0
ASH	#/MIN	20.38	20.38	100.0
OXYGEN	SCFM	18.31	18.31	100.0
			10.84 TO H2O	
			7.47 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.07	0.98	47.0
		1.04 SHALE	0.21 LIQ	
		1.03 COMB	0.69 VAP	
			0.08 SHALE	
KEROGEN	#/MIN	3.30	3.78	114.5
			0.23 SHALE	
			2.79 OIL	
			0.75 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	3.13	3.13	99.9
			0.21 SHALE	
			2.37 OIL	
			0.55 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	4.80	4.80	100.0
			1.20 SHALE	
			2.37 OIL	
			1.23 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.44	0.53	120.6
			0.02 SHALE	
			0.32 OIL	
			0.19 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.16	0.13	80.3
SULFUR	#/MIN	0.23	0.24	105.5
			0.19 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	37.52	36.54	97.4

0.281 #/MIN C 0.114 #/MIN H 2.458 C/H COMB RATIO
92.13 VOL%FA 93.47WT.%FA

DATA SUMMARY

STARTING DATE 11078 TO 11178

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.77	H2O FA	WT%	2.32
OIL FA	GPT	25.60			
MIN CO2	WT%	20.07	ASH	WT%	66.80
CARBON	WT%	15.74	HYDROGEN	WT%	1.70
NITROGEN	WT%	0.51	SULFUR	WT%	0.75

RAW SHALE MOISTURE WT% (UNGROUND) 1.09

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	7.76
1.500	38.57
1.050	20.41
0.742	15.51
0.525	13.06
0.371	3.67
0.263	0.20
0.185	0.00
0.131	0.00
PAN	0.82

FACTORS

DA (IN.)=	1.14
DV (IN.)=	1.41
DV/DA =	1.24

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	7.9
VIS	SUS-130	98.8	SEDIMENT	ML/100G	0.5
VIS	SUS-210	47.1	POUR	DEG F	85.0
CARBON	WT%	84.91	HYDROGEN	WT%	11.58
NITROGEN	WT%	2.10	SULFUR	WT%	0.64

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	7.9

PRODUCT WATER PROPERTIES

CARBON	WT%	4.71	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.78	SULFUR	WT%	4.02
CO2	WT%	3.56			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	3.44	C2H4	VOL%	0.37
N2+AR	VOL%	63.25	C2H6	VOL%	0.34
O2	VOL%	0.00	C3'S	VOL%	0.28
CO	VOL%	2.91	C4'S	VOL%	0.15
CH4	VOL%	1.22	C5+	VOL%	0.24
CO2	VOL%	27.02	H2S	VOL%	0.22
			NH3	VOL%	0.55

GROSS HEAT BTU/SCF 74.19

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.03			
OIL FA	GPT	0.07			
MIN CO2	WT%	15.28	ASH	WT%	85.92
CARBON	WT%	5.05	HYDROGEN	WT%	0.12
NITROGEN	WT%	0.16	SULFUR	WT%	0.82

TEMPERATURES DEG F

RAW SHALE IN	37	RET SHALE OUT	400
AIR TD IN	195	AIR MD IN	195
GAS BD IN	310	GAS MD IN	310
GAS TD IN	310	GAS PROD OUT	310
COOLING WATER IN	74	COOLING WATER OUT	78
PRODUCT OIL OUT	141		
AMBIENT AIR	37	OFF GAS	136

RATES AND QUANTITIES

RAW SHALE	TPH	0.94	THROUGHPUT PHF2		381.9
RET SHALE	TPH	0.73	RET/RAW	WT%	77.7
AIR TOP	SCFM	71.0		SCF/T	4530.1
AIR MID	SCFM	16.2		SCF/T	1032.2
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	87.2		SCF/T	5562.3

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		11.737			
SP GR		1.038			
GAS TOP	SCFM	22.8		SCF/T	1455.4
GAS MID	SCFM	23.0		SCF/T	1470.2
GAS BTM	SCFM	211.9		SCF/T	13519.7
TOTAL GAS	SCFM	257.8		SCF/T	16445.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	75.1		SCF/T	4790.6
COOLING WATER	GPM	66.0	BARO PRESS IN HG		23.8
AMB AIR REL HUM	%	74.0	BED PD IN H2O/FT		0.4

OIL YIELD WT% FA= 90.9
OIL YIELD VOL% FA= 89.7

***PILOT PLANT ***
STARTING DATE 11578 TO 11678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.88	45.99	66.8
ASH	#/MIN	25.15	25.15	100.0
OXYGEN	SCFM	18.31	18.31	100.0
			21.21 TO H2O	
			-2.90 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.91	1.26	43.2
		0.90 SHALE	0.27 LIQ	
		2.01 COMB	0.88 VAP	
			0.12 SHALE	
KEROGEN	#/MIN	6.24	4.71	75.4
			0.62 SHALE	
			3.56 OIL	
			0.51 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.80	3.88	80.7
			0.60 SHALE	
			3.05 OIL	
			0.21 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.96	6.03	86.7
			2.09 SHALE	
			3.05 OIL	
			0.88 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.63	0.72	113.8
			0.02 SHALE	
			0.41 OIL	
			0.28 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.28	0.13	44.6
SULFUR	#/MIN	0.27	0.26	96.0
			0.21 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	46.85	42.26	90.2

-0.057 #/MIN C 0.224 #/MIN H -0.253 C/H COMB RATIO
83.48 VOL%FA 84.48WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 11578 TO 11678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.88	68.89	100.0
ASH	#/MIN	25.15	25.15	100.0
OXYGEN	SCFM	18.31	18.31	100.0
			10.82 TO H2O	
			7.49 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.93	1.69	87.9
		0.90 SHALE	0.27 LIQ	
		1.03 COMB	1.31 VAP	
			0.12 SHALE	
KEROGEN	#/MIN	6.24	5.07	81.3
			0.62 SHALE	
			3.56 OIL	
			0.88 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.80	4.31	89.7
			0.60 SHALE	
			3.05 OIL	
			0.65 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.96	6.47	93.0
			2.09 SHALE	
			3.05 OIL	
			1.31 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.63	0.64	101.2
			0.02 SHALE	
			0.41 OIL	
			0.20 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.28	0.14	47.9
SULFUR	#/MIN	0.27	0.27	99.4
			0.21 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	46.85	45.77	97.7

0.294 #/MIN C 0.114 #/MIN H 2.572 C/H COMB RATIO
83.48 VOL%FA 84.48WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 11578 TO 11678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.88	68.89	100.0
ASH	#/MIN	22.62	22.62	100.0
OXYGEN	SCFM	18.31	18.31	100.0
			8.43 TO H2O	
			9.88 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.61	1.68	104.6
		0.81 SHALE	0.27 LIQ	
		0.80 COMB	1.31 VAP	
			0.10 SHALE	
KEROGEN	#/MIN	5.61	5.05	90.0
			0.56 SHALE	
			3.56 OIL	
			0.92 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.32	4.32	99.9
			0.54 SHALE	
			3.05 OIL	
			0.72 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.26	6.26	100.0
			1.88 SHALE	
			3.05 OIL	
			1.31 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.57	0.61	107.8
			0.02 SHALE	
			0.41 OIL	
			0.18 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.26	0.13	51.9
SULFUR	#/MIN	0.25	0.25	101.9
			0.19 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	42.80	42.61	99.5

0.370 #/MIN C 0.089 #/MIN H 4.163 C/H COMB RATIO
92.83 VOL.%FA 93.94WT.%FA

DATA SUMMARY

STARTING DATE 11578 TO 11678
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.64	H2O FA	WT%	0.73
OIL FA	GPT	27.90			
MIN CO2	WT%	19.94	ASH	WT%	63.56
CARBON	WT%	17.58	HYDROGEN	WT%	1.68
NITROGEN	WT%	0.72	SULFUR	WT%	0.69

RAW SHALE MOISTURE WT% (UNGROUND) 1.52

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	0.00
1.500	0.00
1.050	0.00
0.742	0.00
0.525	0.00
0.371	0.00
0.263	0.00
0.185	0.00
0.131	0.00
PAN	0.00

FACTORS

DA (IN.)	=	0.00
DV (IN.)	=	0.00
DV/DA	=	0.00

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	7.9
VIS	SUS-130	92.9	SEDIMENT	ML/100G	0.4
VIS	SUS-210	45.6	POUR	DEG F	85.0
CARBON	WT%	35.73	HYDROGEN	WT%	11.64
NITROGEN	WT%	1.85	SULFUR	WT%	0.64

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	7.9

PRODUCT WATER PROPERTIES

CARBON	WT%	4.71	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.70	SULFUR	WT%	4.02
CO2	WT%	3.56			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	3.95	C2H4	VOL%	0.42
N2+AR	VOL%	61.93	C2H6	VOL%	0.36
O2	VOL%	0.00	C3'S	VOL%	0.32
CO	VOL%	3.65	C4'S	VOL%	0.35
CH4	VOL%	1.50	C5+	VOL%	0.27
CO2	VOL%	26.28	H2S	VOL%	0.30
			NH3	VOL%	0.68

GROSS HEAT BTU/SCF 93.35

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.03			
OIL FA	GPT	0.07			
MIN CO2	WT%	17.42	ASH	WT%	80.23
CARBON	WT%	6.67	HYDROGEN	WT%	0.10
NITROGEN	WT%	0.11	SULFUR	WT%	0.67

TEMPERATURES DEG F

RAW SHALE IN	36	RET SHALE OUT	344
AIR TD IN	192	AIR MD IN	192
GAS BD IN	296	GAS MD IN	296
GAS TD IN	296	GAS PROD OUT	296
COOLING WATER IN	70	COOLING WATER OUT	73
PRODUCT OIL OUT	148		
AMBIENT AIR	36	OFF GAS	146

RATES AND QUANTITIES

RAW SHALE	TPH	1.19	THROUGHPUT PHF2		482.1
RET SHALE	TPH	0.94	RET/RAW	WT%	79.2

AIR TOP	SCFM	70.6	SCF/T	3567.9
AIR MID	SCFM	16.6	SCF/T	839.4
AIR BTM	SCFM	0.0	SCF/T	0.0
TOTAL AIR	SCFM	87.2	SCF/T	4407.3

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 19.890
SP GR 0.994

GAS TOP	SCFM	22.2	SCF/T	1123.9
GAS MID	SCFM	25.1	SCF/T	1270.7
GAS BTM	SCFM	279.3	SCF/T	14116.8
TOTAL GAS	SCFM	326.7	SCF/T	16511.4

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	92.7	SCF/T		4686.1
COOLING WATER	GPM	65.0	BARO PRESS IN HG		23.7
AMB AIR REL HUM	%	82.0	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 84.4
OIL YIELD VOL% FA= 83.5

***PILOT PLANT ***
STARTING DATE 11678 TO 11778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.83	48.47	70.4
ASH	#/MIN	25.11	25.11	100.0
OXYGEN	SCFM	18.30	18.30	100.0
			12.57 TO H2O	
			5.73 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.24	1.29	57.8
		1.05 SHALE	0.28 LIQ	
		1.19 COMB	0.92 VAP	
			0.09 SHALE	
KEROGEN	#/MIN	8.41	5.29	62.9
			0.74 SHALE	
			3.71 OIL	
			0.82 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	5.60	4.48	79.9
			0.72 SHALE	
			3.16 OIL	
			0.58 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.52	6.40	85.1
			2.36 SHALE	
			3.16 OIL	
			0.86 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.71	0.66	92.0
			0.02 SHALE	
			0.40 OIL	
			0.22 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.14	68.1
SULFUR	#/MIN	0.34	0.30	89.4
			0.24 SHALE	
			0.03 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	48.28	42.80	88.7

0.200 #/MIN C 0.133 #/MIN H 1.508 C/H COMB RATIO
84.86 VOL%FA 84.92WT.%FA

STARTING DATE 11678 TO 11778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.83	68.83	100.0
ASH	#/MIN	25.11	25.11	100.0
OXYGEN	SCFM	18.30	18.30	100.0
			5.25 TO N2O	
			13.04 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.55	1.68	108.9
		1.05 SHALE	0.28 LIQ	
		0.50 COMB	1.31 VAP	
			0.09 SHALE	
KEROGEN	#/MIN	8.41	5.62	66.8
			0.74 SHALE	
			3.71 OIL	
			1.15 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	5.60	4.84	86.4
			0.72 SHALE	
			3.16 OIL	
			0.95 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.52	6.76	89.9
			2.36 SHALE	
			3.16 OIL	
			1.22 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.71	0.62	86.6
			0.02 SHALE	
			0.40 OIL	
			0.18 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.15	71.9
SULFUR	#/MIN	0.34	0.31	91.7
			0.24 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	46.28	45.75	94.8

0.443 #/MIN C 0.055 #/MIN H 7.989 C/H COMB RATIO
84.06 VOL%FA 84.92WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 11678 TO 11778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.83	68.83	100.0
ASH	#/MIN	21.42	21.42	100.0
OXYGEN	SCFM	18.30	18.30	100.0
			3.53 TO H2O	
			14.76 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.23	1.67	135.9
		0.89 SHALE	0.28 LIQ	
		0.34 COMB	1.31 VAP	
			0.08 SHALE	
KEROGEN	#/MIN	7.17	5.53	77.1
			0.63 SHALE	
			3.71 OIL	
			1.17 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.78	4.77	99.9
			0.61 SHALE	
			3.16 OIL	
			0.99 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.42	6.42	100.0
			2.01 SHALE	
			3.16 OIL	
			1.22 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.61	0.60	97.9
			0.02 SHALE	
			0.40 OIL	
			0.17 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.18	0.14	80.4
SULFUR	#/MIN	0.29	0.27	95.2
			0.21 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	42.16	41.08	97.4

0.498 #/MIN C 0.037 #/MIN H 13.362 C/H COMB RATIO
98.54 VOL%FA 99.56WT.%FA

DATA SUMMARY

STARTING DATE 11678 TO 11778
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.65	H2O FA	WT%	0.98
OIL FA	GPT	27.90			
MIN CO2	WT%	17.20	ASH	WT%	61.29
CARBON	WT%	18.36	HYDROGEN	WT%	1.85
NITROGEN	WT%	0.51	SULFUR	WT%	0.82

RAW SHALE MOISTURE WT% (UNGROUND) 1.55

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	2.90
1.500	34.56
1.050	22.78
0.742	20.46
0.525	13.32
0.371	2.70
0.263	2.51
0.185	0.19
0.131	0.00
PAN	0.58

FACTORS

DA (IN.)	=	1.03
DV (IN.)	=	1.29
DV/DA	=	1.25

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.5	WATER	WT%	7.9
VIS	SUS-130	88.6	SEDIMENT	ML/100G	0.4
VIS	SUS-210	44.7	POUR	DEG F	85.0
CARBON	WT%	35.42	HYDROGEN	WT%	10.92
NITROGEN	WT%	1.81	SULFUR	WT%	0.77

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.5	WATER	WT%	7.9

PRODUCT WATER PROPERTIES

CARBON	WT%	4.71	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.70	SULFUR	WT%	4.02
CO2	WT%	3.56			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.81	C2H4	VOL%	0.59
N2+AR	VOL%	64.42	C2H6	VOL%	0.69
O2	VOL%	0.00	C3'S	VOL%	0.71
CO	VOL%	2.24	C4'S	VOL%	0.60
CH4	VOL%	2.62	C5+	VOL%	0.30
CO2	VOL%	22.02	H2S	VOL%	0.30
			NH3	VOL%	0.69

GROSS HEAT BTU/SCF 131.67

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.03			
OIL FA	GPT	0.08			
MIN CO2	WT%	13.98	ASH	WT%	79.01
CARBON	WT%	7.43	HYDROGEN	WT%	0.11
NITROGEN	WT%	0.15	SULFUR	WT%	0.76

TEMPERATURES DEG F

RAW SHALE IN	37	RET SHALE OUT	369
AIR TD IN	191	AIR MD IN	191
GAS BD IN	296	GAS MD IN	296
GAS TD IN	296	GAS PROD OUT	296
COOLING WATER IN	75	COOLING WATER OUT	80
PRODUCT OIL OUT	139		
AMBIENT AIR	37	OFF GAS	150

RATES AND QUANTITIES

RAW SHALE	TPH	1.23	THROUGHPUT PHF2		499.1
RET SHALE	TPH	0.95	RET/RAW	WT%	77.6
AIR TOP	SCFM	71.0		SCF/T	3464.2
AIR MID	SCFM	16.2		SCF/T	789.4
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	87.1		SCF/T	4253.5

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.555			
SP GR		0.967			
GAS TOP	SCFM	22.2		SCF/T	1085.7
GAS MID	SCFM	25.1		SCF/T	1227.5
GAS BTM	SCFM	279.3		SCF/T	13637.2
TOTAL GAS	SCFM	326.7		SCF/T	15950.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	94.7		SCF/T	4623.0
COOLING WATER	GPM	65.0	BARO PRESS IN HG		23.9
AMB AIR REL HUM	%	78.0	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 84.8
OIL YIELD VOL% FA= 84.1

***PILOT PLANT ***
STARTING DATE 12078 TO 12178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	69.89	44.31	63.4
ASH	#/MIN	25.38	25.38	100.0
OXYGEN	SCFM	18.58	18.58	100.0
			12.92 TO H2O	
			5.66 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.79	1.63	58.6
		1.56 SHALE	0.35 LIQ	
		1.23 COMB	0.92 VAP	
			0.37 SHALE	
KEROGEN	#/MIN	6.74	6.25	92.7
			0.85 SHALE	
			4.60 OIL	
			0.78 GAS	
			0.03 WATER	
ORGANIC CARBON	#/MIN	5.67	5.27	92.9
			0.84 SHALE	
			3.87 OIL	
			0.55 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.54	7.15	94.7
			2.39 SHALE	
			3.87 OIL	
			0.86 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.67	0.73	109.6
			0.01 SHALE	
			0.51 OIL	
			0.21 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.23	0.19	82.1
SULFUR	#/MIN	0.33	0.31	94.6
			0.25 SHALE	
			0.03 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	47.31	44.04	93.1

0.208 #/MIN C 0.136 #/MIN H 1.524 C/H COMB RATIO
94.77 VOL%FA 96.26WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 12078 TO 12178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	69.89	69.89	100.0
ASH	#/MIN	25.38	25.38	100.0
OXYGEN	SCFM	18.58	18.58	100.0
			1.98 TO H2O	
			16.60 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.75	2.16	123.7
		1.56 SHALE	0.35 LIQ	
		0.19 COMB	1.44 VAP	
			0.37 SHALE	
KEROGEN	#/MIN	6.74	6.69	99.2
			0.85 SHALE	
			4.60 OIL	
			1.21 GAS	
			0.03 WATER	
ORGANIC CARBON	#/MIN	5.67	5.77	101.7
			0.84 SHALE	
			3.87 OIL	
			1.04 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.54	7.64	101.3
			2.39 SHALE	
			3.87 OIL	
			1.36 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.67	0.66	98.9
			0.01 SHALE	
			0.51 OIL	
			0.14 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.23	0.19	85.5
SULFUR	#/MIN	0.33	0.33	98.3
			0.25 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	47.31	47.97	101.4

0.576 #/MIN C 0.821 #/MIN H 27.574 C/H COMB RATIO
94.77 VOL%FA 96.25WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 12078 TO 12178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	69.89	69.89	100.0
ASH	#/MIN	25.88	25.88	100.0
OXYGEN	SCFM	18.58	18.58	100.0
			2.24 TO H2O	
			16.34 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.80	2.17	120.3
		1.59 SHALE	0.35 LIQ	
		0.21 COMB	1.44 VAP	
			0.38 SHALE	
KEROGEN	#/MIN	6.87	6.70	97.5
			0.87 SHALE	
			4.60 OIL	
			1.21 GAS	
			0.03 WATER	
ORGANIC CARBON	#/MIN	5.78	5.78	99.9
			0.86 SHALE	
			3.87 OIL	
			1.04 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.69	7.69	100.0
			2.44 SHALE	
			3.87 OIL	
			1.36 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.68	0.67	97.5
			0.01 SHALE	
			0.51 OIL	
			0.14 GAS	
			0.08 WATER	
ORG. NITROGEN	#/MIN	0.23	0.20	84.4
SULFUR	#/MIN	0.34	0.33	97.9
			0.25 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	48.10	48.60	101.0

0.568 #/MIN C 0.024 #/MIN H 24.836 C/H COMB RATIO
92.96 VOL%FA 94.43WT.%FA

DATA SUMMARY

STARTING DATE 12078 TO 12178
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.97	H2O FA	WT%	2.34
OIL FA	GPT	31.30			
MIN CO2	WT%	17.18	ASH	WT%	63.59
CARBON	WT%	18.90	HYDROGEN	WT%	1.94
NITROGEN	WT%	0.57	SULFUR	WT%	0.83

RAW SHALE MOISTURE WT% (UNGROUND) 1.54

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	4.76
1.500	40.00
1.050	23.43
0.742	17.33
0.525	9.14
0.371	2.48
0.263	1.52
0.185	0.38
0.131	0.19
PAN	0.76

FACTORS

DA (IN.)	=	1.11
DV (IN.)	=	1.39
DV/DA	=	1.25

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.4	WATER	WT%	7.9
VIS	SUS-130	104.1	SEDIMENT	ML/100G	0.4
VIS	SUS-210	58.1	POUR	DEG F	85.0
CARBON	WT%	84.14	HYDROGEN	WT%	11.03
NITROGEN	WT%	2.13	SULFUR	WT%	0.65

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.4	WATER	WT%	7.9

PRODUCT WATER PROPERTIES

CARBON	WT%	4.71	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.70	SULFUR	WT%	4.02
CO2	WT%	3.56			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.21	C2H4	VOL%	0.66
N2+AR	VOL%	61.51	C2H6	VOL%	0.47
O2	VOL%	0.00	C3'S	VOL%	0.50
CO	VOL%	3.29	C4'S	VOL%	0.49
CH4	VOL%	2.03	C5+	VOL%	0.30
CO2	VOL%	24.66	H2S	VOL%	0.35
			NH3	VOL%	0.51

GROSS HEAT BTU/SCF 118.78

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.20			
OIL FA	GPT	0.53			
MIN CO2	WT%	17.64	ASH	WT%	78.71
CARBON	WT%	7.42	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.20	SULFUR	WT%	0.77

TEMPERATURES DEG F

RAW SHALE IN	36	RET SHALE OUT	348
AIR TD IN	191	AIR MD IN	191
GAS BD IN	234	GAS MD IN	284
GAS TD IN	234	GAS PROD OUT	284
COOLING WATER IN	76	COOLING WATER OUT	82
PRODUCT OIL OUT	138		
AMBIENT AIR	36	OFF GAS	151

RATES AND QUANTITIES

RAW SHALE	TPH	1.20	THROUGHPUT PHF2		486.3
RET SHALE	TPH	0.97	RET/RAW	WT%	80.8
AIR TOP	SCFM	70.8		SCF/T	3548.1
AIR MID	SCFM	17.7		SCF/T	884.6
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	88.5		SCF/T	4432.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		21.103			
SP GR		0.974			
GAS TOP	SCFM	16.3		SCF/T	817.0
GAS MID	SCFM	25.6		SCF/T	1282.3
GAS BTM	SCFM	287.3		SCF/T	14392.4
TOTAL GAS	SCFM	329.1		SCF/T	16491.7
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	91.3		SCF/T	4574.3
COOLING WATER	GPM	66.0	BARO PRESS IN HG		23.8
AMB AIR REL HUM	%	75.0	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 96.1
OIL YIELD VOL% FA= 94.8

***PILOT PLANT ***
STARTING DATE 12178 TO 12278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	71.83	50.24	69.9
ASH	#/MIN	25.99	25.99	100.0
OXYGEN	SCFM	19.09	19.09	100.0
			12.25 TO H2O	
			6.85 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.55	1.57	61.6
		1.38 SHALE	0.32 LIQ	
		1.16 COMB	0.66 VAP	
			0.60 SHALE	
KEROGEN	#/MIN	6.76	6.01	88.9
			0.92 SHALE	
			4.21 OIL	
			0.86 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	6.04	5.12	84.7
			0.91 SHALE	
			3.57 OIL	
			0.62 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.98	7.06	88.5
			2.49 SHALE	
			3.57 OIL	
			0.98 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.74	0.69	93.6
			0.00 SHALE	
			0.47 OIL	
			0.22 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.24	0.17	68.8
SULFUR	#/MIN	0.39	0.33	86.3
			0.27 SHALE	
			0.03 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	48.18	45.55	94.5

0.251 #/MIN C 0.129 #/MIN H 1.939 C/H COMB RATIO
84.46 VOL%FA 86.02WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 12178 TO 12278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	71.83	71.83	100.0
ASH	#/MIN	25.99	25.99	100.0
OXYGEN	SCFM	19.09	19.09	100.0
			3.06 TO H2O	
			16.04 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.67	1.85	110.6
		1.38 SHALE	0.32 LIQ	
		0.29 COMB	0.94 VAP	
			0.60 SHALE	
KEROGEN	#/MIN	6.76	6.38	94.4
			0.92 SHALE	
			4.21 OIL	
			1.23 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	6.04	5.54	91.7
			0.91 SHALE	
			3.57 OIL	
			1.05 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.98	7.48	93.7
			2.49 SHALE	
			3.57 OIL	
			1.40 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.74	0.63	85.6
			0.00 SHALE	
			0.47 OIL	
			0.16 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.24	0.17	70.9
SULFUR	#/MIN	0.39	0.34	88.9
			0.27 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	48.18	48.70	101.1

0.560 #/MIN C 0.032 #/MIN H 17.367 C/H COMB RATIO
84.46 VOL%FA 86.02WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 12178 TO 12278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	71.83	71.83	100.0
ASH	#/MIN	23.62	23.62	100.0
OXYGEN	SCFM	19.09	19.09	100.0
			1.73 TO H2O	
			17.36 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.42	1.80	126.4
		1.26 SHALE	0.32 LIQ	
		0.16 COMB	0.94 VAP	
			0.54 SHALE	
KEROGEN	#/MIN	6.15	6.32	102.8
			0.83 SHALE	
			4.21 OIL	
			1.25 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	5.49	5.49	99.9
			0.83 SHALE	
			3.57 OIL	
			1.08 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.25	7.25	100.0
			2.26 SHALE	
			3.57 OIL	
			1.40 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.67	0.62	92.0
			0.00 SHALE	
			0.47 OIL	
			0.14 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.17	75.3
SULFUR	#/MIN	0.35	0.32	90.9
			0.24 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	44.43	45.64	102.7

0.603 #/MIN C 0.018 #/MIN H 32.981 C/H COMB RATIO
92.92 VOL%FA 94.64WT.%FA

DATA SUMMARY

STARTING DATE 12178 TO 12278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	12.00	H2O FA	WT%	2.31
OIL FA	GPT	31.40			
MIN CO2	WT%	17.39	ASH	WT%	63.72
CARBON	WT%	19.56	HYDROGEN	WT%	2.07
NITROGEN	WT%	0.60	SULFUR	WT%	0.95

RAW SHALE MOISTURE WT% (UNGROUND) 1.07

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	2.86
1.500	36.12
1.050	22.45
0.742	18.57
0.525	12.86
0.371	3.27
0.263	2.24
0.185	0.61
0.131	0.20
PAN	0.82

FACTORS

DA (IN.)	=	1.01
DV (IN.)	=	1.30
DV/DA	=	1.28

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.1	WATER	WT%	7.9
VIS	SUS-130	135.2	SEDIMENT	ML/100C	0.3
VIS	SUS-210	46.9	POUR	DEG F	85.0
CARBON	WT%	84.74	HYDROGEN	WT%	11.10
NITROGEN	WT%	1.09	SULFUR	WT%	0.67

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.1	WATER	WT%	7.9

PRODUCT WATER PROPERTIES

CARBON	WT%	4.71	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.70	SULFUR	WT%	4.02
CO2	WT%	3.56			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.34	C2H4	VOL%	0.70
N2+AR	VOL%	61.49	C2H6	VOL%	0.50
O2	VOL%	0.00	C3'S	VOL%	0.53
CO	VOL%	3.32	C4'S	VOL%	0.43
CH4	VOL%	2.09	C5+	VOL%	0.33
CO2	VOL%	24.52	H2S	VOL%	0.35
			NH3	VOL%	0.39

GROSS HEAT BTU/SCF 120.01

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.17			
OIL FA	GPT	0.44			
MIN CO2	WT%	17.19	ASH	WT%	77.19
CARBON	WT%	7.40	HYDROGEN	WT%	0.21
NITROGEN	WT%	0.20	SULFUR	WT%	0.80

TEMPERATURES DEG F

RAW SHALE IN	36	RET SHALE OUT	353
AIR TD IN	190	AIR MD IN	190
GAS BD IN	284	GAS MD IN	284
GAS TD IN	284	GAS PROD OUT	284
COOLING WATER IN	73	COOLING WATER OUT	80
PRODUCT OIL OUT	138		
AMBIENT AIR	36	OFF GAS	158

RATES AND QUANTITIES

RAW SHALE	TPH	1.22	THROUGHPUT PHF2		496.8
RET SHALE	TPH	1.01	RET/RAW	WT%	82.5
AIR TOP	SCFM	71.0		SCF/T	3480.0
AIR MID	SCFM	20.0		SCF/T	979.2
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	90.9		SCF/T	4459.2

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		14.470			
SP GR		1.002			
GAS TOP	SCFM	16.3		SCF/T	800.7
GAS MID	SCFM	25.6		SCF/T	1256.8
GAS BTM	SCFM	290.5		SCF/T	14247.5
TOTAL GAS	SCFM	332.5		SCF/T	16305.1
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	95.5		SCF/T	4684.6
COOLING WATER	GPM	67.0	BARO PRESS IN HG		23.9
AMB AIR REL HUM	%	66.0	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 85.9
OIL YIELD VOL% FA= 84.5

***PILOT PLANT ***
STARTING DATE 12578 TO 12678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	78.27	54.51	69.6
ASH	#/MIN	26.25	26.25	100.0
OXYGEN	SCFM	20.81	20.81	100.0
			17.60 TO H2O	
			3.16 TO CO&CO2	
			0.05 GAS	
WATER	#/MIN	3.11	1.42	45.7
		1.44 SHALE	0.39 LIQ	
		1.67 COMB	0.99 VAP	
			0.05 SHALE	
KEROGEN	#/MIN	7.85	6.95	88.5
			0.90 SHALE	
			5.14 OIL	
			0.88 GAS	
			0.03 WATER	
ORGANIC CARBON	#/MIN	6.97	5.81	83.4
			0.86 SHALE	
			4.34 OIL	
			0.60 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	8.80	7.65	86.9
			2.24 SHALE	
			4.34 OIL	
			1.06 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.87	0.90	102.9
			0.04 SHALE	
			0.56 OIL	
			0.29 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.25	0.19	76.6
SULFUR	#/MIN	0.42	0.37	88.5
			0.33 SHALE	
			0.03 OIL	
			0.00 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	49.87	45.75	91.7

0.134 #/MIN C 0.186 #/MIN H 0.723 C/H COMB RATIO
84.60 VOL%FA 86.17WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 12578 TO 12678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	78.27	78.27	100.0
ASH	#/MIN	26.25	26.25	100.0
OXYGEN	SCFM	20.81	20.81	100.0
			8.15 TO H2O	
			12.59 TO CO&CO2	
			0.07 GAS	
WATER	#/MIN	2.22	1.85	83.7
		1.44 SHALE	0.39 LIQ	
		0.77 COMB	1.42 VAP	
			0.05 SHALE	
KEROGEN	#/MIN	7.85	7.36	93.6
			0.90 SHALE	
			5.14 OIL	
			1.29 GAS	
			0.03 WATER	
ORGANIC CARBON	#/MIN	6.97	6.27	90.0
			0.86 SHALE	
			4.34 OIL	
			1.06 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	8.80	8.12	92.2
			2.24 SHALE	
			4.34 OIL	
			1.52 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.87	0.84	96.5
			0.04 SHALE	
			0.56 OIL	
			0.23 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.25	0.19	76.6
SULFUR	#/MIN	0.42	0.37	88.5
			0.33 SHALE	
			0.03 OIL	
			0.00 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	49.87	49.26	98.8

0.453 #/MIN C 0.086 #/MIN H 5.268 C/H COMB RATIO
84.60 VOL%FA 86.17WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 12578 TO 12678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	78.27	78.27	100.0
ASH	#/MIN	23.49	23.49	100.0
OXYGEN	SCFM	20.81	20.81	100.0
			6.20 TO H2O	
			14.53 TO CO&CO2	
			0.07 GAS	
WATER	#/MIN	1.88	1.85	98.3
		1.29 SHALE	0.39 LIQ	
		0.59 COMB	1.42 VAP	
			0.04 SHALE	
KEROGEN	#/MIN	7.03	7.29	103.7
			0.80 SHALE	
			5.14 OIL	
			1.32 GAS	
			0.03 WATER	
ORGANIC CARBON	#/MIN	6.23	6.23	99.9
			0.77 SHALE	
			4.34 OIL	
			1.11 GAS	
			0.02 WATER	
TOTAL CARBON	#/MIN	7.88	7.88	100.0
			2.00 SHALE	
			4.34 OIL	
			1.52 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.78	0.82	104.7
			0.04 SHALE	
			0.56 OIL	
			0.21 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.19	82.8
SULFUR	#/MIN	0.38	0.34	89.7
			0.29 SHALE	
			0.03 OIL	
			0.00 GAS	
			0.02 WATER	
O'ALL WEIGHT	#/MIN	45.43	45.88	101.0

0.516 #/MIN C 0.065 #/MIN H 7.874 C/H COMB RATIO
94.53 VOL%FA 96.29WT.%FA

DATA SUMMARY

STARTING DATE 12578 TO 12678

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	14.32	H2O FA	WT%	1.97
OIL FA	GPT	37.50			
MIN CO2	WT%	16.19	ASH	WT%	62.99
CARBON	WT%	21.13	HYDROGEN	WT%	2.31
NITROGEN	WT%	0.60	SULFUR	WT%	1.01

RAW SHALE MOISTURE WT% (UNGROUND) 1.47

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	7.06
1.500	37.25
1.050	22.75
0.742	16.86
0.525	11.37
0.371	2.35
0.263	1.57
0.185	0.20
0.131	0.20
PAN	0.39

FACTORS

DA (IN.)= 1.10
DV (IN.)= 1.39
DV/DA = 1.26

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.2	WATER	WT%	7.9
VIS	SUS-130	103.5	SEDIMENT	ML/100G	0.6
VIS	SUS-210	47.9	POUR	DEG F	85.0
CARBON	WT%	34.37	HYDROGEN	WT%	10.98
NITROGEN	WT%	2.31	SULFUR	WT%	0.57

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.2	WATER	WT%	7.9

PRODUCT WATER PROPERTIES

CARBON	WT%	4.71	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.70	SULFUR	WT%	4.02
CO2	WT%	3.56			

STARTING DATE 12578 TO 12678

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.59	C2H4	VOL%	0.78
N2+AR	VOL%	62.48	C2H6	VOL%	0.61
O2	VOL%	0.06	C3'S	VOL%	0.68
CO	VOL%	3.30	C4'S	VOL%	0.56
CH4	VOL%	2.47	C5+	VOL%	0.32
CO2	VOL%	23.16	H2S	VOL%	0.00
			NH3	VOL%	0.00

GROSS HEAT BTU/SCF 131.95

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.09			
OIL FA	GPT	0.23			
MIN CO2	WT%	15.78	ASH	WT%	81.73
CARBON	WT%	5.97	HYDROGEN	WT%	0.14
NITROGEN	WT%	0.19	SULFUR	WT%	1.02

TEMPERATURES DEG F

RAW SHALE IN	28	RET SHALE OUT	378
AIR TD IN	179	AIR MD IN	179
GAS BD IN	278	GAS MD IN	278
GAS TD IN	278	GAS PROD OUT	278
COOLING WATER IN	56	COOLING WATER OUT	71
PRODUCT OIL OUT	132		
AMBIENT AIR	28	OFF GAS	153

RATES AND QUANTITIES

RAW SHALE	TPH	1.25	THROUGHPUT PHF2		507.7
RET SHALE	TPH	0.96	RET/RAW	WT%	77.1
AIR TOP	SCFM	71.6		SCF/T	3437.7
AIR MID	SCFM	27.4		SCF/T	1317.4
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	99.1		SCF/T	4755.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.269			
SP GR		0.974			
GAS TOP	SCFM	17.2		SCF/T	827.8
GAS MID	SCFM	40.8		SCF/T	1956.8
GAS BTM	SCFM	261.0		SCF/T	12525.5
TOTAL GAS	SCFM	319.0		SCF/T	15310.2
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	108.1		SCF/T	5186.6
COOLING WATER	GPM	67.0	BARO PRESS IN HG		24.0
AND AIR REL HUM	%	64.0	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 96.1
OIL YIELD VOL% FA= 84.6

***PILOT PLANT ***
***PILOT PLANT ***
STARTING DATE 12677 TO 12777

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	77.94	50.96	65.4
ASH	#/MIN	25.53	25.53	100.0
OXYGEN	SCFM	20.72	20.72	100.0
			19.60 TO H2O	
			1.11 TO CO&CO2	
			0.02 GAS	
WATER	#/MIN	3.09	1.73	55.8
		1.23 SHALE	0.32 LIQ	
		1.86 COMB	1.33 VAP	
			0.07 SHALE	
KEROGEN	#/MIN	6.71	5.91	88.2
			0.82 SHALE	
			4.31 OIL	
			0.76 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	5.85	4.91	84.0
			0.78 SHALE	
			3.66 OIL	
			0.46 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.66	6.72	87.8
			2.08 SHALE	
			3.66 OIL	
			0.97 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.72	0.83	116.0
			0.04 SHALE	
			0.50 OIL	
			0.30 GAS	
			0.09 WATER	
ORG. NITROGE.'	#/MIN	0.23	0.20	85.2
SULFUR	#/MIN	0.33	0.32	95.1
			0.26 SHALE	
			0.03 OIL	
			0.01 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	47.64	43.68	91.7

0.061 #/MIN C 0.287 #/MIN H 0.293 C/H COMB RATIO
86.05 VOL%FA 86.93WT.%FA

***PILOT PLANT ***
***PILOT PLANT FORCED AIR MB BALANCE ***
STARTING DATE 12677 TO 12777

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	77.94	77.94	100.0
ASH	#/MIN	25.53	25.53	100.0
OXYGEN	SCFM	20.72	20.72	100.0
			8.72 TO H2O	
			11.97 TO CO&CO2	
			0.02 GAS	
WATER	#/MIN	2.06	2.43	117.9
		1.23 SHALE	0.32 LIQ	
		0.83 COMB	2.03 VAP	
			0.07 SHALE	
KEROGEN	#/MIN	6.71	6.36	94.8
			0.82 SHALE	
			4.31 OIL	
			1.21 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	5.85	5.43	92.8
			0.78 SHALE	
			3.66 OIL	
			0.97 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.66	7.24	94.5
			2.08 SHALE	
			3.66 OIL	
			1.48 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.72	0.77	106.6
			0.04 SHALE	
			0.50 OIL	
			0.23 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.23	0.21	92.4
SULFUR	#/MIN	0.33	0.32	97.3
			0.26 SHALE	
			0.03 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	47.64	47.90	100.6

0.423 #/MIN C 0.092 #/MIN H 4.597 C/H COMB RATIO
86.05 VOL%FA 86.93WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 12677 TO 12777

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	77.94	77.94	100.0
ASH	#/MIN	23.61	23.61	100.0
OXYGEN	SCFM	20.72	20.72	100.0
			7.25 TO H2O	
			13.44 TO CO&CO2	
			0.02 GAS	
WATER	#/MIN	1.83	2.42	132.6
		1.14 SHALE	0.32 LIQ	
		0.69 COMB	2.03 VAP	
			0.07 SHALE	
KEROGEN	#/MIN	6.20	6.32	102.0
			0.76 SHALE	
			4.31 OIL	
			1.23 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	5.41	5.41	99.9
			0.72 SHALE	
			3.66 OIL	
			1.01 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.08	7.08	100.0
			1.92 SHALE	
			3.66 OIL	
			1.48 GAS	
			0.02 WATER	
ORG. HYDROGEN	#/MIN	0.66	0.75	112.6
			0.03 SHALE	
			0.50 OIL	
			0.21 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.21	97.9
SULFUR	#/MIN	0.31	0.30	98.8
			0.24 SHALE	
			0.03 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	44.61	45.56	102.1

0.470 #/MIN C 0.077 #/MIN H 6.140 C/H COMB RATIO
93.07 VOL%FA 94.82WT.%FA

***PILOT PLANT ***
STARTING DATE 22578 TO 22678

DATA SUMMARY

STARTING DATE 12677 TO 12777

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	12.49	H2O FA	WT%	2.09
OIL FA	GPT	32.80			
MIN CO2	WT%	16.68	ASH	WT%	64.33
CARBON	WT%	19.29	HYDROGEN	WT%	2.04
NITROGEN	WT%	0.58	SULFUR	WT%	0.84

RAW SHALE MOISTURE WT% (UNGROUND) 1.00

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)	FACTORS	
2.120	2.85	DA (IN.)=	1.20
1.500	48.86	DV (IN.)=	1.44
1.050	23.38	DV/DA =	1.21
0.742	13.12		
0.525	7.98		
0.371	1.71		
0.263	1.14		
0.185	0.19		
0.131	0.19		
PAN	0.57		

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	10.2
VIS	SUS-130	97.7	SEDIMENT	ML/100G	0.7
VIS	SUS-210	48.1	POUR	DEG F	85.0
CARBON	WT%	34.89	HYDROGEN	WT%	11.50
NITROGEN	WT%	2.31	SULFUR	WT%	0.62

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.9	WATER	WT%	7.9

PRODUCT WATER PROPERTIES

CARBON	WT%	4.71	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.70	SULFUR	WT%	4.02
CO2	WT%	3.56			

***PILOT PLANT ***

STARTING DATE 12677 TO 12777

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.26	C2H4	VOL%	0.66
N2+AR	VOL%	63.00	C2H6	VOL%	0.76
O2	VOL%	0.02	C3'S	VOL%	0.49
CO	VOL%	2.71	C4'S	VOL%	0.56
CH4	VOL%	1.93	C5+	VOL%	0.34
CO2	VOL%	24.03	H2S	VOL%	0.20
			NH3	VOL%	1.04

GROSS HEAT BTU/SCF 124.15

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.05			
OIL FA	GPT	0.13			
MIN CO2	WT%	15.32	ASH	WT%	82.27
CARBON	WT%	6.70	HYDROGEN	WT%	0.14
NITROGEN	WT%	0.18	SULFUR	WT%	0.85

TEMPERATURES DEG F

RAW SHALE IN	30	RET SHALE OUT	386
AIR TD IN	184	AIR MD IN	184
GAS BD IN	282	GAS MD IN	282
GAS TD IN	232	GAS PROD OUT	282
COOLING WATER IN	66	COOLING WATER OUT	70
PRODUCT OIL OUT	135		
AMBIENT AIR	30	OFF GAS	162

RATES AND QUANTITIES

RAW SHALE	TPH	1.19	THROUGHPUT PHF2		483.5
RET SHALE	TPH	0.92	RET/RAW	WT%	78.2
AIR TOP	SCFM	71.3		SCF/T	3594.3
AIR MID	SCFM	27.3		SCF/T	1377.4
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	98.7		SCF/T	4971.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		25.684			
SP GR		0.958			
GAS TOP	SCFM	17.2		SCF/T	868.3
GAS MID	SCFM	40.7		SCF/T	2052.6
GAS BTM	SCFM	263.9		SCF/T	13299.8
TOTAL GAS	SCFM	321.9		SCF/T	16220.8
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	108.8		SCF/T	5485.0
COOLING WATER	GPM	65.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	72.0	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 86.0

OIL YIELD VOL% FA= 85.1

APPENDIX 3.2

PILOT PLANT RETORTING RESEARCH - RICH SHALE

***PILOT PLANT ***
STARTING DATE 22578 TO 22678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	77.20	101.18	131.1
ASH	#/MIN	28.57	28.57	100.0
OXYGEN	SCFM	20.52	20.52	100.0
			8.21 TO H2O	
			12.31 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.77	1.00	36.2
		1.99 SHALE	0.13 LIQ	
		0.78 COMB	0.87 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.08	7.56	93.5
			1.05 SHALE	
			5.21 OIL	
			1.29 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.42	6.36	85.8
			0.99 SHALE	
			4.35 OIL	
			1.01 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	9.46	8.41	88.9
			2.61 SHALE	
			4.35 OIL	
			1.44 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.88	0.89	101.0
			0.06 SHALE	
			0.59 OIL	
			0.24 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.26	0.22	84.4
SULFUR	#/MIN	0.49	0.43	88.7
			0.35 SHALE	
			0.03 OIL	
			0.04 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	53.63	53.44	99.7

0.439 #/MIN C 0.087 #/MIN H 5.063 C/H COMB RATIO
82.70 VOL%FA 83.97WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 22578 TO 22678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	77.20	77.20	100.0
ASH	#/MIN	28.57	28.57	100.0
OXYGEN	SCFM	20.52	20.52	100.0
			15.33 TO H2O	
			5.19 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	3.45	0.80	23.1
		1.99 SHALE	0.13 LIQ	
		1.46 COMB	0.66 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.08	7.25	89.7
			1.05 SHALE	
			5.21 OIL	
			0.98 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.42	6.02	81.2
			0.99 SHALE	
			4.35 OIL	
			0.67 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	9.46	8.07	85.2
			2.61 SHALE	
			4.35 OIL	
			1.10 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.88	0.93	105.4
			0.06 SHALE	
			0.59 OIL	
			0.28 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.26	0.21	81.2
SULFUR	#/MIN	0.49	0.42	86.6
			0.35 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	53.63	50.45	94.1

0.199 #/MIN C 0.162 #/MIN H 1.230 C/H COMB RATIO
82.70 VOL%FA 83.97WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 22578 TO 22678

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	77.20	77.20	100.0
ASH	#/MIN	22.75	22.75	100.0
OXYGEN	SCFM	20.52	20.52	100.0
			11.72 TO H2O	
			8.80 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.70	0.80	29.5
		1.59 SHALE	0.13 LIQ	
		1.11 COMB	0.66 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	6.44	7.08	110.1
			0.84 SHALE	
			5.21 OIL	
			1.02 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	5.91	5.91	100.0
			0.79 SHALE	
			4.35 OIL	
			0.76 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.54	7.54	100.0
			2.08 SHALE	
			4.35 OIL	
			1.10 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.70	0.88	125.2
			0.05 SHALE	
			0.59 OIL	
			0.24 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.20	95.1
SULFUR	#/MIN	0.39	0.35	90.5
			0.28 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	44.23	43.23	97.7

0.316 #/MIN C 0.124 #/MIN H 2.552 C/H COMB RATIO
103.84 VOL%FA 105.44WT.%FA

DATA SUMMARY

STARTING DATE 22578 TO 22678
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	13.64	H2O FA	WT%	2.96
OIL FA	GPT	35.70			
MIN CO2	WT%	16.49	ASH	WT%	62.79
CARBON	WT%	20.80	HYDROGEN	WT%	2.27
NITROGEN	WT%	0.58	SULFUR	WT%	1.07

RAW SHALE MOISTURE WT% (UNGROUND) 1.40

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.6	WATER	WT%	2.8
VIS	SUS-130	99.3	SEDIMENT	ML/100G	3.4
VIS	SUS-210	47.9	POUR	DEG F	85.0
CARBON	WT%	83.53	HYDROGEN	WT%	11.35
NITROGEN	WT%	2.15	SULFUR	WT%	0.66

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.6	WATER	WT%	2.8

PRODUCT WATER PROPERTIES

CARBON	WT%	4.49	HYDROGEN	WT%	10.37
NITROGEN	WT%	2.80	SULFUR	WT%	4.18
CO2	WT%	5.21			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.14	C2H4	VOL%	0.68
N2+AR	VOL%	67.97	C2H6	VOL%	0.59
O2	VOL%	0.00	C3'S	VOL%	0.39
CO	VOL%	2.57	C4'S	VOL%	0.28
CH4	VOL%	2.15	C5+	VOL%	0.32
CO2	VOL%	18.90	H2S	VOL%	0.36
			NH3	VOL%	0.64

GROSS HEAT BTU/SCF 110.41

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	15.73	ASH	WT%	80.60
CARBON	WT%	7.36	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.20	SULFUR	WT%	0.98

TEMPERATURES DEG F

RAW SHALE IN	40	RET SHALE OUT	399
AIR TD IN	235	AIR MD IN	205
GAS BD IN	293	GAS MD IN	293
GAS TD IN	293	GAS PROD OUT	293
COOLING WATER IN	91	COOLING WATER OUT	99
PRODUCT OIL OUT	142		
AMBIENT AIR	40	OFF GAS	146

RATES AND QUANTITIES

RAW SHALE	TPH	1.37	THROUGHPUT PHF2		554.3
RET SHALE	TPH	1.06	RET/RAW	WT%	77.9
AIR TOP	SCFM	70.9		SCF/T	3117.0
AIR MID	SCFM	26.8		SCF/T	1178.3
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	97.7		SCF/T	4295.3

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		10.938			
SP GR		0.988			
GAS TOP	SCFM	17.2		SCF/T	754.6
GAS MID	SCFM	39.9		SCF/T	1755.3
GAS BTM	SCFM	227.1		SCF/T	9981.9
TOTAL GAS	SCFM	284.2		SCF/T	12491.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	167.2		SCF/T	7347.1
COOLING WATER	GPM	21.0	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	58.0	BED PD IN H2O/FT		0.9

OIL YIELD WT% FA= 83.9
OIL YIELD VOL% FA= 82.7

***PILOT PLANT ***
STARTING DATE 22678 TO 22778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	76.99	87.48	113.6
ASH	#/MIN	28.61	28.61	100.0
OXYGEN	SCFM	20.47	20.47	100.0
			0.92 TO H2O	
			19.54 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.83	0.95	51.8
		1.74 SHALE	0.10 LIQ	
		0.09 COMB	0.85 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.26	8.67	105.0
			1.06 SHALE	
			5.68 OIL	
			1.93 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.39	7.36	99.6
			1.00 SHALE	
			4.73 OIL	
			1.63 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	9.47	9.44	99.7
			2.71 SHALE	
			4.73 OIL	
			2.00 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.89	0.96	108.2
			0.06 SHALE	
			0.64 OIL	
			0.26 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.26	0.25	94.7
SULFUR	#/MIN	0.48	0.46	96.1
			0.36 SHALE	
			0.04 OIL	
			0.06 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	53.69	54.38	101.3

0.675 #/MIN C 0.010 #/MIN H 69.170 C/H COMB RATIO
88.40 VOL%FA 89.77WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 22678 TO 22778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	76.99	76.99	100.0
ASH	#/MIN	28.61	28.61	100.0
OXYGEN	SCFM	20.47	20.47	100.0
			5.19 TO H2O	
			15.28 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.24	0.85	37.8
		1.74 SHALE	0.10 LIQ	
		0.49 COMB	0.75 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.26	8.44	102.2
			1.06 SHALE	
			5.68 OIL	
			1.70 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.39	7.12	96.4
			1.00 SHALE	
			4.73 OIL	
			1.39 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	9.47	9.20	97.2
			2.71 SHALE	
			4.73 OIL	
			1.76 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.89	0.98	109.9
			0.06 SHALE	
			0.64 OIL	
			0.27 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.26	0.24	92.3
SULFUR	#/MIN	0.48	0.45	94.7
			0.36 SHALE	
			0.04 OIL	
			0.05 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	59.69	52.85	98.4

0.532 #/MIN C 0.055 #/MIN H 9.714 C/H COMB RATIO
88.40 VOL.%FA 89.77WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 22678 TO 22778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	76.99	76.99	100.0
ASH	#/MIN	27.47	27.47	100.0
OXYGEN	SCFM	20.47	20.47	100.0
			4.55 TO H2O	
			15.91 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.11	0.85	40.2
		1.67 SHALE	0.10 LIQ	
		0.43 COMB	0.75 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	7.93	8.41	106.0
			1.02 SHALE	
			5.68 OIL	
			1.70 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.10	7.10	100.0
			0.96 SHALE	
			4.73 OIL	
			1.40 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	9.10	9.10	100.0
			2.60 SHALE	
			4.73 OIL	
			1.76 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.85	0.97	113.4
			0.06 SHALE	
			0.64 OIL	
			0.27 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.25	0.24	94.9
SULFUR	#/MIN	0.46	0.44	95.5
			0.34 SHALE	
			0.04 OIL	
			0.05 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	51.86	51.43	99.2

0.552 #/MIN C 0.048 #/MIN H 11.490 C/H COMB RATIO
92.04 VOL%FR 93.47WT.%FR

DATA SUMMARY

STARTING DATE 22678 TO 22778
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	13.82	H2O FA	WT%	2.80
OIL FA	GPT	36.20			
MIN CO2	WT%	16.66	ASH	WT%	62.50
CARBON	WT%	20.69	HYDROGEN	WT%	2.25
NITROGEN	WT%	0.57	SULFUR	WT%	1.05

RAW SHALE MOISTURE WT% (UNGROUND) 1.00

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.7	WATER	WT%	1.9
VIS	SUS-130	96.1	SEDIMENT	ML/100G	2.0
VIS	SUS-210	47.4	POUR	DEG F	85.0
CARBON	WT%	83.24	HYDROGEN	WT%	11.31
NITROGEN	WT%	2.01	SULFUR	WT%	0.73

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.7	WATER	WT%	1.9

PRODUCT WATER PROPERTIES

CARBON	WT%	1.49	HYDROGEN	WT%	10.37
NITROGEN	WT%	2.80	SULFUR	WT%	4.18
CO2	WT%	5.21			

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PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	6.17	C2H4	VOL%	0.78
N2+AR	VOL%	59.32	C2H6	VOL%	0.59
O2	VOL%	0.00	C3'S	VOL%	2.50
CO	VOL%	2.90	C4'S	VOL%	0.53
CH4	VOL%	2.82	C5+	VOL%	0.32
CO2	VOL%	22.65	H2S	VOL%	0.47
			NH3	VOL%	0.94

GROSS HEAT BTU/SCF 186.68

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	17.49	ASH	WT%	79.88
CARBON	WT%	7.57	HYDROGEN	WT%	0.16
NITROGEN	WT%	3.22	SULFUR	WT%	1.00

TEMPERATURES DEG F

RAW SHALE IN	43	RET SHALE OUT	408
AIR TD IN	235	AIR MD IN	205
GAS BD IN	295	GAS MD IN	295
GAS TD IN	295	GAS PROD OUT	295
COOLING WATER IN	39	COOLING WATER OUT	96
PRODUCT OIL OUT	144		
AMBIENT AIR	43	OFF GAS	151

RATES AND QUANTITIES

RAW SHALE	TPH	1.37	THROUGHPUT PHF2		557.6
RET SHALE	TPH	1.07	RET/RAW	WT%	78.2
AIR TOP	SCFM	70.7		SCF/T	3890.4
AIR MID	SCFM	26.7		SCF/T	1168.3
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	97.5		SCF/T	4258.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		10.840			
SP GR		1.010			
GAS TOP	SCFM	17.1		SCF/T	747.1
GAS MID	SCFM	39.0		SCF/T	1737.6
GAS BTM	SCFM	226.1		SCF/T	9881.8
TOTAL GAS	SCFM	283.0		SCF/T	12366.6
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	165.4		SCF/T	7227.1
COOLING WATER	GPM	21.0	BARO PRESS IN HG		23.9
AMB AIR REL HUM	%	63.0	BED PD IN H2O/FT		0.9

OIL YIELD WT% FA= 89.7
OIL YIELD VOL% FA= 88.4

***PICUT PLANT ***
STARTING DATE 30178 TO 30278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.78	76.16	110.7
ASH	#/MIN	28.02	28.02	100.0
OXYGEN	SCFM	18.28	18.28	100.0
			11.80 TO H2O	
			6.46 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.62	1.49	57.0
		1.50 SHALE	0.15 LIQ	
		1.12 COMB	1.34 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	7.67	7.10	92.6
			1.16 SHALE	
			4.93 OIL	
			1.00 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.00	5.98	85.4
			1.10 SHALE	
			4.15 OIL	
			0.72 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	9.10	8.08	88.8
			2.65 SHALE	
			4.15 OIL	
			1.27 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.87	0.88	101.0
			0.06 SHALE	
			0.56 OIL	
			0.25 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.25	0.23	91.7
SULFUR	#/MIN	0.43	0.38	89.1
			0.32 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
OVERALL WEIGHT	#/MIN	51.54	50.95	98.9

0.249 #/MIN C 0.125 #/MIN H 2.000 C/H COMB RATIO
78.70 VOL.%FA 79.84WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 30178 TO 30278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.78	68.78	100.0
ASH	#/MIN	28.02	28.02	100.0
OXYGEN	SCFM	18.28	18.28	100.0
			14.49 TO H2O	
			3.77 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.87	1.36	47.4
		1.50 SHALE	0.15 LIQ	
		1.38 COMB	1.21 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	7.67	6.99	91.1
			1.16 SHALE	
			4.93 OIL	
			0.89 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.00	5.86	83.7
			1.10 SHALE	
			4.15 OIL	
			0.60 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	9.10	7.96	87.4
			2.65 SHALE	
			4.15 OIL	
			1.14 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.87	0.89	102.8
			0.06 SHALE	
			0.56 OIL	
			0.27 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.25	0.23	90.6
SULFUR	#/MIN	0.43	0.38	88.5
			0.32 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	51.54	49.90	96.8

0.159 #/MIN C 0.153 #/MIN H 1.037 C/H COMB RATIO
78.70 VOL%FA 79.84WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 30178 TO 30278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.78	68.78	100.0
ASH	#/MIN	23.06	23.06	100.0
OXYGEN	SCFM	18.28	18.28	100.0
			10.71 TO H2O	
			7.54 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2:25	1.36	60.5
		1.23 SHALE	0.15 LIQ	
		1.02 COMB	1.21 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	6.31	6.84	108.4
			0.95 SHALE	
			4.93 OIL	
			0.95 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	5.76	5.76	100.6
			0.90 SHALE	
			4.15 OIL	
			0.70 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.49	7.49	100.0
			2.18 SHALE	
			4.15 OIL	
			1.14 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.71	0.84	117.9
			0.05 SHALE	
			0.56 OIL	
			0.23 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.21	103.4
SULFUR	#/MIN	0.35	0.32	91.7
			0.26 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	43.59	43.69	100.2

0.280 #/MIN C 0.113 #/MIN H 2.477 C/H COMB RATIO
95.65 VOL%FA 97.04WT.%FA

DATA SUMMARY

STARTING DATE 30178 TO 30278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	13.90	H2O FA	WT%	2.38
OIL FA	GPT	36.40			
MIN CO2	WT%	17.30	ASH	WT%	63.06
CARBON	WT%	20.48	HYDROGEN	WT%	2.22
NITROGEN	WT%	0.56	SULFUR	WT%	0.96

RAW SHALE MOISTURE WT% (UNGROUND) 0.98

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	3.3
VIS	SUS-130	92.1	SEDIMENT	ML/100G	3.0
VIS	SUS-210	48.0	POUR	DEG F	85.0
CARBON	WT%	34.20	HYDROGEN	WT%	11.40
NITROGEN	WT%	2.35	SULFUR	WT%	0.63

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	3.3

PRODUCT WATER PROPERTIES

CARBON	WT%	4.50	HYDROGEN	WT%	10.28
NITROGEN	WT%	2.98	SULFUR	WT%	3.76
CO2	WT%	5.15			

OIL YIELD VOL% FM= 73.7

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	6.16	C2H4	VOL%	0.82
N2+AR	VOL%	63.33	C2H6	VOL%	0.74
O2	VOL%	0.02	C3'S	VOL%	0.63
CO	VOL%	2.95	C4'S	VOL%	0.20
CH4	VOL%	2.53	C5+	VOL%	0.06
CO2	VOL%	21.60	H2S	VOL%	0.28
			NH3	VOL%	0.69

GROSS HEAT BTU/SCF 113.37

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	15.28	ASH	WT%	80.03
CARBON	WT%	7.58	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.22	SULFUR	WT%	0.90

TEMPERATURES DEG F

RAW SHALE IN	33	RET SHALE OUT	381
AIR TD IN	198	AIR MD IN	198
GAS BD IN	295	GAS MD IN	295
GAS TD IN	295	GAS PROD OUT	295
COOLING WATER IN	36	COOLING WATER OUT	92
PRODUCT OIL OUT	149		
AMBIENT AIR	33	OFF GAS	154

RATES AND QUANTITIES

RAW SHALE	TPH	1.33	THROUGHPUT PHF2		541.4
RET SHALE	TPH	1.05	RET/RAW	WT%	78.8
AIR TOP	SCFM	71.1		SCF/T	3199.6
AIR MID	SCFM	16.0		SCF/T	719.3
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	87.1		SCF/T	3918.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.060			
SP GR		0.953			
GAS TOP	SCFM	17.0		SCF/T	765.9
GAS MID	SCFM	22.5		SCF/T	1011.4
GAS BTM	SCFM	231.9		SCF/T	10438.2
TOTAL GAS	SCFM	271.4		SCF/T	12215.6
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	148.6		SCF/T	6687.0
COOLING WATER	GPM	20.0	BARO PRESS IN HG		23.7
AMB AIR REL HUM	%	94.0	BED PD IN H2O/FT		0.9

OIL YIELD WT% FA= 79.7
OIL YIELD VOL% FA= 73.7

***PILOT PLANT ***
STARTING DATE 30278 TO 30378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.64	74.17	108.1
ASH	#/MIN	28.64	28.64	100.0
OXYGEN	SCFM	18.25	18.24	100.0
			5.36 TO H2O	
			12.85 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.06	1.54	74.9
		1.55 SHALE	0.21 LIQ	
		0.51 COMB	1.33 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.64	7.19	83.3
			1.07 SHALE	
			4.96 OIL	
			1.16 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.21	6.15	85.3
			1.00 SHALE	
			4.19 OIL	
			0.95 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	9.35	8.30	88.7
			2.79 SHALE	
			4.19 OIL	
			1.31 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.90	0.82	91.2
			0.06 SHALE	
			0.56 OIL	
			0.19 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.25	0.21	81.4
SULFUR	#/MIN	0.44	0.40	91.6
			0.34 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	53.35	52.07	97.6

0.457 #/MIN C 0.057 #/MIN H 8.082 C/H COMB RATIO
76.74 VOL%FA 77.79WT.%FA

***PILOT PLANT FUNCLO MIN. N2 BALANCE ***
STARTING DATE 30278 TO 30378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.64	68.64	100.0
ASH	#/MIN	28.64	28.64	100.0
OXYGEN	SCFM	18.25	18.24	100.0
			7.50 TO H2O	
			10.72 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.26	1.44	63.8
		1.55 SHALE	0.21 LIQ	
		0.71 COMB	1.23 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.64	7.11	82.3
			1.07 SHALE	
			4.96 OIL	
			1.07 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.21	6.05	83.9
			1.00 SHALE	
			4.19 OIL	
			0.85 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	9.35	8.20	87.7
			2.79 SHALE	
			4.19 OIL	
			1.22 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.90	0.83	92.6
			0.06 SHALE	
			0.56 OIL	
			0.20 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.25	0.21	80.5
SULFUR	#/MIN	0.44	0.40	91.1
			0.34 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	53.35	51.26	96.1

0.385 #/MIN C 0.079 #/MIN H 4.867 C/H COMB RATIO
76.74 VOL%FA 77.79WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 30278 TO 30378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.64	68.64	100.0
ASH	#/MIN	23.60	23.60	100.0
OXYGEN	SCFM	18.25	18.24	100.0
			4.73 TO H2O	
			13.49 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.72	1.44	83.6
		1.27 SHALE	0.21 LIQ	
		0.45 COMB	1.23 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	7.12	6.95	97.7
			0.88 SHALE	
			4.96 OIL	
			1.11 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	5.94	5.94	99.9
			0.82 SHALE	
			4.19 OIL	
			0.92 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.71	7.71	100.0
			2.30 SHALE	
			4.19 OIL	
			1.22 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.74	0.79	106.8
			0.05 SHALE	
			0.56 OIL	
			0.17 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.19	90.4
SULFUR	#/MIN	0.36	0.34	94.3
			0.28 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	45.13	44.92	99.5

0.475 #/MIN C 0.050 #/MIN H 9.526 C/H COMB RATIO
93.11 VOL%FA 94.38WT.%FA

DATA SUMMARY

STARTING DATE 30278 TO 30378
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	13.75	H2O FA	WT%	2.55
OIL FA	GPT	36.00			
MIN CO2	WT%	17.00	ASH	WT%	61.81
CARBON	WT%	20.19	HYDROGEN	WT%	2.22
NITROGEN	WT%	0.55	SULFUR	WT%	0.95

RAW SHALE MOISTURE WT% (UNGROUND) 0.78

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	4.5
VIS	SUS-130	93.0	SEDIMENT	ML/100G	4.9
VIS	SUS-210	47.7	POUR	DEG F	85.0
CARBON	WT%	34.49	HYDROGEN	WT%	11.37
NITROGEN	WT%	1.69	SULFUR	WT%	0.64

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.9	WATER	WT%	4.5

PRODUCT WATER PROPERTIES

CARBON	WT%	4.50	HYDROGEN	WT%	10.28
NITROGEN	WT%	2.98	SULFUR	WT%	3.76
CO2	WT%	5.15			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.98	C2H4	VOL%	0.94
N2+AR	VOL%	62.17	C2H6	VOL%	0.69
O2	VOL%	0.02	C3'S	VOL%	0.69
CO	VOL%	3.30	C4'S	VOL%	0.20
CH4	VOL%	2.65	C5+	VOL%	0.06
CO2	VOL%	22.35	H2S	VOL%	0.28
			NH3	VOL%	0.69

GROSS HEAT BTU/SCF 117.56

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	13.14	ASH	WT%	79.38
CARBON	WT%	7.72	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.24	SULFUR	WT%	0.93

TEMPERATURES DEG F

RAW SHALE IN	36	RET SHALE OUT	369
AIR TD IN	197	AIR MD IN	197
GAS BD IN	233	GAS MD IN	283
GAS TD IN	233	GAS PROD OUT	283
COOLING WATER IN	75	COOLING WATER OUT	83
PRODUCT OIL OUT	150		
AMBIENT AIR	36	OFF GAS	166

RATES AND QUANTITIES

RAW SHALE	TPH	1.39	THROUGHPUT PHF2		564.5
RET SHALE	TPH	1.08	RET/RAW	WT%	77.9
AIR TOP	SCFM	70.9		SCF/T	3061.9
AIR MID	SCFM	15.9		SCF/T	688.4
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	86.9		SCF/T	3750.3

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.060			
SP GR		0.958			
GAS TOP	SCFM	17.4		SCF/T	749.5
GAS MID	SCFM	22.9		SCF/T	989.0
GAS BTM	SCFM	240.1		SCF/T	10362.6
TOTAL GAS	SCFM	280.4		SCF/T	12101.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	147.4		SCF/T	6362.5
COOLING WATER	GPM	20.6	BARO PRESS IN HG		23.7
AMB AIR REL HUM	%	94.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 77.7
OIL YIELD VOL% FA= 75.7

***PILOT PLANT ***
STARTING DATE 31378 TO 31478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	78.45	80.12	102.1
ASH	#/MIN	25.65	25.65	100.0
OXYGEN	SCFM	20.85	20.85	100.0
			13.31 TO H2O	
			7.51 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.57	1.39	53.9
		1.31 SHALE	0.23 LIQ	
		1.26 COMB	1.15 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.11	7.11	87.7
			1.26 SHALE	
			4.63 OIL	
			1.21 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	7.11	6.07	85.4
			1.21 SHALE	
			3.96 OIL	
			0.89 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	8.93	7.90	88.4
			2.45 SHALE	
			3.96 OIL	
			1.48 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.85	0.87	102.5
			0.05 SHALE	
			0.52 OIL	
			0.30 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.26	0.23	86.7
SULFUR	#/MIN	0.42	0.34	82.2
			0.28 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	49.36	47.95	97.1

0.287 #/MIN C 0.141 #/MIN H 2.040 C/H COMB RATIO
79.82 VOL%FA 81.06WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 31378 TO 31478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	78.45	78.45	100.0
ASH	#/MIN	25.65	25.65	100.0
OXYGEN	SCFM	20.85	20.85	100.0
			13.94 TO H2O	
			6.88 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.63	1.36	51.8
		1.31 SHALE	0.23 LIQ	
		1.32 COMB	1.13 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.11	7.08	87.3
			1.26 SHALE	
			4.63 OIL	
			1.18 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	7.11	6.04	84.9
			1.21 SHALE	
			3.96 OIL	
			0.86 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	8.93	7.87	88.1
			2.45 SHALE	
			3.96 OIL	
			1.45 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.85	0.87	102.9
			0.05 SHALE	
			0.52 OIL	
			0.31 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.26	0.23	86.3
SULFUR	#/MIN	0.42	0.34	82.1
			0.28 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	49.36	47.71	96.7

0.266 #/MIN C 0.147 #/MIN H 1.805 C/H COMB RATIO
79.82 VOL%FA 81.06WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 31378 TO 31478 :

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	78.45	78.45	100.0
ASH	#/MIN	21.43	21.43	100.0
OXYGEN	SCFM	20.85	20.85	100.0
			10.25 TO H2O	
			10.58 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.06	1.36	66.0
		1.09 SHALE	0.23 LIQ	
		0.97 COMB	1.13 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	6.77	6.93	102.3
			1.05 SHALE	
			4.63 OIL	
			1.24 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	5.94	5.93	99.9
			1.01 SHALE	
			3.96 OIL	
			0.96 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.46	7.46	100.0
			2.04 SHALE	
			3.96 OIL	
			1.45 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.71	0.83	116.6
			0.04 SHALE	
			0.52 OIL	
			0.27 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.22	98.1
SULFUR	#/MIN	0.35	0.30	85.2
			0.23 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	42.49	42.50	100.0

0.384 #/MIN C 0.108 #/MIN H 3.553 C/H COMB RATIO
95.53 VOL%FA 97.02WT.%FA

DATA SUMMARY

STARTING DATE 31378 TO 31478
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	13.81	H2O FA	WT%	2.15
OIL FA	GPT	36.20			
MIN CO2	WT%	16.20	ASH	WT%	62.04
CARBON	WT%	21.61	HYDROGEN	WT%	2.29
NITROGEN	WT%	0.64	SULFUR	WT%	1.01

RAW SHALE MOISTURE WT% (UNGROUND) 1.00

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	5.4
VIS	SUS-130	98.1	SED'MENT	ML/100G	0.2
VIS	SUS-210	48.8	POUR	DEG F	85.0
CARBON	WT%	85.59	HYDROGEN	WT%	11.16
NITROGEN	WT%	2.12	SULFUR	WT%	0.59

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	5.4

PRODUCT WATER PROPERTIES

CARBON	WT%	4.21	HYDROGEN	WT%	10.31
NITROGEN	WT%	2.96	SULFUR	WT%	4.35
CO2	WT%	5.00			

***PILOT PLANT FORCED MIN. N2 BALANCE ***

STARTING DATE 31378 TO 31478

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.90	C2H4	VOL%	0.82
N2+AR	VOL%	62.50	C2H6	VOL%	0.73
O2	VOL%	0.02	C3'S	VOL%	0.64
CO	VOL%	2.93	C4'S	VOL%	0.19
CH4	VOL%	2.46	C5+	VOL%	0.49
CO2	VOL%	21.90	H2S	VOL%	0.28
			NH3	VOL%	1.14

GROSS HEAT BTU/SCF 136.81

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.04			
MIN CO2	WT%	14.34	ASH	WT%	81.02
CARBON	WT%	7.73	HYDROGEN	WT%	0.15
NITROGEN	WT%	0.22	SULFUR	WT%	0.87

TEMPERATURES DEG F

RAW SHALE IN	33	RET SHALE OUT	411
AIR TD IN	199	AIR MD IN	199
GAS BD IN	293	GAS MD IN	293
GAS TD IN	293	GAS PROD OUT	293
COOLING WATER IN	71	COOLING WATER OUT	75
PRODUCT OIL OUT	140		
AMBIENT AIR	33	OFF GAS	147

RATES AND QUANTITIES

RAW SHALE	TPH	1.24	THROUGHPUT PHF2		503.7
RET SHALE	TPH	0.95	RET/RAW	WT%	76.6
AIR TOP	SCFM	61.0		SCF/T	2951.5
AIR MID	SCFM	38.3		SCF/T	1852.3
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	99.3		SCF/T	4803.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		15.930			
SP GR		0.977			
GAS TOP	SCFM	16.3		SCF/T	788.9
GAS MID	SCFM	55.5		SCF/T	2686.1
GAS BTM	SCFM	184.0		SCF/T	8903.4
TOTAL GAS	SCFM	255.9		SCF/T	12378.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	152.5		SCF/T	7377.2
COOLING WATER	GPM	21.9	BARO PRESS IN HG		28.8
AMB AIR REL HUM	%	82.6	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 81.0

OIL YIELD VOL% FA= 79.8

***PILOT PLANT ***
STARTING DATE 31478 TO 31578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	79.40	89.02	112.1
ASH	#/MIN	25.89	25.89	100.0
OXYGEN	SCFM	21.11	21.11	100.0
			5.43 TO H2O	
			15.68 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.83	0.72	39.2
		1.32 SHALE	0.09 LIQ	
		0.52 COMB	0.63 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.23	6.96	84.6
			1.06 SHALE	
			4.66 OIL	
			1.24 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.18	6.02	83.9
			1.02 SHALE	
			3.99 OIL	
			1.01 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	9.04	7.88	87.2
			2.25 SHALE	
			3.99 OIL	
			1.64 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.87	0.75	87.1
			0.04 SHALE	
			0.53 OIL	
			0.18 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.27	0.20	72.5
SULFUR	#/MIN	0.41	0.35	86.0
			0.27 SHALE	
			0.03 OIL	
			0.05 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	49.93	48.71	97.6

0.559 #/MIN C 0.057 #/MIN H 9.752 C/H COMB RATIO
78.44 VOL%FA 79.61WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 31478 TO 31578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	79.40	79.40	100.0
ASH	#/MIN	25.89	25.89	100.0
OXYGEN	SCFM	21.11	21.11	100.0
			9.69 TO H2O	
			11.42 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.24	0.65	29.1
		1.32 SHALE	0.09 LIQ	
		0.92 COMB	0.56 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	8.23	6.81	82.8
			1.06 SHALE	
			4.66 OIL	
			1.09 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	7.18	5.85	81.4
			1.02 SHALE	
			3.99 OIL	
			0.84 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	9.04	7.70	85.2
			2.25 SHALE	
			3.99 OIL	
			1.46 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.87	0.79	90.7
			0.04 SHALE	
			0.53 OIL	
			0.21 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.27	0.19	71.5
SULFUR	#/MIN	0.41	0.34	84.7
			0.27 SHALE	
			0.03 OIL	
			0.04 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	49.93	47.37	94.9

0.416 #/MIN C 0.102 #/MIN H 4.066 C/H COMB RATIO
78.44 VOL%FA 79.61WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 31478 TO 31578

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	79.40	79.40	100.0
ASH	#/MIN	20.80	20.80	100.0
OXYGEN	SCFM	21.11	21.11	100.0
			5.02 TO H2O	
			16.08 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.54	0.65	42.3
		1.06 SHALE	0.09 LIQ	
		0.48 COMB	0.56 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	6.61	6.68	101.0
			0.85 SHALE	
			4.66 OIL	
			1.16 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	5.77	5.77	100.0
			0.82 SHALE	
			3.99 OIL	
			0.96 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.26	7.26	100.0
			1.80 SHALE	
			3.99 OIL	
			1.46 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.70	0.73	104.7
			0.03 SHALE	
			0.53 OIL	
			0.17 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.18	82.4
SULFUR	#/MIN	0.33	0.29	89.1
			0.22 SHALE	
			0.03 OIL	
			0.04 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	41.63	41.18	98.9

0.565 #/MIN C 0.053 #/MIN H 10.665 C/H COMB RATIO
97.63 VOL%FA 99.08WT.%FA

DATA SUMMARY

STARTING DATE 31478 TO 31578
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	14.01	H2O FA	WT%	2.14
OIL FA	GPT	36.70			
MIN CO2	WT%	16.26	ASH	WT%	61.92
CARBON	WT%	21.61	HYDROGEN	WT%	2.31
NITROGEN	WT%	0.65	SULFUR	WT%	0.97

RAW SHALE MOISTURE WT% (UNGROUND) 1.00

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	2.2
VIS	SUS-130	97.9	SEDIMENT	ML/100G	0.3
VIS	SUS-210	49.0	POUR	DEG F	85.0
CARBON	WT%	85.54	HYDROGEN	WT%	11.35
NITROGEN	WT%	2.07	SULFUR	WT%	0.59

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	2.2

PRODUCT WATER PROPERTIES

CARBON	WT%	4.21	HYDROGEN	WT%	10.31
NITROGEN	WT%	2.96	SULFUR	WT%	4.35
CO2	WT%	5.00			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.16	C2H4	VOL%	0.65
N2+AR	VOL%	61.33	C2H6	VOL%	0.58
O2	VOL%	0.00	C3'S	VOL%	0.45
CO	VOL%	3.17	C4'S	VOL%	0.03
CH4	VOL%	2.07	C5+	VOL%	0.15
CO2	VOL%	25.56	H2S	VOL%	0.38
			NH3	VOL%	0.47

GROSS HEAT BTU/SCF 94.29

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	14.30	ASH	WT%	82.20
CARBON	WT%	7.13	HYDROGEN	WT%	0.13
NITROGEN	WT%	0.23	SULFUR	WT%	0.86

TEMPERATURES DEG F

RAW SHALE IN	30	RET SHALE OUT	401
AIR TD IN	191	AIR MD IN	191
GAS BD IN	291	GAS MD IN	291
GAS TD IN	291	GAS PROD OUT	291
COOLING WATER IN	63	COOLING WATER OUT	67
PRODUCT OIL OUT	137		
AMBIENT AIR	30	OFF GAS	148

RATES AND QUANTITIES

RAW SHALE	TPH	1.25	THROUGHPUT PHF2		569.4
RET SHALE	TPH	0.95	RET/RAW	WT%	75.3
AIR TOP	SCFM	61.7		SCF/T	2953.2
AIR MID	SCFM	38.8		SCF/T	1853.5
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	100.5		SCF/T	4806.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		8.350			
SP GR		1.027			
GAS TOP	SCFM	16.4		SCF/T	783.6
GAS MID	SCFM	55.8		SCF/T	2669.7
GAS BTM	SCFM	184.9		SCF/T	8843.7
TOTAL GAS	SCFM	257.1		SCF/T	12297.0
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	158.4		SCF/T	7574.3
COOLING WATER	GPM	21.9	BARO PRESS IN HG		23.9
AMB AIR REL HUM	%	77.0	BED PD IN H2O/FT		0.9

OIL YIELD WT% FA= 79.5
OIL YIELD VOL% FA= 73.4

APPENDIX 3.3

PILOT PLANT RETORTING RESEARCH - MIDDLE OFF-GAS

***PILOT PLANT ***
STARTING DATE 31178 TO 31278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	78.81	85.43	108.4
ASH	#/MIN	26.27	26.27	100.0
OXYGEN	SCFM	20.95	20.95	100.0
			3.85 TO H2O	
			17.06 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.56	1.42	91.6
		1.19 SHALE	0.28 LIQ	
		0.37 COMB	1.14 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	5.27	5.39	102.2
			0.82 SHALE	
			3.25 OIL	
			1.29 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.65	4.64	99.8
			0.77 SHALE	
			2.78 OIL	
			1.08 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.44	6.43	99.9
			2.07 SHALE	
			2.78 OIL	
			1.57 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.58	0.60	103.5
			0.05 SHALE	
			0.36 OIL	
			0.18 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.18	91.6
SULFUR	#/MIN	0.33	0.35	107.6
			0.28 SHALE	
			0.02 OIL	
			0.04 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	46.72	48.17	102.7

0.680 #/MIN C 0.041 #/MIN H 14.745 C/H COMB RATIO
79.79 VOL%FA 81.17WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 31178 TO 31278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	78.81	78.81	100.0
ASH	#/MIN	26.27	26.27	100.0
OXYGEN	SCFM	20.95	20.95	100.0
			6.57 TO H2O	
			14.35 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.81	1.34	73.7
		1.19 SHALE	0.28 LIQ	
		0.62 COMB	1.05 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	5.27	5.28	100.2
			0.82 SHALE	
			3.25 OIL	
			1.19 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.65	4.52	97.2
			0.77 SHALE	
			2.78 OIL	
			0.96 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.44	6.31	98.0
			2.07 SHALE	
			2.78 OIL	
			1.45 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.58	0.61	106.5
			0.05 SHALE	
			0.36 OIL	
			0.20 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.18	90.3
SULFUR	#/MIN	0.33	0.35	106.8
			0.28 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	46.92	47.22	100.6

0.509 #/MIN C 0.069 #/MIN H 7.335 C/H COMB RATIO
79.79 VOL%FA 81.17WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 31178 TO 31278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	78.81	78.81	100.0
ASH	#/MIN	25.51	25.51	100.0
OXYGEN	SCFM	20.95	20.95	100.0
			6.05 TO H2O	
			14.87 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.73	1.34	77.3
		1.16 SHALE	0.28 LIQ	
		0.57 COMB	1.05 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	5.12	5.27	102.9
			0.80 SHALE	
			3.25 OIL	
			1.20 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.52	4.51	99.9
			0.75 SHALE	
			2.78 OIL	
			0.98 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.25	6.25	100.0
			2.01 SHALE	
			2.78 OIL	
			1.45 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.56	0.61	108.4
			0.05 SHALE	
			0.36 OIL	
			0.20 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.18	91.9
SULFUR	#/MIN	0.32	0.34	107.3
			0.28 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	45.77	46.28	101.1

0.525 #/MIN C 0.064 #/MIN H 8.233 C/H COMB RATIO
82.18 VOL%FA 83.61WT.%FA

DATA SUMMARY

STARTING DATE 31178 TO 31278
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.31	H2O FA	WT%	2.05
OIL FA	GPT	27.00			
MIN CO2	WT%	16.83	ASH	WT%	67.56
CARBON	WT%	16.55	HYDROGEN	WT%	1.71
NITROGEN	WT%	0.51	SULFUR	WT%	0.84

RAW SHALE MOISTURE WT% (UNGROUND) 1.00

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.4	WATER	WT%	9.0
VIS	SUS-130	113.2	SEDIMENT	ML/100G	0.6
VIS	SUS-210	50.1	POUR	DEG F	85.0
CARBON	WT%	35.38	HYDROGEN	WT%	10.98
NITROGEN	WT%	2.15	SULFUR	WT%	0.60

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.4	WATER	WT%	9.0

PRODUCT WATER PROPERTIES

CARBON	WT%	4.21	HYDROGEN	WT%	10.31
NITROGEN	WT%	2.96	SULFUR	WT%	4.35
CO2	WT%	5.00			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.52	C2H4	VOL%	0.73
N2+AR	VOL%	61.91	C2H6	VOL%	0.65
O2	VOL%	0.02	C3'S	VOL%	0.55
CO	VOL%	3.06	C4'S	VOL%	0.29
CH4	VOL%	2.26	C5+	VOL%	0.16
CO2	VOL%	23.87	H2S	VOL%	0.30
			NH3	VOL%	0.67

GROSS HEAT BTU/SCF 112.23

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	14.76	ASH	WT%	81.28
CARBON	WT%	5.41	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.21	SULFUR	WT%	0.88

TEMPERATURES DEG F

RAW SHALE IN	38	RET SHALE OUT	414
AIR TD IN	198	AIR MD IN	198
GAS BD IN	298	GAS MD IN	298
GAS TD IN	298	GAS PROD OUT	298
COOLING WATER IN	76	COOLING WATER OUT	82
PRODUCT OIL OUT	145		
AMBIENT AIR	38	OFF GAS	145

RATES AND QUANTITIES

RAW SHALE	TPH	1.17	THROUGHPUT PKF2		473.8
RET SHALE	TPH	0.97	RET/RAW	WT%	83.1
AIR TOP	SCFM	61.3		SCF/T	3152.1
AIR MID	SCFM	38.5		SCF/T	1978.3
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	99.8		SCF/T	5130.4

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		14.850			
SP GR		0.990			
GAS TOP	SCFM	16.3		SCF/T	839.4
GAS MID	SCFM	55.4		SCF/T	2847.5
GAS BTM	SCFM	184.2		SCF/T	9473.9
TOTAL GAS	SCFM	255.9		SCF/T	13160.8
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	162.1		SCF/T	8334.1
COOLING WATER	GPM	22.5	BARO PRESS IN HG		28.8
AMB AIR REL HUM	%	75.0	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 81.1
OIL YIELD VOL% FA= 79.8

PILOT PLANT-MID OFF GAS
STARTING DATE 31978 TO 31978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	79.86	82.35	103.1
ASH	#/MIN	27.42	27.42	100.0
OXYGEN	SCFM	21.23	21.23	100.0
			0.69 TO H2O	
			20.54 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.28	1.54	120.0
		1.22 SHALE	0.13 LIQ	
		0.07 COMB	1.41 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	6.40	5.27	82.3
			0.71 SHALE	
			3.34 OIL	
			1.22 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.96	4.57	92.1
			0.65 SHALE	
			2.82 OIL	
			1.09 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.86	6.47	94.3
			2.13 SHALE	
			2.82 OIL	
			1.51 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.63	0.55	87.1
			0.05 SHALE	
			0.38 OIL	
			0.11 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.14	62.5
SULFUR	#/MIN	0.29	0.27	94.2
			0.23 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	49.74	49.43	99.4

0.703 #/MIN C 0.007 #/MIN H 97.038 C/H COMB RATIO
71.61 VOL%FA 72.74WT.%FA

PILOT PLANT

STARTING DATE 31878 TO 31978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	79.86	79.86	100.0
ASH	#/MIN	27.42	27.42	100.0
OXYGEN	SCFM	21.23	21.23	100.0
			1.80 TO H2O	
			19.43 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.39	1.50	107.8
		1.22 SHALE	0.13 LIQ	
		0.17 COMB	1.37 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	6.40	5.23	81.7
			0.71 SHALE	
			3.34 OIL	
			1.18 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.96	4.52	91.2
			0.65 SHALE	
			2.82 OIL	
			1.05 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.86	6.42	93.6
			2.13 SHALE	
			2.82 OIL	
			1.46 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.63	0.55	88.4
			0.05 SHALE	
			0.38 OIL	
			0.12 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.14	62.5
SULFUR	#/MIN	0.29	0.27	94.0
			0.23 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	49.74	49.06	98.6

0.666 #/MIN C 0.019 #/MIN H 35.088 C/H COMB RATIO
71.63 VOL%FA 72.74WT.%FA

PILOT PLANT- FORCED TOT. CARBON AND ATM. N2 BALANCES***
STARTING DATE 31878 TO 31978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	79.86	79.86	100.0
ASH	#/MIN	24.89	24.89	100.0
OXYGEN	SCFM	21.23	21.23	100.0
			0.30 TO H2O	
			20.93 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.13	1.50	132.1
		1.11 SHALE	0.13 LIQ	
		0.03 COMB	1.37 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	5.81	5.19	89.3
			0.64 SHALE	
			3.34 OIL	
			1.20 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.50	4.50	100.0
			0.59 SHALE	
			2.82 OIL	
			1.08 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.22	6.22	100.0
			1.94 SHALE	
			2.82 OIL	
			1.46 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.57	0.53	93.8
			0.05 SHALE	
			0.38 OIL	
			0.10 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.13	65.9
SULFUR	#/MIN	0.26	0.25	95.5
			0.21 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	45.85	45.96	100.2

0.714 #/MIN C 0.003 #/MIN H 229.015 C/H COMB RATIO
76.90 VOL%FA 80.15WT.%FA

DATA SUMMARY

STARTING DATE 31878 TO 31978
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.03	H2O FA	WT%	1.92
OIL FA	GPT	28.90			
MIN CO2	WT%	16.74	ASH	WT%	65.95
CARBON	WT%	16.49	HYDROGEN	WT%	1.72
NITROGEN	WT%	0.53	SULFUR	WT%	0.70

RAW SHALE MOISTURE WT% (UNGROUND) 1.00

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.7	WATER	WT%	4.1
VIS	SUS-130	93.7	SEDIMENT	ML/100G	0.6
VIS	SUS-210	49.0	POUR	DEG F	85.0
CARBON	WT%	34.47	HYDROGEN	WT%	11.34
NITROGEN	WT%	2.10	SULFUR	WT%	0.51

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.7	WATER	WT%	4.1

PRODUCT WATER PROPERTIES

CARBON	WT%	4.30	HYDROGEN	WT%	10.58
NITROGEN	WT%	2.67	SULFUR	WT%	3.54
CO2	WT%	4.89			

COMBINED MID AND TOP PROD GAS PROPERTIES (DRY)**

H2	VOL%	3.99	C2H4	VOL%	0.59
N2+AR	VOL%	62.30	C2H6	VOL%	0.39
O2	VOL%	0.00	C3'S	VOL%	0.31
CO	VOL%	2.90	C4+	VOL%	0.47
CH4	VOL%	1.52	H2S	VOL%	0.22
CO2	VOL%	26.38	NH3	VOL%	0.92

GROSS HEAT BTU/SCF 87.04

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	16.17	ASH	WT%	81.61
CARBON	WT%	6.35	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.19	SULFUR	WT%	0.68

TEMPERATURES DEG F

RAW SHALE IN	44	RET SHALE OUT	347
AIR TD IN	212	AIR MD IN	212
GAS BD IN	303	GAS MD IN	303
GAS TD IN	303	GAS PROD OUT	303
COOLING WATER IN	88	COOLING WATER OUT	93
PRODUCT OIL OUT	142		
AMBIENT AIR	44	OFF GAS	145
COMBINED MID AND TOP OFF GAS TEMP			289

RATES AND QUANTITIES

RAW SHALE	TPH	1.25	THROUGHPUT PHF2		506.6
RET SHALE	TPH	1.01	RET/RAW	WT%	80.8
AIR TOP	SCFM	62.6		SCF/T	3009.2
AIR MID	SCFM	38.5		SCF/T	1853.2
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	101.1		SCF/T	4862.4

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.380			
SP GR		0.997			
GAS TOP	SCFM	16.5		SCF/T	792.7
GAS MID	SCFM	55.2		SCF/T	2655.5
GAS BTM	SCFM	261.3		SCF/T	12570.3
TOTAL GAS	SCFM	333.0		SCF/T	16018.5
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	75.7		SCF/T	3641.3
MID OFF GAS	SCFM	86.2		SCF/T	4148.4
COOLING WATER	GPM	21.3	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	50.0	BED PD IN H2O/FT		0.9

OIL YIELD WT% FA= 72.7
OIL YIELD VOL% FA= 71.6

PILOT PLANT-MID OFF GAS
STARTING DATE 32178 TO 32278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	79.25	85.24	107.6
ASH	#/MIN	26.84	26.84	100.0
OXYGEN	SCFM	21.07	21.07	100.0
			5.26 TO H2O	
			15.80 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.75	1.75	99.7
		1.25 SHALE	0.24 LIQ	
		0.50 COMB	1.51 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	5.44	4.47	82.2
			0.59 SHALE	
			2.83 OIL	
			1.03 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.51	3.82	84.8
			0.54 SHALE	
			2.40 OIL	
			0.88 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.40	5.72	89.4
			1.81 SHALE	
			2.40 OIL	
			1.50 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.57	0.52	91.4
			0.04 SHALE	
			0.32 OIL	
			0.15 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.12	63.1
SULFUR	#/MIN	0.27	0.25	91.8
			0.20 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	43.14	47.88	99.5

0.545 #/MIN C 0.056 #/MIN H 9.811 C/H COMB RATIO
72.26 VOL%FA 73.41WT.%FA

PILOT PLANT-FORCED ATM. N2***
STARTING DATE 32178 TO 32278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	79.25	79.25	100.0
ASH	#/MIN	26.84	26.84	100.0
OXYGEN	SCFM	21.07	21.07	100.0
			7.95 TO H2O	
			13.12 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	2.01	1.64	81.8
		1.25 SHALE	0.24 LIQ	
		0.76 COMB	1.40 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	5.44	4.38	80.6
			0.59 SHALE	
			2.83 OIL	
			0.95 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.51	3.72	82.5
			0.54 SHALE	
			2.40 OIL	
			0.77 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.40	5.61	87.7
			1.81 SHALE	
			2.40 OIL	
			1.40 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.57	0.54	95.2
			0.04 SHALE	
			0.32 OIL	
			0.17 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.12	63.1
SULFUR	#/MIN	0.27	0.25	91.3
			0.20 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	48.14	46.98	97.6

0.456 #/MIN C 0.084 #/MIN H 5.439 C/H COMB RATIO
72.26 VOL%FA 73.41WT.%FA

***PILOT PLANT ***

PILOT PLANT- FORCED TOT. CARBON AND ATM. N2 BALANCES***
STARTING DATE 32178 TO 32278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	79.25	79.25	100.0
ASH	#/MIN	22.24	22.24	100.0
OXYGEN	SCFM	21.07	21.07	100.0
			4.11 TO H2O	
			16.96 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.43	1.64	115.0
		1.04 SHALE	0.24 LIQ	
		0.39 COMB	1.40 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	4.51	4.35	96.5
			0.49 SHALE	
			2.83 OIL	
			1.02 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	3.74	3.73	99.9
			0.45 SHALE	
			2.40 OIL	
			0.88 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	5.30	5.30	100.0
			1.50 SHALE	
			2.40 OIL	
			1.40 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.47	0.50	104.7
			0.04 SHALE	
			0.32 OIL	
			0.13 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.16	0.11	70.0
SULFUR	#/MIN	0.23	0.21	94.6
			0.17 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	41.21	41.50	100.7

0.579 #/MIN C 0.043 #/MIN H 13.369 C/H COMB RATIO
87.18 VOL.%FA 88.58WT.%FA

DATA SUMMARY

STARTING DATE 32178 TO 32278

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.66	H2O FA	WT%	1.80
OIL FA	GPT	25.30			
MIN CO2	WT%	17.37	ASH	WT%	67.21
CARBON	WT%	16.03	HYDROGEN	WT%	1.63
NITROGEN	WT%	0.48	SULFUR	WT%	0.68

RAW SHALE MOISTURE WT% (UNGROUND) 1.32

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.6	WATER	WT%	8.7
VIS	SUS-130	94.1	SEDIMENT	ML/100G	0.7
VIS	SUS-210	49.0	POUR	DEG F	85.0
CARBON	WT%	84.71	HYDROGEN	WT%	11.40
NITROGEN	WT%	1.98	SULFUR	WT%	0.58

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.6	WATER	WT%	8.7

PRODUCT WATER PROPERTIES

CARBON	WT%	4.29	HYDROGEN	WT%	10.63
NITROGEN	WT%	2.74	SULFUR	WT%	3.66
CO2	WT%	4.80			

***PILOT PLANT ***
STARTING DATE 40678 TO 40778
STARTING DATE 32178 TO 32278

COMBINED MID AND TOP PROD GAS PROPERTIES (DRY)**

H2	VOL%	3.83	C2H4	VOL%	0.54
N2+AR	VOL%	62.75	C2H6	VOL%	0.38
O2	VOL%	0.00	C3'S	VOL%	0.33
CO	VOL%	2.41	C4+	VOL%	0.26
CH4	VOL%	1.46	H2S	VOL%	0.17
CO2	VOL%	26.96	NH3	VOL%	0.92

GROSS HEAT BTU/SCF 75.30

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	14.47	ASH	WT%	83.85
CARBON	WT%	5.64	HYDROGEN	WT%	0.14
NITROGEN	WT%	0.18	SULFUR	WT%	0.64

TEMPERATURES DEG F

RAW SHALE IN	47	RET SHALE OUT	307
AIR TD IN	215	AIR MD IN	215
GAS BD IN	330	GAS MD IN	300
GAS TD IN	300	GAS PROD OUT	300
COOLING WATER IN	90	COOLING WATER OUT	95
PRODUCT OIL OUT	143		
AMBIENT AIR	47	OFF GAS	141
COMBINED MID AND TOP OFF GAS TEMP			342

RATES AND QUANTITIES

RAW SHALE	TPH	1.20	THROUGHPUT PHF2		486.4
RET SHALE	TPH	0.96	RET/RAW	WT%	80.2
AIR TOP	SCFM	61.9		SCF/T	3099.8
AIR MID	SCFM	38.4		SCF/T	1925.4
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	100.3		SCF/T	5025.2

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.960			
SP GR		0.996			
GAS TOP	SCFM	16.3		SCF/T	814.1
GAS MID	SCFM	56.0		SCF/T	2803.7
GAS BTM	SCFM	300.4		SCF/T	15044.7
TOTAL GAS	SCFM	372.6		SCF/T	18662.5
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	36.2		SCF/T	1811.9
MID OFF GAS	SCFM	131.5		SCF/T	6584.7
COOLING WATER	GPM	21.9	BARO PRESS IN HG		24.8
AMB AIR REL HUM	%	56.8	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 73.3
OIL YIELD VOL% FA= 72.3

PILOT PLANT-MID OFF GAS
STARTING DATE 32378 TO 32478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	87.48	89.91	102.8
ASH	#/MIN	25.22	25.22	100.0
OXYGEN	SCFM	23.25	23.25	100.0
			3.57 TO H2O	
			19.69 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.62	2.16	133.3
		1.28 SHALE	0.25 LIQ	
		0.34 COMB	1.91 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	4.94	4.75	96.3
			0.28 SHALE	
			3.14 OIL	
			1.31 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.21	4.07	96.7
			0.25 SHALE	
			2.67 OIL	
			1.14 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.19	6.05	97.8
			1.67 SHALE	
			2.67 OIL	
			1.70 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.53	0.55	103.5
			0.03 SHALE	
			0.36 OIL	
			0.16 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.12	61.8
SULFUR	#/MIN	0.26	0.27	101.9
			0.21 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
OVERALL WEIGHT	#/MIN	47.16	47.49	100.7

0.673 #/MIN C 0.038 #/MIN H 17.886 C/H COMB RATIO
87.52 VOL%FA 88.86WT.%FA

***PILOT PLANT ***
STARTING DATE 40678 TO 40778
PILOT PLANT-FORCED ATM. N2***
STARTING DATE 32378 TO 32478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	87.48	87.48	100.0
ASH	#/MIN	25.22	25.22	100.0
OXYGEN	SCFM	23.25	23.25	100.0
			4.64 TO H2O	
			18.62 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.72	2.11	122.5
		1.28 SHALE	0.25 LIQ	
		0.44 COMB	1.86 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	4.94	4.72	95.5
			0.28 SHALE	
			3.14 OIL	
			1.27 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.21	4.03	95.7
			0.25 SHALE	
			2.67 OIL	
			1.09 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.19	6.01	97.1
			1.67 SHALE	
			2.67 OIL	
			1.65 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.53	0.56	105.0
			0.03 SHALE	
			0.36 OIL	
			0.17 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.12	61.8
SULFUR	#/MIN	0.26	0.26	101.7
			0.21 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	47.16	47.11	99.9

0.638 #/MIN C 0.049 #/MIN H 13.031 C/H COMB RATIO
87.52 VOL%FA 88.86WT.%FA

PILOT PLANT- FORCED TOT. CARBON AND ATM. N2 BALANCES***
STARTING DATE 32378 TO 32478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	87.48	87.48	100.0
ASH	#/MIN	24.22	24.22	100.0
OXYGEN	SCFM	23.25	23.25	100.0
			3.84 TO H2O	
			19.41 TO CO&CO2	
			0.00 GAS	
WATER	#/MIN	1.60	2.11	132.1
		1.23 SHALE	0.25 LIQ	
		0.37 COMB	1.86 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	4.74	4.72	99.5
			0.27 SHALE	
			3.14 OIL	
			1.29 GAS	
			0.02 WATER	
ORGANIC CARBON	#/MIN	4.04	4.04	99.9
			0.24 SHALE	
			2.67 OIL	
			1.11 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	5.94	5.94	100.0
			1.60 SHALE	
			2.67 OIL	
			1.65 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.51	0.55	107.4
			0.03 SHALE	
			0.36 OIL	
			0.16 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.18	0.11	63.3
SULFUR	#/MIN	0.25	0.25	102.5
			0.21 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	45.62	45.92	100.6

0.663 #/MIN C 0.041 #/MIN H 16.341 C/H COMB RATIO
91.13 VOL%FA 92.53WT.%FA

***PILOT PLANT ***
STARTING DATE 40678 TO 40773

DATA SUMMARY

STARTING DATE 32378 TO 32478

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.24	H2O FA	WT%	2.30
OIL FA	GPT	24.20			
MIN CO2	WT%	18.92	ASH	WT%	65.88
CARBON	WT%	16.16	HYDROGEN	WT%	1.65
NITROGEN	WT%	0.49	SULFUR	WT%	0.68

RAW SHALE MOISTURE WT% (UNGROUND) 1.04

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.7	WATER	WT%	8.5
VIS	SUS-130	99.3	SEDIMENT	ML/100G	0.1
VIS	SUS-210	47.9	POUR	DEG F	85.0
CARBON	WT%	35.10	HYDROGEN	WT%	11.34
NITROGEN	WT%	1.91	SULFUR	WT%	0.60

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.7	WATER	WT%	8.5

PRODUCT WATER PROPERTIES

CARBON	WT%	4.47	HYDROGEN	WT%	10.56
NITROGEN	WT%	2.69	SULFUR	WT%	3.50
CO2	WT%	4.94			

COMBINED MID AND TOP PROD GAS PROPERTIES (DRY)**

H2	VOL%	3.69	C2H4	VOL%	0.60
N2+AR	VOL%	62.78	C2H6	VOL%	0.39
O2	VOL%	0.00	C3'S	VOL%	0.29
CO	VOL%	2.48	C4+	VOL%	0.75
CH4	VOL%	1.41	H2S	VOL%	0.19
CO2	VOL%	26.48	NH3	VOL%	0.94

GROSS HEAT BTU/SCF 97.73

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	17.21	ASH	WT%	83.51
CARBON	WT%	5.53	HYDROGEN	WT%	0.10
NITROGEN	WT%	0.16	SULFUR	WT%	0.71

TEMPERATURES DEG F

RAW SHALE IN	40	RET SHALE OUT	346
AIR TD IN	206	AIR MD IN	206
GAS BD IN	298	GAS MD IN	298
GAS TD IN	298	GAS PROD OUT	298
COOLING WATER IN	81	COOLING WATER OUT	85
PRODUCT OIL OUT	142		
AMBIENT AIR	40	OFF GAS	147
COMBINED MID AND TOP OFF GAS TEMP			342

RATES AND QUANTITIES

RAW SHALE	TPH	1.15	THROUGHPUT	PHF2	466.4
RET SHALE	TPH	0.91	RET/RAW	WT%	78.9
AIR TOP	SCFM	62.2		SCF/T	3248.8
AIR MID	SCFM	38.6		SCF/T	2017.9
AIR BTM	SCFM	9.9		SCF/T	518.8
TOTAL AIR	SCFM	110.7		SCF/T	5785.5

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		21.920			
SP GR		0.988			
GAS TOP	SCFM	16.3		SCF/T	852.2
GAS MID	SCFM	56.2		SCF/T	2934.7
GAS BTM	SCFM	298.8		SCF/T	15612.0
TOTAL GAS	SCFM	371.3		SCF/T	19399.0
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	41.1		SCF/T	2146.6
MID OFF GAS	SCFM	142.3		SCF/T	7436.1
COOLING WATER	GPM	21.9	BARO PRESS IN HG		23.9
AMB AIR REL HUM	%	82.0	BED PD IN H2O/FT		1.0

OIL YIELD WT% FA= 88.8
OIL YIELD VOL% FA= 87.5

APPENDIX 3.4

PILOT PLANT RETORTING RESEARCH - TOP GAS RATIO

PILOT PLANT
STARTING DATE 40678 TO 40778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	65.63	78.50	119.6
ASH	#/MIN	29.75	29.75	100.0
OXYGEN	SCFM	17.45	17.45	100.0
			14.19 TO H2O	
			3.16 TO CO&CO2	
			0.09 GAS	
WATER	#/MIN	2.66	1.26	47.5
		1.31 SHALE	0.15 LIQ	
		1.35 COMB	0.94 VAP	
			0.18 SHALE	
KEROGEN	#/MIN	5.83	4.99	85.6
			0.76 SHALE	
			3.17 OIL	
			1.05 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.84	4.10	84.8
			0.72 SHALE	
			2.64 OIL	
			0.73 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.99	6.25	89.5
			2.30 SHALE	
			2.64 OIL	
			1.30 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.62	0.71	114.8
			0.04 SHALE	
			0.36 OIL	
			0.30 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.18	84.6
SULFUR	#/MIN	0.29	0.30	102.7
			0.24 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	51.13	50.19	98.2

0.130 #/MIN C 0.150 #/MIN H 0.860 C/H COMB RATIO
70.60 VOL%FA 71.68WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 40678 TO 40778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	65.63	65.63	100.0
ASH	#/MIN	29.75	29.75	100.0
OXYGEN	SCFM	17.45	17.45	100.0
			18.16 TO H2O	
			-0.80 TO CO&CO2	
			0.08 GAS	
WATER	#/MIN	3.03	1.11	36.5
		1.31 SHALE	0.15 LIQ	
		1.73 COMB	0.78 VAP	
			0.18 SHALE	
KEROGEN	#/MIN	5.83	4.79	82.2
			0.76 SHALE	
			3.17 OIL	
			0.85 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.84	3.89	80.4
			0.72 SHALE	
			2.64 OIL	
			0.52 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.99	6.04	86.5
			2.30 SHALE	
			2.64 OIL	
			1.09 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.62	0.73	117.6
			0.04 SHALE	
			0.36 OIL	
			0.32 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.17	81.9
SULFUR	#/MIN	0.29	0.29	101.2
			0.24 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	51.13	48.49	94.8

-0.001 #/MIN C 0.192 #/MIN H -0.007 C/H COMB RATIO
70.60 VOL%FA 71.68WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 40678 TO 40778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	65.63	65.63	100.0
ASH	#/MIN	23.74	23.74	100.0
OXYGEN	SCFM	17.45	17.45	100.0
			13.93 TO H2O	
			3.44 TO CO&CO2	
			0.08 GAS	
WATER	#/MIN	2.37	1.07	45.3
		1.04 SHALE	0.15 LIQ	
		1.32 COMB	0.78 VAP	
			0.14 SHALE	
KEROGEN	#/MIN	4.65	4.71	101.2
			0.61 SHALE	
			3.17 OIL	
			0.92 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	3.86	3.86	100.0
			0.58 SHALE	
			2.64 OIL	
			0.64 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	5.58	5.58	100.0
			1.84 SHALE	
			2.64 OIL	
			1.09 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.49	0.67	136.5
			0.03 SHALE	
			0.36 OIL	
			0.27 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.17	0.16	93.7
SULFUR	#/MIN	0.23	0.24	105.3
			0.20 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.01 WATER	
O'ALL WEIGHT	#/MIN	42.09	41.12	97.7

0.134 #/MIN C 0.147 #/MIN H 0.914 C/H COMB RATIO
88.48 VOL%FA 89.83WT.%FA

DATA SUMMARY

STARTING DATE 40678 TO 40778

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.96	H2O FA	WT%	1.95
OIL FA	GPT	26.10			
MIN CO2	WT%	17.79	ASH	WT%	67.11
CARBON	WT%	15.76	HYDROGEN	WT%	1.61
NITROGEN	WT%	0.47	SULFUR	WT%	0.65

RAW SHALE MOISTURE WT% (UNGROUND) 0.99

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	5.1
VIS	SUS-130	0.0	SEDIMENT	ML/100G	1.8
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	83.46	HYDROGEN	WT%	11.49
NITROGEN	WT%	2.00	SULFUR	WT%	0.59

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.8	WATER	WT%	5.1

PRODUCT WATER PROPERTIES

CARBON	WT%	3.98	HYDROGEN	WT%	10.64
NITROGEN	WT%	2.99	SULFUR	WT%	3.58
CO2	WT%	3.38			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.85	C2H4	VOL%	0.61
N2+AR	VOL%	67.12	C2H6	VOL%	0.58
O2	VOL%	0.08	C3'S	VOL%	0.61
CO	VOL%	2.07	C4'S	VOL%	0.48
CH4	VOL%	2.14	C5+	VOL%	0.78
CO2	VOL%	19.59	H2S	VOL%	0.28
			NH3	VOL%	0.81

GROSS HEAT BTU/SCF 143.37

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.02			
MIN CO2	WT%	15.89	ASH	WT%	81.52
CARBON	WT%	5.31	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.20	SULFUR	WT%	0.67

TEMPERATURES DEG F

RAW SHALE IN	51	RET SHALE OUT	415
AIR TD IN	213	AIR MD IN	213
GAS BD IN	322	GAS MD IN	302
GAS TD IN	332	GAS PROD OUT	302
COOLING WATER IN	86	COOLING WATER OUT	90
PRODUCT OIL OUT	148		
AMBIENT AIR	51	OFF GAS	155

RATES AND QUANTITIES

RAW SHALE	TPH	1.33	THROUGHPUT	PHF2	540.1
RET SHALE	TPH	1.09	RET/RAW	WT%	82.3

AIR TOP	SCFM	67.7	SCF/T	3055.2
AIR MID	SCFM	15.4	SCF/T	692.5
AIR BTM	SCFM	0.0	SCF/T	0.0
TOTAL AIR	SCFM	83.1	SCF/T	3747.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 14.410
SP GR 0.991

GAS TOP	SCFM	21.3	SCF/T	961.5
GAS MID	SCFM	23.7	SCF/T	1068.8
GAS BTM	SCFM	207.4	SCF/T	9357.8
TOTAL GAS	SCFM	252.4	SCF/T	11388.1
GAS SEAL LOSS NOT INCLUDED				
GAS PRODUCT	SCFM	136.6	SCF/T	6164.5

COOLING WATER	GPM	15.8	BARO PRESS IN HG		23.9
AMB AIR REL HUM	%	49.0	BED PD IN H2O/FT		0.8

OIL YIELD WT% FA= 71.6
OIL YIELD VOL% FA= 73.6

***PILOT PLANT ***
STARTING DATE 41078 TO 41178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	72.03	77.13	107.1
ASH	#/MIN	23.20	23.20	100.0
OXYGEN	SCFM	19.15	19.15	100.0
			11.98 TO H2O	
			7.13 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.22	1.41	63.6
		1.08 SHALE	0.00 LIQ	
		1.14 COMB	1.41 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	5.05	3.97	78.5
			0.48 SHALE	
			2.48 OIL	
			1.01 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.59	3.28	71.4
			0.45 SHALE	
			2.09 OIL	
			0.74 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.24	4.93	79.0
			1.40 SHALE	
			2.09 OIL	
			1.44 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.58	0.56	95.6
			0.03 SHALE	
			0.28 OIL	
			0.25 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.10	52.7
SULFUR	#/MIN	0.27	0.26	97.0
			0.23 SHALE	
			0.01 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	42.37	41.04	96.9

0.275 #/MIN C 0.126 #/MIN H 2.177 C/H COMB RATIO
64.71 VOL%FA 66.09WT.%FA

***PILOT PLANT FORCED WITH. N2 BALANCE ***
STARTING DATE 41078 TO 41178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	72.03	72.03	100.0
ASH	#/MIN	23.20	23.20	100.0
OXYGEN	SCFM	19.15	19.15	100.0
			14.09 TO H2O	
			5.03 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.42	1.32	54.5
		1.08 SHALE	0.00 LIQ	
		1.34 COMB	1.32 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	5.05	3.88	76.9
			0.48 SHALE	
			2.48 OIL	
			0.92 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.59	3.18	69.3
			0.45 SHALE	
			2.09 OIL	
			0.64 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.24	4.83	77.5
			1.40 SHALE	
			2.09 OIL	
			1.34 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.58	0.57	98.0
			0.03 SHALE	
			0.28 OIL	
			0.26 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.10	52.2
SULFUR	#/MIN	0.27	0.26	96.4
			0.23 SHALE	
			0.01 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	42.37	40.28	95.1

0.205 #/MIN C 0.149 #/MIN H 1.379 C/H COMB RATIO
64.71 VOL%FA 66.0WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 41078 TO 41178 ;

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	72.03	72.03	100.0
ASH	#/MIN	16.46	16.46	100.0
OXYGEN	SCFM	19.15	19.15	100.0
			6.94 TO H2O	
			12.18 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.42	1.32	92.5
		0.77 SHALE	0.00 LIQ	
		0.66 COMB	1.32 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	3.58	3.87	108.1
			0.34 SHALE	
			2.48 OIL	
			1.05 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	3.26	3.26	100.0
			0.32 SHALE	
			2.09 OIL	
			0.85 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	4.43	4.43	100.0
			0.99 SHALE	
			2.09 OIL	
			1.34 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.41	0.48	117.6
			0.02 SHALE	
			0.28 OIL	
			0.18 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.14	0.09	66.2
SULFUR	#/MIN	0.19	0.20	101.7
			0.16 SHALE	
			0.01 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	32.09	32.41	101.0

0.433 #/MIN C 0.073 #/MIN H 5.917 C/H COMB RATIO
91.21 VOL%FA 93.15WT.%FA

DATA SUMMARY

STARTING DATE 41078 TO 41178

OPERATING TIME (HRS) 24
OPERATING FACTOR 99.29 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.73	H2O FA	WT%	1.97
OIL FA	GPT	28.10			
MIN CO2	WT%	17.31	ASH	WT%	66.29
CARBON	WT%	17.83	HYDROGEN	WT%	1.88
NITROGEN	WT%	0.56	SULFUR	WT%	0.78

RAW SHALE MOISTURE WT% (UNGROUND) 1.10

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	2.0
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	54.38	HYDROGEN	WT%	11.16
NITROGEN	WT%	2.20	SULFUR	WT%	0.42

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	2.0

PRODUCT WATER PROPERTIES

CARBON	WT%	4.05	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.74	SULFUR	WT%	4.05
CO2	WT%	3.94			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.80	C2H4	VOL%	0.49
N2+AR	VOL%	63.26	C2H6	VOL%	0.41
O2	VOL%	0.02	C3'S	VOL%	0.37
CO	VOL%	2.92	C4'S	VOL%	0.47
CH4	VOL%	1.67	C5+	VOL%	0.46
CO2	VOL%	24.57	H2S	VOL%	0.26
			NH3	VOL%	0.30

GROSS HEAT BTU/SCF 111.53

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	12.90	ASH	WT%	85.60
CARBON	WT%	5.16	HYDROGEN	WT%	0.12
NITROGEN	WT%	0.13	SULFUR	WT%	0.84

TEMPERATURES DEG F

RAW SHALE IN	40	RET SHALE OUT	411
AIR TD IN	204	AIR MD IN	204
GAS BD IN	297	GAS MD IN	297
GAS TD IN	297	GAS PROD OUT	297
COOLING WATER IN	80	COOLING WATER OUT	91
PRODUCT OIL OUT	143		
AMBIENT AIR	40	OFF GAS	150

RATES AND QUANTITIES

RAW SHALE	TPH	1.05	THROUGHPUT PHF2		426.4
RET SHALE	TPH	0.81	RET/RAW	WT%	77.4
AIR TOP	SCFM	55.7		SCF/T	3180.1
AIR MID	SCFM	35.5		SCF/T	2029.8
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	91.2		SCF/T	5209.9

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.590			
SP GR		0.987			
GAS TOP	SCFM	13.2		SCF/T	755.8
GAS MID	SCFM	61.8		SCF/T	3530.4
GAS BTM	SCFM	153.2		SCF/T	8756.8
TOTAL GAS	SCFM	228.3		SCF/T	13043.0
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	151.6		SCF/T	8664.8
COOLING WATER	GPM	15.5	BARO PRESS IN HG		24.0
AND AIR REL HUM	%	67.3	BED PD IN H2O/FT		0.5

OIL YIELD WT% FA= 66.0
OIL YIELD VOL% FA= 64.7

***PILOT PLANT ***
STARTING DATE 41178 TO 41278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	71.39	71.74	100.5
ASH	#/MIN	23.11	23.11	100.0
OXYGEN	SCFM	18.98	18.98	100.0
			10.09 TO H2O	
			8.86 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.97	1.46	74.5
		1.01 SHALE	0.05 LIQ	
		0.96 COMB	1.41 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	4.73	4.50	95.2
			0.52 SHALE	
			2.96 OIL	
			1.02 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.10	3.74	91.2
			0.49 SHALE	
			2.49 OIL	
			0.77 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	5.81	5.45	93.8
			1.50 SHALE	
			2.49 OIL	
			1.47 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.55	0.59	107.9
			0.03 SHALE	
			0.33 OIL	
			0.22 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.17	0.12	69.6
SULFUR	#/MIN	0.27	0.27	99.6
			0.22 SHALE	
			0.01 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	42.01	41.53	98.9

0.323 #/MIN C 0.106 #/MIN H 3.036 C/H COMB RATIO
81.45 VOL%FA 82.82WT.%FA

PILOT PLANT FORCED ATM. N2 BALANCESTM. NO BALANCES ***
STARTING DATE 41178 TO 41278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	71.39	71.39	100.0
ASH	#/MIN	23.11	23.11	100.0
OXYGEN	SCFM	18.98	18.98	100.0
			10.25 TO H2O	
			8.70 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.98	1.46	73.6
		1.01 SHALE	0.05 LIQ	
		0.97 COMB	1.40 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	4.73	4.49	95.1
			0.52 SHALE	
			2.96 OIL	
			1.01 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.10	3.74	91.0
			0.49 SHALE	
			2.49 OIL	
			0.76 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	5.81	5.44	93.7
			1.50 SHALE	
			2.49 OIL	
			1.46 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.55	0.59	108.1
			0.03 SHALE	
			0.33 OIL	
			0.22 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.17	0.12	69.6
SULFUR	#/MIN	0.27	0.27	99.5
			0.22 SHALE	
			0.01 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	42.01	41.47	98.7

0.318 #/MIN C 0.108 #/MIN H 2.938 C/H COMB RATIO
81.45 VOL%FA 82.82WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 41178 TO 41278

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	71.39	71.39	100.0
ASH	#/MIN	21.14	21.14	100.0
OXYGEN	SCFM	18.98	18.98	100.0
			8.16 TO H2O	
			10.79 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.70	1.46	85.9
		0.92 SHALE	0.05 LIQ	
		0.78 COMB	1.40 VAP	
			0.00 SHALE	
KEROGEN	#/MIN	4.32	4.49	103.8
			0.48 SHALE	
			2.96 OIL	
			1.05 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	3.75	3.75	100.0
			0.45 SHALE	
			2.49 OIL	
			0.82 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	5.31	5.31	100.0
			1.37 SHALE	
			2.49 OIL	
			1.46 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.50	0.57	113.2
			0.03 SHALE	
			0.[illegible]3 OIL	
			0.20 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.15	0.11	73.6
SULFUR	#/MIN	0.24	0.25	101.1
			0.20 SHALE	
			0.01 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	39.01	39.14	100.3

0.384 #/MIN C 0.086 #/MIN H 4.463 C/H COMB RATIO
89.05 VOL%FA 90.56WT.%FA

DATA SUMMARY

STARTING DATE 41178 TO 41278
OPERATING TIME (HRS) 24
OPERATING FACTOR 99.67 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.30	H2O FA	WT%	1.67
OIL FA	GPT	27.00			
MIN CO2	WT%	18.04	ASH	WT%	66.66
CARBON	WT%	16.76	HYDROGEN	WT%	1.76
NITROGEN	WT%	0.48	SULFUR	WT%	0.77

RAW SHALE MOISTURE WT% (UNGROUND) 1.22

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.6	WATER	WT%	2.0
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.03	HYDROGEN	WT%	11.28
NITROGEN	WT%	2.11	SULFUR	WT%	0.39

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.6	WATER	WT%	2.0

PRODUCT WATER PROPERTIES

CARBON	WT%	4.05	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.74	SULFUR	WT%	4.05
CO2	WT%	0.94			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.62	C2H4	VOL%	0.61
N2+AR	VOL%	60.98	C2H6	VOL%	0.51
O2	VOL%	0.02	C3'S	VOL%	0.45
CO	VOL%	2.64	C4'S	VOL%	0.36
CH4	VOL%	1.93	C5+	VOL%	0.38
CO2	VOL%	26.99	H2S	VOL%	0.31
			NH3	VOL%	0.19

GROSS HEAT BTU/SCF 110.72

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.03			
MIN CO2	WT%	13.54	ASH	WT%	84.65
CARBON	WT%	5.48	HYDROGEN	WT%	0.12
NITROGEN	WT%	0.16	SULFUR	WT%	0.81

TEMPERATURES DEG F

RAW SHALE IN	47	RET SHALE OUT	377
AIR TD IN	238	AIR MD IN	208
GAS BD IN	296	GAS MD IN	296
GAS TD IN	296	GAS PROD OUT	296
COOLING WATER IN	87	COOLING WATER OUT	91
PRODUCT OIL OUT	143		
AMBIENT AIR	47	OFF GAS	156

RATES AND QUANTITIES

RAW SHALE	TPH	1.04	THROUGHPUT PHF2		422.3
RET SHALE	TPH	0.82	RET/RAW	WT%	78.7
AIR TOP	SCFM	55.3		SCF/T	3190.4
AIR MID	SCFM	35.1		SCF/T	2022.9
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	90.4		SCF/T	5213.3

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.160			
SP GR		0.994			
GAS TOP	SCFM	13.2		SCF/T	763.1
GAS MID	SCFM	64.7		SCF/T	3731.4
GAS BTM	SCFM	153.3		SCF/T	8841.3
TOTAL GAS	SCFM	231.2		SCF/T	13335.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	147.4		SCF/T	8501.3
COOLING WATER	GPM	15.5	BARO PRESS IN HG		23.9
AMB AIR REL HUM	%	59.2	BED PD IN H2O/FT		0.6

OIL YIELD WT% FA= 82.7
OIL YIELD VOL% FA= 81.4

***PILOT PLANT ***
STARTING DATE 42878 TO 42978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.07	69.10	101.5
ASH	#/MIN	28.66	28.66	100.0
OXYGEN	SCFM	18.09	18.09	100.0
			7.13 TO H2O	
			10.94 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.29	1.57	121.9
		0.61 SHALE	0.09 LIQ	
		0.68 COMB	1.40 VAP	
			0.07 SHALE	
KEROGEN	#/MIN	6.73	5.40	80.2
			0.75 SHALE	
			3.45 OIL	
			1.19 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	5.54	4.57	82.5
			0.39 SHALE	
			2.91 OIL	
			0.97 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.63	6.66	87.3
			2.20 SHALE	
			2.91 OIL	
			1.54 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.78	0.67	86.3
			0.07 SHALE	
			0.40 OIL	
			0.21 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.24	0.18	76.7
SULFUR	#/MIN	0.36	0.34	96.2
			0.29 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
OVERALL WEIGHT	#/MIN	50.25	49.09	97.7

0.386 #/MIN C 0.075 #/MIN H 5.124 C/H COMB RATIO
67.85 VOL.%FA 68.98WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 42878 TO 42978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.07	68.07	100.0
ASH	#/MIN	28.66	28.66	100.0
OXYGEN	SCFM	18.09	18.09	100.0
			7.62 TO H2O	
			10.45 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.33	1.55	116.1
		0.61 SHALE	0.09 LIQ	
		0.72 COMB	1.38 VAP	
			0.07 SHALE	
KEROGEN	#/MIN	6.73	5.38	79.9
			0.75 SHALE	
			3.45 OIL	
			1.17 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	5.54	4.55	82.1
			0.69 SHALE	
			2.91 OIL	
			0.94 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.63	6.64	87.0
			2.20 SHALE	
			2.91 OIL	
			1.52 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.78	0.68	86.7
			0.07 SHALE	
			0.40 OIL	
			0.21 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.24	0.18	76.5
SULFUR	#/MIN	0.36	0.34	96.2
			0.29 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	50.25	48.93	97.4

0.369 #/MIN C 0.080 #/MIN H 4.596 C/H COMB RATIO
67.85 VOL%FA 68.98WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 42878 TO 42978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.07	68.07	100.0
ASH	#/MIN	23.44	23.44	100.0
OXYGEN	SCFM	18.09	18.09	100.0
			3.69 TO H2O	
			14.38 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	0.85	1.53	181.0
		0.50 SHALE	0.09 LIQ	
		0.35 COMB	1.38 VAP	
			0.06 SHALE	
KEROGEN	#/MIN	5.50	5.30	96.4
			0.61 SHALE	
			3.45 OIL	
			1.24 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.53	4.53	100.0
			0.56 SHALE	
			2.91 OIL	
			1.05 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.24	6.24	100.0
			1.80 SHALE	
			2.91 OIL	
			1.52 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.64	0.62	97.6
			0.05 SHALE	
			0.40 OIL	
			0.17 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.17	86.1
SULFUR	#/MIN	0.29	0.29	99.2
			0.24 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	42.29	42.57	100.7

0.496 #/MIN C 0.039 #/MIN H 12.741 C/H COMB RATIO
82.97 VOL%FA 84.37WT.%FA

DATA SUMMARY

STARTING DATE 42970 TO 42978
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	11.53	H2O FA	WT%	0.65
OIL FA	GPT	30.20			
MIN CO2	WT%	17.69	ASH	WT%	66.14
CARBON	WT%	17.60	HYDROGEN	WT%	1.87
NITROGEN	WT%	0.55	SULFUR	WT%	0.82

RAW SHALE MOISTURE WT% (UNGROUND) 0.75

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.5	WATER	WT%	3.0
VIS	SUS-130	0.0	SEDIMENT	ML/100G	2.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.52	HYDROGEN	WT%	11.51
NITROGEN	WT%	2.25	SULFUR	WT%	0.65

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.5	WATER	WT%	3.0

PRODUCT WATER PROPERTIES

CARBON	WT%	4.05	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.74	SULFUR	WT%	4.05
CO2	WT%	0.94			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.33	C2H4	VOL%	0.57
N2+AR	VOL%	60.55	C2H6	VOL%	0.56
O2	VOL%	0.02	C3'S	VOL%	0.49
CO	VOL%	2.69	C4'S	VOL%	0.68
CH4	VOL%	1.54	C5+	VOL%	0.68
CO2	VOL%	27.13	H2S	VOL%	0.24
			NH3	VOL%	0.52

GROSS HEAT BTU/SCF 135.39

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.03			
MIN CO2	WT%	15.93	ASH	WT%	82.19
CARBON	WT%	6.31	HYDROGEN	WT%	0.21
NITROGEN	WT%	0.23	SULFUR	WT%	0.84

TEMPERATURES DEG F

RAW SHALE IN	47	RET SHALE OUT	374
AIR TD IN	212	AIR MD IN	212
GAS BD IN	230	GAS MD IN	280
GAS TD IN	230	GAS PROD OUT	280
COOLING WATER IN	84	COOLING WATER OUT	91
PRODUCT OIL OUT	150		
AMBIENT AIR	47	OFF GAS	144

RATES AND QUANTITIES

RAW SHALE	TPH	1.30	THROUGHPUT PHF2		527.9
RET SHALE	TPH	1.05	RET/RAW	WT%	80.5
AIR TOP	SCFM	70.3		SCF/T	3242.7
AIR MID	SCFM	15.9		SCF/T	733.9
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	86.2		SCF/T	3976.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		20.580			
SP GR		0.970			
GAS TOP	SCFM	23.8		SCF/T	1097.5
GAS MID	SCFM	25.8		SCF/T	1189.2
GAS BTM	SCFM	220.8		SCF/T	10189.8
TOTAL GAS	SCFM	270.3		SCF/T	12476.5
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	143.7		SCF/T	6632.2
COOLING WATER	GPM	16.1	BARO PRESS IN HG		28.9
AMB AIR REL HUM	%	49.0	BED PD IN H2O/FT		6.7

OIL YIELD WT% FA= 68.9
OIL YIELD VOL% FA= 67.8

PILOT PLANT
STARTING DATE 42978 TO 43078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.62	62.75	91.5
ASH	#/MIN	26.52	26.52	100.0
OXYGEN	SCFM	18.24	18.24	100.0
			12.36 TO H2O	
			5.86 TO CO&CO2	
			0.02 GAS	
WATER	#/MIN	1.94	1.33	68.7
		0.76 SHALE	0.09 LIQ	
		1.17 COMB	1.16 VAP	
			0.09 SHALE	
KEROGEN	#/MIN	5.96	4.87	81.7
			0.73 SHALE	
			3.12 OIL	
			1.01 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.52	4.06	89.8
			0.69 SHALE	
			2.64 OIL	
			0.74 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.45	5.99	92.9
			2.09 SHALE	
			2.64 OIL	
			1.26 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.61	0.66	107.9
			0.05 SHALE	
			0.36 OIL	
			0.26 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.17	80.3
SULFUR	#/MIN	0.30	0.30	98.4
			0.25 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	46.96	44.83	95.5

0.216 #/MIN C 0.130 #/MIN H 1.660 C/H COMB RATIO
74.94 VOL%FA 76.29WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 42978 TO 43078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.62	68.62	100.0
ASH	#/MIN	26.52	26.52	100.0
OXYGEN	SCFM	18.24	18.24	100.0
			10.01 TO H2O	
			8.20 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.71	1.44	83.9
		0.76 SHALE	0.09 LIQ	
		0.95 COMB	1.26 VAP	
			0.09 SHALE	
KEROGEN	#/MIN	5.96	4.97	83.5
			0.73 SHALE	
			3.12 OIL	
			1.12 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.52	4.18	92.4
			0.69 SHALE	
			2.64 OIL	
			0.86 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.45	6.11	94.7
			2.09 SHALE	
			2.64 OIL	
			1.38 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.61	0.65	105.8
			0.05 SHALE	
			0.36 OIL	
			0.24 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.17	81.2
SULFUR	#/MIN	0.30	0.30	99.0
			0.25 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	46.96	45.71	97.3

0.294 #/MIN C 0.106 #/MIN H 2.784 C/H COMB RATIO
74.94 VOL%FA 76.29WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 42978 TO 43078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.62	68.62	100.0
ASH	#/MIN	24.44	24.44	100.0
OXYGEN	SCFM	18.24	18.24	100.0
			8.50 TO H2O	
			9.71 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.51	1.43	94.7
		0.70 SHALE	0.09 LIQ	
		0.81 COMB	1.26 VAP	
			0.08 SHALE	
KEROGEN	#/MIN	5.49	4.94	90.0
			0.67 SHALE	
			3.12 OIL	
			1.14 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.17	4.17	100.0
			0.63 SHALE	
			2.64 OIL	
			0.90 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	5.95	5.95	100.0
			1.93 SHALE	
			2.64 OIL	
			1.38 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.57	0.63	111.4
			0.04 SHALE	
			0.36 OIL	
			0.23 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.16	85.1
SULFUR	#/MIN	0.28	0.28	100.3
			0.23 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
OVERALL WEIGHT	#/MIN	43.80	43.18	98.6

0.343 #/MIN C 0.090 #/MIN H 3.816 C/H COMB RATIO
81.32 VOL%FA 82.78WT.%FA

DATA SUMMARY

STARTING DATE 42978 TO 43078
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.22	H2O FA	WT%	1.12
OIL FA	GPT	26.80			
MIN CO2	WT%	17.69	ASH	WT%	66.30
CARBON	WT%	16.13	HYDROGEN	WT%	1.66
NITROGEN	WT%	0.52	SULFUR	WT%	0.76

RAW SHALE MOISTURE WT% (UNGROUND) 0.78

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	20.5	WATER	WT%	3.0
VIS	SUS-130	0.0	SEDIMENT	ML/100G	2.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.52	HYDROGEN	WT%	11.51
NITROGEN	WT%	2.25	SULFUR	WT%	0.65

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	20.5	WATER	WT%	3.0

PRODUCT WATER PROPERTIES

CARBON	WT%	4.05	HYDROGEN	WT%	10.71
NITROGEN	WT%	2.74	SULFUR	WT%	4.05
CO2	WT%	3.94			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.99	C2H4	VOL%	0.69
N2+AR	VOL%	62.64	C2H6	VOL%	0.68
O2	VOL%	0.02	C3'S	VOL%	0.48
CO	VOL%	2.43	C4'S	VOL%	0.53
CH4	VOL%	2.23	C5+	VOL%	0.69
CO2	VOL%	23.82	H2S	VOL%	0.25
			NH3	VOL%	0.54

GROSS HEAT BTU/SCF 143.03

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.02			
OIL FA	GPT	0.05			
MIN CO2	WT%	16.03	ASH	WT%	82.30
CARBON	WT%	5.50	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.23	SULFUR	WT%	0.79

TEMPERATURES DEG F

RAW SHALE IN	45	RET SHALE OUT	326
AIR TD IN	237	AIR MD IN	207
GAS BD IN	230	GAS MD IN	280
GAS TD IN	230	GAS PROD OUT	280
COOLING WATER IN	80	COOLING WATER OUT	90
PRODUCT OIL OUT	145		
AMBIENT AIR	45	OFF GAS	147

RATES AND QUANTITIES

RAW SHALE	TPH	1.20	THROUGHPUT PHF2		487.3
RET SHALE	TPH	0.97	RET/RAW	WT%	80.6
AIR TOP	SCFM	70.9		SCF/T	3545.7
AIR MID	SCFM	15.9		SCF/T	797.1
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	86.9		SCF/T	4342.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.560			
SP GR		0.986			
GAS TOP	SCFM	25.0		SCF/T	1250.0
GAS MID	SCFM	25.5		SCF/T	1276.1
GAS BTM	SCFM	215.0		SCF/T	10747.7
TOTAL GAS	SCFM	265.5		SCF/T	13273.8
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	124.5		SCF/T	6226.9
COOLING WATER	GPM	16.1	BARO PRESS IN HG		23.8
AMB AIR REL HUM	%	75.0	BED PD IN H2O/FT		0.4

OIL YIELD WT% FA= 76.2
OIL YIELD VOL% FA= 74.9

APPENDIX 3.5

PILOT PLANT RETORTING RESEARCH - AIR AND GAS FLOWS

STARTING DATE 70878 TO 70978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	70.14	66.23	94.4
ASH	#/MIN	28.23	28.23	100.0
OXYGEN	SCFM	18.65	18.65	100.0
			14.58 TO H2O	
			4.04 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.07	1.52	73.5
		0.69 SHALE	0.15 LIQ	
		1.39 COMB	1.24 VAP	
			0.14 SHALE	
KEROGEN	#/MIN	6.27	5.32	84.7
			0.98 SHALE	
			3.44 OIL	
			0.88 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.96	4.45	89.7
			0.93 SHALE	
			2.92 OIL	
			0.59 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.00	6.49	92.7
			2.38 SHALE	
			2.92 OIL	
			1.18 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.67	0.72	107.3
			0.05 SHALE	
			0.39 OIL	
			0.28 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.23	0.21	89.3
SULFUR	#/MIN	0.34	0.34	101.0
			0.28 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
OVERALL WEIGHT	#/MIN	49.46	47.97	97.0

0.175 #/MIN C 0.154 #/MIN H 1.135 C/H COMB RATIO
80.11 VOL%FA 81.73WT.%FA

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***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 70878 TO 70978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	70.14	70.14	100.0
ASH	#/MIN	28.23	28.23	100.0
OXYGEN	SCFM	18.65	18.65	100.0
			13.07 TO H2O	
			5.55 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.93	1.60	82.7
		0.69 SHALE	0.15 LIQ	
		1.24 COMB	1.31 VAP	
			0.14 SHALE	
KEROGEN	#/MIN	6.27	5.38	85.7
			0.98 SHALE	
			3.44 OIL	
			0.95 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.96	4.52	91.1
			0.93 SHALE	
			2.92 OIL	
			0.66 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	7.08	6.56	93.7
			2.38 SHALE	
			2.92 OIL	
			1.25 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.67	0.71	106.0
			0.05 SHALE	
			0.39 OIL	
			0.27 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.23	0.21	90.6
SULFUR	#/MIN	0.34	0.35	101.5
			0.28 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
OVERALL WEIGHT	#/MIN	49.46	48.55	98.2

0.226 #/MIN C 0.138 #/MIN H 1.638 C/H COMB RATIO
80.11 VOL%FA 81.73WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 70878 TO 70978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	70.14	70.14	100.0
ASH	#/MIN	25.53	25.53	100.0
OXYGEN	SCFM	18.65	18.65	100.0
			11.00 TO H2O	
			7.62 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.67	1.58	94.9
		0.62 SHALE	0.15 LIQ	
		1.04 COMB	1.31 VAP	
			0.12 SHALE	
KEROGEN	#/MIN	5.67	5.32	93.8
			0.89 SHALE	
			3.44 OIL	
			0.98 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.49	4.49	100.0
			0.84 SHALE	
			2.92 OIL	
			0.72 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.33	6.33	100.0
			2.15 SHALE	
			2.92 OIL	
			1.25 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.61	0.69	112.9
			0.05 SHALE	
			0.39 OIL	
			0.25 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.20	96.5
SULFUR	#/MIN	0.31	0.32	103.5
			0.26 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	45.38	45.24	99.7

0.292 #/MIN C 0.116 #/MIN H 2.516 C/H COMB RATIO
88.57 VOL%FA 90.37WT.%FA

DATA SUMMARY

STARTING DATE 70878 TO 70978
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.90	H2O FA	WT%	1.32
OIL FA	GPT	25.90			
MIN CO2	WT%	17.57	ASH	WT%	66.36
CARBON	WT%	16.46	HYDROGEN	WT%	1.73
NITROGEN	WT%	0.54	SULFUR	WT%	0.80

RAW SHALE MOISTURE WT% (UNGROUND) 0.30

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	4.6
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.6
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.90	HYDROGEN	WT%	11.47
NITROGEN	WT%	2.12	SULFUR	WT%	0.70

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	4.6

PRODUCT WATER PROPERTIES

CARBON	WT%	3.20	HYDROGEN	WT%	10.44
NITROGEN	WT%	1.64	SULFUR	WT%	3.16
CO2	WT%	9.25			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	6.32	C2H4	VOL%	0.76
N2+AR	VOL%	61.96	C2H6	VOL%	0.50
O2	VOL%	0.02	C3'S	VOL%	0.42
CO	VOL%	3.23	C4'S	VOL%	0.64
CH4	VOL%	2.17	C5+	VOL%	0.29
CO2	VOL%	22.39	H2S	VOL%	0.34
			NH3	VOL%	1.26

GROSS HEAT BTU/SCF 119.65

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.02			
MIN CO2	WT%	15.29	ASH	WT%	81.53
CARBON	WT%	5.86	HYDROGEN	WT%	0.19
NITROGEN	WT%	0.23	SULFUR	WT%	0.82

TEMPERATURES DEG F

RAW SHALE IN	76	RET SHALE OUT	414
AIR TD IN	236	AIR MD IN	236
GAS BD IN	256	GAS MD IN	266
GAS TD IN	256	GAS PROD OUT	266
COOLING WATER IN	120	COOLING WATER OUT	129
PRODUCT OIL OUT	143		
AMBIENT AIR	76	OFF GAS	159

RATES AND QUANTITIES

RAW SHALE	TPH	1.28	THROUGHPUT PHF2		518.2
RET SHALE	TPH	1.04	RET/RAW	WT%	81.4
AIR TOP	SCFM	72.4		SCF/T	3405.3
AIR MID	SCFM	16.4		SCF/T	769.3
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	88.8		SCF/T	4174.5

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		19.590			
SP GR		0.958			
GAS TOP	SCFM	25.9		SCF/T	1219.5
GAS MID	SCFM	25.1		SCF/T	1179.1
GAS BTM	SCFM	227.0		SCF/T	10674.0
TOTAL GAS	SCFM	278.0		SCF/T	13072.6
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	132.9		SCF/T	6250.5
COOLING WATER	GPM	13.8	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	14.3	BED PD IN H2O/FT		0.0

OIL YIELD WT% FA= 81.6
OIL YIELD VOL% FA= 80.1

***PILOT PLANT ***
STARTING DATE 70978 TO 71078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	69.85	66.27	94.9
ASH	#/MIN	27.33	27.33	100.0
OXYGEN	SCFM	18.57	18.57	100.0
			12.08 TO H2O	
			6.47 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.91	1.44	75.3
		0.76 SHALE	0.05 LIQ	
		1.15 COMB	1.26 VAP	
			0.13 SHALE	
KEROGEN	#/MIN	6.28	5.18	82.4
			0.98 SHALE	
			3.21 OIL	
			0.98 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.74	4.35	91.9
			0.94 SHALE	
			2.71 OIL	
			0.71 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.66	6.27	94.2
			2.33 SHALE	
			2.71 OIL	
			1.23 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.65	0.67	103.7
			0.05 SHALE	
			0.36 OIL	
			0.26 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.20	91.7
SULFUR	#/MIN	0.33	0.33	101.5
			0.27 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	48.18	46.61	96.7

0.245 #/MIN C 0.127 #/MIN H 1.920 C/H COMB RATIO
75.82 VOL%FA 77.30WT.%FA

*** 129. PLANT FORCED WITH N2 BALANCE ***
STARTING DATE 70978 TO 71078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	69.85	69.85	100.0
ASH	#/MIN	27.33	27.33	100.0
OXYGEN	SCFM	18.57	18.57	100.0
			10.69 TO H2O	
			7.85 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.78	1.51	84.7
		0.76 SHALE	0.05 LIQ	
		1.02 COMB	1.33 VAP	
			0.13 SHALE	
KEROGEN	#/MIN	6.28	5.24	83.4
			0.98 SHALE	
			3.21 OIL	
			1.04 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.74	4.42	93.3
			0.94 SHALE	
			2.71 OIL	
			0.77 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.66	6.34	95.2
			2.33 SHALE	
			2.71 OIL	
			1.30 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.65	0.66	102.5
			0.05 SHALE	
			0.36 OIL	
			0.25 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.21	92.9
SULFUR	#/MIN	0.33	0.33	102.0
			0.27 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	48.18	47.14	97.8

0.291 #/MIN C 0.113 #/MIN H 2.582 C/H COMB RATIO
75.82 VOL%FA 77.30WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 70978 TO 71078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	69.85	69.85	100.0
ASH	#/MIN	25.32	25.32	100.0
OXYGEN	SCFM	18.57	18.57	100.0
			9.27 TO H2O	
			9.27 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.59	1.50	94.3
		0.71 SHALE	0.05 LIQ	
		0.88 COMB	1.33 VAP	
			0.12 SHALE	
KEROGEN	#/MIN	5.82	5.19	89.1
			0.91 SHALE	
			3.21 OIL	
			1.07 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.39	4.39	100.0
			0.87 SHALE	
			2.71 OIL	
			0.81 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.17	6.17	100.0
			2.16 SHALE	
			2.71 OIL	
			1.30 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.60	0.65	107.5
			0.05 SHALE	
			0.36 OIL	
			0.23 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.20	97.2
SULFUR	#/MIN	0.30	0.31	103.4
			0.25 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	45.13	44.67	99.0

0.337 #/MIN C 0.098 #/MIN H 3.441 C/H COMB RATIO
81.85 VOL%FA 83.45WT.%FA

DATA SUMMARY

STARTING DATE 70978 TO 71078

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.06	H2O FA	WT%	1.42
OIL FA	GPT	26.30			
MIN CO2	WT%	17.06	ASH	WT%	66.28
CARBON	WT%	16.14	HYDROGEN	WT%	1.73
NITROGEN	WT%	0.54	SULFUR	WT%	0.79

RAW SHALE MOISTURE WT% (UNGROUND) 0.43

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	1.7
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.4
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.41	HYDROGEN	WT%	11.38
NITROGEN	WT%	2.10	SULFUR	WT%	0.72

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	1.7

PRODUCT WATER PROPERTIES

CARBON	WT%	3.36	HYDROGEN	WT%	10.27
NITROGEN	WT%	1.69	SULFUR	WT%	3.44
CO2	WT%	3.30			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.31	C2H4	VOL%	0.69
N2+AR	VOL%	62.17	C2H6	VOL%	0.54
O2	VOL%	0.02	C3'S	VOL%	0.48
CO	VOL%	2.83	C4'S	VOL%	0.76
CH4	VOL%	2.92	C5+	VOL%	0.00
CO2	VOL%	22.70	H2S	VOL%	0.34
			NH3	VOL%	1.24

GROSS HEAT BTU/SCF 128.02

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.01			
OIL FA	GPT	0.02			
MIN CO2	WT%	1[illegible].29	ASH	WT%	81.53
CARBON	WT%	5.96	HYDROGEN	WT%	0.19
NITROGEN	WT%	0.26	SULFUR	WT%	0.82

TEMPERATURES DEG F

RAW SHALE IN	77	RET SHALE OUT	396
AIR TD IN	233	AIR MD IN	233
GAS BD IN	270	GAS MD IN	270
GAS TD IN	270	GAS PROD OUT	270
COOLING WATER IN	121	COOLING WATER OUT	127
PRODUCT OIL OUT	145		
AMBIENT AIR	74	OFF GAS	168

RATES AND QUANTITIES

RAW SHALE	TPH	1.24	THROUGHPUT PHF2		502.4
RET SHALE	TPH	1.01	RET/RAW	WT%	81.3
AIR TOP	SCFM	72.0		SCF/T	3494.5
AIR MID	SCFM	16.4		SCF/T	794.2
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	88.4		SCF/T	4288.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 19.900
SP GR 0.965

GAS TOP	SCFM	25.8	SCF/T	1253.0
GAS MID	SCFM	25.0	SCF/T	1211.4
GAS BTM	SCFM	226.1	SCF/T	10966.6
TOTAL GAS	SCFM	276.9	SCF/T	13431.0

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	133.1	SCF/T	6455.2

COOLING WATER	GPM	13.5	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	21.5	BED PD IN H2O/FT		0.0

OIL YIELD WT% FA= 77.2
OIL YIELD VOL% FA= 75.8

***PILOT PLANT ***
STARTING DATE 72278 TO 72378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	70.22	55.71	79.3
ASH	#/MIN	25.18	25.18	100.0
OXYGEN	SCFM	18.67	18.67	100.0
			11.58 TO H2O	
			7.06 TO CO&CO2	
			0.02 GAS	
WATER	#/MIN	1.73	1.75	101.1
		0.63 SHALE	0.02 LIQ	
		1.10 COMB	1.63 VAP	
			0.11 SHALE	
KEROGEN	#/MIN	5.63	5.24	93.0
			0.76 SHALE	
			3.42 OIL	
			1.06 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.54	4.39	96.9
			0.71 SHALE	
			2.90 OIL	
			0.79 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.40	6.26	97.8
			2.13 SHALE	
			2.90 OIL	
			1.23 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.64	0.70	109.8
			0.05 SHALE	
			0.39 OIL	
			0.25 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.20	97.3
SULFUR	#/MIN	0.29	0.29	102.2
			0.24 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
OVERALL WEIGHT	#/MIN	45.09	44.12	97.9

0.262 #/MIN C 0.122 #/MIN H 2.141 C/H COMB RATIO
88.28 VOL%FA 90.08WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 72278 TO 72378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	70.22	70.22	100.0
ASH	#/MIN	25.18	25.18	100.0
OXYGEN	SCFM	18.67	18.67	100.0
			5.38 TO H2O	
			13.26 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.14	2.17	190.6
		0.63 SHALE	0.02 LIQ	
		0.51 COMB	2.05 VAP	
			0.11 SHALE	
KEROGEN	#/MIN	5.63	5.54	98.2
			0.76 SHALE	
			3.42 OIL	
			1.35 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.54	4.72	104.0
			0.71 SHALE	
			2.90 OIL	
			1.11 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.40	6.58	102.8
			2.13 SHALE	
			2.90 OIL	
			1.56 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.64	0.67	104.8
			0.05 SHALE	
			0.39 OIL	
			0.22 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.21	103.2
SULFUR	#/MIN	0.28	0.30	105.1
			0.24 SHALE	
			0.02 OIL	
			0.04 GAS	
			0.00 WATER	
OVALL WEIGHT	#/MIN	45.09	46.53	103.2

0.470 #/MIN C 0.057 #/MIN H 8.281 C/H COMB RATIO
88.28 VOL%FA 90.08WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 72278 TO 72378

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	70.22	70.22	100.0
ASH	#/MIN	26.24	26.24	100.0
OXYGEN	SCFM	18.67	18.67	100.0
			6.08 TO H2O	
			12.56 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.23	2.18	176.6
		0.66 SHALE	0.02 LIQ	
		0.58 COMB	2.05 VAP	
			0.11 SHALE	
KEROGEN	#/MIN	5.87	5.56	94.6
			0.79 SHALE	
			3.42 OIL	
			1.34 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.73	4.73	100.0
			0.74 SHALE	
			2.90 OIL	
			1.09 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.67	6.67	100.0
			2.21 SHALE	
			2.90 OIL	
			1.56 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.67	0.68	102.0
			0.06 SHALE	
			0.39 OIL	
			0.23 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.21	100.6
SULFUR	#/MIN	0.29	0.31	104.2
			0.25 SHALE	
			0.02 OIL	
			0.04 GAS	
			0.00 WATER	
OVERALL WEIGHT	#/MIN	46.70	47.86	102.5

0.447 #/MIN C 0.064 #/MIN H 6.969 C/H COMB RATIO
84.71 VOL%FA 86.44WT.%FA

DATA SUMMARY

STARTING DATE 72278 TO 72378
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.98	H2O FA	WT%	1.01
OIL FA	GPT	26.13			
MIN CO2	WT%	17.99	ASH	WT%	66.19
CARBON	WT%	16.83	HYDROGEN	WT%	1.79
NITROGEN	WT%	0.53	SULFUR	WT%	0.74

RAW SHALE MOISTURE WT% (UNGROUND) 0.64

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.9	WATER	WT%	0.6
VIS	SUS-130	0.0	SEDIMENT ML/100G		0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.79	HYDROGEN	WT%	11.53
NITROGEN	WT%	2.09	SULFUR	WT%	0.58

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.9	WATER	WT%	0.6

PRODUCT WATER PROPERTIES

CARBON	WT%	5.62	HYDROGEN	WT%	10.04
NITROGEN	WT%	2.66	SULFUR	WT%	3.84
CO2	WT%	0.19			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.63	C2H4	VOL%	0.54
N2+AR	VOL%	60.80	C2H6	VOL%	0.43
O2	VOL%	0.03	C3'S	VOL%	0.86
CO	VOL%	3.12	C4'S	VOL%	0.96
CH4	VOL%	1.54	C5+	VOL%	0.62
CO2	VOL%	24.42	H2S	VOL%	0.40
			NH3	VOL%	1.35

GROSS HEAT BTU/SCF 159.33

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.36			
OIL FA	GPT	0.93			
MIN CO2	WT%	16.53	ASH	WT%	80.09
CARBON	WT%	6.76	HYDROGEN	WT%	0.21
NITROGEN	WT%	0.25	SULFUR	WT%	0.75

TEMPERATURES DEG F

RAW SHALE IN	72	RET SHALE OUT	355
AIR TD IN	233	AIR BD IN	233
GAS BD IN	253	GAS BD IN	253
GAS TD IN	253	GAS PROD OUT	253
COOLING WATER IN	116	COOLING WATER OUT	123
PRODUCT OIL OUT	175		
AMBIENT AIR	72	OFF GAS	182

RATES AND QUANTITIES

RAW SHALE	TPH	1.14	THROUGHPUT PHF2		463.5
RET SHALE	TPH	0.94	RET/RAW	WT%	82.6
AIR TOP	SCFM	72.0		SCF/T	3797.8
AIR MID	SCFM	16.8		SCF/T	885.4
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	88.9		SCF/T	4673.2

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 27.200
SP GR 0.960

GAS TOP	SCFM	25.6		SCF/T	1344.3
GAS MID	SCFM	25.5		SCF/T	1342.7
GAS BTM	SCFM	231.2		SCF/T	12154.7
TOTAL GAS	SCFM	282.3		SCF/T	14841.6

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	125.9		SCF/T	6616.8
COOLING WATER	GPM	13.2	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	29.0	BED PD IN H2O/FT		8.2

OIL YIELD WT% FA= 90.0
OIL YIELD VOL% FA= 83.3

***PILOT PLANT ***
STARTING DATE 72378 TO 72478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.77	59.08	85.9
ASH	#/MIN	25.02	25.02	100.0
OXYGEN	SCFM	18.28	18.28	100.0
			10.54 TO H2O	
			7.72 TO CO&CO2	
			0.02 GAS	
WATER	#/MIN	1.55	1.51	97.0
		0.55 SHALE	0.16 LIQ	
		1.00 COMB	1.27 VAP	
			0.07 SHALE	
KEROGEN	#/MIN	6.12	5.08	83.0
			0.74 SHALE	
			3.22 OIL	
			1.10 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.62	4.26	92.2
			0.70 SHALE	
			2.72 OIL	
			0.83 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.45	6.09	94.4
			2.07 SHALE	
			2.72 OIL	
			1.29 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.68	0.67	99.3
			0.05 SHALE	
			0.38 OIL	
			0.25 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.16	83.1
SULFUR	#/MIN	0.29	0.27	95.6
			0.22 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	45.06	43.72	97.0

0.284 #/MIN C 0.111 #/MIN H 2.557 C/H COMB RATIO
78.51 VOL%FA 79.30WT.%FA

***PROGRAM FORCED WITH N2 BALANCE ***
STARTING DATE 72378 TO 72478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.77	68.77	100.0
ASH	#/MIN	25.02	25.02	100.0
OXYGEN	SCFM	18.28	18.28	100.0
			6.44 TO H2O	
			11.81 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.16	1.71	147.4
		0.55 SHALE	0.16 LIQ	
		0.61 COMB	1.48 VAP	
			0.07 SHALE	
KEROGEN	#/MIN	6.12	5.27	86.2
			0.74 SHALE	
			3.22 OIL	
			1.29 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.62	4.47	96.8
			0.70 SHALE	
			2.72 OIL	
			1.05 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.45	6.30	97.7
			2.07 SHALE	
			2.72 OIL	
			1.50 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.68	0.65	96.2
			0.05 SHALE	
			0.38 OIL	
			0.22 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.17	85.6
SULFUR	#/MIN	0.29	0.28	97.2
			0.22 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
OVERALL WEIGHT	#/MIN	45.06	45.24	100.4

0.422 #/MIN C 0.068 #/MIN H 6.203 C/H COMB RATIO
78.51 VOL%FA 79.30WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 72378 TO 72478

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	68.77	68.77	100.0
ASH	#/MIN	24.18	24.18	100.0
OXYGEN	SCFM	18.28	18.28	100.0
			5.86 TO H2O	
			12.39 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.09	1.71	157.2
		0.53 SHALE	0.16 LIQ	
		0.56 COMB	1.48 VAP	
			0.07 SHALE	
KEROGEN	#/MIN	5.91	5.26	88.9
			0.72 SHALE	
			3.22 OIL	
			1.30 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.46	4.46	100.0
			0.67 SHALE	
			2.72 OIL	
			1.06 GAS	
			0.01 WATER	
TOTAL CARBON	#/MIN	6.23	6.23	100.0
			2.00 SHALE	
			2.72 OIL	
			1.50 GAS	
			0.01 WATER	
ORG. HYDROGEN	#/MIN	0.65	0.64	98.4
			0.05 SHALE	
			0.38 OIL	
			0.22 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.17	87.5
SULFUR	#/MIN	0.28	0.27	97.8
			0.22 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	43.76	44.20	101.0

0.440 #/MIN C 0.062 #/MIN H 7.121 C/H COMB RATIO
81.25 VOL%FA 82.07WT.%FA

DATA SUMMARY

STARTING DATE 72378 TO 72478
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.66	H2O FA	WT%	0.74
OIL FA	GPT	27.90			
MIN CO2	WT%	17.59	ASH	WT%	65.62
CARBON	WT%	16.91	HYDROGEN	WT%	1.86
NITROGEN	WT%	0.52	SULFUR	WT%	0.75

RAW SHALE MOISTURE WT% (UNGROUND) 0.70

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	5.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.2
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.42	HYDROGEN	WT%	11.71
NITROGEN	WT%	2.05	SULFUR	WT%	0.54

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	21.4	WATER	WT%	5.3

PRODUCT WATER PROPERTIES

CARBON	WT%	4.37	HYDROGEN	WT%	10.42
NITROGEN	WT%	3.29	SULFUR	WT%	2.88
CO2	WT%	3.20			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.04	C2H4	VOL%	0.64
N2+AR	VOL%	60.96	C2H6	VOL%	0.48
O2	VOL%	0.03	C3'S	VOL%	1.05
CO	VOL%	3.10	C4'S	VOL%	1.39
CH4	VOL%	1.93	C5+	VOL%	0.60
CO2	VOL%	24.19	H2S	VOL%	0.34
			NH3	VOL%	0.86

GROSS HEAT BTU/SCF 156.98

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.09			
OIL FA	GPT	0.22			
MIN CO2	WT%	15.19	ASH	WT%	80.62
CARBON	WT%	5.66	HYDROGEN	WT%	0.18
NITROGEN	WT%	0.20	SULFUR	WT%	0.72

TEMPERATURES DEG F

RAW SHALE IN	72	RET SHALE OUT	368
AIR TD IN	236	AIR MD IN	236
GAS BD IN	251	GAS MD IN	251
GAS TD IN	251	GAS PROD OUT	251
COOLING WATER IN	116	COOLING WATER OUT	123
PRODUCT OIL OUT	176		
AMBIENT AIR	72	OFF GAS	173

RATES AND QUANTITIES

RAW SHALE	TPH	1.14	THROUGHPUT PHF2		464.5
RET SHALE	TPH	0.93	RET/RAW	WT%	81.4
AIR TOP	SCFM	71.2		SCF/T	3736.4
AIR MID	SCFM	15.8		SCF/T	829.3
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	87.0		SCF/T	4565.6

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		21.650			
SP GR		0.981			
GAS TOP	SCFM	25.6		SCF/T	1342.8
GAS MID	SCFM	25.3		SCF/T	1326.1
GAS BTM	SCFM	231.5		SCF/T	12141.2
TOTAL GAS	SCFM	282.4		SCF/T	14810.1
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	123.7		SCF/T	6488.0
COOLING WATER	GPM	13.8	BACK PRESS IN HG		24.1
AMB AIR REL HUM	%	26.0	BED PD IN H2O/FT		0.1

OIL YIELD WT% FAF 79.2

***PILOT PLANT ***
STARTING DATE 72978 TO 73078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	73.47	71.50	97.3
ASH	#/MIN	26.21	26.21	100.0
OXYGEN	SCFM	19.53	19.53	100.0
			15.02 TO H2O	
			4.48 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.47	1.61	65.2
		1.04 SHALE	0.04 LIQ	
		1.43 COMB	1.48 VAP	
			0.09 SHALE	
KEROGEN	#/MIN	6.67	5.21	78.0
			0.57 SHALE	
			3.52 OIL	
			1.11 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.64	4.29	92.6
			0.53 SHALE	
			2.97 OIL	
			0.78 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.58	6.23	94.8
			1.73 SHALE	
			2.97 OIL	
			1.53 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.61	0.74	121.3
			0.04 SHALE	
			0.40 OIL	
			0.31 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.17	83.7
SULFUR	#/MIN	0.30	0.29	93.8
			0.23 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
OVERALL WEIGHT	#/MIN	48.15	45.72	94.9

0.191 #/MIN C 0.159 #/MIN H 1.203 C/H COMB RATIO
88.58 VOL%FA 90.71WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 72978 TO 73078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	73.47	73.47	100.0
ASH	#/MIN	26.21	26.21	100.0
OXYGEN	SCFM	19.53	19.53	100.0
			14.18 TO H2O	
			5.32 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.39	1.65	69.1
		1.04 SHALE	0.04 LIQ	
		1.35 COMB	1.52 VAP	
			0.09 SHALE	
KEROGEN	#/MIN	6.67	5.24	78.6
			0.57 SHALE	
			3.52 OIL	
			1.15 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.64	4.33	93.5
			0.53 SHALE	
			2.97 OIL	
			0.82 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.58	6.27	95.4
			1.73 SHALE	
			2.97 OIL	
			1.57 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.61	0.74	120.6
			0.04 SHALE	
			0.40 OIL	
			0.30 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.21	0.17	84.2
SULFUR	#/MIN	0.30	0.29	94.1
			0.23 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	48.15	46.02	95.6

0.219 #/MIN C 0.150 #/MIN H 1.464 C/H COMB RATIO
88.58 VOL%FA 90.71WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 72978 TO 73078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	73.47	73.47	100.0
ASH	#/MIN	24.58	24.58	100.0
OXYGEN	SCFM	19.53	19.53	100.0
			12.55 TO H2O	
			6.95 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.17	1.64	75.9
		0.98 SHALE	0.04 LIQ	
		1.19 COMB	1.52 VAP	
			0.08 SHALE	
KEROGEN	#/MIN	6.26	5.24	83.7
			0.54 SHALE	
			3.52 OIL	
			1.18 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.35	4.35	100.0
			0.50 SHALE	
			2.97 OIL	
			0.87 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.17	6.17	100.0
			1.62 SHALE	
			2.97 OIL	
			1.57 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.57	0.72	125.1
			0.04 SHALE	
			0.40 OIL	
			0.29 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.17	87.7
SULFUR	#/MIN	0.29	0.27	95.4
			0.22 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	45.60	44.09	96.7

0.271 #/MIN C 0.132 #/MIN H 2.046 C/H COMB RATIO
94.47 VOL%FA 96.74WT.%FA

DATA SUMMARY

STARTING DATE 72978 TO 73078
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.54	H2O FA	WT%	1.64
OIL FA	GPT	25.00			
MIN CO2	WT%	17.49	ASH	WT%	64.46
CARBON	WT%	16.17	HYDROGEN	WT%	1.69
NITROGEN	WT%	0.51	SULFUR	WT%	0.75

RAW SHALE MOISTURE WT% (UNGROUND) 0.91

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.5	WATER	WT%	1.3
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.8
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.53	HYDROGEN	WT%	11.24
NITROGEN	WT%	1.90	SULFUR	WT%	0.67

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.5	WATER	WT%	1.3

PRODUCT WATER PROPERTIES

CARBON	WT%	3.37	HYDROGEN	WT%	10.24
NITROGEN	WT%	2.59	SULFUR	WT%	3.21
CO2	WT%	3.61			

***PILOT PLANT FORCED UNDERFEED ***

STARTING DATE 72978 TO 73078

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.57	C2H4	VOL%	0.70
N2+AR	VOL%	61.26	C2H6	VOL%	0.40
O2	VOL%	0.03	C3'S	VOL%	1.15
CO	VOL%	3.04	C4'S	VOL%	0.61
CH4	VOL%	1.75	C5+	VOL%	0.51
CO2	VOL%	24.72	H2S	VOL%	0.33
			NH3	VOL%	0.94

GROSS HEAT BTU/SCF 146.22

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.14			
OIL FA	GPT	0.37			
MIN CO2	WT%	14.14	ASH	WT%	84.60
CARBON	WT%	5.58	HYDROGEN	WT%	0.16
NITROGEN	WT%	3.21	SULFUR	WT%	0.74

TEMPERATURES DEG F

RAW SHALE IN	76	RET SHALE OUT	376
AIR TD IN	233	AIR MD IN	233
GAS BD IN	252	GAS MD IN	252
GAS TD IN	252	GAS PROD OUT	252
COOLING WATER IN	119	COOLING WATER OUT	128
PRODUCT OIL OUT	171		
AMBIENT AIR	76	OFF GAS	167

RATES AND QUANTITIES

RAW SHALE	TPH	1.22	THROUGHPUT PHF2		495.4
RET SHALE	TPH	0.93	RET/RAW	WT%	76.2
AIR TOP	SCFM	77.2		SCF/T	3798.8
AIR MID	SCFM	15.8		SCF/T	774.9
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	93.0		SCF/T	4573.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		21.100			
SP GR		0.987			
GAS TOP	SCFM	20.5		SCF/T	1008.7
GAS MID	SCFM	25.0		SCF/T	1230.7
GAS BTM	SCFM	228.1		SCF/T	11216.0
TOTAL GAS	SCFM	273.6		SCF/T	13455.4
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	147.9		SCF/T	7275.1
COOLING WATER	GPM	14.8	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	31.0	BED PD IN H2O/FT		0.7

OIL YIELD WT% FA= 90.6

OIL YIELD VOL% FA= 83.6

***PILOT PLANT ***
STARTING DATE 73070 TO 73178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	73.29	69.90	95.4
ASH	#/MIN	27.03	27.03	100.0
OXYGEN	SCFM	19.48	19.48	100.0
			14.68 TO H2O	
			4.77 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.93	1.64	85.2
		0.54 SHALE	0.03 LIQ	
		1.39 COMB	\.48 VAP	
			0.13 SHALE	
KEROGEN	#/MIN	5.96	4.90	83.6
			0.57 SHALE	
			3.24 OIL	
			1.09 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.69	4.05	86.4
			0.53 SHALE	
			2.75 OIL	
			0.77 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.66	6.02	90.4
			1.74 SHALE	
			2.75 OIL	
			1.53 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.67	0.69	103.7
			0.04 SHALE	
			0.36 OIL	
			0.30 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.16	75.4
SULFUR	#/MIN	0.27	0.30	107.4
			0.24 SHALE	
			0.02 OIL	
			0.04 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	47.76	46.46	97.3

0.196 #/MIN C 0.155 #/MIN H 1.267 C/H COMB RATIO
74.56 VOL%FA 76.24WT.%FA

***PILOT PLANT FORCED AIR. RE BALANCE ***
STARTING DATE 73078 TO 73178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	73.29	73.29	100.0
ASH	#/MIN	27.03	27.03	100.0
OXYGEN	SCFM	19.48	19.48	100.0
			13.14 TO H2O	
			6.31 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.78	1.72	96.2
		0.54 SHALE	0.03 LIQ	
		1.25 COMB	1.56 VAP	
			0.13 SHALE	
KEROGEN	#/MIN	5.86	4.97	84.8
			0.57 SHALE	
			3.24 OIL	
			1.15 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.69	4.12	87.9
			0.53 SHALE	
			2.75 OIL	
			0.84 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.66	6.10	91.5
			1.74 SHALE	
			2.75 OIL	
			1.61 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.67	0.68	102.3
			0.04 SHALE	
			0.36 OIL	
			0.29 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.17	76.4
SULFUR	#/MIN	0.27	0.30	108.1
			0.24 SHALE	
			0.02 OIL	
			0.04 GAS	
			0.00 WATER	
TOTAL WEIGHT	#/MIN	47.76	47.09	98.4

0.248 #/MIN C 0.139 #/MIN H 1.787 C/H COMB RATIO
74.56 VOL%FA 76.24WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 73078 TO 73178

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	73.29	73.29	100.0
ASH	#/MIN	23.92	23.92	100.0
OXYGEN	SCFM	19.48	19.48	100.0
			10.03 TO H20	
			9.42 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.43	1.70	119.3
		0.47 SHALE	0.03 LIQ	
		0.95 COMB	1.56 VAP	
			0.12 SHALE	
KEROGEN	#/MIN	5.19	4.96	95.6
			0.51 SHALE	
			3.24 OIL	
			1.21 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.15	4.15	100.0
			0.47 SHALE	
			2.75 OIL	
			0.93 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	5.90	5.90	100.0
			1.54 SHALE	
			2.75 OIL	
			1.61 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.59	0.65	109.2
			0.04 SHALE	
			0.[illegible] OIL	
			0.25 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.16	82.8
SULFUR	#/MIN	0.24	0.27	110.9
			0.21 SHALE	
			0.02 OIL	
			0.04 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	43.09	43.32	100.5

0.347 #/MIN C 0.106 #/MIN H 3.281 C/H COMB RATIO
84.24 VOL%FA 86.13WT.%FA

DATA SUMMARY

STARTING DATE 73078 TO 73178

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.51	H2O FA	WT%	0.68
OIL FA	GPT	27.50			
MIN CO2	WT%	17.93	ASH	WT%	66.89
CARBON	WT%	16.49	HYDROGEN	WT%	1.73
NITROGEN	WT%	0.54	SULFUR	WT%	0.68

RAW SHALE MOISTURE WT% (UNGROUND) 0.64

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.5	WATER	WT%	1.0
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.8
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.82	HYDROGEN	WT%	11.03
NITROGEN	WT%	1.90	SULFUR	WT%	0.64

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.5	WATER	WT%	1.0

PRODUCT WATER PROPERTIES

CARBON	WT%	4.66	HYDROGEN	WT%	10.28
NITROGEN	WT%	3.07	SULFUR	WT%	2.88
CO2	WT%	3.84			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.22	C2H4	VOL%	0.61
N2+AR	VOL%	60.60	C2H6	VOL%	0.38
O2	VOL%	0.03	C3'S	VOL%	0.93
CO	VOL%	2.92	C4'S	VOL%	1.23
CH4	VOL%	1.52	C5+	VOL%	0.53
CO2	VOL%	26.16	H2S	VOL%	0.38
			NH3	VOL%	1.04

GROSS HEAT BTU/SCF 138.33

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.07			
OIL FA	GPT	0.19			
MIN CO2	WT%	13.84	ASH	WT%	84.38
CARBON	WT%	5.44	HYDROGEN	WT%	0.17
NITROGEN	WT%	0.18	SULFUR	WT%	0.74

TEMPERATURES DEG F

RAW SHALE IN	77	RET SHALE OUT	386
AIR TD IN	235	AIR MD IN	235
GAS BD IN	253	GAS MD IN	253
GAS TD IN	253	GAS PROD OUT	253
COOLING WATER IN	120	COOLING WATER OUT	129
PRODUCT OIL OUT	170		
AMBIENT AIR	77	OFF GAS	164

RATES AND QUANTITIES

RAW SHALE	TPH	1.21	THROUGHPUT PMF2		492.3
RET SHALE	TPH	0.96	RET/RAW	WT%	79.3
AIR TOP	SCFM	77.0		SCF/T	3813.8
AIR MID	SCFM	15.7		SCF/T	778.0
AIR BTM	SCFM	0.0		SCF/T	0.0
TOTAL AIR	SCFM	92.8		SCF/T	4591.8

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		21.320			
SP GR		0.995			
GAS TOP	SCFM	20.5		SCF/T	1015.0
GAS MID	SCFM	25.0		SCF/T	1238.3
GAS BTM	SCFM	228.0		SCF/T	11285.6
TOTAL GAS	SCFM	273.5		SCF/T	13538.9
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	146.6		SCF/T	7256.0
COOLING WATER	GPM	14.8	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	34.0	BED PD IN H2O/FT		0.4

OIL YIELD WT% FA= 76.1
OIL YIELD VOL% FA= 74.6

***PILOT PLANT ***
STARTING DATE 80678 TO 80778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	84.72	84.63	99.9
ASH	#/MIN	29.15	29.15	100.0
OXYGEN	SCFM	22.52	22.52	100.0
			9.03 TO H2O	
			13.46 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.39	1.62	116.5
		0.53 SHALE	0.09 LIQ	
		0.86 COMB	1.47 VAP	
			0.06 SHALE	
KEROGEN	#/MIN	6.60	5.48	83.1
			0.73 SHALE	
			3.39 OIL	
			1.35 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	5.44	4.63	85.0
			0.68 SHALE	
			2.85 OIL	
			1.09 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.58	6.76	89.2
			2.23 SHALE	
			2.85 OIL	
			1.68 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.76	0.69	90.6
			0.05 SHALE	
			0.39 OIL	
			0.25 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.21	96.0
SULFUR	#/MIN	0.32	0.30	93.0
			0.25 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	52.31	51.89	99.2

0.486 #/MIN C 0.095 #/MIN H 5.097 C/H COMB RATIO
68.97 VOL%FA 70.50WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 80678 TO 80778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	84.72	84.72	100.0
ASH	#/MIN	29.15	29.15	100.0
OXYGEN	SCFM	22.52	22.52	100.0
			8.99 TO H2O	
			13.49 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.39	1.62	116.9
		0.53 SHALE	0.09 LIQ	
		0.85 COMB	1.47 VAP	
			0.06 SHALE	
KEROGEN	#/MIN	6.60	5.48	83.1
			0.73 SHALE	
			3.39 OIL	
			1.35 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	5.44	4.63	85.0
			0.68 SHALE	
			2.85 OIL	
			1.09 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.58	6.76	89.2
			2.23 SHALE	
			2.85 OIL	
			1.68 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.76	0.69	90.6
			0.05 SHALE	
			0.39 OIL	
			0.25 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.21	96.0
SULFUR	#/MIN	0.32	0.30	93.0
			0.25 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	52.31	51.91	99.2

0.487 #/MIN C 0.095 #/MIN H 5.130 C/H COMB RATIO
68.97 VOL%FA 70.50WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 80673 TO 80778

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	84.72	84.72	100.0
ASH	#/MIN	24.71	24.71	100.0
OXYGEN	SCFM	22.52	22.52	100.0
			5.66 TO H2O	
			16.83 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	0.99	1.61	163.0
		0.45 SHALE	0.09 LIQ	
		0.54 COMB	1.47 VAP	
			0.05 SHALE	
KEROGEN	#/MIN	5.59	5.42	97.0
			0.62 SHALE	
			3.39 OIL	
			1.41 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.61	4.61	100.0
			0.58 SHALE	
			2.85 OIL	
			1.18 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.42	6.42	100.0
			1.89 SHALE	
			2.85 OIL	
			1.68 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.65	0.65	100.2
			0.04 SHALE	
			0.39 OIL	
			0.21 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.18	0.20	107.0
SULFUR	#/MIN	0.28	0.26	95.9
			0.21 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	45.60	46.47	101.9

0.594 #/MIN C 0.060 #/MIN H 9.937 C/H COMB RATIO
81.36 VOL%FA 83.16WT.%FA

DATA SUMMARY

STARTING DATE 80678 TO 80778
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.95	H2O FA	WT%	0.76
OIL FA	GPT	28.70			
MIN CO2	WT%	17.83	ASH	WT%	66.39
CARBON	WT%	17.26	HYDROGEN	WT%	1.82
NITROGEN	WT%	0.49	SULFUR	WT%	0.74

RAW SHALE MOISTURE WT% (UNGROUND) 0.45

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)	FACTORS	
2.120	2.59	DA (IN.)=	1.08
1.500	35.37	DV (IN.)=	1.33
1.050	28.52	DV/DA =	1.23
0.742	17.78		
0.525	10.19		
0.371	2.41		
0.263	1.67		
0.185	0.19		
0.131	0.19		
PAN	1.11		

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	2.9
VIS	SUS-130	0.0	SEDIMENT	ML/100G	1.5
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.13	HYDROGEN	WT%	11.57
NITROGEN	WT%	2.16	SULFUR	WT%	0.64

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	2.9

PRODUCT WATER PROPERTIES

CARBON	WT%	3.31	HYDROGEN	WT%	10.84
NITROGEN	WT%	1.47	SULFUR	WT%	1.55
CO2	WT%	3.71			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.08	C2H4	VOL%	0.64
N2+AR	VOL%	62.51	C2H6	VOL%	0.35
O2	VOL%	0.02	C3'S	VOL%	0.57
CO	VOL%	3.20	C4'S	VOL%	0.72
CH4	VOL%	1.54	C5+	VOL%	0.48
CO2	VOL%	24.50	H2S	VOL%	0.25
			NH3	VOL%	1.14

GROSS HEAT BTU/SCF 126:62

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.04			
OIL FA	GPT	0.11			
MIN CO2	WT%	15.87	ASH	WT%	81.64
CARBON	WT%	5.24	HYDROGEN	WT%	0.16
NITROGEN	WT%	0.21	SULFUR	WT%	0.70

TEMPERATURES DEG F

RAW SHALE IN	75	RET SHALE OUT	487
AIR TD IN	236	AIR MD IN	236
GAS BD IN	257	GAS MD IN	257
GAS TD IN	257	GAS PROD OUT	257
COOLING WATER IN	131	COOLING WATER OUT	134
PRODUCT OIL OUT	154		
AMBIENT AIR	75	OFF GAS	174

RATES AND QUANTITIES

RAW SHALE	TPH	1.32	THROUGHPUT PHF2		534.9
RET SHALE	TPH	1.07	RET/RAW	WT%	81.3
AIR TOP	SCFM	77.0		SCF/T	3507.5
AIR MID	SCFM	16.0		SCF/T	730.6
AIR BTM	SCFM	14.2		SCF/T	646.6
TOTAL AIR	SCFM	107.2		SCF/T	4884.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		18.590			
SP GR		0.998			
GAS TOP	SCFM	19.7		SCF/T	895.7
GAS MID	SCFM	24.9		SCF/T	1133.5
GAS BTM	SCFM	230.5		SCF/T	10498.9
TOTAL GAS	SCFM	275.0		SCF/T	12528.1
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	166.3		SCF/T	7575.3
COOLING WATER	GPM	14.8	BARO PRESS IN HG		24.2
AMB AIR REL HUM	%	20.0	BED PD IN H2O/FT		0.9

OIL YIELD WT% FA= 70.4
OIL YIELD VOL% FA= 63.0

***PILOT PLANT ***
STARTING DATE 80778 TO 80878

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	85.24	85.03	99.8
ASH	#/MIN	26.21	26.21	100.0
OXYGEN	SCFM	22.66	22.66	100.0
			13.72 TO H2O	
			8.90 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.79	1.66	92.9
		0.49 SHALE	0.03 LIQ	
		1.30 COMB	1.52 VAP	
			0.11 SHALE	
KEROGEN	#/MIN	5.81	5.37	92.4
			0.63 SHALE	
			3.56 OIL	
			1.18 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.64	4.47	96.4
			0.60 SHALE	
			2.99 OIL	
			0.88 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.51	6.34	97.4
			1.80 SHALE	
			2.99 OIL	
			1.55 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.65	0.72	110.2
			0.03 SHALE	
			0.40 OIL	
			0.29 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.19	98.3
SULFUR	#/MIN	0.28	0.28	99.5
			0.24 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	47.62	47.49	99.7

0.343 #/MIN C 0.145 #/MIN H 2.367 C/H COMB RATIO
86.19 VOL%FA 87.91WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 80778 TO 80878

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	85.24	85.24	100.0
ASH	#/MIN	26.21	26.21	100.0
OXYGEN	SCFM	22.66	22.66	100.0
			13.64 TO H2O	
			8.99 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.78	1.67	93.5
		0.49 SHALE	0.03 LIQ	
		1.30 COMB	1.53 VAP	
			0.11 SHALE	
KEROGEN	#/MIN	5.81	5.37	92.4
			0.63 SHALE	
			3.56 OIL	
			1.18 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.64	4.47	96.5
			0.60 SHALE	
			2.99 OIL	
			0.88 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.51	6.35	97.5
			1.80 SHALE	
			2.99 OIL	
			1.55 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.65	0.72	110.1
			0.03 SHALE	
			0.40 OIL	
			0.29 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.19	98.4
SULFUR	#/MIN	0.28	0.28	99.5
			0.24 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	47.62	47.53	99.8

0.346 #/MIN C 0.144 #/MIN H 2.401 C/H COMB RATIO
86.19 VOL%FA 87.91WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 80778 TO 80878

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	85.24	85.24	100.0
ASH	#/MIN	25.31	25.31	100.0
OXYGEN	SCFM	22.66	22.66	100.0
			12.82 TO H2O	
			9.81 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.69	1.66	98.6
		0.47 SHALE	0.03 LIQ	
		1.22 COMB	1.53 VAP	
			0.11 SHALE	
KEROGEN	#/MIN	5.61	5.36	95.6
			0.61 SHALE	
			3.56 OIL	
			1.19 GAS	
			0.00 WATER	
ORGANIC CARBON	#/MIN	4.48	4.48	100.0
			0.58 SHALE	
			2.99 OIL	
			0.91 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.28	6.28	100.0
			1.74 SHALE	
			2.99 OIL	
			1.55 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.63	0.71	112.5
			0.03 SHALE	
			0.40 OIL	
			0.28 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.19	100.9
SULFUR	#/MIN	0.27	0.27	100.1
			0.23 SHALE	
			0.02 OIL	
			0.02 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	46.27	46.44	100.4

0.372 #/MIN C 0.135 #/MIN H 2.749 C/H COMB RATIO
89.27 VOL%FA 91.05WT.%FA

DATA SUMMARY

STARTING DATE 80778 TO 80878

OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	10.33	H2O FA	WT%	0.76
OIL FA	GPT	27.00			
MIN CO2	WT%	17.51	ASH	WT%	66.90
CARBON	WT%	16.61	HYDROGEN	WT%	1.75
NITROGEN	WT%	0.49	SULFUR	WT%	0.72

RAW SHALE MOISTURE WT% (UNGROUND) 0.48

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.7	WATER	WT%	0.7
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.9
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	34.11	HYDROGEN	WT%	11.15
NITROGEN	WT%	2.31	SULFUR	WT%	0.63

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.7	WATER	WT%	0.7

PRODUCT WATER PROPERTIES

CARBON	WT%	0.00	HYDROGEN	WT%	0.00
NITROGEN	WT%	0.00	SULFUR	WT%	0.00
CO2	WT%	0.00			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	4.85	C2H4	VOL%	0.43
N2+AR	VOL%	63.95	C2H6	VOL%	0.27
O2	VOL%	0.02	C3'S	VOL%	0.38
CO	VOL%	3.25	C4'S	VOL%	0.74
CH4	VOL%	1.31	C5+	VOL%	0.52
CO2	VOL%	23.00	H2S	VOL%	0.20
			NH3	VOL%	1.08

GROSS HEAT BTU/SCF 119.95

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.02			
OIL FA	GPT	0.05			
MIN CO2	WT%	14.00	ASH	WT%	83.20
CARBON	WT%	5.72	HYDROGEN	WT%	0.15
NITROGEN	WT%	0.17	SULFUR	WT%	0.75

TEMPERATURES DEG F

RAW SHALE IN	77	RET SHALE OUT	494
AIR TD IN	236	AIR MD IN	236
GAS BD IN	253	GAS MD IN	253
GAS TD IN	253	GAS PROD OUT	253
COOLING WATER IN	123	COOLING WATER OUT	130
PRODUCT OIL OUT	146		
AMBIENT AIR	77	OFF GAS	169

RATES AND QUANTITIES

RAW SHALE	TPH	1.18	THROUGHPUT	PHF2	477.3
RET SHALE	TPH	0.95	RET/RAW	WT%	80.4

AIR TOP	SCFM	77.1	SCF/T	3937.3
AIR MID	SCFM	16.6	SCF/T	844.9
AIR BTM	SCFM	14.2	SCF/T	725.9
TOTAL AIR	SCFM	107.9	SCF/T	5508.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL% 19.440
SP GR 0.983

GAS TOP	SCFM	20.2	SCF/T	1028.8
GAS MID	SCFM	25.3	SCF/T	1292.0
GAS BTM	SCFM	231.9	SCF/T	11836.5
TOTAL GAS	SCFM	277.3	SCF/T	14158.1

GAS SEAL LOSS NOT INCLUDED

GAS PRODUCT	SCFM	165.0	SCF/T	8424.6

COOLING WATER	GPM	14.8	BARO PRESS IN HG	24.2
AMB AIR REL HUM	%	24.0	BED PD IN H2O/FT	0.9

OIL YIELD WT% FA= 87.8
OIL YIELD VOL% FA= 85.2

***PILOT PLANT ***
STARTING DATE 82878 TO 82978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	83.83	73.87	88.1
ASH	#/MIN	28.25	28.25	100.0
OXYGEN	SCFM	22.28	22.28	100.0
			17.50 TO H2O	
			4.75 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	2.25	2.22	98.8
		0.59 SHALE	0.13 LIQ	
		1.66 COMB	2.04 VAP	
			0.05 SHALE	
KEROGEN	#/MIN	6.00	4.97	82.7
			0.67 SHALE	
			3.28 OIL	
			1.01 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.95	4.08	82.4
			0.63 SHALE	
			2.77 OIL	
			0.68 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.00	6.12	87.5
			1.97 SHALE	
			2.77 OIL	
			1.38 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.70	0.72	102.9
			0.04 SHALE	
			0.36 OIL	
			0.32 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.23	0.22	94.4
SULFUR	#/MIN	0.30	0.30	103.2
			0.25 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	50.45	49.06	97.2

0.197 #/MIN C 0.185 #/MIN H 1.067 C/H COMB RATIO
76.67 VOL%FA 78.45WT.%FA

***PILOT PLANT FORCED ATM. N2 BALANCE ***
STARTING DATE 82878 TO 82978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	83.83	83.83	100.0
ASH	#/MIN	28.25	28.25	100.0
OXYGEN	SCFM	22.28	22.28	100.0
			13.47 TO H2O	
			8.78 TO CO&CO2	
			0.04 GAS	
WATER	#/MIN	1.87	2.50	133.8
		0.59 SHALE	0.13 LIQ	
		1.28 COMB	2.32 VAP	
			0.05 SHALE	
KEROGEN	#/MIN	6.00	5.13	85.5
			0.67 SHALE	
			3.28 OIL	
			1.17 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.95	4.27	86.2
			0.63 SHALE	
			2.77 OIL	
			0.87 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.00	6.31	90.2
			1.97 SHALE	
			2.77 OIL	
			1.57 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.70	0.70	99.4
			0.04 SHALE	
			0.36 OIL	
			0.29 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.23	0.22	98.6
SULFUR	#/MIN	0.30	0.31	104.6
			0.25 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.00 WATER	
OVALL WEIGHT	#/MIN	50.45	50.64	100.4

0.332 #/MIN C 0.142 #/MIN H 2.335 C/H COMB RATIO
76.67 VOL%FA 78.45WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 82878 TO 82978

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	83.83	83.83	100.0
ASH	#/MIN	24.40	24.40	100.0
OXYGEN	SCFM	22.28	22.28	100.0
			10.05 TO H2O	
			12.20 TO CO&CO2	
			0.04 GAS	
WATER	#/MIN	1.46	2.49	170.5
		0.51 SHALE	0.13 LIQ	
		0.95 COMB	2.32 VAP	
			0.04 SHALE	
KEROGEN	#/MIN	5.19	5.10	98.3
			0.58 SHALE	
			3.28 OIL	
			1.23 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.28	4.28	100.0
			0.54 SHALE	
			2.77 OIL	
			0.96 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.04	6.04	100.0
			1.70 SHALE	
			2.77 OIL	
			1.57 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.61	0.65	108.1
			0.04 SHALE	
			0.36 OIL	
			0.26 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.20	0.21	109.2
SULFUR	#/MIN	0.26	0.28	107.9
			0.21 SHALE	
			0.03 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	44.69	46.02	103.0

0.441 #/MIN C 0.106 #/MIN H 4.160 C/H COMB RATIO
88.76 VOL%FA 90.82WT.%FA

DATA SUMMARY

OPERATING DATE 62878 TO 62978
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.91	H2O FA	WT%	1.06
OIL FA	GPT	26.00			
MIN CO2	WT%	17.75	ASH	WT%	66.96
CARBON	WT%	16.58	HYDROGEN	WT%	1.78
NITROGEN	WT%	0.54	SULFUR	WT%	0.70

RAW SHALE MOISTURE WT% (UNGROUND) 0.33

SCREEN ANALYSIS

AMOUNT RETAINED (SCREEN OPEN. INCHES)	(WT% RETAINED ON EACH SCREEN)
2.120	7.57
1.500	40.00
1.050	21.94
0.742	17.09
0.525	9.32
0.371	1.94
0.262	1.17
0.185	0.19
0.131	0.19
PAN	0.56

FACTORS

DA (IN.)	=	1.15
DV (IN.)	=	1.43
DV/DA	=	1.24

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	4.2
VIS	SUS-130	0.0	SEDIMENT	ML/100C	1.1
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.39	HYDROGEN	WT%	10.98
NITROGEN	WT%	2.20	SULFUR	WT%	0.79

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.8	WATER	WT%	4.2

PRODUCT WATER PROPERTIES

CARBON	WT%	2.88	HYDROGEN	WT%	11.34
NITROGEN	WT%	1.09	SULFUR	WT%	1.40
CO2	WT%	3.71			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.11	C2H4	VOL%	0.64
N2+AR	VOL%	62.38	C2H6	VOL%	0.40
O2	VOL%	0.03	C3'S	VOL%	0.48
CO	VOL%	2.90	C4'S	VOL%	0.55
CH4	VOL%	1.46	C5+	VOL%	0.39
CO2	VOL%	23.76	H2S	VOL%	0.29
			NH3	VOL%	1.60

GROSS HEAT BTU/SCF 121.15

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	14.45	ASH	WT%	83.25
CARBON	WT%	5.80	HYDROGEN	WT%	0.14
NITROGEN	WT%	0.21	SULFUR	WT%	0.73

TEMPERATURES DEG F

RAW SHALE IN	70	RET SHALE OUT	484
AIR TD IN	229	AIR MD IN	229
GAS BD IN	279	GAS MD IN	279
GAS TD IN	279	GAS PROD OUT	279
COOLING WATER IN	114	COOLING WATER OUT	121
PRODUCT OIL OUT	171		
AMBIENT AIR	70	OFF GAS	177

RATES AND QUANTITIES

RAW SHALE	TPH	1.27	THROUGHPUT PHF2		514.0
RET SHALE	TPH	1.02	RET/RAW	WT%	80.4
AIR TOP	SCFM	75.7		SCF/T	3589.1
AIR MID	SCFM	15.6		SCF/T	740.3
AIR BTM	SCFM	14.8		SCF/T	700.7
TOTAL AIR	SCFM	106.1		SCF/T	5030.1

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		26.630			
SP GR		0.948			
GAS TOP	SCFM	23.0		SCF/T	1091.0
GAS MID	SCFM	23.8		SCF/T	1130.2
GAS BTM	SCFM	234.5		SCF/T	11115.7
TOTAL GAS	SCFM	281.4		SCF/T	13337.0
GAS SEAL LOSS NOT INCLUDED					
GAS PRODUCT	SCFM	161.4		SCF/T	7650.2
COOLING WATER	GPM	14.8	BARO PRESS IN HG		24.1
AMB AIR REL HUM	%	22.0	BED PD IN H2O/FT		0.7

OIL YIELD WT% FA= 70.4
OIL YIELD VOL% FA= 75.7

***PILOT PLANT ***
STARTING DATE 82978 TO 83078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	84.32	78.78	93.4
ASH	#/MIN	29.25	29.25	100.0
OXYGEN	SCFM	22.41	22.41	100.0
			12.49 TO H2O	
			9.89 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.94	1.95	100.8
		0.75 SHALE	0.17 LIQ	
		1.19 COMB	1.74 VAP	
			0.04 SHALE	
KEROGEN	#/MIN	6.57	5.23	79.6
			0.71 SHALE	
			3.34 OIL	
			1.17 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	5.31	4.37	82.2
			0.66 SHALE	
			2.82 OIL	
			0.88 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.43	6.49	87.3
			2.24 SHALE	
			2.82 OIL	
			1.42 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.73	0.69	95.3
			0.05 SHALE	
			0.37 OIL	
			0.27 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.20	88.3
SULFUR	#/MIN	0.32	0.30	93.5
			0.24 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	52.50	51.24	97.6

0.356 #/MIN C 0.132 #/MIN H 2.703 C/H COMB RATIO
76.24 VOL%FA 77.91WT.%FA

STARTING DATE 82978 TO 83078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	84.32	84.32	100.0
ASH	#/MIN	29.25	29.25	100.0
OXYGEN	SCFM	22.41	22.41	100.0
			10.40 TO H2O	
			11.98 TO CO&CO2	
			0.03 GHS	
WATER	#/MIN	1.74	2.08	119.4
		0.75 SHALE	0.17 LIQ	
		0.99 COMB	1.86 VAP	
			0.04 SHALE	
KEROGEN	#/MIN	6.57	5.32	81.0
			0.71 SHALE	
			3.34 OIL	
			1.26 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	5.31	4.47	84.1
			0.66 SHALE	
			2.82 OIL	
			0.98 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	7.43	6.59	88.6
			2.24 SHALE	
			2.82 OIL	
			1.52 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.73	0.68	93.6
			0.05 SHALE	
			0.37 OIL	
			0.26 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.22	0.20	90.3
SULFUR	#/MIN	0.32	0.30	94.2
			0.24 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	52.50	52.07	99.2

0.426 #/MIN C 0.110 #/MIN H 3.882 C/H COMB RATIO
76.24 VOL%FA 77.91WT.%FA

***PILOT PLANT FORCED TOT. CARBON AND ATM. N2 BALANCES ***
STARTING DATE 82978 TO 83078

MATERIAL AND ELEMENTAL BALANCES

BALANCES	UNITS	IN	OUT	% REC.
ATM. NITROGEN	SCFM	84.32	84.32	100.0
ASH	#/MIN	24.49	24.49	100.0
OXYGEN	SCFM	22.41	22.41	100.0
			7.18 TO H2O	
			15.20 TO CO&CO2	
			0.03 GAS	
WATER	#/MIN	1.31	2.07	157.9
		0.63 SHALE	0.17 LIQ	
		0.68 COMB	1.86 VAP	
			0.03 SHALE	
KEROGEN	#/MIN	5.50	5.25	95.5
			0.59 SHALE	
			3.34 OIL	
			1.31 GAS	
			0.01 WATER	
ORGANIC CARBON	#/MIN	4.45	4.45	100.0
			0.55 SHALE	
			2.82 OIL	
			1.07 GAS	
			0.00 WATER	
TOTAL CARBON	#/MIN	6.22	6.22	100.0
			1.88 SHALE	
			2.82 OIL	
			1.52 GAS	
			0.00 WATER	
ORG. HYDROGEN	#/MIN	0.61	0.64	104.9
			0.04 SHALE	
			0.37 OIL	
			0.23 GAS	
			0.00 WATER	
ORG. NITROGEN	#/MIN	0.19	0.19	101.2
SULFUR	#/MIN	0.27	0.26	97.8
			0.20 SHALE	
			0.02 OIL	
			0.03 GAS	
			0.00 WATER	
O'ALL WEIGHT	#/MIN	45.29	46.23	102.1

0.529 #/MIN C 0.076 #/MIN H 6.982 C/H COMB RATIO
91.05 VOL%FA 93.04WT.%FA

DATA SUMMARY

STARTING DATE 82978 TO 83078
OPERATING TIME (HRS) 24
OPERATING FACTOR 100.00 %

RAW SHALE PROPERTIES

OIL FA	WT%	9.70	H2O FA	WT%	1.38
OIL FA	GPT	25.40			
MIN CO2	WT%	17.57	ASH	WT%	66.19
CARBON	WT%	16.81	HYDROGEN	WT%	1.80
NITROGEN	WT%	0.50	SULFUR	WT%	0.72

RAW SHALE MOISTURE WT% (UNGROUND) 0.32

PRODUCT OIL PROPERTIES

GRAVITY	DEG API	19.7	WATER	WT%	5.2
VIS	SUS-130	0.0	SEDIMENT	ML/100G	0.0
VIS	SUS-210	0.0	POUR	DEG F	85.0
CARBON	WT%	84.48	HYDROGEN	WT%	11.02
NITROGEN	WT%	1.68	SULFUR	WT%	0.67

RUN DOWN OIL PROPERTIES

GRAVITY	DEG API	19.7	WATER	WT%	5.2

PRODUCT WATER PROPERTIES

CARBON	WT%	2.68	HYDROGEN	WT%	11.25
NITROGEN	WT%	0.95	SULFUR	WT%	2.18
CO2	WT%	3.84			

PRODUCT GAS PROPERTIES (DRY)

H2	VOL%	5.20	C2H4	VOL%	0.75
N2+AR	VOL%	63.61	C2H6	VOL%	0.42
O2	VOL%	0.03	C3'S	VOL%	0.55
CO	VOL%	2.61	C4'S	VOL%	0.54
CH4	VOL%	1.55	C5+	VOL%	0.43
CO2	VOL%	22.66	H2S	VOL%	0.29
			NH3	VOL%	1.35

GROSS HEAT BTU/SCF 124.71

RETORTED SHALE PROPERTIES

OIL FA	WT%	0.00			
OIL FA	GPT	0.00			
MIN CO2	WT%	15.15	ASH	WT%	81.41
CARBON	WT%	5.24	HYDROGEN	WT%	0.15
NITROGEN	WT%	0.21	SULFUR	WT%	0.67

TEMPERATURES DEG F

RAW SHALE IN	71	RET SHALE OUT	494
AIR TD IN	230	AIR MD IN	230
GAS BD IN	279	GAS MD IN	279
GAS TD IN	279	GAS PROD OUT	279
COOLING WATER IN	115	COOLING WATER OUT	123
PRODUCT OIL OUT	172		
AMBIENT AIR	71	OFF GAS	175

RATES AND QUANTITIES

RAW SHALE	TPH	1.33	THROUGHPUT	PHF2	538.4
RET SHALE	TPH	1.08	RET/RAW	WT%	81.3

AIR TOP	SCFM	76.1	SCF/T	3442.2
AIR MID	SCFM	16.1	SCF/T	728.8
AIR BTM	SCFM	14.6	SCF/T	659.7
TOTAL AIR	SCFM	106.7	SCF/T	4830.7

(GAS FLOWS SHOWN ON A WET BASIS)

MOISTURE VOL%		22.850		
SP GR		0.960		
GAS TOP	SCFM	23.3	SCF/T	1052.5
GAS MID	SCFM	24.9	SCF/T	1126.2
GAS BTM	SCFM	234.0	SCF/T	10590.8
TOTAL GAS	SCFM	282.2	SCF/T	12769.5
GAS SEAL LOSS NOT INCLUDED				
GAS PRODUCT	SCFM	160.5	SCF/T	7264.6

COOLING WATER	GPM	14.8	BARO PRESS IN HG		24.0
AMB AIR REL HUM	%	24.0	BED PD IN H2O/FT		0.7

OIL YIELD WT% FA= 77.8
OIL YIELD VOL% FA= 75.2

APPENDIX 4.0

DATA PROCESSING

4.0 DATA PROCESSING

4.1 INTRODUCTION

The computing equipment used was a Hewlett-Packard 9830A general purpose programmable calculator. The program language is called BASIC. Input is by typewriter keyboard and output by the 9866A line printer. There is a built-in tape drive for large capacity storage. The read/write memory size is 15072 16-bit words.

Programs are written and edited at the keyboard and are stored on tape casettes. Data is stored in test data files on tape cassettes and called from the keyboard.

Manufacturer's software tapes were used for polynomial regression and analysis of variance.

4.2 CALCULATIONS

Gas Calculations

A gas calculation program was written to calculate specific gravity, molecular weight, and gross and net heating value based on the composition of the retort gas. The specific gravity determined in this program is then input to the flow calculations program along with orifice differential pressure and flowing temperature and pressure to calculate bottom, middle, top, and product gas flow rates (SCFM). The air flows (bottom, middle and top) are also calculated. These values along with other input data are stored on computer data tapes. This information can then be loaded into common memory and run through material and heat balance programs.

Raw Shale Rates

The raw shale rate is calculated using net weighbelt data per unit time and adjusted using the weighbelt correction factor.

Crude Oil Production

The initial and final tank gagings, initial and final oil temperature, water content, and API gravity are input into the calculations used to determine the volume of dry oil at 60°F. It is assumed that crude shale oil behaves like a hydrocarbon.

4.3 MATERIAL BALANCES

Eleven individual material balances are calculated from operating and laboratory data for each test day. These balances are briefly discussed below:

(1) Atmospheric Nitrogen Balance

The atmospheric nitrogen balance is calculated from the measured quantities of air input, product gas output, and Vol% N_2 of the product gas measured by the gas chromatograph. The N_2 content of air is assumed to be 79 Vol%. This balance indicates the accuracy of air and product gas measurements. This balance should be less than 100% if gas losses are encountered through the rotary seals, recycle gas blower or other equipment.

Gas losses are estimated by calculating the quantity of gas required to force this balance to 100%. All material balances are calculated on an unadjusted basis and a forced atmospheric nitrogen balance basis by adding these estimated gas losses to the product gas.

(2) Ash Balance

The ash balance is used to calculate the retorted shale rate by assuming a 100% ash balance. The ash remains virtually unchanged during retorting (consisting primarily of SiO_2, CaO, Al_2O_3, MgO,

Fe_2O_3, and other mineral oxides). The equation used for calculating the retorted shale rate is:

$$\text{Ret. Rate} = \text{Raw Rate} * \frac{\text{Wt\% Ash, Raw}}{\text{Wt\% Ash, Ret}}$$

(3) Oxygen Balance

The oxygen balance is also assumed to be 100%. The difference in the quantities of O_2 input from air (assuming 21 Vol% O_2 in air) and O_2 out with the product gas (Vol% O_2 in product gas measured by the gas chromatograph) is used to calculate the quantities of CO, CO_2 and H_2O formed by combustion.

The production of CO and CO_2 by pyrolysis has been calculated from a material balance of the Fischer Assay. The production of CO_2 from the decomposition of mineral carbonates is calculated for each test day. Thus, net carbon oxides from combustion are determined. Any excess air not used to burn carbon is used to calculate the water formed by combustion.

(4) Water Balance

The water balance is calculated using the raw shale Fischer Assay wt% H_2O, wt% surface moisture, and the water formed by combustion of hydrogen, the retorted shale Fischer Assay wt% H_2O, water in product gas, and water in the product oil. It is assumed that the retorted shale is totally water-free.

(5) Kerogen Balance

The kerogen balance is calculated by subtracting ash, mineral CO_2, and Fischer Assay water from the raw shale and assuming the remaining material to be the organic, or kerogen, material. The kerogen out in the product gas is calculated as the summation of all hydrocarbon gas components including H_2, H_2S,

NH_3 and Fischer Assay plus combustion CO, CO_2 and H_2O. The kerogen out in the retorted shale is calculated from the organic carbon and organic hydrogen remaining in the retorted shale. The kerogen out in the product water is calculated from the amounts of organic carbon and total nitrogen in the product water. The dry product oil produced is all kerogen material.

(6) Organic Carbon Balance

The organic carbon in the raw and retorted shale and product water is calculated from the difference of total carbon and mineral carbon from mineral CO_2. The organic carbon out in oil is calculated using the wt% carbon of the oil. The organic carbon out in the product gas is calculated by summation of the carbon out in all of the hydrocarbon gases including Fischer Assay and combustion CO and CO_2. It is assumed in these calculations that the inorganic carbon balance is 100%.

(7) Total Carbon Balance

The total carbon balance is calculated the same as the organic carbon balance except that mineral carbon is not subtracted from the total carbon in the raw shale, retorted shale, product water, and product gas.

A forced total carbon balance is run for all Pilot Plant test periods after first forcing the atmospheric nitrogen balance.

The total carbon balance is forced to 100% by adjusting the raw and retorted shale rates. The same ratio is kept between the raw and retorted shale rates so that a 100% ash balance is maintained.

(8) Organic Hydrogen Balance

The organic hydrogen in the raw and retorted shale is calculated by subtracting the hydrogen in the Fischer Assay water from the total hydrogen. The organic hydrogen in the oil is calculated using the wt% hydrogen of the oil. The organic hydrogen in the product gas is calculated as the summation of the hydrogen in all hydrocarbon gases including H_2, H_2S, NH_3 and the H_2O formed by combustion. The organic hydrogen in the product water is calculated from the hydrogen in ammonium ions and dissolved hydrocarbons. The dissolved hydrocarbons are assumed to have a C:H mole ratio of 1:2.

(9) Organic Nitrogen Balance

The organic nitrogen in raw shale, retorted shale, oil and product water is based on the total nitrogen of those products. The organic nitrogen out in the product gas is calculated from the nitrogen in ammonia (NH_3).

(10) Sulfur Balance

The sulfur in the raw shale, retorted shale, oil and product water is based on the total sulfur of those products. The sulfur out in the product gas is calculated from the sulfur in H_2S.

(11) Overall Weight Balance

The weight of material in is calculated from the rates of raw shale and air in. The weight of material out is calculated from the rates of retorted shale, product gas, product water, and product oil out.

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