RUN NO. 59-J
HOURS 206-230
CATALYST Spent CM&S

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

	FRESH FEED			WET GAS	At Wt. Balance		RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		CONDENSATE			
	%	m/hr	#/hr	%	m/hr	#/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	37.477	16.399	459.33	6.420	0.965	27.03	2.504	18.903	3.469	-15.434	-432.30				
H_2 2.016	58.500	25.598	51.60	37.350	5.616	11.32	14.565	40.163	20.181	-19.982	-40.28				
CO_2 44.010	2.433	1.065	46.87	31.255	4.697	206.72	12.188	13.253	16.885	3.632	159.85	10.030			
N_2 28.016	0.150	0.066	1.85	2.280	0.343	9.61	0.889	0.955	1.232						
CH_4 16.042	1.440	0.630	10.10	13.360	2.008	32.21	5.210	5.840	7.218	1.378	22.11	1.387			
C_2H_4 28.052				2.590	0.389	10.91	1.010	1.010	1.399	0.389	10.91	0.685			
C_2H_6 30.069				0.875	0.132	3.97	0.341	0.341	0.473	0.132	3.97	0.249			
C_1+C_2											36.99	2.321			
C_3H_6 42.078				2.180	0.328	13.80	0.850	0.850	1.178	0.328	13.80	0.866	4.32	3.194	0.200
C_3H_8 44.094				0.200	0.030	1.32	0.078	0.078	0.108	0.030	1.32	0.083	4.24	0.311	0.020
C_4H_8 56.104				1.555	0.234	13.13	0.606	0.606	0.840	0.234	13.13	0.824	5.00	2.626	0.165
C_4H_{10} 58.120				0.630	0.095	5.52	0.246	0.246	0.341	0.095	5.52	0.346	4.86	1.136	0.071
C_5H_{10} 70.130				0.795	0.120	8.42	0.310	0.310	0.430	0.120	8.42	0.528	5.45	1.545	0.097
C_5H_{12} 72.146				0.225	0.034	2.45	0.088	0.088	0.122	0.034	2.45	0.154	5.25	0.467	0.029
C_6H_{12} 84.156				0.285	0.043	3.62	0.111	0.111	0.154	0.043	3.62	0.227	5.54	0.653	0.041
C_5-C_6											48.26	3.028		9.932	0.623
TOTAL		43.758	569.75		15.034	350.03	38.996	82.754	62.046						
H_2+CO	95.977	41.997	1593794	SCFH	6.581		17.069	59.066	23.650	-35.416					
H_2/CO		1.56	Factor	627433	5.82		5.82	2.12	5.82	1.29					

Weight Recovery, %	96.97	Catalyst Age, hrs.	230	Space Velocity, vhv	2404	RECOVERED OIL	0.530**
Pressure, psig	402	Inlet Velocity, Ft/sec	1.03	Catalyst Vol., CF	7.21	TOTAL OIL	
Temperature, °F	700	Bed Depth, Ft	10.93	Weight, #	765	WATER SOLUBLE CHEMICALS	0.301**
Recycle Ratio	0.89	Bed Density, #/CF	116	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$ = 13.67		TOTAL LIQUID PRODUCTS C_5+	

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY	
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+ / C_1+	
65.64	94.12	78.06	84.33	81.65	49.75	59.96	78.93	HYDROCARBON TOTAL—C_1+
								GROSS WATER
								NET WATER

	74.33	4.664	11.423	0.717
	122.59	7.692	21.355	1.340
	15.95	1.001	1.980	0.124
	138.54	8.693	23.335	1.464
7.185**	129.44	8.121	15.539	0.975
	145.39	9.122	17.519	1.099
	175.53	11.014		

YIELD BASIS H_2+CO FED

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	73.0	8.339	98.0	8.172
400-550	14.0	1.599	91.4	1.461
550 +	13.0	1.485	114.6	1.702

	RECOVERY %	#/hr	gal/hr	
PROPYLENE	41.2	5.69		
C_3 POLY GASO.	87.5	4.98	0.833	
C_3 POLY TAR	12.5	0.71	0.094	

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	-	-	68.0
C_4 POLY GASO.	5.98	11.49	1.921	1.5
C_4H_{10}	4.86	(5.52) 5.48	(1.136) 1.127	68.0
C_4-FREE GASO.			11.670	5.8
C_4 POLY TAR	7.53	1.64	0.218	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	14.718	0.9235	5007
GAS OIL	1.461	0.0917	497
FUEL OIL	1.702	0.1068	579
POLY TAR	0.312	0.0196	106
TOTAL	18.193	1.1416	6189
W. S. CHEM.	1.980	0.1242	673
TOTAL	20.173	1.2658	6862

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-J
HOURS 206-230

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

OPERATING CONDITIONS				PRODUCT TESTS			CATALYST DATA						
PRESSURES PSIG		RATES S.C.F.H.			OIL	WATER	INVENTORY DATA		PARTICLE SIZE				
Oxygen	429	Fresh Feed	16606	°API	49.3	10.5	In Reactor at Start of Period		Screen Analysis			Sedimentation	
Natural Gas	427	Recycle	14799	Neut. No.	28.1	28.2	Fresh Catalyst Added		Mesh	Microns	%	Microns	%
Generator Outlet	410	Combined Feed	31405	Sap. No.	45.2	37.7	Total		On 40	419+	37.5	80+	
Reactor Inlet	402	Wet Gas—Measured	5424	Hydrox. No.			Catalyst Recovered	100	100	150	41.5	40—80	
Condenser Inlet		Adjusted	5706	Bromine No.	89		In Reactor at End of Period		150	105	8.3	20—40	
Product Accumulator	374	Loss	282	Pour °F.	below -35°				200	74	5.9	10—20	
				Chemicals, % by K_2CO_3		11.3	REACTOR d-p, Inches H_2O		250	62	3.2	0—20	
							No. Height		325	44	2.8		
TEMPERATURES—°F.		Recycle/Fresh Feed	0.89				0 See Period A	39	<325		0.8		
Oxygen	331	Inlet Velocity—ft./sec.	1.03				1	56	CATALYST				
Natural Gas	322	Fresh Feed Rate—S.C.F.H.	15938	HEMPEL, DIST. %		°API	2	55	Bulk Density, Lbs./Cu.Ft.				
Generator	--	per Cu. Ft. Dense Bed	2404	205 °F.			3	50	Aerated			130	
Quench Accumulator	148	per Lb. Catalyst	20.73	400	72.0	53.8	4	24	Settled			131	
Reactor Inlet	120	per Sq. Ft.	24148	400-550	14.0	35.9	Total	224	Compacted			157	
Condenser Inlet	580			550+	14.0				Particle Density, gm./cc.			3.96	
Product Accumulator	92	Heat Transfer Calculations					CALCULATED FROM dp		NH_3 Value, ml./gm.				
Catalyst No. Height		Steam Rate = 316#/hr		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	116	N_2 Surface, m^2/gm.				
1 See Period A	621	@ 728 psia & 489°F		Naphtha °F.			Inventory, Lbs.	769					
2	701	1203 BTU/#		IBP	106		Bed Depth, Ft.	10.04	CHEMICAL ANALYSIS				
3	708	Water in @ 70.6°F = 39°F		10%	146		Vol., Cu. Ft.	6.63	Fe				
4	680	Net BTU/# steam = 1164		50%	236				C			11.8	
5	714	1164 x 316 = 367824		90%	356				O				
6	698	Ave. Bed Temp = 700°F		EP	392				H				
7	676	dT = 700-489=211°F		Rec.	97.0				K_2O, W+, % basis Fe				
8	665	Tube Area = 19.7 sq ft							X-Ray Analysis—				
9	667								$Fe_{20}C_9$				
10	660	$K = \frac{367824}{(19.7)(211)} = 88.5$ BTU/°F/sq ft							Fe_3O_4				
11	637								Fe				

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

RUN NO. 59-K
HOURS 230-254
CATALYST Spent CM&S

	FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H_2+CO FED			
					At Wt. Balance							CONDENSATE			
	%	m/hr	#/hr	%	m/hr	#/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	37.627	14.947	418.67	11.430	1.598	44.76	4.856	19.803	6.454	-13.349	-373.91				
H_2 2.016	58.843	23.373	47.12	39.523	5.527	11.14	16.791	40.164	22.318	-17.846	-35.98				
CO_2 44.010	2.240	0.890	39.17	28.393	3.970	174.73	12.063	12.953	16.033	3.080	135.56	9.321			
N_2 28.016	0.243	0.097	2.72	1.307	0.183	5.13	0.555	0.652	0.738						
CH_4 16.042	1.047	0.416	6.67	10.103	1.413	22.67	4.292	4.708	5.705	0.997	16.00	1.100			
C_2H_4 28.052				2.627	0.367	10.30	1.116	1.116	1.483	0.367	10.30	0.708			
C_2H_6 30.068				1.013	0.142	4.27	0.430	0.430	0.572	0.142	4.27	0.294			
C_1+C_2											30.57	2.102			
C_3H_6 42.078				2.173	0.304	12.79	0.923	0.923	1.227	0.304	12.79	0.879	4.32	2.961	0.204
C_3H_8 44.094				0.197	0.028	1.23	0.084	0.084	0.112	0.028	1.23	0.085	4.24	0.290	0.020
C_4H_8 56.104				1.497	0.209	11.73	0.636	0.636	0.845	0.209	11.73	0.807	5.00	2.346	0.161
C_4H_{10} 58.120				0.523	0.073	4.24	0.222	0.222	0.295	0.073	4.24	0.292	4.86	0.872	0.060
C_5H_{10} 70.130				0.770	0.108	7.57	0.327	0.327	0.435	0.108	7.57	0.521	5.45	1.389	0.096
C_5H_{12} 72.146				0.237	0.033	2.38	0.101	0.101	0.134	0.033	2.38	0.164	5.25	0.453	0.031
C_6H_{12} 84.156				0.207	0.029	2.44	0.088	0.088	0.117	0.029	2.44	0.168	5.54	0.440	0.030
C_3-C_6											42.38	2.916		8.751	0.602
TOTAL		39.723	514.31		13.984	315.38	42.485	82.208	63.778						
H_2+CO	96.470	38.320	145428525 SCFH		7.125		21.647	59.987	28.772	-31.195					
H_2/CO		1.56	Factor 6876230		3.46		3.46	2.03	3.46	1.34					

Weight Recovery, %	95.65	Catalyst Age, hrs.		Space Velocity, vhv	1791
Pressure, psig	413	Inlet Velocity, Ft/sec	0.98	Catalyst Vol., CF	8.12
Temperature, °F	672	Bed Depth, Ft	12.3	Weight, #	982
Recycle Ratio	1.07	Bed Density, #/CF	121	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$ =	8.44

	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF
RECOVERED OIL	0.473**	66.34	4.562		10.410	0.716
TOTAL OIL		108.72	7.478		19.161	1.318
WATER SOLUBLE CHEMICALS	0.269**	14.27	0.981		1.809	0.124
TOTAL LIQUID PRODUCTS C_3+		122.99	8.459		20.970	1.442
NET WATER	6.567**	118.32	8.136		14.204	0.977
GROSS WATER		132.59	9.117		16.013	1.101
HYDROCARBON TOTAL—C_1+		153.56	10.559			

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
64.80	89.31	76.35	81.41	67.41	44.43	52.02	80.09

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	73.5	7.651	98.0	7.498
400-550	14.8	1.541	91.4	1.408
550 +	11.7	1.218	114.6	1.396

	RECOVERY %	#/hr	gal/hr
PROPYLENE	40.1	5.13	
C_3 POLY GASO.	87.5	4.49	0.751
C_3 POLY TAR	12.5	0.64	0.085

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.64	0.128	68.0
C_4 POLY GASO.	5.98	9.70	1.623	1.5
C_4H_{10}	4.86	4.24	0.872	68.0
C_4-FREE GASO.			10.531	5.8
C_4 POLY TAR	7.53	1.39	0.185	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	13.154	0.9045	4904
GAS OIL	1.408	0.0968	525
FUEL OIL	1.396	0.0960	520
POLY TAR	0.270	0.0186	101
TOTAL	16.228	1.1159	6050
W. S. CHEM.	1.809	0.1244	674
TOTAL	18.037	1.2403	6724

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-K
HOURS 230-254

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	431	Fresh Feed	15075
Natural Gas	430	Recycle	16123
Generator Outlet		Combined Feed	31198
Reactor Inlet	413	Wet Gas—Measured	4931
Condenser Inlet		Adjusted	5307
Product Accumulator	377	Loss	376
TEMPERATURES—°F.		Recycle/Fresh Feed	1.07
Oxygen	342	Inlet Velocity—ft./sec.	0.98
Natural Gas	334	Fresh Feed Rate—S.C.F.H.	14543
Generator	--	per Cu.Ft. Dense Bed	1791
Quench Accumulator	152	per Lb. Catalyst	14.81
Reactor Inlet	143	per Sq. Ft.	22035
Condenser Inlet	56.5	Heat Transfer Calculations	
Product Accumulator	89	Steam Rate=276#/hr	
Catalyst No. Height		@721 psia & 495°F=	
1 See Period A	611	1202 BTU/#	
2	669	Water in @ 71.4°F=39°F	
3	678	Net BTU/# Steam=1163	
4	653	1163x276=320988	
5	686	Ave. Bed Temp=672°F	
6	673	dT=672-495=177°F	
7	652	Tube Area=22.2 sq ft	
8	642		
9	643	$K = \frac{320988}{(22.2)(177)} = 81.7$ BTU/°F/sq ft	
10	637		
11	614		

PRODUCT TESTS

	OIL	WATER
° API	51.8	10.7
Neut. No.	30.9	28.7
Sap. No.	49.6	38.6
Hydrox. No.		
Bromine No.	91	
Pour °F.	below -40	
Chemicals, % by K_2CO_3		11.3
HEMPEL, DIST. %		°API
205 °F.		
400	72.5	55.2
400-550	14.8	37.4
550+	12.7	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	110	
10%	140	
50%	226	
90%	346	
EP	388	
Rec.	97.0	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	219
Total	
Catalyst Recovered	98
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	42
1	63
2	61
3	60
4	60
Total	286
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	121
Inventory, Lbs.	982
Bed Depth, Ft.	12.30
Vol., Cu. Ft.	8.12

PARTICLE SIZE

Screen Analysis			Sedimentation	
Mesh	Microns	%	Microns	%
On 40	419+	34.6	80+	
100	150	43.8	40—80	
150	105	8.9	20—40	
200	74	6.9	10—20	
250	62	2.8	0—20	
325	44	1.4		
<325		1.6		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	135
Settled	136
Compacted	160
Particle Density, gm./cc.	4.10
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	66.5
C	9.65
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	1.44

RUN NO. 59-L
HOURS 254-267
CATALYST

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

FRESH FEED				WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H_2+CO FED								
					At Wt. Balance							CONDENSATE				YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*				
	%	m/hr	#/hr	%	m/hr	#/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF		CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
CO 28.010	36.437	14.514	406.54	9.360	1.110	31.08	3.945	18.459	5.055	-13.404	-375.46									
H_2 2.016	60.180	23.972	48.33	34.040	4.036	8.13	14.348	38.320	18.384	-19.936	-40.20					400 EP	71.9	7.889	98.0	7.731
CO_2 44.010	2.463	0.981	43.17	32.826	3.891	171.23	13.836	14.817	17.727	2.910	128.06	8.768				400-550	12.8	1.404	91.4	1.283
N_2 28.016	0.107	0.043	1.20	1.457	0.173	4.85	0.614	0.657	0.787							550 +	15.3	1.679	114.6	1.924
CH_4 16.042	0.813	0.324	5.20	11.660	1.382	22.17	4.914	5.238	6.296	1.058	16.97	1.162								
C_2H_6 28.052				2.557	0.303	8.50	1.078	1.078	1.381	0.303	8.50	0.582					RECOVERY %	#/hr	gal/hr	
C_2H_6 30.068				1.427	0.169	5.08	0.601	0.601	0.770	0.169	5.08	0.348				PROPYLENE	48.0	6.24		
C_1+C_2											30.55	2.092				C_3 POLY GASO.	87.5	5.46	0.913	
C_3H_6 42.078				2.610	0.309	13.00	1.100	1.100	1.409	0.309	13.00	0.890	4.32	3.009	0.206	C_3 POLY TAR	12.5	0.78	0.104	
C_3H_8 44.094				0.313	0.037	1.63	0.132	0.132	0.169	0.037	1.63	0.112	4.24	0.384	0.026					
C_4H_8 56.104				1.753	0.208	11.67	0.739	0.739	0.947	0.208	11.67	0.799	5.00	2.334	0.160		#/gal	#/hr	gal/hr	RVP
C_4H_{10} 58.120				0.733	0.087	5.05	0.309	0.309	0.396	0.087	5.05	0.346	4.86	1.039	0.071	C_4H_8	5.00	-	-	68.0
C_5H_{10} 70.130				0.340	0.100	7.01	0.354	0.354	0.454	0.100	7.01	0.480	5.45	1.286	0.088	C_4 POLY GASO.	5.98	10.21	1.708	1.5
C_5H_{12} 72.146				0.207	0.025	1.80	0.087	0.087	0.112	0.025	1.80	0.123	5.25	0.343	0.023	C_4H_{10}	4.86	(5.05) 4.97	(1.039) 1.023	68.0
C_6H_{12} 84.156				0.217	0.026	2.19	0.091	0.091	0.117	0.026	2.19	0.150	5.54	0.395	0.027	C_4-FREE GASO.			10.668	5.8
C_5-C_6											42.35	2.900		8.790	0.601	C_4 POLY TAR	7.53	1.46	0.194	
TOTAL		39.834	504.44		11.856	293.39	42.148	81.982	61.717											
H_2+CO	96.617	38.486	1460559 SCFH		5.146		18.293	56.779	23.439	-33.340							gal/hr	gal/MCF	Bbl/Day	
H_2/CO		1.65	Factor 684669		3.64		3.64	2.08	3.64	1.49						10 # RVP 400 EP GASOLINE	13.399	0.9174	4974	
Weight Recovery, %		97.98	Catalyst Age, hrs.			Space Velocity, vhv		1586	RECOVERED OIL	0.502**	70.47	4.825		10.972	0.751	GAS OIL	1.283	0.0878	476	
Pressure, psig		410	Inlet Velocity, Ft/sec		0.97	Catalyst, Vol., CF		9.21	TOTAL OIL		112.82	7.725		19.762	1.352	FUEL OIL	1.924	0.1317	714	
Temperature, °F		657	Bed Depth, Ft		13.95	Weight, #		1225	WATER SOLUBLE CHEMICALS	0.304**	16.15	1.106		2.037	0.139	POLY TAR	0.298	0.0204	111	
Recycle Ratio		1.06	Bed Density, #/CF		133	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$		= 9.33	TOTAL LIQUID PRODUCTS C_3+		128.97	8.831		21.799	1.491	TOTAL	16.904	1.1573	6275	
FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY		NET WATER	6.907**	124.43	8.519		14.937	1.023	W. S. CHEM.	2.037	0.1395	756	
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+ / C_1+		GROSS WATER		140.58	9.625		16.974	1.162	TOTAL	18.941	1.2968	7031	
70.24	92.35	83.16	86.63	72.61	52.03	58.72	80.85		HYDROCARBON TOTAL—C_1+		159.52	10.923								

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-L
HOURS 254-267

OPERATING CONDITIONS				PRODUCT TESTS			CATALYST DATA					
PRESSURES PSIG		RATES S.C.F.H.			OIL	WATER	INVENTORY DATA		PARTICLE SIZE			
Oxygen	435	Fresh Feed	15117				In Reactor at Start of Period		Screen Analysis			Sedimentation
Natural Gas	435	Recycle	15995	°API	10.8	51.9	Fresh Catalyst Added	307	Mesh	Microns	%	Microns %
Generator Outlet	417	Combined Feed	31112	Neut. No.	29.2	25.8	Total		On 40	419+	36.1	80+
Reactor Inlet	410	Wet Gas—Measured	4343	Sap. No.	47.8	35.0	Catalyst Recovered	52	100	150	41.7	40—80
Condenser Inlet		Adjusted	4499	Hydrox. No.			In Reactor at End of Period		150	105	8.3	20—40
Product Accumulator	375	Loss	156	Bromine No.	89				200	74	6.5	10—20
				Pour °F.	below -40				250	62	2.0	0—20
				Chemicals, % by K_2CO_3		12.0	REACTOR d-p, Inches H_2O		325	44	3.6	
							No. Height		<325		1.8	
TEMPERATURES—°F.		Recycle/Fresh Feed	1.06				0 See Period A	46				
Oxygen	300	Inlet Velocity—ft./sec.	0.97				1	66	CATALYST			
Natural Gas	334	Fresh Feed Rate—S.C.F.H.	14606	HEMPEL, DIST. %			2	68	Bulk Density, Lbs./Cu.Ft.			
Generator		per Cu. Ft. Dense Bed	1586	205 °F.		°API	3	67	Aerated			143
Quench Accumulator	138	per Lb. Catalyst	11.92	400	70.9	54.6	4	156	Settled			145
Reactor Inlet	208	per Sq. Ft.	22130	400-550	12.8	36.8	Total	357	Compacted			169
Condenser Inlet	549			550+	16.3				Particle Density, gm./cc.			4.20
Product Accumulator	87	Heat Transfer Calculations					CALCULATED FROM dp		NH_3 Value, ml./gm.			
Catalyst No. Height		Steam Rate = 359#/hr		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	133	N_2 Surface, m^2/gm.			
1 See Period A	617	@ 707 psia & 505°F =		Naphtha °F.			Inventory, Lbs.	1225				
2	654	1201 BTU/#		IBP	104		Bed Depth, Ft.	13.95	CHEMICAL ANALYSIS			
3	660	Water in @ 59.1=27.1		10%	140		Vol., Cu. Ft.	9.21	Fe			
4	642	Net BTU/# steam=1174		50%	224				C			9.85
5	666	1174x359=421466		90%	348				O			
6	667	Ave. Bed Temp.=657°F		EP	392				H			
7	653	dT=657-505=152°F		Rec.	97.5				K_2O, W+, % basis Fe			
8	633	Tube Area=25.4 sq ft							X-Ray Analysis—			
9	629								$Fe_{2n}C_9$			
10	626	$K = \frac{421466}{(25.4)(152)} = 110.7$ BTU/°F/sq ft							Fe_3O_4			
11	599								Fe			

RUN NO. 59-M
HOURS 267-291
CATALYST

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

	FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H_2+CO FED			
	%	m/hr	#/hr	%	At Wt. Balance m/hr	At Wt. Balance #/hr	m/hr	m/hr	m/hr	m/hr	#/hr	CONDENSATE #/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	37.333	14.247	399.07	7.840	0.872	24.42	3.226	17.473	4.098	-13.375	-374.65				
H_2 2.016	59.107	22.556	45.47	31.484	3.503	7.06	12.957	35.513	16.460	-19.053	-38.41				
CO_2 44.010	2.627	1.002	44.10	34.267	3.812	167.78	14.101	15.103	17.913	2.810	123.68	8.856			
N_2 28.016	0.063	0.024	0.67	1.863	0.207	5.80	0.767	0.791	0.974						
CH_4 16.042	0.870	0.332	5.33	11.953	1.330	21.34	4.919	5.251	6.249	0.998	16.01	1.146			
C_2H_4 28.052				2.850	0.317	8.89	1.173	1.173	1.490	0.317	8.89	0.637			
C_2H_6 30.068				1.610	0.179	5.38	0.663	0.663	0.842	0.179	5.38	0.385			
C_1+C_2											30.28	2.168			
C_3H_6 42.078				3.353	0.373	15.70	1.380	1.380	1.753	0.373	15.70	1.124	4.32	3.634	0.260
C_3H_8 44.094				0.400	0.045	1.98	0.165	0.165	0.210	0.045	1.98	0.142	4.24	0.467	0.033
C_4H_8 56.104				2.257	0.251	14.08	0.929	0.929	1.180	0.251	14.08	1.008	5.00	2.816	0.202
C_4H_{10} 58.120				0.687	0.076	4.42	0.283	0.283	0.359	0.076	4.42	0.316	4.86	0.909	0.065
C_5H_{10} 70.130				1.013	0.113	7.92	0.417	0.417	0.530	0.113	7.92	0.567	5.45	1.453	0.104
C_6H_{12} 72.146				0.210	0.023	1.66	0.086	0.086	0.109	0.023	1.66	0.119	5.25	0.316	0.023
C_7H_{12} 84.156				0.213	0.024	2.02	0.088	0.088	0.112	0.024	2.02	0.145	5.54	0.365	0.026
C_3-C_6											47.78	3.421		9.960	0.713
TOTAL		38.166	494.64		11.125	288.45	41.154	79.320	60.042						
H_2+CO	96.440	36.803	1396644 SCFH	4.375			16.183	52.986	20.558	-32.428					
H_2/CO		1.58	Factor 716002	4.02			4.02	2.03	4.02	1.42					

Weight Recovery, %	97.95	Catalyst Age, hrs.		Space Velocity, vhv	1073	RECOVERED OIL	0.454**
Pressure, psig	417	Inlet Velocity, Ft/sec	0.92	Catalyst Vol., CF	13.01	TOTAL OIL	
Temperature, °F	650	Bed Depth, Ft	19.71	Weight, #	1795	WATER SOLUBLE CHEMICALS	0.309**
Recycle Ratio	1.08	Bed Density, #/CF	138	Effluent $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$ Shift Ratio	=10.28	TOTAL LIQUID PRODUCTS C_3+	

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	$CO+H_2$	C_3+/C_1+
70.85	93.88	84.47	88.11	76.55	53.65	61.20	80.85

NET WATER	7.000**	126.12	9.030		15.140	1.084
GROSS WATER		142.49	10.202		17.205	1.232
HYDROCARBON TOTAL—C_1+		158.13	11.322			

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	72.0	7.182	98.0	7.038
400-550	14.4	1.436	91.4	1.313
550 +	13.6	1.357	114.6	1.555

	RECOVERY %	#/hr	gal/hr
PROPYLENE	49.2	7.72	
C_3 POLY GASO.	87.5	6.75	1.129
C_3 POLY TAR	12.5	0.97	0.129

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.63	0.126	68.0
C_4 POLY GASO.	5.98	11.77	1.968	1.5
C_4H_{10}	4.86	4.42	0.909	68.0
C_4-FREE GASO.			10.301	5.8
C_4 POLY TAR	7.53	1.68	0.223	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	13.304	0.9526	5165
GAS OIL	1.313	0.0940	510
FUEL OIL	1.555	0.1113	603
POLY TAR	0.352	0.0252	137
TOTAL	16.524	1.1831	6415
W. S. CHEM.	2.065	0.1479	802
TOTAL	18.589	1.3310	7217

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-M
HOURS 267-291

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	440	Fresh Feed	14482
Natural Gas	440	Recycle	15618
Generator Outlet	423	Combined Feed	30100
Reactor Inlet	417	Wet Gas—Measured	4073
Condenser Inlet		Adjusted	4222
Product Accumulator	373	Loss	149
TEMPERATURES—°F.		Recycle/Fresh Feed	1.08
Oxygen	303	Inlet Velocity—ft./sec.	0.92
Natural Gas	331	Fresh Feed Rate—S.C.F.H.	13966
Generator		per Cu. Ft. Dense Bed	1073
Quench Accumulator	157	per Lb. Catalyst	7.78
Reactor Inlet	296	per Sq. Ft.	21161
Condenser Inlet	544	Heat Transfer Calculations	
Product Accumulator	90	Steam Rate=389#/hr	
Catalyst No. Height		@ 705 psia & 506°F=	
1 See Period A	629	1201 BTU/#	
2	652	Water in @ 61.3=29.3	
3	659	Net BTU/# steam=1172	
4	621	1172x389=455908	
5	664	Ave. Bed Temp=650	
6	663	dT=650-506=144°F	
7	652	Tube Area=35.7 sq ft	
8	642		
9	633	$K=\frac{455908}{(35.7)(144)}=88.7$ BTU/°F/sqft	
10	627		
11	604		

PRODUCT TESTS			
	OIL	WATER	
°API	52.5	10.8	
Neut. No.	30.2	26.8	
Sap. No.	49.1	35.8	
Hydrox. No.			
Bromine No.	89		
Pour °F.	below -40		
Chemicals, % by K_2CO_3		12.0	
HEMPEL. DIST. %		°API	
205 °F.			
400	71.0	54.5	
400-550	14.4	37.1	
550+	14.6		
A. S. T. M. DIST. ON			
Naphtha °F.			
IBP	108		
10%	144		
50%	228		
90%	350		
EP	390		
Rec.	97.0		

CATALYST DATA								
INVENTORY DATA		PARTICLE SIZE						
		Screen Analysis			Sedimentation	
In Reactor at Start of Period		Mesh	Microns	%	Microns	%
Fresh Catalyst Added	288	On 40	419+	45.8	80+	
Total		100	150	39.2	40—80	
Catalyst Recovered	64.3	150	105	7.3	20—40	
In Reactor at End of Period		200	74	4.9	10—20	
		250	62	1.0	0—20	
REACTOR d-p, Inches H_2O		325	44	1.4		
No. Height		<325		0.4		
0 See Period A	48					
1	68	CATALYST				
2	72	Bulk Density, Lbs./Cu.Ft.				
3	70	Aerated			145	
4	265	Settled			146	
Total	523	Compacted			167	
		Particle Density, gm./cc.			4.55	
CALCULATED FROM dp		NH_3 Value, ml./gm.				
Density, Lbs./Cu.Ft.	138	N_2 Surface, m^2/gm.				
Inventory, Lbs.	1795					
Bed Depth, Ft.	19.71	CHEMICAL ANALYSIS				
Vol., Cu. Ft.	13.01	Fe				
		C			7.18	
		O				
		H				
		K_2O, W+. % basis Fe				
		X-Ray Analysis—				
		$Fe_{20}C_9$				
		Fe_3O_4				
		Fe				

RUN NO. 59-N
HOURS 291-315
CATALYST Spent CM&S

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

	FRESH FEED			WET GAS	At Wt. Balance		RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H_2+CO FED			
												CONDENSATE			
	%	m/hr	#/hr	%	m/hr	#/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF
CO 28.010	38.420	14.040	393.25	7.670	0.844	23.64	3.160	17.200	4.004	-13.196	-369.61				
H_2 2.016	57.880	21.150	42.63	31.302	3.444	6.95	12.898	34.048	16.342	-17.706	-35.68				
CO_2 44.010	2.676	0.978	43.04	36.600	4.029	177.32	15.080	16.058	19.109	3.051	134.28	10.055			
N_2 28.016	0.177	0.065	1.82	1.617	0.178	4.99	0.666	0.731	0.844						
CH_4 16.042	0.847	0.310	4.97	11.413	1.256	20.15	4.703	5.013	5.959	0.946	15.18	1.137			
C_2H_4 28.052				2.747	0.302	8.47	1.132	1.132	1.434	0.302	8.47	0.634			
C_2H_6 30.068				1.623	0.179	5.38	0.669	0.669	0.848	0.179	5.38	0.403			
C_1+C_2											29.03	2.174			
C_3H_6 42.078				2.767	0.305	12.83	1.140	1.140	1.445	0.305	12.83	0.961	4.32	2.970	0.222
C_3H_8 44.094				0.317	0.035	1.54	0.131	0.131	0.166	0.035	1.54	0.115	4.24	0.363	0.027
C_4H_8 56.104				1.867	0.205	11.50	0.769	0.769	0.974	0.205	11.50	0.861	5.00	2.300	0.172
C_4H_{10} 58.120				0.640	0.070	4.07	0.264	0.264	0.334	0.070	4.07	0.305	4.86	0.837	0.063
C_5H_{10} 70.130				0.973	0.107	7.50	0.401	0.401	0.508	0.107	7.50	0.562	5.45	1.376	0.103
C_5H_{12} 72.146				0.197	0.022	1.59	0.081	0.081	0.103	0.022	1.59	0.119	5.25	0.303	0.023
C_6H_{12} 84.156				0.267	0.029	2.44	0.110	0.110	0.139	0.029	2.44	0.183	5.54	0.440	0.033
C_3-C_6											41.47	3.106		8.589	0.643
TOTAL		36.543	485.71		11.005	288.37	41.204	77.747	59.849						
H_2+CO	96.300	35.190	13354884 SCFH		4.288		16.058	51.248	20.346	-30.902					
H_2/CO		1.51	Factor 748789		4.08		4.08	1.98	4.08	1.34					
									RECOVERED OIL	0.400**	56.14	4.204		8.839	0.662
									TOTAL OIL		97.61	7.310		17.428	1.305
									WATER SOLUBLE CHEMICALS	0.308**	16.32	1.222		2.044	0.153
									TOTAL LIQUID PRODUCTS C_3+		113.93	8.532		19.472	1.458
									NET WATER	6.932**	124.88	9.351		14.991	1.123
									GROSS WATER		141.20	10.573		17.035	1.276
									HYDROCARBON TOTAL—C_1+		142.96	10.706			

Weight Recovery, %	95.71	Catalyst Age, hrs.		Space Velocity, vhv	1102
Pressure, psig	420	Inlet Velocity, Ft/sec	0.90	Catalyst Vol., CF	12.12
Temperature, °F	653	Bed Depth, Ft	18.36	Weight, #	1709
Recycle Ratio	1.13	Bed Density, #/C.F	141	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$	11.25

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	$CO+H_2$	C_3+/C_1+
69.88	93.99	83.72	87.81	76.72	52.00	60.30	79.69

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	74.7	6.603	98.0	6.471
400-550	11.6	1.025	91.4	0.937
550 +	13.7	1.211	114.6	1.388

	RECOVERY %	#/hr	gal/hr
PROPYLENE	47.5	6.09	
C_3 POLY GASO.	87.5	5.33	0.891
C_3 POLY TAR	12.5	0.76	0.101

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.44	0.088	68.0
C_4 POLY GASO.	5.98	9.68	1.618	1.5
C_4H_{10}	4.86	4.07	0.837	68.0
C_4-FREE GASO.			9.481	5.8
C_4 POLY TAR	7.53	1.38	0.183	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	12.024	0.9003	4881
GAS OIL	0.937	0.0702	381
FUEL OIL	1.388	0.1039	563
POLY TAR	0.284	0.0213	115
TOTAL	14.633	1.0957	5940
W. S. CHEM.	2.044	0.1531	830
TOTAL	16.677	1.2488	6770

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-N
HOURS 291-315

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

OPERATING CONDITIONS				PRODUCT TESTS			CATALYST DATA				
PRESSURES PSIG		RATES S.C.F.H.			OIL	WATER	INVENTORY DATA		PARTICLE SIZE		
Oxygen	442	Fresh Feed	13868	°API	53.5	10.7	In Reactor at Start of Period		Screen Analysis		Sedimentation
Natural Gas	441	Recycle	15637	Neut. No.	31.1	26.0	Fresh Catalyst Added		Mesh / Microns / %		Microns / %
Generator Outlet	425	Combined Feed	29505	Sap. No.	51.2	34.4	Total		On 40	419+	40.6	80+	
Reactor Inlet	420	Wet Gas—Measured	3875	Hydrox. No.			Catalyst Recovered	47	100	150	39.8	40—80	
Condenser Inlet		Adjusted	4177	Bromine No.	91		In Reactor at End of Period		150	105	8.0	20—40	
Product Accumulator	375	Loss	302	Pour °F.	below -40				200	74	6.0	10—20	
				Chemicals, % by K_2CO_3		12.0	REACTOR d-p, Inches H_2O		250	62	3.2	0—20	
							No. Height		325	44	2.0		
TEMPERATURES—°F.		Recycle/Fresh Feed	1.13				0 See period A	49	<325		0.4		
Oxygen	345	Inlet Velocity—ft./sec.	0.90				1	70	CATALYST				
Natural Gas	307	Fresh Feed Rate—S.C.F.H. H_2*CO	13355	HEMPEL. DIST. %		°API	2	73	Bulk Density, Lbs./Cu.Ft.				
Generator	--	per Cu.Ft. Dense Bed	1102	205 °F.			3	71	Aerated			145	
Quench Accumulator	156	per Lb. Catalyst	7.81	400	73.7	54.6	4	235	Settled			146	
Reactor Inlet	316	per Sq. Ft.	20235	400-550	11.6	36.2	Total	498	Compacted			169	
Condenser Inlet	545	Heat Transfer Calculations		550+	14.7				Particle Density, gm./cc.			4.42	
Product Accumulator	88	Steam Rate=382#/hr					CALCULATED FROM dp		NH_3 Value, ml./gm.				
Catalyst No. Height		@ 705 psis & 506°F		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	141	N_2 Surface, m^2/gm.				
1 See Period A	631	1201 BTU/#		Naphtha °F.			Inventory, Lbs.	1702					
2	650	Water in @ 64.1=32°F		IBP	114		Bed Depth, Ft.	18.36	CHEMICAL ANALYSIS				
3	656	Net BTU/# steam=1169		10%	142		Vol., Cu. Ft.	12.12	Fe			69.7	
4	642	1169x382=446558		50%	224				C			7.61	
5	661	Ave. Bed Temp=653°F		90%	356				O			.16	
6	660	dT=653-506=147°F		EP	386				H				
7	650	Tube Area=33.4 sq ft		Rec.	96.5				K_2O, W+, % basis Fe			•	
8	637	$K=\frac{446558}{(33.4)(147)}=90.95$ BTU/°F/sq ft							X-Ray Analysis—				
9	628								$Fe_{20}C_9$				
10	626								Fe_3O_4				
11	603								Fe				

RUN NO. 59-0
HOURS 315-339
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	38.015	13.313	372.89	8.523	0.966	27.06	3.537	16.850	4.503	-12.347	-345.83				
H_2 2.016	58.030	20.323	40.97	32.010	3.630	7.32	13.284	33.607	16.914	-16.693	-33.65				
CO_2 44.010	2.773	0.971	42.73	35.900	4.071	179.13	14.897	15.868	18.968	3.100	136.40	10.685			
N_2 28.016	0.237	0.083	2.33	1.317	0.149	4.17	0.547	0.630	0.696						
CH_4 16.042	0.947	0.332	5.33	11.427	1.296	20.79	4.742	5.074	6.038	0.964	15.46	1.211			
C_2H_4 28.052				2.583	0.293	8.22	1.072	1.072	1.365	0.293	8.22	0.644			
C_2H_6 30.068				1.583	0.179	5.38	0.657	0.657	0.836	0.179	5.38	0.421			
C_1+C_2											29.06	2.276			
C_3H_6 42.078				2.803	0.318	13.38	1.163	1.163	1.481	0.318	13.38	1.048	4.32	3.097	0.243
C_3H_8 44.094				0.313	0.035	1.54	0.130	0.130	0.165	0.035	1.54	0.121	4.24	0.363	0.028
C_4H_8 56.104				1.710	0.194	10.88	0.710	0.710	0.904	0.194	10.88	0.852	5.00	2.176	0.170
C_4H_{10} 58.120				0.577	0.065	3.78	0.239	0.239	0.304	0.065	3.78	0.296	4.86	0.778	0.061
C_5H_{10} 70.130				0.797	0.090	6.31	0.331	0.331	0.421	0.090	6.31	0.494	5.45	1.158	0.091
C_6H_{12} 72.146				0.210	0.024	1.73	0.087	0.087	0.111	0.024	1.73	0.136	5.25	0.330	0.026
C_6H_{12} 84.156				0.247	0.028	2.36	0.103	0.103	0.131	0.028	2.36	0.185	5.54	0.426	0.033
C_5-C_6											39.98	3.132		8.328	0.652
TOTAL		35.022	464.25		11.339	292.15	41.499	76.521	59.513						
H_2+CO	96.043	33.636	12765075 SCFH	4.596			16.821	50.457	21.417	-29.040					
H_2/CO		1.53	Factor 783387	3.76			3.76	1.99	3.76	1.35					

Weight Recovery, %	94.07	Catalyst Age, hrs.		Space Velocity, vhv	1120	RECOVERED OIL	0.343**	48.06
Pressure, psig	419	Inlet Velocity, Ft/sec	0.89	Catalyst Vol., CF	11.40	TOTAL OIL		88.04
Temperature, °F	657	Bed Depth, Ft	17.27	Weight, #	1630	WATER SOLUBLE CHEMICALS	0.284**	15.08
Recycle Ratio	1.18	Bed Density, #/CF	143	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$	= 11.78	TOTAL LIQUID PRODUCTS C_5+		103.12

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	6.048**	108.96
67.62	92.74	82.14	86.34	73.28	49.67	57.55	78.01	GROSS WATER		124.04
								HYDROCARBON TOTAL—C_1+		132.18

**Included in Reactor Effluent Total

YIELD BASIS H_2+CO FED — YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	73.0	5.489	98.0	5.379
400-550	14.0	1.053	91.4	0.962
550 +	13.0	0.978	114.6	1.121

	RECOVERY %	#/hr	gal/hr
PROPYLENE	44.0	5.89	
C_3 POLY GASO.	87.5	5.15	0.861
C_3 POLY TAR	12.5	0.74	0.098

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	0.21	0.042	68.0
C_4 POLY GASO.	5.98	9.34	1.561	1.5
C_4H_{10}	4.86	3.78	0.778	68.0
C_4-FREE GASO.			8.154	5.8
C_4 POLY TAR	7.53	1.33	0.177	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	10.535	0.8253	4474
GAS OIL	0.962	0.0754	409
FUEL OIL	1.121	0.0878	476
POLY TAR	0.275	0.0215	117
TOTAL	12.893	1.0100	5476
W. S. CHEM.	1.903	0.1491	808
TOTAL	14.796	1.1591	6284

Form ML—11

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. 59-0
HOURS 315-339

OPERATING CONDITIONS — PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	442	Fresh Feed	13291
Natural Gas	441	Recycle	15749
Generator Outlet	425	Combined Feed	29040
Reactor Inlet	419	Wet Gas—Measured	3898
Condenser Inlet		Adjusted	4303
Product Accumulator	375	Loss	405
TEMPERATURES—°F.		Recycle/Fresh Feed	1.18
Oxygen	308	Inlet Velocity—ft./sec.	0.89
Natural Gas	351	Fresh Feed Rate—S.C.F.H. H_2+CO	12765
Generator	--	per Cu. Ft. Dense Bed	1120
Quench Accumulator	145	per Lb. Catalyst	7.83
Reactor Inlet	336	per Sq. Ft.	19341
Condenser Inlet	548		
Product Accumulator	90	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate=374#/hr	
1 See Period A	639	@705 psia & 506°F=	
2	655	1201 BTU/#	
3	657	Water in @ 76.3=44.3°F	
4	650	Net BTU/# steam=1157	
5	663	1157x374=432718	
6	661	Ave. Bed Temp=657°F	
7	652	dT=657-506=151°F	
8	633	Tube Area=31.4 sq ft	
9	630	$K = \frac{432718}{(31.4)(151)} = 91.3$ BTU/°F/sq ft	
10	630		
11	605		

PRODUCT TESTS	OIL	WATER
°API	52.5	11.0
Neut. No.	32.4	27.9
Sap. No.	51.7	37.3
Hydrox. No.		
Bromine No.	93	
Pour °F.		
Chemicals, % by K_2CO_3		12.7
HEMPEL, DIST. %		°API
205 °F.		
400	72.0	54.6
400-550	14.0	36.2
550+	14.0	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	118	
10%	144	
50%	224	
90%	340	
EP	380	
Rec.	98.0	

CATALYST DATA — INVENTORY DATA		PARTICLE SIZE
In Reactor at Start of Period		Screen Analysis / Sedimentation
Fresh Catalyst Added		Mesh / Microns / % / Microns / %
Total		On 40 / 419+ / 56.9 / 80+
Catalyst Recovered	81	100 / 150 / 35.7 / 40—80
In Reactor at End of Period		150 / 105 / 4.4 / 20—40
		200 / 74 / 1.6 / 10—20
REACTOR d-p, Inches H_2O		250 / 62 / 0.6 / 0—20
No. Height		325 / 44 / 0.4
0 See Period A	49	<325 / / 0.4 / /
1	71	CATALYST
2	73	Bulk Density, Lbs./Cu.Ft.
3	72	Aerated 145
4	210	Settled 146
Total	475	Compacted 167
		Particle Density, gm./cc. 4.55
CALCULATED FROM dp		NH_3 Value, ml./gm.
Density, Lbs./Cu.Ft.	143	N_2 Surface, m^2/gm.
Inventory, Lbs.	1630	
Bed Depth, Ft.	17.27	CHEMICAL ANALYSIS
Vol., Cu. Ft.	11.40	Fe
		C 8.52
		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-P
HOURS 339-363
CATALYST

	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	CONDENSATE #/gal	CONDENSATE gal/hr	CONDENSATE gal/MCF
CO 28.010	37.087	12.356	346.09	9.570	0.971	27.20	3.980	16.336	4.951	-11.385	-318.89				
H_2 2.016	59.113	19.693	39.70	33.763	3.427	6.91	14.042	33.735	17.469	-16.266	-32.79				
CO_2 44.010	2.620	0.873	38.42	35.580	3.611	158.95	14.796	15.669	18.407	2.738	120.53	9.910			
N_2 28.016	0.180	0.060	1.68	1.600	0.162	4.54	0.665	0.725	0.827						
CH_4 16.042	1.000	0.333	5.34	9.413	0.955	15.32	3.914	4.247	4.869	0.622	9.98	0.821			
C_2H_4 28.052				2.170	0.220	6.17	0.902	0.902	1.122	0.220	6.17	0.507			
C_2H_6 30.068				1.373	0.139	4.18	0.517	0.517	0.710	0.139	4.18	0.344			
C_1+C_2											20.33	1.672			
C_3H_6 42.078				2.470	0.251	10.56	1.027	1.027	1.278	0.251	10.56	0.868	4.32	2.444	0.201
C_3H_8 44.094				0.287	0.029	1.28	0.119	0.119	0.148	0.029	1.28	0.105	4.24	0.302	0.025
C_4H_8 56.104				1.707	0.173	9.71	0.710	0.710	0.883	0.173	9.71	0.798	5.00	1.942	0.160
C_4H_{10} 58.120				0.690	0.070	4.07	0.287	0.287	0.357	0.070	4.07	0.335	4.86	0.837	0.069
C_5H_{10} 70.130				0.877	0.089	6.24	0.365	0.365	0.454	0.089	6.24	0.513	5.45	1.145	0.094
C_5H_{12} 72.146				0.180	0.018	1.30	0.075	0.075	0.093	0.018	1.30	0.107	5.25	0.248	0.020
C_6H_{12} 84.156				0.320	0.032	2.69	0.133	0.133	0.165	0.032	2.69	0.221	5.54	0.486	0.040
C_3-C_6											35.85	2.947		7.404	0.609
TOTAL		33.315	431.22		10.147	259.12	41.586	74.901	58.408						
H_2+CO	96.200	32.049	12162566 SCFH		4.398		18,022	50.071	22.420	-27.651					
H_2/CO		1.59	Factor 822194		3.53		3.53	2.07	3.52	1.43					

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY,%	gal/hr
400 EP	75.0	5.640	98.0	5.527
400-550	14.4	1.083	91.4	0.990
550 +	10.6	0.797	114.6	0.913

	RECOVERY %	#/hr	gal/hr	
PROPYLENE	46.8	4.94		
C_3 POLY GASO.	87.5	4.32	0.722	
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	8.50	1.421	1.5
C_4H_{10}	4.86	(4.07) 3.87	(0.837) 0.797	68.0
C_4 FREE GASO.			8.128	5.8
C_4 POLY TAR	7.53	1.21	0.161	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	10.346	0.8506	4612
GAS OIL	0.990	0.0814	441
FUEL OIL	0.913	0.0751	407
POLY TAR	0.243	0.0200	108
TOTAL	12.492	1.0271	5568
W. S. CHEM.	1.903	0.1565	849
TOTAL	14.395	1.1836	6417

Weight Recovery, %	99.00	Catalyst Age, hrs.		Space Velocity, vhv	1128	RECOVERED OIL	0.343** 48.06
Pressure, psig	419	Inlet Velocity, Ft/sec	0.87	Catalyst Vol., CF	10.78	TOTAL OIL	83.91
Temperature, °F	654	Bed Depth, Ft	16.33	Weight, #	1520	WATER SOLUBLE CHEMICALS	0.284** 15.08
Recycle Ratio	1.25	Bed Density, #/CF	141	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$	10.74	TOTAL LIQUID PRODUCTS C_3+	98.99

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	6.048** 108.96
69.54	92.14	82.60	86.28	69.69	48.22	55.82	82.96	GROSS WATER	124.04
								HYDROCARBON TOTAL—C_1+	119.32

10.199	14.983	1.231	TOTAL
9.810			

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-P
HOURS 339-363

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	442	Fresh Feed	12643
Natural Gas	441	Recycle	15782
Generator Outlet	424	Combined Feed	28425
Reactor Inlet	419	Wet Gas—Measured	3787
Condenser Inlet		Adjusted	3851
Product Accumulator	375	Loss	64
TEMPERATURES—°F.		Recycle/Fresh Feed	1.25
Oxygen	319	Inlet Velocity—ft./sec.	0.87
Natural Gas	327	Fresh Feed Rate—S.C.F.H.	12163
Generator		per Cu. Ft. Dense Bed	1128
Quench Accumulator	147	per Lb. Catalyst	8.00
Reactor Inlet	336	per Sq. Ft.	18429
Condenser Inlet	544		
Product Accumulator	91	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate=350#/hr	
1 See Per. A	631	@ 705 psia & 506°F=	
2	652	1201 BTU/#	
3	657	Water in @ 76.7=45°F	
4	645	Net BTU/# steam=1156	
5	660	1156x350=404600	
6	658	Ave. Bed Temp=654°F	
7	647	dT=654-506=148°F	
8	627	Tube Area=29.6 sq ft	
9	629	$K=\frac{404600}{(29.6)(148)}=92.4$ BTU/°F/sq ft	
10	626		
11	600		

PRODUCT TESTS	OIL	WATER
°API	52.4	11.0
Neut. No.	33.2	29.4
Sap. No.	52.4	39.0
Hydrox. No.		
Bromine No.	91	
Pour °F.		
Chemicals, % by K_2CO_3		12.7
HEMPEL. DIST. %		°API
205 °F.		
400	74.0	53.1
400-550	14.4	37.4
550+	11.6	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	114	
10%	140	
50%	224	
90%	352	
EP	388	
Rec.	97.0	

CATALYST DATA						
INVENTORY DATA		PARTICLE SIZE				
In Reactor at Start of Period		Screen Analysis			Sedimentation	
Fresh Catalyst Added		Mesh	Microns	%	Microns	%
Total		On 40	419+	39.1	80+	
Catalyst Recovered	76	100	150	40.7	40—80	
In Reactor at End of Period		150	105	8.4	20—40	
		200	74	7.2	10—20	
REACTOR d-p, Inches H_2O		250	62	1.6	0—20	
No. Height		325	44	2.0		
0 See Period A	49	<325		1.0		
1	71	CATALYST				
2	72	Bulk Density, Lbs./Cu.Ft.				
3	71	Aerated			146	
4	180	Settled			149	
Total	443	Compacted			177	
		Particle Density, gm./cc.			4.71	
CALCULATED FROM dp		NH_3 Value, ml./gm.				
Density, Lbs./Cu.Ft.	141	N_2 Surface, m^2/gm.				
Inventory, Lbs.	1520					
Bed Depth, Ft.	16.33	CHEMICAL ANALYSIS				
Vol., Cu. Ft.	10.78	Fe				
		C			8.40	
		O				
		H				
		K_2O, W+, % basis Fe				
		X-Ray Analysis—				
		$Fe_{20}C_9$				
		Fe_3O_4				
		Fe				

RUN NO. 59-Q
HOURS 363-387
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	35.853	11.801	330.55	10.183	1.034	28.96	4.437	16.238	5.471	-10.767	-301.59
H_2 2.016	60.767	20.001	40.32	36.556	3.712	7.48	15.930	35.931	19.642	-16.289	-32.84
CO_2 44.010	2.300	0.757	33.32	29.537	2.997	131.89	12.872	13.629	15.869	2.240	98.57
N_2 28.016	0.107	0.035	0.98	1.853	0.188	5.27	0.807	0.842	0.995		
CH_4 16.042	0.973	0.320	5.13	11.577	1.175	18.85	5.045	5.365	6.220	0.855	13.72
C_2H_4 28.052				2.290	0.233	6.54	0.998	0.998	1.231	0.233	6.54
C_2H_6 30.068				1.623	0.165	4.96	0.707	0.707	0.872	0.165	4.96
C_1+C_2											25.22
C_3H_6 42.078				2.497	0.254	10.69	1.088	1.088	1.342	0.254	10.69
C_3H_8 44.094				0.327	0.033	1.46	0.142	0.142	0.175	0.033	1.46
C_4H_8 56.104				1.603	0.163	9.14	0.699	0.699	0.862	0.163	9.14
C_4H_{10} 58.120				0.667	0.068	3.95	0.291	0.291	0.359	0.068	3.95
C_5H_{10} 70.130				0.797	0.081	5.68	0.347	0.347	0.428	0.081	5.68
C_5H_{12} 72.146				0.187	0.019	1.37	0.081	0.081	0.100	0.019	1.37
C_6H_{12} 84.156				0.303	0.031	2.61	0.132	0.132	0.163	0.031	2.61
C_3-C_6											34.90
TOTAL		32.914	410.30		10.153	238.85	43.576	76.490	60.318		
H_2+CO	96.620	31.802	12068.80 SCFH		4.746		20.367	52.169	25.113	-27.056	
H_2/CO		1.69	Factor 828582		3.59		3.59	2.21	3.59	1.51	

Weight Recovery, %	100.62	Catalyst Age, hrs.		Space Velocity, vhv	1179	RECOVERED OIL
Pressure, psig	415	Inlet Velocity, Ft/sec	0.89	Catalyst Vol., CF	10.24	TOTAL OIL
Temperature, °F	652	Bed Depth, Ft	15.52	Weight, #	1455	WATER SOLUBLE CHEMICALS
Recycle Ratio	1.32	Bed Density, #/CF	142	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$	= 9.58	TOTAL LIQUID PRODUCTS C_5+

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY	
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+ /C_1+	
69.15	91.24	81.44	85.08	66.31	45.33	51.86	79.73	

					YIELD BASIS H_2+CO FED				
					CONDENSATE				
					#/MCF	#/gal	gal/hr	gal/MCF	
0.347**	48.74	4.039		7.620	0.631				
	83.64	6.931		14.854	1.230				
0.293**	15.54	1.288		1.973	0.163				
	99.18	8.219		16.827	1.393				
5.949**	107.17	8.880		12.865	1.066				
	122.71	10.168		14.838	1.229				
	124.40	10.309							

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY,%	gal/hr
400 EP	77.0	5.867	98.0	5.750
400-550	11.6	0.884	91.4	0.808
550 +	11.4	0.869	114.6	0.996
		7.620		

	RECOVERY %	#/hr	gal/hr	
PROPYLENE	46.2	4.94		
C_3 POLY GASO.	87.5	4.32	0.722	
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	8.00	1.337	1.5
C_4H_{10}	4.86	(3.95) 3.85	(0.813) 0.793	68.0
C_4-FREE GASO.			8.246	5.8
C_4 POLY TAR	7.53	1.14	0.151	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	10.376	0.8597	4661
GAS OIL	0.808	0.0669	363
FUEL OIL	0.996	0.0825	447
POLY TAR	0.233	0.0193	105
TOTAL	12.413	1.0284	5576
W.S CHEM.	1.973	0.1635	886
TOTAL	14.386	1.1919	6462

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-Q
HOURS 363-387

OPERATING CONDITIONS				PRODUCT TESTS			CATALYST DATA				
PRESSURES PSIG		RATES S.C.F.H.			OIL	WATER	INVENTORY DATA		PARTICLE SIZE		
Oxygen	438	Fresh Feed	12491	°API	52.7	11.0	In Reactor at Start of Period		Screen Analysis		Sedimentation
Natural Gas	437	Recycle	16537	Neut. No.	33.2	30.0	Fresh Catalyst Added		Mesh / Microns / %		Microns / %
Generator Outlet	421	Combined Feed	29028	Sap. No.	52.4	39.6	Total		On 40 / 419+ / 36.3		80+
Reactor Inlet	415	Wet Gas—Measured	3894	Hydrox. No.			Catalyst Recovered	70	100 / 150 / 43.3		40—80
Condenser Inlet		Adjusted	3853	Bromine No.	93		In Reactor at End of Period		150 / 105 / 8.2		20—40
Product Accumulator	375	Loss	-41	Pour °F.					200 / 74 / 5.5		10—20
				Chemicals, % by K_2CO_3		13.3	REACTOR d-p, Inches H_2O		250 / 62 / 2.0		0—20
							No. Height		325 / 44 / 3.0		
TEMPERATURES—°F.		Recycle/Fresh Feed	1.32				0 See Period A	49	<325 / 1.7		
Oxygen	330	Inlet Velocity—ft./sec.	0.89				1	71	CATALYST		
Natural Gas	322	Fresh Feed Rate—S.C.F.H. H_2+CO	12069	HEMPEL, DIST. %		°API	2	73	Bulk Density, Lbs./Cu.Ft.		
Generator	--	per Cu.Ft. Dense Bed	1179	205 °F.			3	71	Aerated		148
Quench Accumulator	139	per Lb. Catalyst	8.29	400	76.0	54.4	4	160	Settled		149
Reactor Inlet	340	per Sq. Ft.	18286	400-550	11.6	37.0	Total	424	Compacted		169
Condenser Inlet	542			550+	12.4				Particle Density, gm./cc.		4.46
Product Accumulator	89	Heat Transfer Calculations					CALCULATED FROM dp		NH_3 Value, ml./gm.		
Catalyst No. Height		Steam Rate=330#/hr		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	142	N_2 Surface, m^2/gm.		
1 See Per. A	620	@ 705 psia & 506°F=		Naphtha °F.			Inventory, Lbs.	1455			
2	649	1201 BTU/#		IBP	108		Bed Depth, Ft.	15.52	CHEMICAL ANALYSIS		
3	655	Water in @=69.9=380F		10%	136		Vol., Cu. Ft.	10.24	Fe		68.4
4	644	Net BTU/# steam=1163		50%	220				C		8.17
5	656	1163x330=383790		90%	348				O		.27
6	655	Ave. Bed Temp=652		EP	384				H		
7	640	dT=652-506=146°F		Rec.	96.5				K_2O, W+, % basis Fe		
8	623	Tube Area=29.2 sq ft							X-Ray Analysis—		
9	624	U= 383790 / (29.2)(146) = 90.0 BTU/°F/sq ft							$Fe_{20}C_9$		
10	623								Fe_3O_4		
11	596								Fe		

RUN NO. 59-R
HOURS 387-411
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	37.374	11.602	324.99	10.133	1.053	29.49	4.247	15.849	5.300	-10.549	-295.50				
H_2 2.016	58.430	18.139	36.58	33.307	3.463	6.98	13.961	32.100	17.424	-14.676	-29.60				
CO_2 44.010	2.733	0.848	37.32	31.887	3.311	145.70	13.365	14.213	16.676	2.463	108.38	9.602			
N_2 28.016	0.310	0.096	2.69	1.697	0.176	4.93	0.711	0.807	0.887						
CH_4 16.042	1.153	0.358	5.74	10.833	1.126	18.06	4.541	4.899	5.667	0.768	12.32	1.092			
C_2H_4 28.052				2.540	0.264	7.41	1.065	1.065	1.329	0.264	7.41	0.657			
C_3H_6 30.068				1.670	0.174	5.23	0.700	0.700	0.874	0.174	5.23	0.463			
C_1+C_2											24.96	2.212			
C_3H_8 42.078				3.037	0.316	13.30	1.273	1.273	1.589	0.316	13.30	1.178	4.32	3.079	0.273
C_3H_8 44.094				0.343	0.036	1.59	0.144	0.144	0.180	0.036	1.59	0.141	4.24	0.375	0.033
C_4H_8 56.104				2.153	0.224	12.57	0.902	0.902	1.126	0.224	12.57	1.114	5.00	2.514	0.223
C_4H_{10} 58.120				0.800	0.083	4.82	0.335	0.335	0.418	0.083	4.82	0.427	4.86	0.992	0.088
C_5H_{10} 70.130				1.050	0.109	7.64	0.440	0.440	0.549	0.109	7.64	0.677	5.48	1.402	0.124
C_5H_{12} 72.146				...0.207	0.022	1.59	0.087	0.087	0.109	0.022	1.59	0.141	5.25	0.303	0.027
C_6H_{12} 84.156				0.343	0.036	3.03	0.144	0.144	0.180	0.036	3.03	0.268	5.54	0.547	0.048
C_5-C_6											44.54	3.946		9.212	0.816
TOTAL		31.043	407.32		10.391	262.34	41.915	72.958	57.782						
H_2+CO	95.804	29.741	11286669 SCFH		4.516		18.208	47.949	22.724	-25.225					
H_2/CO		1.56	Factor 8860009		3.29		3.29	2.03	3.29	1.39					

Weight Recovery, %	95.31	Catalyst Age, hrs.		Space Velocity, vhv	1167	RECOVERED OIL	0.308**	43.23	3.830		6.673	0.591
Pressure, psig	414	Inlet Velocity, Ft/sec	0.85	Catalyst Vol., CF	9.67	TOTAL OIL		87.77	7.776		15.885	1.407
Temperature, °F	645	Bed Depth, Ft	14.65	Weight, #	1363	WATER SOLUBLE CHEMICALS	0.247**	13.10	1.161		1.633	0.145
Recycle Ratio	1.35	Bed Density, #/CF	141	Effluent $(H_2)(CO_2)$ / Shift Ratio $(H_2O)(CO)$	11.14	TOTAL LIQUID PRODUCTS C_3+		100.87	8.937		17.518	1.552

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY	NET WATER	4.921**	88.65	7.854		10.642	0.943
Contraction	CO	H_2	H_2+CO	CO	H_2	$CO+H_2$	C_3+/C_1+	GROSS WATER		101.75	9.015		12.275	1.088
66.53	90.92	80.91	84.82	66.56	45.72	52.61	80.16	HYDROCARBON TOTAL—C_1+		125.83	11.149			

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE@	CORRECTED HEMPEL, %	gal/hr	TREATING RECOVERY, %	gal/hr
400 EP	73.9	4.931	98.0	4.832
400-550	13.6	0.908	91.4	0.830
550 +	12.5	0.834	114.6	0.956

	RECOVERY %	#/hr	gal/hr
PROPYLENE	42.4	5.64	
C_3 POLY GASO.	87.5	4.93	0.824
C_3 POLY TAR	12.5	0.71	0.094

	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	-	-	68.0
C_4 POLY GASO.	5.98	11.00	1.839	1.5
C_4H_{10}	4.86	[4.82) 4.09	(0.992) 0.842	68.0
C_4-FREE GASO.			7.908	5.8
C_4 POLY TAR	7.53	1.57	0.208	

	gal/hr	gal/MCF	Bbl/Day
10 # RVP 400 EP GASOLINE	10.589	0.9382	5087
GAS OIL	0.830	0.0735	398
FUEL OIL	0.956	0.0847	459
POLY TAR	0.302	0.0268	145
TOTAL	12.677	1.1232	6089
W. S. CHEM.	1.633	0.1447	785
TOTAL	14.310	1.2679	6874

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-R
HOURS 387-411

OPERATING CONDITIONS			
PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	436	Fresh Feed	11781
Natural Gas	435	Recycle	15907
Generator Outlet	418	Combined Feed	27688
Reactor Inlet	414	Wet Gas—Measured	3656
Condenser Inlet		Adjusted	3943
Product Accumulator	375	Loss	287
TEMPERATURES—°F.		Recycle/Fresh Feed	1.35
Oxygen	312	Inlet Velocity—ft./sec.	0.85
Natural Gas	315	Fresh Feed Rate—S.C.F.H. H_2+CO	11287
Generator		per Cu. Ft. Dense Bed	1167
Quench Accumulator	161	per Lb. Catalyst	8.28
Reactor Inlet	350	per Sq. Ft.	17102
Condenser Inlet	533	Heat Transfer Calculations	
Product Accumulator	93	Steam Rate=301#/hr	
Catalyst No. Height		@ 705 psia & 506°F=	
1 See Per. A	612	1201 BTU/#	
2	639	Water in @ 66.8°F=35	
3	652	Net BTU/# steam=1166	
4	641	1166x301=350966	
5	647	Ave. Bed Temp=645°F	
6	646	dT=645-506=139°F	
7	625	Tube Area=26.6 sq ft	
8	614	$U=\frac{350966}{(26.6)(139)}=94.9$ BTU/°F/sq ft	
9	615		
10	613		
11	587		

PRODUCT TESTS	OIL	WATER
°API	51.6	10.8
Neut. No.	36.5	31.8
Sap. No.	54.1	41.0
Hydrox. No.		
Bromine No.	93	
Pour °F.		
Chemicals, % by K_2CO_3		13.3
HEMPEL, DIST. %		°API
205 °F.		
400	72.9	53.0
400-550	13.6	36.8
550+	13.5	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	108	
10%	142	
50%	224	
90%	342	
EP	392	
Rec.	97.5	

CATALYST DATA						
INVENTORY DATA		PARTICLE SIZE				
In Reactor at Start of Period		Screen Analysis			Sedimentation	
Fresh Catalyst Added		Mesh	Microns	%	Microns	%
Total		On 40	419+	36.7	80+	
Catalyst Recovered	67	100	150	39.5	40—80	
In Reactor at End of Period		150	105	9.0	20—40	
		200	74	7.4	10—20	
REACTOR d-p, Inches H_2O		250	62	1.8	0—20	
No. Height		325	44	2.8		
0 See Period A	48	<325		2.8		
1	70	CATALYST				
2	72	Bulk Density, Lbs./Cu.Ft.				
3	72	Aerated			146	
4	135	Settled			147	
Total	397	Compacted			175	
		Particle Density, gm./cc.			4.44	
CALCULATED FROM dp		NH_3 Value, ml./gm.				
Density, Lbs./Cu.Ft.	141	N_2 Surface, m^2/gm.				
Inventory, Lbs.	1363					
Bed Depth, Ft.	14.65	CHEMICAL ANALYSIS				
Vol., Cu. Ft.	9.67	Fe				
		C			8.58	
		O				
		H				
		K_2O, W+, % basis Fe				
		X-Ray Analysis—				
		$Fe_{2.2}C_9$				
		Fe_3O_4				
		Fe				

RUN NO. 59-S
HOURS 411-421
CATALYST Spent CM&S

THE TEXAS COMPANY — MONTEBELLO LABORATORY
YIELD CALCULATIONS

	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	37.947	14.576	408.28	11.490	1.710	47.90	5.169	19.745	6.879	-12.866	-360.38				
H_2 2.016	58.850	22.605	45.58	41.824	6.225	12.55	18.818	41.423	25.043	-16.380	-33.03				
CO_2 44.010	2.560	0.983	43.26	25.623	3.816	167.94	11.528	12.511	15.344	2.833	124.68	8.836			
N_2 28.016	0.350	0.134	3.76	1.737	0.259	7.26	0.781	0.915	1.040						
CH_4 16.042	0.293	0.113	1.81	10.213	1.520	24.38	4.595	4.708	6.115	1.407	22.57	1.600			
C_2H_4 28.052				2.303	0.343	9.62	1.036	1.036	1.379	0.343	9.62	0.682			
C_2H_6 30.068				1.313	0.195	5.86	0.591	0.591	0.786	0.195	5.86	0.415			
C_1+C_2											38.05	2.697			
C_3H_6 42.078				2.003	0.298	12.54	0.901	0.901	1.199	0.298	12.54	0.889	4.32	2.903	0.206
C_3H_8 44.094				0.403	0.060	2.65	0.181	0.181	0.241	0.060	2.65	0.188	4.24	0.625	0.044
C_4H_8 56.104				1.317	0.196	11.00	0.593	0.593	0.789	0.196	11.00	0.780	5.00	2.200	0.156
C_4H_{10} 58.120				0.687	0.102	5.93	0.309	0.309	0.411	0.102	5.93	0.420	4.86	1.220	0.086
C_5H_{10} 70.130				0.707	0.105	7.36	0.318	0.318	0.423	0.105	7.36	0.522	5.45	1.350	0.096
C_5H_{12} 72.146				0.177	0.026	1.88	0.080	0.080	0.106	0.026	1.88	0.133	5.25	0.358	0.025
C_6H_{12} 84.156				0.203	0.030	2.52	0.091	0.091	0.121	0.030	2.52	0.179	5.54	0.455	0.032
C_3-C_6											43.88	3.111		9.111	0.645
TOTAL		38.411	502.69		14.885	319.39	44.991	83.402	66.594						
H_2+CO	96.797	37.181	14110099 SCFH		7.935		23.987	61.168	31.922	-29.246					
H_2/CO		1.55	Factor 708712		3.64		3.64	2.10	3.64	1.27					

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

	CORRECTED HEMPEL %	gal/hr	TREATING RECOVERY %	gal/hr
400 EP	73.0	6.916	98.0	6.778
400-550	16.0	1.516	91.4	1.386
550 +	11.0	1.042	114.6	1.194
	RECOVERY %	#/hr	gal/hr	
PROPYLENE	36.3	4.55		
C_3 POLY GASO.	87.5	3.98	0.666	
C_3 POLY TAR	12.5	0.57	0.076	
	#/gal	#/hr	gal/hr	RVP
C_4H_8	5.00	-	-	68.0
C_4 POLY GASO.	5.98	9.63	1.610	1.5
C_4H_{10}	4.86	(5.93) 4.52	(1.220) 0.931	68.0
C_4-FREE GASO.			9.607	5.8
C_4 POLY TAR	7.53	1.37	0.182	
	gal/hr	gal/MCF	Bbl/Day	
10 # RVP 400 EP GASOLINE	12.148	0.8609	4667	
GAS OIL	1.386	0.0982	532	
FUEL OIL	1.194	0.0846	459	
POLY TAR	0.258	0.0183	99	
TOTAL	14.986	1.0620	5757	
W. S. CHEM.	1.662	0.1178	639	
TOTAL	16.648	1.1798	6396	

Weight Recovery, %	93.85	Catalyst Age, hrs.		Space Velocity, vhv	1512
Pressure, psig	416	Inlet Velocity, Ft/sec	0.98	Catalyst Vol., CF	9.33
Temperature, °F	656	Bed Depth, Ft	14.13	Weight, #	1352
Recycle Ratio	1.17	Bed Density, #/CF	145	Effluent Shift Ratio $\frac{(H_2)(CO_2)}{(H_2O)(CO)}$ =	9.26

	NET CHANGE m/hr	NET CHANGE #/hr	#/MCF	#/gal	gal/hr	gal/MCF
RECOVERED OIL	0.438**	61.48	4.357		9.474	0.671
TOTAL OIL		105.36	7.468		18.585	1.316
WATER SOLUBLE CHEMICALS	0.248**	13.14	0.931		1.662	0.118
TOTAL LIQUID PRODUCTS C_3+		118.50	8.399		20.257	1.434
NET WATER	6.032**	108.68	7.702		13.047	0.925
GROSS WATER		121.82	8.635		14.709	1.043
HYDROCARBON TOTAL—C_1+		156.55	11.096			

FRESH FEED CONVERSION — %				TOTAL FEED CONVERSION — %			SELECTIVITY
Contraction	CO	H_2	H_2+CO	CO	H_2	CO+H_2	C_3+/C_1+
61.25	88.27	72.46	78.66	65.16	39.54	47.81	75.69

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-S
HOURS 411-421

THE TEXAS COMPANY — MONTEBELLO LABORATORY
DATA SUMMARY

OPERATING CONDITIONS

PRESSURES PSIG		RATES S.C.F.H.	
Oxygen	437	Fresh Feed	14577
Natural Gas	436	Recycle	17074
Generator Outlet	422	Combined Feed	31651
Reactor Inlet	416	Wet Gas—Measured	5102
Condenser Inlet		Adjusted	5649
Product Accumulator	375	Loss	547
TEMPERATURES—°F.		Recycle/Fresh Feed	1.17
Oxygen	316	Inlet Velocity—ft./sec.	0.98
Natural Gas	301	Fresh Feed Rate—S.C.F.H. H_2+CO	14110
Generator		per Cu. Ft. Dense Bed	1512
Quench Accumulator	130	per Lb. Catalyst	10.44
Reactor Inlet	243	per Sq. Ft.	21379
Condenser Inlet	544		
Product Accumulator	97.2	Heat Transfer Calculations	
Catalyst No. Height		Steam Rate = 272#/hr	
1 See Per. A	611	@ 705 psia & 506°F =	
2	650	1201 BTU/#	
3	658	Water in @ 67°F = 35°F	
4	642	Net BTU/# steam = 1166	
5	664	1166x272 = 317152	
6	665	Ave. Bed Temp = 656°F	
7	639	dT = 656-506 = 150°F	
8	625	Tube Area = 25.6	
9	626	$K = \frac{317152}{(25.6)(150)} = 82.6$ BTU/°F/sq ft	
10	622		
11	593		

PRODUCT TESTS

	OIL	WATER
° API	50.0	10.8
Neut. No.	32.3	29.3
Sap. No.	49.9	38.4
Hydrox. No.		
Bromine No.	91	
Pour °F.		
Chemicals, % by K_2CO_3		11.3
HEMPEL, DIST. %		°API
205 °F.		
400	72.0	53.0
400-550	16.0	36.7
550+	12.0	
A. S. T. M. DIST. ON		
Naphtha °F.		
IBP	118	
10%	144	
50%	236	
90%	350	
EP	380	
Rec.	97.0	

CATALYST DATA

INVENTORY DATA	
In Reactor at Start of Period	
Fresh Catalyst Added	
Total	
Catalyst Recovered	30½
In Reactor at End of Period	
REACTOR d-p, Inches H_2O	
No. Height	
0 See Period A	50
1	72
2	74
3	73
4	125
Total	394
CALCULATED FROM dp	
Density, Lbs./Cu.Ft.	145
Inventory, Lbs.	1352
Bed Depth, Ft.	14.13
Vol., Cu. Ft.	9.33

PARTICLE SIZE

Screen Analysis Mesh	Microns	%	Sedimentation Microns	%
On 40	419+	32.5	80+	
100	150	41.8	40—80	
150	105	10.8	20—40	
200	74	8.7	10—20	
250	62	3.2	0—20	
325	44	1.6		
<325		1.4		

CATALYST	
Bulk Density, Lbs./Cu.Ft.	
Aerated	146
Settled	148
Compacted	172
Particle Density, gm./cc.	4.46
NH_3 Value, ml./gm.	
N_2 Surface, m^2/gm.	
CHEMICAL ANALYSIS	
Fe	
C	9.38
O	
H	
K_2O, W+, % basis Fe	
X-Ray Analysis—	
$Fe_{20}C_9$	
Fe_3O_4	
Fe	