Brownsville Design Conditions

The following yields and operating conditions were predicted by HRI in Case VI Process Specs. Sect. 350 and are the goal we are shooting for:

	Per Reactor	Total
Syn. Gas Feed Rate (MMSCFH)	5.0	10.0
Recycle/F.F. ratio	1.0	1.0
Catalyst Holdup Tons	99	198
Steam Prod'n. M#/Hr.	215.5	431
Cat. Bed Density #/C.F.	100	
Reactor Press.	425	
Reactor Effluent Temp. °F.	650	
% CO Conv. (on F.F.)	98.2	
% H_2 Conv. (on F.F.)	86.3	
% H_2+CO Conv. (on F.F.)	90.4	
Fresh Feed Comp: Mol %		
CO	33.14	
H_2	61.12	
CO_2	1.30	
N_2+ A	2.95	
CH_4	1.07	
H_2O	0.43	

In the design, the water-gas shift reaction was assumed to be in equilibrium $\frac{(H_2)(CO_2)}{(CO)(H_2O)}$ = 22 at 650°F) at the reactor outlet.

The predicted yields were as follows:

	BPOD	BPOD Ex Casinghead 10# RVP Gaso.*
Casinghead C_4's	150	
Casinghead Gaso.	179	
Synthetic C_4's	164	
Synthetic Gaso. (DB)	4781	
Poly Gaso.	915	
Total Gaso.	6189	6079
Gas Oil	946	947
Waxy Btms.	103	103
Poly Tar	99	95
Total Oil	7337	7224
Water Sol. Chemicals 213,168#/day @ 8#/gal =	631	631
Water	9144	
Total Synthetic Oil plus WSC Bbls/MMSCF of Syn. Gas	31.8	32.6

* From PR TDC 802 - 37P page 88

The total C_3+ yield, including water soluble chemicals can be calculated from the breakdown of the reactor effluent streams reported in the HRI Process Specs. for Sect. 350 (Case 6 design) as follows:

TABLE A

Total C_3+ Design Yields For Two Reactors And 10,000,000 SCFH of Fresh Feed

	#/Hr. Flash Vapor	#/Hr. Stripper Feed	Net Reactor Effluent #/Hr.	#/Gal.	#/Bbl.	BPH
N_2	21,865	73	21,938	8.33	349.9	
CO	4,412	20	4,432	8.33	349.9	
CO_2	69,529	2,666	72,195	8.33	349.9	
H_2	7,447	10	4,457	8.33	349.9	
C_1	11,554	179	11,733	2.40	100.8	
$C_2=$	6,062	232	6,294	3.25	136.5	
C_2+	5,649	306	5,955	2.63	110.5	
$C_3=$	5,871	710	6,581	4.33	181.9	36.18
C_3+	537	70	607	4.25	178.5	3.40
C_4-	4,435	1,249	5,684	5.04	211.7	26.85
C_4+	388	128	516	4.80	201.6	2.56
C_5-	6,251	5,565	11,816	5.25	220.5	53.59
C_6	2,466	6,182	8,648	5.66	237.7	36.38
C_7	966	6,834	7,800	5.91	248.2	31.43
C_8	408	7,032	7,440	6.10	256.2	29.04
C_9	121	5,719	5,840	6.41	269.2	21.69
C_{10}	60	7,090	7,150	6.61	277.6	25.76
C_{11}	17	7,924	7,941	6.83	286.9	27.68
C_{13}		2,580	2,580	6.95	291.9	8.84
C_{15}		2,970	2,970	7.05	296.1	10.03
C_{17}		2,230	2,230	7.10	298.2	7.48
C_{20}		4,540	4,540	7.20	302.4	15.01
	145,038	64,309	209,347			335.92
Water Sol. Chems.			8,882		336.0	26.30
Water			104,045			
Total Out			322,274			362.22
Total In (F.F.)			322,571			8700 BPD

The total C_3+ and WSC in the reactor effluent amounts to 362.2 BPH or 8700 BPD. The difference between this figure and the lower corresponding figure reported above in the predicted yield table is, of course, due to the poly contractions and the C_3, C_4 and other losses.

The total C_3+ Incl. WSC leaving the reactors amounts to 91,225#/Hr. which divided by 14 = 6,516 CH_2 radicals per hr. which is 74.05% of the 8,800 Mols of CO fed to the reactors in the fresh feed.

The other design factors used in these correlations were similarly calculated as follows:

% CO in F.F. to WSC = 7.2
% CO in F.F. to CO_2 Made = 14.73
% CO in F.F. to CH_4 Made = 5.1
% H_2 in F.F. to H_2O Made = 34.9