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**THE TEXAS COMPANY**

**REFINING DEPARTMENT  
TECHNICAL & RESEARCH DIVISION**



**REPORT ON**

**LOW SPACE VELOCITY OPERATION  
ALAN WOOD CATALYST**

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**MONTEBELLO RUN 51**

Laboratory MONTEBELLO

Report No. TDC-802-39-P

Date APRIL 2, 1951

**PERSONAL AND  
CONFIDENTIAL**

STRICTLY CONFIDENTIAL

BRIEF OF PARTIAL REPORT

Laboratory Montebello  
Date Approved April 2, 1951  
Date Work Completed Nov. 9, 1949

Experiment No. TDC-802  
Partial Report No. 39  
Subject: Hydrocarbon  
Synthesis

Subject: Low Space Velocity Operation With Alan Wood Catalyst

Object: To determine whether a decrease in synthesis gas throughput corresponding to the use of three or four reactors instead of two at Brownsville would raise the yield with Alan Wood magnetite catalyst to the original design level.

History: Previous operation at flow rates corresponding to full Brownsville design throughput with Alan Wood magnetite catalyst at Montebello had resulted in yields approximately 20 per cent under design. Since Run 49 had indicated that yields could be increased by decreasing the fresh feed space velocity at constant linear velocity by raising the bed height, the present work was undertaken to determine whether additional increases in yields could be obtained by decreasing the linear velocity at the maximum bed height level.

Experimental Work: Work was done at 400 psig, 650°F, 1:1 recycle at fresh feed rates corresponding to 2/3 and 1/2 Brownsville design. During a short period at 2/3 feed rate 6 mol per cent water was injected into the feed gas.

Conclusions: 1. A reduction in fresh feed rate corresponding to the use of three reactors instead of two at Brownsville, resulted in an increase of total liquid yield equivalent from 6386 to 7129 Bbl./Day, basis the Brownsville design feed rate. This corresponds to an increase in income of about \$4,450 per day and will justify the cost of a third reactor if the plant continues to operate on a catalyst of the Alan Wood activity level.

2. A further decrease in fresh feed rate corresponding to the use of four reactors at Brownsville failed to show any further increase in yield. This places the minimum allowable inlet velocity at about 0.6 ft./sec.

3. The injection of steam into the reactor inlet at a rate approximating the quantity produced in the generator resulted in a drop of about 10 per cent in total liquid yield indicating that the removal of water vapor from the fresh feed is probably justified economically.

4. A correlation of conversion with selectivity shows a progressive loss in selectivity as inlet velocity is reduced below 1 ft./sec. This loss does not offset the effect of space velocity between the two-reactor and three-reactor conditions but does offset the effect between the three-reactor and four-reactor conditions.

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HYDROCARBON SYNTHESIS

PARTIAL REPORT NO. 39

Montebello Laboratory  
Work Completed November 9, 1949

Experiment No. TDC-802  
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LOW SPACE VELOCITY OPERATION  
ALAN WOOD CATALYST

MONTEBELLO RUN 51

INDEX

	<u>Page</u>
I. INTRODUCTION	1
II. EQUIPMENT AND METHOD OF OPERATION	1
III. RESULTS AND DISCUSSION	3
A. Total Liquid Yield	3
B. Operation at 7 MCFH Fresh Feed Rate	8
C. Steam Injection	12
D. Product Distribution	13
IV. CONCLUSIONS	23
V. FUTURE WORK	24
VI. APPENDIX	26
Index to Appendix	27

INDEX TO FIGURES

<u>Figure No.</u>		<u>Page</u>
1	Variation of Yield with Catalyst Age	4
2	Relation of Yield to Space Velocity	5
3	Relation of Conversion to Space Velocity	9
4	Conversion vs. Selectivity	10
5	Methane Yield vs. Conversion	14
6	C <sub>2</sub> Yield vs. Conversion	15
7	C <sub>3</sub> Yield vs. Conversion	16
8	C <sub>4</sub> Yield vs. Conversion	17
9	Yield of C <sub>5</sub> and Heavier vs. Conversion	18
10	Total Liquid Yield vs. Conversion	19
11	Yield of Chemicals from Water Layer vs. Catalyst Age	20
12	Yield of Chemicals from Water Layer vs. Conversion	21
13	Total Liquid Yield vs. Conversion-Selectivity Product	22

INDEX TO TABLES

<u>Table No.</u>		<u>Page</u>
I	Summary of Yield Data	2
II	Operation at Low Inlet Velocity	7

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HYDROCARBON SYNTHESIS

PARTIAL REPORT NO. 39

Montebello Laboratory  
Work Completed November 9, 1949

Experiment No. TDC-802  
Report Approved April 2, 1951

LOW SPACE VELOCITY OPERATION  
ALAN WOOD CATALYST

MONTEBELLO RUN 51

I. INTRODUCTION

Previous reports have indicated that design yields can not be obtained with the Alan Wood catalyst at Brownsville. It was found, however, that a substantial increase in yield could be secured by increasing the bed level from the original design value of 8 feet to about 20 feet. A further increase in level was not possible, the level being limited at that point by excessive carry-over. It was apparent, however, that additional catalyst could be provided and higher yields secured by constructing an additional reactor, designed to operate in parallel with the existing two. The results of such an operation were studied at Montebello in Run 51 which was carried out over the period September 22, 1949 through November 9, 1949.

II. EQUIPMENT AND METHOD OF OPERATION

The catalyst, equipment, and method of operation were identical with Run 49 as described in Partial Report No. 37<sup>1</sup>/ except that the feed rate was reduced to two-thirds the value previously used. Operating conditions were:

Pressure	400 psig
Temperature	650 °F.
Bed Depth	22 feet
Fresh Feed	10 MCFH
Recycle Ratio	1/1

<sup>1</sup>/Experiment No. TDC-802, January 10, 1951.

Exp. TDC-802-39-P 2

TABLE I

SUMMARY OF YIELD DATA

Alan Wood Catalyst, 400 psig, 650°F.

Period	Hours on Stream	Average Catalyst Age, Hrs.	Rates, MCFH	Inlet Velocity	Bed Depth	Space Velocity v/hr/v	Yield of C <sub>3+</sub> , #/MCF of H <sub>2</sub> +CO Fed	Yield Basis <sup>1</sup> Brownsville Bbl/Day
51-A	8	8	Fresh Feed 9.5	Re-Cycle 10.6	0.66	18.5	732	10.43
B	32		10.4	10.9	0.66	20.0	755	9.81
C	56		11.4	11.7	0.71	19.6	843	9.40
D	80		10.8	11.5	0.69	19.1	819	9.76
E	104		10.7	12.0	0.69	19.8	777	9.51
51-1	266	174	10.2	11.4	0.65	21.7	683	9.53
51-2	450	272	10.4	11.3	0.67	22.6	664	9.08
51-3	643	377	9.7	10.8	0.62	24.2	578	9.08
51-4 <sup>(2)</sup>	782	438	10.1	12.3	0.68	23.6	624	8.30
51-5	854	470	10.1	11.9	0.66	22.9	644	8.72
48-1	190	137	16.5	17.2	1.08	11.2	2143	7.04
49-1	341	192	15.4	15.5	1.04	21.0	1074	8.37
49-2	497	298	15.9	23.5	1.36	19.0	1214	8.21
46-1	204	168	16.6	18.7	1.07	8.55	2825	5.76
46-2	369	183	16.9	17.7	1.05	10.55	2314	6.46
46-3	537	162	16.4	17.2	1.05	10.99	2178	6.64
Stanolind Run D-201								
29-1	21		3.62	3.75	0.47	12.5	851	9.95
2	47		3.60	3.68	0.46	12.3	866	9.63
3	119		3.62	3.64	0.46	11.8	922	8.71
4	191		3.63	3.58	0.46	11.8	926	8.54
5	263		3.65	3.66	0.48	11.0	1003	8.49
6	349		3.54	3.61	0.55	11.8	904	8.54
7	456		3.60	3.64	0.51	11.8	906	8.48
8	481		3.62	3.60	0.45	11.5	946	8.31
9	652		3.59	3.60	0.46	11.3	966	7.91
10	695		3.61	3.64	0.47	11.8	922	8.02

(1) Indicated production basis Brownsville Design Feed Rate

(2) Water Injected into Combined Feed.

These conditions were held essentially constant throughout the run. During the periods BB and CC, fresh feed rates were reduced to 7 MCFH and in periods FF through KK (Hours 643-782) water was injected into the feed preheater at a rate of 30 lbs./hr., corresponding to 6 mole per cent of the fresh feed. This approximates the quantity which would be present if raw synthesis gas were fed directly from the generator to the reactor.

### III. RESULTS AND DISCUSSION

#### A. Total Liquid Yield

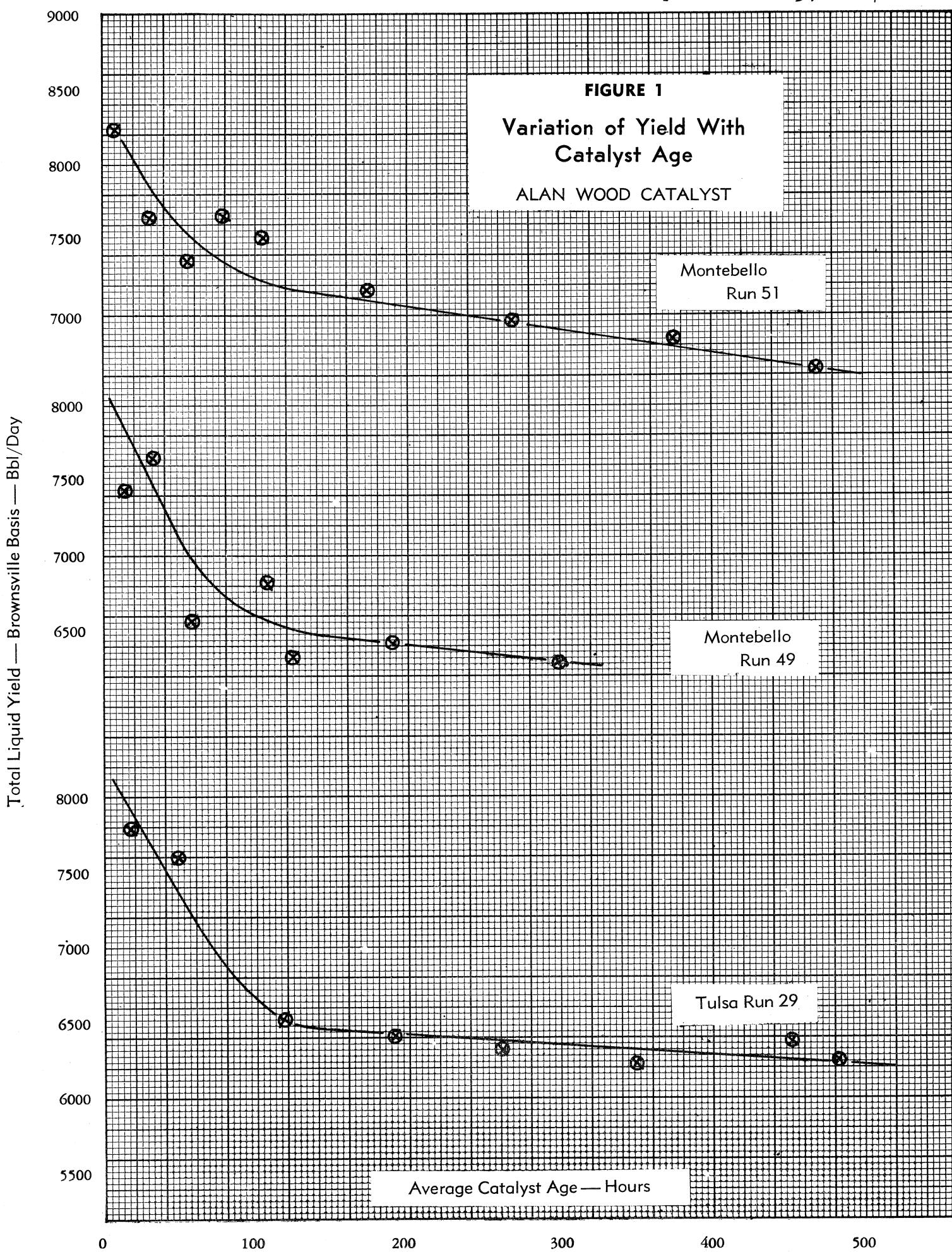
The opposite Table I summarizes the yield and operating data for Run 51 together with similar data for previous runs at Montebello and Tulsa on this same catalyst.

It is evident from this tabulation that Run 51 showed the customary, rapid decline in yield during the first 100 hours. After this period yields declined at a much lower and substantially linear rate.

This is illustrated in the following Figure 1 which shows the total liquid yield on a Brownsville design feed basis, plotted against the average age of the catalyst.

The yield shown for Run 51 was obtained under maximum bed depth conditions on a basis equivalent to the use of three reactors at Brownsville. The yields shown for Montebello Run 49 and Stanolind Run D-201-29 correspond to the use of maximum bed depth on a basis equivalent to the use of two reactors.

All of these runs show a rapid initial decline in yield during the first 100 hours followed by a substantially linear decline amounting to 1 or 2 per cent per 100 hours. The initial decline is smaller in the high yield operation of Run 51



Exp. TDC-802-39-P 5

8000

7500

7000

6500

6000

5500

5000

4500

4000

Total Liquid Yield Basis Brownsville Design Feed Rate — Bbl/Day

**FIGURE 2**  
**Relation of Yield to Space Velocity**

ALAN WOOD CATALYST

400 psig      650°F      1/1 Recycle Ratio

Catalyst Age, About 200 Hours

Space Velocity Basis  $H_2 + CO$  —  $v/hr/v$ 

500

1000

1500

2000

2500

3000

(about 15 per cent) than in the lower yield operations of Runs 29 and 49 where it amounted to about 20 per cent.

The yield data for Montebello Runs 46, 48, 49, and 51 and for Stanolind Run D-201-29 are plotted against space velocity in the opposite Figure 2. The data points represent catalyst age values of 137 to 298 hours and indicate a linear relationship between total liquid yield and space velocity.

A direct comparison of Runs 51-1 and 49-1 is given in the following tabulation:

Run No.	51-1	49-1
Catalyst Age, Hours	174	192
Fresh Feed Rate, MCFH	10.2	15.4
Recycle Ratio	1.07	1.01
Bed Depth, Ft.	21.7	21.0
Space Velocity, v/hr/v	683	1074
Conversion, % of H <sub>2</sub> + CO Fed	85.6	78.0
Selectivity, C <sub>3</sub> */C <sub>1</sub> *, %	82.9	82.3
Yield of C <sub>3</sub> *, #/MCF gal/MCF	9.53	8.37
	1.61	1.36

#### Yield Basis Brownsville Design Feed Rate, Bbl/Day

Gasoline	5108	4721
Gas Oil	558	629
Fuel Oil	512	350
Poly Tar	113	98
Total	6291	5797
Chemicals from Water	838	588
Total	7129	6386
Value of Products, \$/Day	\$36,750	\$32,300

The indicated gain of \$4,450 per day will justify the installation of a third reactor at Brownsville if operations are comparable to those given here. It should be pointed out, however, that the use of a more active catalyst is a much more attractive method of improving liquid yield since no additional equipment is required.



TABLE II  
OPERATION AT LOW INLET VELOCITY

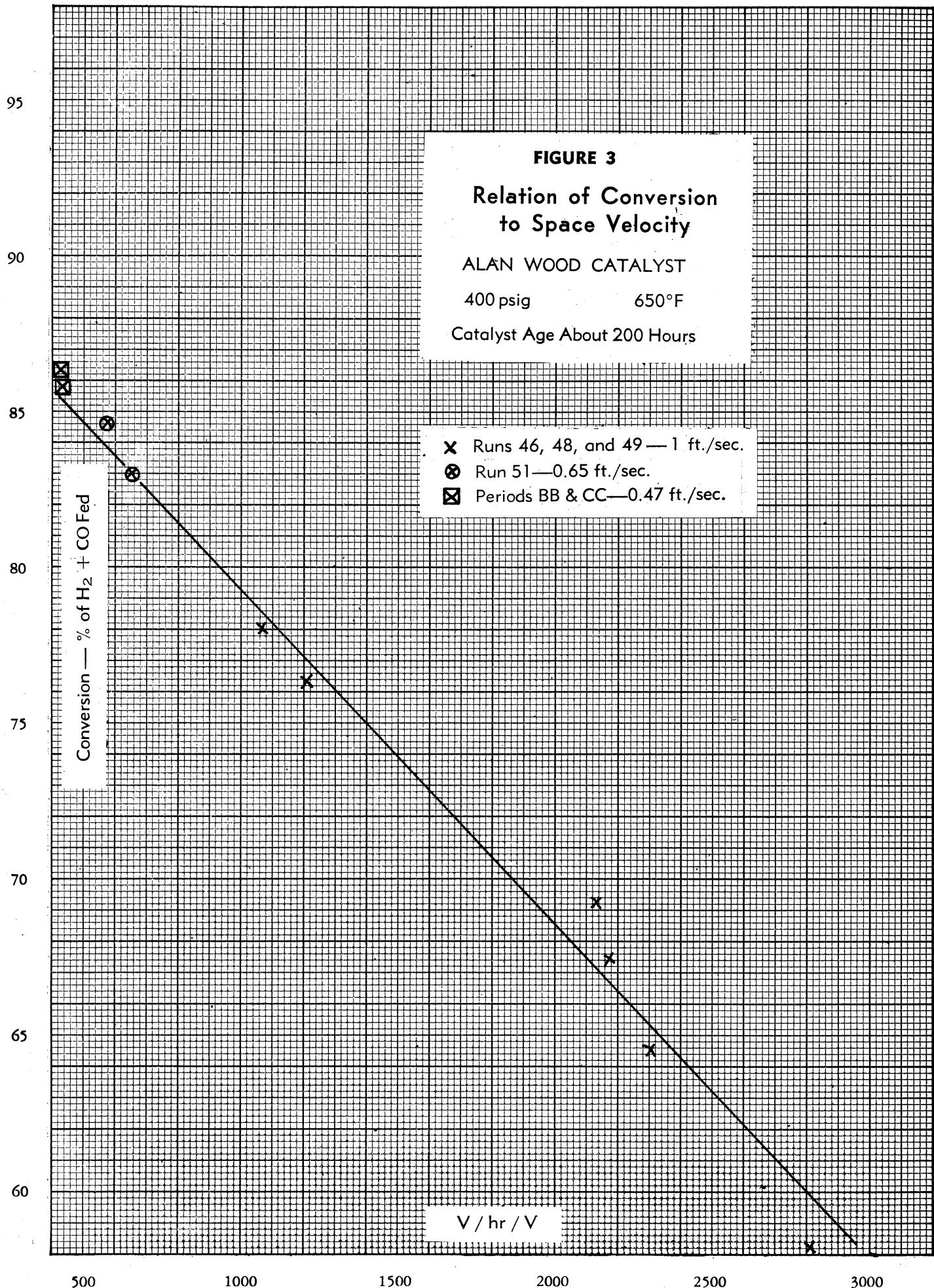
Period	<u>AA</u>	<u>BB</u>	<u>CC</u>	<u>DD</u>
Inlet Velocity, Ft./Sec.	0.65	0.48	0.47	0.69
<u>FLOW RATES, MCFH</u>				
Fresh Feed	10.2	7.1	7.3	10.6
Recycle	11.5	8.4	8.3	12.2
Recycle Ratio	1.13	1.17	1.14	1.14
Bed Depth, Ft.	24.5	24.1	24.1	22.6
Space Velocity, v/hr/v	589	433	438	672
Conversion, % of H <sub>2</sub> + CO Fed	83.8	86.4	86.0	85.1
Selectivity, C <sub>3+</sub> /C <sub>1+</sub> , %	79.5	76.2	78.4	81.0
<u>YIELD OF C<sub>3+</sub></u>				
#/MCF of H <sub>2</sub> + CO Fed	9.08	9.18	8.62	8.98
gal/MCF of H <sub>2</sub> + CO Fed	1.54	1.56	1.45	1.49
<u>YIELDS BASIS BROWNSVILLE FEED RATE, BBL./DAY</u>				
Gasoline	4837	4772	4493	4638
Gas Oil	393	410	357	548
Fuel Oil	530	514	421	560
Poly Tar	<u>105</u>	<u>103</u>	<u>92</u>	<u>80</u>
Total	5864	5798	5363	5820
Chemicals from Water	<u>979</u>	<u>1044</u>	<u>1030</u>	<u>1073</u>
Total	6843	6842	6393	6894

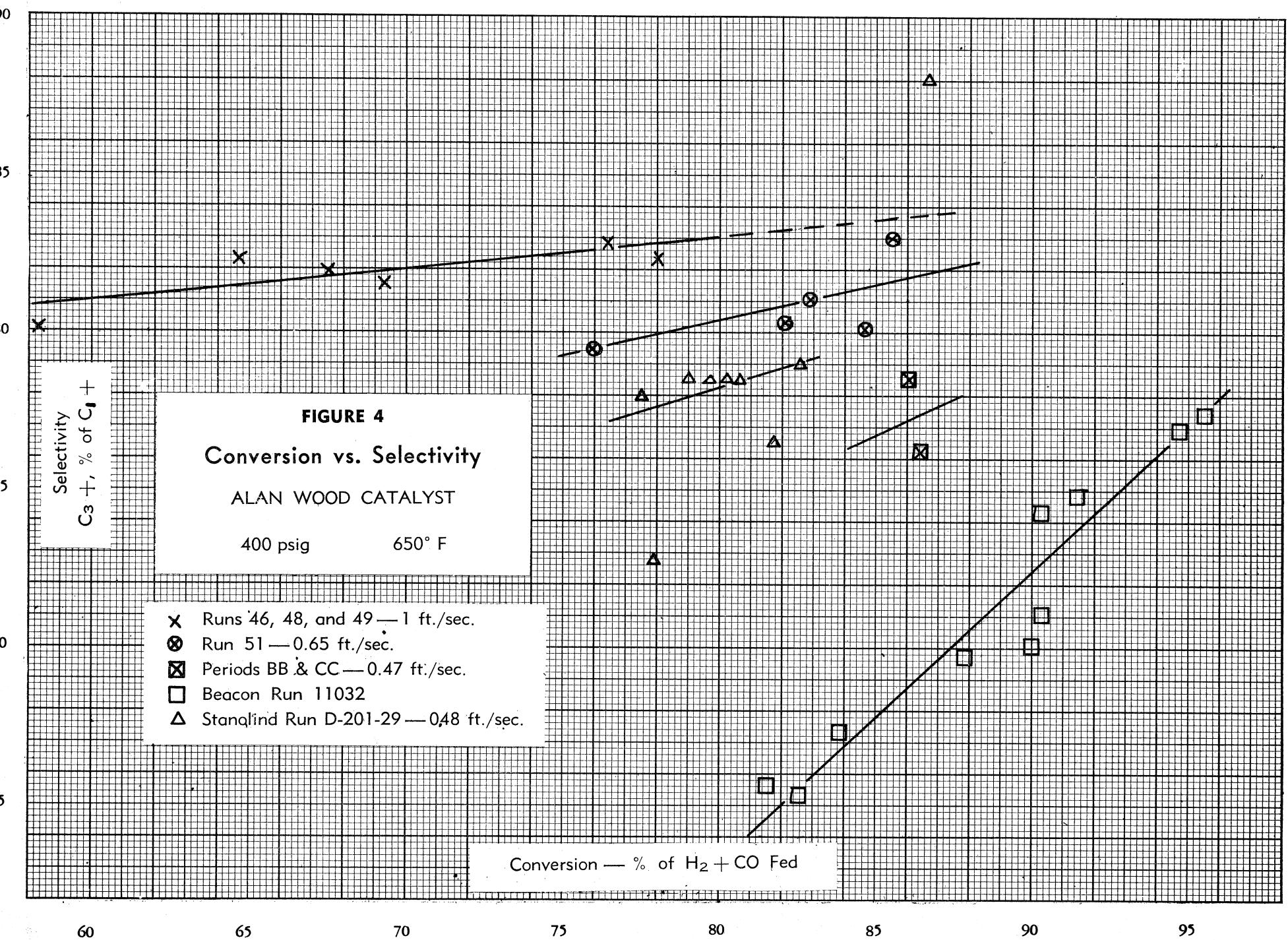
B. Operation at 7 MCFH Fresh Feed Rate

The linear increase in yield with decreased space velocity was not continued during periods BB and CC when the fresh feed rate was reduced from 10 MCFH to 7 MCFH - an amount corresponding to the use of four reactors at Brownsville. The data for these periods are compared with the results obtained in adjacent periods in the opposite Table II.

These data show that the reduction in fresh feed rate from 10.4 to 7.2 MCFH did result in an increase in conversion but that there was a corresponding loss in selectivity which offset the gain. The relation of conversion to space velocity is shown in the following Figure 3, while the relation between conversion and selectivity is plotted in Figure 4, page 10. This latter figure shows that the upward trend of selectivity with conversion which had been established by Runs 46, 48, and 49 was interrupted in Run 51 and that there was a further loss in selectivity in Periods BB and CC.

It will be recalled that Runs 46, 48, and 49 were all made with linear inlet velocities of 1 ft./sec. or higher, increased conversion being obtained by increasing the bed depth. Run 51 was made with the same bed depth as Run 49, conversion being increased by reducing the fresh feed rate from 15 MCFH to 10 MCFH. Figure 4 indicates that this decrease in fresh feed rate, and the corresponding decrease in inlet velocity from 1.0 to 0.65 ft./sec. resulted in a loss of about 2 per cent in selectivity. The further reduction in inlet velocity to 0.47 ft./sec. in periods BB and CC resulted in a further loss of about 5 per cent in selectivity.





This decrease in selectivity with decreased inlet velocity is believed to reflect an increase in contact time due to less active agitation of the bed. This system behaves as though the reactions which produce C<sub>1</sub> and C<sub>2</sub> hydrocarbons are slower than the reactions which produce liquids, so that prolonged contact time results in higher, but less selective conversion. This type of behavior is shown even more clearly by the small baffled reactors at Beacon where even lower selectivities are encountered.

Data from the Stanolind operation of Run D-201-29 are also shown in Figure 4. This run was made with an inlet velocity of 0.48 ft./sec., the same as that used in periods 51BB and 51DD, but with twice the space velocity. The selectivity is intermediate, between the 0.65 and 0.47 ft./sec. Montebello data. The Stanolind catalyst was much more finely ground than that used at Montebello and this may permit operation at somewhat lower inlet velocity.

Summarizing the above, pilot plant data indicate that selectivity increases with conversion when conversion is increased by increasing bed depth at constant inlet velocity. When conversion is increased at constant bed depth by decreasing feed rate and inlet velocity, selectivity decreases. These effects are thought to result from competition between a rapid oil-forming reaction and a slower reaction which produces gaseous hydrocarbons. The Beacon laboratory reactor operates at high inlet velocity but uses a very finely divided catalyst and a baffled capillary tube - a combination which results in excessively smooth fluidization, excessive contact time, and very low selectivities.

### C. Steam Injection

Since there is a substantial heat loss in cooling the generator product from the waste heat boiler outlet temperature to cooling water temperature, consideration has been given to the direct feeding of the generator effluent to the synthesis reactors. In order to simulate such an operation, water was injected into the feed preheater during Run 51-4 in an amount corresponding to 6 mole per cent of the total. The effect is shown in the following tabulation:

#### EFFECT OF STEAM INJECTION

Period	51-3	51-4	51-5
Catalyst Age, Hours	377	438	470
Space Velocity, v/hr/v	578	624	644
Conversion, % of H <sub>2</sub> + CO Fed	84.6	75.9	82.1
Selectivity, C <sub>3</sub> */C <sub>1</sub> *, %	80.0	79.4	80.3
Yield, basis H <sub>2</sub> + CO Fed			
#/MCF	9.09	8.30	8.72
gal/MCF	1.54	1.41	1.48

#### Yield Basis Brownsville Design Feed Rate, Bbl/Day

Gasoline	4828	4211	4708
Gas Oil	434	334	428
Fuel Oil	497	430	460
Poly Tar	101	99	99
Total	5860	5079	5695
Chemicals from Water	989	1079	913
Total	6849	6158	6608
Value of Products, \$/Day <sup>1/</sup>	\$36,411	\$33,787	\$34,976

These figures show a net loss of about \$2,000 per day, indicating that the removal of water vapor from the reactor feed is probably justifiable economically.

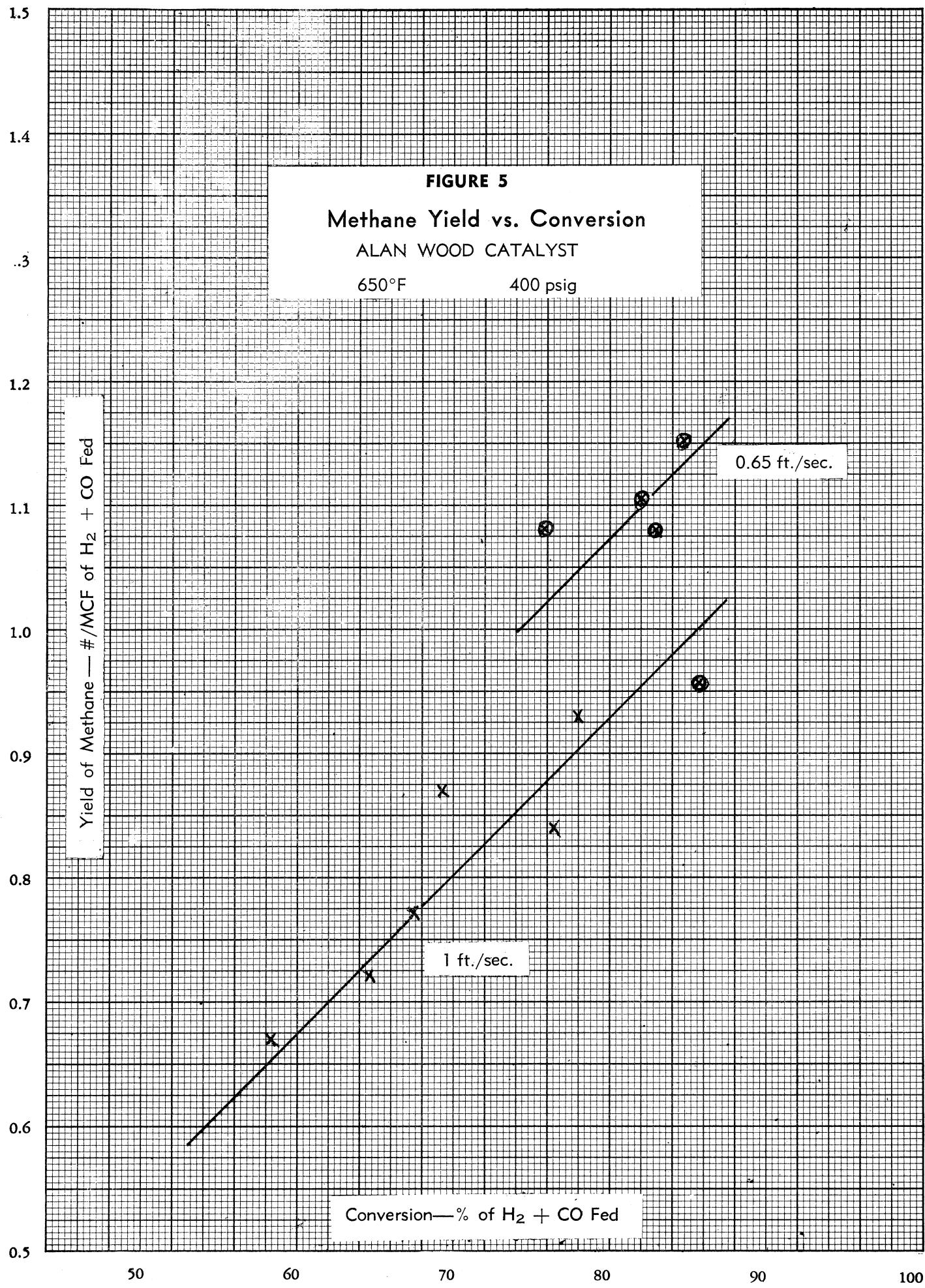
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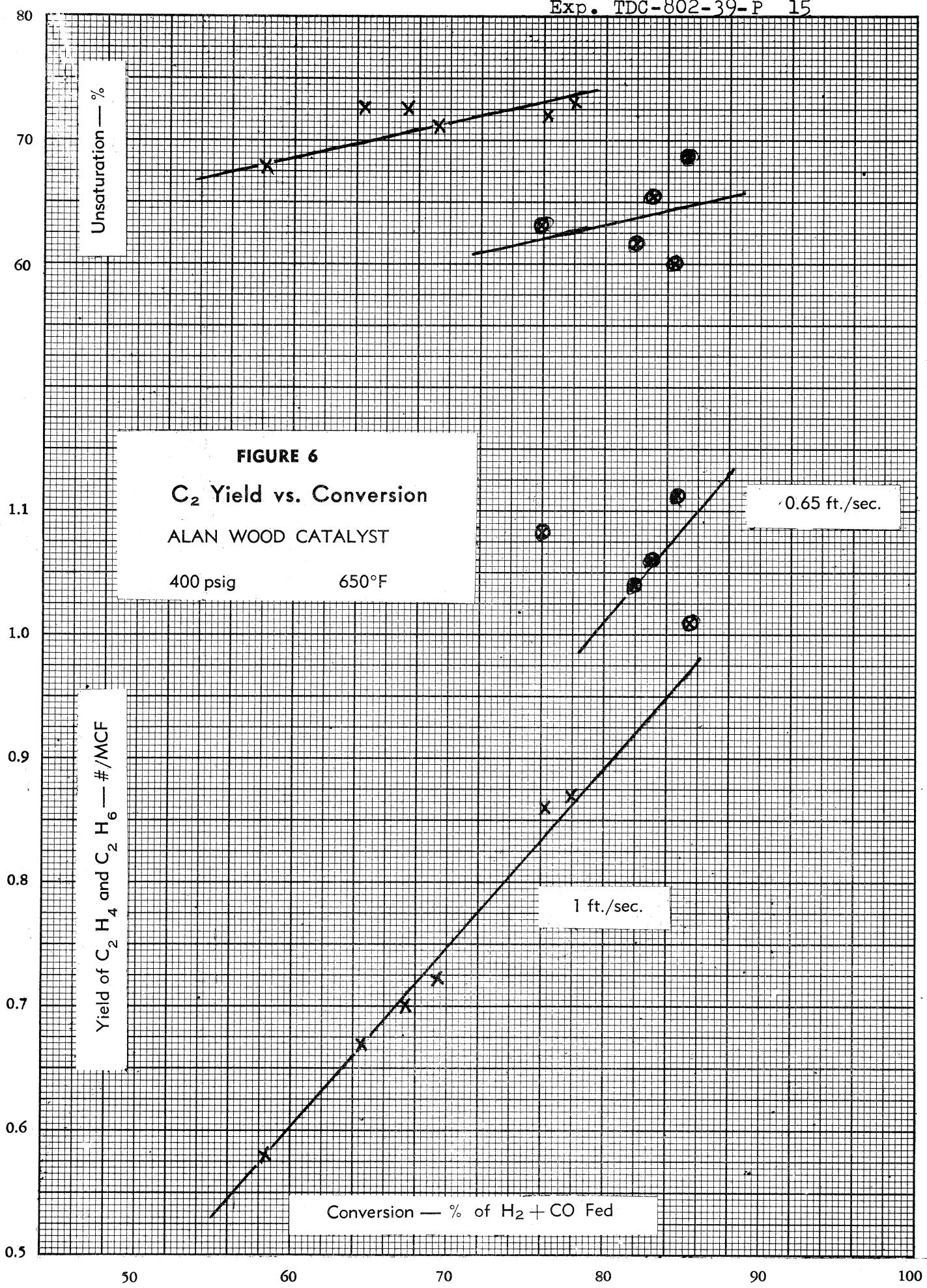
<sup>1/</sup>Based on gasoline at \$5.04 per bbl., gas oil at \$3.25 per bbl., fuel oil at \$1.30 per bbl., and chemicals at \$10.00 per bbl.

D. Product Distribution

The following plots show yields of the various hydrocarbon products as functions of conversion level. Data from Runs 46, 48, 49, and 51 are shown. The lower selectivity of Run 51 is reflected in higher yields of C<sub>1</sub>, C<sub>2</sub>, and C<sub>3</sub> fractions and a lower yield of C<sub>5+</sub>. The unsaturation of the C<sub>2</sub> fraction is also lower.

In contrast to the hydrocarbon yields which are independent of catalyst age, the yield of chemicals is strongly influenced by this factor during the first 300 hours of operation.





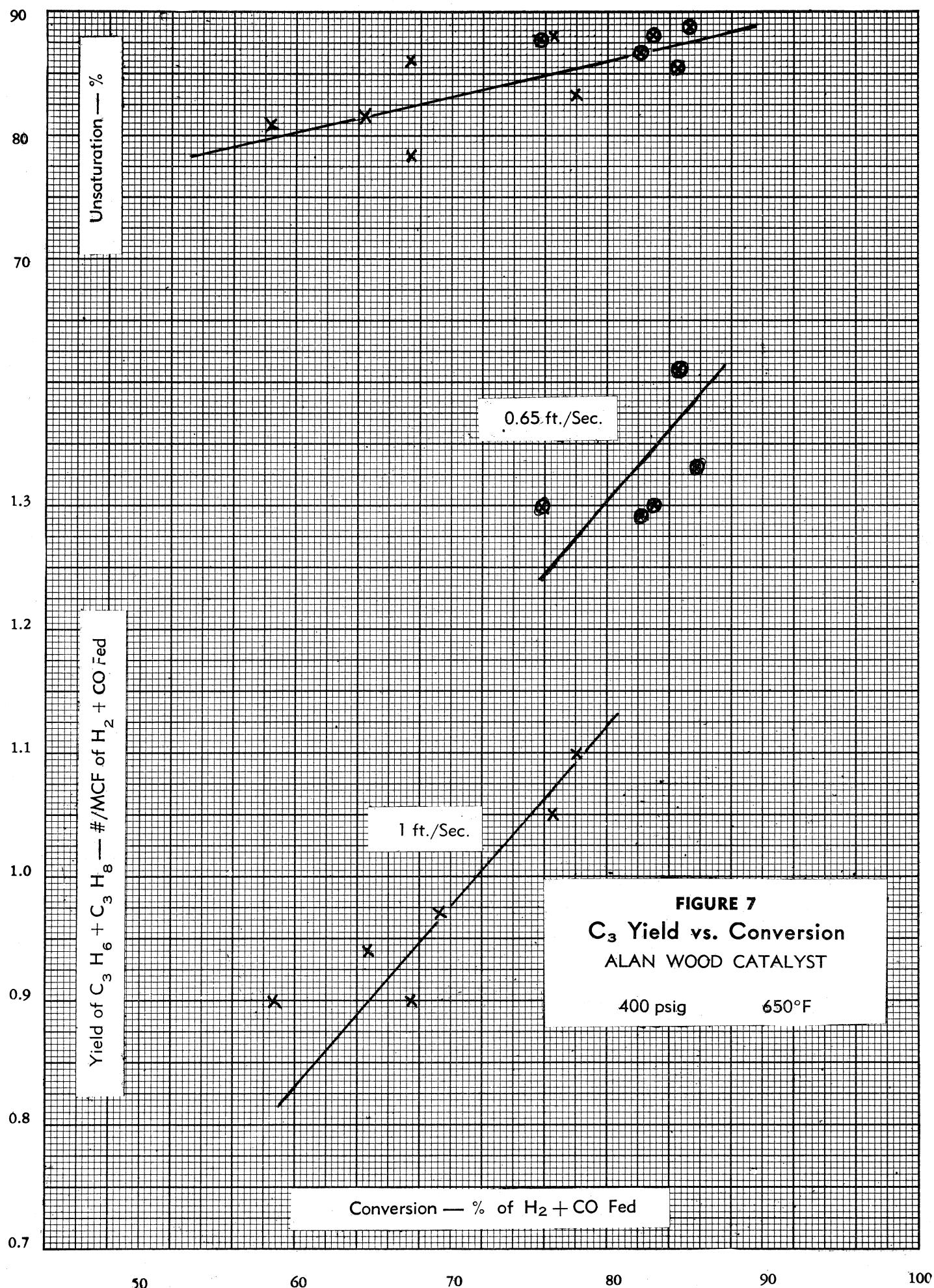
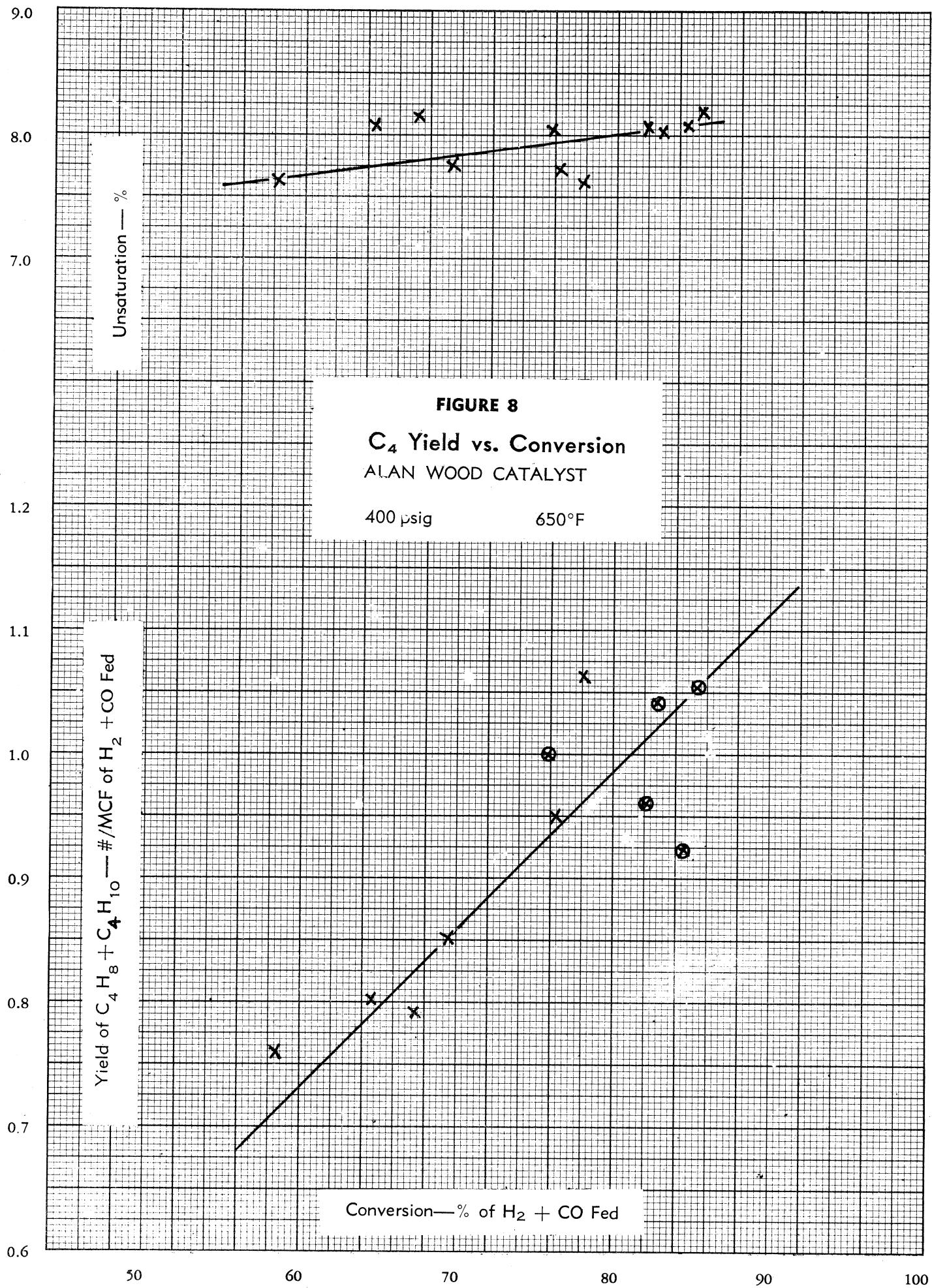
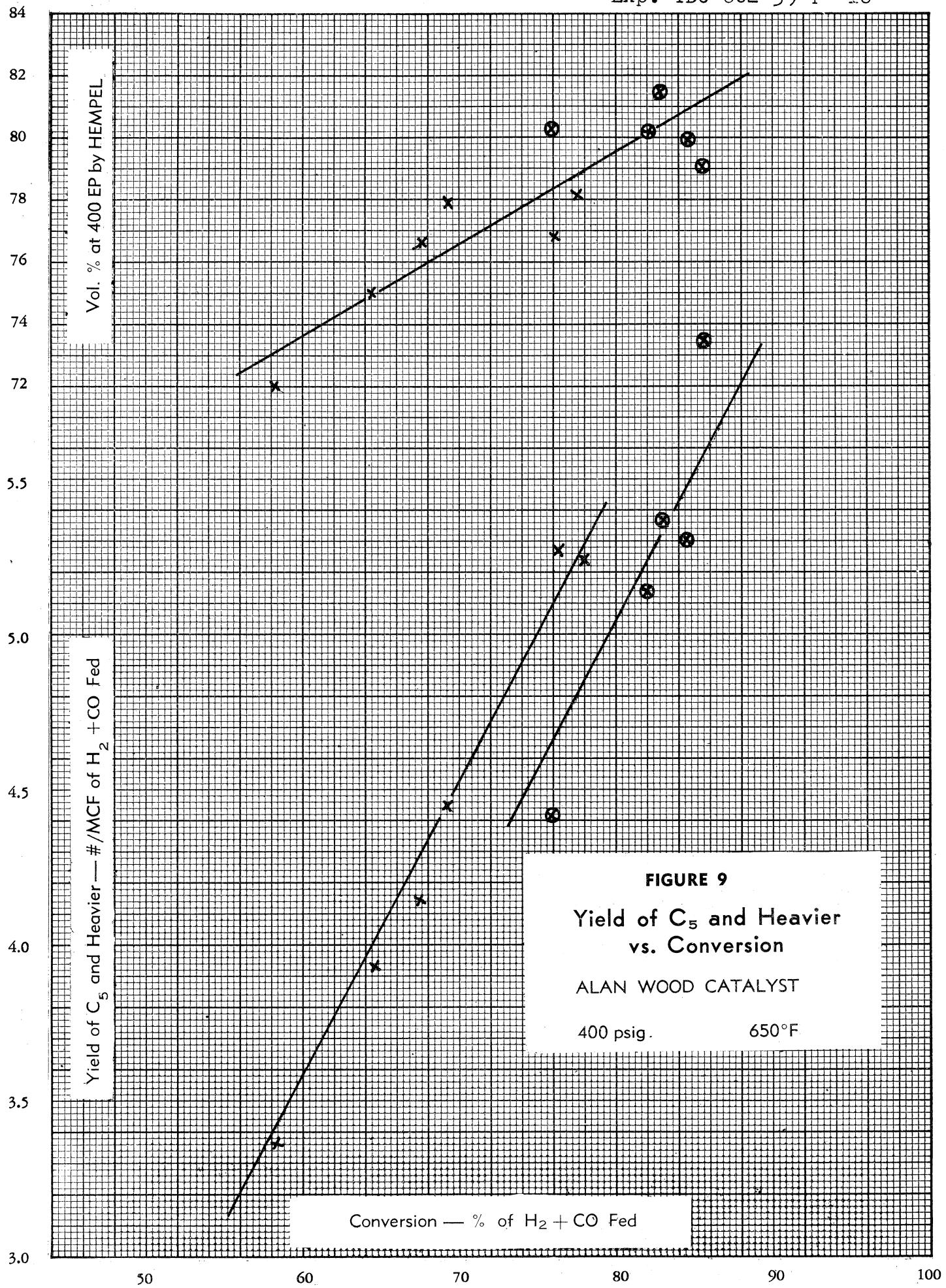
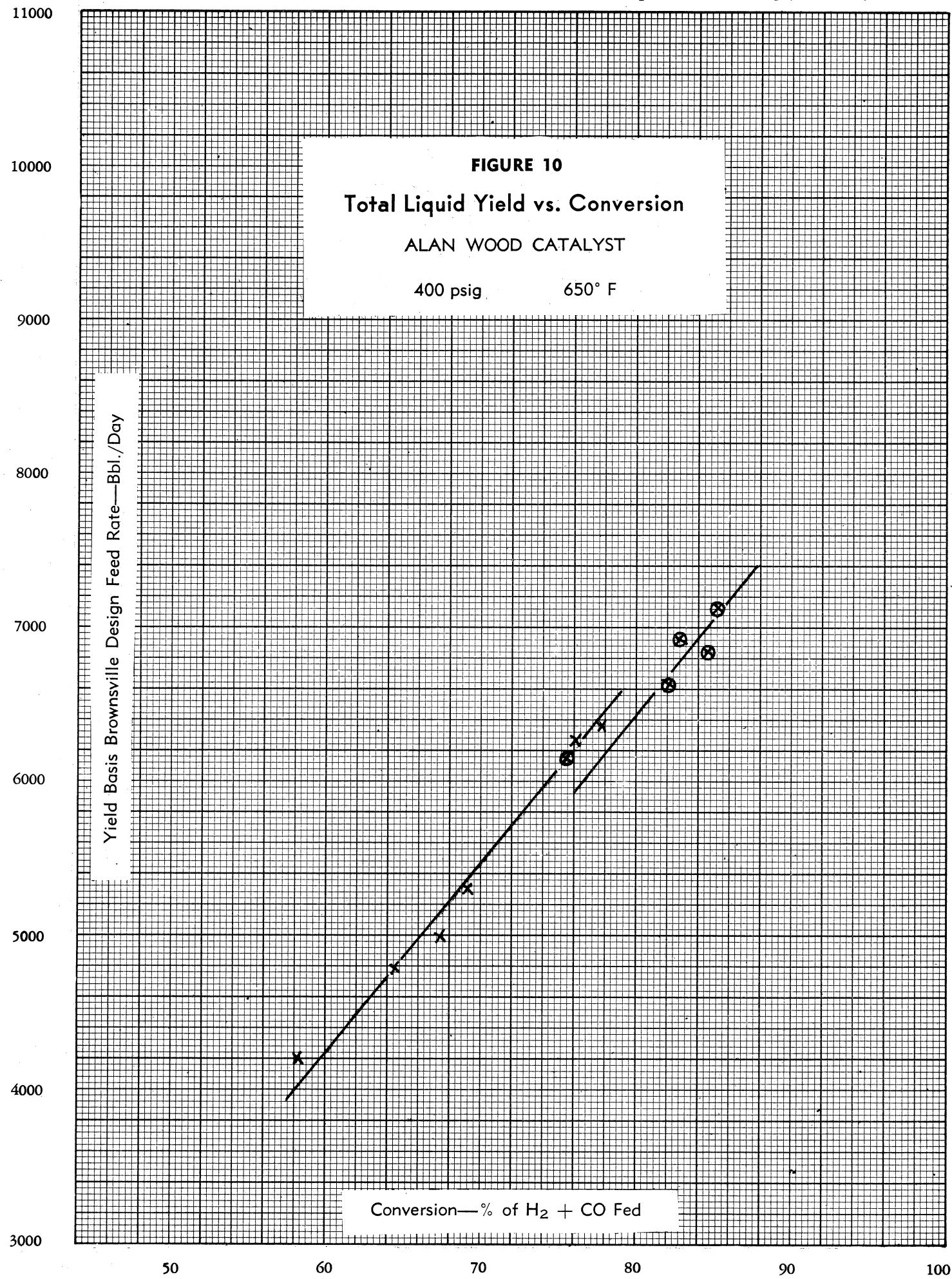
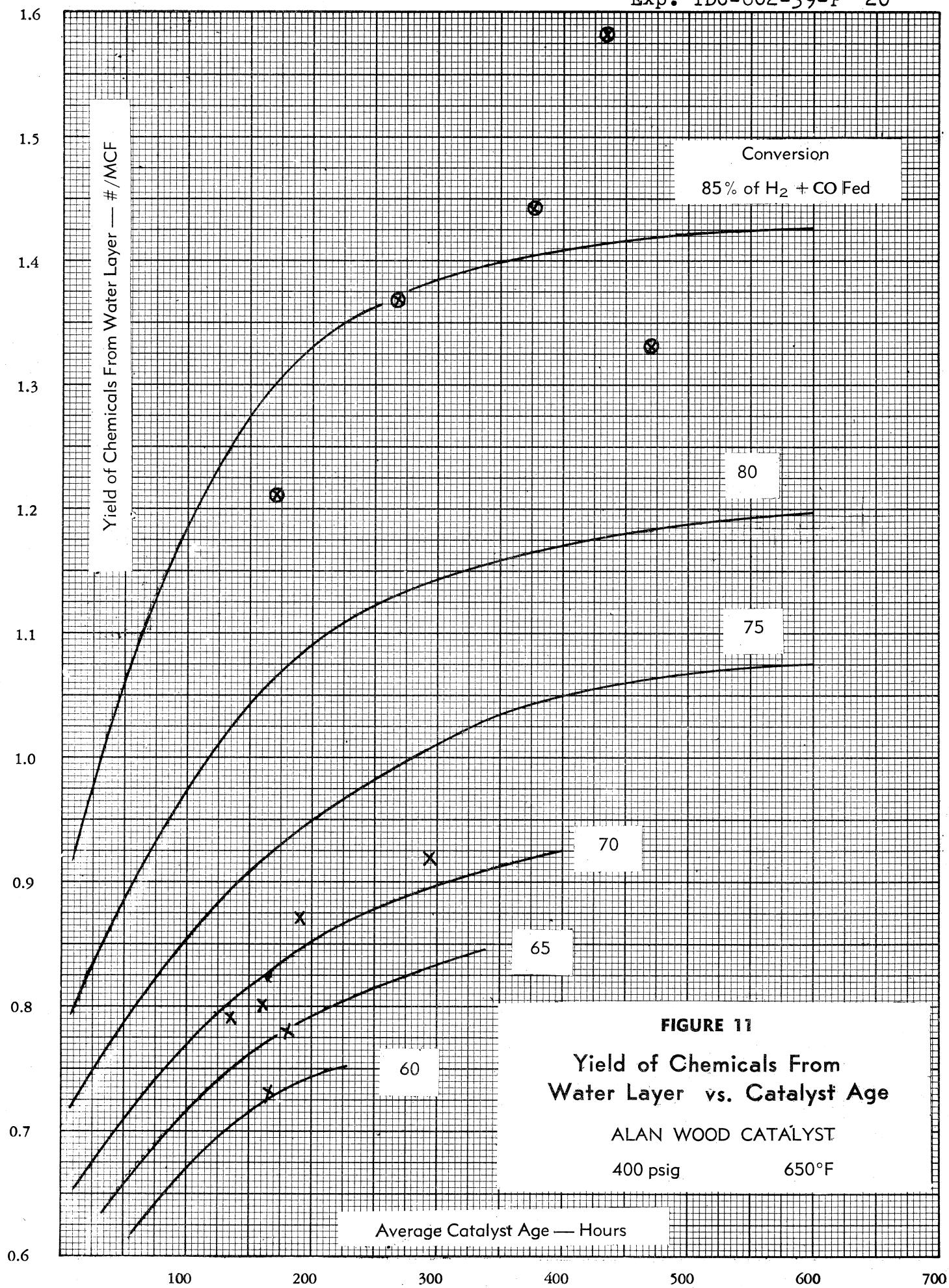


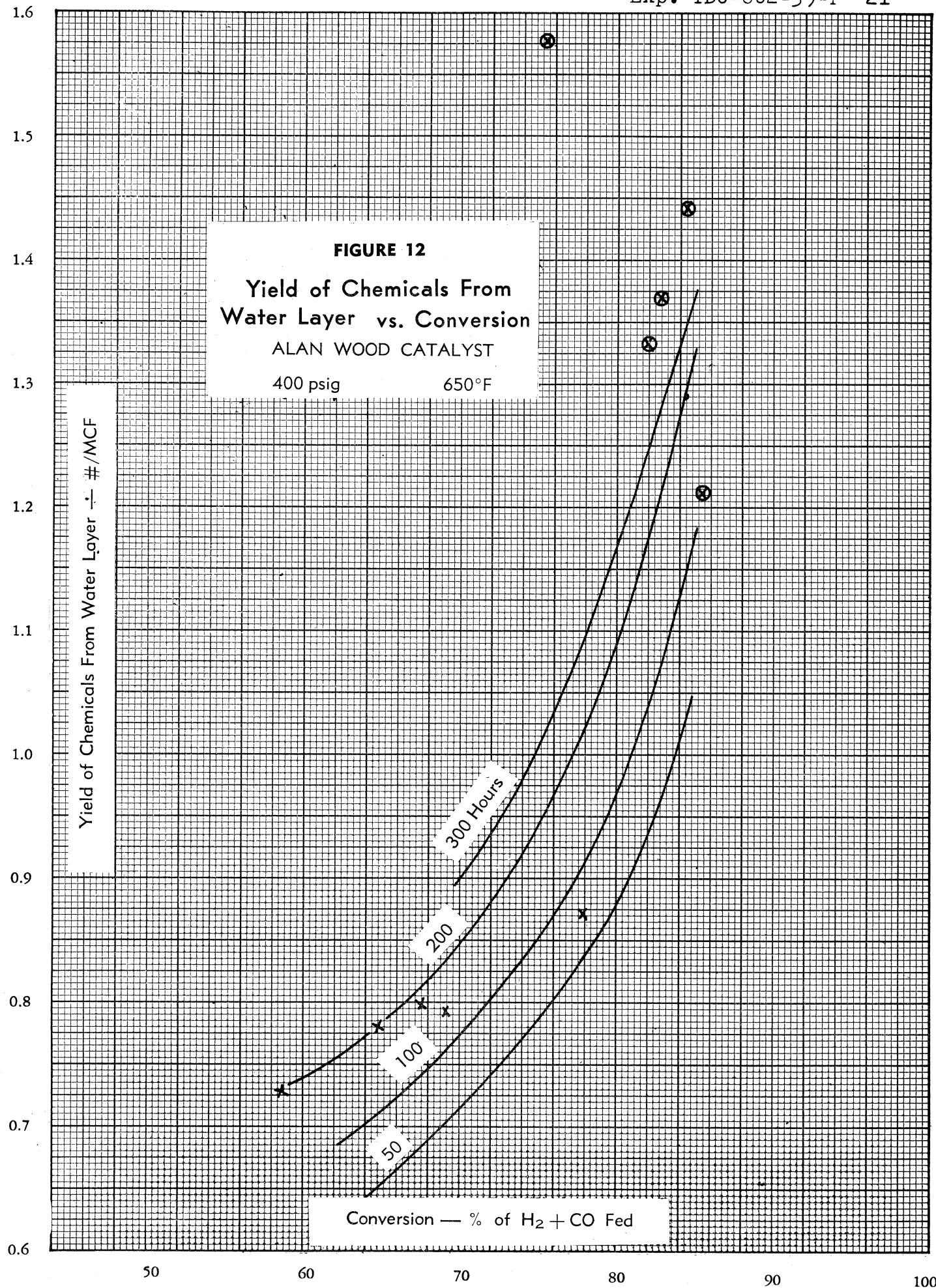
FIGURE 7  
 $C_3$  Yield vs. Conversion  
 ALAN WOOD CATALYST

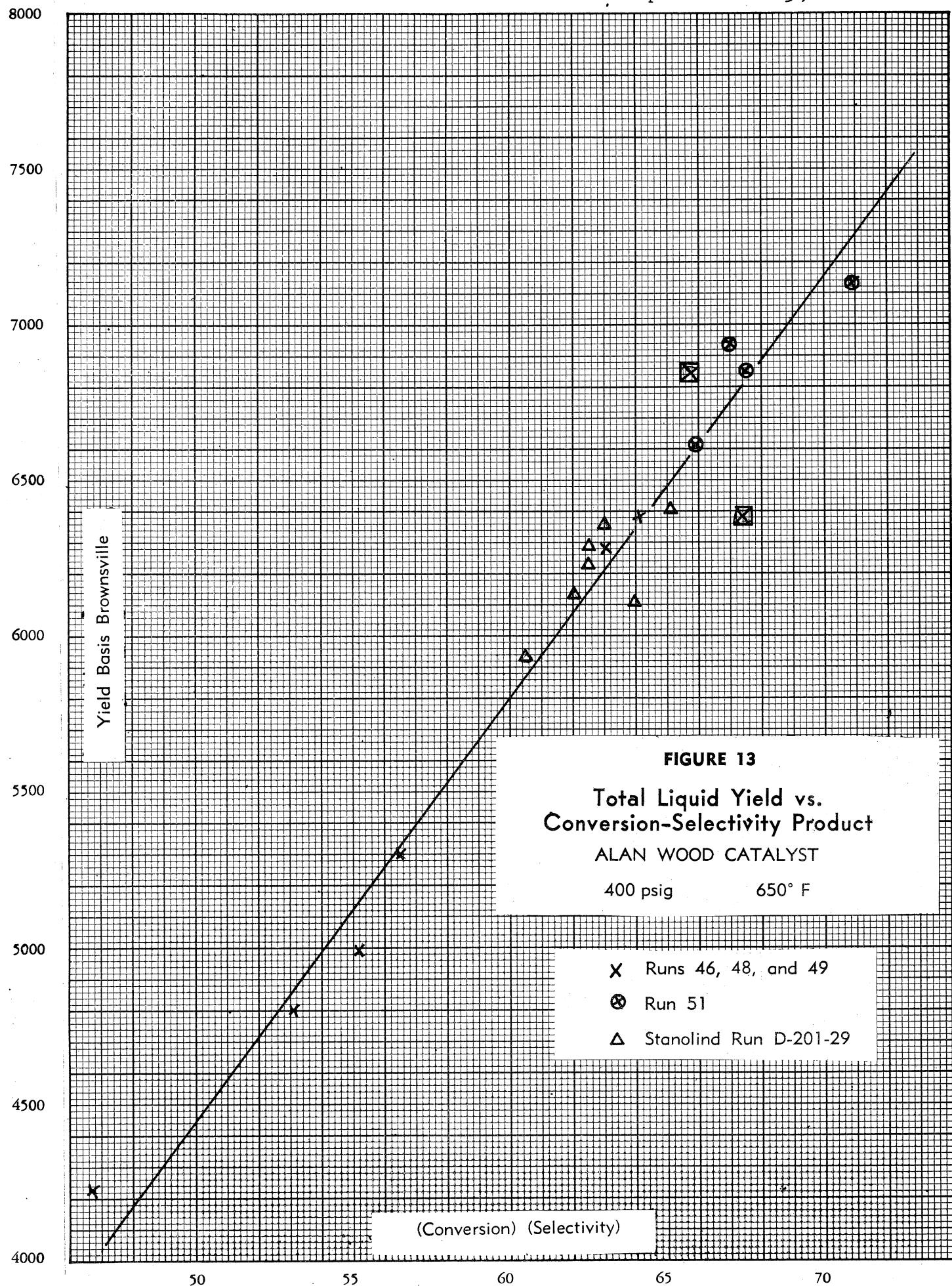












**FIGURE 13**  
Total Liquid Yield vs.  
Conversion-Selectivity Product

ALAN WOOD CATALYST

400 psig      650° F

- X Runs 46, 48, and 49
- O Run 51
- Δ Stanolind Run D-201-29

IV. CONCLUSIONS

1. A reduction in fresh feed rate corresponding to the use of three reactors instead of two at Brownsville, resulted in an increase of total liquid yield equivalent from 6386 to 7129 Bbl./Day, basis the Brownsville design feed rate. This corresponds to an increase in income of about \$4,450 per day and will justify the cost of a third reactor if the plant continues to operate on a catalyst of the Alan Wood activity level.

2. A further decrease in fresh feed rate corresponding to the use of four reactors at Brownsville failed to show any further increase in yield. This places the minimum allowable inlet velocity at about 0.6 ft./sec.

3. The injection of steam into the reactor inlet at a rate approximating the quantity produced in the generator resulted in a drop of about 10 per cent in total liquid yield indicating that the removal of water vapor from the fresh feed is probably justified economically.

4. A correlation of conversion with selectivity shows a progressive loss in selectivity as inlet velocity is reduced below 1 ft./sec. This loss does not offset the effect of space velocity between the two-reactor and three-reactor conditions but does offset the effect between the three-reactor and four-reactor conditions.

V. FUTURE WORK

1. Additional data should be obtained on the Alan Wood catalyst ground to finer particle size.
2. Efforts should be made to find a more active catalyst.

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VI. APPENDIX

INDEX TO APPENDIX

	<u>Page</u>
A. Composite Period Data for Run 51	28
B. Individual Period Data for Run 51	34
C. Detailed Data for Run 11032 (Beacon)	78

A. COMPOSITE PERIOD DATA FOR RUN 51

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
**YIELD CALCULATIONS**

51-1  
RUN NO. 51 F/M  
HOURS 104-226  
CATALYST AGE 174

FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED								
	%	m/hr	#/hr	%	At Wt. Balance m/hr	m/hr	m/hr	m/hr	m/hr	#/hr	CONDENSATE	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS	BASIS BROWNSVILLE DESIGN FEED RATE*		
CO <sub>28.010</sub>	37.835	10.238	286.77	8.473	0.712	19.94	2.454	12.692	3.166	- 9.526	266.83								
H <sub>2</sub> <sub>2.016</sub>	57.583	15.582	31.41	35.879	3.016	6.08	10.392	25.974	13.408	-12.566	-25.33				400 EP	76.8	6.320		
CO <sub>2</sub> <sub>44.010</sub>	3.440	0.931	40.97	34.296	2.883	126.88	9.934	10.865	12.817	1.952	85.91	8.779			400-550	13.4	1.103		
N <sub>2</sub> <sub>28.016</sub>	0.753	0.204	5.72	2.420	0.203	5.69	0.701	0.905	0.904						550 +	9.8	0.806		
CH <sub>4</sub> <sub>16.042</sub>	0.389	0.105	1.68	8.168	0.687	11.02	2.366	2.471	3.053	0.582	9.34	0.954					8.229		
C <sub>6</sub> H <sub>6</sub> <sub>28.052</sub>				2.799	0.235	6.59	0.811	0.811	1.046	0.235	6.59	0.673			RECOVERY %	#/hr	gal/hr		
C <sub>2</sub> H <sub>6</sub> <sub>30.058</sub>				1.293	0.109	3.28	0.375	0.375	0.484	0.109	3.28	0.335			PROPYLENE	46.1	5.30		
C <sub>1</sub> +C <sub>2</sub>											19.21	1.963			C <sub>3</sub> POLY GASO.	87.5	4.64		
C <sub>3</sub> H <sub>8</sub> <sub>42.078</sub>				3.242	0.273	11.49	0.939	0.939	1.212	0.273	11.49	1.174	4.32	2.660	0.272	C <sub>3</sub> POLY TAR	12.5	0.66	
C <sub>5</sub> H <sub>8</sub> <sub>44.094</sub>				0.418	0.035	1.54	0.121	0.121	0.156	0.035	1.54	0.157	4.24	0.363	0.037				
C <sub>4</sub> H <sub>8</sub> <sub>56.104</sub>				1.762	0.148	8.30	0.510	0.510	0.658	0.148	8.30	0.484	5.00	1.660	0.170	#/gal	#/hr	gal/hr	
C <sub>3</sub> H <sub>10</sub> <sub>58.120</sub>				0.396	0.033	1.92	0.115	0.115	0.148	0.033	1.92	0.196	4.86	0.395	0.040	C <sub>4</sub> H <sub>8</sub>	5.00	1.31	
C <sub>5</sub> H <sub>10</sub> <sub>70.130</sub>				0.610	0.051	3.58	0.177	0.177	0.228	0.051	3.58	0.366	5.45	0.657	0.067	C <sub>4</sub> POLY GASO.	5.98	6.12	
C <sub>2</sub> H <sub>2</sub> <sub>72.146</sub>				0.091	0.008	0.58	0.026	0.026	0.034	0.008	0.58	0.059	5.25	0.110	0.011	C <sub>4</sub> H <sub>10</sub>	4.86	1.92	
C <sub>4</sub> H <sub>2</sub> <sub>84.156</sub>				0.153	0.013	1.09	0.044	0.044	0.057	0.013	1.09	0.111	5.84	0.197	0.020	C <sub>4</sub> -FREE GASO.		7.934	
C <sub>3</sub> -C <sub>4</sub>											28.50	2.912		6.042	0.617	C <sub>4</sub> POLY TAR	7.53	0.87	
TOTAL	27.060	366.55		8.406	207.98	28.965	56.025	43.180											
H <sub>2</sub> +CO	25.820	9765.78	SCFH	3.728		12.846	38.666	16.574	22.092							gal/hr	gal / MCF	Bbl/Day	
H <sub>2</sub> .CO	1.52	Factor:	102189	4.24		4.24	2.05	4.24	1.32							10 # RVP 400 EP GASOLINE	9.219	0.9421	5108
OPERATING DATA									RECOVERED OIL	O.377*	52.91	5.407	6.43	8.229	0.841	GAS OIL	1.008	0.1030	558
Pressure, psig	414	Inlet Velocity, Ft/sec	0.65	Catalyst					TOTAL OIL		81.41	8.319		14.271	1.458	FUEL OIL	0.924	0.0944	512
Temperature, °F		Bed Depth, Ft	21.70	Weight, #	2085				WATER SOLUBLE CHEMICALS	O.223*	11.85	1.211	7.837	1.512	0.155	POLY TAR	0.204	0.0208	113
Recycle Ratio	1.07	Bed Density, # C/F	146	Volume, Cuft	14.33				TOTAL LIQUID PRODUCTS C <sub>3</sub> +		93.26	9.530		15.783	1.613	TOTAL	11.355	1.1604	6291
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %			SELECTIVITY	NET WATER	5.209*	93.84	9.589	8.321	11.277		W. S. CHEM.	1.512	0.1545	838	
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + C <sub>4</sub> +	GROSS WATER		105.69	10.800	8.264	12.789		TOTAL	12.867	1.3149	7129	
68.94	93.04	80.64	85.56	75.06	48.38	57.14	82.92	HYDROCARBON		112.47	11.493								

Form ML-11

<sup>a</sup>Included in Reactor Effluent Total

$$r/\text{NCM} = 16.21 \times \frac{\text{g}}{\text{MCF}} \quad \text{at } 2488 \text{ MCFH}, \text{ H}_2 + \text{CO, Bbl/Day} = 54.21 \times \frac{\text{gal}}{\text{MCF}}$$

## DATA SUMMARY

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA					
PRESSURES PSIG		RATES S.C.F.H.		OIL	WATER	INVENTORY DATA		PARTICLE SIZE			
Oxygen		Fresh Feed	10,256	° API	51.7	10.7	In Reactor at Start of Period		Screen Analysis		Sedimentation
Natural Gas		Recycle	10,978	Neut. No.	41.9	40.1	Fresh Catalyst Added		Mesh	Microns	%
Generator Outlet		Combined Feed	21,234	Sap. No.	52.1	42.1	Total		On 40	419+	12.2
Reactor Inlet	414	Wet Gas—Measured		Hydrox. No.			Catalyst Recovered		100	150	63.7
Condenser Inlet		Adjusted	3,186	Bromine No.	87		In Reactor at End of Period		150	105	12.4
Product Accumulator	390	Loss		Pour °F.					200	74	7.6
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	11.6	REACTOR d-p, Inches H <sub>2</sub> O			250	62	1.6
						No. Height			325	44	1.6
TEMPERATURES—°F.		Recycle/Fresh Feed	1.07						<325		0.3
Oxygen		Inlet Velocity—ft./sec.	0.65					CATALYST			
Natural Gas		Fresh Feed Rate— $\frac{\text{SCFH}}{\text{H}_2\text{CO}}$	9,736	HEMPEL. DIST. %				Bulk Density, Lbs./Cu.Ft.			
Generator		per Cu. Ft. Dense Bed	683	205 °F.				Aerated			
Quench Accumulator		per Lb. Catalyst	4.69	400	75.8	57.0		Settled			
Reactor Inlet	612	per sq. ft.	14,927	400-550	13.4	37.0		Compacted			
Condenser Inlet				550+	10.8			Particle Density, gm./cc.			
Product Accumulator	62						CALCULATED FROM dp	NH <sub>3</sub> Value, ml./gm.			
Catalyst No.	Height			A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	146	N <sub>2</sub> Surface, m <sup>2</sup> /gm.		
1	Inches 12	646		Naphtha °F.			Inventory, Lbs.	2085			
2	43.2	649		IBP	96		Bed Depth, Ft.	21.70	CHEMICAL ANALYSIS		
3	74.4	660		10%	132		Vol., cu. ft.	14.33	Fe		
4	136.8	643		50%	223				C		
5	199.2	628		90%	348				O		
6	230.4	621	Avg. Bed Temp., °F.	639	EP	401			H		
7	261.6	619	dT, °F.	121	Rec.	97.6			K <sub>2</sub> O, W+. % basis Fe		
8	292.8	610	K, BTU/hr/sq.ft/°F.	113.3					X-Ray Analysis—		
9	323.0	588	Steam Rate, #/hr.	411.7					Fe <sub>2</sub> O <sub>3</sub>		
10	342.0	582							Fe <sub>3</sub> O <sub>4</sub>		
11									Fe		

**THE TEXAS COMPANY — MONTEBELLO LABORATORY**  
**YIELD CALCULATIONS**

51-2  
 RUN NO. 51 N/U  
 HOURS 266-450  
 CATALYST AGE 272

FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED						
	C <sub>t</sub>	m hr	#/hr	%	At. Wt. Balance	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS	BASIS BROWNSVILLE DESIGN FEED RATE*	
CO <sub>28.010</sub>	37.622	10.301	288.53	9.831	0.910	25.49	2.924	13.225	3.834	- 9.391	-263.04						
H <sub>2</sub> <sub>2.016</sub>	57.787	15.923	31.90	38.299	3.543	7.14	11.392	27.215	14.935	-12.280	-24.76				400 EP	79.0 5.863 98.0 5.746	
CO <sub>24.010</sub>	2.923	0.800	35.21	29.580	2.736	120.41	8.799	9.599	11.535	1.936	85.20	8.605			400-550	12.2 0.905 91.4 0.827	
N <sub>26.016</sub>	0.722	0.198	5.55	2.303	0.213	5.97	0.685	0.983	0.898						550 +	8.8 0.653 114.6 0.748	
CH <sub>416.042</sub>	0.946	0.259	4.15	9.969	0.922	14.79	2.965	3.224	3.887	0.663	10.64	1.075				7.421	
C <sub>2</sub> H <sub>428.052</sub>				2.569	0.238	6.68	0.764	0.764	1.002	0.238	6.68	0.675					
C <sub>2</sub> H <sub>635.068</sub>				1.366	0.126	3.79	0.406	0.406	0.532	0.126	3.79	0.383			PROPYLENE	42.8 4.81	
C <sub>1</sub> +C <sub>2</sub>											21.11	2.132			C <sub>3</sub> POLY GASO.	87.5 4.21 0.704	
C <sub>3</sub> H <sub>842.078</sub>				2.891	0.267	11.23	0.360	0.860	1.127	0.267	11.23	1.134	4.32	2.600	0.263	C <sub>3</sub> POLY TAR	12.5 0.60 0.080
C <sub>3</sub> H <sub>844.094</sub>				0.384	0.036	1.59	0.114	0.114	0.150	0.036	1.59	0.161	4.24	0.375	0.038		
C <sub>4</sub> H <sub>1056.104</sub>				1.592	0.147	8.25	0.474	0.474	0.521	0.147	8.25	0.833	5.00	1.650	0.167		#/gal #/hr gal/hr RVP
C <sub>4</sub> H <sub>1058.120</sub>				0.393	0.036	2.09	0.117	0.117	0.153	0.036	2.09	0.211	4.86	0.430	0.043	C <sub>4</sub> H <sub>8</sub>	5.00 0.262 68.0
C <sub>5</sub> H <sub>1070.130</sub>				0.567	0.053	3.72	0.169	0.169	0.222	0.053	3.72	0.376	5.45	0.683	0.069	C <sub>4</sub> POLY GASO.	5.98 1.015 1.5
C <sub>5</sub> H <sub>1272.146</sub>				0.108	0.010	0.72	0.032	0.032	0.042	0.010	0.72	0.073	5.25	0.137	0.014	C <sub>4</sub> H <sub>10</sub>	4.86 0.430 68.0
C <sub>6</sub> H <sub>1284.156</sub>				0.148	0.014	1.18	0.044	0.044	0.058	0.014	1.18	0.119	5.84	0.213	0.022	C <sub>4</sub> -FREE GASO.	7.483 5.8
C <sub>3</sub> -C <sub>6</sub>											28.78	2.907	6.088	0.615		C <sub>4</sub> POLY TAR	7.58 0.116
TOTAL	27.381	365.34		8.251	213.05	29.746	57.127	44.650									
H <sub>2</sub> +CO	26.124	9901	S.C.F.H.	4.453		14.316	40.440	18.769	-21.671							gal/hr gal/MCF Bbl/Day	
H <sub>2</sub> /CO	1.54	1010		3.89		3.89	2.06	3.89	1.31						10 # RVP 400 EP GASOLINE	9.190 0.9282 5032	
OPERATING DATA									RECOVERED OIL	0.339*	47.54	4.802	6.406	7.421	0.750	GAS OIL	0.827 0.0835 453
Pressure, psig	411	Inlet Velocity, Ft/sec	0.67	Catalyst					TOTAL OIL	76.32	7.708	13.509	1.365			FUEL OIL	0.748 0.0755 409
Temperature, °F	601	Bed Depth, Ft	22.60	Weight, #	1963				WATER SOLUBLE CHEMICALS	0.2555*	13.53	1.367	7.998	1.713	0.173	POLY TAR	0.196 0.0198 107
Recycle Ratio	1.09	Bed Density, #/CF	132	Volume, Cuft	14.91				TOTAL LIQUID PRODUCTS C <sub>3</sub> +	89.85	9.075	15.222	1.537			TOTAL	10.961 1.1071 6002
FRESH FEED CONVERSION - %			TOTAL FEED CONVERSION - %			SELECTIVITY			NET WATER	5.059*	91.14	9.205	8.321	10.953		W. S. CHEM.	1.713 0.1730 938
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + C <sub>1</sub> +		GROSS WATER	104.67	10.572	8.264	12.666			TOTAL	12.674 1.2801 6940
	66.21	91.17	77.61	82.95	71.01	45.12	53.59	80.98	TOTAL-C <sub>1</sub> +	110.96	11.207						

g/NCM = 16.91 ×  $\frac{1}{\tau}$  / MCF \* 9488 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal / MCF

HOURS 266-450

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA					
PRESSURES PSIG			RATES S.C.F.H.			PARTICLE SIZE					
Oxygen			Fresh Feed			Screen Analysis					
Natural Gas			Recycle			Sedimentation					
Generator Outlet			Combined Feed			456 Mesh Microns % Microns %					
Reactor Inlet			Wet Gas—Measured			On 40 419+ 9.1 80+					
Condenser Inlet			Adjusted			Catalyst Recovered					
Product Accumulator			Loss			In Reactor at End of Period					
Steam						150 105 14.2 20-40					
						200 74 9.8 10-20					
						250 62 2.4 0-20					
						No. Height					
						325 44 2.8					
TEMPERATURES—°F.			Recycle/Fresh Feed			<325 1.3					
Oxygen			Inlet Velocity—ft./sec.			CATALYST					
Natural Gas			Fresh Feed Rate—S.C.F.H.			Bulk Density, Lbs./Cu.Ft.					
Generator			per Cu.Ft. Dens Bed			Aerated					
Quench Accumulator			per Lb. Catalyst			150					
Reactor Inlet			5.04			Settled					
Condenser Inlet			400-550			151					
Product Accumulator			15,002			Compacted					
Catalyst No. Height			550+			167					
1			Naphtha °F.			Particle Density, gm./cc.					
2			IBP			4.4					
3			10%			CALCULATED FROM dp					
4			130			NH <sub>3</sub> Value, ml./gm.					
5			220			9.4					
6			A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.					
7			Inventory, Lbs.			132 N <sub>2</sub> Surface, m <sup>2</sup> /gm.					
8			1963			CHEMICAL ANALYSIS					
9			Bed Depth, Ft.			Fe					
10			22.60			C					
11			Vol., cu. ft.			O					
12			14.91			H					
13			K <sub>2</sub> O, W+, % basis Fe			K <sub>2</sub> O, W+, % basis Fe					
14			X-Ray Analysis—			Fe <sub>2</sub> O <sub>3</sub> C <sub>6</sub>					
15			Fe <sub>2</sub> O <sub>4</sub>			Fe <sub>2</sub> O <sub>4</sub>					
16			Fe			Fe					

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
**YIELD CALCULATIONS**

51-3  
RUN NO. 51 V/EE  
HOURS 474-643  
CATALYST AGE 377

#9488 MCEH H<sub>2</sub> + CO, Bbl/Day = 5.321.6 X gal/MC

## DATA SUMMARY

Hours 474-643

OPERATING CONDITIONS				PRODUCT TESTS			CATALYST DATA											
PRESSURES PSIG		RATES S.C.F.H.			OIL	WATER	INVENTORY DATA		PARTICLE SIZE									
Oxygen		Fresh Feed	9,696	°API	52.0	11.2	In Reactor at Start of Period		Screen Analysis		Sedimentation							
Natural Gas		Recycle	10,818	Neut. No.	40.0	37.7	Fresh Catalyst Added		407	Mesh	Microns	%	Microns					
Generator Outlet		Combined Feed	20,514	Sap. No.	50.3	39.4	Total	=	45#/Day	On 40	419+	11.5	80+					
Reactor Inlet	416	Wet Gas—Measured		Hydrox. No.			Catalyst Recovered		100	150	60.1	40–80						
Condenser Inlet		Adjusted	3,150	Bromine No.	81		In Reactor at End of Period		150	105	14.5	20–40						
Product Accumulator	391	Loss		Pour °F.					200	74	9.2	10–20						
Steam	807			Chemicals, % by K <sub>2</sub> CO <sub>3</sub>		14.1	REACTOR d-p, Inches H <sub>2</sub> O		250	62	1.7	0–20						
							No.	Height	325	44	1.9							
TEMPERATURES—°F.		Recycle/Fresh Feed	1.12						<325		1.1							
Oxygen		Inlet Velocity—ft./sec.	0.62						CATALYST									
Natural Gas		Fresh Feed Rate—S.C.F.H. H <sub>2</sub> + CO	3,238	HEMPPEL. DIST. %					Bulk Density, Lbs./Cu.Ft.									
Generator		per Cu.Ft. Dense Bed	578	205 °F.		°API			Aerated		150							
Quench Accumulator		per Lb. Catalyst	4.35	400	77.0	56.9			Settled		152							
Reactor Inlet	659	per sq. ft.	13,997	400-550	11.5	36.8			Compacted		168							
Condenser Inlet				550+	11.5				Particle Density, gm./cc.		4.45							
Product Accumulator	54						CALCULATED FROM dp		NH <sub>3</sub> Value, ml./gm.									
Catalyst No.	Height			A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	133	N <sub>2</sub> Surface, m <sup>2</sup> /gm.									
1	626			Naphtha °F.			Inventory, Lbs.	2,123										
2	649			IBP	93		Bed Depth, Ft.	24.23	CHEMICAL ANALYSIS									
3	658			10%	128		Vol., cu. ft.	15.99	Fe									
4	643			50%	220				C									
5	629			90%	348				O									
6	626	Avg., Bed Temp, °F.	637	EP	400				H									
9	625	dT, °F.	118	Recovered	97.8				K <sub>2</sub> O, W+, % basis Fe									
10	617	K, BTU/hr/sq.ft/°F.	105.7						X-Ray Analysis—									
11	595								Fe <sub>2</sub> O <sub>3</sub> C <sub>6</sub>									
12	581								Fe <sub>3</sub> O <sub>4</sub>									
									Fe									

H<sub>2</sub>O Injection
 RUN NO. 51-4  
 51 FF/KK  
 HOURS 643-782  
 CATALYST AGE 438

 THE TEXAS COMPANY — MONTEBELLO LABORATORY  
 YIELD CALCULATIONS

FRESH FEED				WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE	YIELD BASIS H <sub>2</sub> + CO FED					
	%	m/hr	#/hr	%	At. Wt.	Balance	m/hr	m/hr	m/hr	m/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS	BASIS BROWNSVILLE DESIGN FEED RATE*
CO <sub>2,010</sub>	37.985	10.098	282.84	9.263	1.040	29.13	3.012	13.110	4.052	- 9.058 -253.71					CORRECTED HEMPEL, %	gal/hr TREATING RECOVERY, %
H <sub>2</sub> <sub>2,016</sub>	58.292	15.538	31.33	45.873	5.150	10.38	14.914	30.452	20.064	-10.388 -20.95					77.1	4.507
CO <sub>2,010</sub>	2.731	0.728	32.04	27.891	3.132	137.84	9.068	9.796	12.200	2.404 105.80					11.4	0.666
N <sub>2,016</sub>	0.718	0.191	5.35	2.166	0.243	6.81	0.704	0.895	0.947						550 +	11.5 0.672
CH <sub>4,042</sub>	0.374	0.100	1.80	6.710	0.753	12.08	2.181	2.281	2.934	0.653 10.48	1.078					5.845
C <sub>2</sub> H <sub>6,052</sub>				2.037	0.229	6.42	0.662	0.662	0.891	0.229 6.42	0.661				RECOVERY, %	#/hr gal/hr
C <sub>2</sub> H <sub>6,058</sub>					1.202	0.135	4.06	0.391	0.391	0.526 0.135	4.06	0.418			PROPYLENE	33.8 3.72
XEROX H <sub>2</sub> O		1.679	30.25					1.679		20.98 2.157					C <sub>3</sub> POLY GASO.	87.5 3.26 0.544
C <sub>2</sub> H <sub>6,078</sub>				2.353	0.262	11.02	0.758	0.758	1.020	0.262 11.02	1.154	4.32	2.551 0.263		C <sub>3</sub> POLY TAR	12.5 0.46 0.061
C <sub>2</sub> H <sub>6,094</sub>				0.334	0.037	1.63	0.108	0.108	0.145	0.037 1.63	0.168	4.24	0.384 0.040			
C <sub>2</sub> H <sub>6,104</sub>					1.238	0.139	7.80	0.403	0.403	0.542 0.139	7.80	0.803	5.00 1.560 0.160		#/gal	#/hr gal/hr RVP
C <sub>2</sub> H <sub>10,120</sub>				0.299	0.034	1.98	0.097	0.097	0.131	0.034 1.98	0.204	4.86	0.407 0.042		C <sub>4</sub> H <sub>8</sub>	5.00 0.172 68.0
C <sub>2</sub> H <sub>10,130</sub>				0.452	0.051	3.58	0.147	0.147	0.198	0.061 3.58	0.369	5.45	0.657 0.068		C <sub>4</sub> POLY GASO.	5.98 1.015 1.5
C <sub>2</sub> H <sub>12,146</sub>				0.086	0.010	0.72	0.028	0.028	0.038	0.010 0.72	0.074	5.25	0.137 0.014		C <sub>4</sub> H <sub>10</sub>	4.86 0.407 68.0
C <sub>2</sub> H <sub>12,156</sub>				0.115	0.013	1.09	0.037	0.037	0.050	0.013 1.09	0.112	5.54	0.197 0.020		C <sub>4</sub> FREE GASO.	5.952 5.8
C <sub>3</sub> C <sub>6</sub>	(26.655)										27.82	2.863	5.893 0.607		C <sub>4</sub> POLY TAR	7.53 0.116
TOTAL	28.334	386.89		11.228	234.54	32.511	60.845	49.833								
H <sub>2</sub> +CO	25.636	9716	S.C.F.H.		6.190	17.926	43.562	24.116	-19.446						10 # RVP 400 EP GASOLINE	7.546 0.7767 4211
H <sub>2</sub> /CO	1.54	1029230		4.95		4.95	2.32	4.95	1.15						GAS OIL	0.809 0.0627 334
OPERATING DATA										RECOVERED OIL	0.268#	37.54	3.864	5.423	5.845	0.601
Pressure, psig	415	Inlet Velocity, Ft/sec	0.68	Catalyst						TOTAL OIL	65.36	6.727	11.738	1.208		
Temperature, °F	831	Bed Depth, Ft	23.60	Weight, #	2003					WATER SOLUBLE CHEMICALS	0.288#	15.30	1.575	7.911	1.934	0.199
Recycle Ratio	1.22	Bed Density, #/C.F.	129	Volume, Cuft	15.57					TOTAL LIQUID PRODUCTS C <sub>3</sub> +	80.66	8.302	13.672	1.407		
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %			SELECTIVITY	NET WATER	5.538#	99.78	10.270	8.32111.991				
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>1</sub> +	GROSS WATER			115.08	11.844	8.264	13.925		
	57.88	89.70	66.86	75.35	59.00	34.11	44.64	TOTAL-C <sub>1</sub> +	101.62	10.459					TOTAL	11.036 1.1359 6158

Form ML-11

g/NCM = 16.91 × #/MCF \* 9488 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal/MCF

HOURS 643-782

OPERATING CONDITIONS				PRODUCT TESTS				CATALYST DATA			
PRESSURES PSIG				RATES S.C.F.H.				INVENTORY DATA			
Oxygen				Fresh Feed				In Reactor at Start of Period			
Natural Gas				Recycle				Fresh Catalyst Added			
Generator Outlet				Combined Feed				307			
Reactor Inlet				Wet Gas—Measured				Mesh Microns %			
Condenser Inlet				Adjusted				Total			
Product Accumulator				Loss				On 40			
Steam				Hydrox. No.				150			
TEMPERATURES—°F.				Bromine No.				50.7 59.7			
Oxygen				Pour °F.				40—80			
Natural Gas				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>				150			
Generator				13.8				16.1 75.8			
Quench Accumulator				REACTOR d-p, Inches H <sub>2</sub> O				200			
Reactor Inlet				No. Height				10.2 86.0			
Condenser Inlet				Chemical Analysis				2.6 88.6			
Product Accumulator				Particle Density, gm./cc.				0—20			
Catalyst No. Height				CALCULATED FROM dp				4.4			
1				A. S. T. M. DIST. ON				NH <sub>3</sub> Value, ml./gm.			
2				Naphtha °F.				N <sub>2</sub> Surface, m <sup>2</sup> /gm.			
3				IBP				2,003			
4				10%				Bed Depth, Ft.			
5				Vol., cu. ft.				23.60			
6				50%				CHEMICAL ANALYSIS			
7				227				Fe			
8				350				C			
9				400				O			
10				98				H			
11				EP				K <sub>2</sub> O, W+, % basis Fe			
12				Recovered				X-Ray Analysis—			
				98.0				Fe <sub>2</sub> O <sub>3</sub>			
				156				Fe <sub>3</sub> O <sub>4</sub>			
								Fe			

51-5  
RUN NO. 51 LL/NN  
HOURS 782-854  
CATALYST AGE 470

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE			YIELD BASIS H <sub>2</sub> + CO FED								
	%	m/hr	#/hr	%	At Wt Balance	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS	BASIS BROWNSVILLE DESIGN FEED RATE*				
CO <sub>28.010</sub>	37.461	9.980	279.54	9.368	0.859	24.06	2,940	12.920	3.799	- 9.121	-255.48									
H <sub>2</sub> <sub>2.016</sub>	58.988	15.715	31.68	40.873	3.749	7.56	12,829	28.544	16.578	-11.966	- 24.12				400 EP	77.7	5.445			
CO <sub>2</sub> <sub>44.010</sub>	2.840	0.757	33.32	29.904	2.742	120.68	9.386	10.143	12.128	1.985	87.36	8.971			400-550	12.0	0.841			
N <sub>2</sub> <sub>28.016</sub>	0.512	0.136	3.81	2.361	0.216	6.05	0.741	0.877	0.957						550 +	10.3	0.722			
CH <sub>4</sub> <sub>16.042</sub>	0.199	0.053	0.85	7.895	0.724	11.61	2,478	2.531	5.202	0.671	10.76	1.105					7.008			
C <sub>2</sub> H <sub>6</sub> <sub>28.052</sub>				2.342	0.215	6.03	0.735	0.735	0.950	0.215	6.03	0.619				RECOVERY %	#/hr	gal/hr		
C <sub>2</sub> H <sub>6</sub> <sub>30.056</sub>				1.469	0.135	4.06	0.461	0.461	0.596	0.135	4.06	0.417			PROPYLENE	41.7	4.49			
C <sub>1</sub> +C <sub>2</sub>											20.85	2.141				C <sub>3</sub> POLY GASO.	87.5	3.93	0.657	
C <sub>3</sub> H <sub>8</sub> <sub>42.078</sub>				2.792	0.256	10.77	0.876	0.876	1.132	0.256	10.77	1.106	4.32	2.495	0.256	C <sub>3</sub> POLY TAR	12.5	0.55	0.073	
C <sub>2</sub> H <sub>6</sub> <sub>44.094</sub>				0.446	0.041	1.81	0.140	0.140	0.181	0.041	1.81	0.186	4.24	0.427	0.044					
C <sub>3</sub> H <sub>8</sub> <sub>56.104</sub>				1.451	0.133	7.46	0.455	0.455	0.588	0.133	7.46	0.766	5.00	1.492	0.153		#/gal	#/hr	RVP	
C <sub>3</sub> H <sub>8</sub> <sub>58.120</sub>				0.356	0.033	1.92	0.112	0.112	0.145	0.033	1.92	0.197	4.86	0.395	0.040	C <sub>4</sub> H <sub>8</sub>	5.00		0.240	
C <sub>2</sub> H <sub>6</sub> <sub>70.130</sub>				0.513	0.047	3.30	0.161	0.161	0.208	0.047	3.30	0.339	5.45	0.606	0.062	C <sub>4</sub> POLY GASO.	5.98		0.916	
C <sub>3</sub> H <sub>8</sub> <sub>72.146</sub>				0.100	0.009	0.65	0.031	0.031	0.040	0.009	0.65	0.067	5.25	0.124	0.013	C <sub>4</sub> H <sub>10</sub>	4.86		0.395	
C <sub>4</sub> H <sub>8</sub> <sub>84.156</sub>				0.130	0.012	1.01	0.041	0.041	0.053	0.012	1.01	0.104	5.54	0.182	0.019	C <sub>4</sub> -FREE GASO.			6.905	
C <sub>3</sub> -C <sub>4</sub>													26.92	2.764	5.719	0.587	C <sub>4</sub> POLY TAR	7.53		0.104
TOTAL	26.641	349.20		9.171	206.97		31.388	58.029	45.799											
H <sub>2</sub> +CO	25.695	9738.4	S.C.F.H.		4.608		15.769	41.464	20.377	- 21.087						gal/hr	gal/MCF	Bbl/Day		
H <sub>2</sub> /CO	1.57	102686		4.36			4.36	2.21	4.36	1.31						10 # RVP 400 EP GASOLINE	8.456	0.8683	4708	
OPERATING DATA									RECOVERED OIL	0.321*	45.06	4.627	6.43	7.008	0.720	GAS OIL	0.769	0.0790	426	
Pressure, psig	417	Inlet Velocity, Ft/sec	0.66	Catalyst			TOTAL OIL			71.98	7.391		12.727	1.307	FUEL OIL	0.827	0.0849	460		
Temperature, °F	832	Bed Depth, Ft	22.91	Weight, #	2011		WATER SOLUBLE CHEMICALS	0.245*	12.98	1.333	7.915	1.640	0.168	POLY TAR	0.177	0.0182	99			
Recycle Ratio	1.18	Bed Density, #/C.F.	133	Volume, Cu ft			TOTAL LIQUID PRODUCTS C <sub>3</sub> +	84.96	8.724		14.367	1.475		TOTAL	10.229	1.0504	5695			
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %			SELECTIVITY	NET WATER	4.674*	84.20	8.646	8.321	10.119		W. S. CHEM.	1.640	0.1684	913		
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + C <sub>4</sub> +	GROSS WATER		97.18	9.979	8.264	11.759		TOTAL	11.869	1.2188	6608		
	65.58	91.39	76.14	82.07	70.60	41.92	50.86	HYDROCARBON TOTAL-C <sub>1</sub> +		105.81	10.865									

$\delta$ /NCM =  $16.81 \times \delta$ /MCE       $\delta$  oxygen MCEH H<sub>2</sub> + CO<sub>2</sub> Rh/Dex =  $5431.6 \times \delta$ /MCE

## DATA SUMMARY

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA					
PRESURES PSIG		RATES S.C.F.H.		OIL	WATER	INVENTORY DATA			PARTICLE SIZE		
Oxygen		Fresh Feed	10,097	° API	51.7	11.1	In Reactor at Start of Period		Screen Analysis	Sedimentation	
Natural Gas		Recycle	11,896	Neut. No.	42.7	41.4	Fresh Catalyst Added		Mesh	Microns	%
Generator Outlet		Combined Feed	21,993	Sap. No.	54.9	43.1	Total	On 40	419+	11.4	80+
Reactor Inlet	417	Wet Gas—Measured		Hydrox. No.			Catalyst Recovered.	100	150	52.6	40—80
Condenser Inlet		Adjusted	3,476	Bromine No.	77		In Reactor at End of Period	150	105	64.0	20—40
Product Accumulator	388	Loss		Pour °F.				200	74	14.5	10—20
Steam	795			Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	14.0	REACTOR d-p, Inches H <sub>2</sub> O	250	62	78.5	11.0	89.6
						No. Height	325	44	90.7	1.1	0—20
							325		94.1	3.4	
TEMPERATURES—°F.		Recycle/Fresh Feed	1.18							5.9	
Oxygen		Inlet Velocity—ft./sec.	0.66						CATALYST		
Natural Gas		Fresh Feed Rate—S.C.F.H. H <sub>2</sub> + CO	9,738	HEMPEL, DIST. %					Bulk Density, Lbs./Cu.Ft.		
Generator		per Cu.Ft. Dense Bed	644	205 °F.	° API				Aerated	156	
Quench Accumulator		per Lb. Catalyst	4.94	400	76.7	56.3			Settled	158	
Reactor Inlet	832	per sq. ft.	14,754	400-550	12.0	36.7			Compacted	180	
Condenser Inlet				550+	11.3				Particle Density, gm./cc.	4.6	
Product Accumulator	62						CALCULATED FROM dp		NH <sub>3</sub> Value, ml./gm.	7.3	
Catalyst No.	Height			A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	133	N <sub>2</sub> Surface, m <sup>2</sup> /gm.		
1	542			Naphtha °F.			Inventory, Lbs.	2011			
2	654			IBP	98		Bed Depth, Ft.	22.91	CHEMICAL ANALYSIS		
3	658			10%	133		Vol., cu. ft.	15.12	Fe		
4	639			50%	225				C		
5	625	Avg., Bed Temp. °F.	622	90%	354				O		
6	622	dT, °F.	105	EP	403				H		
7	616	K, BTU/hr./sq.ft./°F.	160	Recovered	98.0				K <sub>2</sub> O, W+, % basis Fe		
8	611								X-Ray Analysis—		
9	592								Fe <sub>2</sub> O <sub>3</sub>		
10	579								Fe <sub>3</sub> O <sub>4</sub>		
11									Fe		
12											

B. INDIVIDUAL PERIOD DATA FOR RUN 51

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 51-A  
HOURS 0-6

FRESH FEED				WET GAS		RECYCLE		COMBINED FED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> +CO FED							
	%	m/hr	#/hr	%	At Wt. Balance	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	#/MCF	#/gal	gal/hr	gal/MCF	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	Unsat.
CO <sub>22.010</sub>	38.370	9.621	269.46	6.100	0.436	18.81	1.705	11.387	8.142	- 9.185	-877.28									Distribution of	
H <sub>2</sub> <sub>18.016</sub>	55.887	14.012	28.85	27.351	1.983	5.04	7.646	81.658	9.599	-18.080	-84.31									Recovered Oil	
CO <sub>24.010</sub>	4.917	1.233	54.96	37.810	2.701	118.84	10.677	11.810	15.278	1.468	0.456	7.208								400 EP	
N <sub>2</sub> <sub>18.016</sub>	0.775	0.194	5.44	3.873	0.855	7.14	1.000	1.184	1.285											400-EPD	
CH <sub>14.042</sub>	0.053	0.013	0.81	14.810	1.037	16.64	4.059	4.072	5.096	1.024	16.43	1.854								550+	
C <sub>2</sub> H <sub>14.042</sub>																				68.0	
C <sub>3</sub> H <sub>12.010</sub>																				0.168	
C <sub>4</sub> H <sub>10.010</sub>																				0.707	
C <sub>5</sub> H <sub>12.010</sub>																				0.202	
C <sub>6</sub> H <sub>14.010</sub>																				550+	
C <sub>7</sub> H <sub>16.010</sub>																				0.202	
C <sub>8</sub> H <sub>18.010</sub>																				68.0	
C <sub>9</sub> H <sub>20.010</sub>																				0.168	
C <sub>10</sub> H <sub>22.010</sub>																				0.707	
C <sub>11</sub> H <sub>24.010</sub>																				0.202	
C <sub>12</sub> H <sub>26.010</sub>																				550+	
C <sub>13</sub> H <sub>28.010</sub>																				0.202	
C <sub>14</sub> H <sub>30.010</sub>																				68.0	
C <sub>15</sub> H <sub>32.010</sub>																				0.168	
C <sub>16</sub> H <sub>34.010</sub>																				0.707	
C <sub>17</sub> H <sub>36.010</sub>																				0.202	
C <sub>18</sub> H <sub>38.010</sub>																				550+	
C <sub>19</sub> H <sub>40.010</sub>																				0.202	
C <sub>20</sub> H <sub>42.010</sub>																				68.0	
C <sub>21</sub> H <sub>44.010</sub>																				0.168	
C <sub>22</sub> H <sub>46.010</sub>																				0.707	
C <sub>23</sub> H <sub>48.010</sub>																				0.202	
C <sub>24</sub> H <sub>50.010</sub>																				550+	
C <sub>25</sub> H <sub>52.010</sub>																				0.202	
C <sub>26</sub> H <sub>54.010</sub>																				68.0	
C <sub>27</sub> H <sub>56.010</sub>																				0.168	
C <sub>28</sub> H <sub>58.010</sub>																				0.707	
C <sub>29</sub> H <sub>60.010</sub>																				0.202	
C <sub>30</sub> H <sub>62.010</sub>																				550+	
C <sub>31</sub> H <sub>64.010</sub>																				0.202	
C <sub>32</sub> H <sub>66.010</sub>																				68.0	
C <sub>33</sub> H <sub>68.010</sub>																				0.168	
C <sub>34</sub> H <sub>70.010</sub>																				0.707	
C <sub>35</sub> H <sub>72.010</sub>																				0.202	
C <sub>36</sub> H <sub>74.010</sub>																				550+	
C <sub>37</sub> H <sub>76.010</sub>																				0.202	
C <sub>38</sub> H <sub>78.010</sub>																				68.0	
C <sub>39</sub> H <sub>80.010</sub>																				0.168	
C <sub>40</sub> H <sub>82.010</sub>																				0.707	
C <sub>41</sub> H <sub>84.010</sub>																				0.202	
C <sub>42</sub> H <sub>86.010</sub>																				550+	
C <sub>43</sub> H <sub>88.010</sub>																				0.202	
C <sub>44</sub> H <sub>90.010</sub>																				68.0	
C <sub>45</sub> H <sub>92.010</sub>																				0.168	
C <sub>46</sub> H <sub>94.010</sub>																				0.707	
C <sub>47</sub> H <sub>96.010</sub>																				0.202	
C <sub>48</sub> H <sub>98.010</sub>																				550+	
C <sub>49</sub> H <sub>100.010</sub>																				0.202	
C <sub>50</sub> H <sub>102.010</sub>																				68.0	
C <sub>51</sub> H <sub>104.010</sub>																				0.168	
C <sub>52</sub> H <sub>106.010</sub>																				0.707	
C <sub>53</sub> H <sub>108.010</sub>																				0.202	
C <sub>54</sub> H <sub>110.010</sub>																				550+	
C <sub>55</sub> H <sub>112.010</sub>																				0.202	
C <sub>56</sub> H <sub>114.010</sub>																				68.0	
C <sub>57</sub> H <sub>116.010</sub>																				0.168	
C <sub>58</sub> H <sub>118.010</sub>																				0.707	
C <sub>59</sub> H <sub>120.010</sub>																				0.202	
C <sub>60</sub> H <sub>122.010</sub>																				550+	
C <sub>61</sub> H <sub>124.010</sub>																				0.202	
C <sub>62</sub> H <sub>126.010</sub>																				68.0	
C <sub>63</sub> H <sub>128.010</sub>																				0.168	
C <sub>64</sub> H <sub>130.010</sub>																				0.707	
C <sub>65</sub> H <sub>132.010</sub>																				0.202	
C <sub>66</sub> H <sub>134.010</sub>																				550+	
C <sub>67</sub> H <sub>136.010</sub>																				0.202	
C <sub>68</sub> H <sub>138.010</sub>																				68.0	
C <sub>69</sub> H <sub>140.010</sub>																				0.168	
C <sub>70</sub> H <sub>142.010</sub>																				0.707	
C <sub>71</sub> H <sub>144.010</sub>																				0.202	
C <sub>72</sub> H <sub>146.010</sub>																				550+	
C <sub>73</sub> H <sub>148.010</sub>																				0.202	
C <sub>74</sub> H <sub>150.010</sub>																				68.0	
C <sub>75</sub> H <sub>152.010</sub>																				0.168	
C <sub>76</sub> H <sub>154.010</sub>																				0.707	
C <sub>77</sub> H <sub>156.010</sub>																				0.202	
C <sub>78</sub> H <sub>158.010</sub>																				550+	
C <sub>79</sub> H <sub>160.010</sub>																				0.202	
C <sub>80</sub> H <sub>162.010</sub>																				68.0	
C <sub>81</sub> H <sub>164.010</sub>																				0.168	
C <sub>82</sub> H <sub>166.010</sub>																				0.707	
C <sub>83</sub> H <sub>168.010</sub>																				0.202	
C <sub>84</sub> H <sub>170.010</sub>																				550+	
C <sub>85</sub> H <sub>172.010</sub>																					

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
DATA SUMMARY

RUN NO. 51 B

OPERATING CONDITIONS			PRODUCT TESTS		CATALYST DATA					
PRESURES PSIG	RATES S.C.F.H.		OIL	WATER	INVENTORY DATA			PARTICLE SIZE		
Oxygen	439	Fresh Feed	10455	* API	51.8	10.8	In Reactor at Start of Period	Screen Analysis		
Natural Gas	435	Recycle	10899	Neut. No.	41.0	37.8	Fresh Catalyst Added	0	Mesh	Micros
Generator Outlet	420	Combined Feed	21352	Sap. No.	49.4	38.4	Total	On 40	419+	16.2
Reactor Inlet	410	Wet Gas—Measured	2198	Hydrox. No.			Catalyst Recovered	18	100	56.7
Condenser Inlet		Adjusted	2799	Bromine No.	84.8		In Reactor at End of Period	150	106	11.2
Product Accumulator	397	Loss	601	Four °F.				200	74	8.6
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	9.0		REACTOR d.p. Inches H <sub>2</sub> O	250	62	2.6
					No.	Height "		325	44	1.6
								<325		0.4
TEMPERATURES—°F.			Recycle/Fresh Feed	1.04			0 0 - 12	28		
Oxygen	454	Inlet Velocity—ft./sec.	0.66				1 12 - 43.8	73	CATALYST	
Natural Gas	787	Fresh Feed Rate—S.C.F.H.	9986	HEMPPEL. DIST. %	"API	2	43.2 - 74.4	71	Bulk Density, Lbs./Cu.Ft.	
Generator	2865	per Cu.Ft. Dense Bed	755	205 °F.		3	74.4 - 105.6	75	Aerated	150
Quench Accumulator	135	per lb. Catayst	5.28	400	71.3	4	105.6 - 342.0	305	Settled	151
Reactor Inlet	387	per Sq. Ft.	15130	400-550	17.6	35.8	Total	551	Compacted	170
Condenser Inlet				550+	11.1				Particle Density, gm./cc.	4.5
Product Accumulator	71	Heat Transfer Calculations					CALCULATED FROM dp		NH <sub>3</sub> Value, ml./gm.	1.4
Catalyst No.	Height "	Steam Rate = 357.9 #/hr	A. S. T. M. DIST. ON				Density, Lbs./Cu.Ft.	143	N <sub>2</sub> Surface, m <sup>2</sup> /gm.	
1	12.0	± 602 psia ± 518°F		Naphtha °F.			Inventory, Lbs.	1891		
2	43.2	± 1196 BTU/#		IBP	106		Bed Depth, Ft.	20.03	CHEMICAL ANALYSIS	
3	74.4	673 Water in ± 157°F ± 125 BTU/#	10%	136		Ga. Pt.	13.22	Fe		
4	5	135.8 655 Heat Transferred/lb. steam	50%	288				C		
5	199.2	630 ± 1071 BTU	90%	348				0		
6	250.4	612 (1071) (557.9) ± 383311 BTU/hr	EP	400				H		
9	261.6	Ave. Bed Temperature	Rec.	98.0				K <sub>2</sub> O. Wt. % basis Fe		
10	292.0	± 646°F						X-Ray Analysis—		
11	311.0	dt = 646-518 ± 128°F						Fe <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>		
12	342.0	Tube Area ± 30.9 ft <sup>2</sup>						Fe <sub>3</sub> O <sub>4</sub>		
		K = $\frac{383300}{(128)(50.8)}$ = 96.9						Fe		

FRESH FEED			WET GAS			RECYCLE		COMBINED FEED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED								
%	m/hr	#/hr	%	At. Wt.	Balance	m/hr	m/hr	m/hr	m/hr	m/hr	#/hr	gal/MCF	CONDENSATE	gal/hr	gal/MCF	#/hr	#/MCF	gal/hr	POLYMER	gal	%	
CO <sub>2</sub> 0.000	37,487	10,316	288.95	5.466	0.404	11.32	1.572	11.888	1.976	- 9,912	277.64								Distribution of			
H <sub>2</sub> 0.016	58,857	16,032	32.32	31.114	8.297	4.63	8.947	24.979	11.244	- 13.735	27.69								Recovered oil			
CO <sub>2</sub> 0.110	3,440	0.947	41.68	40.082	2.960	150.27	11.528	12.473	14.486	2,013	88.59	8.871							400 BR	0.665		
N <sub>2</sub> 0.016	0.753	0.207	5.80	2.442	1.030	5.04	0.703	0.910	0.883										400-550	0.164		
CH <sub>4</sub> 0.642	0.063	0.017	0.27	8.843	0.653	10.48	2.543	2.560	3.196	0.636	10.21	1.022							550+	0.103		
C <sub>2</sub> H <sub>6</sub> 0.012				3.123	0.251	6.48	0.988	0.898	1.128	0.251	6.48	0.649								70.6		
C <sub>3</sub> H <sub>8</sub> 0.048				1.803	0.096	2.89	0.375	0.375	0.471	0.086	2.89	0.289										
C <sub>4</sub> +C <sub>5</sub>													19.58	1.561								
C <sub>6</sub> H <sub>6</sub> 0.078				3.973	0.286	12.05	1.114	1.114	1.400	0.286	12.05	1.805	4.32	2,788	0.279	10.83	1.085	6.25	1,732	0.173		
C <sub>6</sub> H <sub>6</sub> 0.078				0.450	0.033	1.45	0.129	0.129	0.182	0.033	1.45	0.146	4.24	0.344	0.034							
C <sub>6</sub> H <sub>6</sub> 0.078				1.927	0.142	7.97	0.554	0.554	0.695	0.142	7.97	0.788	5.00	1,594	0.160	7.57	0.788	6.10	1,241	0.124		
C <sub>6</sub> H <sub>6</sub> 0.078				0.465	0.034	1.98	0.155	0.155	0.187	0.034	1.98	0.198	4.86	0.407	0.041	1.98	0.198	4.86	0.407	0.040		
C <sub>6</sub> H <sub>6</sub> 0.078				0.670	0.050	3.51	1.193	1.193	1.243	0.606	3.51	0.351	9.45	0.644	0.064	3.51	0.351	9.45	0.644	0.064		
C <sub>6</sub> H <sub>6</sub> 0.078				0.073	0.005	0.36	0.081	0.081	0.026	0.005	0.36	0.058	5.25	0.069	0.007	0.36	0.036	5.25	0.069	0.007		
C <sub>6</sub> H <sub>6</sub> 0.078				0.170	0.013	1.09	0.049	0.049	0.088	0.013	1.09	0.109	5.54	0.197	0.020	1.09	0.109	5.54	0.197	0.020		
C <sub>6</sub> -C <sub>8</sub>													28.40	2.844	6.040	0.606	25.34	2.538	4,290	0.430		
TOTAL	27,520	369.02		7,384	199.46	26.757	56.277	42.301														
H <sub>2</sub> +CO	26,348	9986	S.C.F.H.	2,701		10.519	36.887	15.280	-23.847													
H <sub>2</sub> /CO	1.55	1.55	100.041	5.68		2.10	5.69	1.38														
CUMULATIVE TOTALS												EFFLUENT	RECOVERED OIL									
H <sub>2</sub> +CO,MCF												CAVITATOR #	C <sub>3</sub> +, gal	gal/MCF	gal/#	0.420*	59.83	5.891	9,309	0.938	59.83	5.891
Previous Total												SHIFT RATIO	TOTAL OIL									
Current Period												WATER SOURCE	15.349									
New Total												(H <sub>2</sub> ) <sub>2</sub> (CO) <sub>2</sub> 14.8	CHEMICALS	0.184*	9.75	0.978	8.821	1.188	0.119	9.75	0.976	
FRESH FEED CONVERSION - %												TOTAL LIQUID PRODUCES	C <sub>3</sub> +	NET WATER	16.537	1.666	94.92	9.505	14.787	1.481		
CONSTRUCTION												GROSS WATER	5,550*	99,990	0.013	12,007	1,202					
H <sub>2</sub> 1.55												HYDROCARBON	109.74	10,989	10.8	13,195	1,321					

\*Included in Reactor Effluent Total

$$\text{cc/M3} = 141.3 \times \text{gal/MCF}$$

Hour	Gas Analyses				Generator Balance								Weight Balance						
	1400	2200	0600	Average	M/Hr	C	H	O	Mol %	M/Hr	C	H	O	# hr Measured	At. Wt. Balance				
FRESH FEED									0 <sub>2</sub> 14.850	0.98	7.647 0.099			WET GAS	156.82	199.46			
CO <sub>2</sub> 14.010	38.89	37.82	55.95	37.407	10.316	10.316		10.818	CO 2.010					OIL	59.85	59.85			
H <sub>2</sub> 2.014	56.10	57.69	60.98	58.257	18.032		32.064		H <sub>2</sub> 2.016					WATER	109.74	109.74			
CO <sub>2</sub> 4.410	4.39	3.57	2.36	3.440	0.947	0.947		1.894	CO 4.410	2.47	0.249	0.249	0.498	TOTAL	326.19	369.05			
N <sub>2</sub> 1.014	0.79	0.89	0.58	0.755	0.807				N <sub>2</sub> 1.014	3.78	0.381			FRESH FEED	369.05				
CH <sub>4</sub> 16.042	0.04	0.02	0.13	0.083	0.017	0.017	0.068		CH <sub>4</sub> 16.042	80.30	8.095	8.095	32.380	WEIGHT BALANCE	88.391				
					M. W.	15.4026			C <sub>2</sub> H <sub>6</sub> 16.042	8.10	0.817	1.634	4.902						
					H <sub>2</sub> O				C <sub>2</sub> H <sub>6</sub> 16.042	4.11	0.434	1.242	3.312	WET GAS FACTOR		1.97355			
						B.182	4.076		C <sub>2</sub> H <sub>6</sub> 16.042	0.15	0.018	0.060	0.150						
							11.980	40.294	C <sub>2</sub> H <sub>6</sub> 16.042	0.11	0.011	0.068	0.132	INDICATED LOSS—S C F H		601			
					BALANCE	99.48	98.55	101.88	TOTAL		11.346	40.876	15.990						
<b>WET GAS</b>																			
<b>GAS FLOW RATES</b>																			
CO 14.010	4.36	5.80	6.94	5.456	VTR	PRESSURE	TEMP.	S. C. F. H.	M. W.	M/HR	HOUR	GAGE	GAL	°F	FACTOR	GAL AT 60 # GAL	# GAL/Hr		
H <sub>2</sub> 2.014	28.47	31.77	33.10	31.114		415.4	95					OIL	5'11 <sup>3</sup>	316.58	68	0.9990	316.57	51.8	
CO <sub>2</sub> 4.410	43.69	41.42	35.23	40.082	FRESH FEED	20.89	0.9768	10433	1.4593	27.520			1'10	96.08	68	0.9961	95.65	6.487	
N <sub>2</sub> 1.014	2.85	1.93	2.56	2.443	WET GAS	1.60	71									220.68	1417.0		
CH <sub>4</sub> 16.042	9.38	8.65	8.50	8.643	79.51	6.73	4.02	0.9696	2198	1.03522	5.798					2.80	*18.0		
C <sub>2</sub> H <sub>6</sub> 16.042	3.92	3.83	2.92	3.123	RECYCLE	410.0	126									223.42	1435.0		
C <sub>2</sub> H <sub>6</sub> 16.042	1.86	1.30	1.35	1.303	115.14	4.30	80.61	0.9480	9951	1.035	26.855								
C <sub>2</sub> H <sub>6</sub> 4.474	3.80	3.85	4.77	3.878	BLEED	410.0	120												
C <sub>2</sub> H <sub>6</sub> 16.042	0.45	0.37	0.55	0.450	5.08	9.4	20.61	0.9420	948	1.035	8.808								
C <sub>2</sub> H <sub>6</sub> 7.514	1.76	1.88	2.44	1.287	NATURAL GAS	434.0	198	10899			26.787			7'1 <sup>3</sup>	377.68	78	0.9979	376.68	10.8
C <sub>2</sub> H <sub>6</sub> 7.514	0.37	0.43	0.61	0.463	28.43	5.74	21.20	0.9883	3780	1.2105	10.081			2 <sup>1</sup>	107.43	56	1.0003	107.46	8.317
C <sub>2</sub> H <sub>6</sub> 7.514	0.59	0.58	0.37	0.570	OXYGEN	419.6	83							1'8 <sup>3</sup>	68.73	68	0.9992	68.68	
C <sub>2</sub> H <sub>6</sub> 7.514	0.07	0.08	0.07	0.075	27.07	5.95	20.84	0.9786	2898		7.647			0'5 <sup>3</sup>	15.49	64	0.9965	15.43	
C <sub>2</sub> H <sub>6</sub> 7.514	0.18	0.16	0.20	0.170	STEAM	31.2										316.68	8833.0		
					M. W.	99.110	215.7	5.61	0.9888	587.94	A.m								

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 a  
HOURS 38-56

FRESH FEED			WET GAS			RECYCLE		COMBINED FEED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED								
%	m/hr	#hr	%	At Wt. Balance	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	%/MCF	CONDENSATE	GAL/HR	gal/MCF	GAL/HR	%/MCF	GAL/HR	%/MCF	% Unsat.
CO <sub>24.00</sub>	85.185	10.556	895.11	7.437	0.606	16.97	9.301	18.887	9.207	—	9.280	278.14		Distribution of								
H <sub>2</sub> <sub>24.00</sub>	60.880	18.885	36.80	56.726	2.998	6.04	11.361	29.617	14.386	—	18.281	80.74		Recovered oil								
CO <sub>24.00</sub>	8.553	0.780	35.45	51.830	2.594	114.85	10.607	12.443	1.836	80.80	7.404			400 XP							0.045	
N <sub>24.00</sub>	0.787	0.238	6.61	2.050	0.167	4.68	0.654	0.870	0.801					400-550							0.124	
CH <sub>424.00</sub>	0.697	0.209	5.35	10.580	0.859	15.76	3.254	3.463	4.112	0.649	10.41	0.984		550+							0.118	
C <sub>24.00</sub>					3.093	0.252	7.07	0.957	0.957	1.209	0.258	7.07	0.648								70.8	
C <sub>34.00</sub>					1.877	0.104	3.15	0.398	0.398	0.499	0.104	3.15	0.387									
C <sub>4+C<sub>5</sub></sub>														20.61	1.889							
CH <sub>424.00</sub>					3.583	0.287	12.08	1.099	1.099	1.386	0.287	12.08	1.107	4.32	2.798	0.256	10.87	0.896	6.28	1.740	0.169	88.8
					0.457	0.037	1.63	0.141	0.141	0.178	0.087	1.63	0.149	4.34	0.394	0.036						
C <sub>24.00</sub>					1.855	0.149	8.56	0.567	0.567	0.716	0.169	8.56	0.766	8.00	1.678	0.185	7.94	0.728	6.10	1.502	0.119	81.6
C <sub>34.00</sub>					0.413	0.034	1.98	0.128	0.128	0.182	0.034	1.98	0.181	4.88	0.407	0.037	1.98	0.181	4.88	0.407	0.037	
C <sub>424.00</sub>					0.617	0.050	3.51	0.191	0.191	0.241	0.050	3.51	0.382	8.45	0.644	0.059	3.51	0.322	5.45	0.644	0.059	88.9
C <sub>524.00</sub>					0.077	0.006	0.43	0.024	0.024	0.030	0.006	0.43	0.059	8.28	0.088	0.008	0.43	0.039	8.28	0.088	0.008	
C <sub>624.00</sub>					0.147	0.012	1.01	0.045	0.045	0.057	0.018	1.01	0.083	8.84	0.188	0.017	1.01	0.093	8.84	0.188	0.017	
C <sub>7-C<sub>8</sub></sub>																						
TOTAL	28.997	375.32		8.155	194.80	30.935	50.932	45.876						29.00	8.658		6.167	0.555	25.74	2.359	4.357	0.399
H <sub>2</sub> +CO	95.985	28.792	S.C.F.H.	5.601		13.682	42.454	17.263	25.191													
H <sub>2</sub> /CO	1.733	9264082		4.94					2.307													
CUMULATIVE TOTALS																						
H <sub>2</sub> +CO/MCF Catalyst # C <sub>2</sub> +/C <sub>3</sub> +/C <sub>4</sub> +/C <sub>5</sub> +/C <sub>6</sub> +/C <sub>7</sub> +/C <sub>8</sub> +/C <sub>9</sub> +/C <sub>10</sub> +/C <sub>11</sub> +/C <sub>12</sub> +/C <sub>13</sub> +/C <sub>14</sub> +/C <sub>15</sub> +/C <sub>16</sub> +/C <sub>17</sub> +/C <sub>18</sub> +/C <sub>19</sub> +/C <sub>20</sub> +/C <sub>21</sub> +/C <sub>22</sub> +/C <sub>23</sub> +/C <sub>24</sub> +/C <sub>25</sub> +/C <sub>26</sub> +/C <sub>27</sub> +/C <sub>28</sub> +/C <sub>29</sub> +/C <sub>30</sub> +/C <sub>31</sub> +/C <sub>32</sub> +/C <sub>33</sub> +/C <sub>34</sub> +/C <sub>35</sub> +/C <sub>36</sub> +/C <sub>37</sub> +/C <sub>38</sub> +/C <sub>39</sub> +/C <sub>40</sub> +/C <sub>41</sub> +/C <sub>42</sub> +/C <sub>43</sub> +/C <sub>44</sub> +/C <sub>45</sub> +/C <sub>46</sub> +/C <sub>47</sub> +/C <sub>48</sub> +/C <sub>49</sub> +/C <sub>50</sub> +/C <sub>51</sub> +/C <sub>52</sub> +/C <sub>53</sub> +/C <sub>54</sub> +/C <sub>55</sub> +/C <sub>56</sub> +/C <sub>57</sub> +/C <sub>58</sub> +/C <sub>59</sub> +/C <sub>60</sub> +/C <sub>61</sub> +/C <sub>62</sub> +/C <sub>63</sub> +/C <sub>64</sub> +/C <sub>65</sub> +/C <sub>66</sub> +/C <sub>67</sub> +/C <sub>68</sub> +/C <sub>69</sub> +/C <sub>70</sub> +/C <sub>71</sub> +/C <sub>72</sub> +/C <sub>73</sub> +/C <sub>74</sub> +/C <sub>75</sub> +/C <sub>76</sub> +/C <sub>77</sub> +/C <sub>78</sub> +/C <sub>79</sub> +/C <sub>80</sub> +/C <sub>81</sub> +/C <sub>82</sub> +/C <sub>83</sub> +/C <sub>84</sub> +/C <sub>85</sub> +/C <sub>86</sub> +/C <sub>87</sub> +/C <sub>88</sub> +/C <sub>89</sub> +/C <sub>90</sub> +/C <sub>91</sub> +/C <sub>92</sub> +/C <sub>93</sub> +/C <sub>94</sub> +/C <sub>95</sub> +/C <sub>96</sub> +/C <sub>97</sub> +/C <sub>98</sub> +/C <sub>99</sub> +/C <sub>100</sub> +/C <sub>101</sub> +/C <sub>102</sub> +/C <sub>103</sub> +/C <sub>104</sub> +/C <sub>105</sub> +/C <sub>106</sub> +/C <sub>107</sub> +/C <sub>108</sub> +/C <sub>109</sub> +/C <sub>110</sub> +/C <sub>111</sub> +/C <sub>112</sub> +/C <sub>113</sub> +/C <sub>114</sub> +/C <sub>115</sub> +/C <sub>116</sub> +/C <sub>117</sub> +/C <sub>118</sub> +/C <sub>119</sub> +/C <sub>120</sub> +/C <sub>121</sub> +/C <sub>122</sub> +/C <sub>123</sub> +/C <sub>124</sub> +/C <sub>125</sub> +/C <sub>126</sub> +/C <sub>127</sub> +/C <sub>128</sub> +/C <sub>129</sub> +/C <sub>130</sub> +/C <sub>131</sub> +/C <sub>132</sub> +/C <sub>133</sub> +/C <sub>134</sub> +/C <sub>135</sub> +/C <sub>136</sub> +/C <sub>137</sub> +/C <sub>138</sub> +/C <sub>139</sub> +/C <sub>140</sub> +/C <sub>141</sub> +/C <sub>142</sub> +/C <sub>143</sub> +/C <sub>144</sub> +/C <sub>145</sub> +/C <sub>146</sub> +/C <sub>147</sub> +/C <sub>148</sub> +/C <sub>149</sub> +/C <sub>150</sub> +/C <sub>151</sub> +/C <sub>152</sub> +/C <sub>153</sub> +/C <sub>154</sub> +/C <sub>155</sub> +/C <sub>156</sub> +/C <sub>157</sub> +/C <sub>158</sub> +/C <sub>159</sub> +/C <sub>160</sub> +/C <sub>161</sub> +/C <sub>162</sub> +/C <sub>163</sub> +/C <sub>164</sub> +/C <sub>165</sub> +/C <sub>166</sub> +/C <sub>167</sub> +/C <sub>168</sub> +/C <sub>169</sub> +/C <sub>170</sub> +/C <sub>171</sub> +/C <sub>172</sub> +/C <sub>173</sub> +/C <sub>174</sub> +/C <sub>175</sub> +/C <sub>176</sub> +/C <sub>177</sub> +/C <sub>178</sub> +/C <sub>179</sub> +/C <sub>180</sub> +/C <sub>181</sub> +/C <sub>182</sub> +/C <sub>183</sub> +/C <sub>184</sub> +/C <sub>185</sub> +/C <sub>186</sub> +/C <sub>187</sub> +/C <sub>188</sub> +/C <sub>189</sub> +/C <sub>190</sub> +/C <sub>191</sub> +/C <sub>192</sub> +/C <sub>193</sub> +/C <sub>194</sub> +/C <sub>195</sub> +/C <sub>196</sub> +/C <sub>197</sub> +/C <sub>198</sub> +/C <sub>199</sub> +/C <sub>200</sub> +/C <sub>201</sub> +/C <sub>202</sub> +/C <sub>203</sub> +/C <sub>204</sub> +/C <sub>205</sub> +/C <sub>206</sub> +/C <sub>207</sub> +/C <sub>208</sub> +/C <sub>209</sub> +/C <sub>210</sub> +/C <sub>211</sub> +/C <sub>212</sub> +/C <sub>213</sub> +/C <sub>214</sub> +/C 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THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONSRUN NO. 51 D  
HOURS 56-80

FRESH FEED				WET GAS			RECYCLE		COMBINED FEED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED														
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/hr	CONDENSATE	CO <sub>2</sub>	#/gal	gal/hr	gal/MCF	#/hr	POLYMER	#/MCF	#/gal	gal/hr	gal/MCF	Unsat.				
CO <sub>2</sub> 28.00	56.945	10.509	894.56	6.745	0.549	15.38	2.054	12.553	2.603	-9.960	279.98								Distribution of										
H <sub>2</sub> 2.04	58.943	10.775	55.81	36.350	2.960	5.97	11.070	27.843	14.030	-13.813	-27.84								Recovered Oil										
CO <sub>2</sub> 24.00	2.700	0.768	33.80	32.980	2.688	118.08	10.055	10.803	12.718	1.916	84.28	8.161							400 EF	0.659									
N <sub>2</sub> 0.04	0.807	0.230	6.44	2.107	0.172	4.82	0.642	0.672	0.814										400-EF	0.118									
CH <sub>4</sub> 16.04	0.587	0.167	2.68	9.743	0.793	12.72	2.967	3.134	3.760	0.626	10.04	0.971							550+	0.087									
C <sub>2</sub> H <sub>6</sub> 2.04				3.133	0.255	7.16	0.954	0.954	1.209	0.255	7.16	0.691								70.7									
C <sub>3</sub> H <sub>8</sub> 5.04				1.800	0.106	3.19	0.395	0.395	0.502	0.106	3.19	0.309																	
C <sub>4</sub> +C <sub>5</sub>													20.38	1.971															
C <sub>6</sub> H <sub>6</sub> 0.04				3.707	0.302	12.71	1.129	1.129	1.431	0.302	12.71	1.288	4.32	2.942	0.284	11.144	1.106	6.25	1.830	0.177	89.0								
C <sub>2</sub> H <sub>2</sub> 0.04				0.457	0.037	1.63	0.159	0.159	0.176	0.037	1.63	0.158	4.24	0.384	0.037														
C <sub>2</sub> H <sub>2</sub> 0.04				2.110	0.172	9.65	0.643	0.643	0.815	0.172	9.65	0.933	3.00	1.930	0.187	9.17	0.887	6.10	1.503	0.145	82.5								
C <sub>2</sub> H <sub>2</sub> 0.04				0.447	0.036	2.09	0.136	0.136	0.172	0.036	2.09	0.202	4.88	0.430	0.042	2.09	0.430	4.88	0.430	0.042									
C <sub>2</sub> H <sub>2</sub> 0.04				0.713	0.058	4.07	0.217	0.217	0.275	0.058	4.07	0.394	8.48	0.747	0.072	4.07	0.747	8.48	0.747	0.072	89.9								
C <sub>2</sub> H <sub>2</sub> 0.04				0.080	0.007	0.51	0.024	0.024	0.031	0.007	0.51	0.049	5.28	0.097	0.009	0.51	0.097	5.28	0.097	0.009									
C <sub>2</sub> H <sub>2</sub> 0.04				0.160	0.013	1.09	0.049	0.049	0.062	0.013	1.09	0.105	5.54	0.197	0.019	1.09	0.197	5.54	0.197	0.019									
C <sub>2</sub> C <sub>6</sub>																													
TOTAL	28.446	371.09		8.143	199.06	30.454	58.900	44.954																					
H <sub>2</sub> +CO	95.906	27.292	10340	S.C.F.H.	3.509		13.124	40.406	16.633	23.773																			
H <sub>2</sub> /CO	1.60	9671294	5.59				2.22		1.39																				
CUMULATIVE TOTALS				H <sub>2</sub> +CO MCF Catalyst # C <sub>2</sub> +, gal gal/MCF gal/#			EFFLUENT								RECOVERED OIL								SHIFTS RATIO						
Previous Total																													
Current Period																													
New Total																													
FRESH FEED CONVERSION - %																													
Combustion CO H <sub>2</sub> H <sub>2</sub> +CO CO H <sub>2</sub> CO+H <sub>2</sub> C <sub>2</sub> + C <sub>3</sub> +	71.37	94.78	82.35	87.14	79.28	49.61	58.84	83.20																					

\*Included in Reactor Effluent Total

g/M3 = 16.91 x MCF

cc/M3 = 141.3 x gal/MCF.

OPERATING CONDITIONS		PRODUCT TESTS				CATALYST DATA			
PRESURES PSIG	RATES S.C.F.H.	OIL	WATER	INVENTORY DATA					PARTICLE SIZE
Oxygen	437	Fresh Feed	10781	* API	51.0	10.6	In Reactor at Start of Period		Screen Analysis Sedimentation
Natural Gas	434	Recycle	11542	Neut. No.	45.8	39.4	Fresh Catalyst Added 53 = 80	Mesh Microns	% Microns %
Generator Outlet	417	Combined Feed	22323	Sap. No.	54.4	39.7	Total	On 40 419+	16.1 80+
Reactor Inlet	410	Wet Gas - Measured	2934	Hydrox. No.			Catalyst Recovered	6	100 150 64.1 40-80
Condenser Inlet		Adjusted	3086	Bromine No.	83.1		In Reactor at End of Period	150 105 11.0 20-40	
Product Accumulator	395	Loss	102	Pour °F.				200 74 7.2 10-20	
				Chemicals, v by K <sub>2</sub> CO <sub>3</sub>	10.5	REACTOR d-p. Inches H <sub>2</sub> O		250 62 1.2 0-20	
					No. Height "			325 44 0.2	
TEMPERATURES - °F.		Recycle/Fresh Feed	1.07						
Oxygen	361	Inlet Velocity - ft./sec.	0.69				0 0 - 12 29 <25 0.2		
Natural Gas	755	Fresh Feed Rate - S.C.F.H.	10340	HEMPEL DIST. %	*	API	1 18 - 43.2 75		CATALYST
Generator	2305	per Cu.Ft. Dense Bed	819	205 °F.			2 43.2 - 74.4 74		Bulk Density, Lbs./Cu.Ft.
Quench Accumulator	120	per Lb. Catalyst	5.50	400	76.3	56.8	3 74.4 - 105.6 75		Aerated
Reactor Inlet	554	per Sq. Ft.	15667	400-550	13.6	56.7	4 105.6 - 342.0 295		Settled
Condenser Inlet				550+	10.1		5 342.0		Compacted
Product Accumulator	60	Heat Transfer Calculations							Particle Density, gm./cc.
Catalyst No. Height "		Steam Rate # 408.2 #/hr		A. S. T. M. DIST. ON					N <sub>2</sub> Value, ml./gm.
1	12.0	649 @ 756 psia & 518°F		Naphtha °F.					2.92
2	43.2	652		IBP	100				
3	74.4	665	Water in @ 158°F = 125 BTU/lb	10%	134				
5	136.6	649	Heat Transferred/lb. steam	50%	226				
7	199.2	632	= 1072 BTU	90%	350				
8	230.4	618	(1072)(408.2) = 437590 BTU/hr	EP	399				
9	261.6	611	Ave. Bed Temperature	Rec.	97.5				K <sub>2</sub> O, W+, % basis Fe
10	292.8	606	= 644-518 = 126°F						X-Ray Analysis
11	311.0	586	dT = 644-518 = 126°F						Fe <sub>2</sub> O <sub>3</sub>
12	542.0	579	Tube Area = 30.9 ft <sup>2</sup>						Fe <sub>2</sub> O <sub>4</sub>
			K = 126/(30.9) = 112.4						Fe

GAS ANALYSES				GENERATOR BALANCE				WEIGHT BALANCE				
HOUR	AVERAGE	M/HR	C	H	O	Mol %	M/Hr	C	H	O	Measured	At Wt. Balance
FRESH FEED												
CO <sub>2</sub> 28.00	37.28	37.04	36.51	58.943	10.509	10.509	10.509	CO <sub>2</sub> 28.00	0.45	7.295	14.674	WET GAS 192.45 199.06
H <sub>2</sub> 2.04	58.90	58.85	59.01	58.963	16.773			H <sub>2</sub> 2.04				OIL 57.56 57.56
CO <sub>2</sub> 24.00	2.71	2.76	2.65	2.700	0.768	0.768		CO <sub>2</sub> 24.00	2.05	0.208	0.208	WATER 114.45 114.45
N <sub>2</sub> 0.04	0.71	0.91	0.80	0.807	0.230			N <sub>2</sub> 0.04	1.71	0.174		FRESH FEED 371.07
CH <sub>4</sub> 16.04	0.37	0.34	1.05	0.587	0.167	0.167	0.588	CH <sub>4</sub> 16.04	82.88	8.410	35.640	WEIGHT BALANCE 98.22
								CH <sub>4</sub> 16.04	8.43	0.855	1.710	
								CH <sub>4</sub> 16.04	4.32	0.438	1.314	WET GAS FACTOR 1.034347
								CH <sub>4</sub> 16.04	0.13	0.013	0.082	INDICATED LOSS—SCFH 108
									0.05	0.005	0.025	
BALANCE	97.85	97.46	103.58					TOTAL	11.719	42.484	15.090	
WET GAS				GAS FLOW RATES				LIQUID PRODUCT RATES				
CO <sub>2</sub> 28.00	6.17	7.74	6.32	6.745	V/R	PRESSURE	TEMP.	S.C.F.H.	M. W.	M/HR	HOUR GAGE	GAL °F FACTOR GAL AT 60 #/GAL #
H <sub>2</sub> 2.04	38.09	54.97	35.99	36.350		412.4	75				714	388.59 60 1.000 388.59 51.0 57.56
CO <sub>2</sub> 24.00	35.68	32.74	32.84	32.960</td								

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONSRUN NO. 51 E  
HOURS 80-104

FRESH FEED			WET GAS			RECYCLE			COMBINED FRESH			EFFLUENT			NET CHANGE			YIELD BASIS H <sub>2</sub> + CO FED								
	%	m/hr	#/hr		%	At Wt.	Balance	#/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	#/gal	#/hr	#/MCF	#/gal	#/hr	#/MCF	#/gal	#/hr	#/MCF	#/gal	%
CO <sub>28.00</sub>	36.98	10.408	891.63	8.167	0.705	19.69	2.586	12.994	3.289	—	9.705	-271.84													Distribution of	
H <sub>2</sub> <sub>28.00</sub>	58.084	16.341	38.84	35.540	5.062	6.17	10.284	28.598	18.513	—	18.288	-26.77													Recovered Oil	
CO <sub>28.00</sub>	8.850	0.717	31.68	30.048	2.586	113.81	9.515	10.250	12.099	1.069	82.63	8.113													400 NP	
N <sub>2</sub> <sub>28.00</sub>	0.785	0.812	5.84	2.500	0.198	5.85	0.788	0.840	0.988																400-S60	
C <sub>2</sub> H <sub>28.00</sub>	1.680	0.486	7.38	13.187	1.158	18.81	4.176	4.652	5.311	0.679	10.68	1.074													550+	
C <sub>3</sub> H <sub>28.00</sub>				2.897	0.249	6.88	0.917	0.917	1.186	0.249	6.98	0.688													69.7	
C <sub>4</sub> H <sub>28.00</sub>				1.857	0.108	3.85	0.398	0.398	0.508	0.108	3.85	0.391														
C <sub>5</sub> +C <sub>6</sub>																										21.12
C <sub>6</sub> H <sub>28.00</sub>				5.360	0.288	12.12	1.061	1.061	1.349	0.288	18.18	1.198	4.32	2.806	0.877	10.91	1.076	6.28	1.748	0.178	88.8					
C <sub>7</sub> H <sub>28.00</sub>				0.485	0.058	1.59	0.134	0.134	0.170	0.058	1.59	0.157	4.24	0.375	0.057											
C <sub>8</sub> H <sub>28.00</sub>				1.663	0.143	8.02	0.587	0.587	0.670	0.143	8.02	0.791	5.00	1.604	0.158	7.68	0.752	6.10	1.249	0.123	80.7					
C <sub>9</sub> H <sub>28.00</sub>				0.397	0.054	1.98	0.126	0.126	0.160	0.034	1.98	0.195	4.86	0.407	0.040	1.98	0.195	4.86	0.407	0.040						
C <sub>10</sub> H <sub>28.00</sub>				0.557	0.048	3.37	0.176	0.176	0.224	0.048	3.37	0.332	5.45	0.618	0.061	3.37	0.332	5.45	0.618	0.061	88.8					
C <sub>11</sub> H <sub>28.00</sub>				0.070	0.006	0.45	0.082	0.082	0.098	0.006	0.45	0.042	5.28	0.082	0.006	0.45	0.042	5.28	0.082	0.006						
C <sub>12</sub> H <sub>28.00</sub>				0.150	0.013	1.09	0.047	0.047	0.060	0.013	1.09	0.108	5.84	0.208	0.021	1.09	0.108	5.84	0.208	0.021						
C <sub>13</sub> C <sub>4</sub>																										
TOTAL	28.143	369.29			8.608	202.26	31.665	59.808	46.405																	
H <sub>2</sub> +CO	95.077	26.749	10138	S.C.F.H.	3.762		12.840	39.589	16.402	22.987																
H <sub>2</sub> /CO	1.57	9864004	4.35						2.05	1.37																
CUMULATIVE TOTALS																										
H <sub>2</sub> +CO/MCF	Catalyst #	C <sub>2</sub> H <sub>2</sub> gal	gal/MCF	gal/#																						
Previous Total																										
Current Period																										
New Total																										
FRESH FEED CONVERSION — %																										
Conversion	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> +C <sub>4</sub>																			
	73.03	93.25	81.28	85.94	74.69	49.94	58.05	82.03																		

\*Included in reactor effluent Total

g/M3 = 16.91 × #/MCF  
cc/M3 = 141.3 × gal/MCF

OPERATING CONDITIONS		PRODUCT TESTS			INVENTORY DATA			CATALYST DATA			PARTICLE SIZE			
PRESSES PSIG		RATES S.C.F.H.			OIL	WATER		In Reactor at Start of Period			Screen Analysis		Sedimentation	
Oxygen	437	Fresh Feed	10663	* API	53.7	10.7		Fresh Catalyst Added	59	= 89	Mesh	Microns	%	
Natural Gas	434	Recycle	12001	Neut. No.	41.5	37.8	Total	On 40	419+	18.5	80+			
Generator Outlet	422	Combined Feed	22564	Sap. No.	48.8	42.1	Catalyst Recovered	21	100	150	40-80			
Reactor Inlet	418	Wet Gas-Measured	2937	Hydrox. No.			In Reactor at End of Period	150	105	9.0	20-40			
Condenser Inlet		Adjusted	3263	Bromine No.	85.1			200	74	5.8	10-20			
Product Accumulator	399	Loss	326	Pour °F.				250	62	1.0	0-20			
				Chemicals, ~ by K <sub>2</sub> CO <sub>3</sub>			No. Height "	325	44	1.0				
TEMPERATURES - °F.		Recycle/Fresh Feed	1.13				0 0 - 12 28			<225	0.2			
Oxygen	339	Inlet Velocity - ft./sec.	0.69				1 12.0 - 45.2 74					CATALYST		
Natural Gas	727	Fresh Feed Rate - S.C.F.H.	10138	HEMPEL DIST. %	* API		2 43.2 - 74.4 74					Bulk Density, Lbs./Cu.Ft.		
Generator	2330	per Cu.Ft. Dense Bed	777	205 °F.			3 74.4 - 105.6 75					Aerated	129	
Quench Accumulator	2330	per lb. Catalyst	5.25	400	75.3	57.5	4 105.6 - 342.0 512					Settled	131	
Reactor Inlet	572	per Sq. Ft.	15361	400-550	12.0	37.1	Total	563				Compacted	148	
Condenser Inlet				550+	18.7							Particle Density, gm./cc.	4.6	
Product Accumulator	55	Heat Transfer Calculations					CALCULATED FROM dp					N <sub>2</sub> Value, ml./gm.		
Catalyst No.	Height "	Steam Rate = 408.2 #/hr			A. S. T. M. DIST. ON		Density, Lbs./Cu.Ft.	148				N <sub>2</sub> Surface, m <sup>2</sup> /gm.		
1	12.0	645	0.799.4 psia & 518°F		Naphtha °F.		Inventory, Lbs.	1932						
2	43.2	649	= 1197 BTU/#		IBP	100	Bed Depth, Ft.	19.78						
3	74.4	657	Water in @ 156°F = 124 BTU/#	10%		131	Grs. Ft.	13.05						
4	136.8	640	Heat Transferred/lb. steam	50%		221						C		
5	199.2	628	= 1073 BTU/hr	90%		352						O		
6	250.4	616	(1073)(408.2) = 438000 BTU/hr	EP		403						H		
9	261.6	606	Ave. Bed Temperature	Rec.		97.5						K <sub>2</sub> O. W+. % basis Fe		
10	292.8	602	= 639°F = 121°F									X-Ray Analysis		
11	511	586	dt = 639-618 = 121°F									Fe <sub>2</sub> O <sub>3</sub>		
12	342	575	Tube Area = 30.9 ft <sup>2</sup>									Fe <sub>3</sub> O <sub>4</sub>		
			K = 458000/(121)(30.9)	= 117.1								Fe		

HOUR	GAS ANALYSES			GENERATOR BALANCE			WEIGHT BALANCE			# hr Measured	At. Wt. Balance	
	AVERAGE	M/Hr	C	H	O	Mol %	M/Hr	C	H	O		
FRESH FEED												
CO <sub>28.00</sub>	36.68	7.82	8.12	8.167	VTR	417.8	69				13.260	WET GAS
H <sub>2</sub> <sub>28.00</sub>	35.86	35.64	35.12	35.540	FRESH FEED							OIL
CO <sub>28.00</sub>	28.09	29.68	32.46	30.042	79.31	4.39	20.80	0.9915	10.663	1.4851	28.134	1.13*
N <sub>2</sub> <sub>28.00</sub>	1.84	2.64	2.42	2.300	WET GAS							5.15*
C <sub>2</sub> H <sub>28.00</sub>	15.90	13.84	9.82	13.187	79.31	8.26	4.08	1.0048	2937	1.1098	7.748	220.55
C <sub>3</sub> H <sub>28.00</sub>	2.79	2.83	3.07	2.897	RECYCLE							55.45
C <sub>4</sub> H <sub>28.00</sub>	1.16	1.19	1.42	1.257	115.14	4.31	20.85	0.9555	10.939	1.1098	28.962	1.0049
C <sub>5</sub> H <sub>28.00</sub>	3.00	3.86	3.80	3.850	BLEED							1.0025
C <sub>6</sub> H <sub>28.00</sub>	0.59	0.40	0.48	0.485	5.02	0.6	20.85	0.9555	10.662	1.1098	28.903	1.0049
C <sub>7</sub> H <sub>28.00</sub>	1.42	1.65	1.92	1.663	NATURAL GAS							3.16
C <sub>8</sub> H <sub>28.00</sub>	0.20	0.39	0.62	0.397	2.65	5.80	1.10	0.9924	3757	1.205	20.824	1.0025
C <sub>9</sub> H <sub>28.00</sub>	0.49	0.55</										

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONSRUN NO. 51 =  
HOURS 104-188

FRESH FEED			WET GAS			RECYCLE			COMBINED FRESH			EFFLUENT			NET CHANGE			YIELD BASIS H <sub>2</sub> + CO FED											
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	POLYMER	%									
CO	36.753	10.057	821.70	7.033	0.572	16.08	2.806	18.865	2.778	9.465	26.66								Distribution of										
H <sub>2</sub>	58.470	16.009	38.87	34.860	2.837	5.79	10.854	26.945	15.771	-13.178	26.55								Recovered oil										
CO <sub>2</sub>	8.680	0.780	51.69	31.693	2.579	113.80	9.941	10.661	12.580	1.859	81.81	8.881							400 sp	0.611									
N <sub>2</sub>	0.767	0.810	5.88	2.080	0.169	4.73	0.658	0.868	0.881										400-550	0.086									
CH <sub>4</sub>	1.400	0.388	6.14	19.860	0.998	16.01	3.845	4.228	4.845	0.615	9.87	0.999							550+	0.140									
C <sub>2</sub> H <sub>6</sub>							2.970	0.841	6.76	0.932	0.952	1.175	0.241	6.74	0.884					69.3									
C <sub>3</sub> H <sub>8</sub>							1.513	0.107	3.82	0.412	0.412	0.519	0.107	3.23	0.386														
C <sub>4</sub> +C <sub>5</sub>																			19.84	0.009									
C <sub>6</sub> H <sub>6</sub>							3.800	0.309	18.00	1.192	1.192	1.601	0.309	15.00	1.318	4.32	3.009	0.304	11.70	1.184	6.28	1.872	0.190	89.7					
C <sub>2</sub> H <sub>2</sub>							0.437	0.036	1.59	0.137	0.137	0.173	0.036	1.58	0.161	4.24	0.375	0.036											
C <sub>2</sub> H <sub>2</sub>							2.127	0.175	9.71	0.667	0.667	0.840	0.175	9.71	0.983	5.00	1.942	0.198	9.22	0.953	6.10	1.512	0.153	82.2					
C <sub>2</sub> H <sub>2</sub>							0.460	0.037	2.15	0.144	0.144	0.181	0.037	2.15	0.818	4.88	0.442	0.045	2.15	0.818	4.88	0.442	0.045						
C <sub>2</sub> H <sub>2</sub>							0.710	0.058	4.07	0.223	0.223	0.281	0.058	4.07	0.412	5.45	0.747	0.076	4.07	0.412	5.45	0.747	0.076	89.1					
C <sub>2</sub> H <sub>2</sub>							0.087	0.007	0.51	0.027	0.027	0.034	0.007	0.51	0.058	5.25	0.097	0.010	0.51	0.058	5.25	0.097	0.010						
C <sub>2</sub> H <sub>2</sub>							0.170	0.014	1.18	0.053	0.053	0.087	0.014	1.18	0.119	5.84	0.213	0.022	1.18	0.119	5.84	0.213	0.022						
C <sub>2</sub> -C <sub>6</sub>																			32.81	3.261	6.825	0.691	29.83	2.916	4.883	0.494			
TOTAL	27.380	557.68	8.139	198.17	31.366	58.746	45.578																						
H <sub>2</sub> +CO	95.203	26.056	9879	S.C.F.H.	3.409	15.140	39.206	16.549	22.657																				
H <sub>2</sub> /CO		1.59			5.96				2.80	1	1.59																		
CUMULATIVE TOTALS																													
H <sub>2</sub> +CO/MCF Catalyst # C <sub>2</sub> +C <sub>6</sub> gal/MCF gal/#																													
Previous Total																													
Current Period																													
New Total																													
FRESH FEED CONVERSION - %																													
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>2</sub> +C <sub>6</sub>																						
	70.27	94.31	88.28	86.92	77.35	48.89	57.79	82.97																					

\*Included in Reactor Effluent Total

g/M3 = 16.91 ± MCF  
cc/M3 = 141.3 gal/MCF

OPERATING CONDITIONS		PRODUCT TESTS			CATALYST DATA			PARTICLE SIZE		
PRESSURES PSIG		RATES S.C.P.H.			OIL	WATER	INVENTORY DATA	PARTICLE SIZE		
Oxygen	439		Fresh Feed	10377	* API	53.5	10.8	In Reactor at Start of Period		
Natural Gas	427		Recycle	11898	Neut. No.	41.7	38.6	Fresh Catalyst Added	62	94
Generator Outlet	424		Combined Feed	22825	Sap. No.	47.8	40.3	Total	On 40	419+
Reactor Inlet	419		Wet Gas-Measured	2767	Hydrox. No.			Catalyst Recovered	32	100
Condenser Inlet			Adjusted	3084	Bromine No.	94.5		In Reactor at End of Period	150	105
Product Accumulator	401		Loss	317	Pour °F.			Total	250	62
					Chemicals, s by K <sub>2</sub> CO <sub>3</sub>	11.5		REACTOR d-p. Inches H <sub>2</sub> O	250	2.2
								No. Height "	325	44
TEMPERATURES - °F.			Recycle/Fresh Feed	1.14						
Oxygen	317		Inlet Velocity - ft./sec.	0.68				0	=	12
Natural Gas	721		Fresh Feed Rate - S.C.F.H.	9879	HEMPEL DIST. %			1	12.0	- 45.2
Generator	2325		per Cu.Ft. Dense Bed	724		205 °F.		2	45.2	- 74.4
Quench Accumulator			per Lb. Catalyst	4.86		400		3	74.4	- 105.6
Reactor Inlet	620		per Sq. Ft.	14968		400-550		4	105.6	- 342.0
Condenser Inlet						550+		5	74.4	- 120.0
Product Accumulator	56		Heat Transfer Calculations							
Catalyst No.		Height "	Steam Rate = 420.8 #/hr	A. S. T. M. DIST. ON						
1	12.0	648	@ 790 psia & 517°F	Naphtha °F.						
2	43.2	649	= 1197 BTU/#	IRP	96					
3	74.4	654	Water in @ 155°F = 121 BTU/#		10%	127				
4	136.8	641	Heat Transferred/lb. steam		50%	217				
5	199.2	587	= 1076 BTU		90%	345				
6	230.4	617	(1076)(420.8) = 452781 BTU/hr	EP		398				
9	261.6	613	Ave. Bed Temperature	Rec.		97.5				
10	292.8	605	= 639-617 = 122°F							
11	511	590	dt = 539-617 = 122°F							
12	342	581	Tube Area = 31.4 in <sup>2</sup>							
			E = (122)/(51.5)			119.5				

GAS ANALYSES			GENERATOR BALANCE						WEIGHT BALANCE					
HOUR	AVERAGE	M/Hr	C	H	O	Mol %	M/Hr	C	H	O	#/hr	Measured	At Wt. Balance	
FRESH FEED														
CO	36.58	36.54	37.14	36.783	10.057	10.057	10.057	10.057	10.057	10.057	13.646	WET GAS	177.83	
H <sub>2</sub>	58.22	58.31	58.88	58.470	16.009	32.018							OIL	52.74
CO <sub>2</sub>	2.57	2.50	2.88	2.630	0.720	0.720	1.440	2.04	0.208	0.202	0.404	WATER	106.75	
N <sub>2</sub>	0.73	1.76	3.28	31.593	79.31	4.27	80.82	0.9887	10377	1.4884	27.380	TOTAL	337.32	
CH <sub>4</sub>	1.95	1.65	2.84	2.080			1.50	86				FRESH FEED	557.71	
CO <sub>2</sub>	13.71	13.98	9.11	18.860	79.31	7.95	4.02	1.0059	2767	1.0903	7.302	WEIGHT BALANCE	94.30	
C <sub>2</sub> H <sub>6</sub>	8.84	8.84	3.15	2.870			481.8	113						
C <sub>3</sub> H <sub>8</sub>	1.81	1.87	1.46	1.513	115.14	4.34	20.89	0.9526	10842	1.0903	89.607			
C <sub>2</sub> H <sub>2</sub>	3.49	3.69	3.83	3.800			481.8	115						
C <sub>2</sub> H <sub>2</sub>	0.38	0.41	0.54	0.457			1046	1.0903	2.756					
C <sub>2</sub> H <sub>2</sub>	8.00	8.19	2.19	2.197			437.4	190	1.0886	31.586				
CO <sub>2</sub>	0.40	0.49	0.49	0.460	28.463	5.66	21.86	0.8944	3746	1.0842	9.884	WATER		
C <sub>2</sub> H <sub>2</sub>	0.70	0.77	0.66	0.710			450.0	70						
C														

**THE TEXAS COMPANY — MONTEBELLO LABORATORY**

RUN NO. 51-6

\*Included in Reactor Effluent Total

$$g/M_3 = 16.91 \times MCF$$

$$sc/M_3 = 141.3 \times sc/MCF$$

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONSRUN NO. 81-8  
HOURS 168-176

FRESH FEED			WET GAS			RECYCLE		COMBINED FEED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED					
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	#/hr	m/hr	m/hr	#/hr	CONDENSATE	WATER	POLYMER	%		
				m/hr	#/hr									gal/hr	gal/MCF	gal/hr	gal/MCF	Units	
CO <sub>2</sub> 10.40	37.800	10,460	292.98	8.398	0.738	20.50	2,488	18.988	5.160	9.788	272.48							Distribution of	
H <sub>2</sub> 16.16	58.380	16,316	38.09	37.568	3.300	6.66	10.985	27.369	14.263	-13.116	26.44							Recovered OIL	
CO <sub>2</sub> 16.04	3.085	0.880	37.41	32.563	2.861	125.91	9.494	10.344	12.356	2.011	88.50	8.668						400 HF	
N <sub>2</sub> 16.04	1.085	0.287	8.88	8.200	0.193	5.41	0.641	0.838	0.834									400-SFO	
CH <sub>4</sub> 16.04	0.340	0.096	1.54	8.970	0.788	12.64	2.615	2.711	3.403	0.692	11.10	1.090						0.130	
C <sub>2</sub> H <sub>2</sub> 16.04				2.880	0.855	7.10	0.840	0.840	1.093	0.285	7.10	0.697						550+	
C <sub>2</sub> H <sub>4</sub> 16.04				1.310	0.116	3.46	0.382	0.382	0.497	0.116	3.46	0.340						0.048	
C <sub>3</sub> +C <sub>4</sub>													21.66	2.186					88.7
C <sub>2</sub> H <sub>6</sub> 16.04				3.088	0.871	11.40	0.899	0.899	1.170	0.271	11.40	1.110	4.32	8.588	0.859	10.88	1.007	0.25	
C <sub>3</sub> H <sub>8</sub> 16.04				0.410	0.056	1.59	0.120	0.120	0.156	0.036	1.59	0.156	4.24	0.376	0.037			1.642 0.161	
C <sub>4</sub> H <sub>10</sub> 16.04				1.583	0.137	7.89	0.456	0.456	0.593	0.137	7.69	0.756	8.00	1.658	0.151	7.80	0.717	6.10	
C <sub>5</sub> H <sub>12</sub> 16.04				0.345	0.030	1.74	0.100	0.100	0.130	0.030	1.74	0.171	4.88	0.358	0.055	1.74	0.171	4.86	
C <sub>6</sub> H <sub>16</sub> 16.04				0.540	0.047	3.30	0.157	0.157	0.204	0.047	3.30	0.324	5.45	0.608	0.059	3.30	0.324	5.45	
C <sub>7</sub> H <sub>16</sub> 16.04				0.100	0.009	0.86	0.029	0.029	0.058	0.009	0.86	0.084	5.28	0.124	0.018	0.86	0.084	5.28	
C <sub>8</sub> H <sub>18</sub> 16.04				0.147	0.013	1.09	0.043	0.043	0.056	0.013	1.09	0.107	5.84	0.197	0.019	1.09	0.107	5.84	
C <sub>9</sub> -C <sub>12</sub>													27.46	2.698	5.637	0.573	24.34	2.390	4.125 0.405
TOTAL	28.119	573.34		9.785	209.13	29.156	57.275	44.077											
H <sub>2</sub> +CO	95.580	10186	S.C.F.H.	4.038		13.381	40.287	17.413	22.844										
H <sub>2</sub> /CO	1.57	93174		4.51					2.12			1.55							
CUMULATIVE TOTALS																			
Previous Total																			
Current Period																			
New Total																			
FRESH FEED CONVERSION — %	TOTAL FEED CONVERSION — %			SELECTIVITY — %															
Construction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> +C <sub>4</sub>	C <sub>3</sub> +C <sub>4</sub>	GROSS WATER									g/M3 = 16.91 ± .005/MCF	
	93.00	79.90	85.00	75.48	47.92	56.75	80.90		111.06	10.903								cc/M3 = 141.3 ± gal/MCF	
68.76										11.40	11.33								

\*Included in Reactor Effluent Total

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA						PARTICLE SIZE								
PRESSURES PSIG			RATES S.C.P.H.			OIL			WATER			INVENTORY DATA			PARTICLE SIZE					
Oxygen	441	Fresh Feed	10657	* API	52.5	10.8	In Reactor at Start of Period					Screen Analysis								
Natural Gas	438	Recycle	11060	Neut. No.	40.7	38.1	Fresh Catalyst Added 50 ±	76	Total	76	100	150	11.5	80+						
Generator Outlet	423	Combined Feed	81707	Sap. No.	50.6	40.1	On 40	419+												
Rector Inlet	419	Wet Gas—Measured	2886	Hydrox. No.			Catalyst Recovered	30	100	150	65.3	40-80								
Condenser Inlet		Adjusted	5330	Bromine No.	88.3		In Reactor at End of Period	150	105	120	18.3	20-40								
Product Accumulator	399	Loss	444	Pour °F.				200	74	9.7	10-20									
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>			REACTOR d.p. Inches H <sub>2</sub> O	250	62	1.8	0-20									
							No. Height "	325	44	2.0										
TEMPERATURES — °F.	Recycle/Fresh Feed			1.04				0	0	- 18.0	29	325	1.4							
Oxygen	346	Inlet Velocity—ft./sec.	0.69					1	18	- 48.2	76	100	CATALYST							
Natural Gas	738	Fresh Feed Rate—S.C.P.H.	10186	HEMPEL DIST. %				2	43.2	- 74.4	73		Bulk Density, Lbs./Cu.Ft.							
Generator	2310	per Cu.Ft. Demas Bed	734	205 °F.				3	74.4	- 105.6	74		Aerated	148						
Quench Accumulator		per Lb. Catalyst	4.93	400				4	105.6	- 542.0	350		Settled	150						
Reactor Inlet	588	per Sq. Ft.	15455	400-550				5	36.4		502		Compacted	163						
Condenser Inlet				550+	5.2								Particle Density, gm./cc.	4.4						
Product Accumulator	63	Heat Transfer Calculations											CALCULATED FROM dp	N <sub>2</sub> Value, ml./gm.	9.03					
Catalyst No. Height "		Steam Rate = 482.6 #/hr	A. S. T. M. DIST. ON										Density, Lbs./Cu.Ft.	149	N <sub>2</sub> Surface, m <sup>2</sup> /gm.					
1	18.0	645	@ 798.6 psia & 518°F	Naphtha °F.									Inventory, Lbs.	2066						
2	45.2	649	= 1197 BTU/#	IHP	96								Bed Depth, Ft.	21.01	CHEMICAL ANALYSIS					
3	74.4	658	Water in @ 150°F = 189 BTU/#	10%	128									13.87	Fe					
4	136.0	640	Heat Transferred/lb. steam	50%	220										C					
5	199.8	628	= 1068 BTU	90%	351										O					
6	830.4	680	(1068)(422.6) = 451307 BTU/lb	EP	409										H					
9	261.6	618	Ave. Bed Temperature = 459°F Rec.	97.5											K <sub>2</sub> O, W+, % basis Fe					
10	992.8	609	GT = 639-518 = 121°F	Rec.	97.5										X-Ray Analysis—					
11	311.0	584	Tube Area = 31.5 ft <sup>2</sup>												Fe <sub>2</sub> C <sub>6</sub>					
12	348.0	579	K = 16337/(31.5) = 118.4												Fe <sub>2</sub> O <sub>3</sub>					
															Fe					

GAS ANALYSES			GENERATOR BALANCE						WEIGHT BALANCE									
HOUR	1400	8800	0600	AVERAGE	M/Hr	C	H	O	Mol %	M/Hr	C	H	O		% hr	Measured	At Wt. Balance	
FRESH FEED																		
CO <sub>2</sub> 16.04	8.37	8.08	8.38	8.323	V/R	PRESSURE	TEMP.	S. C. F. H.	M. W.	M/Hr	HOUR	GAGE	GAL	°F FACTOR	GAL AT 60	147# /GAL	#	
H <sub>2</sub> 16.04	38.93	36.77	37.00	37.566		418.5	78									88.81	58.8	53.18
CO <sub>2</sub> 16.04	51.40	37.33	57.00	10.460		10.460												
H <sub>2</sub> 16.04	58.49	58.18	58.380	16.416														
CO <sub>2</sub> 16.04	3.58	8.89	3.18	3.085	0.851	0.851	1.708	CO <sub>2</sub> 16.04	8.28	0.285	0.885	0.480	0.480	TOTAL	346.80	373.37		
N <sub>2</sub> 16.04	1.06	1.08	1.09	1.058	0.297													
CH <sub>4</sub> 16.04	0.74	0.88</td																

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONSRUN NO. 51 T  
HOURS 176-200

FRESH FEED			WET GAS			RECYCLE			COMBINED FEED			EFFLUENT			NET CHANGE			YIELD BASIS H <sub>2</sub> +CO FED					
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	#/hr	m/hr	m/hr	#/hr	#/MCF	CONDENSATE	gals	gal/MCF	#/hr	#/MCF	POLYMER	gals	gal/hr	gal/MCF	Units		
CO	39.910	10.417	891.78	8.670	0.750	20.70	2,357	12.754	3.076	-9.678	271.08						Distribution of						
H <sub>2</sub>	54.906	14.331	28.69	33.023	2.013	6.67	8.901	23.232	11.714	-11.518	23.22						Recovered oil						
CO <sub>2</sub>	4.487	1.171	51.64	39.134	3.334	146.73	10.546	11.719	13.882	2.163	95.191	10.146					400 EP			0.668			
N <sub>2</sub>	0.660	0.172	4.68	2.603	0.213	5.97	0.675	0.547	0.988								400-550			0.130			
CH <sub>4</sub>	0.037	0.010	0.16	6.570	0.560	8.98	1.771	1.781	2.351	0.550	8.82	0.940					850+			0.066			
C <sub>2</sub> H <sub>6</sub>				2.685	0.243	6.82	0.769	0.769	1.012	0.243	6.82	0.727								71.1			
C <sub>3</sub> H <sub>8</sub>				1.157	0.099	2.98	0.312	0.312	0.411	0.099	2.98	0.318											
C <sub>4</sub> +C <sub>5</sub>												18.62	1.995										
C <sub>6</sub> H <sub>6</sub>				2.917	0.246	10.44	0.788	0.788	1.034	0.246	10.44	1.113	4.32	2.417	0.256	9.40	1.002	6.25	1.804	0.160	91.2		
C <sub>6</sub> H <sub>6</sub>				0.280	0.024	1.06	0.075	0.075	0.099	0.024	1.06	0.113	4.24	0.250	0.027								
C <sub>6</sub> H <sub>6</sub>				1.660	0.141	7.91	0.447	0.447	0.588	0.141	7.91	0.843	5.00	1.582	0.169	7.51	0.800	6.10	1.231	0.151	81.7		
C <sub>6</sub> H <sub>6</sub>				0.373	0.032	1.86	0.101	0.101	0.135	0.038	1.86	0.198	4.86	0.383	0.041	1.96	0.198	4.86	0.383	0.041			
C <sub>6</sub> H <sub>6</sub>				0.587	0.050	3.51	0.168	0.158	0.208	0.050	3.51	0.374	5.45	0.644	0.069	3.51	0.374	5.45	0.644	0.069	84.2		
C <sub>6</sub> H <sub>6</sub>				0.110	0.009	0.65	0.030	0.030	0.039	0.009	0.65	0.069	5.25	0.124	0.015	0.65	0.069	5.25	0.124	0.013			
C <sub>6</sub> H <sub>6</sub>				0.165	0.014	1.18	0.044	0.044	0.058	0.014	1.18	0.126	5.54	0.213	0.023	1.18	0.126	5.54	0.213	0.023			
C <sub>6</sub> C <sub>6</sub>												26.61	2.836	5.615	0.698	24.11	2.569	4.099	4.437				
TOTAL	26.101	377.19		8.519	224.46	26.954	53.055	41.040															
H <sub>2</sub> +CO	94.816	24.748	S.C.F.H.	3.652		11.238	35.986	14.790	-21.196														
H <sub>2</sub> /CO	1.38			106597	3.81		1.82		1.19														
<b>CUMULATIVE TOTALS</b>																							
H <sub>2</sub> +CO/MCF Catalyst # C <sub>3</sub> +RH gal/MCF gal/Hr												EFFLUENT	RECOVERED OIL	0.36876	51.71	5.512	7.989	0.852	51.71	5.512	7.989	0.852	
Previous Total												SHIFT RATIO		78.32	8.348	13.602	1.450	75.82	8.081	12.088	1.289		
Current Period													(H <sub>2</sub> O)CO <sub>2</sub> 10.6	0.211*	11.18	1.192	7.97	1.402	0.149	11.18	1.192	1.402	0.149
New Total													(H <sub>2</sub> O)CO	89.50	9.540	16.004	1.699	87.00	9.273	15.490	1.438		
FRESH FEED CONVERS ON - %			TOTAL FEED CONVERS ON - %			SELECTIVITY			NET WATER			4.987*	89.84	9.576	10.788	1.150							
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>4</sub>		GROSS WATER			101.02	10.767		12.190	1.299							
67.36	92.93	80.57	85.65	75.88	49.58	58.90	82.78		HYDROCARBON			108.1281	1.524										

\*Included in Reactor Effluent Total

g/M3 = 16.91  $\times$  gal/MCF  
cc/M3 = 141.3  $\times$  gal/MCF.

OPERATING CONDITIONS			PRODUCT TESTS						CATALYST DATA												
PRESSURES PSIG			RATES S.C.F.H.						INVENTORY DATA												
Oxygen	443	Fresh Feed	9895	* API	50.5	10.7	In Reactor at Start of Period														
Natural Gas	439	Recycle	10218	Neut. No.	45.0	43.1	Fresh Catalyst Added	50	76	Mesh	Microns	%	Microns	%							
Generator Outlet	416	Combined Feed	20113	Sap. No.	57.3	44.0	Total			On 40	419+	13.2									
Reactor Inlet	412	Wet Gas—Measured	2733	Hydrox. No.			Catalyst Recovered	34	100	150	65.4	40-80									
Condenser Inlet		Adjusted	3230	Bromine No.	86.0		In Reactor at End of Period			150	105	12.0									
Product Accumulator	392	Loss	497	Pour °F.						200	74	7.6	10-20								
				Chemicals, % by K <sub>2</sub> O <sub>3</sub>			REACTOR d.p. Inches H <sub>2</sub> O	11.5		250	62	1.6	0-20								
							No. Height "			325	44	1.6									
TEMPERATURES—°F.		Recycle/Fresh Feed	1,033				0 0 - 12 29			<325		0.6									
Oxygen	325	Inlet Velocity—ft./sec.	0.63				1 12 - 43.2 75			CATALYST											
Natural Gas	770	Fresh Feed Rate—S.C.F.H.	9382	HEMPEL DIST. %			2 43.2 - 74.4 71			Bulk Density, Lbs./Cu.Ft.											
Generator		per Cu.Ft. Dense Bed	656	295 °F.			3 74.4 - 105.6 74			Aerated											
Quench Accumulator		per Lb. Catalyst	4.48	400			4 105.6 - 342.0 360			Settled											
Reactor Inlet	627	per Sq. Ft.	14215	400-550	15.3		Total	609		Compacted											
Condenser Inlet				550+	7.7					Particle Density, gm./cc.	4.4										
Product Accumulator	64	Heat Transfer Calculations								NH <sub>3</sub> Value, ml./gm.	5.39										
Catalyst No. Height "		Steam Rate = 417.2 #/hr	A. S. T. M. DIST. ON							N <sub>2</sub> Surface, m <sup>2</sup> /gm.											
1	12.0	646	@ 796 psia & 518°F							146											
2	45.2	648	= 1197 BTU/#	IBP	98																
3	74.4	655	Water in @ 158°F & 186 BTU/#	10%	131																
4	126.8	640	Heat Transferred/lb. steam	50%	285																
5	199.2	626	(1071)(417.2) = 446821 BTU/hr	90%	255																
6	230.4	618	Ave. Bed Temperature	EP	401																
9	261.6	617	= 639°F	Rec.	97.5																
10	292.8	607	dT = 639-510 = 121°F																		
11	311.0	579	Tube Area = 31.9 ft <sup>2</sup>																		
12	342.0	572	K = 446821/(31.9) = 11.58		115.8																
				BALANCE	102.84	95.55	105.35	TOTAL	11.278	40.698	16.844										
<b>GAS ANALYSES</b>																					
GAS FLOW RATES			GENERATOR BALANCE						WEIGHT BALANCE												
CO	8.94	8.69	8.38	8.670	VTR	PRESSURE	TEMP.	S. C. F. H.	M. W.	M/Hr	HOUR	GAGE	°F	FACTOR	GAL AT 60 #/GAL	API #/GAL	#	2 HR. GAL/Hr			
H <sub>2</sub>	33.74	32.60	32.73	33.023	FRESH FEED			412.0	78												
CO <sub>2</sub>	38.45	39.84	39.11	39.134	79.31	4.34	20.66	0.9851	9895	1.41537	26.101	OIL	61.11*	366.77	62	0.9990	366.40	50.5	51.71		
N <sub>2</sub>	2.48	2.59	2.44	2.503	WET GAS				1.5	64					313*	176.91	52	1.0039	177.60	6.473	7.989
CH <sub>4</sub>	6.69	6.56	6.46	6.570	79.31	6.21	4.02	0.9862	2733	1.04822	7.209										
C <sub>2</sub> H <sub>6</sub>	2.79	2.98	2.79	2.855	RECYLE			415.2	123												
C <sub>3</sub> H <sub>8</sub>	1.16	1.16	1.16	1.157	115.14	4.10	20.73	0.9444	9242	1.04822	24.379										
C <sub>4</sub> H <sub>10</sub>	2.91	2.61	3.25	2.917	BLEED			416.2	123												
C <sub>5</sub> H <sub>12</sub>	0.29	0.20	0.35	0.280	5.02	9.5	20.73	0.9444	976	1.04822	2.575	WATER									
C <sub>6</sub> H <sub>6</sub>	1.49	1.56	1.94	1.660	NATURAL GAS																

THE TEXAS COMPANY -- MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 51-7  
HOURS 200-204

FRESH FEED			WET GAS			RECYCLE			COMBINED FEED			EFFLUENT			NET CHANGE			YIELD BASIS H <sub>2</sub> +CO FED					
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	#/hr	%/MCF	CONDENSATE	gal/hr	POLYMER	gal/hr	#/hr	%/MCF	gal/hr	gal/MCF	Unsat.			
CO <sub>2</sub> 44.00%	38.643	10.946	897.07	7.890	0.657	18.40	2.856	12.503	2.912	0.657	-268.67									Distribution of			
H <sub>2</sub> 44.00%	57.070	18.176	30.59	36.053	3.008	6.05	10.303	25.478	13.308	-12.173	-24.54									Recovered Oil			
CO <sub>2</sub> 44.00%	5.600	0.957	42.12	34.647	2.885	126.97	9.901	10.858	12.786	1.928	84.88	8.804								400 EP			
H <sub>2</sub> 44.00%	0.700	0.186	5.91	2.377	0.198	6.55	0.679	0.855	0.877											400-550			
CH <sub>4</sub> 44.00%	0.087	0.085	0.37	7.717	0.643	10.32	2.205	2.228	2.848	0.620	9.95	1.038								550+			
C <sub>2</sub> H <sub>6</sub> 30.04%				2.900	0.241	6.78	0.889	0.889	1.070	0.241	6.78	0.701								88.1			
C <sub>3</sub> H <sub>8</sub> 20.04%				1.555	0.113	3.40	0.387	0.387	0.500	0.113	3.40	0.355											
C <sub>4</sub> +C <sub>5</sub>													20.05	2.084									
C <sub>6</sub> H <sub>6</sub> 4.57%				5.453	0.286	12.03	0.981	0.981	1.287	0.286	12.03	1.248	4.32	2.788	0.289	10.82	1.123	8.25	1.735	0.180	89.0		
C <sub>2</sub> H <sub>2</sub> 0.01%				0.467	0.039	1.72	0.133	0.133	0.172	0.039	1.72	0.178	4.24	0.406	0.042								
C <sub>2</sub> H <sub>2</sub> 0.01%				1.880	0.165	8.70	0.552	0.552	0.687	0.165	8.70	0.903	5.00	1.740	0.181	8.27	0.856	6.10	1.356	0.141	82.4		
C <sub>2</sub> H <sub>2</sub> 0.01%				0.397	0.033	1.92	0.113	0.113	0.146	0.033	1.92	0.199	4.88	0.395	0.041	1.92	0.199	4.88	0.395	0.041			
C <sub>2</sub> H <sub>2</sub> 0.01%				0.653	0.054	3.79	0.187	0.187	0.241	0.054	3.79	0.393	8.48	0.698	0.072	3.79	0.393	8.48	0.698	0.072	88.5		
C <sub>2</sub> H <sub>2</sub> 0.01%				0.090	0.007	0.51	0.026	0.026	0.055	0.007	0.51	0.055	8.28	0.097	0.010	0.51	0.055	8.28	0.097	0.010			
C <sub>2</sub> H <sub>2</sub> 0.01%				0.185	0.014	1.18	0.047	0.047	0.061	0.014	1.18	0.122	8.84	0.213	0.022	1.18	0.122	8.84	0.213	0.022			
C <sub>2</sub> -C <sub>4</sub>													29.85	3.097		6.331	0.657	26.50	2.748	4.489	0.466		
TOTAL	26.589	365.36		8.327	207.29	28.576	55.167	42.611															
H <sub>2</sub> +CO	95.613	25.423	S.C.F.H.	3.659		12.558	37.951						-21.766										
H <sub>2</sub> /CO	1.48		103755	4.569		2.04							1.289										
CUMULATIVE TOTALS																							
Previous Total																							
Current Period																							
New Total																							
FRESH FEED CONVERSION - %																							
Conversion	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>2</sub> +C <sub>4</sub>																
	68.70	95.59	80.23	65.82	76.71	47.78	57.51	82.73															
	116.23	12.059																					

\*Included in Reactor Effluent Total

g/M3 = 16.91 x #/MCF

cc/M3 = 141.3 x gal/MCF

OPERATING CONDITIONS		PRODUCT TESTS						CATALYST DATA						PARTICLE SIZE													
PRESSURES PSIG		RATES S.C.F.H.						OIL						WATER						INVENTORY DATA							
Oxygen	438	Fresh Feed	10080	* API	51.4	10.8	In Reactor at Start of Period													Screen Analysis							
Natural Gas	435	Recycle	10824	Neut. No.	43.3	40.1	Fresh Catalyst Added	52	=	79										Mesh Microns %	Microns %						
Generator Outlet	415	Combined Feed	20814	Sap. No.	52.0	43.7	Total													On 40	419+	9.8					
Reactor Inlet	411	Wet Gas-Measured	2884	Hydrox. No.			Catalyst Recovered	21		100	150									40-80							
Condenser Inlet		Adjusted	3157	Bromine No.	95.4		In Reactor at End of Period	150		105	140									200	74	7.8					
Product Accumulator	390	Loss	273	Pour *			Reactor d.p. Inches H <sub>2</sub> O	250		250	62									250	62	2.0					
							Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	12.0											No.	Height"	325	44	1.8				
TEMPERATURES - °F.																											
Oxygen	301	Inlet Velocity--ft./sec.	0.64																	0	0	- 12	29			1.6	
Natural Gas	752	Fresh Feed Rate--S.C.P.H.	9638	HEMPEL, DIST. %																1	12.0	- 43.2	76	CATALYST			
Generator		per Cu.Ft. Dense Bed	659	205 °F.																2	43.2	- 74.4	72	Bulk Dens'ty, Lbs./Cu.Ft.			
Quench Accumulator		per Lb. Catalyst	4.45	400	77.0	56.6														3	74.4	- 105.6	74	Aerated		145	
Reactor Inlet	635	per Sq. Ft.	14603	400-550	12.0	36.8														4	105.6	- 342.0	380	Settled		146	
Condenser Inlet			550+		11.0															5	11.0		631	Compacted		161	
Product Accumulator	67	Heat Transfer Calculations																								Particle Density, gm./cc.	
Catalyst No.	Height "	Steam Rate = 419.4 #/hr																								4.3	
1	12.0	648	0.796 psia ± 518°p																							NH <sub>3</sub> Value, ml./gm.	
2	43.2	651																								6.86	
3	74.4	672	Water in @ 160°F = 127 BTU/lb																							N <sub>2</sub> Surface, m <sup>2</sup> /gm.	
4	126.8	641	Heat Transferred/10 <sup>3</sup> steam																								
5	199.2	625																									
6	230.4	619	(1070)(419.4) = 448758 BTU/hr																								
9	261.6	619	Ave. Bed Temperature																							K <sub>2</sub> O, W+, % basis Fe	
10	292.8	609	ΔT = 659°F = 121°F																							X-Ray Analysis	
11	311.0	588																								Fe <sub>2</sub> O <sub>3</sub>	
12	342.0	582	Tube Area = 32.2 ft <sup>2</sup>																							Fe <sub>3</sub> O <sub>4</sub>	
			K = 448758																							Fe	
			= (181)(32.2)																								

GAS ANALYSES		GENERATOR BALANCE						WEIGHT BALANCE																	
HOUR	1400	2200	0600	AVERAGE	M/Hr	C	H	O	Mol %	M/Hr	C	H	O	Mol %	M/Hr	GAGE	GAL	*F	FACTOR	GAL AT 60	API #/GAL	#	# HR GAL HR		
FRESH FEED					V/R	PRESSURE	TEMP.																		

FRESH FEED			WET GAS			RECYCLE		COMBINED FEED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED						
%	m/hr	#/hr	%	At. Wt.	Balance	m/hr	m/hr	m/hr	m/hr	m/hr	#/hr	\$/MCF	\$/gal	gal/MCF	#/hr	\$/MCF	gal/hr	gal/MCF	POLYMER	%
CO 88.810	88.816	10,048	881.87	6.300	0.641	17.95	2,284	18.269	2.865	-9,404	263.42								Distribution of	
H <sub>2</sub> 14.454	55.785	14,458	89.08	31.008	2.395	4.82	8,309	22.751	10.704	-18,082	24.86								Recovered Oil	
CO <sub>2</sub> 0.900	4.180	1,084	47.71	39.705	3.063	184.81	10,640	11,784	15.708	1,979	67.10	9,891							400 HP	
CH <sub>4</sub> 0.104	0.900	0.207	5.80	2.585	0.199	5.58	0.693	0.900	0.893										400-550	
C <sub>2</sub> H <sub>6</sub> 0.470	0.470	1,188	1.96	6.465	0.499	8.00	1.732	1.884	2.231	0.377	6.04	0.851							550+	
C <sub>3</sub> H <sub>8</sub> 0.258				2.735	0.211	5.92	0.733	0.735	0.944	0.211	5.92	0.638							68.4	
C <sub>4</sub> H <sub>10</sub> 0.248				1.265	0.098	2.95	0.339	0.338	0.437	0.098	2.95	0.318								
C <sub>5</sub> +C <sub>6</sub>											14.91	1.608								
C <sub>2</sub> H <sub>4</sub> 0.079				3.570	0.276	11.61	0.987	0.987	1.233	0.276	11.61	1.888	4.32	2,688	0.289	10.45	1.127	6.25	1,672 0.180	
C <sub>2</sub> H <sub>6</sub> 0.074				0.470	0.036	1.59	0.186	0.186	0.162	0.036	1.59	0.173	1.24	0.372	0.040					
C <sub>3</sub> H <sub>8</sub> 0.104				2.260	0.175	9.82	0.806	0.806	0.781	0.175	9.82	1.056	8.00	1.984	0.212	9.33	1.006	6.10	1,530 0.165	
C <sub>4</sub> H <sub>10</sub> 0.070				0.490	0.058	2.21	0.181	0.181	0.161	0.058	2.21	0.236	4.88	0.456	0.049	2.91	0.258	4.88	0.456 0.049	
C <sub>5</sub> H <sub>12</sub> 0.130				0.840	0.065	4.66	0.225	0.225	0.290	0.085	4.66	0.496	5.49	0.837	0.090	4.56	0.492	5.45	0.837 0.090	
C <sub>2</sub> H <sub>2</sub> 0.022				0.115	0.009	0.65	0.031	0.031	0.040	0.009	0.65	0.070	5.25	0.124	0.013	0.65	0.070	5.25	0.124 0.013	
C <sub>3</sub> H <sub>6</sub> 0.195				0.195	0.016	1.26	0.058	0.058	0.067	0.015	1.26	0.136	5.54	0.287	0.024	1.26	0.136	5.54	0.287 0.024	
C <sub>4</sub> -C <sub>6</sub>											31.70	3.416		6,671	0.712	28.46	5.069		4,846 0.581	
TOTAL	25.880	365.92		7,718	211.75	26.798	52.678	40.196												
H <sub>2</sub> +CO	94.540	9275	S.C.F.H.	3.054		10,553	35.000	35.569	-81.453											
H <sub>2</sub> /CO	1.44	107016		3.73			1.86			1.28										
CUMULATIVE TOTALS										EFFLUENT										
H <sub>2</sub> +CO,MCR	Catalyst #	G <sub>3</sub> *.R <sub>3</sub>	RH/MCF	RH/#						RECOVERED OIL	0.3592	50.40	5.434	7,735	0.834	50.40	5.434	7,735	0.834	
Previous Total										SHIFT RATIO										
Current Period										TOTAL OIL	82.10	6.055		14.406	1.555	78.86	8.503	12,581	1.347	
New Total										WATER SOLUBLE CHEMICALS	0.2898	12.13	1.308		1.501	0.16	12.13	1.308	1.501	0.162
FRESH FEED CONVERSION -- %	TOTAL FEED CONVERSION - %			SELECTIVITY						TOTAL LIQUID PRODUCTS C <sub>3</sub> +	94.28	10.160		15.907	1.715	90.99	9.811	14,082	1.509	
Conversion	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + C <sub>4</sub>			NET WATER	5,088*	91.66	9.888		11,006	1.187				
										GROSS WATER	103.79	11.180			18,507	1.346				
										HYDROCARBON										
										TOTAL C <sub>1</sub> -C <sub>6</sub>	109.14	11.768								

\*Included in Reactor Effluent Total

$$\text{cc/M3} = 141.3 \times \text{gal/MCF}$$

GAS ANALYSES			GENERATOR BALANCE								WEIGHT BALANCE			
HOUR	1000	1400	AVERAGE	M/HR	C	H	O	Mol %	M/HR	C	H	O	#/hr Measured	At. Wt. Balance
FRESH FEED														
CO <sub>2±0.01</sub>	38.68	38.95						O <sub>2±0.001</sub>	8.470 0.021				16.988	WET GAS 192.12 211.73
CO <sub>2±0.01</sub>	55.40	56.05	56.785	14.492	28.844			CO <sub>2±0.01</sub>						OIL 56.40 50.40
H <sub>2</sub> <sub>14.00</sub>	4.20	4.18	4.190	1.084	1.094	2.168		H <sub>2</sub> <sub>14.00</sub>						WATER 103.79 103.79
N <sub>2±0.01</sub>	0.84	0.75		0.800	0.807			N <sub>2±0.01</sub>	1.00	0.099				TOTAL 347.31 365.92
CH <sub>4±0.02</sub>	0.88	0.06		0.470	0.128	0.122	0.488	CH <sub>4±0.02</sub>	83.84	8.807	8.867	35.068		FRESH FEED 365.92
								C <sub>2</sub> H <sub>6±0.02</sub>	8.85	0.819	1.658	4.914		WEIGHT BALANCE 94.91
								C <sub>3</sub> H <sub>8±0.02</sub>						
								C <sub>4</sub> H <sub>10±0.02</sub>						
								C <sub>5</sub> H <sub>12±0.02</sub>						
								C <sub>6</sub> H <sub>14±0.02</sub>						
								C <sub>7</sub> H <sub>16±0.02</sub>						
								C <sub>8</sub> H <sub>18±0.02</sub>						
								C <sub>9</sub> H <sub>20±0.02</sub>						
								C <sub>10</sub> H <sub>22±0.02</sub>						
								C <sub>11</sub> H <sub>24±0.02</sub>						
								C <sub>12</sub> H <sub>26±0.02</sub>						
								C <sub>13</sub> H <sub>28±0.02</sub>						
								C <sub>14</sub> H <sub>30±0.02</sub>						
								C <sub>15</sub> H <sub>32±0.02</sub>						
								C <sub>16</sub> H <sub>34±0.02</sub>						
								C <sub>17</sub> H <sub>36±0.02</sub>						
								C <sub>18</sub> H <sub>38±0.02</sub>						
								C <sub>19</sub> H <sub>40±0.02</sub>						
								C <sub>20</sub> H <sub>42±0.02</sub>						
								C <sub>21</sub> H <sub>44±0.02</sub>						
								C <sub>22</sub> H <sub>46±0.02</sub>						
								C <sub>23</sub> H <sub>48±0.02</sub>						
								C <sub>24</sub> H <sub>50±0.02</sub>						
								C <sub>25</sub> H <sub>52±0.02</sub>						
								C <sub>26</sub> H <sub>54±0.02</sub>						
								C <sub>27</sub> H <sub>56±0.02</sub>						
								C <sub>28</sub> H <sub>58±0.02</sub>						
								C <sub>29</sub> H <sub>60±0.02</sub>						
								C <sub>30</sub> H <sub>62±0.02</sub>						
								C <sub>31</sub> H <sub>64±0.02</sub>						
								C <sub>32</sub> H <sub>66±0.02</sub>						
								C <sub>33</sub> H <sub>68±0.02</sub>						
								C <sub>34</sub> H <sub>70±0.02</sub>						
								C <sub>35</sub> H <sub>72±0.02</sub>						
								C <sub>36</sub> H <sub>74±0.02</sub>						
								C <sub>37</sub> H <sub>76±0.02</sub>						
								C <sub>38</sub> H <sub>78±0.02</sub>						
								C <sub>39</sub> H <sub>80±0.02</sub>						
								C <sub>40</sub> H <sub>82±0.02</sub>						
								C <sub>41</sub> H <sub>84±0.02</sub>						
								C <sub>42</sub> H <sub>86±0.02</sub>						
								C <sub>43</sub> H <sub>88±0.02</sub>						
								C <sub>44</sub> H <sub>90±0.02</sub>						
								C <sub>45</sub> H <sub>92±0.02</sub>						
								C <sub>46</sub> H <sub>94±0.02</sub>						
								C <sub>47</sub> H <sub>96±0.02</sub>						
								C <sub>48</sub> H <sub>98±0.02</sub>						
								C <sub>49</sub> H <sub>100±0.02</sub>						
								C <sub>50</sub> H <sub>102±0.02</sub>						
								C <sub>51</sub> H <sub>104±0.02</sub>						
								C <sub>52</sub> H <sub>106±0.02</sub>						
								C <sub>53</sub> H <sub>108±0.02</sub>						
								C <sub>54</sub> H <sub>110±0.02</sub>						
								C <sub>55</sub> H <sub>112±0.02</sub>						
								C <sub>56</sub> H <sub>114±0.02</sub>						
								C <sub>57</sub> H <sub>116±0.02</sub>						
								C <sub>58</sub> H <sub>118±0.02</sub>						
								C <sub>59</sub> H <sub>120±0.02</sub>						
								C <sub>60</sub> H <sub>122±0.02</sub>						
								C <sub>61</sub> H <sub>124±0.02</sub>						
								C <sub>62</sub> H <sub>126±0.02</sub>						
								C <sub>63</sub> H <sub>128±0.02</sub>						
								C <sub>64</sub> H <sub>130±0.02</sub>						
								C <sub>65</sub> H <sub>132±0.02</sub>						
								C <sub>66</sub> H <sub>134±0.02</sub>						
								C <sub>67</sub> H <sub>136±0.02</sub>						
								C <sub>68</sub> H <sub>138±0.02</sub>						
								C <sub>69</sub> H <sub>140±0.02</sub>						
								C <sub>70</sub> H <sub>142±0.02</sub>						
								C <sub>71</sub> H <sub>144±0.02</sub>						
								C <sub>72</sub> H <sub>146±0.02</sub>						
								C <sub>73</sub> H <sub>148±0.02</sub>						
								C <sub>74</sub> H <sub>150±0.02</sub>						
								C <sub>75</sub> H <sub>152±0.02</sub>						
								C <sub>76</sub> H <sub>154±0.02</sub>						
								C <sub>77</sub> H <sub>156±0.02</sub>						
								C <sub>78</sub> H <sub>158±0.02</sub>						
								C <sub>79</sub> H <sub>160±0.02</sub>						
								C <sub>80</sub> H <sub>162±0.02</sub>						
								C <sub>81</sub> H <sub>164±0.02</sub>						
								C <sub>82</sub> H <sub>166±0.02</sub>						
								C <sub>83</sub> H <sub>168±0.02</sub>						
								C <sub>84</sub> H <sub>170±0.02</sub>						
								C <sub>85</sub> H <sub>172±0.02</sub>						
								C <sub>86</sub> H <sub>174±0.02</sub>						
								C <sub>87</sub> H <sub>176±0.02</sub>						
								C <sub>88</sub> H <sub>178±0.02</sub>						
								C <sub>89</sub> H <sub>180±0.02</sub>						
								C <sub>90</sub> H <sub>182±0.02</sub>						
								C <sub>91</sub> H <sub>184±0.02</sub>						
								C <sub>92</sub> H <sub>186±0.02</sub>						
								C <sub>93</sub> H <sub>188±0.02</sub>						
								C <sub>94</sub> H <sub>190±0.02</sub>						
								C <sub>95</sub> H <sub>192±0.02</sub>						
								C <sub>96</sub> H <sub>194±0.02</sub>						
								C <sub>97</sub> H <sub>196±0.02</sub>						
								C <sub>98</sub> H <sub>198±0.02</sub>						
								C <sub>99</sub> H <sub>200±0.02</sub>						
								C <sub>100</sub> H <sub>202±0.02</sub>						
								C <sub>101</sub> H <sub>204±0.02</sub>						
								C <sub>102</sub> H <sub>206±0.02</sub>						
								C <sub>103</sub> H <sub>208±0.02</sub>						
								C <sub>104</sub> H <sub>210±0.02</sub>						
								C <sub>105</sub> H <sub>212±0.02</sub>						
								C <sub>106</sub> H <sub>214±0.02</sub>						
								C <sub>107</sub> H <sub>216±0.02</sub>						
								C <sub>108</sub> H <sub>218±0.02</sub>						
								C <sub>109</sub> H <sub>220±0.02</sub>						
								C <sub>110</sub> H <sub>222±0.02</sub>						
								C <sub>111</sub> H <sub>224±0.02</sub>						
								C <sub>112</sub> H <sub>226±0.02</sub>						
								C <sub>113</sub> H <sub>228±0.02</sub>						
								C <sub>114</sub> H <sub>230±0.02</sub>						
								C <sub>115</sub> H <sub>232±0.02</sub>						
								C <sub>116</sub> H <sub>234±0.02</sub>						
								C <sub>117</sub> H <sub>236±0.02</sub>						
								C <sub>118</sub> H <sub>238±0.02</sub>						
								C <sub>119</sub> H <sub>240±0.02</sub>						
								C <sub>120</sub> H <sub>242±0.02</sub>						
								C <sub>121</sub> H <sub>244±0.02</sub>						
								C <sub>122</sub> H <sub>246±0.02</sub>						
								C <sub>123</sub> H <sub>248±0.02</sub>						
								C <sub>124</sub> H <sub>250±0.02</sub>						
								C <sub>125</sub> H <sub>252±0.02</sub>						
								C <sub>126</sub> H <sub>254±0.02</sub>						
								C <sub>127</sub> H <sub>256±0.02</sub>						
								C <sub>128</sub> H <sub>258±0.02</sub>						

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 L  
HOURS 935-948

FRESH FEED			WET GAS			RECYCLE		COMBINED FEED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED								
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	gal/hr	gal/MCF	#/hr	#/MCF	gal/hr	gal/MCF	U%			
CO <sub>0.010</sub>	56.880	10,084	280.75	9.650	0.887	24.00	2.794	12.818	3.681	-9.187	286.77								Distribution			
H <sub>2</sub> <sub>0.04</sub>	59.155	16.185	38.58	39.007	3.468	6.99	11.318	27.483	14.788	-18.697	25.80								of Recovered OIL			
CO <sub>0.010</sub>	3.350	0.910	40.05	31.778	2.826	104.55	9.821	10.151	12.047	1.916	64.50	6.190							0.885			
N <sub>2</sub> <sub>0.010</sub>	0.480	0.188	5.80	2.345	0.209	5.68	0.681	0.870	0.890										400 EP 0.110			
CH <sub>4</sub> <sub>0.042</sub>	0.148	0.040	0.64	7.420	0.680	10.69	2.155	2.195	2.615	0.620	9.95	1.002							550e. 0.095			
C <sub>1</sub> H <sub>6</sub> <sub>0.012</sub>				2.490	0.222	5.23	0.723	0.723	0.845	0.222	5.82	0.628							66.2			
C <sub>2</sub> H <sub>6</sub> <sub>0.018</sub>				1.270	0.113	3.40	0.369	0.369	0.482	0.113	3.40	0.342										
C <sub>3</sub> + C <sub>4</sub>											18.58	1.972										
CaH <sub>6</sub> <sub>0.078</sub>				2.990	0.266	11.19	0.868	0.868	1.134	0.266	11.19	1.187	4.32	2.590	0.281	10.07	1.014	6.05	1.611 0.162 86.8			
C <sub>5</sub> H <sub>12</sub> <sub>0.014</sub>				0.455	0.041	1.81	0.132	0.132	0.175	0.041	1.81	0.182	4.24	0.427	0.043							
C <sub>6</sub> H <sub>14</sub> <sub>0.010</sub>				1.585	0.135	7.68	0.445	0.445	0.879	0.135	7.68	0.768	8.00	1.656	0.184	7.25	0.730	6.10	1.189 0.180 79.8			
C <sub>7</sub> H <sub>16</sub> <sub>0.007</sub>				0.385	0.034	1.98	0.112	0.112	0.146	0.034	1.98	0.190	4.86	0.407	0.041	1.98	0.192	4.88	0.407 0.041			
C <sub>8</sub> H <sub>18</sub> <sub>0.010</sub>				0.610	0.045	3.16	0.148	0.148	0.195	0.045	3.16	0.318	5.45	0.580	0.058	3.16	0.318	5.45	0.580 0.058 87.9			
C <sub>9</sub> H <sub>20</sub> <sub>0.012</sub>				0.070	0.006	0.43	0.020	0.020	0.026	0.006	0.43	0.043	5.25	0.088	0.008	0.45	0.043	5.25	0.088 0.008			
C <sub>10</sub> H <sub>22</sub> <sub>0.016</sub>				0.125	0.011	0.93	0.036	0.036	0.047	0.011	0.93	0.084	9.54	0.168	0.017	0.93	0.084	9.54	0.168 0.017			
TOTAL	27.328	359.35		8.894	208.55	29.018	56.346	43.389			27.15	2.732		5.780	0.582	23.82	2.398		4.037 0.406			
H <sub>2</sub> + CO	96.835	26.189	9929	S.C.F.H.	4.325		14.112	40.301		-21.864												
H <sub>2</sub> /CO	1.61	100715			4.047			2.14		1.385												
CUMULATIVE TOTALS				H <sub>2</sub> + CO MCF Catalyst # C <sub>2</sub> + C <sub>4</sub> gal/MCF gal/H						EFFLUENT		RECOVERED OIL		0.353*	50.87	5.1256	4.48	7.846	0.790	50.87	5.123	7.846 0.790
Previous Total										SHIFT RATIO		TOTAL OIL		78.00	7.855	7.72	13.626	1.372	74.69	7.581		11.883 1.196
Current Period										WATER SOLUBLE CHEMICALS		(H <sub>2</sub> O)CO <sub>2</sub> (H <sub>2</sub> O)CO		0.217*	11.60	1.1589	0.535	1.380	0.139	11.50	1.158	1.380 0.139
New Total										TOTAL LIQUID PRODUCTS C <sub>2</sub> +		NET WATER		89.50	9.014		15.006	1.511	86.19	8.679		13.263 1.335
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - % SELECTIVITY						HYDROCARBON		CROSS WATER		4.907*	88.41	8.904	9.328	10.616	1.089			
Contraction	CO	H <sub>2</sub>	H <sub>4</sub> + CO	CO	H <sub>2</sub>	CO + H <sub>2</sub>	C <sub>2</sub> + C <sub>4</sub>							99.83	0.106		11.998	1.206				
67.45	91.45	78.55	85.49	71.52	46.20	54.25	89.05							109.05	10.986							

\*Included in Reactor Effluent Total

$$g/M^3 = 16.91 \times \pm/MCF.$$

$$\text{cc/M3} = 141.3 \times \text{gal/MC}$$

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA					
PRESURES PSIG	RATES S.C.P.H.			OIL	WATER	INVENTORY DATA			PARTICLE SIZE		
Oxygen	421	Fresh Feed	10360	* API	50.6	10.4	In Reactor at Start of Period		Screen Analysis	Sedimentation	
Natural Gas	419	Recycle	11001	Neut. No.	40.7	39.5	Fresh Catalyst Added	0	Mesh	Microns	%
Generator Outlet	412	Combined Feed	21381	Sap. No.	51.5	40.1	Total	On 40	419+	11.7	80+
Reactor Inlet	409	Wet Gas - Measured	2989	Hydrox. No.			Catalyst Recovered	76	100	150	62.7
Condenser Inlet		Adjusted	3372	Bromine No.	80.1		In Reactor at End of Period		150	105	11.6
Product Accumulator	356	Loss	403	Pour *F.					200	74	8.1
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>		11.5	REACTOR d-p. Inches H <sub>2</sub> O		250	62	2.0
							No. Height *		325	44	1.7
TEMPERATURES - °F.		Recycle/ Fresh Feed	1.06					<325			2.2
Oxygen	341	Inlet Velocity - ft./sec.	0.67				0 0 - 12 26				
Natural Gas	724	Fresh Feed Rate - S.C.F.H.	9929	HEMPEL. DIST. %			1 12.0 - 45.2 67				
Generator		per Cu.Ft. Dense Bed	678	205 °F.			2 45.2 - 74.4 72				
Quench Accumulator		per lb. Catayst	4.88	400	74.0	58.5	3 74.4 - 105.6 75		Aerated		150
Reactor Inlet	571	per Sq. Ft.	15044	400-550	14.0	37.9	4 105.6 - 342.0 555		Settled		152
Condenser Inlet				550+	12.0		Total	593	Compacted		164
Product Accumulator	63	Heat Transfer Calculations							Particle Density, gm./cc.		4.5
Catalyst No.	Height *	Steam Rate = 361.8 #/hr			A. S. T. M. DIST. ON		CALCULATED FROM dp			NH <sub>3</sub> Value, ml./gm.	8.45
1	12.0	658	8 829 psia & 522 °F		Naphtha °F.		Density, Lbs./Cu.Ft.	139	N <sub>2</sub> Surface, m <sup>2</sup> /gm.		
2	45.2	644	= 1196 BTU/#		IBP	96	Inventory, Lbs.	2035			
3	74.4	675	Water in @ 150 °F = 118 BTU/lb	10%	136		Bed Depth, Ft.	22.18			
4	136.8	646	Heat Transferred /lb. steam	50%			Cu. Ft.	14.64			
5	199.2	680	= 1078 BTU	90%	344					O	
6	330.4	683	(1078)(361.8) = 384774 BTU/hr	EP	398					H	
9	261.6	621	Ave. Bed Temperature = 659 °F						K <sub>2</sub> O. Wt. + % basis Fe		
10	292.8	611	dT = 659-622 = 117 °F						X-Ray Analysis		
11	511.0	588	Tube Area = 32.2 ft <sup>2</sup>						Fe <sub>2</sub> O <sub>3</sub>		
12	342.0	586	E = (117)(32.2) = 102.1						Fe		

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 51 M

HOURS 242-266

FRESH FEED				WET GAS			RECYCLE		COMBINED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED										
%	m/hr	#/hr	%	At. Wt.	Balance	#/hr	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/MCF	#/hr	#/MCF	#/gal	gal/MCF	#/hr	#/MCF	#/gal	gal/MCF	%
CO	37.687	10.388	889.28	9.610	0.819	82.94	2.865	13.193	3.388	-9.502	266.34														
H <sub>2</sub>	58.655	16.075	32.40	58.555	3.283	6.62	11.479	27.558	14.765	-12.790	25.87														
CO <sub>2</sub>	2.970	0.814	35.88	30.790	2.683	115.45	9.173	9.087	11.796	1.809	79.63	7.986													
N <sub>2</sub>	0.583	0.160	4.48	2.620	0.223	6.26	0.781	0.941	1.004																
CH <sub>4</sub>	0.107	0.029	0.47	7.883	0.671	10.76	2.349	2.378	3.080	0.642	10.29	1.028													
C <sub>2</sub> H <sub>6</sub>																									
C <sub>3</sub> H <sub>8</sub>																									
C <sub>4</sub> H <sub>10</sub>																									
C <sub>5</sub> +C <sub>6</sub>																									
C <sub>7</sub> +C <sub>8</sub>																									
C <sub>9</sub> +C <sub>10</sub>																									
C <sub>11</sub> +C <sub>12</sub>																									
TOTAL	27.404	368.445		8.518	199.75	29.792	57.198	44.889																	
H <sub>2</sub> +CO	96.340	26.401	10009	S.C.F.H.	4.102	14.342	40.743	16.444	-22.299																
H <sub>2</sub> /CO	1.556	999100			4.01		2.09		1.35																
CUMULATIVE TOTALS				H <sub>2</sub> +CO/MCF Catalyst #	C <sub>2</sub> + C <sub>3</sub>	gal/MCF	gal/MCF	gal/#																	
Previous Total																									
Current Period																									
New Total																									
FRESH FEED CONVERSION — %																									
Connaction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>2</sub> + C <sub>3</sub>	GROSS WATER																	
	68.92	92.07	79.57	84.46	72.09	46.42	54.73	82.06																	

\*Included in Reactor Effluent Total

g/M3 = 16.91 x #/MCF.  
cc/M3 = 141.3 x gal/MCF.

OPERATING CONDITIONS		PRODUCT TESTS			CATALYST DATA						PARTICLE SIZE		
PRESSURES PSIG		RATES S.C.F.H.			OIL			WATER			INVENTORY DATA		
Oxygen	427	Fresh Feed	10389	*API	52.3	11.0					In Reactor at Start of Period		
Natural Gas	427	Recycle	11294	Neut. No.	35.8	38.0					Fresh Catalyst Added 51 #	77	Mesh Microns %
Generator Outlet	420	Combined Feed	21683	Sep. No.	50.3	40.5					Total	On 40	419+ 11.6 80+
Reactor Inlet	415	Wet Gas-Measured	3009	Hydrox. No.							Catalyst Recovered	105	100 150 67.0 40-80
Condenser Inlet		Adjusted	3229	Bromine No.	77.8						In Reactor at End of Period	150	105 12.4 20-40
Product Accumulator	395	Loss	220	Pour °F.							No. Height	325	74 5.6 10-20
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>		12.0					REACTOR d.p. Inches H <sub>2</sub> O	250	62 1.0 0-20
TEMPERATURES—°F.		Recycle/Fresh Feed	1.09										
Oxygen	332	Inlet Velocity—ft/sec.	0.68								Density, Lbs./Cu.Ft.	136	N <sub>2</sub> Surface, m <sup>2</sup> /gm. 7.4
Natural Gas	805	Fresh Feed Rate—S.C.F.H.	10009	HEMPEL DIST. %									
Generator	2375	Per Cu.Ft. Dense Bed	669	205 °F.									
Quench Accumulator		per Lb. Catalyst	4.92	400	76.0	57.2							
Reactor Inlet	604	per Sq. Ft.	15165	400-550	13.7	37.5							
Condenser Inlet				550+	10.5								
Product Accumulator	53	Heat Transfer Calculations											
Catalyst No.	Height "	Steam Rate = 406.8 #/hr.	A. S. T. M. DIST. ON										
1	12.0	645	8830 psia & 522°F	Naphtha °F.									
2	43.2	650	= 1196 BTU/#	IBP	90								
3	74.4	662	Water in @ 156°F = 124 BTU/#	10%	137								
4	136.8	652	Heat Transferred/# steam	50%	226								
5	199.2	635	= 1072 BTU	90%	346								
6	230.4	629	(1072)(406.8) = 43604.9 BTU/hr.	EP	398								
7	261.6	628	Average Bed Temperature	Rec.	97.5								
8	292.8	618	= 643°F										
9	311.0	597	dt = 643-522 = 121°F										
10	342.0	594	Tube Area = 32.6 ft <sup>2</sup>										
11			156049										
12			K = (32.6)(1121)										
			= 110.5										

GAS ANALYSES		GENERATOR BALANCE						WEIGHT BALANCE											
HOUR	1400	0200	0600	AVERAGE	M/Hr	C	H	O	Mol %	M/Hr	C	H	O	2 hr Measured	At. Wt Balance				
FRESH FEED																			
CO	37.29	38.59	37.18	37.687	10.328				0.49	7.259				106.13	199.75				
H <sub>2</sub>	59.29	57.58	59.09	58.653	16.073				10.328	CO				53.63	53.63				
CO <sub>2</sub>	2.93	3.14	2.84	2.970	0.814	0.814			1.628	H <sub>2</sub>				WATER	109.07				
N <sub>2</sub>	0.43	0.63	0.69	0.583	0.160				N <sub>2</sub>	1.83	0.180			FRESH FEED	368.45				
CH <sub>4</sub>	0.06	0.06	0.20	0.107	0.029	0.029	0.116		CH <sub>4</sub>	84.13	8.275	8.275	33.100	WEIGHT BALANCE	96.24				
M. W.	13.2262								C <sub>2</sub> H <sub>6</sub>	8.37	0.823	1.646	4.938						
									C <sub>3</sub> H <sub>8</sub>	3.19	0.514	0.942	2.512						
									C <sub>4</sub> H <sub>10</sub>	0.05	0.005	0.020	0.050						
									C <sub>5</sub> H <sub>12</sub>	0.04	0.004	0.020	0.048						
BALANCE					100.73	97.15	103.88		TOTAL		9.836	11.080	40.648	14.988					
WET GAS		GAS FLOW RATES						LIQUID PRODUCT RATES											
CO	9.94	9.62	9.27	9.610	V/R	PRESSURE	TEMP.	S. C. F. H.	M. W.	M/Hr	HOUR	GAGE	GAL	*F FACTOR	GAL AT 60 #/GAL HR				
H <sub>2</sub>	38.43	37.96	39.22	38.555	FRESH FEED	415.0	67				714"	388.59	67	0.9965	387.23	2505.0			
CO <sub>2</sub>	31.27	31.48	29.62	30.790	79.31	4.30	20.73	0.9953	10389	1.4795	27.404		610"	318.76	60	1.0000	318.76	6469.2	
N <sub>2</sub>	2.54	2.74	2.58	2.620	WET GAS														
CH <sub>4</sub>	7.34	8.11	8.20	7.883	8.26	8.09	4.025	1.0068	3009	1.11108	7.937	218"	142.71	48	1.0059	145.55	52.3		
C <sub>2</sub> H <sub>6</sub>	2.65	2.72	2.81	2.727	RECYCLE	415.8	108							018"	13.28	73	0.9935	13.19	6.410
C <sub>3</sub> H <sub>8</sub>	1.31	1.52	1.45	1.427	115.14	4.03	20.75	0.9568	10236	1.11108	27.001								
C <sub>4</sub> H <sub>10</sub>	3.03	3.01	3.40	3.147	BLEED	416.8	108												
C <sub>5</sub> H <sub>12</sub>	0.41	0.42	0.50	0.453	5.02	9.55	20.75	0.9568	1058	1.11108	2.791								
C <sub>6</sub> H <sub>16</sub>	1.74																		

THE TEXAS COMPANY --- MONTEBELLO LABORATORY  
**YIELD CALCULATIONS**

RUN NO. 51-H  
NUMBER 266-282

FRESH FEED			WET GAS			RECYCLE	COMBINED EFFLUENT	NET CHANGE	YIELD BASIS Hz + CO FED												
%	m.hr	#.hr	%	At. Wt.	Balance	m/hr	m/hr	m/hr	#/MCF	CONDENSATE	POLYMER	%									
				m hr	# hr				#/gal	gal/hr	gal/MCF	#/hr	#/MCF	gal/hr	gal/MCF	Unsats.					
CO <sub>2</sub> <sub>20.010</sub>	37.280	10.432	292.20	9.930	0.894	25.04	3.017	13.449	3.011	-9.538	-267.16				Distribution of						
H <sub>2</sub> <sub>2.016</sub>	58.880	16.478	33.21	40.265	3.622	7.30	12.230	28.705	15.582	-12.853	-25.91				Recovered Oil						
CO <sub>2</sub> <sub>20.010</sub>	3.030	0.848	37.32	29.985	2.699	118.75	9.109	9.957	11.808	1.851	81.43	7.983		400 EP	77.0%	0.630					
N <sub>2</sub> <sub>0.014</sub>	0.560	0.179	5.01	2.500	0.225	5.30	0.760	0.939	0.985					400-550	12.0%	0.098					
CH <sub>4</sub> <sub>0.014</sub>	0.170	0.048	0.777	7.705	0.694	11.13	2.341	2.389	3.035	0.646	10.34	1.016		550+	11.0%	0.090					
C <sub>2</sub> H <sub>6</sub> <sub>24.028</sub>				2.465	0.222	6.23	0.749	0.749	0.971	0.222	6.23	0.611				65.7					
C <sub>3</sub> H <sub>8</sub> <sub>30.048</sub>				1.285	0.116	3.49	0.390	0.390	0.506	0.116	3.49	0.342									
C+C <sub>4</sub>										20.08	1.968										
C <sub>4</sub> H <sub>10</sub> <sub>42.078</sub>				2.925	0.254	10.69	0.888	0.858	1.112	0.264	10.69	1.044	4.32	2.475	0.243	9.62	0.943	6.25	1.539	0.151	87.7
C <sub>5</sub> H <sub>12</sub> <sub>54.094</sub>				0.395	0.036	1.59	0.120	0.120	0.166	0.036	1.58	0.156	4.24	0.375	0.037						
C <sub>6</sub> H <sub>14</sub> <sub>56.010</sub>				1.510	0.156	7.63	0.459	0.459	0.595	0.136	7.63	0.748	5.00	1.526	0.150	7.25	0.711	6.10	1.189	0.117	79.5
C <sub>7</sub> H <sub>16</sub> <sub>70.120</sub>				0.390	0.035	2.03	0.118	0.118	0.153	0.055	2.03	0.198	4.68	0.418	0.041	2.03	0.199	4.68	0.418	0.041	
C <sub>8</sub> H <sub>18</sub> <sub>72.130</sub>				0.505	0.045	3.16	0.153	0.153	0.198	0.045	3.16	0.310	9.45	0.580	0.057	3.16	0.310	5.45	0.580	0.057	82.1
C <sub>9</sub> H <sub>20</sub> <sub>72.145</sub>				0.110	0.010	0.72	0.033	0.033	0.043	0.010	0.72	0.071	5.25	0.137	0.013	0.72	0.071	5.25	0.137	0.013	
C <sub>10</sub> H <sub>22</sub> <sub>74.152</sub>				0.140	0.013	1.09	0.043	0.043	0.056	0.013	1.09	0.107	5.54	0.197	0.019	1.09	0.107	5.54	0.197	0.019	
C <sub>11</sub> C <sub>4</sub>													26.91	2.636	5.708	0.560	23.97	2.340	4.060	0.398	
TOTAL	27.982	368.50		9.001	205.15	30.380	58.362	45.314													
H <sub>2</sub> +CO	96.160	26.907	10201		S.C.F.H.	4.516	15.247	42.154		-22.591											
H <sub>2</sub> /CO	1.579	980296		4.05			2.13		1.35												
CUMULATIVE TOTALS																					
H <sub>2</sub> +CO/MCF	Catalyst #	C <sub>3</sub> +, gal	gal/MCF	gal	#		EFFLUENT			RECOVERED OIL	0.3764	52.74	5.170	8.340	0.618	52.74	5.170	8.340	0.618		
Previous Total							SHIFT RATIO			TOTAL OIL	79.65	7.808	14.048	1.377	76.61	7.510	12.400	1.216			
Current Period							WATER SOLUBLE CHEMICALS			O.2564	13.56	1.329	1.714	0.168	13.56	1.329	1.714	0.168			
New Total							(H <sub>2</sub> ) <sub>1</sub> (CO) <sub>2</sub> 8.9			TOTAL LIQUID PRODUCTS C <sub>1</sub>	93.21	0.157	15.782	1.545	90.17	8.839	14.114	1.394			
FRESH FEED CONVERSION - %	TOTAL FEED CONVERSION - %			SELECTIVITY						NET WATER	5.3014	95.81	9.5634	328.01	1.469	1.124					
Conversion	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> +, C <sub>4</sub> +			GROSS WATER	109.07	10.692	15.185	1.299							
										HYDROCARBON											
67.85	91.45	78.02	83.22	70.92	44.78	53.12	82.76			TOTAL C <sub>1</sub> -	113.28	11.106									
Included in Reactor Effluent Total																M3 = 16.91 x / MCF					

\*Included in Reactor Effluent Total  
g/M3 = 16.91 x ±/MCF,  
cc/M3 = 141.3 gal/MCF

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA				
PRESURES PSIG		RATES S.C.F.H.		OIL	WATER	INVENTORY DATA		PARTICLE SIZE		
Oxygen	424	Fresh Feed	10608	* API	53.6	10.9	In Reactor at Start of Period		Screen Analysis	Sedimentation
Natural Gas	424	Recycle	11517	Neut. No.	40.4	37.6	Fresh Catalyst Added	62 ± 94	Mesh	Micros
Generator Outlet	415	Combined Feed	22125	Sap. No.	46.6	39.1	Total		%	Micros
Reactor Inlet	411	Wet Gas - Measured	3198	Hydrox. No.			Catalyst Recovered	213	On 40	419+
Condenser Inlet		Adjusted	3412	Bromine No.	88.3		In Reactor at End of Period		100	150
Product Accumulator	391	Loss	214	Pour °F.					150	105
				Chemicals, v% by K <sub>2</sub> CO <sub>3</sub>	13.0		REACTOR d-p, Inches H <sub>2</sub> O		200	74
						No.	Height		250	62
								325	44	1.8
								325	44	0-20
									325	2.4
TEMPERATURES - °F.			Recycle/Fresh Feed	1.09			1	12-43.2	63	
Oxygen	398	Inlet Velocity - ft./sec.	0.69				2	43.2-74.4	70	CATALYST
Natural Gas	723	Fresh Feed Rate - S.C.F.H.	CO+H <sub>2</sub> 10201	HEMPEL, DIST. %			3	74.4-105.6	74	Bulk Density, Lbs./Cu.Ft.
Generator		per Cu. Ft. Dense Bed	751	206 °F.		°API	4	105.6-342.0	310	Aerated
Quench Accumulator		per lb. Catayst	5.49	400	77.0	59.4	0	0-12	24	Settled
Reactor Inlet	586	per sq. ft.	15456	400-550	12.0	37.8			541	Compacted
Condenser Inlet				550+	11.0					Particle Density, gm./cc.
Product Accumulator	53	Heat Transfer Calculations								NH <sub>3</sub> Value, ml./gm.
Catalyst No.	Height "	Steam Rate = 395.9#/hr.		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.		133	N <sub>2</sub> Surface, m <sup>2</sup> /gm.
1	12.0	6450 psia + 5220°F	= 1186 BTU/#	Naphtha °F.			Inventory, Lbs.			
2	43.2	644		IBP	90		Bed Depth, Ft.	1957	21.15	CHEMICAL ANALYSIS
3	74.4	650	Water in at 159°F = 126 BTU/#	108	125		Volume, Cu. Ft.	13.96		Fe
4	136.8	644	Heat transferred/# steam	50%	216					C
5	199.2	638	= 1070 BTU	90%	349					O
6	250.4	624	(1070)/(395.9) = 42363 BTU/hr.	EP	401					H
9	261.6	616	Average Bed Temperature							K <sub>2</sub> O, Wt. % basis Fe
10	292.8	608	= 637°F							X-Ray Analysis
11	311.0	590	AT = 637-522 = 115°F							Fe <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
12	342.0	578	Tube Area = 31.6 ft. <sup>2</sup>							Fe <sub>2</sub> O <sub>3</sub>
			x = 42363/115 AT = 116.6							Fe

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 510  
HOURS 262-306

FRESH FEED				WET GAS		RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE	YIELD BASIS H <sub>2</sub> +CO FED												
%	m/hr	#/hr	%	At. Wt. Balance	m/hr	#/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#gal	gal/hr	gal/MCF	#/hr	#/MCF	#gal	gal/hr	gal/MCF	Unsat.		
CO <sub>28.010</sub>	37.870	10.615	297.35	10.150	0.915	25.63	5.057	13.672	3.972	9.700	271.70								Distribution of			
H <sub>2</sub> <sub>28.010</sub>	57.904	16.230	32.72	37.934	3.419	6.69	11.424	27.654	14.843	12.811	25.63								Recovered Oil			
CO <sub>28.010</sub>	3.053	0.856	37.67	30.018	2.705	11.905	9.040	9.896	11.745	1.849	91.56	7.999							400 EP	78.3%	0.620	
N <sub>2</sub> <sub>28.010</sub>	0.640	0.179	5.01	2.833	0.201	5.63	0.672	0.851	0.875										400-550	11.0	0.087	
CH <sub>4</sub> <sub>28.042</sub>	0.533	0.149	2.39	9.265	0.835	13.40	2.780	2.939	3.625	0.686	11.01	1.082							550+	10.7	0.085	
C <sub>2</sub> H <sub>6</sub> <sub>28.048</sub>					2.493	0.225	6.31	0.751	0.751	0.976	0.225	6.31	0.620								64.2	
C <sub>3</sub> H <sub>8</sub> <sub>28.048</sub>					1.390	0.125	3.76	0.419	0.419	0.544	0.125	3.76	0.370									
C <sub>4</sub> +C <sub>5</sub>											1.036	21.06	2.072									
C <sub>2</sub> H <sub>6</sub> <sub>28.048</sub>					2.903	0.262	11.02	0.874	0.874	1.136	0.262	11.02	1.083	4.32	2.551	0.251	9.92	0.975	6.25	1.588	0.156	
C <sub>3</sub> H <sub>8</sub> <sub>28.048</sub>					0.360	0.032	1.41	0.108	0.104	0.140	0.032	1.41	0.159	4.24	0.353	0.033				6.10	1.389	0.136
C <sub>4</sub> H <sub>10</sub> <sub>28.048</sub>					1.763	0.159	8.92	0.531	0.531	0.690	0.159	8.92	0.877	5.00	1.784	0.175	8.47	0.832		78.8		
C <sub>5</sub> H <sub>12</sub> <sub>28.048</sub>					0.473	0.043	2.50	0.142	0.142	0.185	0.043	2.50	0.246	4.86	0.514	0.050	2.50	0.246	4.86	0.514	0.050	
C <sub>6</sub> H <sub>14</sub> <sub>28.048</sub>					0.685	0.062	4.35	0.206	0.206	0.268	0.062	4.35	0.428	5.45	0.798	0.078	4.35	0.428	5.45	0.798	0.078	
C <sub>7</sub> H <sub>16</sub> <sub>28.048</sub>					0.157	0.012	0.87	0.041	0.041	0.053	0.012	0.87	0.086	5.28	0.166	0.016	0.87	0.086	5.28	0.166	0.016	
C <sub>8</sub> H <sub>18</sub> <sub>28.048</sub>					0.200	0.018	1.51	0.060	0.060	0.078	0.018	1.51	0.146	5.84	0.273	0.027	1.51	0.146	5.84	0.273	0.027	
C <sub>9</sub> +C <sub>10</sub>														30.56	3.006	6.418	0.631	27.62	2.715	4.728	0.465	
TOTAL	26.029	375.12		9.013	211.25	30.116	58.145	45.288														
H <sub>2</sub> +CO	26.845	10174	S.C.F.H.		4.334		14.481	41.326	18.815	22.511												
H <sub>2</sub> /CO	1.53	982873			3.74					2.02	1.32											
CUMULATIVE TOTALS				EFFLUENT						RECOVERED ON											8.063	0.792
Previous Total											0.36688	51.45	5.057	8.063	0.792	51.45	5.057					
Current Period											SHFT RATIO	62.03	8.063	14.482	1.423	79.07	7.772	12.791	1.257			
New Total											WATER SOLUBLE OIL	0.261*	13.85	1.361	7.65	1.768	0.174	13.85	1.361	1.768	0.174	
FRESH FEED CONVERSION - %											(H <sub>2</sub> ) (CO <sub>2</sub> ) 8.0											
Conversion CO	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + C <sub>4</sub>				WATER	95.88	9.424	16.280	1.597	92.92	9.133	14.559	1.451			
	67.84	91.38	78.93	83.86	70.95	46.33	54.47	81.98			GROSS WATER	112.41	11.046	13.603	1.537							
											HYDROCARBON TOTAL-C	116.96	11.496									
											Included in Reactor Effluent Total											

g/M3 = 16.91 × ± /MCF.  
cc/M3 = 141.3 × gal/MCF.

OPERATING CONDITIONS		PRODUCT TESTS				CATALYST DATA									
PRESSURES PSIG		RATES S.C.F.H.				OIL		WATER		INVENTORY DATA		PARTICLE SIZE			
Oxygen		Fresh Feed				10623 * API		11.1		53.1		In Reactor at Start of Period			
Natural Gas		Recycle				11414 Neut. No.		39.0		36.9		Fresh Catalyst Added 50 ± 76			
Generator Outlet		Combined Feed				22037 Sap. No.		46.0		37.4		Mesh Microns %			
Reactor Inlet		Wet Gas - Measured				3068 Hydrex. No.		Bromine No.		87.5		Catalyst Recovered 194			
Condenser Inlet		Adjusted				3417				100		100 150 59.7 40-80			
Product Accumulator		Loss				349 Pour °F.				150 105 14.5 20-40		In Reactor at End of Period			
										200 74 9.5 10-20		SELLCTIVITY			
										13.0 REACTOR d.p. Inches H <sub>2</sub> O		No. Height			
										325 44 3.0		NH <sub>3</sub> Value, ml./gm.			
										12.5 N <sub>2</sub> Surface, m <sup>2</sup> /gm.		CALCULATED FROM dp			
										Density, Lbs./Cu.Ft.		Inventory, Lbs.			
										1908		Bed Depth, Ft.			
										21.90		CHEMICAL ANALYSIS			
										4.1		Aerated			
										152		Settled			
										156		Compacted			
										1.5 Particle Density, gm./cc.		K <sub>2</sub> O. W. % basis Fe			
										Fe <sub>2</sub> O <sub>3</sub>		X-Ray Analysis-			
										Fe <sub>2</sub> O <sub>3</sub>		Fe <sub>2</sub> O <sub>3</sub>			
										Fe		Fe			

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 P  
NUMBER 306-330

$$\text{cc/M3} = 141.3 \times \text{gal/MCF}$$

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA					
PRESURES PSIG		RATES S.C.F.H.		OIL	WATER	INVENTORY DATA			PARTICLE SIZE		
Oxygen	424	Fresh Feed	10383	* API	53.4	11.1	In Reactor at Start of Period		Screen Analysis	Sedimentation	
Natural Gas	424	Recycle	10975	Neut. No.	39.1	37.1	Fresh Catalyst Added	63 ± 95	Mesh	419+	10.2
Generator Outlet	414	Combined Feed	21361	Sap. No.	48.7	39.7	Total		Microns	%	80+
Reactor Inlet	411	Wet Gas - Measured	2965	Hydrox. No.			Catalyst Recovered	36	100	150	40-80
Condenser Inlet		Adjusted	3331	Bromine No.	95.9		In Reactor at End of Period		150	105	14.7
Product Accumulator	390	Loss	366	Pour °F.					200	74	6.6
				Chemicals, ~ by K <sub>2</sub> CO <sub>3</sub>	13.5		REACTOR d-p. Inches H <sub>2</sub> O		250	62	0-20
						No. Height			325	44	1.8
TEMPERATURES - °F.	Recycle/Fresh Feed		1.06			1 12-43.2	63		\$35		1.8
Oxygen'	760	Inlet Velocity - ft./sec.	0.69			2 43.2-74.4	70				
Natural Gas	356	Fresh Feed Rate - S.C.F.H. H <sub>2</sub> CO <sub>2</sub>	9908	HEMPEL. DIST. %		°API	3 74.4-105.6	75			
Generator	2560	per Cu. Ft. Dense Bed	677	206 °F.			4 105.6-342.0	335	Aerated		152
Quench Accumulator		per Lb. Catalyst	5.09	400	77.3	58.2	0 0-12	84			154
Reactor Inlet	603	per sq. ft.	15012	400-550	12.0	37.4					167
Condenser Inlet				550+	10.7						4.5
Product Accumulator	Heat Transfer Calculations						CALCULATED FROM dp		NH <sub>3</sub> Value, ml./gm.		10.1
Catalyst No.	Height "	Steam Rate = 401.3 #/hr.		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	133	N <sub>2</sub> Surface, m <sup>2</sup> /gm.		
1	12.0	822 psia & 581°F = 1196 BTU/#	Naphtha °F.				Inventory, Lbs.	1946			
2	43.2	652 Water in @ 156°F = 125 BTU/#	IBP		92		Bed Depth, Ft.	22.17			
3	74.4	656 Heat Transferred/# steam	10%		124		Volume, Cu. Ft.	14.63			
# 5	136.8	645 = 1071 BTU	50%		214				Fe		
# 7	199.2	632 (1071)(401.3) = 429792 BTU/hr	90%		342				C		
# 8	230.8	624 Ave. Bed Temperature	EP		398				O		
9	261.6	618 ± 659°F	Rec.		98.0				H		
10	292.8	609 ΔT = 659-521 = 118°F							K <sub>2</sub> O Wt. % basis Fe		
11	311.0	587 Tube Area = 32.3 ft. <sup>2</sup>							X-Ray Analysis-		
12	342.0	577 K = (118)(32.3) = 112.8							Fe <sub>2</sub> O <sub>3</sub>		
									Fe <sub>3</sub> O <sub>4</sub>		
									Fe		

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 Q

\*Included in Resector Effluent Total

$g/M^3 \approx 16.91 \times 10^{-3} MCF$

$$\text{cc/M3} = 141.3 \times \text{ggl/MCF}$$

OPERATING CONDITIONS			PRODUCT TESTS		CATALYST DATA					
PRESURES PSIG		RATES SCFH		OIL	WATER	INVENTORY DATA			PARTICLE SIZE	
Oxygen	424	Fresh Feed	10276	* API	52.4	11.2	In Reactor at Start of Period		Screen Analysis	Sedimentation
Natural Gas	424	Recycle	11201	Neut. No.	39.5	38.3	Fresh Catalyst Added	70 = 106	Mesh Microns %	Microns %
Generator Outlet	415	Combined Feed	21477	Sap. No.	48.7	39.1	Total	On 40 419 + 8.2	80+	
Reactor Inlet	411	Wet Gas - Measured	3146	Hydrox. No.			Catalyst Recovered	17	100 150 58.7	40-80
Condenser Inlet		Adjusted	3542	Bromine No.	84.7		In Reactor at End of Period	150 105 14.5	20-40	
Product Accumulator	391	Loss	396	Pour °F.				200 74 8.8	10-20	
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>		15.5	REACTOR d-p. Inches H <sub>2</sub> O	250 62 2.0	0-20	
							No. Height	325 44 5.6		
TEMPERATURES - °F.		Recycle/Fresh Feed	1.09					<325	2.2	
Oxygen	364	Inlet Velocity - ft./sec.	0.70				1 12-43.2	63		
Natural Gas	747	Fresh Feed Rate - SCFH.	CO <sub>2</sub> H <sub>2</sub> 974	HEMPEL. DIST. %			2 43.2-74.4	69	CATALYST	
Generator		per Cu. Ft. Dense Bed	630	205 °F.			3 74.4-105.6	75	Bulk Density. Lbs./Cu.Ft.	
Quench Accumulator		per Lb. Catalyst	4.89	400	77.6	57.3	4 105.6-342.0	350	Aerated	148
Reactor Inlet	617	per sq. ft.	14764	400-550	13.0	36.8	0 0-12	24	Settled	149
Condenser Inlet				550+	9.4			581	Compacted	167
Product Accumulator	63	Heat Transfer Calculations							Particle Density. gm./cc.	4.4
Catalyst No.	Height *	Steam Rate = 405.3 #/hr.		A. S. T. M. DIST. ON			CALCULATED FROM dp		NH <sub>3</sub> Value, ml./gm.	8.03
1	18.0	645 @ 815 psia & 521°F = 1196 BTU/hr.		Naphtha °F.			Density. Lbs./Cu.Ft.	129	N <sub>2</sub> Surface, m <sup>2</sup> /gm.	
2	43.2	650 Water in @ 158°F = 125 BTU/hr.		IBP	100		Inventory. Lbs.	1994		
3	74.4	654 Heat Transferred/# steam	10%		132		Bed Depth. Ft.	23.42	CHEMICAL ANALYSIS	
4.5	136.8	1071 BTU	50%		222		Volume. Cu. Ft.	15.46	Fe	
5.7	199.2	626 (1071)(405.3) = 434076 BTU/hr.	90%		348				C	
5.8	230.4	620 Ave. Bed Temperature		EP	400				O	
9	261.6	618 = 658°F		Loss	0.5				H	
10	292.8	607 dt = 636-521 = 115°F					K <sub>2</sub> O. W. % basis Fe		X-Ray Analysis	
11	311.0	584 Tube Area = 33.0 ft. <sup>2</sup>							Fe <sub>2</sub> O <sub>3</sub>	
12	342.0	576 K = T(157)/(33.0) = 114.4							Fe <sub>2</sub> O <sub>4</sub>	
									E <sub>n</sub>	

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 R  
HOURS 354-378

FRESH FEED			WET GAS			RECYCLE		COMBINED FED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED							
	%	m/hr	#/hr	%	At. Wt. Balance	m/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	CONDENSATE	CONDENSATE	POLYMER	POLYMER	%				
													gal/gal/hr	gal/MCF	#/hr	#/MCF	gal/hr	gal/hr	gal/MCF		
CO <sub>2</sub> 0.010	<b>36.925</b>	<b>10.337</b>	<b>286.74</b>	10.197	0.980	<b>26.89</b>	<b>3.004</b>	<b>13.241</b>	<b>3.944</b>	<b>-9.277</b>	<b>-259.88</b>							Distribution of			
H <sub>2</sub> 0.016	<b>88.830</b>	<b>16.311</b>	<b>38.88</b>	38.588	3.651	<b>7.58</b>	<b>11.425</b>	<b>27.758</b>	<b>15.076</b>	<b>-12.580</b>	<b>-56.82</b>							Recovered Oil			
CO <sub>2</sub> 0.010	<b>8.800</b>	<b>0.768</b>	<b>54.16</b>	89.280	8.778	<b>12.078</b>	<b>8.476</b>	<b>9.492</b>	<b>11.448</b>	<b>1.996</b>	<b>88.82</b>	<b>8.82</b>				<b>400 EP</b>	<b>79.2K</b>	0.537			
N <sub>2</sub> 0.014	<b>0.617</b>	<b>0.027</b>	<b>6.36</b>	1.008	0.171	<b>4.79</b>	<b>0.535</b>	<b>0.782</b>	<b>0.706</b>						<b>400-580</b>	<b>12.4</b>	0.085				
CH <sub>4</sub> 16.048	<b>0.630</b>	<b>0.176</b>	<b>8.61</b>	10.080	0.949	<b>15.82</b>	<b>9.972</b>	<b>5.147</b>	<b>3.921</b>	<b>0.774</b>	<b>12.41</b>	<b>1.235</b>				<b>550+</b>	<b>8.1</b>	0.055			
C <sub>2</sub> H <sub>6</sub> 0.018																		66.3			
C <sub>3</sub> H <sub>8</sub> 0.028																					
C <sub>4</sub> +C <sub>5</sub>																					
CaH <sub>6</sub> 0.076																					
CaH <sub>8</sub> 0.050																					
CaH <sub>10</sub> 0.040																					
CaH <sub>12</sub> 0.030																					
CaH <sub>14</sub> 0.020																					
CaH <sub>16</sub> 0.010																					
CaH <sub>18</sub> 0.005																					
CaH <sub>20</sub> 0.002																					
TOTAL	<b>27.726</b>	<b>362.94</b>		9.476	216.53	<b>29.660</b>	<b>57.386</b>	<b>44.116</b>													
H <sub>2</sub> + CO	<b>95.753</b>	<b>26.548</b>		10066	S.C.P.H.	<b>4.811</b>		<b>14.429</b>	<b>40.977</b>	<b>19.040</b>	<b>61.937</b>										
H <sub>2</sub> /CO				1.59	993541		3.80			2.09	1.36										
CUMULATIVE TOTALS			H <sub>2</sub> + CO MCF Catalyst # C <sub>3</sub> +, gal gal/MCF gal/#						EFFLUENT		RECOVERED OIL		<b>0.51266</b>	<b>45.84</b>	<b>4.356</b>	<b>6.611</b>	<b>0.677</b>	<b>43.84</b>	<b>4.356</b>		
Previous Total									SHIFT RATIO		TOTAL OIL		<b>72.289</b>	<b>7.182</b>	<b>12.852</b>	<b>1.277</b>	<b>69.03</b>	<b>6.858</b>	<b>11.095</b>	<b>1.102</b>	
Current Period									(H <sub>2</sub> ) <sub>0</sub> (CO) <sub>2</sub> 9 + (H <sub>2</sub> O)(CO) 9 +		WATER SOLUBLE CHEMICALS		<b>0.2586*</b>	<b>15.68</b>	<b>1.359</b>	<b>7.98</b>	<b>1.737</b>	<b>15.68</b>	<b>1.359</b>	<b>1.737</b>	<b>0.175</b>
New Total									TOTAL LIQUID PRODUCTS C <sub>1</sub> +		NET WATER		<b>85.997</b>	<b>8.541</b>	<b>14.589</b>	<b>1.449</b>	<b>82.71</b>	<b>8.217</b>	<b>12.852</b>	<b>1.275</b>	
FRESH FEED CONVERSION - %			TOTAL FEED CONVERSION - % SELECTIVITY						NET WATER		GROSS WATER		<b>4.409*</b>	<b>88.89</b>	<b>8.832</b>	<b>8.35</b>	<b>10.671</b>	<b>1.060</b>			
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> +, C <sub>4</sub> +		HYDROCARBON		TOTAL C <sub>1</sub> -C <sub>5</sub> +		<b>102.570</b>	<b>10.191</b>		<b>12.408</b>	<b>1.233</b>				
	65.82	90.82	77.82	82.65	70.06	45.64	53.53	77.99					<b>110.230</b>	<b>10.952</b>							

#Included in Reactor Effluent Total g/M3 = 16.91 X # MCF.  
cc/M3 = 141.3 X gal/MCF.

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 S  
HOURS 378-403

53

\*Included in Reactor Effluent Total

$$cc/M3 = 141.3 \times gal/MCF$$

\*Included in Reactor Effluent Total

$$cc/M3 = 141.3 \times gal/MCF.$$

$$\text{cc/MS} = 141.3 \times \text{gol/MCF}$$

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 U  
HOURS 426-450

\*Included in Reactor Effluent Total  
g/M3 = 16.91 x ± /MCF.  
cc/M3 = 141.3 x gal/MCF.

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 51 V  
HOURS ... 450-474

FRESH FEED			WET GAS			RECYCLE		COMBINED FRESH		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> +CO FED								
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	%		
CO <sub>2</sub> 28.01	36.813	10.147	284.22	8.883	0.796	28.30	2.630	12.777	5.426	9.351	261.92				Distribution of							
H <sub>2</sub> 28.01	59.045	16.274	32.81	38.464	3.448	6.95	11.388	27.668	14.836	15.826	25.86				Recovered Oil							
CO <sub>2</sub> 28.01	2.897	0.724	31.86	29.098	2.809	114.82	8.615	9.359	11.824	1.885	92.96	8.285			400 HP					0.582		
N <sub>2</sub> 28.01	0.867	0.239	6.70	2.130	0.191	6.55	0.631	0.870	0.822						400-550					0.101		
CH <sub>4</sub> 28.01	0.850	0.179	2.87	10.053	0.899	14.42	2.971	3.150	3.870	0.720	11.55	1.155			550+					0.083		
C <sub>2</sub> H <sub>6</sub> 28.01					2.800	0.233	6.54	0.770	0.770	1.003	0.233	6.64	0.653							61.0		
C <sub>3</sub> H <sub>8</sub> 28.01					1.663	0.149	4.48	0.492	0.492	0.641	0.149	4.48	0.447									
C <sub>4</sub> -C <sub>6</sub>												22.57	2.253									
C <sub>2</sub> H <sub>4</sub> 28.01					3.543	0.318	15.58	1.049	1.049	1.587	0.318	15.58	1.536	4.32	3.097	0.309	12.04	1.202	6.28	1.927 0.192	85.9	
C <sub>2</sub> H <sub>6</sub> O 28.01					0.583	0.052	2.29	0.173	0.173	0.225	0.052	2.29	0.229	4.24	0.540	0.054						
C <sub>3</sub> H <sub>8</sub> O 28.01					1.790	0.160	8.98	0.530	0.530	0.690	0.160	8.98	0.897	8.00	1.796	0.179	8.55	0.882	6.10	1.389 0.140	82.0	
C <sub>4</sub> H <sub>10</sub> 28.01					0.393	0.035	2.03	0.116	0.116	0.151	0.035	2.03	0.203	4.88	0.418	0.042	2.03	0.203	4.86	0.418 0.042		
C <sub>5</sub> H <sub>12</sub> 28.01					0.610	0.055	3.86	0.181	0.181	0.236	0.055	3.86	0.385	5.48	0.708	0.071	3.86	0.385	5.45	0.708 0.071	89.7	
C <sub>6</sub> H <sub>14</sub> 28.01					0.070	0.006	0.43	0.021	0.021	0.027	0.006	0.43	0.043	5.25	0.682	0.008	0.43	0.043	5.25	0.682 0.008		
C <sub>7</sub> H <sub>16</sub> 28.01					0.140	0.013	1.09	0.041	0.041	0.054	0.013	1.09	0.109	8.54	0.197	0.020	1.09	0.109	8.54	0.197 0.020		
C <sub>8</sub> -C <sub>12</sub>														32.06	3.202	4.69	6.858	0.683	27.98	2.794	5.91 4.731 0.472	
TOTAL	27.563	358.46		8.965	206.92	29.608	57.171	44.152														
H <sub>2</sub> +CO	95.856	26.421	10013.6	S.C.F.H.	4.244	14.018	40.439	18.262	22.177													
H <sub>2</sub> /CO	1.60	998645		4.35		2.16		1.57														
CUMULATIVE TOTALS																						
Previous Total																						
Current Period																						
New Total																						
FRESH FEED CONVERSION - %																						
Conversion	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>2</sub> +C <sub>4</sub> +															
67.47	92.16	78.81	83.94	73.19	46.37	54.84	80.63															
TOTAL FEED CONVERSION - %																						
SELECTIVITY																						
Effluent	CO <sub>2</sub> +CO	Catalyst #	C <sub>2</sub> +C <sub>4</sub>	gal/MCF	gal/#																	
Previous Total																						
Current Period																						
New Total																						
WET GAS																						
RECUPERATOR																						
EFFLUENT																						
RECYCLE																						
WATER																						
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THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 51 W  
HOURS 474-498

57

FRESH FEED			WET GAS			RECYCLE			COMBINED FED.			EFFLUENT			NET CHANGE			YIELD BASIS H <sub>2</sub> + CO FED											
	%	m/hr	#/hr	%	m/hr	At Wt.	Balance	#/hr	m/hr	m/hr	m/hr	m/hr	#/hr	m/hr	#/hr	#/MCF	CONDENSATE	#/gal	gal/hr	gal/MCF	POLYMER	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	Units		
CO	35.995	9.989	278.11	8.623	0.747	20.92	2.335	12.864	3.082	-9.182	-257.19										Distribution of								
H <sub>2</sub>	59.433	16.395	35.08	37.697	3.265	6.58	10.208	26.603	13.474	-13.129	-26.47										Recovered Oil								
CO <sub>2</sub>	2.577	0.711	31.29	30.587	2.649	116.57	0.282	8.993	10.831	1.938	95.28	0.548									400 EP	0.608							
N <sub>2</sub>	0.917	0.255	7.09	2.820	0.244	6.84	0.764	1.017	1.008												400-580	0.093							
C <sub>2</sub> H <sub>6</sub>	1.080	0.298	4.78	9.873	0.855	13.72	2.673	2.971	3.528	0.557	8.94	0.896									550+	0.058							
C <sub>2</sub> H <sub>4</sub>					2.587	0.224	6.28	0.701	0.701	0.925	0.224	6.28	0.629										62.0						
C <sub>2</sub> H <sub>2</sub>					1.587	0.137	4.12	0.450	0.450	0.567	0.137	4.12	0.413																
C <sub>3</sub> +C <sub>4</sub>																					19.34	1.936							
C <sub>4</sub> H <sub>8</sub>					3.170	0.275	11.57	0.856	0.856	1.133	0.275	11.57	1.160	4.32	2.678	0.268	10.41	0.104	6.28	1.666	0.167	87.3							
C <sub>4</sub> H <sub>10</sub>					0.463	0.040	1.76	0.125	0.125	0.165	0.040	1.76	0.176	4.24	0.415	0.042													
C <sub>5</sub> H <sub>12</sub>					1.537	0.133	7.46	0.416	0.416	0.549	0.133	7.46	0.747	5.00	1.492	0.149	7.09	0.711	6.10	1.162	0.116	81.0							
C <sub>6</sub> H <sub>14</sub>					0.360	0.031	1.80	0.097	0.097	0.128	0.051	1.80	0.180	4.86	0.370	0.037	1.80	0.180	4.86	0.370	0.037								
C <sub>7</sub> H <sub>16</sub>					0.503	0.044	3.09	0.136	0.136	0.180	0.044	3.09	0.310	5.45	0.567	0.057	3.09	0.310	5.45	0.567	0.057	86.3							
C <sub>8</sub> H <sub>18</sub>					0.080	0.007	0.51	0.022	0.022	0.029	0.007	0.51	0.051	5.28	0.097	0.010	0.51	0.051	5.28	0.097	0.010								
C <sub>9</sub> +C <sub>10</sub>					0.113	0.010	0.84	0.031	0.031	0.041	0.010	0.84	0.084	5.84	0.182	0.015	0.84	0.084	5.84	0.182	0.015								
C <sub>11</sub> +C <sub>12</sub>																					27.03	2.708	5.771	0.578	25.74	2.379	4.014	0.402	
TOTAL		27.586	354.32		8.662	202.05	27.078	54.664	41.342																				
H <sub>2</sub> +CO	95.426	26.324		S.C.F.H.	4.013		12.543	35.867	16.556	-22.311																			
H <sub>2</sub> /CO	1.65		100232		4.37			2.37		1.43																			
CUMULATIVE TOTALS																													
H <sub>2</sub> +CO+MCF Catalyst #2 C <sub>2</sub> H <sub>6</sub> gal/MCF gal/#																													
Previous Total																													
Current Period																													
New Total																													
FRESH FEED CONVERSION - %			TOTAL FEED CONVERSION - %			SELECTIVITY			NET WATER			EFFLUENT			WATER			INVENTORY DATA			CATALYST DATA								
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> +C <sub>4</sub>		GROSS WATER																				
	68.60	92.48	80.07	84.76	74.87	49.35	57.40	82.19																					
	108.61	100.883																											

\*Included in Reactor Effluent Total

g/M3 = 16.91 x = /MCF

cc/M3 = 141.3 x gal/MCF

OPERATING CONDITIONS		PRODUCT TESTS			CATALYST DATA										PARTICLE SIZE													
PRESSURES PSIG		RATES S.C.F.H.			OIL			WATER			INVENTORY DATA			PARTICLE SIZE														
Oxygen	425	Fresh Feed	10458	* API	52.2	11.2		In Reactor at Start of Period							Screen Analysis													
Natural Gas	425	Recycle	10265	Neut. No.	40.3	38.5		Fresh Catalyst Added	58	#	88	Mesh	Microns	%	Microns	%												
Generator Outlet	418	Combined Feed	20723	Sap. No.	50.3	39.8		Total																				
Reactor Inlet	412	Wet Gas - Measured	3047	Hydrox. No.				Catalyst Recovered	48	100	150	58.2																
Condenser Inlet		Adjusted	3284	Bromine No.				In Reactor at End of Period	150	105	15.2																	
Product Accumulator	591	Loss	237	Pour °F.																								
				Chemicals. v by K <sub>2</sub> O <sub>3</sub>	14.0																							
TEMPERATURES - °F.		Recycle/Fresh Feed			0.98										0	0-12	24	325	1.8									
Oxygen	336	Inlet Velocity - ft./sec.																										
Natural Gas	760	Fresh Feed Rate - S.C.F.H.	9980	HEMPPEL DIST. %																								
Generator		per Cu.Ft. Dense Bed	609	205 °F.																								
Quench Accumulator		per Lb. Catalyst	4.65	400	80.0	56.6																						
Reactor Inlet	627	per sq. ft.	15121	400-550	12.2	35.3																						
Condenser Inlet				550+	7.8																							
Product Accumulator	53	Heat Transfer Calculations																										
Catalyst No.	Height "																											
1	12.0	649	@ 614 psia & 518°F = 1197 BTU/#	Naphtha °F.	A. S. T. M. DIST. ON																							
2	43.2	654	Water in @ 160°F = 128 BTU/#	IBP	88																							
3	74.4	674	Heat Transferred/# steam		10%																							
4	136.8	650			50%																							
5	199.2	637	(1069)(407.7) = 435831 BTU/#		90%																							
6	230.4	635	Average Bed Temperature		EP	408																						
7	261.6	635			Loss	1.0																						
8	292.8	626	WT = 649-51																									

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 51 X  
HOURS 496-522

FRESH FEED			WET GAS		RECYCLE		COMBINED FED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED												
	%	m/hr	#/hr	%	At Wt. Balance	m/hr	#/hr	m/hr	m/hr	#/hr	m/hr	#/hr	#/MCF	CONDENSATE	#/gal	gal/hr	gal/MCF	POLYMER	#/gal	#/hr	gal/MCF	#/gal	#/hr	gal/MCF	Unsat.
CO	28.00%	37.803	10.821	285.99	8.750	0.835	23.338	2.665	18.876	3.498	-9.378	-282.68					Distribution of								
H <sub>2</sub>	2.04%	57.171	15.442	51.13	38.605	3.674	7.407	11.759	27.201	15.435	-11.768	-33.72					Recovered Oil								
CO <sub>2</sub>	4.44%	5.023	0.817	35.98	28.865	2.757	181.269	8.922	9.639	11.579	1.940	65.38	6.770				400 RF	0.577							
N <sub>2</sub>	1.11%	1.113	0.301	8.43	5.445	0.528	9.189	1.049	1.380	1.377						400-M	0.569								
CH <sub>4</sub>	14.04%	0.890	0.840	3.85	9.945	0.847	15.192	3.029	5.269	3.976	0.707	11.34	1.166			550+	0.097								
C <sub>2</sub> H <sub>6</sub>	14.04%					2.560	0.244	6.845	0.780	0.780	1.024	0.244	6.84	0.703										50.8	
C <sub>2</sub> H <sub>4</sub>	20.04%				1.845	0.157	4.781	0.501	0.501	0.658	0.157	4.72	0.485												
C <sub>3</sub> +C <sub>4</sub>																	22.80	2.354							
C <sub>2</sub> H <sub>5</sub>	4.04%				3.170	0.302	12.708	0.956	0.956	1.268	0.302	12.71	1.307	4.32	2.942	0.303	11.44	1.176	6.28	1.830	0.188	85.8			
C <sub>2</sub> H <sub>4</sub>	4.04%				0.525	0.050	2.205	0.160	0.160	0.210	0.050	2.20	0.226	4.24	0.519	0.053									
C <sub>2</sub> H <sub>2</sub>	2.04%				1.450	0.138	"742	0.442	0.442	0.580	0.158	7.74	0.798	9.00	1.548	0.159	7.35	0.756	6.10	1.205	0.124	81.7			
C <sub>3</sub> H <sub>8</sub>	5.04%				0.330	0.031	1.802	0.101	0.101	0.132	0.031	1.80	0.185	4.86	0.370	0.038	1.80	0.185	4.86	0.370	0.058				
C <sub>3</sub> H <sub>6</sub>	7.04%				0.450	0.043	3.016	0.137	0.137	0.180	0.043	3.02	0.311	5.44	0.564	0.057	3.02	0.311	5.45	0.554	0.057	86.0			
C <sub>3</sub> H <sub>2</sub>	7.04%				0.070	0.007	0.505	0.021	0.021	0.028	0.007	0.502	0.052	5.25	0.096	0.010	0.506	0.052	5.25	0.096	0.010				
C <sub>4</sub> -C <sub>4</sub>					0.090	0.009	0.757	0.027	0.027	0.036	0.009	0.757	0.078	5.54	0.137	0.014	0.757	0.078	5.54	0.137	0.014				
TOTAL		27.011	385.36		9.620	216.69	30.450	57.470	45.516	-17.491	-48.63														
H <sub>2</sub> +CO	94.974	25.655	9725	SCFH	4.507		14.424	40.077	18.931	-21.146															
H <sub>2</sub> /CO	1.51	102828			4.41			2.11		1.25															
CUMULATIVE TOTALS																									
CO+CO <sub>2</sub> MCF																									
Previous Total																									
Current Period																									
New Total																									
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %			SELECTIVITY		NET WATER		4.954		89.26		0.178		8.33		10.715		1.102				
Contraction	CO	64.76	91.84	H <sub>2</sub>	76.21	H <sub>2</sub> +CO	82.43	CO	72.83	H <sub>2</sub>	43.26	CO+H <sub>2</sub>	52.76	C <sub>2</sub> +C <sub>4</sub>		GROSS WATER	102.88	10.579	12.459	1.281					

\*Included in Reactor Effluent Total

g/M3 = 16.91 x = /MCF

cc/M3 = 141.3 x gal/MCF

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA										PARTICLE SIZE					
PRESSURES PSIG			RATES S.C.F.H.			OIL			WATER			INVENTORY DATA					PARTICLE SIZE				
Oxygen			Fresh Feed			10240			*API			In Reactor at Start of Period					Screen Analysis				
Natural Gas			Recycle			11547			Neut. No.			Fresh Catalyst Added					Sedimentation				
Generator Outlet			Combined Feed			21787			Sap. No.			Total					On 419+				
Reactor Inlet			Wet Gas - Measured			3133			Hydrox. No.			Catalyst Recovered					80+				
Condenser Inlet			Adjusted			3609			Bromine No.			In Reactor at End of Period					40-80				
Product Accumulator			Loss			476			Pour *F.								200				
									Chemicals, % by K <sub>2</sub> CO <sub>3</sub>								20-40				
									14.0			REACTOR d-p. Inches H <sub>2</sub> O					250				
									No. Height			325									
TEMPERATURES - °F.			Recycle/Fresh Feed			1.13											325				
Oxygen			Inlet Velocity - ft/sec.			0.7											45.2-74.4				
Natural Gas			Fresh Feed Rate = $\frac{\text{SCFH}}{\text{BTU}}$			9725			HEMPPEL, DIST. %								50 ± 76				
Generator			per Cu. Ft. Dense Bed			592			205 °F.								76				
Quench Accumulator			per Lb. Catalyst			4.56			400								Mesh Microns				
Reactor Inlet			per sq. ft.			14735			400-550								80+				
Condenser Inlet			per sq. ft.			1082			50%								40-80				
Product Accumulator			Heat Transfer Calculations														CALCULATED FROM dp				
Catalyst No.			Height "			Steam Rate = 366.2 #/hr.			A. S. T. M. DIST. IN			NH <sub>3</sub> Value, ml/gm					N <sub>2</sub> Surface, m <sup>2</sup> /gm				
1			646																		

**THE TEXAS COMPANY — MONTEBELLO LABORATORY.** Note: Mechanical difficulties during period Y, hours 522-525 RUN NO. 51 Z necessitated a temporary shutdown hours 525-549

FRESH FEED				WET GAS		RECYCLE		COMBINED PERIOD		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED							
	%	m/hr	#/hr	%	At. Wt. Balance	m/hr	#/hr	m/hr	#/hr	m/hr	#/hr	m/hr	#/hr	CONDENSATE	POLYMER	POLYMER	%				
														gal/hr	gal/MCF	gal/hr	gal/MCF	gal/hr	gal/MCF	Unsat.	
CO <sub>2</sub> 100%	37.057	10.382	290.80	8.493	0.708	19.83	2,714	13.096	3.482	-0.674	-270.97								Distribution of		
H <sub>2</sub> O 100%	58.134	16.286	38.83	37.894	3.110	6.87	11,916	28.202	16.088	-13.176	-26.56								Recovered oil		
CO <sub>2</sub> 44.0%	8.575	0.721	31.75	29.864	2.407	105.93	9,223	9.944	11,630	1.686	8.42	8,331							400 EP		
N <sub>2</sub> 100%	0.742	0.208	5.83	2.163	0.180	5.04	0.691	0.899	0.871										400-650		
CH <sub>4</sub> 16.0%	1.493	0.418	6.71	13.040	1.087	17.44	4,166	4.584	5.253	0.869	10.73	1.082							60.6		
C <sub>2</sub> H <sub>6</sub> 2.8%							2,660	0.213	5.98	0.815	0.815	1.028	0.212	5.98	0.592						
C <sub>3</sub> H <sub>8</sub> 0.0%							1.357	0.138	4.16	0.689	0.689	0.667	0.138	4.16	0.410						
C <sub>4</sub> +C <sub>5</sub>																			20.88 2.064		
C <sub>6</sub> H <sub>6</sub> 0.0%							3,050	0.854	10.69	0.974	0.974	1,228	0.264	10.69	1.059	4.32	2,475	0.245	9.62 0.952		
C <sub>6</sub> H <sub>6</sub> 44.0%							0.493	0.041	1.81	0.188	0.188	0.199	0.041	1.81	0.179	4.24	0.427	0.042			
C <sub>2</sub> H <sub>2</sub> 0.0%							1.393	0.116	6.61	0.620	0.620	0.756	0.116	6.61	0.644	5.00	1,302	0.129	6.18 0.611		
C <sub>3</sub> H <sub>6</sub> 0.0%							0.395	0.033	1.92	0.125	0.125	0.168	0.033	1.92	0.190	4.88	0.395	0.039	0.190 4.86		
C <sub>4</sub> H <sub>10</sub> 0.0%							0.443	0.037	2.59	0.142	0.142	0.179	0.037	2.59	0.256	5.45	0.475	0.047	2.59 0.256 5.45		
C <sub>5</sub> H <sub>12</sub> 0.0%							0.077	0.008	0.43	0.085	0.085	0.031	0.006	0.43	0.042	5.28	0.082	0.008	0.43 0.042		
C <sub>6</sub> H <sub>14</sub> 0.0%							0.080	0.008	0.67	0.029	0.029	0.037	0.008	0.67	0.066	8.84	0.121	0.012	0.121 0.012		
C <sub>7</sub> +C <sub>8</sub>																			24.62 2.436		
TOTAL	28,015	567.90		6,358	189.26	31,952	59.987	46,047													
H <sub>2</sub> +CO	26,668	1010.78	S.C.F.H.	3,818		14,630	41.298	18,446													
H <sub>2</sub> /CO	1.57	98839644		4.39				2.15		1.36											
CUMULATIVE TOTALS																					
H <sub>2</sub> +CO/MCF	Catalyst #	C <sub>2</sub> + gal	gal/MCF	gal/H																	
Previous Total																					
Current Period																					
New Total																					
FRESH FEED CONVERSION -- %																					
Conversion	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>2</sub> + C <sub>3</sub>														
70.23	93.18	80.90	85.68	73.87	46.72	85.33	80.98														

\*Included in Reactor Effluent Total

g/M3 = 16.91 × #/MCF  
cc/M3 = 141.3 × gal/MCF.

OPERATING CONDITIONS		PRODUCT TESTS				CATALYST DATA				PARTICLE SIZE				
PRESSURES PSIG		RATES S.C.F.H.				INVENTORY DATA				PARTICLE SIZE				
Oxygen		Fresh Feed				In Reactor at Start of Period				Screen Analysis				
	435		10618	* API	51.8	11.1					Mesh	Microns	%	Micron %
Natural Gas		Recycle				Fresh Catalyst Added				Total				
	435		12110	Neut. No.	39.0	37.4					On 40	419+	13.9	80+
Generator Outlet		Combined Feed				Catalyst Recovered				Catalyst Recovered				
	429		22728	Sap. No.	51.5	59.8					91	100	150	40-80
Reactor Inlet		Wet Gas-Measured				In Reactor at End of Period				Catalyst Recovered				
	422		3180	Hydrox. No.							150	105	12.9	20-40
Condenser Inlet		Adjusted				Effluent				In Reactor at Start of Period				
			3525	Bromine No.	79.9						200	74	7.2	10-20
Product Accumulator		Loss				Shift Ratio				Effluent				
	398		365	Pour °F.							25.18			
		Chemicals, % by K <sub>2</sub> CO <sub>3</sub>				Total				Effluent				
											14.66	12.11	1.10	
TEMPERATURES--°F.		Recycle/Fresh Feed				Inventory Lbs.				Effluent				
	1.14										12.45	12.45	1.14	
Oxygen		Inlet Velocity - ft./sec.				Bed Depth, Ft.				Effluent				
	392										25.18	25.18	1.12	
Natural Gas		Fresh Feed Rate - S.C.F.H.				Volume, Cu. Ft.				Effluent				
	741		1010	H <sub>2</sub> O	1010						16.62	16.62	1.12	
Generator		per Cu. Ft. Dense Bed				NH <sub>3</sub> Value, ml./gm.				Effluent				
	2400		608								10.85	10.85	1.05	
Quench Accumulator		per Lb. Catalyst				Particle Size				Effluent				
			4.79								4.55	4.55	0.55	
Reactor Inlet		per sq. ft.				Particle Density, gm./cc.				Effluent				
	621		15314								1.13	1.13	0.13	
Condenser Inlet		per sq. ft.				CALCULATED FROM dp				Effluent				
			550								1.13	1.13	0.13	
Product Accumulator		Heat Transfer Calculations				NH <sub>3</sub> Surface, m <sup>2</sup> /gm.				Effluent				
											1.13	1.13	0.13	
Catalyst No.		Steam Rate = 420.4 #/hr.				A.S.T.M. DIST. ON				Effluent				
	1	12.0	650	@ 815 psia & 521°F							1.13	1.13	0.13	
		± 1195 BTU/#				Inventory, Lbs.				Effluent				
	2	43.2	655								2111	2111	1.11	
		IBP				Bed Depth, Ft.				Effluent				
	3	74.4	670	Water in @ 159°F = 156 BTU/#	10%						16.62	16.62	1.12	
		218				Volume, Cu. Ft.				Effluent				
	4	136.8	650	Heat Transfer = 1070 BTU/#	50%						16.62	16.62	1.12	
		218				Effluent				Effluent				
	5	199.2	641								16.62	16.62	1.12	
		346				Effluent				Effluent				
	6	250.4	639	(1070)(420.4) = 449828 BTU/hr.	EP						16.62	16.62	1.12	
		400												

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 AA  
HOURS 549-585

FRESH FEED		WET GAS			RECYCLE	COMBINED	EFFLUENT	NET CHANGE	YIELD BASIS H <sub>2</sub> + CO FED												
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	#/hr	%/MCF	gal/hr	gal/MCF	gal/hr	#/MCF	gal/hr	gal/MCF	%				
CO <sub>2</sub> H <sub>2</sub> O	36.993	9.950	876.98	6.903	0.655	16.29	2.099	12.059	2.752	-9.807	280.69					Distribution of					
H <sub>2</sub>	86.480	16.181	30.85	36.140	3.480	6.89	10.991	26.188	14.411	-11.771	-53.74					Recovered Oil					
CO <sub>2</sub>	9.167	0.491	30.41	29.407	8.688	116.30	8.439	2.450	11.387	1.007	27.89	9.820				400 RP					
N <sub>2</sub>	0.793	0.214	5.99	8.077	0.197	5.52	0.658	0.846	0.889						400-500	0.079					
CH <sub>4</sub>	3.297	0.869	15.94	16.613	1.578	25.22	5.052	5.921	6.684	0.703	11.28	1.165				550+	0.073				
C <sub>2</sub> H <sub>6</sub>						2.547	0.241	6.76	0.775	0.775	1.016	0.241	6.76	0.709			62.				
C <sub>3</sub> H <sub>8</sub>						1.698	0.144	4.33	0.463	0.463	0.607	0.144	4.33	0.454							
C <sub>4</sub> +C <sub>5</sub>													28.37	2.346							
C <sub>6</sub> H <sub>6</sub>				3.007	0.285	11.99	0.914	0.914	1.199	0.285	11.99	1.285	4.32	2.778	0.291	10.79	1.132	6.28			
C <sub>6</sub> H <sub>6</sub>				0.390	0.037	1.63	0.119	0.199	0.166	0.037	1.63	0.171	4.24	0.384	0.040			1.727	0.181	88.	
C <sub>6</sub> H <sub>6</sub>				1.485	0.135	7.57	0.453	0.453	0.568	0.185	7.57	0.794	8.00	1.514	0.159	7.19	0.754	6.10	1.179	0.124	80.
C <sub>6</sub> H <sub>6</sub>				0.343	0.032	1.86	0.104	0.104	0.136	0.032	1.86	0.195	4.86	0.383	0.040	1.86	0.195	4.86	0.565	0.040	
C <sub>6</sub> H <sub>6</sub>				0.447	0.042	2.95	0.136	0.136	0.176	0.042	2.95	0.309	8.48	0.541	0.057	2.95	0.309	8.48	0.541	0.057	84.
C <sub>6</sub> H <sub>6</sub>				0.083	0.006	0.58	0.025	0.025	0.035	0.008	0.58	0.063	5.28	0.110	0.012	0.58	0.063	5.28	0.110	0.012	
C <sub>6</sub> H <sub>6</sub>				0.097	0.009	0.76	0.030	0.030	0.039	0.009	0.76	0.080	5.84	0.127	0.014	0.76	0.080	5.84	0.137	0.014	
C <sub>6</sub> -C <sub>4</sub>													27.34	2.868		5.844	0.633	24.13	2.531	4.077	0.428
TOTAL	26.924	459.95		9.464	212.66	80.413	57.357	46.345													
H <sub>2</sub> +CO				9532.2	S.C.F.H.	4.075		13.090	38.241	17.165	21.078										
H <sub>2</sub> /CO				1.53	10490.725	5.84			2.17		1.26										
CUMULATIVE TOTALS		EFFLUENT			RECOVERED OIL				SHIFT RATIO				TOTAL OIL				GROSS WATER				
H <sub>2</sub> +CO,MCF		Catalyst #			C <sub>3</sub> +, gal				#/MCF				WATER SOLUBLE CHEMICALS				101.5010 gal/gal				
Previous Total													0.254*				12.969				
Current Period									(H <sub>2</sub> )/(CO <sub>2</sub> ) <sub>2</sub> 1.21				1.347				1.360				
New Total													1.143				68.961				
FRESH FEED CONVERSION - %		TOTAL FEED CONVERSION - %			SELECTIVITY				NET WATER				1.181				10.570				
Conversion		CO			H <sub>2</sub>				CO <sub>2</sub>				C <sub>3</sub> + / C <sub>4</sub> +				88.05				
H <sub>2</sub>													1.21				9.235				
CO													1.21				10.570				
H <sub>2</sub> O													1.181				1.229				
H <sub>2</sub>													1.21				1.229				
CO													1.21				1.229				
H <sub>2</sub> O													1.21				1.229				
H <sub>2</sub>													1.21				1.229				
CO													1.21				1.229				
H <sub>2</sub> O													1.21				1.229				
H <sub>2</sub>													1.21				1.229				
CO													1.21				1.229				
H <sub>2</sub> O													1.21				1.229				
H <sub>2</sub>													1.21				1.229				
CO													1.21				1.229				
H <sub>2</sub> O													1.21				1.229				
H <sub>2</sub>													1.21				1.229				
CO													1.21				1.229				
H <sub>2</sub> O													1.21				1.229				
H <sub>2</sub>													1.21				1.229				
CO													1.21				1.229				
H <sub>2</sub> O													1.21				1.229				
H <sub>2</sub>													1.21				1.229				
CO													1.21				1.229				
H <sub>2</sub> O													1.21				1.229				
H <sub>2</sub>													1.21				1.229				
CO													1.21				1.229				
H <sub>2</sub> O													1.21				1.229				
H <sub>2</sub>													1.21				1.229				
CO													1.21				1.229				
H <sub>2</sub> O													1.21				1.229				
H <sub>2</sub>																					

\*Included in Reactor Effluent Total

$$\text{cc/M}^3 = 141.3 \times \text{gal/MC}$$

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 BB  
HOURS 583-597

\*Included in Reactor Effluent Total

$$g/M^3 = 16.91 \times \pm/MCF.$$

$$\text{cc/M3} = 141.3 \times \text{gal/MCF}$$

FRESH FEED			WET GAS		RECYCLE		COMBINED FEED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED									
%	m/hr	#/hr	%	At. Wt. Balance m/hr	#/hr	m/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	%	
CO <sub>2</sub> H <sub>2</sub> O	36.966	7.133	199.80	6.787	0.414	11.60	1.494	8.687	1.908	-6.719	-199.80										Distribution of	
H <sub>2</sub>	88.380	11.266	28.71	35.288	2.184	4.34	7.782	19.028	9.916	-9.112	-18.37										Recovered oil	
CO <sub>2</sub> H <sub>2</sub>	2.497	0.482	81.81	32.043	1.987	66.13	7.052	7.434	0.000	1.475	64.92	0.310									400 XP	
N <sub>2</sub> H <sub>2</sub> O	0.780	0.151	4.85	2.435	0.149	4.17	0.536	0.686	0.684											400-550	0.072	
CH <sub>4</sub> H <sub>2</sub> O	1.377	0.266	4.27	12.777	0.780	12.51	2.812	3.078	3.592	0.514	8.24	1.182								550+	0.076	
C <sub>2</sub> H <sub>6</sub> H <sub>2</sub> O				2.475	0.151	4.24	0.544	0.544	0.705	0.151	4.24	0.608									53.5	
C <sub>3</sub> H <sub>8</sub> H <sub>2</sub> O				2.155	0.132	3.97	0.474	0.474	0.606	0.132	3.97	0.569										
C <sub>1</sub> +C <sub>2</sub>											16.42	2.359										
C <sub>4</sub> H <sub>10</sub> H <sub>2</sub> O				3.095	0.189	7.95	0.681	0.681	0.870	0.189	7.95	1.140	4.32	1.840	0.283	7.16	1.027	6.28	1.145	0.164	81.1	
C <sub>5</sub> H <sub>12</sub> H <sub>2</sub> O				0.783	0.044	1.94	0.159	0.159	0.203	0.044	1.94	0.278	4.24	0.458	0.066							
C <sub>6</sub> H <sub>14</sub> H <sub>2</sub> O				1.565	0.083	4.66	0.300	0.300	0.385	0.083	4.66	0.668	5.00	0.932	0.134	4.43	0.635	6.10	0.726	0.104	85.1	
C <sub>7</sub> H <sub>16</sub> H <sub>2</sub> O				0.277	0.017	0.99	0.061	0.061	0.078	0.017	0.99	0.142	4.86	0.204	0.029	0.99	0.142	4.86	0.204	0.029		
C <sub>8</sub> H <sub>18</sub> H <sub>2</sub> O				0.480	0.026	1.82	0.092	0.092	0.118	0.026	1.82	0.261	5.45	0.353	0.048	1.82	0.261	5.45	0.353	0.048	80.8	
C <sub>9</sub> H <sub>20</sub> H <sub>2</sub> O				0.100	0.006	0.43	0.022	0.022	0.026	0.006	0.43	0.062	5.28	0.082	0.012	0.43	0.062	5.28	0.082	0.012		
C <sub>10</sub> H <sub>22</sub> H <sub>2</sub> O				0.090	0.005	0.42	0.020	0.020	0.025	0.005	0.42	0.060	5.54	0.076	0.011	0.42	0.060	5.54	0.076	0.011		
C <sub>11</sub> -C <sub>14</sub>											18.23	2.611										
TOTAL	19.297	252.22		6.108	145.21	22.008	41.305	32.146														
H <sub>2</sub> +CO	95.346	18.399		6973.22	S.C.P.H.	2.568	9.256	27.655	11.824	15.831												
H <sub>2</sub> /CO		1.58	1.43405			5.20			2.21		1.36											
CUMULATIVE TOTALS											EFFLUENT						RECOVERED OIL					
H <sub>2</sub> +CO,MCF											# gal/#						31.58 4.529					
Previous Total											SHIFT RATIO						4.873 0.699					
Current Period											TOTAL OIL						31.58 4.529					
New Total											WATER SOLUBLES CHEMICALS						4.873 0.699					
FRESH FEED CONVERSION - %											SELECTIVITY						4.873 0.699					
Contractor	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>4</sub>				GROSS WATER						4.873 0.699					
	68.35	94.20	80.88	86.04	77.88	47.89	57.24	78.42			DECARBONATION						4.873 0.699					
											DEHYDRATION						4.873 0.699					
											DEA-S <sub>1</sub>						4.873 0.699					

\*Included in Reactor Effluent Total

$$cc/M3 = 141.3 \times gal/MCF.$$

OPERATING CONDITIONS			PRODUCT TESTS		CATALYST DATA				
PRESURES PSIG	RATES S.C.F.H.		OIL	WATER	INVENTORY DATA		PARTICLE SIZE%		
Oxygen	428	Fresh Feed	7314	* API	50.3	11.3	In Reactor at Start of Period		
Natural Gas	429	Recycle	8541	Neut. No.	40.8	36.2	Fresh Catalyst Added	50	76
Generator Outlet	423	Combined Feed	15655	Sap. No.	52.7	58.5	Total	On 40	419+
Reactor Inlet	419	Wet Gas—Measured	1794	Hydrox. No.			Catalyst Recovered	15	100
Condenser Inlet		Adjusted	2315	Bromine No.	82.3		In Reactor at End of Period	150	150
Product Accumulator	398	Loss	521	Pour °F.				150	105
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	14.5			200	74
							REACTOR d.p., Inches H <sub>2</sub> O	250	62
						No. Height		77	12
								225	44
								10	
TEMPERATURES °F.			Recycle/Fresh Feed	1.14				4325	
Oxygen	338	Inlet Velocity—ft./sec.					1	12-43.2	67
Natural Gas	755	Fresh Feed Rate—S.C.F.H.	6973	HEMPPEL, DIST. %			2	43.2-74.4	67
Generator	2400	per Cu. Ft. Dense Bed	428	205 °F.			3	74.4-105.6	77
Quench Accumulator		per Lb. Catalyst	5.27	400	79.0	55.1	4	105.6-342.0	385
Reactor Inlet	786	per sq. ft.	10565	400-550	10.3	36.5		0-12	26
Condenser Inlet				550*					622
Product Accumulator	65	Heat Transfer Calculations							
Catalyst No.	Height *		Steam Rate = 359.9 #/hr.	A. S. T. M. DIST. (N)					
1	12.0		635 psia & 621°F = 1167 BTU/#	Saptha °F.			Density, Lbs./Cu.Ft.	134	N <sub>2</sub> Surface, m <sup>2</sup> /gm.
2	42.2	Water in @ 150°F = 118 BTU/#			102		Inventory, Lbs.	2135	
3	74.4	Heat Transferred/# steam	10%		158		Bed Depth, Ft.	24.14	CHEMICAL ANALYSIS
4	136.8	= 1049 BTU	50%		228				C
5	199.2	610 (1049)/(359.9) = 356555 BTU/hr.	90%		350				O
6	230.4	Average Bed Temperature	EP		402				H
7	261.6	= 625°F							K <sub>2</sub> O, W+, % basis Fe
8	292.8	602							X-Ray Analysis—
9	311.0	dt = 625-521 = 104°F							Fe <sub>2</sub> O <sub>3</sub>
10	342.0	Tube Area = 53.4 ft. <sup>2</sup>							Fe <sub>3</sub> O <sub>4</sub>
11	567	556555							Fe
12		K = (104)/(63.4) = 162.6							

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 DD  
HOURS 616-626

63

\*Included in Reactor Effluent Total

$$\text{cc/M3} = 141.3 \times \text{gal/MCF}$$

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA								
PRESURES PSIG	RATES S.C.F.H.			OIL	WATER	INVENTORY DATA			PARTICLE SIZE					
Oxygen	429	Fresh Feed	10645	"API	52.9	11.0	In Reactor at Start of Period		Screen Analysis	Sedimentation				
Natural Gas	430	Recycle	12155	Neut. No.	59.0	38.2	Fresh Catalyst Added		Mesh Microns	%	Microns	%		
Generator Outlet	425	Combined Feed	22800	Sap. No.	47.5	40.9	Total		On 40	119+	8.8	80+		
Reactor Inlet	420	Wet Gas - Measured	3016	Hydrox. No.			Catalyst Recovered	41	100	150	59.8	40-80		
Condenser Inlet		Adjusted	3130	Bromine No.	80.7		In Reactor at End of Period		150	105	16.2	20-40		
Product Accumulator	388	Loss	114	Pour °F.					200	74	10.4	10-20		
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>		15.0	REACTOR d-p. Inches H <sub>2</sub> O	250	62	2.4	0-20			
							No. Height	325	44	1.6	<0.8			
TEMPERATURES - °F.		Recycle/Fresh Feed	1.14				1	12-43.2	75	<0.8				
Oxygen	290	Inlet Velocity—ft./sec.	0.7				2	45.2-74.4	68	CATALYST				
Natural Gas	745	Fresh Feed Rate—S.C.F.H.	100088	HEMPEL. DIST. %		"API	3	74.4-105.6	76	Bulk Density, Lbs./Cu.Ft.				
Generator		per Cu.Ft. Dense Bed	672	206 °F.			4	105.6-342.0	375	Aerated	161			
Quench Accumulator		per Lb. Catalyst	4.70	400	74.3	58.3	0	0-12	28	Settled	165			
Reactor Inlet	598	per sq. ft.	15209	400-550	13.6	37.4	Total		622	Compressed	167			
Condenser Inlet				550+	12.1					Particle Density, gm./cc.	4.4			
Product Accumulator	44	Heat Transfer Calculations					CALCULATED FROM dp			NH <sub>3</sub> Value, ml./gm.	9.8			
Catalyst No.	Height "	Steam Rate = 388 #/hr.		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	145	N <sub>2</sub> Surface, m <sup>2</sup> /grm.					
1	12.0	596 @ 8115 psig ± 5820°F ± 1195 BTU/#		Naphtha °F.			Inventory, Lbs.	2135						
2	43.2	647		IPB	90		Bed Depth, Ft.	22.62	CHEMICAL ANALYSIS					
3	74.4	652	Water in @ 121°F ± 89 BTU/#	10%	122		Volume, Cu. Ft.	14.95	Fe					
4	136.8	645	Heat Transferred/# steam = 1107 BTU	50%	220				C					
5	199.2	642		90%	344				O					
6	230.4	646	(1107)(388) = 429516 BTU/hr.	EP	398				H					
7	261.6	647	Ave. Bed Temp. = 640°F	Rec.	98.0				K <sub>2</sub> O, Wt. % basis Fe					
8	292.8	644	dt = 640-580 = 120°F						X-Ray Analysis—					
9	311.0	624	Tube Area = 32.5						Fe <sub>2</sub> O <sub>3</sub>					
10	342.0	610	1409516 = 11207 = 110.1						Fe <sub>3</sub> O <sub>4</sub>					
									Fe					

GAS ANALYSES				GENERATOR BALANCE								WEIGHT BALANCE										
HOUR	2800	0200	0600	AVERAGE	M/HR	C	H	O	Mol %	M/HR	C	H	O	#hr Measured	At. Wt. Balance							
FRESH FEED									O <sub>2</sub> % <sub>CO</sub>	0.50	7.541			WET GAS	179.57							
CO % <sub>CO</sub>	37.75	37.50	37.37	37.555	10.366	10.366			CO % <sub>CO</sub>	0.049	7.590			OIL	52.11							
H <sub>2</sub> % <sub>CO</sub>	58.56	58.54	58.55	58.555	16.180		32.240		H <sub>2</sub> % <sub>CO</sub>					WATER	126.48							
CO <sub>2</sub> % <sub>CO</sub>	5.10	2.69	2.69	2.827	0.780	0.780		1.560	CO <sub>2</sub> % <sub>CO</sub>	1.35	0.151	0.151	0.862	TOTAL	358.10							
N <sub>2</sub> % <sub>CO</sub>	0.69	0.64	0.64	0.657	0.181				N <sub>2</sub> % <sub>CO</sub>	0.29	0.285			FRESH FEED	364.90							
CH <sub>4</sub> % <sub>CO</sub>	0.09	0.03	0.03	0.050	0.163	0.163	0.652		CH <sub>4</sub> % <sub>CO</sub>	82.78	8.169	8.169	32.676	WEIGHT BALANCE	98.14							
				M. W.	13.2156714				C <sub>2</sub> H <sub>6</sub> % <sub>CO</sub>	8.55	0.844	1.688	5.064									
									C <sub>2</sub> H <sub>6</sub> % <sub>CO</sub>					WET GAS FACTOR	1.057665							
									H <sub>2</sub> O % <sub>CO</sub>	7.572	3.685											
									C <sub>2</sub> H <sub>6</sub> % <sub>CO</sub>	4.51	0.445	3.355	3.560									
									C <sub>2</sub> H <sub>6</sub> % <sub>CO</sub>	0.07	0.007	0.058	0.070	INDICATED LOSS - SCFH	114							
									C <sub>2</sub> H <sub>6</sub> % <sub>CO</sub>	0.05	0.003	0.018	0.056									
				BALANCE	99.47	97.84	103.79	TOTAL			11.369	41.408	18.048		5130							
WET GAS				GAS FLOW RATES 19.276625								LIQUID PRODUCT RATES										
CO % <sub>CO</sub>	9.58	7.77	8.04	8.645	V/R	PRESSURE	TEMP.	S.C.F.H.	M. W.	M/HR	HOURS	GAGE	GAL	°F	FACTOR	GAL AT 60°	API°	#	\$/HR	GAL/HR		
H <sub>2</sub> % <sub>CO</sub>	59.52	38.99	39.44	59.317	FRESH FEED	480.8	85					OIL	618°	355.66	60	1.0049	355.41	58.9				
CO <sub>2</sub> % <sub>CO</sub>	80.48	80.50	80.77	80.280	88.58	8.75		80.88	1.0048	10468	1.480	87.611			4113°	866.89	87	1.0018	866.69	8.389	8.185	
N <sub>2</sub> % <sub>CO</sub>	1.31	8.10	8.08	1.850				1.50	44													
CH <sub>4</sub> % <sub>CO</sub>	9.74	11.81	11.15	10.695	79.51	8.81		4.0801	0.158	3016	1.133	7.989										
C <sub>2</sub> H <sub>6</sub> % <sub>CO</sub>	2.85	2.41	2.82	2.430	RECYCLE	480.5	100															
C <sub>3</sub> H <sub>8</sub> % <sub>CO</sub>	1.89	1.87	1.88	1.607	80.54	9.75		80.88	0.9860	11111	1.133	29.316										
C <sub>4</sub> H <sub>10</sub> % <sub>CO</sub>	2.66	2.91	2.85	2.807	BLEED	480.5	100															
C <sub>2</sub> H <sub>6</sub> % <sub>CO</sub>	0.84	0.48	0.49	0.505	5.08	9.8		80.88	0.9860		1044	1.133	2.753	WATER								
C <sub>3</sub> H <sub>8</sub> % <sub>CO</sub>	1.19	1.85	1.84	1.827	NATURAL GAS	480.7	195				18188		38.069			7173°	403.87	61	0.9999	403.85	11.0	1B6.48
C <sub>4</sub> H <sub>10</sub> % <sub>CO</sub>	0.34	0.37	0.38	0.347	19.79	8.80		81.10	0.9864	3748	1.938	9.876			517°	896.94	64	0.9996	896.98	8.270	1B6.887	
C <sub>5</sub> H <sub>12</sub> % <sub>CO</sub>	0.40	0.98	0.50	0.298	OXYGEN	488.5	58															
C <sub>2</sub> H <sub>6</sub> % <sub>CO</sub>	0.07	0.07	0.07	0.070	18.88	7.01		81.08	1.0019	2788		7.341										
C <sub>3</sub> H <sub>8</sub> % <sub>CO</sub>	0.31	0.11	0.09	0.102	STEAM	518.5																
C <sub>4</sub> H <sub>10</sub> % <sub>CO</sub>					M. W. 68.68658	218.7	6.08	0.9985										107.01				

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 KE  
HOUSE 626-643

\*Included in Reactor Effluent Total

$$g/M3 = 16.91 \times \#/\text{MCF}$$

OPERATING CONDITIONS			PRODUCT TESTS		CATALYST DATA							
PRESURES PSIG		RATES S.C.F.H.			OIL	WATER	INVENTORY DATA		PARTICLE SIZE			
Oxygen	429	Fresh Feed	10371	* API	52.2	11.1	In Reactor at Start of Period		Screen Analysis	Sedimentation		
Natural Gas	430	Recycle	11832	Neut. No.	40.7	39.2	Fresh Catalyst Added	50 * 76	Mesh	Microns	%	Microns
Generator Outlet	424	Combined Feed	22203	Sap. No.	48.7	40.9	Total	On 40 415+	10.3	80+		
Reactor Inlet	418	Wet Gas - Measured	3042	Hydrox. No.			Catalyst Recovered	56 100	150	56.0	40-80	
Condenser Inlet		Adjusted	3185	Bromine No.	82.6		In Reactor at End of Period	150 105	14.8	20-40		
Product Accumulator	386	Loss	143	Pour °F.					200	74	11.1	10-20
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	14.0		REACTOR d.p. Inches H <sub>2</sub> O	250 62	1.6	0-20		
							No. Height	325 44	5.2			
TEMPERATURES °F.		Recycle/Fresh Feed	1.14				1 12-45.2	70 <325				
Oxygen	343	Inlet Velocity - ft./sec.					2 43.2-74.4	65	CATALYST			
Natural Gas	726	Fresh Feed Rate - S.C.F.H. Cubic ft.	9917	HEMPEL. DIST. %			3 74.4-105.6	78	Bulk Density, Lbs./Cu.Ft.			
Generator	2320	per Cu. Ft. Dens Base	654	205 °F.			4 105.6-342.0	575	Aerated			146
Quench Accumulator		per Lb. Catalyst	4.70	400	74.6	58.3	0 0-12	27	Settled			149
Reactor Inlet	725	per sq. ft.	16025	400-550	13.0	38.7		615	Compacted			164
Condenser Inlet				550+	12.4				Particle Density, gm./cc.			4.4
Product Accumulator	56	Heat Transfer Calculations					CALCULATED FBOM dp		NH <sub>3</sub> Value, ml./gm.			10.6
Catalyst No.	Height *	Steam Rate = 406.2 lbm.		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	135	N <sub>2</sub> Surface, m <sup>2</sup> /gm.			
1	12.0	620 @ 750 psia & 510°F = 1198 BTU/#		Naphtha °F.			Inventory, Lbs.	2111				
2	43.2	651		IPR	92		Bed Depth, Ft.	25.69	CHEMICAL ANALYSIS			
3	74.4	659 Water in @ 134°F = 102 BTU/lb	10%	126			Volume, Cu. Ft.	15.63	Fe			
4	136.8	632 Heat Transferred/F steam	50%	218					C			
5	199.2	617 = 1098 BTU	90%	344					O			
6	250.4	614 (1098)(406.2) = 445200 BTU/hr.	EP	398					H			
9	261.6	618 Ave. Bed Temp. = 610°F	Rec.	975					K <sub>2</sub> O, Wt. % basis Fe			
10	292.8	dt = 610-510 = 100°F							X-Ray Analysis—			
11	311.0	586 Tube Area x 35.2 ft. <sup>2</sup>							Fe <sub>2</sub> C <sub>6</sub>			
12	342.0	574 K = (53.2)(100) * 154.1							Fe <sub>2</sub> O <sub>4</sub>			
									Fe			

\*Included in Reactor Effluent Total

Chem.-Free Water Produced 75.38 7.609

$$cc/M^3 = 141.3 \times \text{vol/MCF}$$

$$\text{cc/M3} = 141.3 \times \text{gal/MCF}$$

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA							
PRESURES PSIG		RATES S.C.F.H.	H <sub>2</sub> O	648		OIL	WATER	INVENTORY DATA			PARTICLE SIZE		
Oxygen	451	Fresh Feed	10893	* API	51.9	11.0	In Reactor at Start of Period				Screen Mesh	Microns	%
Natural Gas	432	Recycle	12401	Neut. No.	44.6	59.7	Fresh Catalyst Added	52 ± 79	Total	On 40	419+	9.1	80+
Generator Outlet	426	Combined Feed	23342	Sap. No.	51.9	40.7							
Reactor Inlet	419	Wet Gas-Measured	3681	Hydrox. No.			Catalyst Recovered	163	100	150	51.6	40-80	
Condenser Inlet		Adjusted	4049	Bromine No.	79.6		In Reactor at End of Period		150	105	15.8	20-40	
Product Accumulator	386	Loss	598	Pour °F.					200	74	12.3	10-20	
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	13.0		REACTOR d-p, Inches H <sub>2</sub> O		250	62	1.6	0-20	
							No. Height		325	44	4.5		
TEMPERATURES -°F.		Recycle/Fresh Feed	1.80					1	12-43.2	71	c325	5.5	
Oxygen	353	Inlet Velocity—ft./sec.						2	45.2-74.4	62	CATALYST		
Natural Gas	705	Fresh Feed Rate <sup>cu. ft./hr.</sup>	24200	9907	HEMPPEL DIST. %	° API	3	74.4-105.6	79	Bulk Density, Lbs./Cu.Ft.			
Generator	2370	per Cu.Ft. Dense Bed	635	205 °F.			4	105.6-342.0	365	Aerated		155	
Quench Accumulator		per lb. Catalyst	4.78	400	74.5	56.8	0	0-12	27	Settled		156	
Reactor Inlet	818	per sq. ft.	18011	400-550	11.0	38.1			604	Compacted		174	
Condenser Inlet				550+	14.7					Particle Density, gm./cc.		4.5	
Product Accumulator	59	Heat Transfer Calculations					CALCULATED FROM dp			NH <sub>3</sub> Value, ml./gm.		15.0	
Catalyst No.	Height #	Steam Rate ± 460.7 #/hr.		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.		133	N <sub>2</sub> Surface, m <sup>2</sup> /gm.			
1	12.0	524	@ 766 psia ± 519°F	Naphtha °F.			Inventory, Lbs.		2073				
2	45.2	638	± 1198 BTU/#	IBP	96		Bed Depth, Ft.		23.62	CHEMICAL ANALYSIS			
3	74.4	641	Water in @ 108°F = 75 BTU/#	10%	132		Volume, Cu. Ft.		15.59	Fe			
4	136.8	628	Heat Transferred/# steam	50%	226					C			
5	199.2	617	± 1155 BTU	90%	348					O			
6	230.4	613	(1123)(460.7) = 517366 BTU/hr.	EP	400					H			
7	261.6	613	Ave. Bed Temp. = 611°F	Rec.	98.0					K <sub>2</sub> O, Wt. % basis Fe			
8	292.8	607	dT = 611-513 = 98°F							X-Ray Analysis			
9	311.0	580	Tube Area = 33.1 ft. <sup>2</sup>							Fe <sub>2</sub> O <sub>3</sub>			
10	342.0	588	K = (35.1)(86) = 158							Fe <sub>2</sub> O <sub>3</sub>			
11										Fe			

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 Gg  
HOURS 663-687

\*Included in Reactor Effluent Total

Water Fed 30.75  
Chem.-Free Water Produced 70.41 7.176

$$\text{cc/M}^3 = 141.3 \times \text{gal/MCF}$$

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 HH  
687-711

OPERATING CONDITIONS				PRODUCT TESTS		CATALYST DATA					
PRESURES PSIG	RATES S.C.F.H.	H <sub>2</sub> O	642		OIL	WATER	INVENTORY DATA			PARTICLE SIZE	
Oxygen	430	Fresh Feed	10159	* API	58.2	11.2	In Reactor at Start of Period			Screen Analysis	Sedimentation
Natural Gas	430	Recycle	12608	Neut. No.	47.2	38.4	Fresh Catalyst Added	50 $\pm$	76	Mesh	Microns
Generator Outlet	424	Combined Feed	23409	Sap. No.	57.8	41.3	Total		On 40	419+	9.7
Reactor Inlet	418	Wet Gas - Measured	4016	Hydrox. No.			Catalyst Recovered		100	150	49.4
Condenser Inlet		Adjusted	4294	Bromine No.	85.9		In Reactor at End of Period		150	105	15.4
Product Accumulator	387	Loss	278	Pour *F.					200	74	10.9
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	14.0		REACTOR d-p. Inches H <sub>2</sub> O		250	62	2.9
							No. Height		325	44	4.1
TEMPERATURES - °F.	Recycle/Fresh Feed			1.24			1	12-45.2	61	<325	6.6
Oxygen	341	Inlet Velocity - ft./sec.					2	43.8-74.4	63	CATALYST	
Natural Gas	674	Fresh Feed Rates S.C.F.H.	8200	9776	HEMPPEL, DIST. %		3	74.4-105.8	76	Bulk Density, Lbs./Cu.Ft.	
Generator	2345	per Cu.Ft. Dense Bed	606	205 *F.			4	105.6-342.0	360	Aerated	156
Quench Accumulator		per Lb. Catalyst	4.89	400	75.0	57.0	0	0-12	23	Settled	159
Reactor Inlet	830	per sq. ft.	14812	400-550	11.3	38.4			583	Compacted	181
Condenser Inlet				550+	15.7					Particle Density, gm./cc.	4.5
Product Accumulator	62	Heat Transfer Calculations					CALCULATED FROM dp			NH <sub>3</sub> Value, ml./gm.	
Catalyst No.	Height "	Steam Rate = 450.3 #/hr.			A. S. T. M. DIST. ON		Density, Lbs./Cu.Ft.	124	N <sub>2</sub> Surface, m <sup>2</sup> /gm.		
1	12.0	530	@ 764 psia & 512°F = 1198 BTU/#		Naphtha *F.		Inventory, Lbs.	2001			
2	43.2	632			IPB	99	Bed Depth, Ft.	24.45	CHEMICAL ANALYSIS		
3	74.4	651	Water in @ 110°F = 77 BTU/#	10%	134		Volume, Cu. Ft.	16.14	Fe		
4	136.8	622	Heat Transferred/# steam = 1119 BTU	50%	224				C		
5	199.2	611		90%	342				O		
6	250.4	607	(1119)(450.3) = 503886 BTU/hr.	EP	400				H		
7	261.6	605	Ave. Bed Temp. = 618°F	Rec.	98.0				K <sub>2</sub> O Wt. % basis Fe		
8	292.8	598	dT = 618-512 = 106°F						X-Ray Analysis		
9	311.0	579	Tube Area = 33.6 ft. <sup>2</sup>						Fe <sub>2</sub> C <sub>6</sub>		
10	342.0	559	K = (33.6)(106) = 141.5						Fe <sub>3</sub> O <sub>4</sub>		
									Fe		

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 II  
HOURS 711-734

\*Included in Reactor Effluent Total

\*Included in Reactor Effluent Total  
 Water Fed 30.17 g/M3 = 16.91 x  $\pm$  MCF.  
 Chem.-Free Water Produced 67.42 6.791 cc/M3 = 141.3 x  $\pm$  MCF

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
 YIELD CALCULATIONS

 RUN NO. 51 KK  
 HOURS 768-782

70

FRESH FEED			WET GAS		RECYCLE		COMBINED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED									
	%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	CONDENSATE	#/gal	POLYMER	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	Unsat.	
CO <sub>2</sub> 20.00	37.833	10.128	883.70	8.997	0.993	27.61	8.942	15.070	3.935	-9.135	-255.89											
H <sub>2</sub> 2.00	58.317	15.613	31.48	15.990	5.065	10.121	15.004	30.617	20.069	-10.540	-21.97											
CO <sub>2</sub> 24.00	8.760	0.756	32.39	28.363	3.151	137.84	9.874	10.010	12.405	8.395	108.45	10.807										
N <sub>2</sub> 20.00	0.550	0.147	4.12	1.877	0.207	5.80	0.614	0.761	0.821													
CH <sub>4</sub> 12.02	0.550	0.147	8.35	6.810	0.768	12.06	2.227	2.374	2.979	0.805	9.70	0.904										
C <sub>2</sub> H <sub>6</sub> 2.00			2.150	0.237	6.65	0.703	0.708	0.940	0.237	6.65	0.881											
C <sub>3</sub> H <sub>8</sub> 2.00			1.200	0.132	3.97	0.392	0.392	0.524	0.132	3.97	0.407											
C <sub>4</sub> +C <sub>5</sub>			H <sub>2</sub> O 1.612	H <sub>2</sub> O 29.04								20.32	2.082									
C <sub>6</sub> H <sub>6</sub> 2.00			2.263	0.250	10.52	0.740	0.740	0.990	0.850	10.52	1.079	4.32	2.435	0.250	9.47	0.971	6.25	1.515	0.156	88.9		
C <sub>7</sub> H <sub>8</sub> 2.00			0.268	0.031	1.37	0.093	0.093	0.124	0.051	1.37	0.140	4.24	0.523	0.033								
C <sub>8</sub> H <sub>10</sub> 2.00			1.257	0.137	7.69	0.404	0.404	0.541	0.157	7.69	0.798	5.00	1.558	0.168	7.31	0.749	6.10	1.198	0.123	80.5		
C <sub>9</sub> H <sub>12</sub> 2.00			0.300	0.033	1.92	0.098	0.098	0.131	0.033	1.92	0.197	4.68	0.395	0.040	1.92	0.197	4.86	0.395	0.040			
C <sub>10</sub> H <sub>12</sub> 2.00			0.437	0.048	3.37	0.143	0.143	0.191	0.046	3.37	0.345	5.45	0.618	0.063	3.37	0.345	5.45	0.618	0.063	82.9		
C <sub>11</sub> H <sub>12</sub> 2.00			0.090	0.010	0.72	0.029	0.029	0.039	0.010	0.72	0.074	5.25	0.137	0.014	0.72	0.074	5.25	0.137	0.014			
C <sub>12</sub> H <sub>16</sub> 2.00			0.103	0.011	0.93	0.034	0.034	0.045	0.011	0.93	0.095	5.54	0.168	0.017	0.93	0.095	5.54	0.168	0.017			
C <sub>3</sub> -C <sub>4</sub>												26.52	2.718	5.614	0.575	23.72	2.431	4.031	0.413			
TOTAL		26,771	354.05		11,037	230.86	32.896	59.467	49.789													
H <sub>2</sub> +CO	96.150	25.741	9758	S.C.F.H.	6.058		17.946	43.687		-10.685												
H <sub>2</sub> /CO		1.54	102480		5.101		5.10	2.34														
CUMULATIVE TOTALS																						
H <sub>2</sub> +CO MCF Catalyst # C <sub>4</sub> + gal/gal/MCF gal/Hr																						
Previous Total																						
Current Period																						
New Total																						
FRESH FEED CONVERSION — %																						
Connection CO H <sub>2</sub> H <sub>2</sub> +CO CO H <sub>2</sub> CO+H <sub>2</sub> C <sub>2</sub> +C <sub>4</sub> S <sub>2</sub> WATER																						
58.77 90.11 67.56 76.47 69.89 34.45 45.05 79.66																						
Water Fed 29.04																						
Chem.-Free Water Produced 70.05 7.179																						
g/M3 = 16.91 ± .MCF																						
cc/M3 = 141.3 ± gal/MCF.																						

OPERATING CONDITIONS		PRODUCT TESTS				CATALYST DATA			
PRESURES PSIG	RATES S.C.F.H.	OIL	WATER	INVENTORY DATA	PARTICLE SIZE				
Oxygen	428	Fresh Feed	10149	* API	51.8	11.2	In Reactor at Start of Period		
Natural Gas	429	Recycle	12395	Neut. No.	44.0	38.8	Fresh Catalyst Added	55 ± 83	Micron % Microns %
Generator Outlet	418	Combined Feed	22544	Sap. No.	52.9	41.5	Total	On 40 419+	5.9 80+
Reactor Inlet	418	Wet Gas-Measured	4010	Hydrox. No.			Catalyst Recovered	100 150	25.6 40-80
Condenser Inlet		Adjusted	4184	Bromine No.	76.1		In Reactor at End of Period	150 105	7.5 20-40
Product Accumulator	387.5	Loss	174	Pour °F.			REACTOR d.p. Inches H <sub>2</sub> O	250 62	1.1 0-20
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	14.0		No. Height	322 44	1.7 2.6
TEMPERATURES — °F.		Recycle/Fresh Feed	1.22						
Oxygen	379	Inlet Velocity—ft./sec.					1 12-43.2	65	
Natural Gas	709	Fresh Feed Rate—S.C.F.H.	9758	HEMPEL DIST. %	0 API		2 43.2-74.4	66	CATALYST
Generator	2340	per Cu. Ft. Dense Bed	634		205 °F.		3 74.4-105.6	80	Bulk Density, Lbs./Cu.Ft.
Quench Accumulator	116	per Lb. Catalyst	4.84	400	78.0	56.4	4 105.6-342.0	350	Aerated
Reactor Inlet	842	per sq. ft.	14785	400-550	10.3	38.0		27	Settled
Condenser Inlet					556	11.7			Compacted
Product Accumulator	65	Heat Transfer Calculations							Particle Density, gm./cc.
Catalyst No. Height"		Steam Rate = 448.7 #/hr.		A. S. T. M. DIST. ON					N <sub>2</sub> Surface, m <sup>2</sup> /gm.
1 12.0	543	@ 765 psia & 513°P		Naphtha °F.					8.5
2 43.2	636	= 1198 BTU		IRP	100				
3 74.4	634	Water in @ 114°F = 80 BTU/#	10%		136				
4 136.8	622	Heat Transferred/# steam	50%		230				
5 199.2	611	= 1118 BTU	90%		356				
6 250.4	606	(448.7)(1118) = 501646 BTU/hr.	EP		402				
9 261.6	602	Ave. Bed Temp. = 608°F							K <sub>2</sub> O/W+ % basis Fe
10 292.8	598	dt = 608-513 = 95°F							X-Ray Analysis—
11 311.0	580	Tube Area = 32.9 ft. <sup>2</sup>							Fe <sub>2</sub> O <sub>3</sub>
12 342.0	574	K = (95)/(32.9) = 161							Fe <sub>2</sub> O <sub>4</sub>
									Fe

GAS ANALYSES		GENERATOR BALANCE				WEIGHT BALANCE						
HOUR	AVERAGE	M/Hr	C	H	O	Mol %	M/Hr	C	H	O	Measured	At Wt. Balance
FRESH FEED												
CO <sub>2</sub> 20.00	37.54	7.42	8.25	8.997	VTR	0.44	7.288	14.664	WET GAS	221.25	250.86	
H <sub>2</sub> 2.00	46.48	44.11	47.08	45.890	PRESSURE	0.044	7.332		OIL	38.00		
CO <sub>2</sub> 24.00	26.76	30.29	28.04	28.363	TEMP.	1.15			WATER	114.25	114.25	
N <sub>2</sub> 20.00	1.40	2.33	1.90	1.877	S.C. F.H.							
CH <sub>4</sub> 12.02	6.74	7.50	6.19	6.810	M. W.	115.14	7.391	4.0250.9958	10149	1.4795	26.771	
C <sub>2</sub> H <sub>6</sub> 3.00	2.31	1.94	2.150	RECYCLE				12.65				
C <sub>3</sub> H <sub>8</sub> 3.20	1.16	1.16	1.200	50.54		0.70	20.80	0.9416	11296	1.1765	29.797	
C <sub>4</sub> H <sub>10</sub> 2.00	2.14	2.22	2.263	BLEED				126.5				
C <sub>6</sub> H <sub>6</sub> 2.00	0.37	0.31	0.27	0.283		5.02	40.80	0.9416	1099	1.1765	2.899	
C <sub>8</sub> H <sub>10</sub> 2.00	1.40	1.15	1									

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 51 LL  
HOURS 782-806

FRESH FEED			WET GAS			RECYCLE		COMBINED FEED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED						
%	m/hr	#/hr	%	At. Wt. balance	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/MCF	#/hr	#/MCF	#/gal	gal/MCF	POLYMER	%
CO <sub>24.010</sub>	37.653	10.038	881.14	8.997	0.807	22.60	8.791	18.889	3.598	-9.231	265.83								Distribution of	
H <sub>2</sub> <sub>24.010</sub>	56.740	15.658	51.57	39.616	3.565	7.17	18.891	27.949	15.847	-12.102	-24.40								Recovered oil	
CO <sub>24.010</sub>	8.847	0.759	33.40	30.783	2.764	181.67	9.654	10.303	19.318	2.005	68.27	9.319							400 EP	
N <sub>24.010</sub>	0.547	0.146	4.09	8.410	0.216	6.05	0.748	0.894	0.964										400-550	
CH <sub>4</sub> <sub>24.010</sub>	0.813	0.057	0.91	8.037	0.721	11.57	2.493	2.550	3.214	0.664	10.56	1.125							550+	
C <sub>2</sub> H <sub>6</sub> <sub>24.010</sub>					2.563	0.212	5.95	0.733	0.733	0.945	0.812	5.95	0.628							
C <sub>3</sub> H <sub>8</sub> <sub>24.010</sub>					1.507	0.155	4.06	0.468	0.468	0.603	0.135	4.06	0.489							
C <sub>4</sub> +C <sub>5</sub>																			20.47	2.188
C <sub>6</sub> H <sub>6</sub> <sub>24.010</sub>					2.947	0.264	11.11	0.914	0.914	1.178	0.264	11.11	1.173	4.32	2.572	0.271	0.99	1.055	6.23	
C <sub>7</sub> H <sub>8</sub> <sub>24.010</sub>					0.517	0.046	2.03	0.160	0.160	0.206	0.046	2.03	0.214	4.24	0.479	0.051				
C <sub>8</sub> H <sub>10</sub> <sub>24.010</sub>					1.810	0.144	8.08	0.499	0.499	0.645	0.144	8.08	0.853	5.00	1.616	0.170	7.68	0.911	6.10	
C <sub>9</sub> H <sub>12</sub> <sub>24.010</sub>					0.380	0.034	1.98	0.118	0.118	0.182	0.034	1.98	0.209	4.86	0.407	0.043				
C <sub>10</sub> H <sub>14</sub> <sub>24.010</sub>					0.680	0.052	3.65	0.180	0.180	0.232	0.052	3.65	0.388	5.45	0.670	0.071	3.65	0.385	5.45	
C <sub>11</sub> H <sub>16</sub> <sub>24.010</sub>					0.103	0.009	0.65	0.032	0.032	0.041	0.009	0.65	0.069	5.28	0.124	0.013	0.65	0.069	5.28	
C <sub>12</sub> H <sub>18</sub> <sub>24.010</sub>					0.140	0.013	1.09	0.043	0.043	0.056	0.013	1.09	0.115	5.84	0.197	0.021	1.09	0.115	5.84	
C <sub>13</sub> -C <sub>4</sub>														28.59	3.018	6.065	0.640	25.04	2.644	
TOTAL	26.658	351.11		8.973	207.66	31.024	57.682	45.271											4.256	0.460
H <sub>2</sub> +CO	93.598	25.696	S.C.F.H.	4.363		15.062	40.778													
H <sub>2</sub> /CO	1.56	105574		4.406		4.40	2.18													
CUMULATIVE TOTALS																				
M <sub>2</sub> +CO/MCF			Catalyst #	C <sub>2</sub> +C <sub>4</sub>	gal/MCF	gal/MCF	gal/#													
Previous Total																				
Current Period																				
New Total																				
FRESH FEED CONVERSION -- %																				
Conversion	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>2</sub> +C <sub>4</sub>													
	66.54	91.96	77.29	85.02	71.95	45.30	52.31	80.86												

\*Included in Reactor Effluent Total

g/M3 = 16.91 × #/MCF.  
cc/M3 = 141.3 × gal/MCF.

OPERATING CONDITIONS		PRODUCT TESTS			CATALYST DATA			PARTICLE SIZE					
PRESSURES PSIG		RATES S.C.F.H.			OIL			INVENTORY DATA			SCREEN ANALYSIS		
Oxygen	429	Fresh Feed	10106	* API	51.8	11.1	In Reactor at Start of Period	76	Mesh	Micros	%	Screen Analysis	Sedimentation
Natural Gas	428	Recycle	11761	Neut. No.	41.8	40.6	Fresh Catalyst Added 60 ±						
Generator Outlet	422	Combined Feed	21867	Sap. No.	74.1		Total	On 40	419	11.8	80+		
Reactor Inlet	416	Wet Gas-Measured	3255	Hydro. No.			Catalyst Recovered	67	100	150	54.2	40-80	
Condenser Inlet		Adjusted	3402	Bromine No.	74.1		In Reactor at End of Period	150	105	15	13.1	20-40	
Product Accumulator		Loss	145	Pour °F.				200	74	10.0	10.0	10-20	
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>	14.0		REACTOR d.p., Inches H <sub>2</sub> O	250	62	1.0	1.0	0-20	
							No. Height	325	44	3.7			
TEMPERATURES—°F.		Recycle/Fresh Feed	1.16				1	12-43.2	66	4325	6.2		
Oxygen	455	Inlet Velocity—ft./sec.	0.7				2	45.2-74.4	67	CATALYST			
Natural Gas	703	Fresh Feed Rate—S.C.F.H.	9472	HEMPPEL DIST. %	50	API	3	74.4-105.6	82	Bulk Density, Lbs./Cu.Ft.			
Generator		per Cu.Ft. Dens Bed	624	205 °F.			4	105.6-342.0	350	Aerated	156		
Quench Accumulator		per Lb. Catalyst	4.69	400			5	0-12	24	Settled	158		
Reactor Inlet	829	per sq. ft.	14352	400-550	12.0	36.0	Total	599		Compacted	179		
Condenser Inlet				550+	11.4					Particle Density, gm./cc.	4.6		
Product Accumulator	61	Heat Transfer Calculations					CALCULATED FROM dp			N <sub>2</sub> Value, ml./gm.	5.98		
Catalyst No.	Height"	Steam Rate = 507.5 #/hr.	A. S. T. M. DIST. ON				Density, Lbs./Cu.Ft.	133	N <sub>2</sub> Surface, m <sup>2</sup> /gm.				
1	12.0	551 @ 815 psia & 510°F	Naphtha °F.				Inventory, Lbs.	2021					
2	45.2	653	IBP	100			Bed Depth, Ft.	23.02	CHEMICAL ANALYSIS				
3	74.4	652 Water in @ 113°F = 79 BTU/lb	10*	135			Volume, Cu. Ft.	15.19	Fe				
5	156.8	639 Heat Transferred/# steam	50%	229					C				
7	199.2	626	90%	358					O				
8	230.4	620 (507.5)(1117) = 566878 BTU/hr.	EP	402					H				
9	261.6	617 Ave. Bed Temperature = 622°F Rec.	98.0						K <sub>2</sub> O. W+.% basis Fe				
10	292.6	611 dt = 522-518 = 104°F							X-Ray Analysis—				
11	311.0	593 Tube Area = 32.7 ft <sup>2</sup>							Fe <sub>2</sub> O <sub>3</sub>				
12	342.0	582 K = (104)(32.7) = 167							Fe <sub>2</sub> O <sub>4</sub>				
									Fe				

GAS ANALYSES		GENERATOR BALANCE						WEIGHT BALANCE					
HOUR	AVERAGE	M/Hr	C	H	O	Mol %	M/Hr	C	H	O	#/hr	Measured	At. Wt. Balance
FRESH FEED													
CO <sub>24.010</sub>	9.05	9.24	8.69	8.997	VTR	0.42	7.651	0.041		14.564	WET GAS	198.77	207.66
H <sub>2</sub> <sub>24.010</sub>	41.16	37.89	59.80	39.616	FRESH FEED	415.9	76				OIL	45.68	45.68
CO <sub>24.010</sub>	29.03	32.44	30.91	30.793	38.66	0.627	0.9850	10106	1.4885	26.658	314*	179.09	97.77
N <sub>2</sub> <sub>24.010</sub>	2.02	2.67	2.54	2.410	WET GAS	1.55	61					170.58	1096.3
C <sub>2</sub> H <sub>6</sub> <sub>24.010</sub>	8.61	7.86	8.14	8.037	115.14	6.279	4.051	0.9900	3256	1.1185	8.689		
C <sub>3</sub> H <sub>8</sub> <sub>24.010</sub>	2.356	2.57	2.36	2.565	RECYCLE	418.5	188						
C <sub>4</sub> H <sub>10</sub> <sub>24.010</sub>	1.465	1.65	1.54	1.507	50.64	9.789	20.81	0.9404	10765	1.1185	8.591		
C <sub>5</sub> H <sub>12</sub> <sub>24.010</sub>	2.98	5.05	2.84	2.947	BLEED	418.5	188						
C <sub>6</sub> H <sub>14</sub> <sub>24.010</sub>	0.52	0.55	0.50	0.517	5.02	9.079	20.81	0.9404	996	1.1185	8.689		
C <sub>7</sub> H <sub>16</sub> <sub>24.010</sub>	1.65	1.67	1.60	1.610	NATURAL GAS	488.5	800				WATER	71.5*	398.95
C <sub>8</sub> H <sub>18</sub> <sub>24.010</sub>	0.34	0.41	0.39	0.380	19.76	8.180	21.05	0.9876	3786	1.1185	8.689	412*	282.85
C <sub>9</sub> H <sub>20</sub> <sub>24.010</sub>	0.61	0.61	0.58	0.580	OXYGEN	487.5	76					816*	198.89
C <sub>10</sub> H <sub>22</sub> <sub>24.010</sub>	0.09	0.09	0.18	0.103	18.68	7.056	21.05	0.9851	2746				

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 51 MM  
HOURS ... 806-830

FRESH FEED			WET GAS			RECYCLE		COMBINED FED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> +CO FED									
%	m/hr	#/hr	%	At Wt Balance	m/hr	#/hr	m/hr	m/hr	#/hr	m/hr	#/hr	m/hr	#/hr	CONDENSATE	#/MCF	gal/gal	gal/MCF	#/hr	gal/gal	#/MCF	POLYMER	%	
CO <sub>28.010</sub>	36.787	9.903	277.34	8.750	0.809	22.66	2.780	12.653	5.559	-0.094	-254.66												
H <sub>2</sub> <sub>28.010</sub>	59.490	16.013	38.28	41.133	3.808	7.66	12.924	26.937	16.728	-18.811	-24.62												
CO <sub>28.010</sub>	2.960	0.797	35.08	30.023	2.776	12.15	9.434	10.231	12.810	1.970	97.07	8.862											
N <sub>28.010</sub>	0.495	0.135	3.75	2.357	0.218	6.11	0.741	0.874	0.959														
CH <sub>28.010</sub>	0.270	0.073	1.17	8.180	0.756	12.13	2.570	2.645	5.326	0.688	10.96	1.116											
C <sub>2</sub> H <sub>28.010</sub>				2.357	0.218	6.12	0.741	0.741	0.959	0.218	6.12	0.623										61.6	
C <sub>2</sub> H <sub>28.010</sub>				1.467	0.136	4.09	0.461	0.461	0.597	0.136	4.08	0.416											
C <sub>1</sub> -C <sub>2</sub>																							
C <sub>2</sub> H <sub>28.010</sub>				2.703	0.250	10.52	0.849	0.849	1.099	0.250	10.68	1.071	4.32	2.435	0.248	9.47	0.964	6.25	1.515	0.154	87.7		
C <sub>2</sub> H <sub>28.010</sub>				0.380	0.035	1.54	0.119	0.119	0.154	0.035	1.54	0.157	4.24	0.365	0.037								
C <sub>2</sub> H <sub>28.010</sub>				1.465	0.135	7.87	0.480	0.480	0.595	0.135	7.87	0.770	5.00	1.515	0.154	7.19	0.732	6.10	1.179	0.120	78.9		
C <sub>2</sub> H <sub>28.010</sub>				0.387	0.036	2.09	0.122	0.122	0.158	0.036	2.09	0.213	4.86	0.430	0.044	2.08	0.213	4.86	0.430	0.044			
C <sub>2</sub> H <sub>28.010</sub>				0.530	0.049	3.44	0.167	0.167	0.216	0.049	3.44	0.350	5.45	0.651	0.064	3.44	0.350	5.45	0.651	0.064	81.7		
C <sub>2</sub> H <sub>28.010</sub>				0.125	0.011	0.79	0.039	0.039	0.050	0.011	0.79	0.080	5.25	0.150	0.015	0.79	0.080	5.25	0.150	0.015			
C <sub>2</sub> H <sub>28.010</sub>				0.147	0.014	1.18	0.046	0.046	0.060	0.014	1.18	0.120	5.84	0.213	0.022	1.18	0.120	5.84	0.213	0.022			
C <sub>3</sub> -C <sub>4</sub>																							
TOTAL	26.919	349.60		9.245	208.05	31.423	58.342	45.639															
H <sub>2</sub> +CO	96.277	25.916		9825	S.C.F.H.	4.611	15.674	41.590		-21.305													
H <sub>2</sub> /CO	1.62	1017811		4.70			2.89		1.34														
CUMULATIVE TOTALS				H <sub>2</sub> +CO,MCF	Catalyst #	C <sub>3</sub> +C <sub>4</sub>	gal/MCF	gal/#															
Previous Total																							
Current Period																							
New Total																							
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %			SELECTIVITY		NET WATER		NET WATER		GROSS WATER		HYDROCARBON		N <sub>2</sub>		NH <sub>3</sub>		H <sub>2</sub> O		
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> +C <sub>4</sub>		GROSS WATER														
	65.66	91.83	76.26	82.21	71.87	49.20	51.25	80.20															
	106.93	10.883																					

\*Included in Reactor Effluent Total

g/M3 = 16.91 x = /MCF  
cc/M3 = 141.3 gal/MCF.

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA																					
PRESSURES PSIG			RATES S.C.F.H.			OIL			WATER			INVENTORY DATA			PARTICLE SIZE												
												In Reactor at Start of Period			Screen Analysis												
Oxygen	428	Fresh Feed	10205	* API	51.7	11.0						Fresh Catalyst Added 50 #	76	Mesh	Microns	"	Microns	"									
Natural Gas	429	Recycle	11913	Neut. No.	43.7	42.7						Total	On 40	419+	12.8	80+											
Generator Outlet	423	Combined Feed	22118	Sap. No.	54.9	43.1						Catalyst Recovered	54	100	150	52.8	40-80										
Reactor Inlet	417	Wet Gas-Measured	3294	Hydrox. No.								In Reactor at End of Period	150	105	15.1	20-40											
Condenser Inlet		Adjusted	3505	Bromine No.	76.0								200	74	9.5	10-20											
Product Accumulator	388	Loss	211	Pour °F.								REACTOR d.p. Inches H <sub>2</sub> O	250	62	1.5	0-20											
												No. Height	325	44	2.3												
TEMPERATURES—°F.		Recycle/Fresh Feed	1.17										1	12-43.2	66	x325	8.0										
Oxygen	442	Inlet Velocity—ft./sec.	0.7										2	43.2-74.4	67	CATALYST											
Natural Gas	683	Fresh Feed Rate—S.C.F.H.	9825	HEMPPEL DIST. %									3	74.4-105.6	81	Bulk Density, Lbs./Cu.Ft.											
Generator		per Cu.Ft. Densit	648		205 °F.								4	105.6-342.0	350	Aerated	156										
Quench Accumulator		per Lb. Catalyst	4.87		400	76.6	56.7						0	0-12	24	Settled	158										
Reactor Inlet	833	per sq. ft.	14886	400-550	13.0	36.6							Total	588	Compacted	186											
Condenser Inlet				550+	10.4																						
Product Accumulator	62	Heat Transfer Calculations											CALCULATED FROM dp		NH <sub>3</sub> Value, ml./gm.	7.5											
Catalyst No.	Height "	Steam Rate = 50.17 #/hr.											Density, Lbs./Cu.Ft.	133	N <sub>2</sub> Surface, m <sup>2</sup> /gm.												
1	19.0	544 @ 806 psia & 510°F	0.7										Inventory, Lbs.	2018													
2	45.2	656											Bed Depth, Ft.	22.99	CHEMICAL ANALYSIS												
3	74.4	658	Water in @ 121°F = 66 BTU/#	10%									Volume, Cu. Ft.	15.17	Fe												
4	136.8	639	Heat Transferred/# steam	50%											C												
5	199.2	625		90%										O													
6	230.4	623	(501.7)(1110) = 556897 BTU/hr.	EP											H												
7	261.6	616	Ave. Bed Temp. = 623°F	Rec.											K <sub>2</sub> O, W+, % basis Fe												
8	292.8	611	dT = 625-519 = 104°F												X-Ray Analysis—												
9	311.0	593	Tube Area = 32.7 ft <sup>2</sup>												Fe <sub>2</sub> O <sub>3</sub>												
10	342.0	578	K = (104)(32.7) = 164												Fe <sub>3</sub> O <sub>4</sub>												
															Fe												

HOUR	GAS ANALYSES			GENERATOR BALANCE						WEIGHT BALANCE						#/hr	Measured	At Wt. Balance
	AVERAGE	M/Hr	C	H	O	Mol %	M/Hr	C	H	O	Mol %	M/Hr	C	H	O			
FRESH FEED																		
CO <sub>28.010</sub>	37.25	35.51	37.60	36.787	9.903	9.903												

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS

RUN NO. 51 MM  
HOURS 850-854

FRESH FEED			WET GAS			RECYCLE		COMBINED FEED		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED										
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	#/hr	m/hr	#/hr	m/hr	#/hr	m/hr	#/hr	CONDENSATE	#/gal	gal/MCF	#/hr	gal/MCF	#/hr	POLYMER	#/gal	gal/hr	gal/MCF	% Unsat.
CO	37.943	9.997	279.99	10.357	0.965	26.97	3.288	15.282	4.248	-9.034	-253.02								Distribution of					
H <sub>2</sub>	58.754	15.474	51.80	41.869	3.893	7.85	15.280	28.754	17.175	-11.581	-28.35								Recovered Oil					
CO <sub>2</sub>	2.713	0.715	51.47	28.697	2.685	116.14	9.166	9.881	11.651	1.970	86.67	8.976							400 EP	0.557				
N <sub>2</sub>	0.497	0.131	5.67	2.317	0.215	6.02	0.755	0.866	0.950										400-SO	0.077				
CH <sub>4</sub>	0.113	0.030	0.48	7.467	0.594	11.13	2.368	0.398	3.062	0.664	10.65	1.104							550+	0.084				
C <sub>2</sub> H <sub>6</sub>				2.307	0.214	6.00	0.732	0.732	0.946	0.214	6.00	0.621								61.7				
C <sub>3</sub> H <sub>8</sub>				1.453	0.133	4.00	0.465	0.465	0.588	0.133	4.00	0.414												
C <sub>4</sub> +C <sub>5</sub>													20.65	2.139										
C <sub>6</sub> H <sub>6</sub>				2.727	0.254	10.69	0.865	0.865	1.119	0.254	10.69	1.107	4.32	2.475	0.257	9.62	0.996	6.25	1.539	0.159	86.1			
C <sub>7</sub> H <sub>8</sub>				0.440	0.041	1.81	0.140	0.140	0.181	0.041	1.81	0.187	4.24	0.427	0.044									
C <sub>8</sub> H <sub>10</sub>				1.280	0.119	6.68	0.406	0.406	0.525	0.119	6.68	0.692	9.00	1.356	0.138	6.35	0.656	6.10	1.041	0.108	81.0			
C <sub>9</sub> H <sub>12</sub>				0.500	0.028	1.65	0.095	0.095	0.123	0.028	1.65	0.169	4.86	0.355	0.025	1.63	0.169	4.86	0.355	0.025				
C <sub>10</sub> H <sub>16</sub>				0.430	0.040	2.81	0.156	0.136	0.176	0.040	2.81	0.291	5.45	0.516	0.053	2.81	0.291	5.45	0.516	0.053	85.1			
C <sub>11</sub> H <sub>16</sub>				0.075	0.007	0.51	0.083	0.083	0.030	0.007	0.51	0.053	5.25	0.097	0.010	0.51	0.053	5.25	0.097	0.010				
C <sub>12</sub> H <sub>16</sub>				0.105	0.010	0.84	0.033	0.033	0.043	0.010	0.84	0.087	5.84	0.152	0.016	0.84	0.087	5.84	0.152	0.016				
C <sub>13</sub> C <sub>4</sub>													24.97	2.586	5.358	0.553	21.76	2.254	3.680	0.381				
TOTAL	26.347	346.81		9.296	205.08	31.718	58.065	46.288																
H <sub>2</sub> +CO	96.677	25.471	9656	S.C.F.H.	4.856		16.565	42.056																
H <sub>2</sub> /CO	1.55	10.8562		4.043		4.04	2.16																	
CUMULATIVE TOTALS																								
H <sub>2</sub> +CO/MCF																								
Catalyst #																								
Previous Total																								
Current Period																								
New Total																								
FRESH FEED CONVERSION - %																								
Conversion	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>2</sub> + C <sub>3</sub>																	
	64.72	90.57	74.84	80.94	69.02	40.28	49.04	79.83																

\*Included in Reactor Effluent Total

g/M3 = 16.91 × #/MCF.  
cc/M3 = 141.3 × gal/MCF

OPERATING CONDITIONS		PRODUCT TESTS				CATALYST DATA				PARTICLE SIZE							
PRESSURES PSIG		RATES S.C.F.H.				OIL				INVENTORY DATA				SCREEN ANALYSIS			
Oxygen	428	Fresh Feed	9988	* API	51.6	11.1	In Reactor at Start of Period										
Natural Gas	429	Recycle	12024	Neut. No.	42.5	40.9	Fresh Catalyst Added	50	*	76	Mesh	Microns	%	Microns	%		
Generator Outlet	423	Combined Feed	22012	Sap. No.			Total			On 40	419	9.5	80+				
Reactor Inlet	417	Wet Gas—Measured	3322	Hydrox. No.			Catalyst Recovered			44	100	150	50.9	40-80			
Condenser Inlet		Adjusted	3524	Bromine No.	79.4		In Reactor at End of Period			150	105	17.6	20-40				
Product Accumulator	388	Loss	204	Pour °F.						200	74	13.4	10-20				
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>		14.0	REACTOR d.p. Inches H <sub>2</sub> O			250	62	0.8	0-20				
TEMPERATURES—°F.		Recycle/Fresh Feed	1.20							1	12-45.2	66	4325	3.8			
Oxygen	360	Inlet Velocity—ft/sec.								2	43.2-74.4	67					
Natural Gas	703	Fresh Feed Rate—SCFH	9656	HEMPEL DIST. %	9API	3	74.4-105.6	79									
Generator		per Cu.Ft. Dense Bed	644	205 °F.		4	105.6-342.0	345									
Quench Accumulator		per Lb. Catalyst	4.84	400		0	0-12	24									
Reactor Inlet	834	per sq. ft.	14630	400-550	11.0	36.6	Total	581									
Condenser Inlet				550+	12.0												
Product Accumulator	62	Heat Transfer Calculations					CALCULATED FROM dp										
Catalyst No.	Height*	Steam Rate ± 407.2 #/hr.	A. S. T. M. DIST. ON				Density, lbs./cu.ft.	133									
1	12.0	532	@ 764 psia & 513OP	Naphtha °F.			Inventory, Lbs.	1994									
2	43.2	654	= 1198 BTU/#	IBP	96		Bed Depth, Ft.	22.71									
3	74.4	663	Water in 110°F = 73 BTU/#	50%	224		VOLUME, cu. ft.	14.99									
4	136.8	638	= 1120 BTU	90%	554												
5	199.2	624															
6	230.4	620	(470.2)(1120) = 526624 BTU/hr.	EP	406												
9	261.6	615	Ave. Bed Temp. = 621°F	REC.	98.0												
10	292.8	611	dT = 621-513 = 108°F														
11	311.0	591	Tube Area = 32.6 ft. <sup>2</sup>														
12	342.0	577	K = (526624)/(108) = 150														

GAS ANALYSES				GENERATOR BALANCE				WEIGHT BALANCE								
HOUR	1400	2200	0600	AVERAGE	M/Hr	C	H	O	Mol %	M/Hr	C	H	O	#/hr	Measured	At. Wt. Balance
FRESH FEED	38.14	37.91	37.76	37.943	9.997	9.997			0.41	7.352					192.33	205.08
CO <sub>2</sub>	58.44	58.65	59.21	58.754	15.474											
H <sub>2</sub>	2.713	3.17	3.17	3.173	0.715	0.715										
CO <sub>2</sub>	2.74	2.92	2.92	2.92	0.715	0.715										
N <sub>2</sub>	0.65	0.57	0.37	0.497	0.131											
CH <sub>4</sub>	0.13	0.05	0.16	0.113	0.030	0.030	0.120									
M. W.	15.1633															
H <sub>2</sub> O	2.68	2.41	2.317	2.317	8.16	8.16	4.280	7.53	0.41	8.355	1.670	5.010				
	26.347	10.742	39.627	16.707												
BALANCE																

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 00-1  
HOURS 854-866

FRESH FEED			WET GAS			RECYCLE		COMBINED LIQUID		EFFLUENT		NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED								
%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	m/hr	m/hr	#/MCF	#/gal	gal/MCF	#/hr	#/MCF	#/gal	gal/MCF	%			
CO <sub>10.010</sub>	<b>37.995</b>	<b>10.072</b>	<b>282.13</b>	<b>12.946</b>	<b>1.430</b>	<b>40.05</b>	<b>4.070</b>	<b>14.142</b>	<b>5.800</b>	<b>-8.642</b>	<b>-242.08</b>								Distribution of			
H <sub>2</sub> <sub>15.014</sub>	<b>56.070</b>	<b>16.396</b>	<b>31.04</b>	<b>45.772</b>	<b>5.055</b>	<b>10.19</b>	<b>14.390</b>	<b>29.785</b>	<b>19.445</b>	<b>-10.340</b>	<b>-20.85</b>								Recovered Oil			
CO <sub>2</sub> <sub>14.510</sub>	<b>2.860</b>	<b>0.758</b>	<b>33.38</b>	<b>25.782</b>	<b>2.048</b>	<b>185.34</b>	<b>8.105</b>	<b>8.863</b>	<b>10.953</b>	<b>2.090</b>	<b>91.98</b>	<b>9.527</b>							400 EP			
N <sub>2</sub> <sub>0.014</sub>	<b>0.345</b>	<b>0.091</b>	<b>2.55</b>	<b>1.770</b>	<b>0.195</b>	<b>5.46</b>	<b>0.556</b>	<b>0.647</b>	<b>0.751</b>									400-550				
CH <sub>4</sub> <sub>16.045</sub>	<b>0.730</b>	<b>0.194</b>	<b>5.11</b>	<b>5.995</b>	<b>0.662</b>	<b>10.62</b>	<b>1.985</b>	<b>2.079</b>	<b>2.547</b>	<b>0.468</b>	<b>7.51</b>	<b>0.778</b>							0.086			
C <sub>2</sub> H <sub>6</sub> <sub>1.044</sub>						<b>2.005</b>	<b>0.221</b>	<b>6.20</b>	<b>0.630</b>	<b>0.630</b>	<b>0.851</b>	<b>0.221</b>	<b>6.20</b>	<b>0.642</b>					64.2			
C <sub>3</sub> H <sub>8</sub> <sub>0.048</sub>						<b>1.110</b>	<b>0.123</b>	<b>3.70</b>	<b>0.349</b>	<b>0.349</b>	<b>0.472</b>	<b>0.123</b>	<b>3.70</b>	<b>0.385</b>								
C <sub>4</sub> +C <sub>5</sub>															<b>17.41</b>	<b>1.803</b>						
C <sub>6</sub> H <sub>6</sub> <sub>4.078</sub>						<b>2.235</b>	<b>0.247</b>	<b>10.39</b>	<b>0.705</b>	<b>0.705</b>	<b>0.950</b>	<b>0.247</b>	<b>10.39</b>	<b>1.077</b>	<b>4.32</b>	<b>2.405</b>	<b>0.249</b>	<b>9.55</b>	<b>0.968</b>			
C <sub>6</sub> H <sub>6</sub> <sub>4.078</sub>						<b>0.310</b>	<b>0.034</b>	<b>1.50</b>	<b>0.097</b>	<b>0.097</b>	<b>0.131</b>	<b>0.034</b>	<b>1.50</b>	<b>0.155</b>	<b>4.24</b>	<b>0.554</b>	<b>0.037</b>					
C <sub>6</sub> H <sub>6</sub> <sub>2.014</sub>						<b>1.185</b>	<b>0.151</b>	<b>7.35</b>	<b>0.375</b>	<b>0.375</b>	<b>0.504</b>	<b>0.131</b>	<b>7.35</b>	<b>0.761</b>	<b>5.00</b>	<b>1.470</b>	<b>0.152</b>	<b>6.98</b>	<b>0.723</b>			
C <sub>6</sub> H <sub>6</sub> <sub>2.014</sub>						<b>0.275</b>	<b>0.030</b>	<b>1.74</b>	<b>0.086</b>	<b>0.086</b>	<b>0.116</b>	<b>0.030</b>	<b>1.74</b>	<b>0.180</b>	<b>4.86</b>	<b>0.358</b>	<b>0.037</b>	<b>1.74</b>	<b>0.180</b>			
C <sub>6</sub> H <sub>6</sub> <sub>7.010</sub>						<b>0.435</b>	<b>0.048</b>	<b>3.37</b>	<b>0.137</b>	<b>0.137</b>	<b>0.180</b>	<b>0.048</b>	<b>3.37</b>	<b>0.349</b>	<b>5.45</b>	<b>0.618</b>	<b>0.064</b>	<b>3.37</b>	<b>0.349</b>			
C <sub>6</sub> H <sub>6</sub> <sub>1.044</sub>						<b>0.070</b>	<b>0.008</b>	<b>0.58</b>	<b>0.022</b>	<b>0.022</b>	<b>0.030</b>	<b>0.008</b>	<b>0.58</b>	<b>0.060</b>	<b>5.25</b>	<b>0.110</b>	<b>0.011</b>	<b>0.58</b>	<b>0.060</b>			
C <sub>6</sub> H <sub>6</sub> <sub>1.044</sub>						<b>0.110</b>	<b>0.012</b>	<b>1.01</b>	<b>0.035</b>	<b>0.035</b>	<b>0.037</b>	<b>0.012</b>	<b>1.01</b>	<b>0.105</b>	<b>5.54</b>	<b>0.182</b>	<b>0.019</b>	<b>1.01</b>	<b>0.105</b>			
C <sub>6</sub> -C <sub>4</sub>															<b>25.94</b>	<b>2.687</b>	<b>5.497</b>	<b>0.569</b>	<b>23.03</b>	<b>2.385</b>		
TOTAL	<b>26.510</b>	<b>352.21</b>				<b>11.044</b>	<b>227.50</b>	<b>51.438</b>	<b>57.948</b>	<b>47.014</b>									<b>5.908</b>	<b>0.405</b>		
H <sub>2</sub> +CO	<b>96.065</b>	<b>9655</b>	S.C.F.H.			<b>6.485</b>		<b>18.460</b>	<b>43.927</b>		<b>-18.982</b>											
H <sub>2</sub> /CO		<b>1.53</b>				<b>103573</b>	<b>3.53</b>			<b>2.11</b>		<b>1.20</b>										
CUMULATIVE TOTALS			H <sub>2</sub> +CO,MCF			Catalyst #	C <sub>6</sub> -C <sub>4</sub> , gal	gal/MCF	gal/#	EFFLUENT		SHIFT RATIO		RECOVERED OIL								
Previous Total										TOTAL OIL		WATER SOLUBLE CHEMICALS		O.2114	11.21	1.161	1.419	0.147	11.21	1.161		
Current Period										(H <sub>2</sub> ) <sub>(CO)</sub>		(H <sub>2</sub> O) <sub>(CO)</sub>							1.419	0.147		
New Total										TOTAL LIQUID PRODUCTS C <sub>6</sub> -		NET WATER		78.06	8.085	15.147	1.362	75.15	7.785	11.558	1.177	
FRESH FEED CONVERSION - %			TOTAL FEED CONVERSION - %			SELECTIVITY			CONDENSATE			POLYMER			YIELD BASIS H <sub>2</sub> + CO FED							
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>6</sub> -C <sub>4</sub>	C <sub>6</sub> -C <sub>4</sub>	CONDENSATE			POLYMER			O.2928	40.91	4.237	6.253	0.645	40.91	4.237	
	58.34	85.80	67.16	74.54	61.11	34.72	45.21	A1.76	GAS WATER			HYDROCARBON			66.85	6.924	11.728	1.215	63.94	6.822	10.139	1.050
									HYDROCARBON			TOTAL C <sub>6</sub> -			0.57	0.47	0.388	10.133	1.050			

#Included in Reactor Effluent Total

$$\text{cc/M3} = 141.3 \times \text{gal/MCF}$$

OPERATING CONDITIONS				PRODUCT TESTS			CATALYST DATA					
PRESSURES PSIG		RATES SCFH				OIL	WATER	INVENTORY DATA			PARTICLE SIZE	
Oxygen	422	Fresh Feed	10050	* API	49.8	10.9	In Reactor at Start of Period			Screen Analysis		Sedimentation
Natural Gas	423	Recycle	11918	Neut. No.	45.9	47.7	Fresh Catalyst Added			Mesh	Microns	%
Generator Outlet	416	Combined Feed	21968	Sap. No.	56.6	49.7	Total			On 40	419+	11.5
Reactor Inlet	409	Wet Gas-Measured	3910	Hydrox. No.			Catalyst Recovered CATALYST REMOVED			100	150	80+
Condenser Inlet		Adjusted	4187	Bromine No.	70.6		In Reactor at End of Period			150	105	51.1
Product Accumulator	588	Loss	277	Pour °F.						200	74	40-80
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>		14.0	REACTOR d-p, Inches H <sub>2</sub> O			250	62	10-20
				(°API-51-00-1)	50.9	10.9	No.	Height	Start	End	325	44
TEMPERATURES -°F.		Recycle/Fresh Feed	1.19				1	12-45.2	67	69	<325	
Oxygen	359	Inlet Velocity- <i>f</i> / <i>t</i> , sec.					2	43.2-74.4	66	65	CATALYST	
Natural Gas	716	Fresh Feed Rate-SCFH	3045	HEMPPEL. DIST. %			3	74.4-105.6	80	77	Bulk Density, Lbs./Cu.Ft.	
Generator		per Cu.Ft. Dense Bed	636-1467	205 °F.			4	105.6-348.0	350	20	Aerated	150
Quench Accumulator		per Lb. Catalyst	4.78-10.95	400	74.0	54.8	0	0-12	25	26	Settled	152
Reactor Inlet	728	per sq. ft.	14629	400-550	12.6	37.2	Total	588	257		Compacted	170
Condenser Inlet				550+		13.4					Particle Density, gm./cc.	4.32
Product Accumulator							CALCULATED FROM dp			N <sub>2</sub> Value, ml./grm.		7.7
Catalyst No.	Height	Start	End	Average	A. S. T. M. DIST. ON		Density, Lbs./Cu.Ft	133	134	N <sub>2</sub> Surface, m <sup>2</sup> /gm.		
1	12.0	530	515	527	Naphtha °F.		Inventory, Lbs.	2018	882			
2	43.2	660	655	662	IBP		Bed Depth, Ft.	23.0	10.0	CHEMICAL ANALYSIS		
3	74.4	665	695	678	10%		Volume, Cu.ft	15.17	6.58	Fe		
4	136.8	642	630	649	50%					C		
5	198.2	642	600	623	90%					O		
6	230.4	620	600	611	EP					H		
9	261.6	620	595	606	Rec.					K <sub>2</sub> O, W+, % basis Fe		
10	292.8	615	590	602						X-Ray Analysis		
11	311.0	595	570	564						Fe <sub>2</sub> 0 <sub>3</sub> Co		
12	342.0	575	555	569						Fe		

**THE TEXAS COMPANY — MONTEBELLO LABORATORY**

RUN NO. 51 00-2

\*Included in Reactor Effluent Total

$$cc/M3 = 141.3 \times gal/MCF.$$

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA					
PRESURES PSIG	RATES S.C.F.H.			OIL	WATER	INVENTORY DATA			PARTICLE SIZE		
Oxygen	416	Fresh Feed	9906	* API	49.8	10.9	In Reactor at Start of Period		Screen Analysis	Sedimentation	
Natural Gas	417	Recycle	13168	Neut. No.	45.9	47.7	Fresh Catalyst Added	0	Mesh Microns %	Microns	%
Generator Outlet	411	Combined Feed	23074	Sap. No.	56.6	49.7	Total	0	40 419+	11.5	80+
Reactor Inlet	404	Wet Gas-Measured	4825	Hydrox. No.			Catalyst Recovered	15	100 150	51.1	40-80
Condenser Inlet		Adjusted	5152	Bromine No.	70.6		In Reactor at End of Period	15	150 105	16.1	20-40
Product Accumulator	369	Loss	327	Pour °F.					200 74	11.3	10-20
				Chemicals, % by K <sub>2</sub> CO <sub>3</sub>			REACTOR d-p, Inches H <sub>2</sub> O	250	62	1.0	0-20
				°API-51-00-2	48.9	10.9	No. Height	325	44	3.6	
TEMPERATURES-°F.	Recycle/Fresh Feed		1.33				1	12-43.2	69	<255	5.4
Oxygen	357	Inlet Velocity- <u>ft./sec.</u>	0.7				2	43.2-74.4	65	CATALYST	
Natural Gas	694	Fresh Feed Rate <u>S.C.F.H.</u>	9540	HEMPEL DIST. %			3	74.4-105.6	75	Bulk Density, Lbs./Cu.Ft.	
Generator		per Cu. Ft. Dense Bed	1461	205 °F.			4	105.6-342.0	20	Aerated	160
Quench Accumulator		per Lb. Catalyst	10.90	400	74.0	54.8	0	0-12	26	Settled	158
Reactor Inlet	501	per sq. ft.	14455	400-550	12.6	37.2	Total	255		Compacted	170
Condenser Inlet				550+	15.4					Particle Density, gm./cc.	4.58
Product Accumulator	57						CALCULATED FROM dp		NH <sub>3</sub> Value, ml./gm.		7.7
Catalyst No.	Height"			A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	134	N <sub>2</sub> Surface, m <sup>2</sup> /gm.		
1	12.0	519		Naphtha °F.			Inventory, Lbs.	875			
2	43.2	655		IPB	106		Bed Depth, Ft.	9.89	CHEMICAL ANALYSIS		
3	74.4	689		10%	142		Volume, Cu. Ft.	6.53	Fe		
4	136.8	631		50%	230				C		
5	199.2	611		90%	348				O		
6	230.4	615		EP	400				H		
7	261.6	612		Rec.	98.0				K <sub>2</sub> O, Wt. % basis Fe		
8	292.8	599							X-Ray Analysis—		
9	311.0	576							Fe <sub>2</sub> O <sub>3</sub>		
10	342.0	561							Fe <sub>3</sub> O <sub>4</sub>		
11									Fe		

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 PP  
HOURS 878-902

$$\text{cc/M3} = 141.3 \times \text{gal/MCF.}$$

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 51 QQ  
HOURS 902-926

\*Included in Reactor Effluent Total

$$\text{cc/M3} = 141.3 \times \text{gal/MCF}$$

OPERATING CONDITIONS			PRODUCT TESTS			CATALYST DATA					
PRESSURES PSIG		RATES S.C.F.H.		OIL	WATER	INVENTORY DATA			PARTICLE SIZE		
Oxygen	425	Fresh Feed	9966	* API	49.2	10.7	In Reactor at Start of Period		Screen Analysis	Sedimentation	
Natural Gas	427	Recycle	12508	Neut. No.	46.4	44.7	Fresh Catalyst Added	57 ■	86	Mesh	Microns
Generator Outlet	421	Combined Feed	22474	Sap. No.	53.1	47.8	Total		On 40 419+	11.0	80+
Reactor Inlet	415	Wet Gas—Measured	4144	Hydrox. No.			Catalyst Recovered		100	150	49.2
Condenser Inlet		Adjusted	4368	Bromine No.	74.4		In Reactor at End of Period		150	105	20-40
Product Accumulator	393	Loss	224	Pour °F.					200	74	11.4
				Chemicals, v by K <sub>2</sub> CO <sub>3</sub>		12.0	REACTOR d.p. Inches H <sub>2</sub> O		250	62	2.2
							No. Height		325	44	5.0
TEMPERATURES—°F.		Recycle/Fresh Feed	1.26				1 12-43.2	64	<325		5.0
Oxygen	350	Inlet Velocity—ft./sec.	0.7				2 43.2-74.4	62	CATALYST		
Natural Gas	707	Fresh Feed Rate— $\frac{\text{SCFH}}{\text{Cu.Ft.}}$	9633	HEMPEL DIST. %			3 74.4-105.6	76	Bulk Density, Lbs./Cu.Ft.		
Generator		per Cu.Ft. Dense Bed	1259	205 °F.			4 105.6-342.0	55	Aerated		150
Quench Accumulator		per Lb. Catalyst	9.89	400	74.6	54.9	0 0-12	24	Settled		152
Reactor Inlet	822	per sq. ft.	14595	400-550	35.3	36.3	Total	281	Compacted		170
Condenser Inlet				550+		12.1			Particle Density, gm./cc.		4.4
Product Accumulator		Heat Transfer Calculations					CALCULATED FROM dp		NH <sub>3</sub> Value, ml./gm.		9.2
Catalyst No.	Height "	Date Not Available		A. S. T. M. DIST. ON			Density, Lbs./Cu.Ft.	126	N <sub>2</sub> Surface, m <sup>2</sup> /gm.		
1	12.0	549		Naphtha °F.			Inventory, Lbs.	964			
2	43.2	709		IBP	96		Bed Depth, Ft.	11.59	CHEMICAL ANALYSIS		
3	74.4	742		10%	136		Volume, Cu. Pt.	7.65	Fe		
4	136.8	681		50%	228				C		
5	199.2	660		90%	352				O		
6	230.4	666		EP	401				H		
7	261.6	661		Rec.	98.0				K <sub>2</sub> O, W+, % basis Fe		
8	292.8	655							X-Ray Analysis—		
9	311.0	631							Fe <sub>2</sub> O <sub>3</sub>		
10	342.0	618							Fe <sub>3</sub> O <sub>4</sub>		
11									Fe		

C. DETAILED DATA FOR RUN 11032 (BEACON)

RUN NO. 11032 Beacon  
 HOURS 0-12  
 CATALYST AGE \_\_\_\_\_

THE TEXAS COMPANY — MONTEBELLO LABORATORY  
 YIELD CALCULATIONS

FRESH FEED				WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED						
	%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*		
CO <sub>28.010</sub>	37.3	5.396	151.14	2.3	0.059	1.65	0.549	5.945	0.608	- 5.337	- 149.49							
H <sub>2</sub> <sub>2.016</sub>	62.7	9.070	18.28	23.1	0.588	1.19	5.514	14.584	6.102	- 8.482	- 17.09				400 EP	78.5 4.217 98.0 4.133		
CO <sub>24.010</sub>				35.6	0.905	39.83	8.497	8.497	9.402	0.905	39.83	7.263			400-550	12.5 0.672 91.4 0.614		
N <sub>22.016</sub>															550 +	9.0 0.483 114.6 0.554		
CH <sub>416.042</sub>				21.7	0.552	8.86	5.180	5.180	5.732	0.552	8.86	1.616						
C <sub>2</sub> H <sub>428.052</sub>				1.7	0.043	1.21	0.406	0.406	0.449	0.043	1.21	0.221						
C <sub>2</sub> H <sub>630.058</sub>				5.4	0.137	4.12	1.289	1.289	1.426	0.137	4.12	0.751			PROPYLENE	70.0 3.54		
C <sub>1</sub> +C <sub>2</sub>											14.19	2.588			C <sub>3</sub> POLY GASO.	87.5 3.10 0.518		
C <sub>3</sub> H <sub>642.078</sub>				4.7	0.120	5.05	1.122	1.122	1.242	0.120	5.05	0.921	4.32	1.169	0.213	C <sub>3</sub> POLY TAR	12.5 0.34 0.045	
C <sub>3</sub> H <sub>844.094</sub>				1.9	0.048	2.12	0.454	0.454	0.502	0.048	2.12	0.387	4.24	0.500	0.091			
C <sub>4</sub> H <sub>1056.104</sub>				2.3	0.059	3.31	0.549	0.549	0.608	0.059	3.31	0.604	5.00	0.662	0.121		#/gal	
C <sub>4</sub> H <sub>1058.120</sub>				0.4	0.010	0.58	0.095	0.095	0.105	0.010	0.58	0.166	4.86	0.119	0.022	C <sub>4</sub> H <sub>8</sub>	5.00 0.280 68.0	
C <sub>5</sub> H <sub>1070.130</sub>				0.9	0.023	1.61	0.215	0.215	0.238	0.023	1.61	0.294	5.45	0.295	0.054	C <sub>4</sub> POLY GASO.	5.98 1.5	
C <sub>3</sub> H <sub>1272.146</sub>													5.25			C <sub>4</sub> H <sub>10</sub>	4.86 0.279 0.119	
C <sub>4</sub> H <sub>1284.156</sub>													5.54			C <sub>4</sub> -FREE GASO.	4.946 5.8	
C <sub>3</sub> -C <sub>4</sub>													12.67	2.310	2.745	0.501	C <sub>4</sub> POLY TAR	7.53 0.032
TOTAL	14.466	169.42		2.544	69.53	23.869	38.335	30.260										
H <sub>2</sub> +CO	14.466	5484	SCFH						20.529		-13.319					gal/hr	gal/MCF	Bbl/Day
H <sub>2</sub> /CO	1.68	Factor:	182348	10.0					2.45		1.59					10 # RVP 400 EP GASOLINE	5.624 1.0255 5560	
OPERATING DATA									RECOVERED OIL							GAS OIL	0.614 0.1120 607	
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst			TOTAL OIL								FUEL OIL	0.554 0.1010 548		
Temperature, °F	Bed Depth, Ft			Weight, #			WATER SOLUBLE CHEMICALS								POLY TAR	0.077 0.0140 76		
Recycle Ratio	Bed Density, #/CF			Volume, Cu ft			TOTAL LIQUID PRODUCTS C <sub>4</sub> +								TOTAL	6.869 1.2575 6818		
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %				SELECTIVITY	NET WATER						W. S. CHEM.	0.425 0.0775 420		
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>1</sub> +		GROSS WATER						TOTAL	7.294 1.3300 7211		
82.41	98.90	93.5	95.5	89.77	58.16	67.31	77.30		HYDROCARBON TOTAL-C <sub>1</sub> +									

Form ML-11

g/NCM = 16.91 X #/MCF      #/MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 X gal/MCF

FRESH FEED				WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED						
	%	m/hr	#/hr	%	At Wt.	Balance	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*		
CO <sub>28.010</sub>	37.3	5.396	151.11	3.8	0.102	2.86	0.906	6.302	1.008	- 5.294	- 148.29							
H <sub>2</sub> <sub>2.016</sub>	62.7	9.070	18.29	24.7	0.664	1.34	5.887	14.957	6.551	- 8.406	- 16.95				400 EP	78.5 3.838 98.0 3.761		
CO <sub>24.010</sub>				36.4	0.978	43.04	8.676	8.676	9.654	0.978	4.30	7.848			400-550	12.5 0.611 91.4 0.558		
N <sub>22.016</sub>															550 +	9.0 0.440 114.6 0.504		
CH <sub>416.042</sub>				19.1	0.513	8.23	4.553	4.553	5.066	0.513	8.23	1.501						
C <sub>2</sub> H <sub>428.052</sub>				1.3	0.035	0.98	0.310	0.310	0.345	0.035	0.98	0.179						
C <sub>2</sub> H <sub>630.058</sub>				5.3	0.142	4.28	1.263	1.263	1.405	0.142	4.27	0.779			PROPYLENE	70.0 3.42		
C <sub>1</sub> +C <sub>2</sub>											13.48	2.459			C <sub>3</sub> POLY GASO.	87.5 2.99 0.500		
C <sub>3</sub> H <sub>642.078</sub>				4.3	0.116	4.86	1.025	1.025	1.141	0.116	4.88	0.890	4.32	1.130	0.206	C <sub>3</sub> POLY TAR	12.5 0.43 0.057	
C <sub>3</sub> H <sub>844.094</sub>				1.7	0.046	2.02	0.405	0.405	0.451	0.046	2.03	0.370	4.24	0.478	0.087			
C <sub>4</sub> H <sub>1056.104</sub>				1.9	0.051	2.86	0.453	0.453	0.504	0.051	2.86	0.522	5.00	0.572	0.104		#/gal	
C <sub>4</sub> H <sub>1058.120</sub>				0.4	0.011	0.62	0.095	0.095	0.106	0.011	0.64	0.117	4.86	0.131	0.084	C <sub>4</sub> H <sub>8</sub>	5.00 0.242 68.0	
C <sub>5</sub> H <sub>1070.130</sub>				1.1	0.030	2.08	0.262	0.262	0.292	0.030	2.10	0.384	5.45	0.386	0.070			
C <sub>3</sub> H <sub>1272.146</sub>													5.25			C <sub>4</sub> H <sub>10</sub>	4.86 0.241 1.5	
C <sub>4</sub> H <sub>1284.156</sub>													5.54			C <sub>4</sub> -FREE GASO.	4.647 5.8	
C <sub>3</sub> -C <sub>4</sub>											12.51	2.282	2.697	0.492		C <sub>4</sub> POLY TAR	7.53 0.028	
TOTAL	14.466	169.40		2.687	73.17	23.836	38.302	26.523										
H <sub>2</sub> +CO	14.466	5484.4	SCFH						21.259		-13.700					gal/hr	gal/MCF	Bbl/Day
H <sub>2</sub> /CO	1.68	Factor:	182335	6.50					2.37		1.59					10 # RVP 400 EP GASOLINE	5.261 0.9593 5201	
OPERATING DATA									RECOVERED OIL							GAS OIL	0.558 0.1017 551	
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst			TOTAL OIL								FUEL OIL	0.504 0.0919 498		
Temperature, °F	Bed Depth, Ft			Weight, #			WATER SOLUBLE CHEMICALS								POLY TAR	0.085 0.0155 84		
Recycle Ratio	Bed Density, #/CF			Volume, Cu ft			TOTAL LIQUID PRODUCTS C <sub>4</sub> +								TOTAL	6.408 1.1684 6334		
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %				SELECTIVITY	NET WATER						W. S. CHEM.	0.795 0.1450 786		
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>1</sub> +		GROSS WATER						TOTAL	7.203 1.3154 7121		
81.43	98.11	92.68	94.70	84.01	56.20	64.44	76.91		HYDROCARBON TOTAL-C <sub>1</sub> +									

Form ML-11

g/NCM = 16.91 X #/MCF      #/MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 X gal/MCF

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 11032\_Beacon  
HOURS 25-36  
CATALYST AGE

FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE	YIELD BASIS H <sub>2</sub> + CO FED						
	%	m/hr	#/hr	%	At Wt. Balance	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*		
CO <sub>28.010</sub>	37.3	7.053	197.55	2.8	0.128	3.59	0.529	7.582	0.657	-6.925	-193.96					
H <sub>2</sub> <sub>2.016</sub>	62.7	11.857	23.90	32.6	1.490	3.00	6.165	18.022	7.655	-10.367	20.90			400 EP	78.5 4.504 98.0 4.414	
CO <sub>24.010</sub>				33.7	1.540	67.83	6.373	7.913	1.540	67.83	9.463			400-550	12.5 0.717 91.4 0.655	
N <sub>2</sub> <sub>28.016</sub>														550 +	9.0 0.516 114.6 0.591	
CH <sub>4</sub> <sub>16.042</sub>				16.4	0.749	12.02	3.101	3.101	0.850	0.749	12.02	1.676				
C <sub>2</sub> H <sub>6</sub> <sub>28.052</sub>				1.3	0.059	1.66	0.246	0.246	0.305	0.059	1.66	0.232			RECOVERY % #/hr gal/hr	
C <sub>2</sub> H <sub>6</sub> <sub>30.068</sub>				4.4	0.201	6.04	0.832	0.832	1.033	0.201	6.04	0.843			PROPYLENE 58.0 4.03	
C <sub>3</sub> +C <sub>2</sub>												19.72	2.751		C <sub>3</sub> POLY GASO. 87.5 3.53 0.590	
C <sub>3</sub> H <sub>8</sub> <sub>42.078</sub>				3.6	0.165	6.94	0.681	0.681	0.846	0.165	6.94	0.968	4.32	1.606 0.224	C <sub>3</sub> POLY TAR 12.5 0.50 0.066	
C <sub>3</sub> H <sub>8</sub> <sub>44.094</sub>				1.5	0.069	3.04	0.284	0.284	0.353	0.069	3.04	0.424	4.24	0.717 0.100		
C <sub>3</sub> H <sub>8</sub> <sub>56.104</sub>				2.1	0.096	5.39	0.397	0.397	0.493	0.096	5.39	0.752	5.00	1.078 0.150		#/gal #/hr gal/hr RVP
C <sub>3</sub> H <sub>8</sub> <sub>58.120</sub>				0.5	0.023	1.34	0.095	0.095	0.118	0.023	1.34	0.187	4.86	0.276 0.039	C <sub>4</sub> H <sub>8</sub> 5.00 0.224 68.0	
C <sub>3</sub> H <sub>8</sub> <sub>70.130</sub>				1.1	0.050	3.51	0.208	0.208	0.258	0.050	3.51	0.490	5.45	0.644 0.090	C <sub>4</sub> POLY GASO. 5.98 0.625 1.5	
C <sub>3</sub> H <sub>8</sub> <sub>72.144</sub>													5.25		C <sub>4</sub> H <sub>10</sub> 4.86 0.276 68.0	
C <sub>4</sub> H <sub>8</sub> <sub>84.156</sub>													5.54		C <sub>4</sub> -FREE GASO. 5.648 5.8	
C <sub>3</sub> -C <sub>4</sub>												20.22		4.321 0.603	C <sub>4</sub> POLY TAR 7.53 0.070	
TOTAL	18.910	221.45		4.570	114.36	18.910	37.820	27.618								
H <sub>2</sub> +CO	18.910	7168	SCFH				25.604		-17.292						gal/hr gal/MCF Bbl/Day	
H <sub>2</sub> /CO	1.68	Factor.		11.64			2.38		1.50						10 # RVP 400 EP GASOLINE 6.773 0.9449 5123	
OPERATING DATA								RECOVERED OIL		34.85	4.862	6.074	5.738	0.800	GAS OIL 0.655 0.0914 496	
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst				TOTAL OIL		55.07	7.683		10.059	1.403	FUEL OIL 0.591 0.0284 154	
Temperature, °F	Bed Depth, Ft			Weight, #				WATER SOLUBLE CHEMICALS		3.25	0.453	8.33	0.390	0.054	POLY TAR 0.136 0.0190 103	
Recycle Ratio	Bed Density, #/CF			Volume, Cu ft				TOTAL LIQUID PRODUCTS C <sub>3</sub> +		58.32	8.136		10.449	1.457	TOTAL 8.125 1.1335 6145	
FRESH FEED CONVERSION - %			TOTAL FEED CONVERSION - %			SELECTIVITY		NET WATER		68.99	9.625		8.282	1.155	W. S. CHEM. 0.390 0.0544 295	
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>4</sub> +	GROSS WATER		72.24	10.078	8.33	8.672	1.210	TOTAL	
75.83	96.04	86.89	90.31	82.92	56.99	65.07	74.17	HYDROCARBON TOTAL—C <sub>1</sub> +								

Form ML-11

g/NCM = 16.91 × #/MCF      0.9488 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal/MCF

FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE	YIELD BASIS H <sub>2</sub> + CO FED						
	%	m/hr	#/hr	%	At Wt. Balance	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*		
CO <sub>28.010</sub>	37.3	7.053	197.55	5.9	0.279	7.81	1.116	8.169	1.395	-6.774	-189.74					
H <sub>2</sub> <sub>2.016</sub>	62.7	11.857	23.90	32.9	1.554	3.13	6.221	18.078	7.775	-10.303	-20.77				400 EP 78.5 3.936 98.0 3.857	
CO <sub>24.010</sub>				33.2	1.568	68.97	6.278	6.278	7.846	1.568	68.97	9.622			400-550 12.5 0.627 91.4 0.573	
N <sub>2</sub> <sub>28.016</sub>														550 +	9.0 0.451 114.6 0.517	
CH <sub>4</sub> <sub>16.042</sub>				15.1	0.713	11.44	2.855	2.855	3.568	0.713	11.44	1.595				
C <sub>2</sub> H <sub>6</sub> <sub>28.052</sub>				1.2	0.057	1.60	0.227	0.227	0.284	0.057	1.60	0.223			RECOVERY % #/hr gal/hr	
C <sub>2</sub> H <sub>6</sub> <sub>30.068</sub>				4.0	0.189	5.68	0.756	0.756	0.945	0.189	5.68	0.792			PROPYLENE 56.5 3.59	
C <sub>3</sub> +C <sub>2</sub>												18.72	2.612		C <sub>3</sub> POLY GASO. 87.5 3.14 0.525	
C <sub>3</sub> H <sub>8</sub> <sub>42.078</sub>				3.2	0.151	6.35	0.605	0.605	0.756	0.151	6.35	0.886	4.32	1.470 0.205	C <sub>3</sub> POLY TAR 12.5 0.45 0.060	
C <sub>3</sub> H <sub>8</sub> <sub>44.094</sub>				1.4	0.066	2.91	0.265	0.265	0.331	0.066	2.91	0.406	4.24	0.686 0.096		
C <sub>3</sub> H <sub>8</sub> <sub>56.104</sub>				1.6	0.076	4.26	0.303	0.303	0.379	0.076	4.26	0.594	5.00	0.852 0.119		#/gal #/hr gal/hr RVP
C <sub>3</sub> H <sub>8</sub> <sub>58.120</sub>				0.4	0.019	1.10	0.076	0.076	0.095	0.019	1.10	0.153	4.86	0.226 0.032	C <sub>4</sub> H <sub>8</sub> 5.00 0.210 68.0	
C <sub>3</sub> H <sub>8</sub> <sub>70.130</sub>				1.1	0.052	3.65	0.208	0.208	0.260	0.052	3.65	0.509	5.45	0.670 0.093	C <sub>4</sub> POLY GASO. 5.98 0.470 1.5	
C <sub>3</sub> H <sub>8</sub> <sub>72.144</sub>													5.25		C <sub>4</sub> H <sub>10</sub> 4.86 0.226 68.0	
C <sub>4</sub> H <sub>8</sub> <sub>84.156</sub>													5.54		C <sub>4</sub> -FREE GASO. 5.052 5.8	
C <sub>3</sub> -C <sub>4</sub>												18.27	2.548	3.904 0.545	C <sub>4</sub> POLY TAR 7.53 0.053	
TOTAL	18.910	221.45		4.723	116.90	18.910	37.820	23.634								
H <sub>2</sub> +CO	18.910	7168	SCFH				26.247		-17.077						gal/hr gal/MCF Bbl/Day	
H <sub>2</sub> /CO	1.68	Factor	139508	5.56			2.24		1.52						10 # RVP 400 EP GASOLINE 5.958 0.8312 4506	
OPERATING DATA								RECOVERED OIL		30.67	4.279	6.117	5.014	0.699	GAS OIL 0.573 0.0799 433	
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst				TOTAL OIL		48.94	6.828		8.918	1.244	FUEL OIL 0.517 0.0721 391	
Temperature, °F	Bed Depth, Ft			Weight, #				WATER SOLUBLE CHEMICALS		4.80	0.670	8.33	0.576	0.080	POLY TAR 0.113 0.0158 86	
Recycle Ratio	Bed Density, #/CF			Volume, Cu ft				TOTAL LIQUID PRODUCTS C <sub>3</sub> +		53.74	7.498		9.494	1.324	TOTAL 7.161 0.9990 5416	
FRESH FEED CONVERSION - %			TOTAL FEED CONVERSION - %			SELECTIVITY		NET WATER		69.08	9.637	8.33	8.293	1.157	W. S. CHEM. 0.576 0.0804 436	
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>4</sub> +	GROSS WATER		73.88	10.3078	8.33	8.867	1.237	TOTAL	
75.02	96.04	86.89	90.31	82.92	56.99	65.07	74.17	HYDROCARBON TOTAL—C <sub>1</sub> +								

Form ML-11

g/NCM = 16.91 × #/MCF      0.9488 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal/MCF

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 11032 Beacon  
HOURS 49-60  
CATALYST AGE

FRESH FEED				WET GAS				RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED						
	%	m/hr	#/hr	%	At Wt. m/hr	Balance #/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS	BASIS BROWNSVILLE DESIGN FEED RATE*			
CO <sub>28.010</sub>	37.3	7.053	197.55	3.8	0.192	5.38	0.719	7.772	0.911	-6.861	-192.17								
H <sub>2</sub> <sub>2.016</sub>	62.7	11.857	23.90	33.4	1.692	3.41	6.316	18.173	8.008	-10.165	-20.49				400 EP	78.5	3.660		
CO <sub>24.010</sub>				31.5	1.596	70.22	5.956	5.956	7.552	1.596	70.229	7.96			400-550	12.5	0.583		
N <sub>2</sub> <sub>28.016</sub>															550 +	9.0	0.420		
CH <sub>4</sub> <sub>16.042</sub>				17.4	0.881	14.13	3.290	3.290	4.171	0.881	14.13	1.971							
C <sub>2</sub> H <sub>4</sub> <sub>28.052</sub>				1.0	0.051	1.43	0.189	0.189	0.240	0.051	1.43	0.199							
C <sub>2</sub> H <sub>6</sub> <sub>30.058</sub>				4.6	0.233	7.01	0.870	0.870	1.103	0.233	7.01	0.978			PROPYLENE	53.1	3.84		
C <sub>1</sub> +C <sub>2</sub>											22.57	3.148			C <sub>3</sub> POLY GASO.	87.5	3.36		
C <sub>3</sub> H <sub>8</sub> <sub>42.078</sub>				3.4	0.172	7.24	0.643	0.643	0.815	0.172	7.24	1.010	4.32	1.676	0.234	C <sub>3</sub> POLY TAR	12.5	0.48	
C <sub>4</sub> H <sub>8</sub> <sub>44.094</sub>				1.6	0.081	3.57	0.303	0.303	0.384	0.081	3.57	0.498	4.24	0.842	0.117				
C <sub>4</sub> H <sub>10</sub> <sub>56.104</sub>				1.8	0.091	5.11	0.340	0.340	0.431	0.091	5.11	0.713	5.00	1.022	0.143				
C <sub>4</sub> H <sub>10</sub> <sub>58.120</sub>				0.5	0.025	1.45	0.095	0.095	0.120	0.025	1.45	0.202	4.86	0.298	0.042	C <sub>4</sub> H <sub>8</sub>	5.00	0.144	
C <sub>5</sub> H <sub>10</sub> <sub>70.130</sub>				1.0	0.051	3.58	0.189	0.189	0.240	0.051	3.58	0.499	5.45	0.657	0.092	C <sub>4</sub> POLY GASO.	5.98	0.645	
C <sub>5</sub> H <sub>12</sub> <sub>72.146</sub>													5.25			C <sub>4</sub> H <sub>10</sub>	4.86	0.298	
C <sub>6</sub> H <sub>12</sub> <sub>84.156</sub>													5.84			C <sub>4</sub> -FREE GASO.		4.806	
C <sub>3</sub> -C <sub>6</sub>													20.95	2.923	4.495	0.627	C <sub>4</sub> POLY TAR	7.53	0.073
TOTAL	18.910	221.45		5.065	122.53	18.910	37.821	23.975											
H <sub>2</sub> +CO	18.910	7168	SCFH				25.945		-17.026							gal/hr	gal/MCF	Bbl/Day	
H <sub>2</sub> /CO	1.68	Factor.	139508	8.81			2.34		1.48							10 # RVP 400 EP GASOLINE	5.893	0.8221	
OPERATING DATA								RECOVERED OIL		28.48	3.9736	108	4.663	0.651	GAS OIL	0.533	0.0744	403	
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst				TOTAL OIL		49.43	6.896	9.158	1.278		FUEL OIL	0.481	0.0671	364	
Temperature, °F	Bed Depth, Ft			Weight, #				WATER SOLUBLE CHEMICALS		3.38	6.472	8.33	0.406	0.057	POLY TAR	0.137	0.0191	104	
Recycle Ratio	Bed Density, #/CF			Volume, Cuft				TOTAL LIQUID PRODUCTS C <sub>3</sub> +		52.81	7.368	9.564	1.334		TOTAL	7.044	0.9827	5328	
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %				SELECTIVITY	NET WATER	67.06	9.355	8.33	8.050		W. S. CHEM.	0.406	0.0566	307	
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>1</sub> +		GROSS WATER	70.44	9.827	8.33	8.456		TOTAL	7.450	1.0393	5635	
73.22	97.28	85.73	90.04	88.38	55.93	65.62	70.06		HYDROCARBON TOTAL—C <sub>1</sub> +	75.38	10.516								

Form ML-11

g/NCM = 16.91 × #/MCF      89488 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal/MCF

FRESH FEED				WET GAS				RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED						
	%	m/hr	#/hr	%	At Wt. m/hr	Balance #/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS	BASIS BROWNSVILLE DESIGN FEED RATE*			
CO <sub>28.010</sub>	37.3	7.053	197.55	4.5	0.220	6.16	0.851	7.904	1.071	-6.833	-191.39								
H <sub>2</sub> <sub>2.016</sub>	62.7	11.857	23.90	32.6	1.592	3.21	6.164	18.021	7.756	-10.265	-20.69				400 EP	78.5	3.851		
CO <sub>24.010</sub>				32.4	1.583	69.66	6.126	6.126	7.709	1.583	69.66	9.718			400-550	12.5	0.613		
N <sub>2</sub> <sub>28.016</sub>														550 +	9.0	0.441	114.6		
CH <sub>4</sub> <sub>16.042</sub>				17.0	0.831	13.33	3.215	3.215	4.046	0.831	13.33	1.960							
C <sub>2</sub> H <sub>4</sub> <sub>28.052</sub>				1.1	0.054	1.51	0.208	0.208	0.262	0.054	1.51	0.211							
C <sub>2</sub> H <sub>6</sub> <sub>30.058</sub>				4.5	0.220	6.61	0.851	0.851	1.071	0.220	6.61	0.922			PROPYLENE	55.0	3.40		
C <sub>1</sub> +C <sub>2</sub>											21.45	2.992			C <sub>3</sub> POLY GASO.	87.5	2.98		
C <sub>3</sub> H <sub>8</sub> <sub>42.078</sub>				3.0	0.147	6.19	0.567	0.567	0.714	0.147	6.19	0.864	4.32	1.453	0.200	C <sub>3</sub> POLY TAR	12.5	0.497	
C <sub>4</sub> H <sub>8</sub> <sub>44.094</sub>				1.6	0.078	3.44	0.303	0.303	0.381	0.078	3.44	0.480	4.24	0.811	0.113				
C <sub>4</sub> H <sub>10</sub> <sub>56.104</sub>				1.6	0.078	4.38	0.303	0.303	0.381	0.078	4.38	0.611	5.00	0.876	0.122				
C <sub>4</sub> H <sub>10</sub> <sub>58.120</sub>				0.5	0.024	1.39	0.095	0.095	0.119	0.024	1.39	0.194	4.86	0.286	0.040	C <sub>4</sub> H <sub>8</sub>	5.00	0.156	
C <sub>5</sub> H <sub>10</sub> <sub>70.130</sub>				1.2	0.059	4.14	0.227	0.227	0.286	0.059	4.14	0.578	5.45	0.760	0.106	C <sub>4</sub> POLY GASO.	5.98	0.527	
C <sub>5</sub> H <sub>12</sub> <sub>72.146</sub>													5.25			C <sub>4</sub> H <sub>10</sub>	4.86	0.286	
C <sub>6</sub> H <sub>12</sub> <sub>84.156</sub>													5.54			C <sub>4</sub> -FREE GASO.	5.031	5.8	
TOTAL	18.910	221.45		4.886	120.02	18.910	37.920	23.796			19.54	2.726	4.166	0.581					
H <sub>2</sub> +CO	18.910	7168	SCFH				25.925		-17.098							gal/hr	gal/MCF	Bbl/Day	
H <sub>2</sub> /CO	1.68	Factor.	7.24				2.28		1.50						10 # RVP 400 EP GASOLINE	6.000	0.8370	4538	
OPERATING DATA								RECOVERED OIL		29.87	4.167	6.089	4.906	0.685	GAS OIL	0.560	0.0781	423	
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst				TOTAL OIL		49.41	6.893	9.072	1.266		FUEL OIL	0.505	0.0704	382	
Temperature, °F	Bed Depth, Ft			Weight, #				WATER SOLUBLE CHEMICALS		2.86	0.399	8.33	0.343	0.048	POLY TAR	0.116	0.0162	88	
Recycle Ratio	Bed Density, #/CF			Volume, Cuft				TOTAL LIQUID PRODUCTS C <sub>3</sub> +		52.27	7.292	9.415	1.313		TOTAL	7.181	1.0018	5431	
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %				SELECTIVITY	NET WATER	68.70	9.584	8.247			W. S. CHEM.	0.343	0.0479	260	
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>1</sub> +		GROSS WATER	71.56	9.983	8.33	8.590		TOTAL	7.524	1.0497	5691	
74.16	96.88	86.57	90.42	86.45	56.96	65.95	70.90		HYDROCARBON TOTAL—C <sub>1</sub> +										

Form ML-11

g/NCM = 16.91 × #/MCF      89488 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal/MCF

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO. 11032 Beacon  
HOURS 73-84  
CATALYST AGE

FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE	YIELD BASIS H <sub>2</sub> + CO FED						
	%	m/hr	#/hr	%	At Wt. Balance	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS	BASIS BROWNSVILLE DESIGN FEED RATE*	
CO <sub>28.010</sub>	37.3	7.053	197.55	4.8	0.268	7.51	0.908	7.961	1.176	- 6.785	-190.04					
H <sub>2</sub> <sub>2.016</sub>	62.7	11.857	23.90	36.4	2.030	4.09	6.883	18.740	8.913	- 9.827	- 19.81			400 EP	78.5 3.294 98.0 3.228	
CO <sub>24.010</sub>				31.1	1.735	76.33	5.881	5.881	7.616	1.735	76.33	10.649			400-550 12.5 0.525 91.4 0.480	
N <sub>2</sub> <sub>28.016</sub>														550 +	9.0 0.378 114.6 0.433	
CH <sub>4</sub> <sub>16.042</sub>				15.2	0.848	13.60	2.874	2.874	3.722	0.848	13.60	1.897				
C <sub>2</sub> H <sub>4</sub> <sub>28.052</sub>				0.9	0.050	1.40	0.170	0.170	0.220	0.050	1.40	0.195			RECOVERY % #/hr gal/hr	
C <sub>2</sub> H <sub>6</sub> <sub>30.068</sub>				4.1	0.229	6.89	0.775	0.775	1.004	0.229	6.89	0.961			PROPYLENE 48.5 3.08	
C <sub>1</sub> +C <sub>2</sub>										21.89	3.053			C <sub>3</sub> POLY GASO.	87.5 2.70 0.451	
C <sub>2</sub> H <sub>2</sub> <sub>42.078</sub>				2.7	0.151	6.35	0.511	0.511	0.662	0.151	6.35	0.886	4.32	1.470 0.205	C <sub>3</sub> POLY TAR 12.5 0.38 0.050	
C <sub>3</sub> H <sub>8</sub> <sub>44.094</sub>				1.4	0.078	3.44	0.265	0.265	0.343	0.078	3.44	0.480	4.24	0.811 0.113		
C <sub>4</sub> H <sub>8</sub> <sub>56.104</sub>				1.7	0.095	5.33	0.321	0.321	0.416	0.095	5.33	0.744	5.00	1.066 0.149	#/gal #/hr gal/hr RVP	
C <sub>4</sub> H <sub>10</sub> <sub>58.120</sub>				0.5	0.028	1.63	0.095	0.095	0.123	0.028	1.63	0.227	4.86	0.335 0.047	C <sub>4</sub> H <sub>8</sub> 5.00 0.098 68.0	
C <sub>5</sub> H <sub>10</sub> <sub>70.130</sub>				1.2	0.067	4.70	0.227	0.227	0.294	0.067	4.70	0.656	5.45	0.862 0.120	C <sub>4</sub> POLY GASO. 5.98 0.708 1.5	
C <sub>6</sub> H <sub>12</sub> <sub>72.146</sub>												5.25		C <sub>4</sub> H <sub>10</sub> 4.86 0.335 68.0		
C <sub>6</sub> H <sub>6</sub> <sub>84.156</sub>												5.54		C <sub>4</sub> -FREE GASO. 4.541 5.8		
C <sub>3</sub> -C <sub>6</sub>										21.45	2.992	4.544	0.634	C <sub>4</sub> POLY TAR 7.53	0.080	
TOTAL	18.910	221.45		5.579	131.27	18.910	37.820	37.820	24.489							
H <sub>2</sub> +CO	18.910	7168	SCFH				26.701		-16.612					gal/hr gal/MCF Bbl/Day		
H <sub>2</sub> /CO	1.68	Factor:	139508	7.57			2.35		1.45					10 # RVP 400 EP GASOLINE 5.682 0.7927 4298		
OPERATING DATA										RECOVERED OIL	25.37	3.539	6.046	4.196	0.585	GAS OIL 0.480 0.0670 363
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst			TOTAL OIL				46.82	6.531		8.740	1.219	FUEL OIL 0.433 0.0604 327
Temperature, °F	Bed Depth, Ft			Weight, #			WATER SOLUBLE CHEMICALS				3.24	0.452	8.33	0.389	0.054	POLY TAR 0.130 0.0181 98
Recycle Ratio	Bed Density, #/CF			Volume, Cuft			TOTAL LIQUID PRODUCTS C <sub>5</sub> +				50.06	6.983		9.129	1.273	TOTAL 6.725 0.9382 5086
FRESH FEED CONVERSION - %			TOTAL FEED CONVERSION - %			SELECTIVITY	NET WATER				61.57	8.590	8.33	7.391	1.031	W. S. CHEM. 0.389 0.0543 294
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>1</sub> +	GROSS WATER			64.81	9.042		7.780	1.085	TOTAL 7.114 0.9925 5381
70.50	96.20	82.88	87.85	85.23	52.44	62.21	69.58	HYDROCARBON TOTAL-C <sub>5</sub> +			71.95	10.038				

Form ML-11 g/NCM = 16.91 × #/MCF \*9484 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal/MCF

FRESH FEED			WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE	YIELD BASIS H <sub>2</sub> + CO FED						
	%	m/hr	#/hr	%	At Wt. Balance	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS	BASIS BROWNSVILLE DESIGN FEED RATE*	
CO <sub>28.010</sub>	37.3	7.053	197.55	5.2	0.342	9.58	0.983	8.036	1.325	- 6.711	-187.97					
H <sub>2</sub> <sub>2.016</sub>	62.7	11.857	23.90	41.1	2.698	5.44	7.772	19.629	10.470	- 9.159	-18.46			400 EP	81.0 2.774 98.0 2.718	
CO <sub>24.010</sub>				28.4	1.866	82.06	5.370	5.370	7.236	1.866	82.06	11.446		400-550 11.3 0.387 91.4 0.354		
N <sub>2</sub> <sub>28.016</sub>														550 +	7.7 0.264 114.6 0.303	
CH <sub>4</sub> <sub>16.042</sub>				13.7	0.900	14.44	2.591	2.591	3.491	0.900	14.44	2.014				
C <sub>2</sub> H <sub>4</sub> <sub>28.052</sub>				0.8	0.053	1.49	0.151	0.151	0.204	0.053	1.49	0.208			RECOVERY % #/hr gal/hr	
C <sub>2</sub> H <sub>6</sub> <sub>30.068</sub>				3.8	0.250	7.52	0.719	0.719	0.969	0.250	7.52	1.049			PROPYLENE 40.8 2.71	
C <sub>1</sub> +C <sub>2</sub>										23.45	3.271			C <sub>3</sub> POLY GASO.	87.5 2.37 0.396	
C <sub>2</sub> H <sub>2</sub> <sub>42.078</sub>				2.4	0.158	6.55	0.454	0.454	0.612	0.158	6.55	0.928	4.32	1.539 0.215	C <sub>3</sub> POLY TAR 12.5 0.34 0.045	
C <sub>3</sub> H <sub>8</sub> <sub>44.094</sub>				1.3	0.085	3.75	0.246	0.246	0.331	0.085	3.75	0.523	4.24	0.884 0.123		
C <sub>4</sub> H <sub>8</sub> <sub>56.104</sub>				1.7	0.112	6.28	0.321	0.321	0.433	0.112	6.28	0.876	5.00	1.256 0.175	#/gal #/hr gal/hr RVP	
C <sub>4</sub> H <sub>10</sub> <sub>58.120</sub>				0.5	0.033	1.92	0.095	0.095	0.128	0.033	1.92	0.268	4.86	0.395 0.055	C <sub>4</sub> H <sub>8</sub> 5.00 0.030 68.0	
C <sub>5</sub> H <sub>10</sub> <sub>70.130</sub>				1.1	0.072	5.05	0.208	0.208	0.280	0.072	5.05	0.704	5.45	0.927 0.129	C <sub>4</sub> POLY GASO. 5.98 0.897 1.5	
C <sub>6</sub> H <sub>12</sub> <sub>72.146</sub>												5.25		C <sub>4</sub> H <sub>10</sub> 4.86 0.395 68.0		
C <sub>6</sub> H <sub>6</sub> <sub>84.156</sub>												5.54		C <sub>4</sub> -FREE GASO. 4.041 5.8		
C <sub>3</sub> -C <sub>6</sub>										23.65	3.299		5.001	0.697	C <sub>4</sub> POLY TAR 7.53	0.102
TOTAL	18.910	221.45		6.569	144.18	18.910	37.820	37.820	25.479							
H <sub>2</sub> +CO	18.910	7169	SCFH				27.665		-15.870					gal/hr gal/MCF Bbl/Day		
H <sub>2</sub> /CO	1.68	Factor:	139489	7.89			2.44		1.36					10 # RVP 400 EP GASOLINE 5.363 0.7480 4055		
OPERATING DATA										RECOVERED OIL	20.72	2.890	6.048	3.425	0.478	GAS OIL 0.354 0.0494 268
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst			TOTAL OIL				44.37	6.189		8.426	1.175	FUEL OIL 0.303 0.0423 229
Temperature, °F	Bed Depth, Ft			Weight, #			WATER SOLUBLE CHEMICALS				3.57	0.512		0.441	0.062	POLY TAR 0.147 0.0205 111
Recycle Ratio	Bed Density, #/CF			Volume, Cuft			TOTAL LIQUID PRODUCTS C <sub>5</sub> +				48.04	6.701		8.867	1.237	TOTAL 6.167 0.0602 4664
FRESH FEED CONVERSION - %			TOTAL FEED CONVERSION - %			SELECTIVITY	NET WATER				52.88	7.376	8.33	6.348	0.885	W. S. CHEM. 0.441 0.0615 333
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>1</sub> +	GROSS WATER			56.55	7.888	8.33	6.789	0.947	TOTAL 6.608 0.9217 4997
65.26	95.15	77.25	83.92	83.51	46.66	57.36	67.20	HYDROCARBON TOTAL-C <sub>5</sub> +								

Form ML-11

g/NCM = 16.91 × #/MCF \*9484 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal/MCF

**THE TEXAS COMPANY — MONTEBELLO LABORATORY  
YIELD CALCULATIONS**

RUN NO ... 11032 Session  
HOURS ... 97-108  
CATALYST AGE ...

FRESH FEED				WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED							
	%	m/hr	#/hr	%	At Wt. Balance	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*				
CO <sub>28.010</sub>	37.3	7.055	107.61	5.2	0.362	10.14	0.084	8.039	1.346	- 6.693	- 187.47								
H <sub>2</sub> <sub>2.016</sub>	62.7	11.360	23.91	42.0	2.928	5.90	7.963	19.823	10.891	- 8.932	- 18.01				400 EP	81.0 2.603	98.0 2.551		
CO <sub>24.010</sub>				28.3	1.969	86.65	5.353	5.353	7.322	1.969	86.65	12.087			400-550	11.3 0.363	91.4 0.332		
N <sub>2</sub> <sub>28.016</sub>															550 +	7.7 0.247	114.6 0.233		
CH <sub>4</sub> <sub>16.042</sub>				13.6	0.946	15.18	2.572	2.572	3.518	0.946	15.48	2.118							
C <sub>2</sub> H <sub>4</sub> <sub>28.052</sub>				0.6	0.042	1.18	0.113	0.113	0.155	0.042	1.18	0.165				RECOVERY %	#/hr	gal/hr	
C <sub>2</sub> H <sub>6</sub> <sub>30.068</sub>				3.6	0.250	7.52	0.681	0.681	0.931	0.250	7.52	1.049				PROPYLENE	38.5 2.48		
C <sub>3</sub> +C <sub>2</sub>											23.88	3.332				C <sub>3</sub> POLY GASO.	87.5 2.17	0.363	
C <sub>3</sub> H <sub>6</sub> <sub>42.078</sub>				2.2	0.153	6.44	0.416	0.416	0.569	0.153	6.44	0.898 4.32	1.491 0.208				C <sub>3</sub> POLY TAR	12.5 0.31	0.041
C <sub>3</sub> H <sub>8</sub> <sub>44.094</sub>				1.5	0.104	4.59	0.284	0.284	0.388	0.104	4.59	0.640 4.24	1.083 0.151						
C <sub>4</sub> H <sub>8</sub> <sub>56.110</sub>				1.3	0.090	5.05	0.246	0.246	0.336	0.090	5.05	0.704 5.00	1.010 0.141				#/gal	#/hr	gal/hr RVP
C <sub>4</sub> H <sub>10</sub> <sub>58.120</sub>				0.5	0.035	2.03	0.095	0.095	0.130	0.035	2.03	0.283 4.86	0.418 0.058	C <sub>4</sub> H <sub>8</sub>	5.00				68.0
C <sub>4</sub> H <sub>10</sub> <sub>70.130</sub>				1.1	0.077	5.40	0.208	0.208	0.285	0.077	5.40	0.753 5.45	0.991 0.138	C <sub>4</sub> POLY GASO.	5.98	0.739	1.5		
C <sub>4</sub> H <sub>12</sub> <sub>72.140</sub>													5.25		C <sub>4</sub> H <sub>10</sub>	4.86		0.259 68.0	
C <sub>4</sub> H <sub>12</sub> <sub>84.150</sub>													5.54		C <sub>4</sub> -FREE GASO.		3.905	5.8	
C <sub>5</sub> -C <sub>6</sub>											23.51	3.279	4.993 0.696		C <sub>4</sub> POLY TAR	7.53		0.077	
TOTAL	18.915			6.956		18.915	37.830	28.799											
H <sub>2</sub> +CO	18.915	7168.78	SCFH	3.290		8.947	27.862		15.625						gal/hr	gal/MCF	Bbl/Day		
H <sub>2</sub> /CO	1.68	Factor:	13949365	8.09			2.46		1.33						10 # RVP 400 EP GASOLINE	4.079	0.5690	3085	
OPERATING DATA								RECOVERED OIL		19.38	2.703	6.032	3.213	0.448	GAS OIL	0.332	0.0463	251	
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst			TOTAL OIL		42.89	5.983		8.206	1.144	FUEL OIL	0.283	0.0395	214		
Temperature, °F	Bed Depth, Ft			Weight, #			WATER SOLUBLE CHEMICALS		2.85	0.398	7.8	0.364	0.051	POLY TAR	0.118	0.0165	89		
Recycle Ratio	Bed Density, #/CF			Volume, Cuft			TOTAL LIQUID PRODUCTS C <sub>5</sub> +		45.74	6.380		8.570	1.195	TOTAL	4.812	0.6712	3639		
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %			SELECTIVITY	NET WATER		49.29	6.976		5.918		W. S. CHEM.	0.364	0.0508	275	
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>4</sub> +	GROSS WATER		52.14	7.273	8.3	6.282		TOTAL	5.176	0.7220	3914	
63.22	94.97	75.31	82.61	83.26	45.06	56.08	65.70	HYDROCARBON TOTAL-C <sub>5</sub> +											

Form ML-11

g/NCF = 16.91 × #/MCF      89488 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal/MCF

FRESH FEED				WET GAS			RECYCLE	COMBINED FEED	EFFLUENT	NET CHANGE		YIELD BASIS H <sub>2</sub> + CO FED							
	%	m/hr	#/hr	%	At Wt. Balance	m/hr	m/hr	m/hr	m/hr	#/hr	#/MCF	#/gal	gal/hr	gal/MCF	YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*				
CO <sub>28.010</sub>	37.3	3.528	98.82	5.8	0.205	5.74	0.549	4.077	0.754	- 3.323	- 93.08								
H <sub>2</sub> <sub>2.016</sub>	62.7	5.930	11.95	43.5	1.540	3.10	4.114	10.044	5.654	- 4.390	8.85				400 EP	81.0 1.249	98.0 1.224		
CO <sub>24.010</sub>				27.6	0.977	43.00	2.610	2.610	3.587	0.977	43.00	11.996			400-550	11.3 0.174	91.4 0.159		
N <sub>2</sub> <sub>28.016</sub>															550 +	7.7 0.119	114.6 0.136		
CH <sub>4</sub> <sub>16.042</sub>				13.1	0.464	7.44	1.239	1.239	1.703	0.464	7.44	2.076				RECOVERY %	#/hr	gal/hr	
C <sub>2</sub> H <sub>4</sub> <sub>28.052</sub>				0.5	0.018	0.50	0.047	0.047	0.065	0.018	0.50	0.139				PROPYLENE	38.2 1.142		
C <sub>2</sub> H <sub>6</sub> <sub>30.068</sub>				3.4	0.120	3.61	0.322	0.322	0.442	0.120	3.61	1.007				C <sub>3</sub> POLY GASO.	87.5 1.00	0.167	
C <sub>3</sub> +C <sub>2</sub>										11.55	3.222								
C <sub>3</sub> H <sub>6</sub> <sub>42.078</sub>				2.0	0.071	2.99	0.189	0.189	0.260	0.071	2.99	0.834	4.32	0.592	0.193	C <sub>3</sub> POLY TAR	12.5 0.14	0.019	
C <sub>3</sub> H <sub>8</sub> <sub>44.094</sub>				1.3	0.046	2.03	0.123	0.123	0.169	0.046	2.03	0.566	4.24	0.479	0.134				
C <sub>4</sub> H <sub>8</sub> <sub>56.110</sub>				1.2	0.042	2.36	0.113	0.113	0.155	0.042	2.36	0.658	5.00	0.472	0.132			RVP	
C <sub>4</sub> H <sub>10</sub> <sub>58.120</sub>				0.7	0.025	1.45	0.066	0.066	0.091	0.025	1.45	0.404	4.86	0.298	0.063	C <sub>4</sub> H <sub>8</sub>	5.00		
C <sub>4</sub> H <sub>10</sub> <sub>70.130</sub>				0.9	0.032	2.24	0.085	0.085	0.117	0.032	2.24	0.625	5.45	0.411	0.115	C <sub>4</sub> POLY GASO.	5.98	0.345	
C <sub>4</sub> H <sub>12</sub> <sub>72.140</sub>													5.25		C <sub>4</sub> H <sub>10</sub>	4.86			
C <sub>4</sub> H <sub>12</sub> <sub>84.150</sub>													5.54		C <sub>4</sub> -FREE GASO.	1.802	5.8		
C <sub>5</sub> -C <sub>6</sub>										11.07	3.088		2.352	0.656		C <sub>4</sub> POLY TAR	7.53	0.059	
TOTAL	9.458	110.77		3.540	74.47	9.458	18.916	14.501											
H <sub>2</sub> +CO	9.458	3584.45	SCFH	1.745				14.121		7.713									
H <sub>2</sub> /CO	1.68	Factor:	278982	7.51				2.46		1.32						10 # RVP 400 EP GASOLINE	2.328	0.6495	3521
OPERATING DATA								RECOVERED OIL		9.30	2.594	6.032	1.542	0.430	GAS OIL	0.159	0.0444	241	
Pressure, psig	Inlet Velocity, Ft/sec			Catalyst			TOTAL OIL		20.37	5.683		3.894	1.086	FUEL OIL	0.136	0.0373	205		
Temperature, °F	Bed Depth, Ft			Weight, #			WATER SOLUBLE CHEMICALS		1.66	0.463		0.211	0.059	POLY TAR	0.058	0.0162	88		
Recycle Ratio	Bed Density, #/CF			Volume, Cuft			TOTAL LIQUID PRODUCTS C <sub>5</sub> +		22.03	6.146		4.105	1.145	TOTAL	2.681	0.7480	4055		
FRESH FEED CONVERSION - %				TOTAL FEED CONVERSION - %			SELECTIVITY	NET WATER		25.33	7.067		3.041		W. S. CHEM.	0.211	0.0589	319	
Contraction	CO	H <sub>2</sub>	H <sub>2</sub> +CO	CO	H <sub>2</sub>	CO+H <sub>2</sub>	C <sub>3</sub> + /C <sub>4</sub> +	GROSS WATER		26.99	7.530	8.3	3.252		TOTAL	2.892	0.8068	4374	
62.67	94.19	74.03	81.55	81.51	43.71	54.62	65.60	HYDROCARBON TOTAL-C <sub>5</sub> +		33.58	9.368								

Form ML-11

g/NCF = 16.91 × #/MCF      89488 MCFH H<sub>2</sub> + CO, Bbl/Day = 5421.6 × gal/MCF