C. ADJUSTMENT OF PILOT PLANT DATA TO BROWNSVILLE CASE VI DESIGN

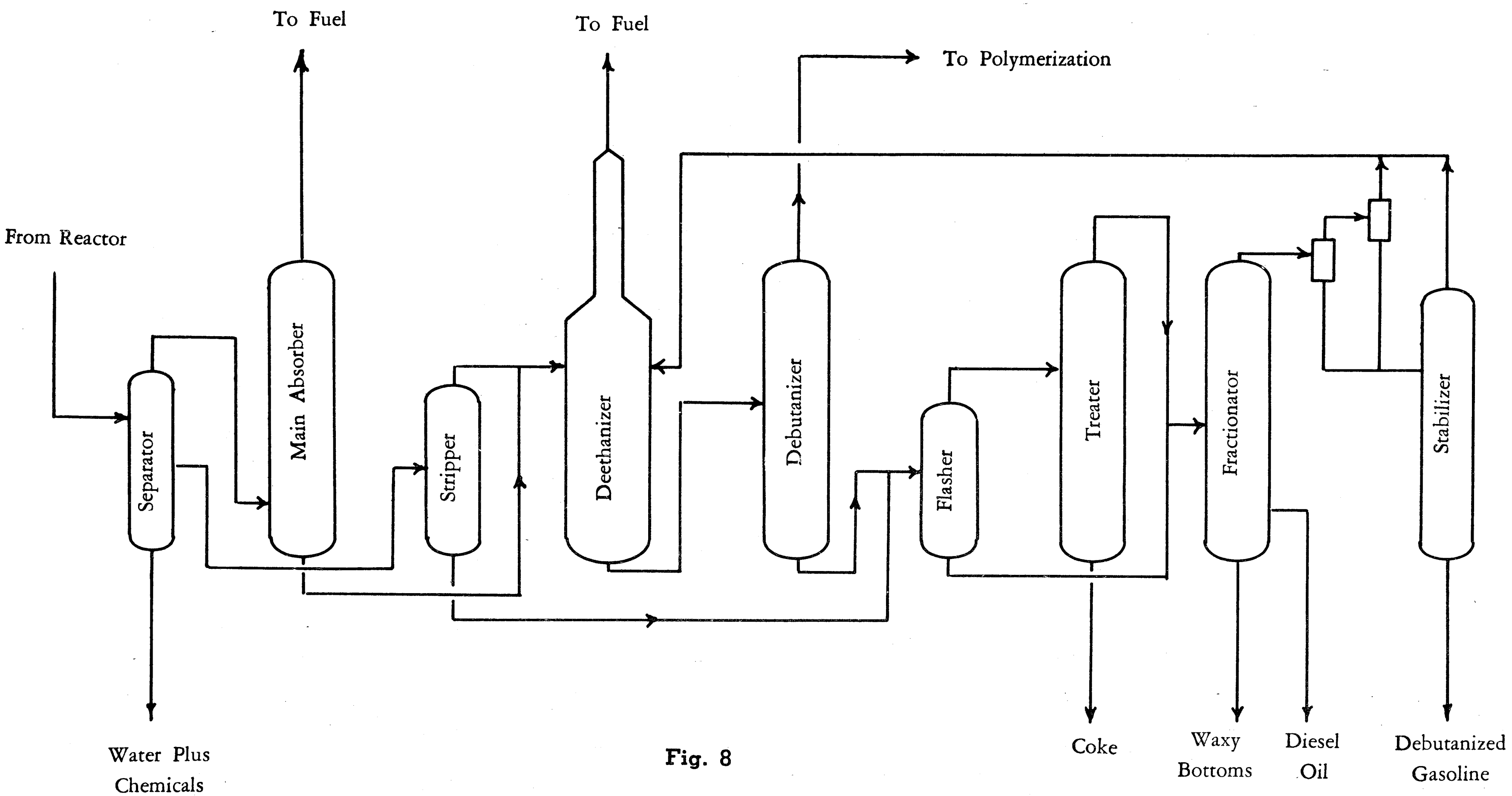

Fig. 8

Simplified Flow Diagram of Brownsville Case VI Recovery and Treating System

ADJUSTMENT OF PILOT PLANT DATA TO BROWNSVILLE CASE VI DESIGN BASIS

1. Introduction

In order to transpose pilot plant yield data to the Brownsville Case VI basis it is necessary to adjust the pilot plant yields for the recovery and polymerization of light ends and for the liquid treating operation. In the past, Montebello data have been reported on a polymer basis on the assumption that 90 per cent of the propylene and 95 per cent of the butylene would be recovered and polymerized and that there would be no liquid volume loss on treating.

2. Recovery and Treating System

A simplified flow diagram of the Brownsville Case VI recovery and treating system is shown in **Figure 8, opposite. This** shows that light ends can be lost either from the main absorber or from the de-ethanizer.

Since the absorber was sized for a velocity of 0.505 ft./sec. and the allowable velocity was 1.27 ft./sec. under design conditions, vapor handling capacity will not limit the absorber unless the feed rate is increased beyond 1.27/0.505 or 251 per cent of design. Since the design feed rate is 2364 MCF/hr. for a reactor fresh feed rate of 10066 MCF/hr. This limit to absorber vapor load will correspond to (2364)(2.51) = 5934 MCF/hr. or a contraction of 41 per cent. This value is so low that it does not seem likely that the vapor handling capacity will ever be a limitation.

Absorber recovery will decline, however, as vapor load

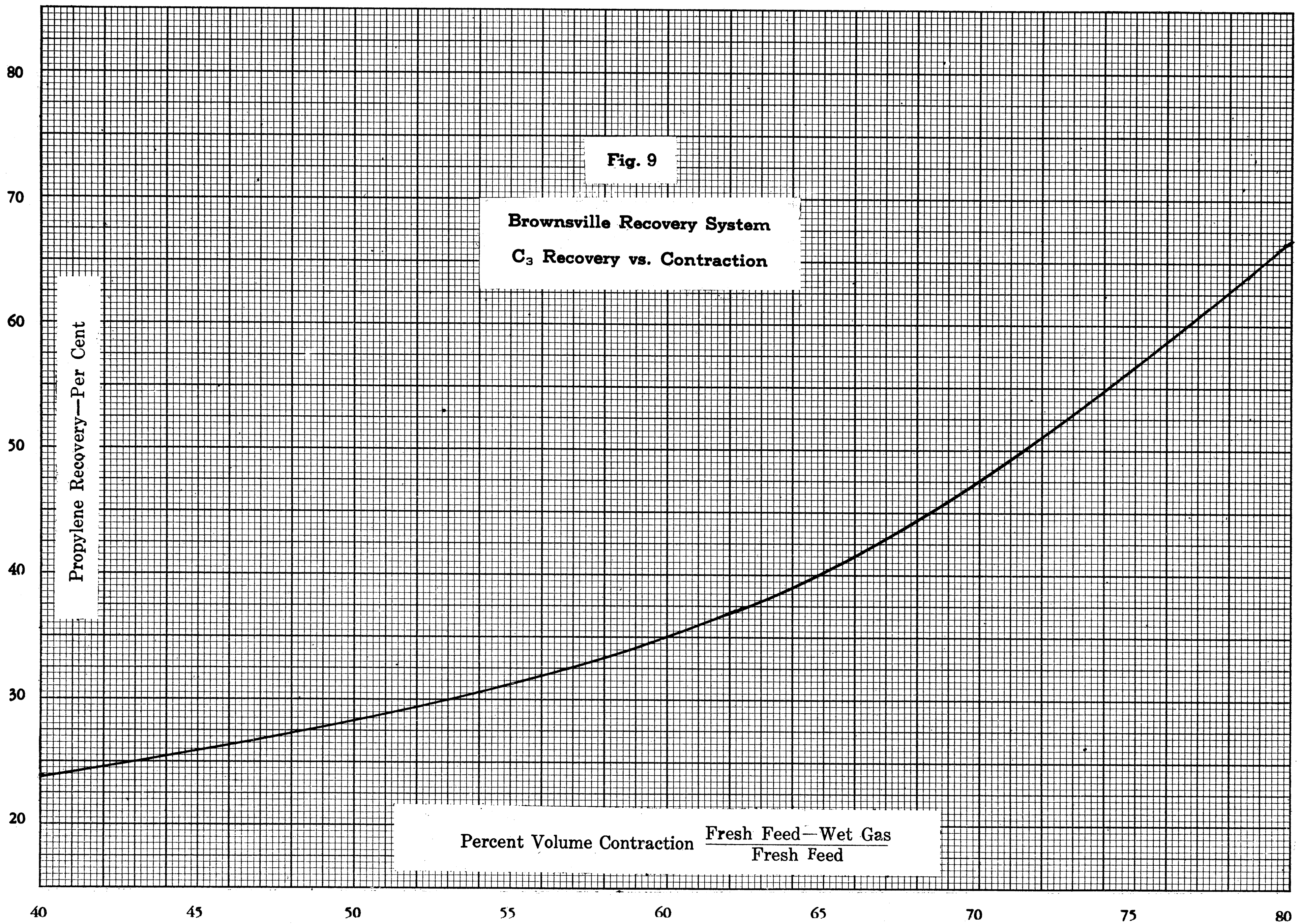
Fig. 9
Brownsville Recovery System
C_3 Recovery vs. Contraction
Propylene Recovery—Per Cent
80
70
60
50
40
30
20
Percent Volume Contraction $\frac{\text{Fresh Feed} - \text{Wet Gas}}{\text{Fresh Feed}}$
40
45
50
55
60
65
70
75
80

is increased if the design lean oil circulation is maintained. The design basis shows the following material balances for the absorber and de-ethanizer:

TABLE VIII-A
BROWNSVILLE CASE VI
MATERIAL BALANCE AROUND RECOVERY SYSTEM - DE-ETHANIZER

Component	Main Absorber- Lean Oil Circulation-2100 m/hr.			%		%		%
	Feed	Absorbed	To Fuel	Recovered	Feed	Recovered	To Fuel	Recovered
N_2	780.9	11.9	769.0		14.5		14.5	
CO	157.6	3.1	154.5		16.6		16.6	
H_2	2223.7	21.1	2202.6		26.0		26.0	
CO_2	1580.2	326.0	1254.2		388.7	4.7	384.0	
CH_4	722.1	45.5	676.6		249.7		249.7	
C_2H_4	216.5	44.9	171.6		62.9		62.9	
C_2H_6	188.3	55.7	132.6		88.3	8.8	79.5	
C_3H_6	139.8	100.8	39.0	72.1	146.6	120.1	26.5	81.9
C_3H_8	12.2	9.5	2.7		27.3	23.7	3.6	
C_4H_8	79.2	79.2		100.0	142.1	142.1		100.0
C_4H_{10}	6.7	6.7			38.9	38.9		
C_5H_{10}	89.3	89.3			116.3	116.3		
C_6H_{12}	27.4	27.4			29.7	29.7		
C_7	9.2	9.2			10.1	10.1		
C_8	3.4	3.4			3.9	3.9		
C_9	0.9	0.9			1.1	1.1		
C_{10}	0.4	0.4			0.5	0.5		
C_{11}	0.1	0.1			0.1	0.1		
Totals								
m/hr.	6237.9	835.1	5402.8		1363.3	500.0	863.3	
#/hr.	145038	38223	106815		56626	29394	27232	
MCF/hr.	2364	316	2048					

72.1 x 81.9 = 59.0% Overall C_3 Recovery.

The rate at which C_3 recovery declines with vapor load has been calculated for this system on the assumption that oil rate will be constant and that de-ethanizer recovery will not improve as absorber recovery declines. The results have been plotted in the opposite Figure 9 in terms of contraction - the decrease in volume of wet gas relative to synthesis reactor feed expressed as a percentage of reactor feed volume.

TABLE IX
BROWNSVILLE CASE VI
MATERIAL BALANCE AROUND LIQUID TREATER

Component	Moles Per Hour: Total Feed	Moles Per Hour: Vapor to De-ethanizer	Moles Per Hour: Stabilizer Bottoms	Moles Per Hour: Diesel Oil	Moles Per Hour: Waxy Bottoms	Moles Per Hour: Coke	Gallons Per Hour: Total Feed	Gallons Per Hour: Vapor to De-ethanizer	Gallons Per Hour: Stabilizer Bottoms	Gallons Per Hour: Diesel Oil	Gallons Per Hour: Waxy Bottoms
N_2											
CO		12.8									
H_2											
CO_2		2.1									
CH_4		9.0									
C_2H_4		9.7									
C_2H_6		1.4									
C_3H_6		28.9						281			
C_3H_8		2.6						27			
C_4H_8	4.1	44.7					46	497			
C_4H_{10}	0.9	9.4					11	114			
C_5H_{10}	175.6	4.4	155.6				2345	59	2080		
C_5H_{12}	19.7	0.1	17.7				313	13	280		
C_6H_{12}	96.1	0.8	86.7				1525	13	1370		
C_7H_{14}	74.2	0.2	67.4				1318	4	1200		
C_8H_{16}	62.0	0.1	56.4				1219	2	1100		
C_9H_{18}	43.2		39.5				912		830		
$C_{10}H_{20}$	47.6		43.5				1080		985		
$C_{11}H_{22}$	48.1		34.6	8.52			1163		835	205	
$C_{13}H_{26}$	14.3			11.79			371			305	
$C_{15}H_{30}$	14.1			11.70			421			349	
$C_{17}H_{34}$	9.3			7.74			314			262	
$C_{20}H_{40}$	15.7			13.32	4.48		630			536	180
Totals											
m/hr.	624.9	126.2	501.4	53.07	4.48						
#/hr.	71486	5708	51702	11704	1300	1072					
gal/hr.	11668	864	8680	1657	180		11668	C_3+1010 C_4+ 702	8680	1657	180

3. Treating System

Material balances around the Brownsville treating system are given in the opposite Table IX. This balance shows liquid feed and product rates as follows:

	Treating Yields-gal./hr. Feed	Products	Treating Yield, Vol. %
C_3H_6		281	
C_4 to 400 E.P.	9699	9382	96.7
Diesel Oil	1812	1657	91.4
Waxy Bottoms	157	180	114.6
	11668	11500	98.6

With a C_3 recovery of 60 per cent, the propylene produced in the treater will yield 122 gal./hr. of polymer and the final yields are:

	Feed	Products	Yield, Vol. %
400 E.P. Gasoline	9699	9504	98.0
Diesel Oil	1812	1657	91.4
Waxy Bottoms	157	180	114.6
	11668	11341	97.2

4. Polymerization System

Since the Brownsville polymerization unit was considerably over-designed, the following Table X was prepared showing adjustments of the Case VI base to the actual quantity of feed available and for the natural gasoline recovered in the natural gasoline absorber. The total gasoline yield has also been adjusted to an arbitrary 10#R.V.P. using vapor pressures for the individual fractions as shown.

In this calculation no credit has been taken for improved performance at reduced feed rate, the design conversion of propylene (98.5%) being retained in the final figures. The original distribution of polymerized olefin ($87\frac{1}{2}$% to gasoline - $12\frac{1}{2}$% to tar) has also been retained.

TABLE X
CORRECTION OF BROWNSVILLE CASE VI
FOR CASINGHEAD AND POLY OVERDESIGN TO 10# R.V.P. PRODUCT

	Poly Plant Design Basis												
	Feed	Dry Gas	Liquid Products	Actual Feed	Casing-head	Net Feed	Dry Gas	C_3 Poly Gaso-line	12½ Wt.% of Tot. C_3 Poly Tar	C_4+ to Gaso-line	C_4- to Gaso-line	12½ Wt.% of Tot. C_4- Poly Gasoline	C_4- Poly Tar
N_2													
CO													
H_2													
CO_2	5.5	5.5		4.7		4.7	4.7						
C_1													
C_2-													
C_2	5.5	5.5		8.8		8.8	8.8						
C_3-	286.2	4.4		120.1		120.1	3.6						
C_3	80.7	80.7		23.7	13.6	10.1	10.1						
C_4-	178.4		17.3	142.1		142.1					50.4		
iC_4+	17.2		17.2	10.4	10.4								
nC_4+	48.1		48.1	28.5	11.1	17.4				17.4			
Poly Gasoline			156.6					36.6				38.4	
Poly Tar			10.2						2.4				2.5
Total m/hr.	621.6	96.1	249.4	338.3		303.2	27.2	36.6	2.4	17.4	50.4	38.4	2.5
Total #/hr.	29756	4144	25612	16722		14926	1066	4281	612	1009	2822	4494	642
Total gal/hr.			4375					716	81	210	560	752	85

	R.V.P	Finished Stab. Gaso-line, gph	(RVP)(gph)
C_4-	68.0	560	38,080
C_4+	68.0	210	14,280
C_5-	19.6	2,080	40,768
C_6	5.0	1,370	6,850
C_7	2.0	1,200	2,400
C_3 Poly	1.5	716	1,074
C_4 Poly	1.5	752	1,128
C_8	1.0	1,100	1,100
C_9	0.5	830	415
C_{10}	0.2	985	197
C_{11}	0.1	835	83.5
Total		10,638	106,375.5

TABLE XI

OVER-ALL PLANT BALANCE

BROWNSVILLE CASE VI EX-CASINGHEAD

	Natural Gas	Oxygen	H20 From Wash Towers	Fresh Feed to Reactors	H20 From Primary Separator	Finished Gasoline	Diesel Oil	Tar	Fuel Gas From Main Absorber	From De-ethan-izer	From Poly Stabilizer	Total Fuel Gas
N_2	488.0	295.5		783.5					769.0	14.5		783.5
CO				8800.0					154.5	16.6		171.1
H_2				16233.9					2202.6	26.0		2228.6
CO_2				344.6					1254.2	384.0	4.7	1642.9
C_1	8746.0			283.7					676.6	65.7		742.3
C_2-									171.6	62.9		234.5
C_2	245.5								132.6	58.5	8.8	199.9
C_3-									39.0	26.5	3.6	69.1
C_3	51.0								2.7	3.6	10.1	16.4
C_4-						50.4						
C_4	18.4					17.4						
C_5-						155.6						
C_5												
C_6						86.7						
C_7						67.4						
Poly Gasoline						75.0						
C_8						56.4						
C_9						39.5						
C_{10}						43.5						
C_{11}						34.6	8.52					
C_{13}							11.79					
C_{15}							11.70					
C_{17}							7.74					
C_{20}							13.32	4.9 4.48				
O_2		5609.6										
H_2O			1615.6	114.8	5796.8							
WSC-$C_2H_5O_{1.5}$ = 53 MW					167.6							
Total moles/hr.	9591.2	5905.1	1615.6	26560.5			53.07	9.38	5402.8	658.3	27.2	6088.3
Total Lbs./hr.	163866	187751	29076	322571	113224	62704	11704	2554	106815	23658	1066	131539
Total gals./hr.						10638	1657	346				
Total MCF/hr.	3635	2238		10066					2047	250	10	2307
								Coke				
				Chemicals	8882 #/hr.			1072				
				Net Water	104342 #/hr.							
				Barrels Per Day		6079	947	198				

	Gals/hr.	Bbls/Day	gal./MCF
Gasoline	10638	6079	1.121
Diesel	1657	947	0.175
Tar	346	198	0.019
WSC	1105	631	0.017
	13746	7855	1.449

5. Over-All Plant Yields

Final plant yields for Brownsville Case VI are summarized in the opposite Table XI. These yields are on a casinghead-free basis, the finished gasoline being shown at 10#R.V.P.

The following material balance is shown:

Generator Feed	#/Hr.	Gal/Hr.	Bbl/Day	Yields Basis H_2 + CO Fed #/MCF	Yields Basis H_2 + CO Fed gal/MCF
Dry Natural Gas	163,866				
Oxygen	187,781				
Total Feed	351,647				
Plant Products					
Water from Wash Tower	29,076				
Water from Separator	104,342				
Fúel Gas	131,539				
Coke	1,072				
Total By-Products	266,029				
400-EP, 10#RVP Gasoline	62,704	10,638	6,079	6.600	1.120
Diesel	11,704	1,657	947	1.232	0.175
Waxy Bottoms	1,300	180	103	0.137	0.019
Poly Tar	1,253	166	95	0.131	0.017
Total Hydrocarbon Liquid	76,961	12,641	7,224	8.100	1.332
Primary W.S. Chemicals	8,882	1,104	631	0.935	0.117
Total Liquid Products	85,843	13,745	7,855	9.035	1.449
Total-All Products	351,872				

It should be noted that the yield of chemicals shown in this balance includes only the primary water soluble chemicals in the original Brownsville design basis. The extraction of chemicals in the oil scrubber and gas scrubber at Brownsville will actually reduce the yield of gasoline and increase the yield of chemicals relative to the values shown in this tabulation.

6. Adjustment of Pilot Plant Data

On the basis of the above review of the Brownsville design it is concluded that pilot plant yield data should be adjusted as follows:

a. Propylene Recovery and Polymerization

Using Figure 9, page 82, determine the recoverable propylene. Convert this to polymer assuming conversion of recovered propylene to liquid products, 87½ weight per cent gasoline and 12½ weight per cent tar.

b. Treating Yields

From the Hempel distillation on the recovered oil (adding 1 per cent for vapor loss to the 400°E. P. figure) calculate treater yields of finished liquids as follows:

400-E.P. Gasoline	98.0 Vol. Per Cent of Fraction Fed
Diesel	91.4
Waxy Bottoms	114.6

c. Butylene Polymerization

Calculate the quantity of butylene which must be polymerized to give a 10# R.V.P. finished gasoline using 68# R.V.P. for butylene, and 5.8# R.V.P. for C_4 free naphtha.

d. Sample Calculation

Period 49-B
16-34 Hours

1). Observed Yields

	#/hr.	gal./hr.
C_3H_6	12.75	2.951
C_4H_8	11.56	2.312
C_4H_{10}	4.42	0.909
C_5H_{10}	6.52	1.195
C_5H_{12}	1.59	0.303
C_6H_{12}	1.94	0.350
R. O.	87.82	13.479

Hempel on Recovered Oil

	Observed	Corrected	°API	#/gal.	#/hr.	gal/hr.
400 EP	71.0 +1.0	72.0	55.8	6.290	61.04	9.705
400/550	17.3	17.3	36.5	7.013	16.35	2.332
550+	11.7 -1.0	10.7	31.4	7.230	10.43	1.442
					87.82	13.479

2). Treating Yields

	Vol. %	gal./hr.	#/hr.
400 E.P.	98.0	9.511	59.82
Diesel	91.4	2.131	14.94
Waxy Bottoms	114.6	1.653	11.95

3). C_3 Polymerization

Contraction = 70.15 per cent   Recovery = 48.0 per cent
C_3H_6 Recovered = (12.75)(0.48) = 6.12 #/hr.
C_3 Poly Gasoline = (6.12)(0.875) = 5.36 @5.98 = 0.896 gph
C_3 Poly Tar = (6.12)(0.125) = 0.76 @7.53 = 0.101 gph

4). C_4 Poly to 10# R.V.P.

	#/hr.	gal/hr.	#/gal.	RVP	(RVP)(gal/hr)
C_5H_{10}	6.52	1.195			
C_5H_{12}	1.59	0.303			
C_6H_{12}	1.94	0.350			
C_3 Poly	5.36	0.896			
Treated 400-EP	59.82	9.511			
	75.23	12.255		5.8	71.079
C_4H_{10}	4.42	0.909		68.0	61.812
C_4H_8	1.02	0.204		68.0	13.872
C_4H_8 Poly	9.22	1.542		1.5	2.313
	89.89	14.910		10.0	149.076
C_4 Poly Tar	1.32	0.175	7.53		

5). Finished Plant Yields

	#/hr.	gal/hr.	gal/MCF H_2 + CO	Barrels Per Day Run 49B	Barrels Per Day Brownsville Basis
400-EP Gasoline	89.89	14.910	1.0297	5583	6079
Diesel	14.94	2.131	0.1472	798	947
Waxy Bottoms	11.95	1.653	0.1142	619	103
Poly Tar	2.08	0.276	0.0191	104	95
Total Hyd.	118.86	18.970	1.3101	7103	7224
W.S. Chemicals	12.02	1.469	0.1015	550	631
Total Liquid	140.88	20.439	1.4116	7653	7855

e. Sample Calculation

Period 49-F through P

1). Observed Yields

From Wet Gas	#/hr.	gal/hr.	#/gal.
C_3H_6	13.51	3.127	4.32
C_4H_8	11.89	2.378	5.00
C_4H_{10}	3.89	0.800	4.86
C_5H_{10}	6.87	1.261	5.45
C_5H_{12}	1.30	0.248	5.25
C_6H_{12}	2.02	0.365	5.54
R. O.	69.10	10.598	6.52

Hempel on Recovered Oil

	Observed		Corrected	°API	#/gal.	#/hr.	gal/hr.
400 EP	73.3	+1.0	74.3	55.5	6.300	49.61	7.874
400/550	17.8		17.8	35.9	7.038	13.28	1.887
550+	8.9	-1.0	7.9	27.3	7.42	6.21	0.837
						69.10	10.598

2). Treater Yields

	Vol.%	gal/hr.	#/hr.
400 E.P	98.0	7.717	48.62
Diesel	91.4	1.725	12.14
Waxy Bottoms	114.6	0.959	7.12

3). C_3 Polymerization

Contraction = 63.0 per cent Recovery = 38.5 per cent

C_3H_6 Recovered = (13.51)(0.385) = 5.20 #/hr.

C_3 Poly Gasoline = (5.20)(0.875) = 4.55 @5.98 = 0.761 gph

C_3 Poly Tar = (5.20)(0.125) = 0.65 @7.53 = 0.086 gph

4). C_4 Poly to 10# R.V.P.

	#/hr.	gal/hr.	#/gal.	RVP	(RVP)(gal/hr.)
C_5H_{10}	6.87	1.261			
C_5H_{12}	1.30	0.248			
C_6H_{12}	2.02	0.365			
C_3 Poly	4.55	0.761			
Treated 400-EP	48.62	7.717			
	63.36	10.352		5.80	60.042
C_4H_{10}	3.89	0.800		68.0	54.400
C_4H_8 Blended	0.93	0.186		68.0	12.648
C_4H_8 Poly	9.59	1.604		1.5	2.406
	77.77	12.942			129.496
C_4Poly Tar	1.37	0.182	7.53		

5). Finished Plant Yields

	#/hr.	gal/hr.	gal/MCF H2 + CO	Barrels Per Day Brownsville Basis
400-EP Gasoline	77.77	12.942	0.8707	4721
Diesel	12.14	1.725	0.1161	629
Waxy Bottoms	7.12	0.959	0.0645	350
Poly Tar	2.02	0.268	0.0180	98
Total Hydrocarbons	99.05	15.894	1.0693	5797
W.S.Chemicals	12.94	1.612	0.1085	588
Total Liquid	111.99	17.506	1.1778	6386

f. Sample Calculation
Period 49-Q through W

1). Observed Yields

From Wet Gas	#/hr.	gal./hr.	#/gal.
C_3H_6	14.10	3.264	4.32
C_4H_8	11.11	2.222	5.00
C_4H_{10}	3.43	0.706	4.86
C_5H_{10}	6.17	1.132	5.45
C_5H_{12}	0.94	0.179	5.25
C_6H_{12}	1.68	0.303	5.54
R. O.	71.74	11.047	6.494

Hempel on Recovered Oil

	Observed		Corrected	°API	#/gal.	#/hr.	gal/hr.
400 EP	72.5	+1.0	73.5	55.7	6.293	51.10	8.120
400/550	17.5		17.5	36.3	7.022	13.57	1.933
550+	10.0	-1.0	9.0	34.1	7.113	7.07	0.994
						71.74	11.047

2). Treater Yields

	Vol. %	gal./hr.	#/hr.
400 E.P.	98.0	7.958	50.08
Diesel	91.4	1.768	12.40
Waxy Bottoms	114.6	1.139	8.10

3). C_3 Polymerization

Contraction = 62.2 per cent C_3 Recovery = 38.0 per cent
C_3H_6 Recovered = (14.10)(0.38) = 5.36 #/hr.
C_3 Poly Gasoline = (5.36)(0.875) = 4.69 @5.98 = 0.784 gph
C_3 Poly Tar = (5.36)(0.125) = 0.67 @7.53 = 0.089 gph

4). C_4 Poly to 10# R.V.P.

	#/hr.	gal/hr.	#/gal.	RVP	(RVP)(gal/hr.)
C_5H_{10}	6.17	1.132			
C_5H_{12}	0.94	0.179			
C_6H_{12}	1.68	0.303			
C_3 Poly	4.69	0.784			
Treated 400-EP	50.08	7.958			
	63.56	10.356		5.8	60.065
C_4H_{10}	3.43	0.706		68.0	48.008
C_4H_8 Blended	1.27	0.254		68.0	17.272
C_4H_8 Poly	8.61	1.440		1.5	2.160
	76.87	12.756			127.505
C_4 Poly Tar	1.23	0.163	7.55		

5). Finished Plant Yields

	#/hr.	gal/hr.	gal/MCF H_2 + CO	Barrels Per Day Brownsville* Basis
400-EP Gasoline	76.87	12.756	0.8363	4534
Diesel		1.768	0.1159	628
Waxy Bottoms		1.139	0.0747	405
Poly Tar	1.90	0.252	0.0165	90
Total Hydrocarbons		15.915	1.0434	5657
W. S. Chemicals		1.744	0.1143	620
Total Liquid		17.659	1.1578	6277

*25,033.9 m/hr. = 9488 MCFH = 227,707 MCF/D ÷ 42 = 5421.6

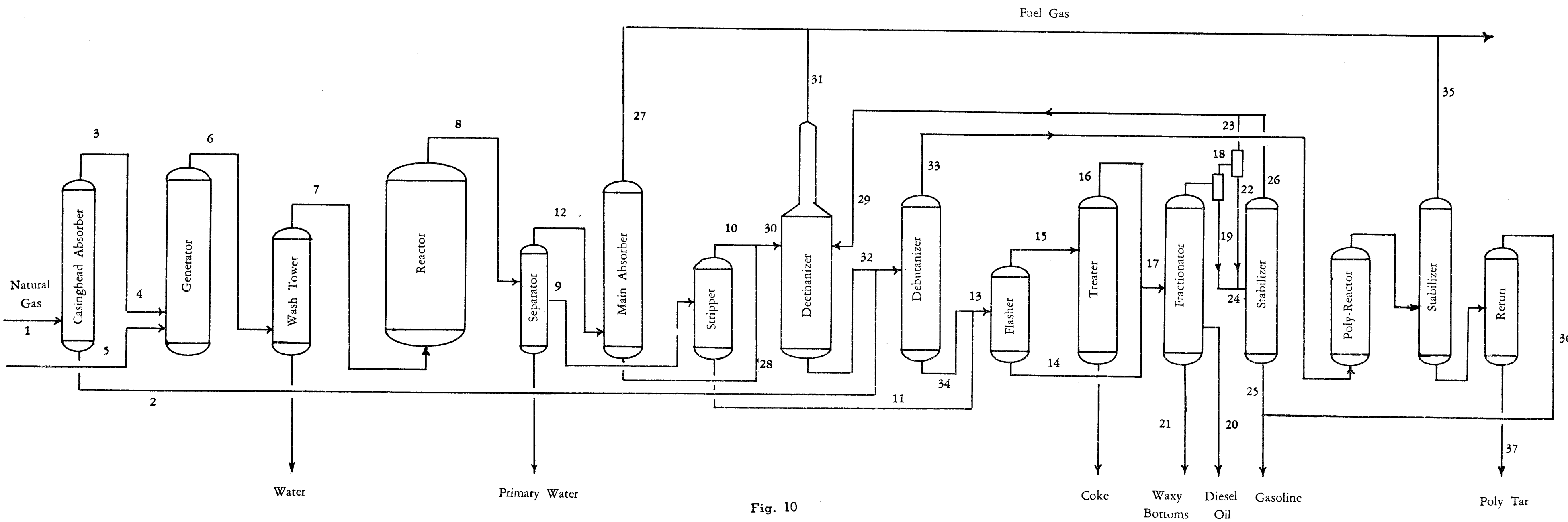

Fig. 10

Numerals refer to table XII

Flow Diagram of Brownsville Synthesis Unit

TABLE XII
DETAILED BROWNSVILLE CASE VI MATERIAL BALANCES

MW		1	2	3	4	5	6	7	8	9	10	11	12	
		NATURAL GASOLINE ABSORBER						Wash Tower	Net	Flash Liquid to	Stripper overhead to De-	Stripper	Flash Vapor	
		Feed	Btms. to Deethanizer	Overhead to Generator	Dry Gas to Generator	Oxygen to Generator	Generator Effluent	Overhead Reactor Feed	Reactor Product	Stripper	ethanizer	Btms. to Treater	to Main Absorber	Wet Gas 10 + 12
28	N_2	488.0		488.0	488.0	295.5	783.5	783.5	783.5	2.6	2.6		780.9	783.5
28	CO						8800.0	8800.0	158.3	0.7	0.7		157.6	158.3
2	H_2						16233.9	16233.9	2228.6	4.9	4.9		2223.7	2228.6
44	CO_2						344.6	344.6	1640.8	60.6	60.6		1580.2	1640.8
16	C_1	8930.0	184.0	8746.0	8824.0		283.7	283.7	733.3	11.2	11.2		722.1	733.3
28	C_2^-								224.8	8.3	8.3		216.5	224.8
30	C_2	266.5	21.0	245.5	237.4				198.5	10.2	10.2		188.3	198.5
42	C_3^-								156.7	16.9	16.9		139.8	156.7
44	C_3	64.6	13.6	51.0	38.3				13.8	1.6	1.6		12.2	13.8
56	C_4^-								101.5	22.3	18.2	4.1	79.2	97.4
58	iC_4^+	22.5	10.4	12.1	3.1									
58	nC_4^+	17.4	11.1	6.3	0.4				8.9	2.2	1.3	0.9	6.7	8.0
70	C_5^-								168.8	79.5	2.8	76.7	89.3	92.1
72	C_5^+	19.7	19.7											
90	C_6								96.1	68.7	1.5	67.2	27.4	28.9
105	C_7								74.2	65.0	0.7	64.3	9.2	9.9
120	C_8								62.0	58.6	0.4	58.2	3.4	3.8
135	C_9								43.2	42.3	0.2	42.1	0.9	1.1
150	C_{10}								47.6	47.2	0.1	47.1	0.4	0.5
165	C_{11}								48.1	48.0		48.0	0.1	0.1
180	C_{13}								14.32	14.32		14.32		
210	C_{15}								14.14	14.14		14.14		
240	C_{17}								9.30	9.30		9.30		
290	C_{20}								15.66	15.66		15.66		
32	O_2					5609.6								
18	H_2O						1730.4	114.8						
Total Moles		9808.7	259.8	9548.9	9591.2	5905.1	28176.1	26560.5	6842.12	604.22	142.2	462.02	6237.9	6380.1
Total Lbs.		171114	6838	164276	163866	187781	351647	322571	209347	64309	5856	58453	145038	150894
Total Gals.												9289		
									To Stanolind					
H_2O								29076	104342					
WSChemicals									8882					
									113224					
							H_2 + CO	25034 m/hr. 9488 MCFH						
End Products														
Gal/hr.														
Lbs/hr.		171114				187781		29076	113224					

TABLE XII (CONT'D)

DETAILED BROWNSVILLE CASE VI MATERIAL BALANCES (CONT'D)

	13 Treater Feed Strpr.Btms.(11) +Debut.Btms(34)	14 Treater Flash Liquid to Fractionator	15 Treater Flash Vapor-Net Feed	16 Treater Reactor Products	17 Treater Fractionator Feed 14 + 16	18 Fractionator Overhead-Flash Vapor 22 + 23	19 Fractionator Overhead-Flash Liquid	20 Diesel Oil	21 Waxy Bottoms	22 Flash Vapor Condensate to Stabilizer	23 Flash Vapor Uncond. to Deethanizer	24 Stabilizer Feed 22 + 19
N_2												
CO				12.8	12.8	12.8					12.8	
H_2												
CO_2				2.1	2.1	2.0	0.1			0.9	1.1	1.0
C_1				9.0	9.0	8.9	0.1			1.6	7.3	1.7
C_2^-				9.7	9.7	9.3	0.4			4.2	5.1	4.6
C_2				1.4	1.4	1.3	0.1			0.7	0.6	0.8
C_3^-				28.9	28.9	24.4	4.5			18.1	6.3	22.6
C_3				2.6	2.6	2.1	0.5			1.6	0.5	2.1
C_4^-	4.1		4.1	44.7	44.7	28.7	16.0			24.8	3.9	40.8
iC_4^+												
nC_4^+	0.9		0.9	9.4	9.4	5.7	3.7			5.0	0.7	8.7
C_5^-	175.6	0.5	175.1	159.5	160.0	77.4	82.6			73.0	4.4	155.6
C_5^+	19.7	0.1	19.6	17.7	17.8	5.7	12.1			5.6	0.1	17.7
C_6	96.1	0.5	95.6	87.0	87.5	11.9	75.6			11.1	0.8	86.7
C_7	74.2	0.6	73.6	67.0	67.6	3.4	64.2			3.2	0.2	67.4
C_8	62.0	0.7	61.3	55.8	56.5	1.0	55.5			0.9	0.1	56.4
C_9	43.2	0.8	42.4	38.7	39.5	0.3	39.2			0.3		39.5
C_{10}	47.6	1.2	46.4	42.3	43.5		43.5					43.5
C_{11}	48.1	1.9	46.2	42.1	44.0		34.6	8.52				34.6
C_{13}	14.3	1.1	13.2	12.0	13.1			11.79				
C_{15}	14.1	1.9	12.2	11.1	13.0			11.70				
C_{17}	9.3	2.0	7.3	6.6	8.6			7.74				
C_{20}	15.7	5.6	10.1	9.2	14.8			13.32	4.48			
Total Moles	624.9	16.9	608.0	669.6	686.5	194.9	432.7	53.07	4.48	151.0	43.9	583.7
Total Lbs.	71486	3539	67947	66875	70414	11458	45952	11704	1300	9605	1653	55757
			Coke	1072								
End Products												
Gal/hr.								1657	180			
Lbs./hr.				1072				11704	1300			

TABLE XII (CONT'D)

DETAILED BROWNSVILLE CASE VI MATERIAL BALANCES (CONT'D)

	25 Stabilizer Bottoms	26 Stabilizer Overhead to Deethanizer	27 Main Absorber Overhead to Fuel	28 Main Absorber Bottoms to Deethanizer	29 Deethanizer Feed from Fract.Stab. 23 + 26	30 Total Deethanizer Feed 29+2+28+10	31 Deethanizer Overhead to Fuel	32 Deethanizer Btms. to Debutanizer	33 Debutanizer Overhead to Poly	34 Debutanizer Btms.to Treater	35 Poly Stab. Overhead to Fuel	36 Poly Gasoline	37 Poly Tar
N_2			769.0	11.9		14.5	14.5						
CO			154.5	3.1	12.8	16.6	16.6						
H_2			2202.6	21.1		26.0	26.0						
CO_2		1.0	1254.2	326.0	2.1	388.7	384.0	4.7	4.7		4.7		
C_1		1.7	676.6	45.5	9.0	249.7	249.7						
C_2^-		4.6	171.6	44.9	9.7	62.9	62.9						
C_2		0.8	132.6	55.7	1.4	88.3	79.5	8.8	8.8		8.8		
C_3^-		22.6	39.0	100.8	28.9	146.6	26.5	120.1	120.1		1.2		
C_3		2.1	2.7	9.5	2.6	27.3	3.6	23.7	23.7		23.7		
C_4^-		40.8		79.2	44.7	142.1		142.1	142.1			43.7	
iC_4^+						10.4		10.4	10.4			10.4	
nC_4^+		8.7		6.7	9.4	28.5		28.5	28.5			28.5	
C_5^-	155.6			89.3	4.4	96.5		96.5		96.5			
C_5	17.7				0.1	19.8		19.8		19.8			
C_6	86.7			27.4	0.8	29.7		29.7		29.7			
C_7	67.4			9.2	0.2	10.1		10.1		10.1		78.9	
C_8	56.4			3.4	0.1	3.9		3.9		3.9			
C_9	39.5			0.9		1.1		1.1		1.1			
C_{10}	43.5			0.4		0.5		0.5		0.5			
C_{11}	34.6			0.1		0.1		0.1		0.1			
C_{13}													
C_{15}													
C_{17}													
C_{20}													
												Gaso.	Tar
Total Moles	501.4	82.3	5402.8	835.1	126.2	1363.3	863.3	500.0	338.3	161.7	38.4	1615	5.1
Total Lbs.	51702	4055	106315	38223	5708	56626	27232	29394	16772	12622	1564	13933	1275
Gal./hr.												2502	169
End Products													
Gal/hr.	8680												
Lbs/hr.	51702		106815				27232				1564	13933	1275

TABLE XIII
TREATING YIELDS

	Moles Per Hour					Gallons Per Hour					
	Total Feed	To Deethanizer	Stabilizer Bottoms	Diesel	Tar	Total Feed	To Deethanizer	Stabilizer Bottoms	Diesel	Tar	Product
N_2											
CO		12.8									
H_2											
CO_2		2.1									
C_1		9.0									
C_2^-		9.7									
C_2		1.4									
C_3^-		28.9					281				
C_3		2.6					27				
C_4^-	4.1	44.7				46	497				
iC_4											
nC_4	0.9	9.4				11	114				
C_5^-	175.6	4.4	155.6			2345	59	2080			
C_5	19.7	0.1	17.7			313	13	280			
C_6	96.1	0.8	86.7			1525	13	1370			
C_7	74.2	0.2	67.4			1318	4	1200			
C_8	62.0	0.1	56.4			1219	2	1100			
C_9	43.2		39.5			912		830			
C_{10}	47.6		43.5			1080		985			
C_{11}	48.1		34.6	8.52		1163		835	205		1040, 80% to Gaso.
C_{13}	14.3			11.79		371			305		
C_{15}	14.1			11.70		421			349		
C_{17}	9.3			7.74		314			262		
C_{20}	15.7			13.32	4.48	630			536	180	716, 75% to Diesel
Total Moles	624.9	126.2	501.4	53.07	4.48						
Total Lbs.	71486	5708	51702	11704	1300						
Total Gals.	11668	864	8680	1657	180	11668	C_4+ 702 C_3+ 1010	8680	1657	180	

Vol. = 113 = 97.5% Vol.

Poly from C_3^- at 60% Rec. = (28.9)(0.60)(42)/5.98 = 122

C_4 to 400 EP Feed = 9699 — C_4 400 EP Product = 9382 = 96.7% Vol.

Total 400 EP = 9504

Diesel Feed = 1812 — Diesel Feed = 1657 = 91.4% Vol.

Fuel Oil = 157 — Fuel Oil = 180 =114.6% Vol.

11668 — 11341 = 97.2% Vol.

TABLE XIV

CORRECTION OF BROWNSVILLE CASE VI DESIGN

FOR POLY PLANT OVERDESIGN AND CASINGHEAD FEED

	POLY PLANT DESIGN			ACTUAL BROWNSVILLE			ACTUAL BROWNSVILLE ON CASINGHEAD FREE BASIS								
	Feed m/hr.	Dry Gas m/hr.	Liquid Product m/hr.	Feed m/hr.	Dry Gas m/hr.	Liquid Product m/hr.	From Casinghead m/hr.	Net Feed m/hr.	Dry Gas m/hr.	Poly Gasoline m/hr.	Poly Gasoline #/hr.	Poly Gasoline gal/hr.	Poly Tar m/hr.	Poly Tar #/hr.	Poly Tar gal/hr.
N_2															
CO															
H_2															
CO_2	5.5	5.5		4.7	4.7			4.7	4.7						
C_1															
$C_2^=$															
C_2	5.5	5.5		8.8	8.8			8.8	8.8						
$C_3^=$	286.2	4.4		120.1	1.2			120.1	2.2						
C_3	80.7	80.7		23.7	23.7		13.6	10.1	10.1						
$C_4^=$	178.4		17.3	142.1		43.7		142.1			28.31	562			
iC_4	17.2		17.2	10.4		10.4	10.4								
nC_4	48.1		48.1	28.5		28.5	11.1	17.4		17.4	10.09	210			
											88.47	1479			
Poly Gaso			156.6			78.9									
Poly Tar			10.2			5.1							4.4	10.95	145
Total moles	621.6	96.1	249.4	338.3	38.4	166.6		303.2	25.8	17.4			4.4		
Total Lbs.	29756	4144	25612	16772	1564	15208		14926	1007		126.87			10.95	
Total Gals.			4375			2671						2251			145

TABLE XV
FINAL BROWNSVILLE YIELD
CASINGHEAD-FREE

Component	MW	#/gal.	RVP	MAIN STABILIZER BOTTOMS m/hr.	#/hr.	gal/hr.	Less Casinghead m/hr.	NET STABILIZER BOTTOMS m/hr.	#/hr.	gal/hr.	TOTAL GASOLINE m/hr.	#/hr.	gal/hr.	For 10#RVP
nC_4^-	56	5.04	68.0								43.7	2447	486	562
iC_4^+	58	4.80	68.0											
nC_4^+	58	4.80	68.0								17.4	1009	210	210
C_5^-	70	5.25	19.6	155.6	10892	2080		155.6	10892	2080	155.6	10892	2080	2080
C_5^+	72	5.66	19.6	17.7	1604	280	17.7							
C_6	90	5.66	5.0	86.7	7803	1370		86.7	7803	1370	86.7	7803	1370	1370
C_7	105	5.91	2.0	67.4	7077	1200		67.4	7077	1200	67.4	7077	1200	1200
Poly Gaso	117	5.98	1.5								78.9	9231	1544	1479
C_8	120	6.10	1.0	56.4	6768	1100		56.4	6768	1100	56.4	6768	1100	1100
C_9	135	6.41	0.5	39.5	5333	830		39.5	5333	830	39.5	5333	830	830
C_{10}	150	6.61	0.2	43.5	6525	985		43.5	6525	985	43.5	6525	985	985
C_{11}	165	6.83	0.1	34.6	5700	835		34.6	5700	835	34.6	5700	835	835
C_{13}	180	6.95												
C_{15}	210	7.05												
C_{17}	240	7.10												
Poly Tar	250	7.53												
C_{20}	290	7.20												
Total				501.4	51702	8680		483.7	50098	8400		62785	10640	10651

RVP 9.53

RVP of C4 Free Gaso. = 5.40