RUN NO. 59-T
HOURS 421-445
CATALYST Spent 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	38.173	14.530	406.98	11.550	1.672	46.83	5.049	19.579	6.721	-12.858	-360.15				
H_2 2.016	58.327	22.201	44.76	39.490	5.717	11.53	17.265	39.466	22.982	-16.484	-33.23				
CO_2 44.010	2.903	1.105	48.63	30.730	4.448	195.78	13.435	14.540	17.883	3.343	147.15	10.556			
N_2	0.297	0.113	3.17	1.650	0.239	6.70	0.721	0.834	0.960						
CH_4 16.042	0.300	0.114	1.83	7.617	1.103	17.69	3.330	3.444	4.433	0.989	15.86	1.138			
C_2H_4 28.052				2.207	0.319	8.95	0.965	0.965	1.284	0.319	8.95	0.642			
C_2H_6 30.068				1.183	0.171	5.14	0.517	0.517	0.688	0.171	5.14	0.369			
C_1+C_2											29.95	2.149			
C_3H_6 42.078				2.183	0.316	13.30	0.954	0.954	1.270	0.316	13.30	0.954	4.32	3.079	0.221
C_3H_8 44.094				0.283	0.041	1.81	0.124	0.124	0.165	0.041	1.81	0.130	4.24	0.427	0.031
C_4H_8 56.104				1.417	0.205	11.50	0.619	0.619	0.824	0.205	11.50	0.825	5.00	2.300	0.165
C_4H_{10} 58.120				0.537	0.078	4.53	0.235	0.235	0.313	0.078	4.53	0.325	4.86	0.932	0.067
C_5H_{10} 70.130				0.750	0.109	7.64	0.328	0.328	0.437	0.109	7.64	0.548	5.45	1.402	0.101
C_5H_{12} 72.146				0.133	0.019	1.37	0.058	0.058	0.077	0.019	1.37	0.098	5.25	0.261	0.019
C_6H_{12} 84.156				0.270	0.039	3.28	0.118	0.118	0.157	0.039	3.28	0.235	5.54	0.592	0.042
C_3-C_6											43.43	3.115		8.993	0.646
TOTAL		38.063	505.37		14.476	336.05	43.718	81.781	64.646						
H_2+CO	95.500	36.731	13939425 SCFH		7.389		22.314	59.045	29.703	-29.342					
H_2/CO		1.53	Factor 717389		3.42		3.42	2.02	3.42	1.28					

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	71.5	5.511	98.0	5.401
400-550	16.0	1.233	91.4	1.127
550 +	12.5	0.964	114.6	1.105

	RECOVERY %	#/hr	gal/hr	
PROPYLENE	37.0	4.92		
C_3 POLY GASO.	87.5	4.30	0.719	
C_3 POLY TAR	12.5	0.62	0.082	

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	--	--	68.0
C_4 POLY GASO.	5.98	10.06	1.683	1.5
C_4H_{10}	4.86	(4.53) 4.15	(0.932) 0.853	68.0
C_4-FREE GASO.			8.375	5.8
C_4 POLY TAR	7.53	1.44	0.191	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	10.911	0.7827	4243
GAS OIL	1.127	0.0808	438
FUEL OIL	1.105	0.0793	430
POLY TAR	0.273	0.0196	106
TOTAL	13.416	0.9624	5217
W. S. CHEM.	1.832	0.1314	712
TOTAL	15.248	1.0938	5929

Weight Recovery, %	95.51	Catalyst Age, hrs.		Space Velocity, vhv	1537	RECOVERED OIL	0.355**	49.86	3.577
Pressure, psig	419	Inlet Velocity, Ft/sec	0.95	Catalyst, Vol. CF	9.07	TOTAL OIL		93.29	6.692
Temperature, °F	657	Bed Depth, Ft	13.74	Weight, #	1270	WATER SOLUBLE CHEMICALS	0.275**	14.57	1.045
Recycle Ratio	1.15	Bed Density, #/CF	140	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$	= 10.50	TOTAL LIQUID PRODUCTS C_3+		107.86	7.737
						NET WATER	5.822**	104.89	7.525
						GROSS WATER		119.46	8.570
						HYDROCARBON TOTAL—C_1+		137.81	9.886

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
61.97	88.49	74.25	79.88	65.67	41.77	49.69	78.27

Form ML—11

**Inc luded in Reactor Effluent Total

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

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

RUN NO. 59-T
HOURS 421-445

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	441	Fresh Feed	14445
Natural Gas	439	Recycle	16591
Generator Outlet	425	Combined Feed	31036
Reactor Inlet	419	Wet Gas—Measured	5123
Condenser Inlet		Adjusted	5494
Product Accumulator	375	Loss	371
TEMPERATURES—°F.		Recycle/Fresh Feed	1.15
Oxygen	313	Inlet Velocity—ft./sec.	0.95
Natural Gas	313	Fresh Feed Rate—S.C.F.H.	13939
Generator		H_2+CO per Cu. Ft. Dense Bed	1537
Quench Accumulator	136	per Lb. Catalyst	10.98
Reactor Inlet	270	per Sq. Ft.	21120
Condenser Inlet	558		
Product Accumulator	96.5	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate=280#/hr	
1 See Per. A	618	@ 705 psia & 506°F	
2	652	1201 BTU/#	
3	659	Water in @ 67°F=35°F	
4	644	Net BTU/# steam=1166	
5	665	1166x280=326480	
6	665	Ave. Bed Temp=657°F	
7	639	dT=657-506=151°F	
8	634	Tube Area=24.8 sq ft	
9	638	$K=\frac{326480}{(24.8)(151)}=87.2$ BTU/°F/sq ft	
10	636		
11	608		

PRODUCT TESTS	OIL	WATER
°API	50.4	10.8
Neut. No.	34.6	32.3
Sap. No.	54.3	41.6
Hydrox. No.		
Bromine No.	93	
Pour °F.		
Chemicals, % by K_2CO_3		12.7
HEMPEL, DIST. %		°API
205 °F.		
400	70.5	52.8
400-550	16.0	36.8
550+	13.5	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	120	
10%	144	
50%	234	
90%	350	
EP	380	
Rec.	96.5	

CATALYST DATA	
INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	
Total	
Catalyst Recovered	48
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	48
1	70
2	70
3	72
4	110
Total	370
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	140
Inventory, Lbs.	1270
Bed Depth, Ft.	13.74
Vol., Cu. Ft.	9.07

PARTICLE SIZE				
Screen Analysis			Sedimentation	
Mesh	Microns	%	Microns	%
On 40	419+	36.3	80+	
100	150	42.7	40—80	
150	105	9.2	20—40	
200	74	7.0	10—20	
250	62	1.8	0—20	
325	44	1.2		
<325		1.8		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	146
Settled	148
Compacted	1.74
Particle Density, gm./cc.	4.30
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	
C	9.71
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

RUN NO. 59-U
HOURS 445-469
CATALYST

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	YIELD BASIS H_2+CO FED CONDENSATE #/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	38.220	14.623	409.59	7.430	0.906	25.38	3.083	17.706	3.989	-13.717	-384.21				
H_2 2.016	58.197	22.267	44.89	33.936	4.137	8.34	14.082	36.349	18.219	-18.130	-36.55				
CO_2 44.010	2.883	1.103	48.54	34.890	4.253	187.17	14.478	15.581	18.731	- 3.150	138.63	9.902			
N_2 28.016	0.467	0.179	5.01	2.987	0.364	10.20	1.240	1.419	1.604						
CH_4 16.042	0.233	0.089	1.43	9.167	1.117	17.92	3.804	3.893	4.921	1.028	16.49	1.178			
C_2H_4 28.052				2.227	0.271	7.60	0.924	0.924	1.195	0.271	7.60	0.543			
C_2H_6 30.068				1.493	0.182	5.47	0.620	0.620	0.802	0.182	5.47	0.391			
C_1+C_2											29.56	2.112			
C_3H_6 42.078				2.760	0.363	14.14	1.145	1.145	1.481	0.336	14.14	1.010	4.32	3.273	0.234
C_3H_8 44.094				0.270	0.033	1.46	0.112	0.112	0.145	0.033	1.46	0.104	4.24	0.344	0.025
C_4H_8 56.104				2.730	0.333	18.68	1.133	1.133	1.466	0.333	18.68	1.334	5.00	3.736	0.267
C_4H_{10} 58.120				0.677	0.083	4.82	0.281	0.281	0.364	0.083	4.82	0.344	4.86	0.992	0.071
C_5H_{10} 70.130				0.937	0.114	7.99	0.389	0.389	0.503	0.114	7.99	0.571	5.45	1.466	0.105
C_5H_{12} 72.146				0.163	0.020	1.44	0.068	0.068	0.088	0.020	1.44	0.103	5.25	0.274	0.020
C_6H_{12} 84.156				0.333	0.041	3.45	0.138	0.138	0.179	0.041	3.45	0.246	5.54	0.623	0.045
C_3-C_6											51.98	3.712		10.708	0.767
TOTAL		38.261	509.47		12.190	314.04	41.497	79.758	61.022						
H_2+CO	96.417	38.890	139997484 SCFH		5.043		17.165	54.055	22.208	-31.847					
H_2/CO		1.52	Factor 714298		4.57		4.57	2.05	4.57	1.32					

Weight Recovery, %		Catalyst Age, hrs.		Space Velocity, vhv	1039	RECOVERED OIL
Pressure, psig	422	Inlet Velocity, Ft/sec	0.91	Catalyst, Vol. CF	13.47	TOTAL OIL
Temperature, °F	646	Bed Depth, Ft	20.41	Weight, #	1980	WATER SOLUBLE CHEMICALS
Recycle Ratio	1.08	Bed Density, #/CF	147	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$ =	13.47	TOTAL LIQUID PRODUCTS C_3+
						NET WATER
						GROSS WATER
						HYDROCARBON TOTAL—C_1+

FRESH FEED CONVERSION — % Contraction	CO	H_2	H_2+CO	TOTAL FEED CONVERSION — % CO	H_2	CO+H_2	SELECTIVITY C_3+/C_1+		RECOVERED OIL	TOTAL OIL	WATER SOLUBLE CHEMICALS	TOTAL LIQUID PRODUCTS C_3+	NET WATER	GROSS WATER	HYDROCARBON TOTAL—C_1+
68.14	93.80	81.42	86.33	77.47	49.88	58.92	81.25		0.440**	61.68	4.406	9.708	0.693	0.272**	14.43
										113.66	8.118	20.416	1.460		1.031
										128.09	9.149	22.241	1.590	6.623**	119.32
										133.75	9.554	16.149	1.154		157.65
										157.65	11.261				

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	75.9	7.368	98.0	7.221
400-550	14.8	1.437	91.4	1.313
550 +	9.3	0.903	114.6	1.035

	RECOVERY %	#/hr	gal/hr
PROPYLENE	44.6	6.31	
C_3 POLY GASO.	87.5	5.52	0.923
C_3 POLY TAR	12.5	0.79	0.105

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.77	0.154	68.0
C_4 POLY GASO.	5.98	15.67	2.621	1.5
C_4H_{10}	4.86	4.82	0.992	68.0
C_4-FREE GASO.			10.507	5.8
C_4 POLY TAR	7.53	2.24	0.297	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	14.274	1.0196	5528
GAS OIL	1.313	0.0938	509
FUEL OIL	1.035	0.0739	401
POLY TAR	0.402	0.0287	156
TOTAL	17.024	1.2160	6594
W. S. CHEM.	1.825	0.1304	707
TOTAL	18.849	1.3464	7301

Form ML—11

**Included in Reactor Effluent Total

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

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

RUN NO. 59-U
HOURS 445-469

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	445	Fresh Feed	14520
Natural Gas	444	Recycle	15748
Generator Outlet	428	Combined Feed	30268
Reactor Inlet	422	Wet Gas—Measured	4224
Condenser Inlet		Adjusted	4626
Product Accumulator	375	Loss	402
TEMPERATURES—°F.		Recycle/Fresh Feed	1.08
Oxygen	313	Inlet Velocity—ft./sec.	0.91
Natural Gas	313	Fresh Feed Rate—S.C.F.H. H_2+CO	14000
Generator		per Cu. Ft. Dense Bed	1039
Quench Accumulator	144	per Lb. Catalyst	7.07
Reactor Inlet	292	per Sq. Ft.	21212
Condenser Inlet	549		
Product Accumulator	99	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate=341#/hr	
1 See Per. A	616	@ 705 psia & 506°F=	
2	641	1201 BTU/#	
3	648	Water in @ 68.5=37 BTU/#	
4	634	Net BTU/# steam=1164	
5	654	1164x341=396924	
6	654	Ave. Bed Temp=646	
7	645	dT=646-506=140°F	
8	638	Tube Area=36.7 sq ft	
9	629	$K=\frac{396924}{(36.7)(140)}$ = 77.3 BTU/°F/sq ft	
10	624		
11	599		

PRODUCT TESTS	OIL	WATER
°API	52.0	10.8
Neut. No.	31.0	27.7
Sap. No.	49.6	37.6
Hydrox. No.		
Bromine No.	93	
Pour °F.		
Chemicals, % by K_2CO_3		11.3
HEMPEL, DIST. %		°API
205 °F.		
400	74.9	55.5
400-550	14.8	38.3
550+	10.3	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	108	
10%	136	
50%	224	
90%	350	
EP	392	
Rec.	96.0	

CATALYST DATA						
INVENTORY DATA		PARTICLE SIZE				
In Reactor at Start of Period		Screen Analysis			Sedimentation	
Fresh Catalyst Added	468	Mesh	Microns	%	Microns	%
Total		On 40	419+	34.0	80+	
Catalyst Recovered	137.7	100	150	40.0	40—80	
In Reactor at End of Period		150	105	10.6	20—40	
		200	74	8.4	10—20	
REACTOR d-p, Inches H_2O		250	62	0.6	0—20	
No. Height		325	44	4.8		
0 See Period A	50	<325		1.6		
1	73	CATALYST				
2	75	Bulk Density, Lbs./Cu.Ft.				
3	74	Aerated			150	
4	305	Settled			151	
Total	577	Compacted			173	
		Particle Density, gm./cc.			4.45	
CALCULATED FROM dp		NH_3 Value, ml./gm.				
Density, Lbs./Cu.Ft.	147	N_2 Surface, m^2/gm.				
Inventory, Lbs.	1980					
Bed Depth, Ft.	20.41	CHEMICAL ANALYSIS				
Vol., Cu. Ft.	13.47	Fe				
		C			8.66	
		O				
		H				
		K_2O, W+, % basis Fe				
		X-Ray Analysis—				
		$Fe_{20}C_9$				
		Fe_3O_4				
		Fe				

RUN NO. 59-V
HOURS 469-493
CATALYST Spent 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	38.960	14.876	416.69	10.483	1.293	36.22	4.376	19.252	5.669	-13.583	-380.47				
H_2 2.016	57.675	22.023	44.40	33.957	4.187	8.44	14.174	36.197	18.361	-17.836	-35.96				
CO_2 44.010	2.690	1.027	45.20	33.263	4.103	180.51	13.885	14.912	17.988	3.076	135.31	9.663			
N_2 28.016	0.115	0.044	1.23	1.677	0.207	5.80	0.700	0.744	0.907						
CH_4 16.042	0.560	0.214	3.43	9.310	1.148	18.42	3.886	4.100	5.034	0.934	14.99	1.070			
C_2H_4 28.052				2.653	0.327	9.17	1.107	1.107	1.434	0.327	9.17	0.655			
C_2H_6 30.068				1.480	0.183	5.50	0.618	0.618	0.801	0.183	5.50	0.393			
C_1+C_2											29.66	2.118			
C_3H_6 42.078				2.900	0.358	15.06	1.211	1.211	1.569	0.358	15.06	1.075	4.32	3.486	0.249
C_3H_8 44.094				0.317	0.039	1.72	0.132	0.132	0.171	0.039	1.72	0.123	4.24	0.406	0.029
C_4H_8 56.104				1.783	0.220	12.34	0.744	0.744	0.964	0.220	12.34	0.881	5.00	2.468	0.176
C_4H_{10} 58.120				0.850	0.105	6.10	0.355	0.355	0.460	0.105	6.10	0.436	4.86	1.255	0.090
C_5H_{10} 70.130				CO 2900	0.111	7.78	0.376	0.376	0.487	0.111	7.78	0.556	5.45	1.428	0.102
C_5H_{12} 72.146				0.130	0.016	1.15	0.054	0.054	0.070	0.016	1.15	0.082	5.25	0.219	0.016
C_6H_{12} 84.156				0.297	0.037	3.11	0.124	0.124	0.161	0.037	3.11	0.222	5.54	0.561	0.040
C_3-C_6											47.26	3.375		9.823	0.702
TOTAL		38.184	510.95		12.334	311.32	41.742	79.926	61.590						
H_2+CO	96.635	36.899	14003378 SCFH		5.480		18.550	55.449	24.030	-31.419					
H_2/CO		1.48	Factor 714113		3.24		3.24	1.88	3.24	1.31					

YIELD BASIS H_2+CO FED

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL. %	gal/hr	TREATING RECOVERY.%	gal/hr
400 EP	76.2	7.382	98.0	7.234
400-550	14.2	1.376	91.4	1.258
550 +	9.6	0.930	114.6	1.066

	RECOVERY %	#/hr	gal/hr	
PROPYLENE	44.0	6.62		
C_3 POLY GASO.	87.5	5.79	0.968	
C_3 POLY TAR	12.5	0.83	0.110	

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	--	--	68.0
C_4 POLY GASO.	5.98	10.80	1.806	1.5
C_4H_{10}	4.86	(6.10) 4.95	(1.255) 1.019	68.0
C_4-FREE GASO.			10.410	5.8
C_4 POLY TAR	7.53	1.54	0.205	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	13.236	0.9452	5124
GAS OIL	1.258	0.0898	487
FUEL OIL	1.066	0.0761	413
POLY TAR	0.315	0.0225	122
TOTAL	15.875	1.1336	6146
W. S. CHEM.	1.999	0.1428	774
TOTAL	17.874	1.2764	6920

Weight Recovery, %		Catalyst Age, hrs.		Space Velocity, vhv 1054	RECOVERED OIL	0.441**	61.85
Pressure, psig	422	Inlet Velocity, Ft/sec	0.96	Catalyst, Vol. CF 13.29	TOTAL OIL		109.11
Temperature, °F	652	Bed Depth, Ft	20.13	Weight, # 1980	WATER SOLUBLE CHEMICALS	0.295**	15.67
Recycle Ratio	1.09	Bed Density, #/C.F	149	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$ = 13.29	TOTAL LIQUID PRODUCTS C_3+		124.78
					NET WATER	6.778**	122.11
					GROSS WATER		137.78
					HYDROCARBON TOTAL—C_1+		154.44

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
67.70	91.31	80.99	85.17	70.55	49.27	56.66	80.80

YIELD BASIS H_2+CO FED	#/hr	#/gal	gal/hr	gal/MCF
9.663				
1.070				
0.655				
0.393				
2.118				
1.075	4.32	3.486	0.249	
0.123	4.24	0.406	0.029	
0.881	5.00	2.468	0.176	
0.436	4.86	1.255	0.090	
0.556	5.45	1.428	0.102	
0.082	5.25	0.219	0.016	
0.222	5.54	0.561	0.040	
3.375		9.823	0.702	
4.417		9.688	0.692	
7.792		19.511	1.394	
1.119		1.999	0.143	
8.911		21.510	1.537	
8.720		14.659	1.407	
9.839		16.658	1.190	
11.029				

Form ML—11

**Included in Reactor Effluent Total

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

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

RUN NO. 59-V
HOURS 469-493

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	445	Fresh Feed	14491
Natural Gas	443	Recycle	15841
Generator Outlet	427	Combined Feed	30332
Reactor Inlet	422	Wet Gas—Measured	4298
Condenser Inlet		Adjusted	4681
Product Accumulator	373	Loss	383
TEMPERATURES—°F.		Recycle/Fresh Feed	1.09
Oxygen	322	Inlet Velocity—ft./sec.	0.96
Natural Gas	308	Fresh Feed Rate—S.C.F.H. H_2+CO	14003
Generator		per Cu. Ft. Dense Bed	1054
Quench Accumulator	145	per Lb. Catalyst	7.07
Reactor Inlet	319	per Sq. Ft.	21217
Condenser Inlet	542		
Product Accumulator	94	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate=368#/hr	
1 See Per. A	624	@ 705 psia & 506°F=	
2	648	1201 BTU/#	
3	656	Water in @ 70°F=38°F	
4	644	Net BTU/# steam=1163	
5	659	1163x368=427984	
6	656	Ave. Bed Temp=652°F	
7	647	dT=652-506=146°F	
8	639	Tube Area=36.3 sq ft	
9	629	K=427984/(146)(36.3)=80.8 BTU/°F/sq ft	
10	624		
11	600		

PRODUCT TESTS	OIL	WATER
°API	52.6	10.9
Neut. No.	30.6	28.4
Sap. No.	50.6	37.5
Hydrox. No.		
Bromine No.	93	
Pour °F.		
Chemicals, % by K_2CO_3		12.0
HEMPEL, DIST. %		°API
205 °F.		
400	75.2	55.6
400-550	14.2	37.3
550+	10.6	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	106	
10%	138	
50%	224	
90%	348	
EP	392	
Rec.	97.0	

CATALYST DATA	
INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	35
Total	
Catalyst Recovered	70.3
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	51
1	75
2	76
3	75
4	300
Total	577
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	149
Inventory, Lbs.	1980
Bed Depth, Ft.	20.13
Vol., Cu. Ft.	13.29

PARTICLE SIZE				
Screen Analysis			Sedimentation	
Mesh	Microns	%	Microns	%
On 40	419+	36.9	80+	
100	150	41.2	40—80	
150	105	9.0	20—40	
200	74	7.5	10—20	
250	62	0.8	0—20	
325	44	3.0		
<325		1.6		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	151
Settled	154
Compacted	177
Particle Density, gm./cc.	4.54
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	69.0
C	7.18
O	.38
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

RUN NO. 59-W
HOURS 493-517
CATALYST Spent 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	YIELD BASIS H_2+CO FED CONDENSATE #/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	37.133	14.369	402.48	9.130	1.113	31.18	3.823	18.192	4.936	-13.256	-371.30				
H_2 2.016	59.624	23.072	46.51	34.917	4.254	8.58	14.621	37.693	18.875	-18.818	-37.93				
CO_2 44.010	2.693	1.042	45.86	33.700	4.107	180.70	14.112	15.154	18.219	3.065	134.84	9.490			
N_2 28.016	0.140	0.054	1.51	1.903	0.232	6.50	0.797	0.851	1.029						
CH_4 16.042	0.410	0.159	2.55	8.900	1.085	17.41	3.727	3.886	4.812	0.926	14.86	1.046			
C_2H_4 28.052				2.753	0.335	9.40	1.153	1.153	1.488	0.335	9.40	0.662			
C_2H_6 30.068				1.457	0.178	5.35	0.610	0.610	0.788	0.178	5.35	0.377			
C_1+C_2											29.61	2.085			
C_3H_6 42.078				2.917	0.355	14.94	1.222	1.222	1.577	0.355	14.94	1.051	4.32	3.458	0.234
C_3H_8 44.094				0.300	0.037	1.63	0.126	0.126	0.163	0.037	1.63	0.115	4.24	0.384	0.027
C_4H_8 56.104				1.883	0.229	12.85	0.789	0.789	1.018	0.229	12.85	0.904	5.00	2.570	0.181
C_4H_{10} 58.120				0.680	0.083	4.82	0.285	0.285	0.368	0.083	4.82	0.339	4.86	0.992	0.070
C_5H_{10} 70.130				0.980	0.119	8.35	0.410	0.410	0.529	0.119	8.35	0.588	5.45	1.532	0.108
C_5H_{12} 72.146				0.153	0.019	1.37	0.064	0.064	0.083	0.019	1.37	0.096	5.25	0.261	0.018
C_6H_{12} 84.156				0.327	0.040	3.37	0.137	0.137	0.177	0.040	3.37	0.237	5.54	0.608	0.043
C_3-C_6											47.33	3.330		9.805	0.690
TOTAL		38.696	498.91		12.186	306.45	41.876	80.572	61.140						
H_2+CO	96.757	37.441	14208765 SCFH		5.367		18.444	55.885	23.811	-32.074					
H_2/CO		1.61	Factor 703790		3.82		3.82	2.07	3.82	1.42					

Weight Recovery, %		Catalyst Age, hrs.		Space Velocity, vhv	1071	RECOVERED OIL	0.452**
Pressure, psig	421	Inlet Velocity, Ft/sec	0.93	Catalyst, Vol. CF	13.27	TOTAL OIL	
Temperature, °F	654	Bed Depth, Ft	20.11	Weight, #	1991	WATER SOLUBLE CHEMICALS	0.278**
Recycle Ratio	1.08	Bed Density, #/CF	150	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$ =	10.97	TOTAL LIQUID PRODUCTS C_3+	
						NET WATER	6.348**
						GROSS WATER	
						HYDROCARBON TOTAL—C_1+	

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
68.51	92.25	81.56	85.67	72.87	49.92	57.39	80.90

	NET CHANGE m/hr	NET CHANGE #/hr
RECOVERED OIL	0.452**	63.34
TOTAL OIL		110.67
WATER SOLUBLE CHEMICALS	0.278**	14.75
TOTAL LIQUID PRODUCTS C_3+		125.42
NET WATER	6.348**	114.37
GROSS WATER		129.12
HYDROCARBON TOTAL—C_1+		155.03

YIELD BASIS H_2+CO FED #/gal	gal/hr	gal/MCF
4.458	9.887	0.696
7.788	19.692	1.386
1.038	1.872	0.132
8.826	21.564	1.518
8.049	13.730	0.966
9.087	15.602	1.098
10.911		

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	76.2	7.534	98.0	7.383
400-550	12.4	1.226	91.4	1.121
550 +	11.4	1.127	114.6	1.292

	RECOVERY %	#/hr	gal/hr	
PROPYLENE	45.2	6.75		
C_3 POLY GASO.	87.5	5.91	0.988	
C_3 POLY TAR	12.5	0.84	0.112	

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.29	0.058	68.0
C_4 POLY GASO.	5.98	10.99	1.838	1.5
C_4H_{10}	4.86	4.82	0.992	68.0
C_4-FREE GASO.			10.772	5.8
C_4 POLY TAR	7.53	1.57	0.208	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	13.660	0.9614	5212
GAS OIL	1.121	0.0789	428
FUEL OIL	1.292	0.0909	493
POLY TAR	0.320	0.0225	122
TOTAL	16.393	1.1537	6255
W. S. CHEM.	1.872	0.1317	714
TOTAL	18.265	1.2854	6969

Form ML—11

**Included in Reactor Effluent Total

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

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

RUN NO. 59-W
HOURS 493-517

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	445	Fresh Feed	14685
Natural Gas	442	Recycle	15892
Generator Outlet	427	Combined Feed	30577
Reactor Inlet	421	Wet Gas—Measured	4212
Condenser Inlet		Adjusted	4624
Product Accumulator	372	Loss	412
TEMPERATURES—°F.		Recycle/Fresh Feed	1.08
Oxygen	323	Inlet Velocity—ft./sec.	0.93
Natural Gas	304	Fresh Feed Rate—S.C.F.H. H_2+CO	14209
Generator	--	per Cu. Ft. Dense Bed	1071
Quench Accumulator	145	per Lb. Catalyst	7.14
Reactor Inlet	330	per Sq. Ft.	21529
Condenser Inlet	540		
Product Accumulator	96	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate=366#/hr	
1 See Per. A	624	@ 705 psia & 506°F=	
2	652	1201 BTU	
3	659	Water in @ 75°F=43°F	
4	647	Net BTU/# Steam=1158	
5	660	1158x366=423828	
6	659	Ave. Bed Temp=654°F	
7	649	dT=654-506=148	
8	639	Tube Area=36.2 sq ft	
9	628	$K = \frac{423828}{(36.2)(148)} = 79.1$ BTU/°F/sq ft	
10	625		
11	602		

PRODUCT TESTS	OIL	WATER
°API	52.4	10.9
Neut. No.	30.7	27.7
Sap. No.	50.4	36.9
Hydrox. No.		
Bromine No.	93	
Pour °F.		
Chemicals, % by K_2CO_3		12.0
HEMPEL, DIST. %		°API
205 °F.		
400	75.2	55.1
400-550	12.4	37.3
550+	12.4	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	110	
10%	142	
50%	224	
90%	350	
EP	388	
Rec.	97.5	

CATALYST DATA	
INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	35
Total	
Catalyst Recovered	68.5
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	52
1	75
2	78
3	75
4	300
Total	580
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	150
Inventory, Lbs.	1991
Bed Depth, Ft.	20.11
Vol., Cu. Ft.	13.27

PARTICLE SIZE Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+	42.5	80+	
100	150	40.8	40—80	
150	105	7.7	20—40	
200	74	4.8	10—20	
250	62	0.8	0—20	
325	44	2.2		
<325		1.2		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	151
Settled	154
Compacted	178
Particle Density, gm./cc.	4.50
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	
C	7.38
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

RUN NO. 59-X
HOURS 517-541
CATALYST Spent 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	37.977	14.638	410.03	9.843	1.205	33.76	4.114	18.752	5.319	-13.433	-376.27				
H_2 2.016	58.560	22.573	45.51	34.486	4.222	8.51	14.413	36.986	18.635	-18.351	-37.00				
CO_2 44.010	2.870	1.106	48.68	33.423	4.093	180.14	13.969	15.075	18.062	2.987	131.46	9.309			
N_2 28.016	0.133	0.051	1.43	1.683	0.206	5.77	0.703	0.754	0.909						
CH_4 16.042	0.460	0.177	2.84	9.560	1.170	18.78	3.996	4.173	5.166	0.993	15.94	1.129			
C_2H_4 28.052				2.740	0.335	9.40	1.145	1.145	1.480	0.335	9.40	0.666			
C_2H_6 30.068				1.457	0.178	5.35	0.609	0.609	0.787	0.178	5.35	0.379			
C_1+C_2											30.69	2.174			
C_3H_6 42.078				2.610	0.319	13.42	1.091	1.091	1.410	0.319	13.42	0.950	4.32	3.106	0.220
C_3H_8 44.094				0.287	0.035	1.54	0.120	0.120	0.155	0.035	1.54	0.109	4.24	0.363	0.026
C_4H_8 56.104				1.737	0.213	11.95	0.726	0.726	0.939	0.213	11.95	0.846	5.00	2.390	0.169
C_4H_{10} 58.120				0.697	0.085	4.94	0.291	0.291	0.376	0.085	4.94	0.350	4.86	1.016	0.072
C_5H_{10} 70.130				0.967	0.118	8.28	0.404	0.404	0.522	0.118	8.28	0.586	3.45	1.519	0.108
C_5H_{12} 72.146				0.140	0.017	1.23	0.059	0.059	0.076	0.017	1.23	0.087	5.25	0.234	0.017
C_6H_{12} 84.156				0.370	0.045	3.79	0.155	0.155	0.200	0.045	3.79	0.268	5.54	0.684	0.048
C_3-C_6											45.15	3.196		9.312	0.660
TOTAL		38.545	508.49		12.241	306.86	41.795	80.340	61.847						
H_2+CO	96.537	37.211	14121432 SCFH		5.427		18.527	55.738	23.954	-31.784					
H_2/CO		1.54	Factor 708143		3.50		3.50	1.97	3.50	1.37					

YIELD BASIS H_2+CO FED — YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	77.4	7.063	98.0	6.922
400-550	14.0	1.278	91.4	1.168
550 +	8.6	0.785	114.6	0.900

	RECOVERY %	#/hr	gal/hr
PROPYLENE	45.0	6.04	
C_3 POLY GASO.	87.5	5.28	0.883
C_3 POLY TAR	12.5	0.76	0.101

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	--	--	68.0
C_4 POLY GASO.	5.98	10.46	1.749	1.5
C_4H_{10}	4.86	(4.94) 4.85	(1.016) 0.998	68.0
C_4-FREE GASO.			10.242	5.8
C_4 POLY TAR	7.53	1.49	0.198	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	12.989	0.9198	4987
GAS OIL	1.168	0.0827	448
FUEL OIL	0.900	0.0637	345
POLY TAR	0.299	0.0212	115
TOTAL	15.356	1.0874	5895
W. S. CHEM.	1.902	0.1347	730
TOTAL	17.258	1.2221	6625

Weight Recovery, %			Catalyst Age, hrs.		Space Velocity, vhv 1064		RECOVERED OIL	0.418**	58.66	4.154	9.126	0.646
Pressure, psig	421		Inlet Velocity, Ft/sec	0.93	Catalyst, Vol. CF 13.27		TOTAL OIL		103.81	7.350	18.438	1.306
Temperature, °F	658		Bed Depth, Ft	20.10	Weight, # 1977		WATER SOLUBLE CHEMICALS	0.279**	14.80	1.048	1.902	0.135
Recycle Ratio	1.08		Bed Density, #/CF	149	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$ =	8.90	TOTAL LIQUID PRODUCTS C_3+		118.61	8.398	20.340	1.441

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY					
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+	NET WATER	7.114**	128.17	9.076	15.386
68.24	91.77	81.30	85.42	71.64	49.62	57.02	79.44	GROSS WATER		142.97	10.124	17.288
								HYDROCARBON TOTAL—C_1+		149.30	10.572	

Form ML—11

**Included in Reactor Effluent Total

g/NCM = 16.91 × #/MCF

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

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

RUN NO. 59-X
HOURS 517-541

OPERATING CONDITIONS				PRODUCT TESTS	OIL	WATER
PRESSURES PSIG		RATES S.C.F.H.				
Oxygen	445	Fresh Feed	14628	°API	52.1	11.0
Natural Gas	442	Recycle	15861	Neut. No.	31.2	28.5
Generator Outlet	426	Combined Feed	30489	Sap. No.	50.9	37.9
Reactor Inlet	421	Wet Gas—Measured	4272	Hydrox. No.		
Condenser Inlet		Adjusted	4645	Bromine No.	95	
Product Accumulator	371	Loss	373	Pour °F.	below -35	
				Chemicals, % by K_2CO_3		11.0
TEMPERATURES—°F.		Recycle/Fresh Feed	1.08			
Oxygen	330	Inlet Velocity—ft./sec.	0.93			
Natural Gas	313	Fresh Feed Rate—S.C.F.H. H_2+CO	14121	HEMPEL, DIST. %		°API
Generator		per Cu. Ft. Dense Bed	1064	205 °F.		
Quench Accumulator	146	per Lb. Catalyst	7.14	400	76.4	55.2
Reactor Inlet	331	per Sq. Ft.	21395	400-550	14.0	37.7
Condenser Inlet	541			550+	9.6	
Product Accumulator	99	Heat Transfer Calculations				
Catalyst No. Height		Steam Rate=373#/hr		A. S. T. M. DIST. ON		
1 See Per. A	619	@ 705 psia & 506°F=		Naphtha °F.		
2	654	1201 BTU/# steam		IBP	110	
3	662	Water in @ 80°F=480°F		10%	136	
4	652	Net BTU/# steam=1153		50%	222	
5	664	1153x373=430069		90%	342	
6	662	Ave. Bed Temp=658°F		EP	386	
7	652	dT=658-506=152°F		Rec.	97.0	
8	641	Tube Area=36.3				
9	630	$K=\frac{430069}{(36.3)(152)}=77.9$ BTU/°F/sq ft				
10	628					
11	604					

CATALYST DATA — INVENTORY DATA		PARTICLE SIZE: Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
In Reactor at Start of Period						
Fresh Catalyst Added	36					
Total		On 40	419+	41.4	80+	
Catalyst Recovered	75.5	100	150	41.4	40—80	
In Reactor at End of Period		150	105	8.1	20—40	
		200	74	5.1	10—20	
REACTOR d-p, Inches H_2O		250	62	1.0	0—20	
No. Height		325	44	1.8		
0 See Period A	51	<325		1.2		
1	74	CATALYST				
2	76	Bulk Density, Lbs./Cu.Ft.				
3	75	Aerated				150
4	300	Settled				151
Total	576	Compacted				175
		Particle Density, gm./cc.				4.43
CALCULATED FROM dp		NH_3 Value, ml./gm.				
Density, Lbs./Cu.Ft.	149	N_2 Surface, m^2/gm.				
Inventory, Lbs.	1977					
Bed Depth, Ft.	20.10	CHEMICAL ANALYSIS				
Vol., Cu. Ft.	13.27	Fe				
		C				8.01
		O				
		H				
		K_2O, W+, % basis Fe				
		X-Ray Analysis—				
		$Fe_{20}C_9$				
		Fe_3O_4				
		Fe				

RUN NO. 59-Y
HOURS 541-565
CATALYST Spent 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	38.547	14.711	412.05	9.737	1.222	34.23	3.798	18.509	5.020	-13.489	-377.82				
H_2 2.016	58.076	22.163	44.67	34.966	4.389	8.85	13.639	35.802	18.028	-17.774	-35.82				
CO_2 44.010	2.460	0.939	41.33	32.937	4.134	181.95	12.848	13.787	16.982	3.195	140.62	10.049			
N_2 28.016	0.310	0.118	3.31	1.803	0.226	6.33	0.703	0.821	0.929						
CH_4 16.042	0.607	0.232	3.72	10.137	1.272	20.41	3.954	4.186	5.226	1.040	16.69	1.193			
C_2H_4 28.052				2.603	0.327	9.17	1.015	1.015	1.342	0.327	9.17	0.655			
C_2H_6 30.068				1.317	0.165	4.96	0.514	0.514	0.679	0.165	4.96	0.354			
C_1+C_2											30.82	2.202			
C_3H_6 42.078				2.730	0.343	14.43	1.065	1.065	1.408	0.343	14.43	1.031	4.32	3.340	0.239
C_3H_8 44.094				0.320	0.040	1.76	0.125	0.125	0.165	0.040	1.76	0.126	4.24	0.415	0.030
C_4H_8 56.104				1.627	0.204	11.45	0.635	0.635	0.839	0.204	11.45	0.818	5.00	2.290	0.164
C_4H_{10} 58.120				0.547	0.069	4.01	0.213	0.213	0.282	0.069	4.01	0.287	4.86	0.825	0.059
C_5H_{10} 70.130				0.813	0.102	7.15	0.317	0.317	0.419	0.102	7.15	0.511	5.48	1.312	0.094
C_5H_{12} 72.146				0.150	0.019	1.37	0.059	0.059	0.078	0.019	1.37	0.098	5.28	0.261	0.019
C_6H_{12} 84.156				0.313	0.039	3.28	0.122	0.122	0.161	0.039	3.28	0.234	5.54	0.592	0.042
C_3-C_6											43.45	3.105		9.035	0.647
TOTAL		38.163	505.08		12.551	309.35	39.007	77.170	59.056						
H_2+CO	96.623	36.874	13993909 SCFH		5.611		17.437	54.311	23.048	-31.263					
H_2/CO		1.51	Factor 714596		3.59		3.59	1.93	3.59	1.32					

Weight Recovery, % 95.06	Catalyst Age, hrs.	Space Velocity, vhv 1064	RECOVERED OIL	** 0.413	57.97	4.143	9.027	0.645
Pressure, psig 416	Inlet Velocity, Ft/sec 0.90	Catalyst, Vol. CF 13.15	TOTAL OIL		101.42	7.248	18.062	1.292
Temperature, °F 657	Bed Depth, Ft 19.93	Weight, # 1960	WATER SOLUBLE CHEMICALS	** 0.289	15.32	1.095	2.004	0.143
Recycle Ratio 1.02	Bed Density, #/CF 149	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$ = 8.97	TOTAL LIQUID PRODUCTS C_3+		116.74	8.343	20.066	1.435
			NET WATER	** 6.796	122.44	8.750	14.699	1.050
			GROSS WATER		137.76	9.845	16.703	1.193
			HYDROCARBON TOTAL—C_1+		147.56	10.545		

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
67.11	91.69	80.20	84.78	72.88	49.65	57.56	79.11

YIELD BASIS H_2+CO FED

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	77.0	6.951	98.0	6.812
400-550	14.0	1.264	91.4	1.155
550 +	9.0	0.812	114.6	0.931

	RECOVERY %	#/hr	gal/hr	
PROPYLENE	43.2	6.23		
C_3 POLY GASO.	87.5	5.45	0.911	
C_3 POLY TAR	12.5	0.78	0.104	

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.62	0.124	68.0
C_4 POLY GASO.	5.98	9.48	1.585	1.5
C_4H_{10}	4.86	4.01	0.825	68.0
C_4-FREE GASO.			9.888	5.8
C_4 POLY TAR	7.53	1.35	0.179	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	12.422	0.8877	4813
GAS OIL	1.155	0.0825	447
FUEL OIL	0.931	0.0665	361
POLY TAR	0.283	0.0202	110
TOTAL	14.791	1.0569	5731
W. S. CHEM.	2.004	0.1432	776
TOTAL	16.795	1.2001	6507

Form ML—11

** Included in Reactor Effluent Total

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

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

RUN NO. 59-Y
HOURS 541-565

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	441	Fresh Feed	14483
Natural Gas	438	Recycle	14803
Generator Outlet	422	Combined Feed	29286
Reactor Inlet	416	Wet Gas—Measured	4379
Condenser Inlet		Adjusted	4763
Product Accumulator	369	Loss	384
TEMPERATURES—°F.		Recycle/Fresh Feed	1.02
Oxygen	324	Inlet Velocity—ft./sec.	0.90
Natural Gas	313	Fresh Feed Rate—S.C.F.H. H_2+CO	13994
Generator		per Cu. Ft. Dense Bed	1064
Quench Accumulator	153	per Lb. Catalyst	7.14
Reactor Inlet	306	per Sq. Ft.	21203
Condenser Inlet	538		
Product Accumulator	98	**Heat Transfer Calculations**	
Catalyst No. Height		**Steam Rate=356#/hr**	
1 **See Per. A**	611	**@ 705 psia & 506°F**	
2	651	**1201 BTU/#**	
3	668	**Water in @ 82.7=41 BTU/#**	
4	652	**Net BTU/# Steam=1160**	
5	662	**1160x356=412960**	
6	660	**Ave. Bed Temp=657**	
7	650	**dT=657-506=151°F**	
8	639	**Tube Area=36.0 sq ft**	
9	627	**$K=\frac{412960}{(36.0)(151)}$ = 76.0 BTU/°F/sq ft**	
10	624		
11	601		

PRODUCT TESTS	OIL	WATER
°API	52.0	11.0
Neut. No.	35.8	33.2
Sap. No.	49.0	37.8
Hydrox. No.		
Bromine No.	93	
Pour °F.	below -35	
Chemicals, % by K_2CO_3		12.0
HEMPEL, DIST. %		°API
205 °F.		
400	76.0	54.7
400-550	14.0	37.7
550+	10.0	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	110	
10%	140	
50%	224	
90%	348	
EP	392	
Rec.	97.0	

CATALYST DATA	
INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	35
Total	
Catalyst Recovered	69¼
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 **See Period A**	51
1	75
2	76
3	74
4	295
Total	571
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	149
Inventory, Lbs.	1960
Bed Depth, Ft.	19.93
Vol., Cu. Ft.	13.15

PARTICLE SIZE				
Screen Analysis			Sedimentation	
Mesh	Microns	%	Microns	%
On 40	419+	54.8	80+	
100	150	33.9	40—80	
150	105	4.5	20—40	
200	74	3.6	10—20	
250	62	0.8	0—20	
325	44	1.2		
<325		1.2		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	152
Settled	154
Compacted	180
Particle Density, gm./cc.	4.58
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	
C	8.24
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

RUN NO. 59-Z
HOURS 565-589
CATALYST Spent 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
CO 28.010	40.040	15.074	422.22	8.313	1.076	30.14	3.200	18.274	4.276	-13.998	-392.08
H_2 2.016	56.717	21.352	43.05	36.407	4.710	9.50	14.013	35.365	18.723	-16.642	-33.55
CO_2 44.010	2.463	0.927	40.80	32.360	4.188	184.31	12.455	13.382	16.643	3.261	143.51
N_2 28.016	0.213	0.080	2.24	1.807	0.234	6.56	0.696	0.776	0.930		
CH_4 16.042	0.567	0.214	3.43	9.630	1.246	19.99	3.707	3.921	4.953	1.032	16.56
C_2H_4 28.052				2.653	0.343	9.62	1.021	1.021	1.346	0.343	9.62
C_2H_6 30.068				1.377	0.178	5.35	0.530	0.530	0.708	0.178	5.35
C_1+C_2											31.53
C_3H_6 42.078				2.867	0.371	15.61	1.104	1.104	1.475	0.371	15.61
C_3H_8 44.094				0.343	0.044	1.94	0.132	0.132	0.176	0.044	1.94
C_4H_8 56.104				1.903	0.246	13.80	0.732	0.732	0.978	0.246	13.80
C_4H_{10} 58.120				0.897	0.116	6.74	0.345	0.345	0.461	0.116	6.74
C_5H_{10} 70.130				0.983	0.127	8.91	0.378	0.378	0.505	0.127	8.91
C_5H_{12} 72.146				0.133	0.017	1.23	0.051	0.051	0.068	0.017	1.23
C_6H_{12} 84.156				0.327	0.042	3.53	0.126	0.126	0.168	0.042	3.53
C_3-C_6											51.76
TOTAL		37.647	511.74		12.938	317.24	38.490	76.137	58.791		
H_2+CO	96.757	36.426	13824 SCFH		5.786		17.213	53.639	22.999	-30.640	
H_2/CO		1.42	Factor 723396		4.38		4.38	1.94	4.38	1.19	

YIELD BASIS H_2+CO FED	#/MCF	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
	10.381			
	1.198			
	0.696			
	0.387			
	2.281			
	1.129	4.32	3.613	0.261
	0.140	4.24	0.458	0.033
	0.998	5.00	2.760	0.200
	0.488	4.86	1.387	0.100
	0.645	5.45	1.635	0.118
	0.089	5.25	0.234	0.017
	0.255	5.54	0.637	0.046
	3.744		10.724	0.776
	4.244		9.175	0.664
	7.988		19.899	1.440
	1.176		2.069	0.150
	9.164		21.968	1.590
	8.650		14.355	1.038
	9.826		16.424	1.188
	11.445			

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	74.4	6.826	98.0	6.689
400-550	14.8	1.358	91.4	1.241
550 +	10.8	0.991	114.6	1.136

	RECOVERY %	#/hr	gal/hr
PROPYLENE	40.9	6.38	
C_3 POLY GASO.	87.5	5.58	0.933
C_3 POLY TAR	12.5	0.80	0.106

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00			68.0
C_4 POLY GASO.	5.98	12.08	2.019	1.5
C_4H_{10}	4.86	(6.74) 5.00	(1.387) 1.029	68.0
C_4-FREE GASO.			10.128	5.8
C_4 POLY TAR	7.53	1.73	0.230	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	13.176	0.9531	5167
GAS OIL	1.241	0.0898	487
FUEL OIL	1.136	0.0822	446
POLY TAR	0.336	0.0243	132
TOTAL	15.889	1.494	6232
W. S. CHEM.	2.069	0.1497	812
TOTAL	17.958	1.2991	7043

Weight Recovery, %	95.21	Catalyst Age, hrs.		Space Velocity, vhv	1050
Pressure, psig	413	Inlet Velocity, Ft/sec	0.88	Catalyst, Vol. CF	13.17
Temperature, °F	648	Bed Depth, Ft	19.96	Weight, #	1963
Recycle Ratio	1.02	Bed Density, #/CF	149	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$	= 10.98

		#/hr	#/gal	gal/hr	gal/MCF
RECOVERED OIL	** 0.418	58.67	4.244	9.175	0.664
TOTAL OIL		110.43	7.988	19.899	1.440
WATER SOLUBLE CHEMICALS	** 0.308	16.25	1.176	2.069	0.150
TOTAL LIQUID PRODUCTS C_3+		126.68	9.164	21.968	1.590
NET WATER	** 6.637	119.56	8.650	14.355	1.038
GROSS WATER		135.83	9.826	16.424	1.188
HYDROCARBON TOTAL—C_1+		158.21	11.445		

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
65.63	92.86	77.94	84.12	76.60	47.06	57.12	80.07

Form ML—11

** Included in Reactor Effluent Total

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

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

RUN NO. 59-Z
HOURS 565-589

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	436	Fresh Feed	14287
Natural Gas	433	Recycle	14607
Generator Outlet	418	Combined Feed	28894
Reactor Inlet	413	Wet Gas—Measured	4531
Condenser Inlet		Adjusted	4910
Product Accumulator	368	Loss	379
TEMPERATURES—°F.		Recycle/Fresh Feed	1.02
Oxygen	339	Inlet Velocity—ft./sec.	0.88
Natural Gas	323	Fresh Feed Rate—S.C.F.H. CO+H_2	13824
Generator		per Cu. Ft. Dense Bed	1050
Quench Accumulator	148	per Lb. Catalyst	7.04
Reactor Inlet	255	per Sq. Ft.	20945
Condenser Inlet	528		
Product Accumulator	98	**Heat Transfer Calculations**	
Catalyst No. Height		**Steam Rate=321#/hr**	
1 See Per. A	590	**@ 705 psia & 507°F**	
2	635	**1201 BTU**	
3	664	**Water in @ 85°F=53°F**	
4	649	**Net BTU/# Steam=1148**	
5	649	**1148x321=368508**	
6	650	**Ave. Bed Temp=648**	
7	641	**dT=648-507=141°F**	
8	631	**Tube Area=36.0 sq ft**	
9	621	**K=** $\frac{368508}{(36.0)(141)}$ **= 72.6 BTU/°F/sq ft**	
10	616		
11	593		

PRODUCT TESTS	OIL	WATER
°API	52.3	11.1
Neut. No.	35.4	34.0
Sap. No.	49.7	37.5
Hydrox. No.		
Bromine No.	93	
Pour °F.	-30	
Chemicals, % by K_2CO_3		12.6
HEMPEL, DIST. %		°API
205 °F.		
400	73.4	54.9
400-550	14.8	38.6
550+	11.8	--
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	110	
10%	144	
50%	228	
90%	350	
EP	394	
Rec.	97.0	

CATALYST DATA					
INVENTORY DATA		PARTICLE SIZE			
In Reactor at Start of Period		Screen Analysis			Sedimentation
Fresh Catalyst Added	34	Mesh	Microns	%	Microns / %
Total		On 40	419+	40.4	80+
Catalyst Recovered	65	100	150	37.4	40—80
In Reactor at End of Period		150	105	8.9	20—40
		200	74	7.3	10—20
REACTOR d-p, Inches H_2O		250	62	1.2	0—20
No. Height		325	44	3.4	
0 See Period A	51	<325		1.4	
1	75	CATALYST			
2	76	Bulk Density, Lbs./Cu.Ft.			
3	75	Aerated			150
4	295	Settled			152
Total	572	Compacted			171
		Particle Density, gm./cc.			4.52
CALCULATED FROM dp		NH_3 Value, ml./gm.			
Density, Lbs./Cu.Ft.	149	N_2 Surface, m^2/gm.			
Inventory, Lbs.	1963				
Bed Depth, Ft.	19.96	CHEMICAL ANALYSIS			
Vol., Cu. Ft.	13.17	Fe			
		C			6.86
		O			
		H			
		K_2O, W+, % basis Fe			
		X-Ray Analysis—			
		$Fe_{20}C_9$			
		Fe_3O_4			
		Fe			

RUN NO. 59-AA
HOURS 589-613
CATALYST Spent 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	YIELD BASIS H_2+CO FED CONDENSATE #/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	39.446	14.825	415.26	7.653	0.977	27.37	2.889	17.714	3.866	-13.848	387.89				
H_2 2.016	56.783	21.342	43.03	35.384	4.518	9.11	13.357	34.699	17.875	-16.824	33.92				
CO_2 44.010	2.797	1.051	46.26	34.987	4.468	196.63	13.208	14.259	17.676	3.417	150.37	10.956			
N_2 28.016	0.237	0.089	2.49	1.947	0.249	6.98	0.735	0.824	0.984						
CH_4 16.042	0.737	0.277	4.45	9.287	1.186	19.03	3.506	3.783	4.692	0.909	14.58	1.062			
C_2H_4 28.052				2.623	0.335	9.40	0.990	0.990	1.325	0.335	9.40	0.685			
C_2H_6 30.068				1.327	0.169	5.08	0.501	0.501	0.670	0.169	5.08	0.370			
C_1+C_2											29.06	2.117			
C_3H_6 42.078				2.613	0.334	14.05	0.986	0.986	1.320	0.334	14.05	1.024	4.32	3.252	0.237
C_3H_8 44.094				0.323	0.041	1.81	0.122	0.122	0.163	0.041	1.81	0.132	4.24	0.426	0.031
C_4H_8 56.104				1.780	0.227	12.74	0.672	0.672	0.899	0.227	12.74	0.928	5.00	2.548	0.186
C_4H_{10} 58.120				0.607	0.078	4.53	0.229	0.229	0.307	0.078	4.53	0.330	4.86	0.932	0.068
C_5H_{10} 70.130				0.973	0.124	8.70	0.367	0.367	0.491	0.124	8.70	0.634	5.45	1.596	0.116
C_5H_{12} 72.146				0.143	0.018	1.30	0.054	0.054	0.072	0.018	1.30	0.095	5.25	0.248	0.018
C_6H_{12} 84.156				0.353	0.045	3.79	0.133	0.133	0.178	0.045	3.79	0.276	5.54	0.684	0.050
C_3-C_6											46.92	3.419		9.686	0.706
TOTAL		37.584	511.49		12.769	320.52	37.750	75.334	57.770						
H_2+CO	96.229	36.167	13725 SCFH		5.495		16.246	52.413	21.741	-30.672					
H_2/CO		1.44	Factor 728597		4.62		4.62	1.96	4.62	1.21					
RECOVERED OIL										** 0.407	57.09	4.160		8.873	0.646
TOTAL OIL											104.01	7.579		18.559	1.352
WATER SOLUBLE CHEMICALS										** 0.302	16.02	1.167		2.040	0.149
TOTAL LIQUID PRODUCTS C_3+											120.03	8.746		20.599	1.501
NET WATER										** 6.542	117.86	8.587		14.149	1.031
GROSS WATER											133.88	9.754		16.189	1.180
HYDROCARBON TOTAL—C_1+											149.09	10.863			

Weight Recovery, % 94.23	Catalyst Age, hrs.	Space Velocity, vhv 1051	
Pressure, psig 413	Inlet Velocity, Ft/sec 0.88	Catalyst, Vol CF 13.06	
Temperature, °F 650	Bed Depth, Ft 19.79	Weight, # 1946	
Recycle Ratio 1.00	Bed Density, #/CF 149	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$ = 12.49	

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
66.27	93.41	78.83	84.81	78.18	48.49	58.52	80.51

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	74.0	6.566	98.0	6.435
400-550	14.8	1.313	91.4	1.200
550 +	11.2	0.994	114.6	1.139

	RECOVERY %	#/hr	gal/hr	
PROPYLENE	40.4	5.676		
C_3 POLY GASO.	87.5	4.967	0.831	
C_3 POLY TAR	12.5	0.710	0.094	

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.230	0.046	68.0
C_4 POLY GASO.	5.98	10.946	1.830	1.5
C_4H_{10}	4.86	4.530	0.932	68.0
C_4-FREE GASO.			9.794	5.8
C_4 POLY TAR	7.53	1.564	0.207	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	12.602	0.9182	4978
GAS OIL	1.200	0.0874	474
FUEL OIL	1.139	0.0830	450
POLY TAR	0.301	0.0219	119
TOTAL	15.242	1.1105	6021
W. S. CHEM.	2.040	0.1486	806
TOTAL	17.282	1.2592	6827

Form ML—11 ** Included in Reactor Effluent Total g/NCM = 16.91 × #/MCF *9488 MCFH H_2 + CO, Bbl/Day = 5421.6 × gal/MCF

RUN NO. 59-AA
HOURS 589-613

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	437	Fresh Feed	14263
Natural Gas	434	Recycle	14326
Generator Outlet	417	Combined Feed	28589
Reactor Inlet	413	Wet Gas—Measured	4400
Condenser Inlet		Adjusted	4846
Product Accumulator	366	Loss	446
TEMPERATURES—°F.		Recycle/Fresh Feed	1.00
Oxygen	294	Inlet Velocity—ft./sec.	0.88
Natural Gas	320	Fresh Feed Rate—S.C.F.H.	13725
Generator	--	$CO+H_2$ per Cu. Ft. Dense Bed	1051
Quench Accumulator	147	per Lb. Catalyst	7.05
Reactor Inlet	272	per Sq. Ft.	20795
Condenser Inlet	535		
Product Accumulator	100	Heat Transfer Calculations	
Catalyst No. Height		SteamRate=336#/hr	
1 See Per. A	601	@ 705 psia & 506°F=	
2	641	1201 BTU	
3	662	Water in @ 84°F=52°F	
4	647	Net BTU/# Steam=1149	
5	653	1149x336=386064	
6	653	Ave. Bed Temp=650	
7	645	dT=650-506=144°F	
8	634	Tube Area=35.8 sq ft	
9	623	$K = \frac{386064}{(35.8)(144)} = 74.9$ BTU/°F/sq ft	
10	617		
11	569		

PRODUCT TESTS	OIL	WATER
°API	51.6	11.0
Neut. No.	38.7	35.8
Sap. No.	47.9	37.5
Hydrox. No.		
Bromine No.	93	
Pour °F.	-30	
Chemicals, % by K_2CO_3		12.6
HEMPEL, DIST. %		°API
205 °F.		
400	73.0	54.0
400-550	14.8	37.8
550+	12.2	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	114	
10%	144	
50%	230	
90%	354	
EP	390	
Rec.	96.5	

CATALYST DATA: INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added (Red.)	36
Total	
Catalyst Recovered	56½
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	51
1	75
2	76
3	75
4	290
Total	567
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	149
Inventory, Lbs.	1946
Bed Depth, Ft.	19.79
Vol., Cu. Ft.	13.06

PARTICLE SIZE: Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+	40.8	80+	
100	150	39.8	40—80	
150	105	7.5	20—40	
200	74	6.1	10—20	
250	62	1.6	0—20	
325	44	2.0		
<325		2.2		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	151
Settled	152
Compacted	176
Particle Density, gm./cc.	4.37
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	68.6
C	6.94
O	.47
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	1.78

RUN NO. 59-BB
HOURS 613-637
CATALYST Spent 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	YIELD BASIS H_2+CO FED CONDENSATE #/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	37.563	14.583	408.45	9.613	1.199	33.58	3.646	18.229	4.845	-13.384	-374.87				
H_2 2.016	59.720	23.184	46.74	36.096	4.503	9.08	13.689	36.873	18.192	-18.681	-37.66				
CO_2 44.010	1.967	0.764	33.62	32.383	4.040	177.79	12.281	13.045	16.321	3.276	144.17	10.059			
N_2 28.016	0.147	0.057	1.60	1.840	0.230	6.44	0.698	0.755	0.928						
CH_4 16.042	0.603	0.234	3.75	9.227	1.151	18.46	3.499	3.733	4.650	0.917	14.71	1.026			
C_2H_4 28.052				2.710	0.338	9.48	1.028	1.028	1.366	0.338	9.48	0.661			
C_2H_6 30.068				1.273	0.159	4.78	0.483	0.483	0.642	0.159	4.78	0.334			
C_1+C_2											28.97	2.021			
C_3H_6 42.078				2.667	0.333	14.01	1.011	1.011	1.344	0.333	14.01	0.977	4.32	3.243	0.226
C_3H_8 44.094				0.290	0.036	1.59	0.110	0.110	0.146	0.036	1.59	0.111	4.24	0.375	0.026
C_4H_8 56.104				1.817	0.227	12.74	0.689	0.689	0.916	0.227	12.74	0.889	5.00	2.548	0.178
C_4H_{10} 58.120				0.637	0.079	4.59	0.242	0.242	0.321	0.079	4.59	0.320	4.86	0.944	0.066
C_5H_{10} 70.130				0.983	0.123	8.63	0.373	0.373	0.496	0.123	8.63	0.602	5.45	1.583	0.110
C_5H_{12} 72.146				0.137	0.017	1.23	0.052	0.052	0.069	0.017	1.23	0.086	5.25	0.234	0.016
C_6H_{12} 84.156				0.327	0.041	3.45	0.124	0.124	0.165	0.041	3.45	0.241	5.54	0.623	0.043
C_3-C_6											46.24	3.226		9.550	0.665
TOTAL		38.822	494.16		12.476	305.85	37.924	76.746	57.571						
H_2+CO	97.283	37.767	1433270 SCFH		5.702		17.335	55.102	33.037	-32.065					
H_2/CO		1.59	Factor 697705		3.76		3.75	2.02	3.75	1.40					

Weight Recovery, % 9585	Catalyst Age, hrs.	Space Velocity, vhv 1113	RECOVERED OIL	** 0.403	56.48	3.941
Pressure, psig 411	Inlet Velocity, Ft/sec 0.91	Catalyst, Vol. CF 12.88	TOTAL OIL		102.72	7.167
Temperature, °F 654	Bed Depth, Ft 19.51	Weight, # 1932	WATER SOLUBLE CHEMICALS	** 0.282	14.98	1.045
Recycle Ratio 0.98	Bed Density, #/CF 150	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$ = 9.45	TOTAL LIQUID PRODUCTS C_3+		117.70	8.212
			NET WATER	** 6.486	116.85	8.153
			GROSS WATER		131.83	9.198
			HYDROCARBON TOTAL—C_1+		146.67	10.233

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
67.86	91.78	80.58	84.90	73.42	50.66	58.19	80.25

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	76.3	6.706	98.0	6.572
400-550	15.6	1.371	91.4	1.253
550 +	8.1	0.712	114.6	0.816

	RECOVERY %	#/hr	gal/hr	
PROPYLENE	44.2	6.19		
C_3 POLY GASO.	87.5	5.42	0.906	
C_3 POLY TAR	12.5	0.77	0.102	

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.21	0.042	68.0
C_4 POLY GASO.	5.98	10.96	1.833	1.5
C_4H_{10}	4.86	4.59	0.944	68.0
C_4-FREE GASO.			9.918	5.8
C_4 POLY TAR	7.53	1.57	0.208	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	12.737	0.8887	4818
GAS OIL	1.253	0.0874	474
FUEL OIL	0.816	0.0569	308
POLY TAR	0.310	0.0216	117
TOTAL	15.116	1.0546	5717
W. S. CHEM.	1.913	0.1335	724
TOTAL	17.029	1.1881	6441

Form ML—11

** Included in Reactor Effluent Total

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

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

RUN NO. 59-BB
HOURS 613-637

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	434	Fresh Feed	14733
Natural Gas	432	Recycle	14392
Generator Outlet	416	Combined Feed	29125
Reactor Inlet	411	Wet Gas—Measured	4417
Condenser Inlet		Adjusted	4735
Product Accumulator	364	Loss	318
TEMPERATURES—°F.		Recycle/Fresh Feed	0.98
Oxygen	283	Inlet Velocity—ft./sec.	0.91
Natural Gas	332	Fresh Feed Rate—S.C.F.H.	14333
Generator		per Cu.Ft. Dense Bed	1113
Quench Accumulator	151	per Lb. Catalyst	7.42
Reactor Inlet	304	per Sq. Ft.	21717
Condenser Inlet	540		
Product Accumulator	100	**Heat Transfer Calculations**	
Catalyst No. Height		**SteamRate=364#/hr**	
1	616	**@ 704 psia & 507°F**	
2	652	**1201 BTU/#**	
3	657	**Water in @ 84°F=52 BTU/#**	
4	646	**Net BTU/# steam=1149**	
5	660	**1149x364=418236**	
6	659	**Ave. BedTemp=654°F**	
7	650	**dT=654-507=147°F**	
8	638	**Tube Area=35.4 sq ft**	
9	627	**K= 418236 / (147)(35.4) =80.4 BTU/°F/sq ft**	
10	622		
11	599		

PRODUCT TESTS	OIL	WATER
° API	51.8	11.0
Neut. No.	38.1	35.3
Sap. No.	50.3	37.9
Hydrox. No.		
Bromine No.	93	
Pour °F.		
Chemicals, % by K_2CO_3		12.0
HEMPEL, DIST. %		°API
205 °F.		
400	75.3	55.5
400-550	15.6	37.5
550+	9.1	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	110	
10%	138	
50%	228	
90%	364	
EP	390	
Rec.	96.0	

CATALYST DATA	
INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	35
Total	
Catalyst Recovered	65.5
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 **See Period A**	51
1	75
2	76
3	76
4	285
Total	563
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	150
Inventory, Lbs.	1932
Bed Depth, Ft.	19.51
Vol., Cu. Ft.	12.88

PARTICLE SIZE				
Screen Analysis			Sedimentation	
Mesh	Microns	%	Microns	%
On 40	419+	39.2	80+	
100	150	42.7	40—80	
150	105	8.0	20—40	
200	74	6.1	10—20	
250	62	1.0	0—20	
325	44	2.0		
<325		1.0		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	148
Settled	149
Compacted	167
Particle Density, gm./cc.	4.44
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
•	
CHEMICAL ANALYSIS	
Fe	
C	5.86
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	

THE TEXAS COMPANY — MONTEBELLO LABORATORY

YIELD CALCULATIONS

RUN NO. 59-CC
HOURS 637-661
CATALYST Spent GM&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	37.990	14.430	404.19	4.983	0.617	17.28	1.864	16.294	2.481	-13.813	-386.91				
H_2 2.016	58.077	22.060	44.47	34.687	4.294	8.66	12.979	35.039	17.273	-17.766	-35.81				
CO_2 44.010	2.883	1.095	48.19	33.924	4.198	184.77	12.694	13.789	16.892	3.103	136.58	9.863			
N_2 28.016	0.317	0.120	3.36	2.273	0.281	7.87	0.850	0.970	1.131						
CH_4 16.042	0.733	0.279	4.48	11.220	1.389	22.28	4.198	4.477	5.587	1.110	17.80	1.285			
C_2H_4 28.052				3.127	0.387	10.86	1.170	1.170	1.557	0.387	10.86	0.784			
C_2H_6 30.068				1.657	0.205	6.16	0.620	0.620	0.825	01205	6.16	0.445			
C_1+C_2											34.82	2.514			
C_3H_6 42.078				3.253	0.403	16.96	1.217	1.217	1.620	0.403	16.96	1.225	4.32	3.926	0.284
C_3H_8 44.094				0.363	0.045	1.98	0.136	0.136	0.181	0.045	1.98	0.143	4.24	0.467	0.034
C_4H_8 56.104				2.143	0.265	14.87	0.802	0.802	1.067	0.265	14.87	1.074	5.00	2.974	0.215
C_4H_{10} 58.120				0.667	0.083	4.82	0.250	0.250	0.333	0.083	4.82	0.348	4.86	0.992	0.072
C_5H_{10} 70.130				1.117	0.138	9.68	0.418	0.418	0.556	0.138	9.68	0.699	5.45	1.776	0.128
C_5H_{12} 72.146				0.193	0.024	1.73	0.072	0.072	0.096	0.024	1.73	0.125	5.25	0.330	0.024
C_6H_{12} 84.156				0.393	0.049	4.12	0.147	0.147	0.196	0.049	4.12	0.298	5.54	0.744	0.054
C_3-C_6											54.16	3.912		11.209	0.811
TOTAL		37.984	504.69		12.378	312.04	57.417	75.401	57.144						
H_2+CO	96.067	36.490	13848058 SCFH		4.911		14.843	51.333	19.754	-31.579					
H_2/CO		1.53	Factor 722122		6.96		6.96	2.15	6.96	1.29					

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

	CORRECTED HEMPEL. %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	75.8	6.770	98.0	6.635
400-550	15.2	1.358	91.4	1.241
550 +	9.0	0.804	114.6	0.921

	RECOVERY %	#/hr	gal/hr
PROPYLENE	43.6	7.39	
C_3 POLY GASO.	87.5	6.47	1.082
C_3 POLY TAR	12.5	0.92	0.122

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.42	0.084	68.0
C_4 POLY GASO.	5.98	12.64	2.114	1.5
C_4H_{10}	4.86	4.82	0.992	68.0
C_4-FREE GASO.			1 0.567	5.8
C_4 POLY TAR	7.53	1.81	0.240	

	gal/hr	gal / MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	13.757	0.9934	5386
GAS OIL	1.241	0.0896	486
FUEL OIL	0.921	0.0665	361
POLY TAR	0.362	0.0261	142
TOTAL	16.281	1.1756	6375
W. S. CHEM.	1.960	0.1415	767
TOTAL	18.241	1.3171	7142

Weight Recovery, % 96.24	Catalyst Age, hrs.	Space Velocity, vhv 1082
Pressure, psig 408	Inlet Velocity, Ft/sec 0.90	Catalyst , Vol, CF 12.80
Temperature, °F 657	Bed Depth, Ft 19.50	Weight, # 1908
Recycle Ratio 0.99	Bed Density, #/CF 149	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$ = 17.70

	NET CHANGE m/hr	NET CHANGE #/hr	#/MCF	#/gal	gal/hr	gal/MCF
RECOVERED OIL	** 0.409	57.33	4.140		8.932	0.645
TOTAL OIL		111.49	8.052		20.141	1.456
WATER SOLUBLE CHEMICALS	** 0.294	15.59	1.126		1.960	0.142
TOTAL LIQUID PRODUCTS C_3+		127.08	9.178		22.101	1.598
NET WATER	** 6.646	119.73	8.646		14.373	1.038
GROSS WATER		135.32	9.772		16.333	1.180
HYDROCARBON TOTAL—C_1+		161.90	11.692			

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	$CO+H_2$	C_3 + /C_1 +
67.41	95.72	80.53	86.54	84.77	50.70	61.52	78.49

Form ML—11

**Included in Reactor Effluent Total

g/NCM = 16.91 × #/MCF

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

THE TEXAS COMPANY — MONTEBELLO LABORATORY

DATA SUMMARY

RUN NO. 59-CC
HOURS 637-661

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	432	Fresh Feed	14415
Natural Gas	429	Recycle	14200
Generator Outlet	414	Combined Feed	28615
Reactor Inlet	408	Wet Gas—Measured	4412
Condenser Inlet		Adjusted	4697
Product Accumulator	360	Loss	285
TEMPERATURES—°F.		Recycle/Fresh Feed	0.99
Oxygen	284	Inlet Velocity—ft./sec.	0.90
Natural Gas	324	Fresh Feed Rate—S.C.F.H. H_2+CO	13848
Generator		per Cu.Ft. Dense Bed	1082
Quench Accumulator	153	per Lb. Catalyst	7.26
Reactor Inlet	315	per Sq. Ft.	20982
Condenser Inlet	541		
Product Accumulator	98	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate=364#/hr	
1	623	@ 705 psia & 507°F=	
2	657	1201 BTU	
3	659	Water in @ 82°F=50°F	
4	648	Net BTU/# Steam=1151	
5	663	1151x364=418964	
6	661	Ave. BedTemp=657	
7	652	dT=657-507=150°F	
8	641	Tube Area=35.2 sq ft	
9	630	$K=\frac{418964}{(35.2)(150)}$ = 79.3 BTU/°F/sq ft	
10	625		
11	601		

PRODUCT TESTS

	OIL	WATER
° API	51.9	10.8
Neut. No.	37.9	36.0
Sap. No.	49.0	36.5
Hydrox. No.		
Bromine No.	93	
Pour °F.	-30	
Chemicals, % by K_2CO_3		12.0
HEMPEL, DIST. %		°API
205 °F.		
400	74.8	54.6
400-550	15.2	37.2
550+	10.0	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	110	
10%	136	
50%	224	
90%	350	
EP	390	
Rec.	96.0	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	39
Total	
Catalyst Recovered	61.5
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	51
1	74
2	76
3	75
4	280
Total	556
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	149
Inventory, Lbs.	1908
Bed Depth, Ft.	19.40
Vol., Cu. Ft.	12.80

PARTICLE SIZE

Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+	56.6	80+	
100	150	31.8	40—80	
150	105	4.4	20—40	
200	74	3.4	10—20	
250	62	0.6	0—20	
325	44	2.0		
<325		1.2		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	152
Settled	153
Compacted	173
Particle Density, gm./cc.	4.46
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	
C	6.61
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	