THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 60-A
HOURS 0-25
CATALYST AGE 25

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010	38.780	10.981	307.58	3.290	0.202	5.66	1.195	12.176	1.397	-10.779	-301.92				
H_2 2.016	57.920	16.401	33.06	24.967	1.535	3.09	9.072	25.473	10.607	-14.866	-29.97				
CO_2 44.010	2.473	0.700	30.81	39.067	2.401	105.67	14.195	14.895	16.596	1.701	74.86	7.204			
N_2 28.016	0.077	0.022	0.61	2.617	0.161	4.51	0.951	0.973	1.112						
CH_4 16.042	0.750	0.212	3.40	16.375	1.006	16.14	5.950	6.162	6.956	0.794	12.74	1.226			
C_2H_4 28.052				2.897	0.178	4.99	1.053	1.053	1.231	0.178	4.99	0.480			
C_2H_6 30.068				1.707	0.105	3.16	0.620	0.620	0.725	0.105	3.16	0.304			
C_1+C_2											20.89	2.010			
C_3H_6 42.078				3.080	0.189	7.95	1.119	1.119	1.308	0.189	7.95	0.765	4.32	1.840	0.177
C_3H_8 44.094				0.418	0.026	1.15	0.152	0.152	0.178	0.026	1.15	0.111	4.24	0.271	0.026
C_4H_8 56.104				2.548	0.157	8.81	0.926	0.926	1.083	0.157	8.81	0.848	5.00	1.762	0.170
C_4H_{10} 58.120				1.093	0.067	3.89	0.397	0.397	0.464	0.067	3.89	0.374	4.86	0.800	0.077
C_5H_{10} 70.130				1.185	0.073	5.12	0.430	0.430	0.503	0.073	5.12	0.493	5.45	0.939	0.090
C_5H_{12} 72.146				0.328	0.020	1.44	0.119	0.119	0.139	0.020	1.44	0.139	5.25	0.274	0.026
C_6H_{12} 84.156				0.428	0.026	2.19	0.156	0.156	0.182	0.026	2.19	0.211	5.54	0.395	0.038
C_3-C_6											30.55	2.940		6.281	0.604
TOTAL		28.316	375.46		6.147		36.335	64.651	49.920						
H_2+CO	96.700	27.382	10391.469	SCFH	1.737		10.267	37.649	12.004	-25.645					
H_2/CO		1.46	Factor. 9623278		7.59		7.59	2.09	7.59	1.38					
RECOVERED OIL										0.516**	72.42	6.969		11.003	1.059
TOTAL OIL											102.97	9.908		17.284	1.663
WATER SOLUBLE CHEMICALS										0.129**	6.85	0.659		0.823	0.079
TOTAL LIQUID PRODUCTS C_3+											109.82	10.568		18.107	1.742
NET WATER										6.793**	122.39	11.778		14.696	1.414
GROSS WATER											129.24	12.437		15.519	1.493
HYDROCARBON TOTAL—C_1+											130.71	12.579			

YIELD BASIS H_2+CO FED — YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	62.3	6.855	98.0	6.718
400-550	19.2	2.113	91.4	1.931
550 +	18.5	2.035	114.6	2.333
	RECOVERY %	#/hr	gal/hr	
PROPYLENE	63.3	5.032		
C_3 POLY GASO.	87.5	4.403	0.736	
C_3 POLY TAR	12.5	0.629	0.084	
	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00		0.041	68.0
C_4 POLY GASO.	5.98		1.259	1.5
C_4H_{10}	4.86		0.800	68.0
C_4-FREE GASO.			9.062	5.8
C_4 POLY TAR	7.53		0.143	
	gal/hr	gal/MCF	Bbl/Day	
10 # RVP 400 EP GASOLINE	11.162	1.0742	5824	
GAS OIL	1.931	0.1858	1007	
FUEL OIL	2.333	0.2245	1217	
POLY TAR	0.227	0.0218	118	
TOTAL	15.653	1.5063	8167	
W. S. CHEM.	0.823	0.0792	429	
TOTAL	16.476	1.5855	8596	

OPERATING DATA — V/hr/V = 943

Pressure, psig	403	Inlet Velocity, Ft/sec	0.77	Catalyst	Fresh CM&S
Temperature, °F	659	Bed Depth, Ft	16.7	Weight, #	1245
Recycle Ratio	1.28	Bed Density, #/CF	113	Volume, Cu ft	11.02

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
78.29	98.16	90.64	93.66	88.53	58.36	68.12	84.62

Form ML-11 K_{shift} = 18.5 **Included in Reactor Effluent Total g/NCM = 16.91×#/MCF *9488 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	421	Fresh Feed	10746
Natural Gas	420	Recycle	13789
Generator Outlet	408	Combined Feed	24535
Reactor Inlet	403	Wet Gas—Measured	1964
Condenser Inlet		Adjusted	2333
Product Accumulator	369	Loss	369
TEMPERATURES—°F.		Recycle/Fresh Feed	1.28
Oxygen	461	Inlet Velocity—ft./sec.	0.77
Natural Gas	809	Fresh Feed Rate—S.C.F.H. H_2 + CO	10391
Generator	2434	per Cu.Ft. Dense Bed	943
Quench Accumulator	137	per Lb. Catalyst	8.35
Reactor Inlet	265	per Sq. Ft.	15744
Condenser Inlet	593		
Product Accumulator	95		
Catalyst No. Height			
1 0'0"			
2 0'9"			
3 1'9"	656		
4 4'5"	650		
5 7'0"	661		
6 12'3"	657		
7 17'5"	672		
8 20'0"	681		
9 22'7"	702		
10 25'2"	678		
11 26'11"	666		

PRODUCT TESTS

	OIL	WATER
°API	47.5	10.0
Neut. No.	36.1	33.2
Sap. No.	41.2	34.0
Hydrox. No.		
Bromine No.	91	
Pour °F.	+20	
Chemicals, % by K_2CO_3		5.3
Additional layer 5.7% assumed to be non-chemical		
HEMPEL. DIST. %		°API
205 °F.		
400	61.3	56.3
400-550	19.2	37.9
550+	19.5	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	110	
10%	146	
50%	246	
90%	358	
EP	402	
Rec.	96	

CATALYST DATA

INVENTORY DATA			
In Reactor at Start of Period			
Fresh Catalyst Added			
Total			
Catalyst Recovered			71
In Reactor at End of Period			
REACTOR d-p, Inches H_2O			
No.	Height		End
0	0-21 3/8		35
1	21 3/8-52 3/4		50
2	52 3/4-84		51
3	84-115 3/8		58
4	115 3/8-353 1/8		175
Total			369
CALCULATED FROM dp			Average
Density, Lbs./Cu.Ft.			113
Inventory, Lbs.			1245
Bed Depth, Ft.			16.70
Vol., Cu. Ft.			11.02
		Start	End
Density		156	106
Inventory		1122	1267
Depth		10.9	18.1
Volume		7.19	11.95

PARTICLE SIZE

Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+	26.5	80+	
100	150	30.2	40—80	
150	105	10.7	20—40	
200	74	8.9	10—20	
250	62	2.6	0—20	
325	44	9.1		
<325		12.0		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	147
Settled	150
Compacted	175
Particle Density, gm./cc.	6.06
NH_3 Value, ml./gm.	
N_2 Surface, m²/gm.	
CHEMICAL ANALYSIS	
Fe	87.3
C	
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

1400	HOUR	2200	0600	1000	AVERAGE	M/HR	C	H	O
	FRESH FEED								
38.81	CO 28.010	39.12	39.03	38.16	38.780	10.981	10.981		10.981
57.82	H_2 2.016	57.70	57.90	58.26	57.920	16.401		32.802	
2.09	CO_2 44.010	2.61	2.56	2.63	2.473	0.700	0.700		1.400
0.03	N_2 28.016	0.13	0.03	0.12	0.077	0.022			
1.25	CH_4 16.042	0.44	0.48	0.83	0.750	0.212	0.212	0.848	
				M. W.	13.26020				
				H_2O 18.016				7.445	3.723
							11.893	41.095	16.104
				BALANCE			106.79	95.19	106.89

	Mol %	M/Hr	C	H	O
O_2 32.000	0.17	7.393 0.016			14.818
CO_2 44.010	1.27	0.124	0.124		0.248
N_2 28.016	0.26	0.025			
CH_4 16.042	83.75	8.155	8.155	32.620	
C_2H_6 30.068	6.61	0.644	1.288	3.864	
C_3H_8 44.094	5.92	0.576	1.728	4.608	
C_4H_{10} 58.120	1.47	0.143	0.572	1.430	
C_5H_{12} 72.146	0.55	0.054	0.270	0.648	
MW =	19.97037				
TOTAL			11.137	43.170	15.066

	#/hr Measured	At Wt. Balance
WET GAS	146.33	173.82
OIL	72.42	72.42
WATER	129.24	129.24
TOTAL	347.99	375.48
FRESH FEED	375.48	
WEIGHT BALANCE	92.68	
WET GAS FACTOR	1.18786	
INDICATED LOSS—S C F H	369 2333	

1400	WET GAS	2200	0600	1000	
3.53	CO 28.010	3.58	3.40	2.65	3.290
24.82	H_2 2.016	24.98	25.49	24.58	24.967
36.16	CO_2 44.010	40.06	40.27	39.78	39.067
2.34	N_2 28.016	2.20	2.47	3.46	2.617
20.35	CH_4 16.042	14.79	15.38	14.98	16.375
2.74	C_2H_4 28.052	2.81	3.07	2.97	2.897
1.54	C_2H_6 30.068	1.76	1.81	1.72	1.707
2.39	C_3H_6 42.078	3.47	3.26	3.20	3.080
0.26	C_3H_8 44.094	0.50	0.47	0.44	0.418
2.34	C_4H_8 56.104	2.84	2.25	2.76	2.548
1.31	C_4H_{10} 58.120	1.05	0.79	1.22	1.093
1.23	C_5H_{10} 70.130	1.27	0.93	1.31	1.185
0.51	C_5H_{12} 72.146	0.28	0.14	0.38	0.328
0.48	C_6H_{12} 84.156	0.41	0.27	0.55	0.428
				M. W.	28.277198

GAS FLOW RATES

		√H	PRESSURE	TEMP.	M. W.	S. C. F. H.	M/HR
FRESH FEED	50.54	7.165	405.6 20.501	81.9 0.9796	2183224 1.4776	10,746	28.316
WET GAS	79.31	6.187	1.36 4.007	73.4 0.9873	1023793 1.0118	1,964	5.175
RECYCLE	79.31	8.319	408.6 20.574	127.2 0.9411	1.0118	12,926	34.061
BLEED	5.02	8.256	20.574	1.0000	1.0118	863	2.274
NATURAL GAS	19.79	8.322	422.7 20.914	195.0 0.8910	1449647 1.2040	3,695	9.737
OXYGEN	18.82	7.277	424.2 20.950	83.8 0.9779		2,806	7.393
STEAM	215.7		31.8				

LIQUID PRODUCT RATES Basis 23 hours

HOUR	GAGE	GAL.	°F	FACTOR	GAL. AT 60	API° #/GAL.	#	#/HR GAL HR
OIL	5'4½"	286.02	70	0.9951	284.62	47.5	1873.37	
	0'7½"	33.06	78	0.9911	32.77	6.582	215.69	
					+1.22		+8.00	
					253.07		1665.68	72.42
								11.003
WATER	7'4½"	390.78	80	0.99759	389.84	10.0	3246.59	
	0'7½"	33.06	92	0.99543	32.91	8.328	274.07	
					356.93		2972.52	129.24
								15.519

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 60-B
HOURS 25-40
CATALYST AGE ______

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010	37.435	11.207	313.92	17.970	2.354	65.94	8.283	19.490	10.637	8.853					
H_2 2.016	59.755	17.889	36.06	49.360	6.467	13.04	22.752	40.641	29.219	11.422					
CO_2 44.010	2.135	0.639	28.12	19.940	2.613	115.00	9.191	9.830	11.804	1.974	86.88	7.868			
N_2 28.016	0.130	0.039	1.09	1.070	0.140	3.92	0.493	0.532	0.633						
CH_4 16.042	0.545	0.163	2.62	5.855	0.767	12.30	2.899	2.862	3.466	0.604	9.68	0.877			
C_2H_4 28.052				1.030	0.135	3.79	0.475	0.475	0.610	0.135	3.79	0.343			
C_2H_6 30.068				0.740	0.097	2.92	0.341	0.341	0.438	0.097	2.92	0.264			
C_1+C_2											16.39	1.484			
C_3H_6 42.078				1.580	0.207	8.71	0.728	0.728	0.935	0.207	8.71	0.789	4.32	2.016	
C_3H_8 44.094				0.280	0.037	1.63	0.129	0.129	0.166	0.037	1.63	0.148	4.24	0.384	
C_4H_8 56.104				0.890	0.117	6.56	0.410	0.410	0.527	0.117	6.56	0.594	5.00	1.312	
C_4H_{10} 58.120				0.575	0.075	4.36	0.265	0.265	0.340	0.075	4.36	0.395	4.86	0.897	
C_5H_{10} 70.130				0.320	0.042	2.95	0.147	0.147	0.189	0.042	2.95	0.267	5.45	0.541	
C_5H_{12} 72.146				0.255	0.033	2.38	0.118	0.118	0.151	0.033	2.38	0.216	5.25	0.453	
C_6H_{12} 84.156				0.135	0.018	1.51	0.062	0.062	0.080	0.018	1.51	0.137	5.54	0.273	
C_3-C_4											28.10	2.545		5.876	0.532
TOTAL		29.937	381.81		13.102	245.01	46.093	76.030	63.836						
H_2+CO	97.190	29.096	11041756 SCFH		8.821		31.035	60.131	39.856	20.275					
H_2/CO		1.60	Factor. 905653		2.75		2.75	2.09	2.75	1.29					

YIELD BASIS H_2+CO FED — YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL %	gal/hr	TREATING RECOVERY %	gal/hr
400 EP	65.8	5.526	98.0	5.415
400-550	16.4	1.377	91.4	1.259
550 +	17.8	1.495	114.6	1.713

	RECOVERY %	#/hr	gal/hr
PROPYLENE	32.0	2.787	
C_3 POLY GASO.	87.5	2.439	0.408
C_3 POLY TAR	12.5	0.348	0.046

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00		-	68.0
C_4 POLY GASO.	5.98		0.960	1.5
C_4H_{10}	4.86		0.654	68.0
C_4-FREE GASO.			7.090	5.8
C_4 POLY TAR	7.53		0.109	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	8.704	0.7883	4274
GAS OIL	1.259	0.1140	618
FUEL OIL	1.713	0.1551	841
POLY TAR	0.155	0.0140	76
TOTAL	11.831	1.0715	5809
W. S. CHEM.	0.878	0.0795	431
TOTAL	12.709	1.1510	6240

OPERATING DATA

V/hr/V = 1670

Pressure, psig	406	Inlet Velocity, Ft/sec	0.91	Catalyst	Fresh CM&S
Temperature, °F	651	Bed Depth, Ft	10.01	Weight, #	971
Recycle Ratio	1.54	Bed Density, #/CF	147	Volume, Cu ft	6.61

	NET CHANGE m/hr	NET CHANGE #/hr	#/MCF	#/gal	gal/hr	gal/MCF
RECOVERED OIL	0.395**	55.40	5.017		8.398	0.761
TOTAL OIL		83.50	7.562		14.274	1.293
WATER SOLUBLE CHEMICALS	0.141**	7.47	0.677		0.878	0.080
TOTAL LIQUID PRODUCTS C_3+		90.97	8.239		15.152	1.372
NET WATER	4.105**	73.95	6.697		8.877	0.804
GROSS WATER		81.42	7.374		9.755	0.884
HYDROCARBON TOTAL—C_1+		107.36	9.723			

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
56.23	79.00	63.85	69.68	45.42	28.10	33.71	84.73

Form ML-11

**Included in Reactor Effluent Total

g/NCM = 16.91 × #/MCF

*9188 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	427	Fresh Feed	11,361
Natural Gas	427	Recycle	17,492
Generator Outlet	414	Combined Feed	28,853
Reactor Inlet	406	Wet Gas—Measured	4,536
Condenser Inlet		Adjusted	4,972
Product Accumulator	370	Loss	436
TEMPERATURES—°F.		Recycle/Fresh Feed	1.54
Oxygen	490	Inlet Velocity—ft./sec.	0.91
Natural Gas	819	Fresh Feed Rate—S.C.F.H. H_2 + CO	11042
Generator	2446	per Cu. Ft. Dense Bed	1670
Quench Accumulator	150	per Lb. Catalyst	11.37
Reactor Inlet	490	per Sq. Ft.	16730
Condenser Inlet	645		
Product Accumulator	77	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate = 326 E/hr.	
1 See Period A	621	@698 psia & 511°F =	
2	654	1200 Btu/#	
3	652	Water in @69°F = 37 Btu/#	
4	647	Net Heat Transferred/# steam	
5	652	= 1163 Btu	
6	642	(1163)(326) = 379,138 Btu/hr.	
7	689	Ave. Bed Temp. = 651°F	
8	703	dT = 651-511 = 140°F	
9	701	Tube Area = 18.0 ft.²	
10	696	$K = \frac{379{,}138}{(140)(18.0)}$ =	
11	691	= 150.5 Btu/°F/ft.²	

PRODUCT TESTS

	OIL	WATER
°API	47.1	9.7
Neut. No.	34.8	45.3
Sap. No.	39.3	45.8
Hydrox. No.		
Bromine No.	85	
Pour °F.		
Chemicals, % by K_2CO_3		9.0
HEMPEL, DIST. %		°API
205 °F.		
400	64.8	58.1
400-550	16.4	40.0
550+	18.8	
A. S. T. M. DIST. ON Naphtha °F.		
IBP	102	
10%	140	
50%	240	
90%	360	
EP	404	
Rec.	95.5	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	
Total	
Catalyst Recovered	72
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	55
1 "	78
2 "	85
3 "	60
4 "	5
Total	283
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	147
Inventory, Lbs.	971
Bed Depth, Ft.	10.01
Vol., Cu. Ft.	6.61

PARTICLE SIZE

Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+		80+	
100	150		40—80	
150	105		20—40	
200	74		10—20	
250	62		0—20	
325	44			
<325				

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	
Settled	
Compacted	
Particle Density, gm./cc.	
NH_3 Value, ml./gm.	
N_2 Surface, m²/gm.	
CHEMICAL ANALYSIS	
Fe	
C	
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

GAS ANALYSES

HOUR	2200	0600		AVERAGE	M/HR	C	H	O
FRESH FEED								
CO 28.010	37.53	37.34		37.435	11.207	11.207		11.207
H_2 2.016	59.82	59.69		59.755	17.889		35.778	
CO_2 44.010	2.19	2.08		2.135	0.639	0.639		1.278
N_2 28.016	0.09	0.17		0.130	0.039			
CH_4 16.042	0.37	0.72		0.545	0.163	0.163	0.652	
			M. W	12.75367				
			H_2O 18.016				6.355	3.178
						12.009	42.785	15.663
			BALANCE			97.26	98.14	102.65
WET GAS								
CO 28.010	17.76	18.18		17.970				
H_2 2.016	50.33	48.39		49.360				
CO_2 44.010	18.41	21.47		19.940				
N_2 28.016	1.28	0.86		1.070				
CH_4 16.042	5.77	5.94		5.855				
C_2H_4 28.052	0.84	1.22		1.030				
C_2H_6 30.068	0.82	0.66		0.740				
C_3H_6 42.078	2.03	1.13		1.580				
C_3H_8 44.094	0.31	0.25		0.280				
C_4H_8 56.104	0.87	0.91		0.890				
C_4H_{10} 58.120	0.93	0.22		0.575				
C_5H_{10} 70.130	0.20	0.44		0.320				
C_5H_{12} 72.146	0.37	0.14		0.255				
C_6H_{12} 84.156	0.08	0.19		0.135				
			M. W.	18.69837				

GENERATOR BALANCE

	Mol %	M/Hr	C	H	O
O_2 32.000	0.20	7.515 0.019			15.068
CO_2 44.010	0.98	0.095	0.095		0.190
N_2 28.016	0.87	0.085			
CH_4 16.042	82.45	8.035	8.035	32.140	
C_2H_6 30.068	6.62	0.645	1.290	3.870	
C_3H_8 44.094	6.25	0.609	1.827	4.872	
C_4H_{10} 58.120	1.85	0.180	0.720	1.800	
C_5H_{12} 72.146	0.78	0.076	0.380	0.912	
MW =	20.35000				
TOTAL			12.347	43.594	15.258

WEIGHT BALANCE

	#/hr Measured	At Wt. Balance
WET GAS	223.52	244.99
OIL	55.40	55.40
WATER	81.42	81.42
TOTAL	360.34	381.81
FRESH FEED	381.81	
WEIGHT BALANCE	94.38	
WET GAS FACTOR	1.09605	
INDICATED LOSS—S C F H	436	
	4972	

GAS FLOW RATES

	√R	PRESSURE	TEMP.	M. W.	S. C. F. H.	M/HR
FRESH FEED 50.54	7.371	406.4 20.521	74.4 0.9864	2269934 1.5066	11,361	29.937
WET GAS 115.14	7.950	1.51 4.026	71.3 0.9893	154826 1.2443	4.536	11.954
RECYCLE 79.31	8.488	410.4 20.618	114.4 0.9514	1.2443	16,431	43.297
BLEED 5.02	8.238	20.618	1.0000	1.2443	1,061	2.796
NATURAL GAS 19.79	8.306	426.9 21.014	185.3 0.8977	1422604 1.1927	3,698	9.744
OXYGEN 18.82	7.312	426.6 21.007	74.1 0.9867		2,852	7.515
STEAM 215.7	5.082	31.4 0.2970		326#/hr.		

LIQUID PRODUCT RATES

Basis 12 hours

HOUR	GAGE	GAL.	°F	FACTOR	GAL. AT 60	API° #/GAL.	#	#/HR GAL HR
OIL	3'0"	161.14	62	0.9990	160.98	47.1	1061.82	
	1'3"	65.01	75	0.9925	64.52	6.596	425.57	
					+4.32		+28.50	
					100.78		664.75	55.40
								8.398
WATER	4'6½"	241.29	70	0.99896	241.04	9.7	2011.72	
	2'4"	124.28	80	0.99759	123.98	8.346	1034.74	
					117.06		976.98	81.42
								9.755

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 60-C
HOURS 40-64
CATALYST AGE ______

	FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H_2+CO FED: CONDENSATE			
	%	m/hr	#/hr	%	At Wt. Balance m/hr	At Wt. Balance #/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	37.977	11.298	316.46	18.856	2.733	76.55	8.881	20.179	11.614	-8.565	-239.91				
H_2 2.016	59.126	17.590	35.46	50.876	7.375	14.87	23.963	41.553	31.338	-10.215	-20.59				
CO_2 44.010	2.067	0.615	27.07	17.217	2.496	109.87	8.109	8.724	10.605	1.881	82.80	7.553			
N_2 28.016	0.160	0.048	1.34	1.150	0.167	4.68	0.542	0.590	0.709						
CH_4 16.042	0.670	0.199	3.19	6.070	0.880	14.12	2.859	3.058	3.739	0.681	10.93	0.997			
C_2H_4 28.052				1.167	0.172	4.82	0.559	0.559	0.731	0.172	4.82	0.440			
C_2H_6 30.068				0.610	0.088	2.65	0.287	0.287	0.375	0.088	2.65	0.242			
C_1+C_2											18.40	1.679			
C_3H_6 42.078				1.590	0.230	9.68	0.749	0.749	0.979	0.230	9.68	0.883	4.32	2.241	0.204
C_3H_8 44.094				0.320	0.046	2.03	0.151	0.151	0.197	0.046	2.03	0.185	4.24	0.479	0.044
C_4H_8 56.104				1.207	0.175	9.82	0.569	0.569	0.744	0.175	9.82	0.896	5.00	1.964	0.179
C_4H_{10} 58.120				0.330	0.048	2.79	0.155	0.155	0.203	0.048	2.79	0.254	4.86	0.574	0.052
C_5H_{10} 70.130				0.447	0.065	4.56	0.211	0.211	0.276	0.065	4.56	0.416	5.45	0.837	0.078
C_5H_{12} 72.146				0.070	0.010	0.72	0.033	0.033	0.043	0.010	0.72	0.066	5.25	0.137	0.012
C_6H_{12} 84.156				0.070	0.010	0.84	0.033	0.033	0.043	0.010	0.84	0.077	5.54	0.152	0.014
C_3-C_6											30.44	2.777		6.384	0.581
TOTAL		29.750	383.52		14.495	258.00	47.101	76.851	66.139						
H_2+CO	97.103	28.888	10962.929	SCFH	10.108		32.844	61.732	42.952	-18.760					
H_2/CO		1.56	Factor. 912164		2.70		2.70	2.06	2.70	1.19					

	NET CHANGE m/hr	NET CHANGE #/hr	#/MCF	#/gal	gal/hr	gal/MCF
RECOVERED OIL	0.318**	44.64	4.072		6.889	0.628
TOTAL OIL		75.08	6.849		13.273	1.209
WATER SOLUBLE CHEMICALS	0.136**	7.21	0.658		0.875	0.080
TOTAL LIQUID PRODUCTS C_3+		82.29	7.507		14.148	1.289
NET WATER	4.089**	73.67	6.720		8.044	0.807
GROSS WATER		80.88	7.378		9.719	0.887
HYDROCARBON TOTAL—C_1+		100.69	9.186			

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	69.0	4.753	98.0	4.658
400-550	17.4	1.199	91.4	1.096
550 +	13.6	0.937	114.6	1.074

	RECOVERY %	#/hr	gal/hr
PROPYLENE	29.4	2.85	
C_3 POLY GASO.	87.5	2.49	0.416
C_3 POLY TAR	12.5	0.36	0.048

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.39	0.078	68.0
C_4 POLY GASO.	5.98	8.25	1.380	1.5
C_4H_{10}	4.86	2.79	0.574	68.0
C_4-FREE GASO.			6.200	5.8
C_4 POLY TAR	7.53	1.18	0.157	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	8.232	0.7509	4071
GAS OIL	1.096	0.1000	542
FUEL OIL	1.074	0.0980	531
POLY TAR	0.205	0.0187	101
TOTAL	10.607	0.9676	5245
W.S. CHEM.	0.875	0.0798	433
TOTAL	11.482	1.0474	5678

OPERATING DATA — V/hr/V = 1702

Pressure, psig	405	Inlet Velocity, Ft/sec	0.93	Catalyst	Fresh CM&S
Temperature, °F	661	Bed Depth, Ft	9.76	Weight, #	992
Recycle Ratio	1.58	Bed Density, #/CF	154	Volume, Cu ft	6.44

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
51.28	75.81	58.07	65.01	42.45	24.58	30.42	81.73

Form ML-11 Kshift = 7.00 **Included in Reactor Effluent Total

g/NCM = 16.01 × #/MCF *9188 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	425	Fresh Feed	11,290
Natural Gas	425	Recycle	17,875
Generator Outlet	413	Combined Feed	29,165
Reactor Inlet	405	Wet Gas—Measured	4,889
Condenser Inlet		Adjusted	5,501
Product Accumulator	369	Loss	612
TEMPERATURES—°F.		Recycle/Fresh Feed	1.58
Oxygen	506	Inlet Velocity—ft./sec.	0.93
Natural Gas	784	Fresh Feed Rate—S.C.F.H. H_2 + CO	10963
Generator	2500	per Cu. Ft. Dense Bed	1702
Quench Accumulator	137	per Lb. Catalyst	11.05
Reactor Inlet	515	per Sq. Ft.	16611
Condenser Inlet	642		
Product Accumulator	82	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate = 227 #/hr.	
1 See Period A	634	@696 psia & 513°F =	
2	662	= 1200 Btu/#	
3	661	Water in @71°F = 39 Btu/#	
4	657	Net Heat Trans./# steam	
5	664	= 1161 Btu	
6	662	Ave. Bed Temp. = 661°F	
7	682	(1161)(227) = 263,547 Btu/hr.	
8	694	dT = 661-513 = 148°F	
9	697	Tube Area = 17.4 ft.^{2}	
10	692	K = $\frac{263,547}{(17.4)(148)}$ =	
11	685	= 102.3 Btu/°F/ft.^{2}	

PRODUCT TESTS

	OIL	WATER
°API	48.7	9.9
Neut. No.	35.5	45.8
Sap. No.	43.8	47.4
Hydrox. No.		
Bromine No.	80	
Pour °F.		
Chemicals, % by K_2CO_3		9.0
HEMPEL. DIST. %		°API
205 °F.		
400	68.0	56.8
400-550	17.4	39.6
550+	14.6	
A. S. T. M. DIST. ON Naphtha °F.		
IBP	102	
10%	146	
50%	247	
90%	364	
EP	403	
Rec.	95.5	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	
Total	
Catalyst Recovered	26.8
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	56
1	78
2	86
3	69
4	0
Total	289
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	154
Inventory, Lbs.	992
Bed Depth, Ft.	9.76
Vol., Cu. Ft.	6.44

PARTICLE SIZE

Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+		80+	
100	150		40—80	
150	105		20—40	
200	74		10—20	
250	62		0—20	
325	44			
<325				

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	
Settled	
Compacted	
Particle Density, gm./cc.	
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	
C	
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

GAS ANALYSES / GENERATOR BALANCE

HOUR	1400	2200	0600	AVERAGE	M/HR	C	H	O
FRESH FEED								
CO 28.010	37.81	37.92	38.20	37.977	11.298	11.298		11.298
H_2 2.016	58.91	59.35	59.12	59.126	17.590		35.180	
CO_2 44.010	1.95	2.12	2.13	2.067	0.615	0.615		1.230
N_2 28.016	0.24	0.13	0.11	0.160	0.048			
CH_4 16.042	1.09	0.48	0.44	0.670	0.199	0.199	0.796	
			M. W	12.89133				
			H_2O 18.016				5.687	2.844
						12.112	41.663	15.372
			BALANCE			99.86	97.25	103.99

	Mol %	M/Hr	C	H	O
O_2 32.000	0.19	7.265 / 0.018			14.566
CO_2 44.010	1.12	0.108	0.108		0.216
N_2 28.016	1.58	0.153			
CH_4 16.042	81.91	7.928	7.928	31.712	
C_2H_6 30.068	6.65	0.644	1.288	3.864	
C_3H_8 44.094	5.96	0.577	1.731	4.616	
C_4H_{10} 58.120	1.87	0.181	0.724	1.810	
C_5H_{12} 72.146	0.72	0.070	0.350	0.840	
MW = 20.370187					
TOTAL			12.129	42.842	14.782

WEIGHT BALANCE

	#/hr Measured	At Wt. Balance
WET GAS	229.30	258.00
OIL	44.64	44.64
WATER	80.88	80.88
TOTAL	354.82	383.52
FRESH FEED	383.52	
WEIGHT BALANCE	92.52	
WET GAS FACTOR	1125163	
INDICATED LOSS—S C F H	612	

WET GAS	1400	2200	0600	AVERAGE
CO 28.010	19.11	19.76	17.70	18.856
H_2 2.016	53.21	53.33	46.09	50.876
CO_2 44.010	14.35	14.43	22.87	17.217
N_2 28.016	1.07	1.27	1.11	1.150
CH_4 16.042	7.09	5.80	5.32	6.070
C_2H_4 28.052	1.18	1.06	1.32	1.187
C_2H_6 30.068	0.66	0.58	0.59	0.610
C_3H_6 42.078	1.56	1.66	1.55	1.590
C_3H_8 44.094	0.30	0.32	0.34	0.320
C_4H_8 56.104	1.01	1.11	1.50	1.207
C_4H_{10} 58.120	0.16	0.34	0.49	0.330
C_5H_{10} 70.130	0.30	0.34	0.70	0.447
C_5H_{12} 72.146	-	-	0.21	0.070
C_6H_{12} 84.156	-	-	0.21	0.070
			M. W.	17.79876

GAS FLOW RATES

	$\sqrt{h}$	PRESSURE	TEMP.	M. W.	S. C. F. H.	M/HR
FRESH FEED 50.54	7.392	404.8 / 20.482	76.3 / 0.9847	2245695 / 1.4986	11,290	29.750
WET GAS 115.14	8.329	1.70 / 4.050	73.8 / 0.9870	1626517 / 1.2753	4,889	12.883
RECYCLE 79.31	8.508	408.4 / 20.569	119.6 / 0.9473	1.2753	16,768	44.184
BLEED 5.02	8.408	20.569	1.0000	1.2753	1,107	2.917
NATURAL GAS 19.79	8.308	424.9 / 20.967	191.0 / 0.8938	1421194 / 1.1921	3,673	9.679
OXYGEN 18.82	7.225	425.2 / 20.620	77.8 / 0.9833		2,757	7.265
STEAM 215.7	3.263	38.5 / 0.3230		227#/hr.		

LIQUID PRODUCT RATES

HOUR	GAGE	GAL.	°F	FACTOR	GAL. AT 60	API° #/GAL.	#	#/HR GAL HR
OIL	6'1"	323.12	62	0.9990	322.80	48.7 / 6.537	2110.14	
	3'0"	161.14	62	0.9990	160.98	47.1 / 6.596	1061.82	
					161.82		1048.32	
					+3.52		+23.00	44.64
					165.34		1071.32	6.889
WATER	7'3"	384.23	78	0.99788	383.42	9.9 / 8.334	3195.42	
	4'6½"	241.29	70	0.99896	241.04	9.7 / 8.346	2011.72	
	2'3/4"	108.67	69	0.99907	108.57	9.9	904.82	
	0'4"	17.70	68	0.99920	17.69	8.334	147.43	80.88
					233.26		1941.11	9.719

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 60-D
HOURS 64-88
CATALYST AGE

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010	37.853	11.257	315.32	18.143	2.293	64.23	8.155	19.412	10.448	-8.964	-251.09				
H_2 2.016	59.324	17.643	35.57	46.883	5.925	11.94	21.073	38.716	26.998	-11.718	-23.63				
CO_2 44.010	1.923	0.572	25.17	22.050	2.787	122.66	9.911	10.483	12.698	2.215	97.49	8.889			
N_2 28.016	0.237	0.070	1.96	1.193	0.151	4.23	0.536	0.606	0.687						
CH_4 16.042	0.663	0.197	3.16	6.003	0.759	12.18	2.698	2.895	3.457	0.562	9.02	0.822			
C_2H_4 28.052				1.277	0.161	4.52	0.574	0.574	0.735	0.161	4.52	0.412			
C_2H_6 30.068				0.630	0.080	2.41	0.283	0.283	0.363	0.080	2.41	0.220			
C_1+C_2											15.95	1.454			
C_3H_6 42.078				1.357	0.171	7.20	0.610	0.610	0.781	0.171	7.20	0.656	4.32	1.667	0.152
C_3H_8 44.094				0.250	0.032	1.41	0.112	0.112	0.145	0.032	1.41	0.129	4.24	0.333	0.030
C_4H_8 56.104				1.047	0.132	7.41	0.471	0.471	0.603	0.132	7.41	0.676	5.00	1.482	0.135
C_4H_{10} 58.120				0.397	0.050	2.91	0.178	0.178	0.228	0.050	2.91	0.265	4.86	0.599	0.055
C_5H_{10} 70.130				0.523	0.066	4.63	0.235	0.235	0.301	0.066	4.63	0.422	5.45	0.850	0.078
C_5H_{12} 72.146				0.070	0.009	0.65	0.031	0.031	0.040	0.009	0.65	0.059	5.25	0.124	0.011
C_6H_{12} 84.156				0.177	0.022	1.85	0.080	0.080	0.102	0.022	1.85	0.169	5.54	0.334	0.030
C_3-C_6											26.06	2.376		5.389	0.491
TOTAL		29.739	381.18		12.638	248.23	44.949	74.688	62.324						
H_2+CO	97.177	28.900	10967.396 SCFH		8.218		29.228	58.128	37.446	-20.682					
H_2/CO		1.57	Factor. 911793		2.58		2.58	1.99	2.58	1.31					

OPERATING DATA V/hr/V = 1519

Pressure, psig	406	Inlet Velocity, Ft/sec	0.90	Catalyst	Fresh CM&S
Temperature, °F	657	Bed Depth, Ft	10.94	Weight, #	1177
Recycle Ratio	1.51	Bed Density, #/CF	163	Volume, Cu ft	7.22

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
57.50	79.63	66.42	71.56	46.18	30.27	35.58	83.81

	NET CHANGE m/hr	NET CHANGE #/hr	#/MCF	#/gal	gal/hr	gal/MCF
RECOVERED OIL	0.347**	48.72	4.442		7.533	0.687
TOTAL OIL		74.78	6.818		12.922	1.178
WATER SOLUBLE CHEMICALS	0.147**	7.79	0.710		0.930	0.085
TOTAL LIQUID PRODUCTS C_3+		82.57	7.528		13.852	1.263
NET WATER	4.243**	76.44	6.970		9.176	0.837
GROSS WATER		84.23	7.680		10.106	0.922
HYDROCARBON TOTAL—C_1+		98.52	8.962			

YIELD BASIS H_2+CO FED — YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL %	gal/hr	TREATING RECOVERY %	gal/hr
400 EP	69.8	5.258	98.0	5.153
400-550	19.2	1.446	91.4	1.322
550 +	11.0	0.829	114.6	0.950

	RECOVERY %	#/hr	gal/hr
PROPYLENE	33.1	2.38	
C_3 POLY GASO.	87.5	2.08	0.348
C_3 POLY TAR	12.5	0.30	0.040

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.24	0.048	68.0
C_4 POLY GASO.	5.98	6.27	1.049	1.5
C_4H_{10}	4.86	2.91	0.599	68.0
C_4-FREE GASO.			6.809	5.8
C_4 POLY TAR	7.53	0.90	0.120	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	8.505	0.7755	4204
GAS OIL	1.322	0.1205	653
FUEL OIL	0.950	0.0866	470
POLY TAR	0.160	0.0146	79
TOTAL	10.937	0.9972	5406
W. S CHEM.	0.930	0.0848	460
TOTAL	11.867	1.0820	5866

Form ML-11 K shift = 7.73 **Included in Reactor Effluent Total

g/NCM = 16.91 X #/MCF *9188 MCFH H_2 + CO, Bbl/Day = 5421.6 X gal/MCF

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	426	Fresh Feed	11,286
Natural Gas	426	Recycle	17,058
Generator Outlet	412	Combined Feed	28,344
Reactor Inlet	406	Wet Gas—Measured	4,441
Condenser Inlet		Adjusted	4,796
Product Accumulator	368	Loss	355
TEMPERATURES—°F.		Recycle/Fresh Feed	1.51
Oxygen	478	Inlet Velocity—ft./sec.	0.90
Natural Gas	784	Fresh Feed Rate—S.C.F.H.	10967
Generator	2523	per Cu. Ft. Dense Bed	1519
Quench Accumulator	121	per Lb. Catalyst	9.32
Reactor Inlet	502	per Sq. Ft.	16617
Condenser Inlet	610		
Product Accumulator	82	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate = 246 #/hr.	
1 See Period A	645	@696 psia & 513°F =	
2	659	= 1200 Btu/#	
3	656	Water in @66°F = 34 Btu/#	
4	652	Net Btu/# steam = 1166 Btu	
5	660	(1166)(246) = 286836 Btu/hr.	
6	652	Ave. Bed Temp. = 657°F	
7	667	dT = 657-513 = 144°F	
8	679	Tube Area = 19.8 ft.^{2}	
9	687	$K = \frac{286,836}{(19.8)(144)}$	
10	678	= 100.6 Btu/°F/sq. ft.	
11	660		

PRODUCT TESTS

	OIL	WATER
°API	49.4	9.9
Neut. No.	37.0	45.7
Sap. No.	45.0	48.3
Hydrox. No.		
Bromine No.	90	
Pour °F.		
Chemicals, % by K_2CO_3		9.2
HEMPEL. DIST. %		°API
205 °F.		
400	68.8	56.9
400-550	19.2	39.4
550+	12.0	
A. S. T. M. DIST. ON Naphtha °F.		
IBP	102	
10%	146	
50%	247	
90%	368	
EP	404	
Rec.	95.0	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	175
Total	
Catalyst Recovered	25
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	56
1	78
2	86
3	83
4	40
Total	343
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	163
Inventory, Lbs.	1177
Bed Depth, Ft.	10.94
Vol., Cu. Ft.	7.22

PARTICLE SIZE

Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+		80+	
100	150		40—80	
150	105		20—40	
200	74		10—20	
250	62		0—20	
325	44			
<325				

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	
Settled	
Compacted	
Particle Density, gm./cc.	
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	
C	
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

GAS ANALYSES / GENERATOR BALANCE

HOUR	1400	2200	0600	AVERAGE	M/HR	C	H	O
FRESH FEED								
CO 28.010	37.81	38.36	37.39	37.853	11.257	11.257		11.257
H_2 2.016	59.11	59.12	59.74	59.324	17.643	·	35.286	
CO_2 44.010	1.97	1.76	2.04	1.923	0.572	0.572		1.144
N_2 28.016	0.11	0.24	0.36	0.237	0.070			
CH_4 16.042	1.00	0.52	0.47	0.663	0.197	0.197	0.788	
			M. W	12.81766				
			H_2O 18.016				6.116	3.058
						12.026	42.190	15.459
			BALANCE			99.25	98.34	102.35

	Mol %	M/Hr	C	H	O
O_2 32.000	0.21	7.410 0.020			14.860
CO_2 44.010	1.25	0.122	0.122		0.244
N_2 28.016	1.33	0.129			
CH_4 16.042	82.47	8.022	8.022	32.088	
C_2H_6 30.068	6.49	0.631	1.262	3.786	
C_3H_8 44.094	5.83	0.567	1.701	4.536	
C_4H_{10} 58.120	1.70	0.165	0.660	1.650	
C_5H_{12} 72.146	0.72	0.070	0.350	0.840	
MW =	20.24936				
TOTAL			12.117	42.900	15.104

WEIGHT BALANCE

	#/hr Measured	At Wt. Balance
WET GAS	229.85	248.23
OIL	48.72	48.72
WATER	84.23	84.23
TOTAL	362.80	381.18
FRESH FEED	381.18	
WEIGHT BALANCE	95.18	
WET GAS FACTOR	1079965	
INDICATED LOSS—S C F H	355	

WET GAS	1400	2200	0600	AVERAGE
CO 28.010	17.63	18.60	18.20	18.143
H_2 2.016	46.51	47.00	47.14	46.883
CO_2 44.010	22.31	21.71	22.13	22.050
N_2 28.016	1.09	1.34	1.15	1.193
CH_4 16.042	6.55	5.80	5.66	6.003
C_2H_4 28.052	1.25	1.21	1.37	1.277
C_2H_6 30.068	0.64	0.63	0.62	0.630
C_3H_6 42.078	1.62	1.00	1.45	1.357
C_3H_8 44.094	0.32	0.16	0.27	0.250
C_4H_8 56.104	1.09	1.03	1.02	1.047
C_4H_{10} 58.120	0.29	0.55	0.35	0.397
C_5H_{10} 70.130	0.51	0.55	0.51	0.523
C_5H_{12} 72.146	-	0.21	-	0.070
C_6H_{12} 84.156	0.19	0.21	0.13	0.177
			M. W.	19.64172

GAS FLOW RATES

	$\sqrt{H}$	PRESSURE	TEMP.	M. W.	S. C. F. H.	M/HR
FRESH FEED 50.54	7.346	405.7 20.504	74.3 0.9865	2258601 1.5029	11,286	29.739
WET GAS 115.14	7.958	1.64 4.042	73.0 0.9877	1473903 1.2140	4,441	11.702
RECYCLE 79.31	8.529	408.3 20.567	117.7 0.9488	1.2140	16,025	42.227
BLEED 5.02	8.238	20.567	1.0000	1.2140	1,033	2.722
NATURAL GAS 19.79	8.312	425.6 20.983	190.0 0.8944	1429674 1.1957	3,691	9.726
OXYGEN 18.82	7.229	425.8 20.988	76.1 0.9849		2,812	7.410
STEAM 215.7	3.521	38.7 0.3238		246#/hr.		

LIQUID PRODUCT RATES

HOUR	GAGE	GAL.	°F	FACTOR	GAL. AT 60	API° #/GAL.	#	#/HR GAL HR
OIL	7'3 3/4"	387.50	73	0.9935	384.98	49.4 6.512	2506.99	
	6'1"	323.12	62	0.9990	322.80	48.7 6.537	2110.14	
	2'7 1/4"	139.26	62	0.9990	139.12	49.4	905.95	
	0'5 1/2"	24.34	84	0.9881	24.05	6.512	156.61	
					+3.53		+23.00	48.72
					180.78		1169.19	7.533
WATER	6'7 1/2"	351.49	70	0.99896	351.12	9.9	2926.23	
	2'3/4"	108.67	69	0.99907	108.57	8.334	904.82	
					242.55		2021.41	84.23
								10.106

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 60-E
HOURS 88-112
CATALYST AGE ____

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010	37.770	11.169	312.81	15.337	1.843	51.62	6.886	18.055	8.729	-9.326	-261.19				
H_2 2.016	59.211	17.508	35.30	47.180	5.668	11.43	21.181	38.689	26.849	-11.840	-23.87				
CO_2 44.010	2.163	0.640	28.17	22.796	2.740	120.59	10.234	10.874	12.974	2.100	92.42	8.492			
N_2 28.016	0.173	0.051	1.43	1.543	0.185	5.18	0.693	0.744	0.878						
CH_4 16.042	0.683	0.202	3.24	6.677	0.802	12.87	2.998	3.200	3.800	0.600	9.63	0.885			
C_2H_4 28.052				1.287	0.155	4.35	0.578	0.578	0.733	0.155	4.35	0.400			
C_2H_6 30.068				0.630	0.076	2.29	0.283	0.283	0.359	0.076	2.29	0.210			
C_1+C_2											16.27	1.495			
C_3H_6 42.078				1.827	0.219	9.22	0.820	0.820	1.039	0.219	9.22	0.847	4.32	2.134	0.196
C_3H_8 44.094				0.417	0.050	2.21	0.187	0.187	0.237	0.050	2.21	0.203	4.24	0.521	0.048
C_4H_8 56.104				1.233	0.148	8.30	0.554	0.554	0.702	0.148	8.30	0.763	5.00	1.660	0.153
C_4H_{10} 58.120				0.410	0.049	2.85	0.184	0.184	0.233	0.049	2.85	0.262	4.86	0.586	0.054
C_5H_{10} 70.130				0.453	0.054	3.79	0.203	0.203	0.257	0.054	3.79	0.348	5.45	0.695	0.064
C_5H_{12} 72.146				0.043	0.005	0.36	0.019	0.019	0.024	0.005	0.36	0.033	5.25	0.069	0.006
C_6H_{12} 84.156				0.167	0.020	1.68	0.075	0.075	0.095	0.020	1.68	0.154	5.54	0.303	0.028
C_3-C_6											28.41	2.610		5.968	0.549
TOTAL		29.570	380.95		12.014	236.74	44.895	74.465	61.950						
H_2+CO	96.981	28.677	10883.2078 SCFH		7.511		28.067	56.744	35.578	-21.166					
H_2/CO		1.57	Factor. 918846		3.08		3.08	2.14	3.08	1.27					

	NET CHANGE m/hr	NET CHANGE #/hr	#/MCF	#/gal	gal/hr	gal/MCF
RECOVERED OIL	0.394**	55.26	5.078		8.597	0.790
TOTAL OIL		83.67	7.688		14.565	1.339
WATER SOLUBLE CHEMICALS	0.150**	7.94	0.730		0.985	0.091
TOTAL LIQUID PRODUCTS C_3+		91.61	8.418		15.550	1.430
NET WATER	4.497**	81.01	7.444		9.725	0.894
GROSS WATER		88.95	8.174		10.710	0.985
HYDROCARBON TOTAL—C_1+		107.88	9.913			

YIELD BASIS H_2+CO FED — YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL %	gal/hr	TREATING RECOVERY %	gal/hr
400 EP	70.2	6.035	98.0	5.914
400-550	17.2	1.479	91.4	1.352
550 +	12.6	1.083	114.6	1.241

	RECOVERY %	#/hr	gal/hr
PROPYLENE	34.4	3.17	
C_3 POLY GASO.	87.5	2.77	0.463
C_3 POLY TAR	12.5	0.40	0.053

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.59	0.118	68.0
C_4 POLY GASO.	5.98	6.75	1.128	1.5
C_4H_{10}	4.86	2.85	0.586	68.0
C_4-FREE GASO.			7.444	5.8
C_4 POLY TAR	7.53	0.96	0.127	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	9.276	0.8523	4621
GAS OIL	1.352	0.1242	673
FUEL OIL	1.241	0.1140	618
POLY TAR	0.180	0.0165	89
TOTAL	12.049	1.1070	6001
W. S. CHEM.	0.985	0.0905	491
TOTAL	13.034	1.1975	6492

OPERATING DATA — V/hr/V = 1221

Pressure, psig	406	Inlet Velocity, Ft/sec	0.89	Catalyst	Fresh CM&S
Temperature, °F	655	Bed Depth, Ft	13.50	Weight, #	1479
Recycle Ratio	1.52	Bed Density, #/CF	166	Volume, Cu ft	8.91

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
59.37	83.50	67.63	73.81	51.65	30.60	37.30	84.92

Form ML-11   K shift = 8.87   **Included in Reactor Effluent Total   g/NCM = 16.91 × #/MCF   *9188 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	427	Fresh Feed	11,222
Natural Gas	426	Recycle	17,038
Generator Outlet	413	Combined Feed	28,260
Reactor Inlet	406	Wet Gas—Measured	4,249
Condenser Inlet		Adjusted	4,559
Product Accumulator	367	Loss	310
TEMPERATURES—°F.		Recycle/Fresh Feed	1.52
Oxygen	477	Inlet Velocity—ft./sec.	0.89
Natural Gas	797	Fresh Feed Rate—S.C.F.H. H_2 + CO	10883
Generator	2514	per Cu. Ft. Dense Bed	1221
Quench Accumulator	121	per Lb. Catalyst	7.36
Reactor Inlet	502	per Sq. Ft.	16489
Condenser Inlet	590		
Product Accumulator	83	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate = 279 #/hr.	
1 See Period A	661	@696 psia & 513°F	
2	657	= 1200 Btu/#	
3	654	Water in @71°F = 39 Btu/#	
4	651	Net Btu/# steam = 1161 Btu	
5	658	(1161)(279) = 323,919 Btu/hr.	
6	655	Ave. Bed Temp. = 655°F	
7	651	dT = 655-513 = 142°F	
8	669	Tube Area = 24.4 ft.²	
9	672	$K = \frac{323,919}{(24.4)(142)}$	
10	664	= 93.4 Btu/°F/ft.²	
11	640		

PRODUCT TESTS

	OIL	WATER
°API	50.8	10.1
Neut. No.	37.2	45.3
Sap. No.	46.5	46.9
Hydrox. No.		
Bromine No.	83	
Pour °F.		
Chemicals, % by K_2CO_3		9.2
HEMPEL. DIST. %		°API
205 °F.		
400	69.2	55.8
400-550	17.2	38.8
550+	13.6	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	101	
10%	145	
50%	249	
90%	375	
EP	408	
Rec.	95.0	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	181
Total	
Catalyst Recovered	49.5
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	55
1	78
2	85
3	88
4	125
Total	431
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	166
Inventory, Lbs.	1479
Bed Depth, Ft.	13.50
Vol., Cu. Ft.	8.91

PARTICLE SIZE

Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+		80+	
100	150		40—80	
150	105		20—40	
200	74		10—20	
250	62		0—20	
325	44			
<325				

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	
Settled	
Compacted	
Particle Density, gm./cc.	
NH_3 Value, ml./gm.	
N_2 Surface, m²/gm.	
CHEMICAL ANALYSIS	
Fe	
C	
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

GAS ANALYSES

HOUR	1400	2200	0600	AVERAGE	M/HR	C	H	O
FRESH FEED								
CO 28.010	38.02	37.62	37.67	37.770	11.169	11.169		11.169
H_2 2.016	58.82	59.34	59.47	59.211	17.508		35.016	
CO_2 44.010	2.09	2.21	2.19	2.163	0.640	0.640		1.280
N_2 28.016	0.19	0.17	0.16	0.173	0.051			
CH_4 16.042	0.88	0.66	0.51	0.683	0.202	0.202	0.808	
			M. W.	12.88304				
			H_2O 18.016				6.114	3.057
						12.011	41.938	15.506
			BALANCE			99.12	97.99	102.85
WET GAS								
CO 28.010	14.25	15.42	16.34	15.337				
H_2 2.016	47.18	46.83	47.53	47.180				
CO_2 44.010	22.38	23.32	22.69	22.796				
N_2 28.016	1.62	1.55	1.46	1.543				
CH_4 16.042	7.67	6.51	5.85	6.677				
C_2H_4 28.052	1.18	1.19	1.49	1.287				
C_2H_6 30.068	0.48	0.76	0.65	0.630				
C_3H_6 42.078	2.42	1.57	1.49	1.827				
C_3H_8 44.094	0.67	0.27	0.31	0.417				
C_4H_8 56.104	1.35	1.25	1.10	1.233				
C_4H_{10} 58.120	0.40	0.57	0.26	0.410				
C_5H_{10} 70.130	0.27	0.57	0.52	0.453				
C_5H_{12} 72.146	-	-	0.13	0.043				
C_6H_{12} 84.156	0.13	0.19	0.18	0.167				
			M. W.	19.70537				

GENERATOR BALANCE

	Mol %	M/Hr	C	H	O
O_2 32.000	0.19	7.375 0.018			14.786
CO_2 44.010	1.49	0.145	0.145		0.290
N_2 28.016	1.33	0.129			
CH_4 16.042	82.14	7.983	7.983	31.932	
C_2H_6 30.068	6.63	0.644	1.288	3.864	
C_3H_8 44.094	5.77	0.561	1.683	4.488	
C_4H_{10} 58.120	1.76	0.171	0.684	1.710	
C_5H_{12} 72.146	0.69	0.067	0.335	0.804	
MW =	20.32451				
TOTAL			12.118	42.798	15.076

WEIGHT BALANCE

	#/hr Measured	At Wt. Balance
WET GAS	220.62	236.74
OIL	55.26	55.26
WATER	88.95	88.95
TOTAL	364.83	380.95
FRESH FEED	380.95	
WEIGHT BALANCE	95.77	
WET GAS FACTOR	1073066	
INDICATED LOSS—S C F H	310	

GAS FLOW RATES

	√R	PRESSURE	TEMP.	M. W.	S. C. F. H.	M/HR
FRESH FEED 50.54	7.358	405.6 20.501	79.2 0.9820	2247140 1.4990	11,222	29.570
WET GAS 115.14	7.633	1.65 4.044	74.6 0.9863	1469142 1.2121	4,249	11.196
RECYCLE 79.31	8.529	408.6 20.574	116.5 0.9497	1.2121	16,020	42.213
BLEED 5.02	8.133	20.574	1.0000	1.2121	1,018	2.682
NATURAL GAS 19.79	8.329	426.1 20.995	192.3 0.8929	1424388 1.1935	3,688	9.718
OXYGEN 18.82	7.213	426.9 21.014	80.2 0.9811		2,799	7.375
STEAM 215.7	3.975	39.1 0.3251		279#/hr.		

LIQUID PRODUCT RATES

HOUR	GAGE	GAL.	°F	FACTOR	GAL. AT 60	API° #/GAL.	#	#/HR GAL HR
OIL	6'5⅛"	342.76	66	0.9970	341.73	50.8 6.462	2208.26	
	2'7¼"	139.26	62	0.9990	139.12	49.4 6.512	905.95	
					+3.71		+24.00	55.26
					206.32		1326.31	8.597
WATER	7'6"	397.32	69	0.99907	396.95	10.1 8.322	3303.42	
	6'7½"	351.49	70	0.99896	351.12	9.9 8.334	2926.23	
	4'3½"	229.28	75	0.99832	228.89	10.1	1904.82	
	0'4"	17.70	72	0.99872	-17.68	8.322	147.13	88.95
					257.04		2134.88	10.710

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 60-F
HOURS 112-136
CATALYST AGE ________

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010	37.963	11.218	314.21	15.897	1.930	54.06	7.109	18.327	9.039	-9.288	-260.15				
H_2 2.016	59.237	17.504	35.29	47.284	5.740	11.57	21.144	38.648	26.884	-11.764	-23.72				
CO_2 44.010	1.957	0.578	25.44	22.863	2.775	122.13	10.224	10.802	12.999	2.197	96.69	8.871			
N_2 28.016	0.240	0.071	1.99	1.363	0.165	4.62	0.610	0.681	0.775						
CH_4 16.042	0.603	0.178	2.86	6.333	0.769	12.34	2.832	3.010	3.601	0.591	9.48	0.870			
C_2H_4 28.052				1.433	0.174	4.88	0.641	0.641	0.815	0.174	4.88	0.448			
C_2H_6 30.068				0.703	0.085	2.56	0.314	0.314	0.399	0.085	2.56	0.235			
C_1+C_2											16.92	1.553			
C_3H_6 42.078				1.627	0.198	8.33	0.728	0.728	0.926	0.198	8.33	0.764	4.32	1.928	0.177
C_3H_8 44.094				0.287	0.035	1.54	0.128	0.128	0.163	0.035	1.54	0.141	4.24	0.363	0.033
C_4H_8 56.104				1.097	0.133	7.46	0.491	0.491	0.624	0.133	7.46	0.684	5.00	1.492	0.137
C_4H_{10} 58.120				0.373	0.045	2.62	0.167	0.167	0.212	0.045	2.62	0.240	4.86	0.539	0.049
C_5H_{10} 70.130				0.533	0.065	4.56	0.238	0.238	0.303	0.065	4.56	0.418	5.45	0.837	0.077
C_5H_{12} 72.146													5.25		
C_6H_{12} 84.156				0.207	0.025	2.10	0.093	0.093	0.118	0.025	2.10	0.193	5.54	0.379	0.035
C_3-C_6											26.61	2.440		5.538	0.508
TOTAL		29.549	379.79		12.139	238.77	44.719	74.268	61.786						
H_2+CO	97.200	28.722	10900.008 SCFH		7.670		28.253	56.975	35.923	-21.052					
H_2/CO		1.56	Factor. 917430		2.97		2.97	2.11	2.97	1.27					

YIELD BASIS H_2+CO FED

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL. %	gal/hr	TREATING RECOVERY %	gal/hr
400 EP	73.4	6.071	98.0	5.950
400-550	15.6	1.290	91.4	1.179
550 +	11.0	0.910	114.6	1.043
	RECOVERY %	#/hr	gal/hr	
PROPYLENE	34.1	2.84		
C_3 POLY GASO.	87.5	2.48	0.415	
C_3 POLY TAR	12.5	0.36	0.048	
	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.77	0.154	68.0
C_4 POLY GASO.	5.98	5.85	0.979	1.5
C_4H_{10}	4.86	2.62	0.539	68.0
C_4-FREE GASO.			7.581	5.8
C_4 POLY TAR	7.53	0.84	0.112	
	gal/hr	gal/MCF	Bbl/Day	
10 # RVP 400 EP GASOLINE	9.253	0.8489	4602	
GAS OIL	1.179	0.1082	587	
FUEL OIL	1.043	0.0957	519	
POLY TAR	0.160	0.0147	80	
TOTAL	11.635	1.0675	5788	
W. S. CHEM.	0.997	0.0915	496	
TOTAL	12.632	1.1590	6284	

OPERATING DATA — V/hr/V = 1225

									m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF
Pressure, psig	406	Inlet Velocity, Ft/sec	0.89	Catalyst	Fresh CM&S			RECOVERED OIL	0.383**	53.76	4.932		8.271	0.759
Temperature, °F	654	Bed Depth, Ft	13.48	Weight, #	1441			TOTAL OIL		80.37	7.372		13.809	1.267
Recycle Ratio	1.51	Bed Density, #/CF	162	Volume, Cu ft	8.90			WATER SOLUBLE CHEMICALS	0.153**	8.12	0.745		0.997	0.091
								TOTAL LIQUID PRODUCTS C_3+		68.49	8.117		14.806	1.358
FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY	NET WATER	4.392**	79.12	7.259		9.498	0.872
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+	GROSS WATER		87.24	8.004		10.495	0.963
58.92	83.80	67.21	73.30	50.68	30.44	36.95	83.95	HYDROCARBON TOTAL—C_1+		105.41	9.670			

Form ML-11 K shift = 8.80 **Included in Reactor Effluent Total g/NCM = 16.91 × #/MCF *9188 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	426	Fresh Feed	11,214
Natural Gas	425	Recycle	16,971
Generator Outlet	412	Combined Feed	28,185
Reactor Inlet	406	Wet Gas—Measured	4,359
Condenser Inlet		Adjusted	4,607
Product Accumulator	366	Loss	248
TEMPERATURES—°F.		Recycle/Fresh Feed	1.51
Oxygen	493	Inlet Velocity—ft./sec.	0.89
Natural Gas	799	Fresh Feed Rate—S.C.F.H. H_2 + CO	10900
Generator	2507	per Cu. Ft. Dense Bed	1225
Quench Accumulator	124	per Lb. Catalyst	7.56
Reactor Inlet	489	per Sq. Ft.	16515
Condenser Inlet	580		
Product Accumulator	84	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate = 275 #/hr.	
1 See Period A	655	@ 696 psia & 513°F =	
2	655	= 1200 Btu/#	
3	655	Water in @ 77°F = 45 Btu/#	
4	650	Net Btu/# steam = 1155 Btu	
5	656	(1155)(275) = 317,625 Btu/hr.	
6	655	Ave. Bed Temp. = 654°F	
7	634	dT = 654-513 = 141°F	
8	648	Tube Area = 24.4 ft.²	
9	654	$K = \frac{317,625}{(141)(24.4)} =$	
10	644	= 92.3 Btu/°F/ft.²	
11	616		

PRODUCT TESTS

	OIL	WATER
°API	50.4	10.2
Neut. No.	36.2	43.5
Sap. No.	48.7	45.6
Hydrox. No.		
Bromine No.	89	
Pour °F.		
Chemicals, % by K_2CO_3		9.5
HEMPEL, DIST. %		°API
205 °F.		
400	72.4	55.5
400-550	15.6	39.3
550+	12.0	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	104	
10%	144	
50%	247	
90%	360	
EP	416	
Rec.	96.5	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	
Total	
Catalyst Recovered	14
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	54
1	77
2	83
3	86
4	120
Total	420
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	162
Inventory, Lbs.	1441
Bed Depth, Ft.	13.48
Vol., Cu. Ft.	8.90

PARTICLE SIZE

Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+		80+	
100	150		40—80	
150	105		20—40	
200	74		10—20	
250	62		0—20	
325	44			
<325				

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	
Settled	
Compacted	
Particle Density, gm./cc.	
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	
C	
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

GAS ANALYSES / GENERATOR BALANCE

HOUR	1400	2200	0600	AVERAGE	M/HR	C	H	O
FRESH FEED								
CO 28.010	37.80	37.73	38.36	37.963	11.218	11.218		11.218
H_2 2.016	59.07	59.79	58.85	59.237	17.504		35.008	
CO_2 44.010	1.91	1.76	2.20	1.957	0.578	0.578		1.156
N_2 28.016	0.11	0.33	0.28	0.240	0.071			
CH_4 16.042	1.11	0.39	0.31	0.603	0.178	0.178	0.712	
			M. W	12.852902				
			H_2O 18.016				6.463	3.232
						11.974	42.183	15.606
			BALANCE			97.48	97.89	103.01

GENERATOR BALANCE

	Mol %	M/Hr	C	H	O
O_2 32.000	0.18	7.433 0.017			14.900
CO_2 44.010	1.29	0.125	0.125		0.250
N_2 28.016	1.32	0.127			
CH_4 16.042	81.42	7.863	7.863	31.452	
C_2H_6 30.068	6.69	0.646	1.292	3.876	
C_3H_8 44.094	6.25	0.604	1.812	4.832	
C_4H_{10} 58.120	1.90	0.183	0.732	1.830	
C_5H_{12} 72.146	0.95	0.092	0.460	1.104	
MW = 20.613628					
TOTAL			12.284	43.094	15.150

WEIGHT BALANCE

	#/hr Measured	At Wt. Balance
WET GAS	225.94	238.79
OIL	53.76	53.76
WATER	87.24	87.24
TOTAL	366.94	379.79
FRESH FEED	379.79	
WEIGHT BALANCE	96.62	
WET GAS FACTOR	1056873	
INDICATED LOSS—S C F H	248	

WET GAS

	1400	2200	0600	AVERAGE
CO 28.010	16.08	16.18	15.43	15.897
H_2 2.016	47.11	47.02	47.72	47.284
CO_2 44.010	22.30	23.09	23.20	22.863
N_2 28.016	1.29	1.33	1.47	1.363
CH_4 16.042	7.11	6.07	5.82	6.333
C_2H_4 28.052	1.42	1.41	1.47	1.433
C_2H_6 30.068	0.63	0.73	0.75	0.703
C_3H_6 42.078	1.65	1.65	1.58	1.627
C_3H_8 44.094	0.31	0.30	0.25	0.287
C_4H_8 56.104	1.08	1.19	1.02	1.097
C_4H_{10} 58.120	0.29	0.35	0.48	0.373
C_5H_{10} 70.130	0.52	0.54	0.54	0.533
C_5H_{12} 72.146				-
C_6H_{12} 84.156	0.21	0.14	0.27	0.207
			M. W.	19.670566

GAS FLOW RATES

	$\sqrt{h}$	PRESSURE	TEMP.	M. W.	S. C. F. H.	M/HR
FRESH FEED 50.54	7.358	405.5 20.499	81.2 0.9802	2252409 1.5008	11,214	29.549
WET GAS 115.14	7.871	1.51 4.026	76.2 0.9848	1471742 1.2132	4,359	11.486
RECYCLE 79.31	8.508	407.3 20.543	121.1 0.9460	1.2132	15,909	41.921
BLEED 5.02	8.492	20.543	1.0000	1.2132	1,062	2.798
NATURAL GAS 19.79	8.338	425.2 20.974	191.3 0.8936	1404410 1.1851	3,665	9.657
OXYGEN 18.82	7.292	426.3 21.000	82.8 0.9788		2,821	7.433
STEAM 215.7	3.992	37.4 0.3191		275#/hr.		

LIQUID PRODUCT RATES

HOUR	GAGE	GAL.	°F	FACTOR	GAL. AT 60	API° #/GAL.	#	#/HR GAL HR
OIL	7'2¼"	380.96	68	0.9961	379.47	50.4 6.476	2457.45	
	6'5⅛"	342.76	66	0.9970	341.73	50.8 6.462	2208.26	
	3'6¼"	188.91	65	0.9975	188.44	50.4	1220.34	
	0'7"	30.98	72	0.9941	30.80	6.476	199.46	
					+3.13		+20.25	53.76
					198.51		1290.32	8.271
WATER	7'5⅜"	395.14	82	0.99726	394.06	10.2 8.317	3277.40	
	4'3⅜"	229.28	75	0.99832	228.89	10.1 8.322	1904.82	
	2'11⅜"	158.84	71	0.99883	158.65	10.2	1319.49	
	1'7"	82.59	76	0.99819	82.44	8.317	685.65	87.24
					241.38		2006.42	10.495

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 60-G
HOURS 136-160
CATALYST AGE

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010	37.593	11.074	310.18	15.646	1.891	52.97	6.944	18.018	8.835	-9.183	-257.21				
H_2 2.016	59.527	17.535	35.35	46.883	5.666	11.42	20.809	38.344	26.475	-11.869	-23.93				
CO_2 44.010	2.057	0.606	26.67	23.420	2.831	124.58	10.395	11.001	13.226	2.225	97.91	9.018			
N_2 28.016	0.263	0.077	2.16	1.293	0.156	4.37	0.574	0.651	0.730						
CH_4 16.042	0.560	0.165	2.65	6.103	0.738	11.84	2.709	2.874	3.447	0.573	9.19	0.846			
C_2H_4 28.052				1.440	0.174	4.88	0.639	0.639	0.813	0.174	4.88	0.450			
C_2H_6 30.068				0.657	0.079	2.38	0.292	0.292	0.371	0.079	2.38	0.219			
C_1+C_2											16.45	1.515			
C_3H_6 42.078				1.827	0.221	9.30	0.811	0.811	1.032	0.221	9.30	0.857	4.32	2.153	0.198
C_3H_8 44.094				0.290	0.035	1.54	0.129	0.129	0.164	0.035	1.54	0.142	4.24	0.363	0.033
C_4H_8 56.104				1.337	0.162	9.09	0.593	0.593	0.755	0.162	9.09	0.837	5.00	1.818	0.167
C_4H_{10} 58.120				0.373	0.045	2.62	0.166	0.166	0.211	0.045	2.62	0.241	4.86	0.539	0.050
C_5H_{10} 70.130				0.557	0.067	4.70	0.247	0.247	0.314	0.067	4.70	0.433	5.45	0.862	0.079
C_5H_{12} 72.146				0.027	0.003	0.22	0.012	0.012	0.015	0.003	0.22	0.020	5.25	0.042	0.004
C_6H_{12} 84.156				0.147	0.018	1.51	0.065	0.065	0.083	0.018	1.51	0.139	5.54	0.273	0.025
C_3-C_6											28.98	2.669		6.050	0.556
TOTAL		29.457	377.01		12.086	241.42	44.385	73.842	61.353						
H_2+CO	97.120	28.609	10857.0448 SCFH		7.557		27.753	56.362	35.310	-21.052					
H_2/CO		1.58	Factor. 921060	3.00			3.00	2.13	3.00	1.29					

YIELD BASIS H_2+CO FED — YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL %	gal/hr	TREATING RECOVERY %	gal/hr
400 EP	71.5	5.349	98.0	5.242
400-550	17.0	1.272	91.4	1.163
550 +	11.5	0.860	114.6	0.986

	RECOVERY %	#/hr	gal/hr
PROPYLENE	34.2	3.18	
C_3 POLY GASO.	87.5	2.78	0.465
C_3 POLY TAR	12.5	0.40	0.053

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.70	0.140	68.0
C_4 POLY GASO.	5.98	7.34	1.228	1.5
C_4H_{10}	4.86	2.62	0.539	68.0
C_4-FREE GASO.			6.884	5.8
C_4 POLY TAR	7.53	1.05	0.139	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	8.791	0.8097	4390
GAS OIL	1.163	0.1071	581
FUEL OIL	0.986	0.0908	492
POLY TAR	0.192	0.0177	96
TOTAL	11.132	1.0253	5559
W. S. CHEM.	0.995	0.0916	497
TOTAL	12.127	1.1169	6056

OPERATING DATA

V/hr/V = 1219

Pressure, psig	403	Inlet Velocity, Ft/sec	0.89	Catalyst	Fresh CM&S
Temperature, °F	652	Bed Depth, Ft	13.50	Weight, #	1390
Recycle Ratio	1.51	Bed Density, #/CF	156	Volume, Cu ft	8.91

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	$CO+H_2$	C_3+/C_1+
58.97	82.92	67.69	73.58	50.97	30.95	37.35	83.88

	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	#/gal	gal/hr	gal/MCF
RECOVERED OIL	0.345**	48.40	4.458		7.481	0.669
TOTAL OIL		77.38	7.127		13.531	1.245
WATER SOLUBLE CHEMICALS	0.155**	8.24	0.759		0.995	0.092
TOTAL LIQUID PRODUCTS C_3+		85.62	7.886		14.526	1.337
NET WATER	4.382**	78.95	7.272		9.478	0.873
GROSS WATER		87.19	8.031		10.473	0.965
HYDROCARBON TOTAL—C_1+		102.07	9.401			

Form ML-11 K shift = 9.04 **Included in Reactor Effluent Total g/NCM = 16.01 × #/MCF *9188 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

DATA SUMMARY

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	425	Fresh Feed	11,179
Natural Gas	424	Recycle	16,844
Generator Outlet	412	Combined Feed	28,023
Reactor Inlet	403	Wet Gas—Measured	4,379
Condenser Inlet		Adjusted	4,587
Product Accumulator	364	Loss	208
TEMPERATURES—°F.		Recycle/Fresh Feed	1.51
Oxygen	510	Inlet Velocity—ft./sec.	0.89
Natural Gas	795	Fresh Feed Rate—S.C.F.H.	10857
Generator	2507	per Cu. Ft. Dense Bed	1219
Quench Accumulator	127	per Lb. Catalyst	7.81
Reactor Inlet	489	per Sq. Ft.	16450
Condenser Inlet	590		
Product Accumulator	84	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate = 263 #/hr.	
1 See Period A	631	@696 psia & 513°F =	
2	652	1200 Btu/#	
3	651	Water in @74°F = 42 Btu/#	
4	649	Net Btu/# steam = 1158 Btu	
5	654	1158 X 263 = 304,554 Btu/hr	
6	653	Ave. Bed Temp. = 652°F	
7	633	dT = 652-513 = 139°F	
8	650	Tube Area = 24.4 sq. ft.	
9	660	$K = \frac{304,554}{(24.4)(139)} =$	
10	657	89.8 Btu/°F/sq. ft.	
11	639		

PRODUCT TESTS

	OIL	WATER
°API	50.5	10.1
Neut. No.	39.1	44.4
Sap. No.	46.8	46.2
Hydrox. No.		
Bromine No.	89	
Pour °F.		
Chemicals, % by K_2CO_3		9.5
HEMPEL. DIST. %		
205 °F.		°API
400	70.5	54.2
400-550	17.0	39.1
550+	12.5	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	104	
10%	142	
50%	240	
90%	352	
EP	410	
Rec.	97.0	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	
Total	
Catalyst Recovered	31.5
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	53
1	75
2	80
3	82
4	115
Total	405
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	156
Inventory, Lbs.	1390
Bed Depth, Ft.	13.50
Vol., Cu. Ft.	8.91

PARTICLE SIZE

Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+		80+	
100	150		40—80	
150	105		20—40	
200	74		10—20	
250	62		0—20	
325	44			
<325				

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	
Settled	
Compacted	
Particle Density, gm./cc.	
NH_3 Value, ml./gm.	
N_2 Surface, m²/gm.	
CHEMICAL ANALYSIS	
Fe	
C	
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

GAS ANALYSES / GENERATOR BALANCE

HOUR	1400	2200	0600	AVERAGE	M/HR	C	H	O
FRESH FEED								
CO 28.010	37.54	37.59	37.65	37.593	11.074	11.074		11.074
H_2 2.016	59.35	59.62	59.61	59.527	17.535		35.070	
CO_2 44.010	2.00	2.11	2.06	2.057	0.606	0.606		1.212
N_2 28.016	0.22	0.27	0.30	0.263	0.077			
CH_4 16.042	0.89	0.41	0.38	0.560	0.165	0.165	0.660	
			M. W	12.798667				
			H_2O 18.016				6.501	3.251
						11.845	42.231	15.537
			BALANCE			96.54	98.10	102.70

	Mol %	M/Hr	C	H	O
O_2 32.000	0.18	7.423 0.017			14.880
CO_2 44.010	1.29	0.124	0.124		0.248
N_2 28.016	1.32	0.127			
CH_4 16.042	81.42	7.855	7.855	31.420	
C_2H_6 30.068	6.69	0.645	1.290	3.870	
C_3H_8 44.094	6.25	0.603	1.809	4.824	
C_4H_{10} 58.120	1.90	0.183	0.732	1.830	
C_5H_{12} 72.146	0.95	0.092	0.460	1.104	
MW = 20.613628					
TOTAL			12.270	43.048	15.128

WEIGHT BALANCE

	#/hr Measured	At Wt. Balance
WET GAS	230.49	241.42
OIL	48.40	48.40
WATER	87.19	87.19
TOTAL	366.08	377.01
FRESH FEED	377.01	
WEIGHT BALANCE	97.10	
WET GAS FACTOR	104742	•
INDICATED LOSS—S C F H	208	

WET GAS

	1400	2200	0600	AVERAGE
CO 28.010	15.28	15.54	16.12	15.646
H_2 2.016	46.92	46.19	47.54	46.883
CO_2 44.010	23.07	24.17	23.02	23.420
N_2 28.016	1.09	1.53	1.26	1.293
CH_4 16.042	6.94	5.97	5.40	6.103
C_2H_4 28.052	1.38	1.39	1.55	1.440
C_2H_6 30.068	0.61	0.66	0.70	0.657
C_3H_6 42.078	1.85	1.84	1.79	1.827
C_3H_8 44.094	0.26	0.26	0.35	0.290
C_4H_8 56.104	1.46	1.29	1.26	1.337
C_4H_{10} 58.120	0.40	0.45	0.27	0.373
C_5H_{10} 70.130	0.61	0.53	0.53	0.557
C_5H_{12} 72.146	-	-	0.08	0.027
C_6H_{12} 84.156	0.13	0.18	0.15	0.147
			M. W.	19.97488

GAS FLOW RATES

	√H	PRESSURE	TEMP.	M. W.	S. C. F. H.	M/HR
FRESH FEED 50.54	7.338	403.3 20.445	81.1 0.9803	2261954 1.5040	11,179	29.457
WET GAS 115.14	7.896	1.74 4.055	74.1 0.9867	144932 1.2039	4,379	11,539
RECYCLE 79.31	8.500	405.7 20.504	124.5 0.9432	1.2039	15,696	41.360
BLEED 5.02	9.263	20.504	1.0000	1.2039	1,148	3.025
NATURAL GAS 19.79	8.354	423.7 20.938	193.1 0.8924	1404410 1.1851	3,661	9.647
OXYGEN 18.82	7.288	425.4 20.978	82.5 0.9790		2,817	7.423
STEAM 215.7	3.829	37.3 0.3188		263#/hr.		

LIQUID PRODUCT RATES

HOUR	GAGE	GAL.	°F	FACTOR	GAL. AT 60	API° #/GAL.	#	#/HR GAL HR
OIL	6'11"	366.77	66	0.9970	365.67	50.5 6.473	2366.98	
	3'6¼"	188.91	65	0.9975	188.44	50.4 6.476	1220.34	
					+2.32		+15.00	48.40
					179.55		1161.64	7.481
WATER	7'6"	397.32	74	0.99846	396.71	10.1 8.322	3301.42	
	2'11⅛"	158.84	71	0.99883	158.65	10.2 8.317	1319.49	
	0'6⅛"	28.77	64	0.99963	28.76	10.1	239.34	
	0'1⅜"	15.49	66	0.99942	15.48	8.322	128.82	87.19
					251.34		2092.45	10.473

RUN NO. 61-0 (A-D)
HOURS 0-89
CATALYST Fresh CM&S

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010		11.315						13.300		-10.955	-306.85				
H_2 2.016		18.075						28.995		-16.108	-32.47				
CO_2 44.010										1.960	86.26	7.734			
N_2 28.016															
CH_4 16.042										0.694	11.13	0.998			
C_2H_4 28.052										0.195	5.47	0.490			
C_3H_6 30.068										0.109	3.28	0.294			
C_1+C_2											19.88	1.782			
C_3H_8 42.078										0.234	9.85	0.883	4.32	2.280	0.204
C_3H_8 44.094										0.041	1.81	0.162	4.24	0.427	0.038
C_4H_8 56.104										0.171	9.59	0.860	5.00	1.918	0.172
C_4H_{10} 58.120										0.046	2.67	0.239	4.86	0.549	0.049
C_5H_{10} 70.130										0.069	4.84	0.434	5.45	0.888	0.080
C_5H_{12} 72.146										0.016	1.15	0.103	5.25	0.219	0.020
C_6H_{12} 84.156										0.021	1.77	0.159	5.54	0.319	0.029
C_3-C_6											31.68	2.840		6.600	0.592
TOTAL															
H_2+CO		29.390	11154 SCFH					42.295		-27.063					
H_2/CO			Factor 896539												
Weight Recovery, %	94.13	Catalyst Age, hrs. Ave.	45	Space Velocity, vhv	754	RECOVERED OIL					73.71	6.608		11.327	1.016
Pressure, psig	382	Inlet Velocity, Ft/sec	0.80	Catalyst Vol., CF	14.90	TOTAL OIL					105.39	9.449		17.927	1.607
Temperature, °F	655	Bed Depth, Ft	22.6	Weight, #	1428	WATER SOLUBLE CHEMICALS					4.98 9.51	0.446 0.853		0.610 1.164	0.055 0.104
Recycle Ratio	1.27	Bed Density, #/CF	96	Effluent Shift Ratio $(H_2)(CO_2)/(H_2O)(CO)$	= 15.12	TOTAL LIQUID PRODUCTS C_3+					119.88	10.748		19.701	1.766
FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %		SELECTIVITY				NET WATER	109.32	9.801		13.112	1.176
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+			GROSS WATER	123.81	11.100		14.886	1.335
77.45	96.82	89.12	92.08	82.37	55.55	63.99	85.78			HYDROCARBON TOTAL—C_1+	139.76	12.530			

YIELD BASIS H_2+CO FED

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	68.7	7.782	98.0	7.626
400-550	17.3	1.960	91.4	1.791
550 +	14.0	1.585	114.6	1.816

	RECOVERY %	#/hr	gal/hr
PROPYLENE	61.6	6.068	
C_3 POLY GASO.	87.5	5.309	0.888
C_3 POLY TAR	12.5	0.759	0.101

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	1.70	0.340	68.0
C_4 POLY GASO.	5.98	6.90	1.154	1.5
C_4H_{10}	4.86	2.67	0.549	68.0
C_4-FREE GASO.			9.940	5.8
C_4 POLY TAR	7.53	0.99	0.131	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	11.983	1.0743	5824
GAS OIL	1.791	0.1606	871
FUEL OIL	1.816	0.1628	883
POLY TAR	0.232	0.0208	113
TOTAL	15.822	1.4185	7691
W. S. CHEM.	0.610 1.164	0.0547 0.1044	297 566
TOTAL	17.596	1.5776	8553

Form ML—11 AI=(27.46)(1.0140)= 27.84

g/NCM = 16.91 × #/MCF *9488 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

RUN NO. 61-1 (E-K)
HOURS 89-239
CATALYST Fresh CM&S

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010		11.226						14.965		-10.400	-291.30				
H_2 2.016		17.808						33.708		-14.363	-28.96				
CO_2 44.010										2.101	92.47	8.327			
N_2 28.016															
CH_4 16.042										0.689	11.05	0.995			
C_2H_4 28.052										0.203	5.69	0.512			
C_3H_6 30.068										0.125	3.76	0.339			
C_1+C_2											20.50	1.846			
C_3H_8 42.078										0.208	8.76	0.789	4.32	2.028	0.183
C_3H_8 44.094										0.041	1.81	0.163	4.24	0.427	0.038
C_4H_8 56.104										0.168	9.43	0.849	5.00	1.886	0.170
C_4H_{10} 58.120										0.053	3.08	0.277	4.86	0.634	0.057
C_5H_{10} 70.130										0.077	5.40	0.486	5.45	0.991	0.089
C_5H_{12} 72.146										0.018	1.30	0.117	5.25	0.248	0.022
C_6H_{12} 84.156										0.025	2.10	0.189	5.54	0.379	0.034
C_3-C_6											31.88	2.871		6.593	0.594
TOTAL															
H_2+CO		29.034	11105 SCFH					48.673		-24.763					
H_2/CO			Factor 900495												
Weight Recovery, %	96.45	Catalyst Age, hrs. Ave. =	164	Space Velocity, vhv	692	RECOVERED OIL					58.81	5.296		9.012	0.812
Pressure, psig	378	Inlet Velocity, Ft/sec	0.85	Catalyst Vol., CF	=15.96	TOTAL OIL					90.69	8.167		15.605	1.405
Temperature, °F	669	Bed Depth, Ft	24.2	Weight, #	1251	WATER SOLUBLE CHEMICALS					4.81 9.86	0.433 0.888		0.602 1.234	0.054 0.111
Recycle Ratio	1.39	Bed Density, #/CF	79	Effluent Shift Ratio $(H_2)(CO_2)/(H_2O)(CO)$	= 11.54	TOTAL LIQUID PRODUCTS C_3+					105.36	9.488		17.441	1.571
FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %		SELECTIVITY				NET WATER	98.70	8.888		11.825	1.065
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+			GROSS WATER	113.37	10.209		13.661	1.230
70.29	92.64	80.65	85.29	69.50	42.61	50.88	83.71			HYDROCARBON TOTAL—C_1+	125.86	11.334			

YIELD BASIS H_2+CO FED

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	72.8	6.561	98.0	6.430
400-550	18.6	1.676	91.4	1.532
550 +	8.6	0.775	114.6	0.888

	RECOVERY %	#/hr	gal/hr
PROPYLENE	49.23	4.313	
C_3 POLY GASO.	87.5	3.774	0.631
C_3 POLY TAR	12.5	0.539	0.072

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.89	0.178	68.0
C_4 POLY GASO.	5.98	7.47	1.250	1.5
C_4H_{10}	4.86	3.08	0.634	68.0
C_4-FREE GASO.			8.679	5.8
C_4 POLY TAR	7.53	1.07	0.142	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	10.741	0.9672	5244
GAS OIL	1.532	0.1380	748
FUEL OIL	0.888	0.0800	434
POLY TAR	0.214	0.0193	105
TOTAL	13.375	1.2044	6530
W. S. CHEM.	0.602 1.234	0.0542 0.1111	294 602
TOTAL	15.211	1.3697	7426

Form ML—11 AI=(26.31)(0.8324)=21.90 Acids = (0.117)(36.20)=4.24%

g/NCM = 16.91 × #/MCF *9488 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 61-A
HOURS 0-17
CATALYST Fresh CM&S

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	37.533	11.226	314.44	4.520	0.297	8.32	1.695	12.921	1.992	-10.929	-306.12				
H_2 2.016	59.630	17.835	35.96	25.300	1.663	3.35	9.487	27.322	11.150	-16.172	-32.61				
CO_2 44.010	2.230	0.667	29.35	38.996	2.562	112.75	14.622	15.289	17.184	1.895	83.40	7.562			
N_2 28.016	0.197	0.059	1.65	4.007	0.263	7.37	1.503	1.562	1.766						
CH_4 16.042	0.410	0.123	1.97	13.977	0.918	14.73	5.241	5.364	6.159	0.795	12.76	1.157			
C_2H_4 28.052				2.960	0.194	5.44	1.110	1.110	1.304	0.194	5.44	0.493			
C_2H_6 30.068				1.557	0.102	3.07	0.584	0.584	0.686	0.102	3.07	0.278			
C_1+C_2											21.27	1.928			
C_3H_6 42.078				3.300	0.217	9.13	1.237	1.237	1.454	0.217	9.13	0.828	4.32	2.113	0.192
C_3H_8 44.094				0.600	0.039	1.72	0.225	0.225	0.264	0.039	1.72	0.156	4.24	0.406	0.037
C_4H_8 56.104				2.443	0.161	9.03	0.916	0.916	1.077	0.161	9.03	0.819	5.00	1.806	0.164
C_4H_{10} 58.120				0.683	0.045	2.62	0.256	0.256	0.301	0.045	2.62	0.238	4.86	0.539	0.049
C_5H_{10} 70.130				1.017	0.067	4.70	0.381	0.381	0.448	0.067	4.70	0.426	5.45	0.862	0.078
C_5H_{12} 72.146				0.310	0.020	1.44	0.116	0.116	0.136	0.020	1.44	0.131	5.25	0.274	0.025
C_6H_{12} 84.156				0.330	0.022	1.85	0.124	0.124	0.146	0.022	1.85	0.168	5.54	0.334	0.030
C_3-C_6											30.49	2.766		6.334	0.575
TOTAL		29.910	383.37		6.570	185.52	37.497	67.407	51.180						
H_2+CO	97.163	29.061	11028.972 SCFH		1.960		11.182	40.243	13.142	-27.101					
H_2/CO		1.59	Factor 906702		5.60		5.60	2.11	5.60	1.48					

YIELD BASIS H_2+CO FED — YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	65.0	7.369	98.0	7.222
400-550	17.6	1.995	91.4	1.823
550 +	17.4	1.973	114.6	2.261
	RECOVERY %	#/hr	gal/hr	
PROPYLENE	62.5	5.71		
C_3 POLY GASO.	87.5	5.00	0.836	
C_3 POLY TAR	12.5	0.71	0.094	
	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	1.56	0.312	68.0
C_4 POLY GASO.	5.98	6.54	1.093	1.5
C_4H_{10}	4.86	2.62	0.539	68.0
C_4-FREE GASO.			9.528	5.8
C_4 POLY TAR	7.53	0.93	0.124	
	gal/hr	gal/MCF	Bbl/Day	
10 # RVP 400 EP GASOLINE	11.472	1.0402	5640	
GAS OIL	1.823	0.1653	896	
FUEL OIL	2.261	0.2050	1111	
POLY TAR	0.218	0.0198	107	
TOTAL	15.774	1.4303	7754	
W. S. CHEM.	0.936	0.0849	460	
TOTAL	16.710	1.5152	8214	

							NET CHANGE m/hr	NET CHANGE #/hr	#/MCF	#/gal	gal/hr	gal/MCF
Weight Recovery, %	89.34	Catalyst Age, hrs.	17	Space Velocity, vhv	858	RECOVERED OIL	0.528**	74.03	6.712		11.337	1.028
Pressure, psig	413	Inlet Velocity, Ft/sec	0.80	Catalyst Vol., CF	12.86	TOTAL OIL		104.52	9.478		17.671	1.603
Temperature, °F	665	Bed Depth, Ft	19.49	Weight, #	1338	WATER SOLUBLE CHEMICALS	0.148**	7.86	0.713		0.936	0.085
Recycle Ratio	1.25	Bed Density, #/CF	104	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$ =	14.9	TOTAL LIQUID PRODUCTS C_3+		112.38	10.191		18.607	1.688
FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY	NET WATER	6.437**	115.96	10.514	13.921	1.262
Contraction	CO	H_2	H_2+CO	CO	H_2	$CO+H_2$	C_3+/C_1+	GROSS WATER		123.82	11.227	14.857	1.347
78.03	97.35	90.68	93.26	84.58	59.19	67.34	84.09	HYDROCARBON TOTAL—C_1+		133.65	12.119		

Form ML—11

**Included in Reactor Effluent Total

g/NCM = 16.91 × #/MCF

*9488 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

GAS ANALYSES HOUR	1400	2200	0600	AVERAGE	M/HR	C	H	O
FRESH FEED								
CO 28.010	37.68	37.49	37.43	37.533	11.226	11.226		11.226
H_2 2.016	59.31	59.65	59.93	59.630	17.835		35.670	
CO_2 44.010	2.14	2.25	2.30	2.230	0.667	0.667		1.334
N_2 28.016	0.17	0.27	0.15	0.197	0.059			
CH_4 16.042	0.70	0.34	0.19	0.410	0.123	0.123	0.492	
			M. W	12.81752				
			H_2O 18.016				6.506	3.253
						12.016	42.668	15.813
			BALANCE			97.64	97.82	103.10

GENERATOR BALANCE	Mol %	M/Hr	C	H	O
O_2 32.000	0.22	7.536 0.022			15.116
CO_2 44.010	1.12	0.111	0.111		0.222
N_2 28.016	1.39	0.137			
CH_4 16.042	82.56	8.160	8.160	32.640	
C_2H_6 30.068	6.41	0.634	1.268	3.804	
C_3H_8 44.094	5.90	0.583	1.749	4.664	
C_4H_{10} 58.120	1.69	0.167	0.568	1.670	
C_5H_{12} 72.146	0.71	0.070	0.350	0.840	
MW =	20.220379				
TOTAL			12.306	43.618	15.338

WEIGHT BALANCE	#/hr Measured	At Wt. Balance
WET GAS	144.66	185.52
OIL	74.03	74.03
WATER	123.82	123.82
TOTAL	342.51	383.37
FRESH FEED	383.37	
WEIGHT BALANCE	89.34	
WET GAS FACTOR	1282455	
INDICATED LOSS—SCFH	549	

WET GAS	1800	0200	0600	
CO 28.010	4.55	4.54	4.47	4.520
H_2 2.016	23.07	25.33	27.50	25.300
CO_2 44.010	36.55	41.00	39.44	38.996
N_2 28.016	4.21	3.57	4.24	4.007
CH_4 16.042	18.13	12.49	11.31	13.977
C_2H_4 28.052	2.94	3.09	2.95	2.960
C_2H_6 30.068	1.62	1.53	1.52	1.557
C_3H_6 42.078	3.32	3.21	3.37	3.300
C_3H_8 44.094	0.45	0.78	0.57	0.600
C_4H_8 56.104	2.59	2.42	2.32	2.443
C_4H_{10} 58.120	0.91	0.42	0.72	0.683
C_5H_{10} 70.130	1.05	0.98	1.02	1.017
C_5H_{12} 72.146	0.37	0.36	0.20	0.310
C_6H_{12} 84.156	0.34	0.28	0.37	0.330
			M. W.	28.236837

GAS FLOW RATES		√H	PRESSURE	TEMP.	M. W.	S. C. F. H.	M/HR
FRESH FEED	50.54	7.317	412.3 20.676	72.9 0.9878	2258627 1.5029	11,351	29.910
WET GAS	79.31	6.100	1.29 3.999	68.0 0.9924	1025256 1.0125	1,944	5.123
RECYCLE	79.31	8.480	413.8 20.700	123.8 0.9438	1.0125	13,304	35.057
BLEED	5.02	8.800	20.700	1.0000	1.0125	926	2.440
NATURAL GAS	19.79	8.411	431.1 21.114	193.5 0.8920	1431723 1.1965	3,751	9.884
OXYGEN	18.82	7.306	430.8 21.107	75.6 0.9854		2,860	7.536
STEAM	215.7	3.911	32.4 4.7 37.1 0.3008		254#/hr.		

LIQUID PRODUCT RATES Basis 15 hours

HOUR	GAGE	GAL.	°F	FACTOR	GAL. AT 60	API° #/GAL.	#	# HR GAL HR
OIL	3'5 3/8"	185.09	57	1.0015	185.37	48.9	1210.47	
	0'3½"	15.49	82	0.9891	15.32	6.530	100.04	
					170.05		1110.43	74.03
								11.337
WATER	5'7½"	299.12	75	0.99832	298.62	9.9	2488.70	
	1'5½"	75.97	82	0.99726	75.76	8.334	631.38	
					222.86		1857.32	123.82
								14.857

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	431	Fresh Feed	11,351
Natural Gas	431	Recycle	14,230
Generator Outlet	419	Combined Feed	25,581
Reactor Inlet	413	Wet Gas—Measured	1,944
Condenser Inlet		Adjusted	2,493
Product Accumulator	378	Loss	549
TEMPERATURES—°F.		Recycle/Fresh Feed	1.25
Oxygen	545	Inlet Velocity—ft./sec.	0.80
Natural Gas	781	Fresh Feed Rate—S.C.F.H. H_2 + CO	11029
Generator	2292	per Cu. Ft. Dense Bed	858
Quench Accumulator	148	per Lb. Catalyst	8.24
Reactor Inlet	218	per Sq. Ft.	16711
Condenser Inlet	594		
Product Accumulator	87	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate = 254#/hr.	
1 0'0"	422	@703 psia & 507°F. =	
2 0'9"	394	1200 Btu/#	
3 1'9"	668	Water in @64°F. = 32 Btu/#	
4 4'5"	654	Net Btu/# steam = 1168 Btu	
5 7'0"	671	(1168)(254) = 296,672 Btu/hr.	
6 12'3"	669	Ave. Bed Temp. = 665°F	
7 17'5"	662	dT = 665-507 = 158°F	
8 20'0"	683	Tube Area = 35.2 sq. ft.	
9 22'7"	703	$K = \frac{296,672}{(35.2)(158)} =$	
10 25'2"	692	53.3 Btu/°F/sq. ft.	
11 26'11"	649		

PRODUCT TESTS	OIL	WATER
°API	48.9	9.9
Neut. No.	30.4	30.7
Sap. No.	39.9	32.8
Hydrox. No.		
Bromine No.	82	
Pour °F.	+20	
Chemicals, % by K_2CO_3		6.3
HEMPEL. DIST. %		°API
205 °F.		
400	64.0	56.7
400-550	17.6	36.6
550+	18.4	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	102	
10%	136	
50%	236	
90%	364	
EP	408	
Rec.	96.0	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	0
Total	
Catalyst Recovered	56
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 0-21 3/8	37
1 21 3/8-52 3/4	48
2 52 3/4-84	60
3 84-115 3/8	50
4 115 3/8-353 1/8	195
Total	390
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	104
Inventory, Lbs.	1338
Bed Depth, Ft.	19.49
Vol., Cu. Ft.	12.86

PARTICLE SIZE Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+	24.3	80+	•
100	150	33.3	40—80	
150	105	14.3	20—40	
200	74	11.3	10—20	
250	62	2.1	0—20	
325	44	9.8		
<325		4.9		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	137
Settled	138
Compacted	168
Particle Density, gm./cc.	4.22
NH_3 Value, ml./gm.	
N_2 Surface, m²/gm.	
CHEMICAL ANALYSIS	
Fe	
C	3.88
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	108
Fe	

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 61-B
HOURS 17-41
CATALYST Fresh CM&S

	FRESH FEED %	FRESH FEED m/hr	FRESH FEED #/hr	WET GAS %	WET GAS At Wt. Balance m/hr	WET GAS At Wt. Balance #/hr	RECYCLE m/hr	COMBINED FEED m/hr	EFFLUENT m/hr	NET CHANGE m/hr	NET CHANGE #/hr	CONDENSATE #/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010	37.610	11.291	316.27	3.603	0.219	6.13	1.340	12.631	1.559	-11.072	-310.14				
H_2 2.016	59.860	17.971	36.23	25.033	1.521	3.07	9.307	27.278	10.828	-16.450	-33.16				
CO_2 44.010	1.827	0.548	24.12	39.987	2.429	106.89	14.866	15.414	17.295	1.881	82.77	7.454			
N_2 28.016	0.173	0.052	1.46	2.963	0.180	5.04	1.102	1.154	1.282						
CH_4 16.042	0.530	0.159	2.55	13.800	0.838	13.44	5.131	5.290	5.969	0.679	10.89	0.981			
C_2H_4 28.052				3.117	0.189	5.30	1.159	1.159	1.348	0.189	5.30	0.477			
C_2H_6 30.068				1.710	0.104	3.13	0.636	0.636	0.740	0.104	3.13	0.282			
C_1+C_2											19.32	1.740			
C_3H_6 42.078				3.940	0.239	10.06	1.465	1.465	1.704	0.239	10.06	0.906	4.32	2.329	0.210
C_3H_8 44.094				0.637	0.039	1.72	0.237	0.237	0.276	0.039	1.72	0.155	4.24	0.406	0.037
C_4H_8 56.104				2.813	0.171	9.59	1.046	1.046	1.217	0.171	9.59	0.864	5.00	1.918	0.173
C_4H_{10} 58.120				0.740	0.045	2.62	0.275	0.275	0.320	0.045	2.62	0.236	4.86	0.539	0.049
C_5H_{10} 70.130				1.097	0.067	4.70	0.408	0.408	0.475	0.067	4.70	0.423	5.45	0.862	0.078
C_5H_{12} 72.146				0.220	0.013	0.94	0.082	0.082	0.095	0.013	0.94	0.085	5.25	0.179	0.016
C_6H_{12} 84.156				0.340	0.021	1.77	0.128	0.126	0.147	0.021	1.77	0.159	5.54	0.319	0.029
C_3-C_6											31.40	2.828		6.552	0.592
TOTAL		30.021	380.63		6.075	174.40	37.180	67.201	50.426						
H_2+CO	97.470	29.254	11104.757	SCFH	1.740		10.647	39.909	12.387	-27.522					
H_2/CO		1.59	Factor 900514		6.95		6.95	2.16	6.95	1.49					

					NET CHANGE m/hr	NET CHANGE #/hr	#/MCF	#/gal	gal/hr	gal/MCF
Weight Recovery, % 95.46	Catalyst Age, hrs. 41	Space Velocity, vhs 720		RECOVERED OIL	0.577**	80.97	7.291		12.498	1.125
Pressure, psig 412	Inlet Velocity, Ft/sec 0.79	Catalyst Vol., CF 15.42		TOTAL OIL		112.37	10.119		19.050	1.717
Temperature, °F 651	Bed Depth, Ft 23.37	Weight, # 1496		WATER SOLUBLE CHEMICALS	0.184**	9.78	0.881		1.206	0.109
Recycle Ratio 1.24	Bed Density, #/CF 97	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$ = 18.74		TOTAL LIQUID PRODUCTS C_3+		122.15	11.000		20.256	1.826
FRESH FEED CONVERSION — %		TOTAL FEED CONVERSION — %	SELECTIVITY	NET WATER	6.410**	115.48	10.399		13.863	1.248
Contraction / CO / H_2 / H_2+CO		CO / H_2 / $CO+H_2$	C_3+/C_1+	GROSS WATER		125.26	11.280		15.069	1.357
79.76 / 98.06 / 91.54 / 94.08		87.66 / 60.31 / 68.96	86.34	HYDROCARBON TOTAL—C_1+		141.47	12.740			

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	67.5	8.436	98.0	8.267
400-550	17.2	2.150	91.4	1.965
550 +	15.3	1.912	114.6	2.191
	RECOVERY %	#/hr	gal/hr	
PROPYLENE	66.5	6.69		
C_3 POLY GASO.	87.5	5.85	0.970	
C_3 POLY TAR	12.5	0.84	0.112	
	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	1.96	0.392	68.0
C_4 POLY GASO.	5.98	6.68	1.116	i.5
C_4H_{10}	4.86	2.62	0.539	68.0
C_4-FREE GASO.			10.605	5.8
C_4 POLY TAR	7.53	0.95	0.126	
	gal/hr	gal/MCF	Bbl/Day	
10 # RVP 400 EP GASOLINE	12.652	1.1393	6177	
GAS OIL	1.965	0.1770	960	
FUEL OIL	2.191	0.1973	1070	
POLY TAR	0.238	0.0214	116	
TOTAL	17.046	1.5350	8323	
W. S. CHEM.	1.206	0.1086	589	
TOTAL	18.252	1.6436	8912	

Form ML—11

**Included in Reactor Effluent Total

g/NCM = 16.91 × #/MCF

*9488 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

GAS ANALYSES HOUR	1400	2200	0600	AVERAGE	GENERATOR BALANCE M/HR	C	H	O		Mol %	M/Hr	C	H	O
FRESH FEED									O_2 32.000	0.25	7.628 / 0.025			15.306
CO 28.010	37.40	37.60	37.83	37.610	11.291	11.291		11.291	CO_2 44.010	1.10	0.109	0.109		0.218
H_2 2.016	59.81	59.82	59.95	59.860	17.971		35.942		N_2 28.016	1.35	0.134			
CO_2 44.010	1.88	1.95	1.65	1.827	0.548	0.548		1.096	CH_4 16.042	82.49	8.177	8.177	32.708	
N_2 28.016	0.14	0.23	0.15	0.173	0.052				C_2H_6 30.068	6.46	0.640	1.280	3.840	
CH_4 16.042	0.77	0.40	0.42	0.530	0.159	0.159	0.636		C_3H_8 44.094	5.99	0.594	1.782	4.752	
			M. W	12.67889					C_4H_{10} 58.120	1.62	0.161	0.644	1.610	
			H_2O 18.016				6.691	3.346	C_5H_{12} 72.146	0.74	0.073	0.365	0.876	
						11.995	43.269	15.733	MW = 20.23442					
			BALANCE			97.07	99.05	101.35	TOTAL			12.357	43.686	15.524

WEIGHT BALANCE	#/hr Measured	At Wt. Balance
WET GAS	157.11	174.40
OIL	80.97	80.97
WATER	125.26	125.26
TOTAL	363.34	380.63
FRESH FEED	380.63	
WEIGHT BALANCE	95.46	
WET GAS FACTOR	1110050	
INDICATED LOSS—S C F H	229	
	2306	

WET GAS	1400	1800	0600	
CO 28.010	3.06	4.00	3.75	3.603
H_2 2.016	25.34	25.26	24.50	25.033
CO_2 44.010	40.13	38.96	40.37	39.987
N_2 28.016	2.93	2.82	3.14	2.963
CH_4 16.042	14.09	14.40	12.91	13.800
C_2H_4 28.052	3.04	3.17	3.14	3.117
C_2H_6 30.068	1.63	1.64	1.86	1.710
C_3H_6 42.078	4.09	3.59	4.14	3.940
C_3H_8 44.094	0.62	0.57	0.72	0.637
C_4H_8 56.104	2.87	2.85	2.72	2.813
C_4H_{10} 58.120	0.68	0.79	0.75	0.740
C_5H_{10} 70.130	1.03	1.26	1.00	1.097
C_5H_{12} 72.146	0.22	0.22	0.22	0.220
C_6H_{12} 84.156	0.27	0.47	0.28	0.340
			M. W.	28.70582

GAS FLOW RATES		$\sqrt{H}$	PRESSURE	TEMP.	M. W.	S. C. F. H.	M/HR
FRESH FEED	50.54	7.329	411.5 / 20.645	75.0 / 0.9859	2283322 / 1.5111	11,393	30.021
WET GAS	79.31	6.554	1.40 / 4.012	68.8 / 0.9917	1008506 / 1.0042	2,077	5.473
RECYCLE	79.31	8.500	413.1 / 20.683	126.1 / 0.9420	1.0042	13,190	34.756
BLEED	5.02	8.821	20.683	1.0000	1.0042	920	2.424
NATURAL GAS	19.79	8.458	430.4 / 21.097	195.5 / 0.8907	1430730 / 1.1961	3,762	9.913
OXYGEN	18.82	7.313	431.0 / 21.112	76.9 / 0.9841		2,859	7.628
STEAM	215.7	3.500	33.5 / 4.7 / 0.3050		230#/hr.		

LIQUID PRODUCT RATES HOUR	GAGE	GAL.	°F	FACTOR	GAL. AT 60	API° #/GAL.	#	# HR GAL HR
OIL	7'2¼"	380.96	70	0.9951	379.09	49.8 / 6.498	2463.33	
	3'5⅜"	185.09	57	1.0015	185.37	48.9 / 6.530	1210.47	
	2'1¼"	111.05	58	1.0010	111.16	49.8	722.32	
	0'3"	13.28	78	0.9911	13.16	6.498	85.51	
					+8.23		+53.50	80.97
					299.95		1943.17	12.498
WATER	7'5½"	395.14	76	0.99819	394.42	10.1 / 8.322	3282.36	
	5'7½"	299.12	75	0.99832	298.62	9.9 / 8.334	2488.70	
	5'9⅞"	309.48	71	0.99883	309.12	10.1	2572.50	
	0'10"	43.36	79	0.99775	43.26	8.322	360.01	125.26
					361.66		3006.15	15.069

OPERATING CONDITIONS PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	431	Fresh Feed	11,393
Natural Gas	430	Recycle	14,110
Generator Outlet	419	Combined Feed	25,503
Reactor Inlet	412	Wet Gas—Measured	2,077
Condenser Inlet		Adjusted	2,306
Product Accumulator	380	Loss	229
TEMPERATURES—°F.		Recycle/Fresh Feed	1.24
Oxygen	506	Inlet Velocity—ft./sec.	0.79
Natural Gas	786	Fresh Feed Rate—S.C.F.H. H_2 + CO	11105
Generator	2284	per Cu.Ft. Dense Bed	720
Quench Accumulator	126	per Lb. Catalyst	7.42
Reactor Inlet	186	per Sq. Ft.	16826
Condenser Inlet	571		
Product Accumulator	84	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate = 230#/hr.	
1 See Period A	-	@706 psia & 505°F. =	
2	-	1201 Btu/#	
3	640	Water in @68°F = 36°Btu/#	
4	658	Net Btu/# steam = 1165 Btu	
5	662	(1165)(230) = 267,950 Btu/hr.	
6	666	Ave. Bed Temp. = 651°F.	
7	654	dT = 651-505 = 146°F.	
8	644	Tube Area = 38.6 sq. ft.	
9	636	$K = \frac{267,950}{(38.6)(146)}$ =	
10	630	47.5 Btu/°F/sq. ft.	
11	612		

PRODUCT TESTS	OIL	WATER
°API	49.8	10.1
Neut. No.	32.8	33.0
Sap. No.	41.1	34.6
Hydrox. No.		
Bromine No.	86	
Pour °F.	+15	
Chemicals, % by K_2CO_3		8.0
HEMPEL. DIST. %		°API
205 °F.		
400	66.5	56.1
400-550	17.2	35.9
550+	16.3	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	100	
10%	136	
50%	236	
90%	378	
EP	410	
Rec.	96.0	

CATALYST DATA INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	0
Total	
Catalyst Recovered	10.5
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	34
1	46
2	55
3	46
4	255
Total	436
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	97
Inventory, Lbs.	1496
Bed Depth, Ft.	23.37
Vol., Cu. Ft.	15.42

PARTICLE SIZE Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+	26.0	80+	
100	150	28.0	40—80	
150	105	12.8	20—40	
200	74	10.2	10—20	
250	62	5.4	0—20	
325	44	8.2		
<325		9.4		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	124
Settled	125
Compacted	155
Particle Density, gm./cc.	4.0
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	
C	8.81
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	100