TABLE 1

Components Used for Material Balance Calculations
Fischer-Tropsch Bench-Scale Reactor

Hydrogen
Carbon Monoxide
Carbon Dioxide
Water
Oxygenates (as ethanol)*
Methane
C2 (as ethylene)
C3 (as propylene)
C4 (as 1-butene)
C5 (as cis 2-pentene)
C6 (as 1-hexene)
C7 (as 1-heptene)
C8 (as octane)
C9 (as 1-nonene)
C10 (as decane)
C11 (as n-undecane)
C12 (as n-dodecane)
C13 (as n-tridecane)
C14 (as n-tetradecane)
C15 (as n-pentadecane)
C16 (as n-hexadecane)
C17, 18 (asn-heptadecane)
C19, 20 (as n-nonadecane)
C21, 22 (as n-heneicosane)
C23, 24 (as n-tricosane)
C25, 26 (as n-pentacosane)
C27+ (as 800-900°F cut of Iranian crude)

*Dimethyl ether also included for iron catalyst cases

TABLE 2

Reaction Yields
pound mole/hr

COMPONENT	CASE 1	CASE 1A	CASE 2	CASE 2A
H_2	(0.784)	(1.50)	(0.758)	(1.50)
CO	(1.184)	(2.67)	(0.470)	(2.67)
CO_2	0.555	1.33	0.075	1.33
H_2O	0.064	.0102	0.323	0.0102
Ethanol	0.0094	0.0212	0.00172	.0059
Dimethyl Ether	0.0106	0.024	--	--
C1	0.023	0.052	0.0192	.0656
C2	0.0105	0.024	0.0017	.0058
C3	0.0105	0.024	0.0032	0.0109
C4	0.0075	0.0170	0.00275	0.0094
C5	0.0060	0.0136	0.0025	0.0085
C6	0.0032	0.0072	0.0019	0.0065
C7	0.0024	0.0054	0.00139	0.0047
C8	0.0021	0.0047	0.00127	.0043
C9	0.0019	0.0043	0.00152	.0052
C10	0.0017	0.0038	0.00169	.0058
C11	0.00141	0.0032	0.00162	.0055
C12	0.00141	0.0032	0.00145	.0050
C13	0.00121	0.0027	0.00135	.0046
C14	0.00119	0.0027	0.00122	.0042
C15	0.00104	0.0024	0.00112	.0038
C16	0.00093	0.0021	0.00105	.0036
C17, 18	0.00167	0.0038	0.00188	.0064
C19, 20	0.00162	0.0037	0.00153	.0052
C21, 22	0.00165	0.0037	0.00122	.0042
C23, 24	0.00165	0.0037	0.00090	.0031
C25, 26	0.00152	0.0034	0.00069	.0024
C27+	0.00344	0.0078	0.00137	.0047

TABLE 3

Material Balance - Case 1

BALANCE POINT	1	2	3	4	5	6	7	8	9	10A	10B	11	12	13	14	15
P, PSIA/T, F	325/70	322/491	322/403	322/403	322/100	322/42	322/42	322/42	45/42	45/42	45/42	322/500		322/300	45/70	600/70
Phase	Gas	Gas	Liquid	Gas	Mixed	Mixed	Gas	Liquid	Gas	Org Liq	Aq. Liq.	Liquid		Liquid	Gas	Aqueous
Mole/Hr:																
H	1.82	1.0362	.0002	1.036	1.036	1.036	1.0359	0.0001	.00010	--	--	--		--	1.0360	
CO	2.82	1.6363	.0003	1.636	1.636	1.636	1.6356	0.0004	.00041	.00003	--	--		--	1.6360	
CO_2	--	.5551	.0001	0.555	0.555	.555	.5528	.0022	.00105	.00115	--	--		--	0.5539	
H_2O	--	.064	--	0.064	0.064	.064	.00281	.0612	--	.00002	.0616	--		--	0.00281	4.15
DM-Ether	--	.0106	--	0.0106	.0106	.0106	.0100	.0006	.00003	.00059	--	--		--	0.0100	
Alcohol		.0094	--	.0094	.0094	.0094	.00104	.00836	--	.00031	.00805	--		--	0.0010	
C1		.023	--	0.023	.023	.023	.023	--	.00002	.00001	--	--		--	0.0230	
C2		.0105	--	0.0105	.0105	.0105	.01046	.00004	.00002	.00002	--	--		--	0.0105	
C3		.0105	--	0.0105	.0105	.0105	.01030	.00020	.00003	.00017	--	--		--	0.0105	
C4		.0075	--	0.0075	.0075	.0075	.00694	.00056	.00002	.00053	--	--		--	0.0070	
C5		.0060	--	0.0060	.0060	.0060	.00445	.00155	.00001	.00154	--	--		--	0.0045	
C6		.00321	.00001	0.00319	.00319	.00319	.00165	.00155	.00001	.00154	--	.000006		.00001	0.00166	
C7		.00241	.00002	0.00239	.00239	.00239	.00061	.00179	--	.00178	--	.000036		.00001	0.00061	
C8		.00212	.00003	0.00209	.00209	.00209	.00017	.00192	--	.00192	--	.00008		.00001	0.00017	
C9		.00193	.00004	0.00189	.00189	.00189	.00008	.00181	--	.00181	--	.000010		.00001	0.00008	
C10		.00174	.00006	0.00169	.00169	.00169	.00167	.00002	.00167	--	.00167	.000014		.00001	0.00002	
C11		.00147	.00007	0.00139	.00139	.00139	.00001	.00139	--	.00139	--	.000017		.00002	0.00001	
C12		.00150	.00012	0.00139	.00139	.00139	--	.00139	--	.00138	--	.000024		.00002		
C13		.00136	.00016	0.00118	.00118	.00118	--	.00118	--	.00118	--	.000029		00003		
C14		.00138	.00024	0.00115	.00115	.00115	--	.00115	--	.00115	--	.000042		.00004		
C15		.00130	.00032	0.00099	.00099	.00099	--	.00099	--	.00099	--	.000053		.00005		
C16		.00128	.00043	0.00086	.00086	.00086	--	.00086	--	.00086	--	.000067		.00007		
C17,18		.00260	.00114	0.00150	.00150	.00150	--	.00150	--	.00150	--	.000170		.00017		
C19,20		.00314	.00185	0.00135	.00135	.00135	--	.00135	--	.00135	--	.000273		.00027		
C21,22		.00487	.00403	0.00099	.00099	.00099	--	.00099	--	.00099	--	.000660		.00066		
C23,24		.00318	.0029	0.00038	.00038	.00038	--	.00038	--	.00038	--	.00127		.00127		
C25,26		.00087	.00083	0.00007	.0007	.00007	--	.00007	--	.00007	--	.001449		.001449		
C27+		.00001	.00001	--	--	--	--	--	--	--	--	.003440		.003440		
Total Moles/Hr		3.404	.013	3.391	3.391	3.391	3.296	3.296	.0952	.0017	.0243	.00798		.00798		
Enthalphy,BTU/Hr				22414	12280	10186	11409	-1223								

TABLE 4

Heat and Material Balance - Case 1A

BALANCE POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PSIA/ F Phase	325/70 Gas	322/498 Gas	322/470 Liquid	322/470 Gas	322/100 Mixed		322/100 Gas	322/100 Liquid	45/84 Gas	45/84 Liquid	322/500 Liquid	45/300 Gas	45/300 Liquid	45/100 Gas	311/70 Water
H	1.66	0.166	--	0.166	0.166		0.166	--	--	--	--	--	--	0.166	
CO	2.97	0.297	--	0.797	0.297		0.2966	.0004	--	--	--	--	--	0.297	
CO_2		1.329	--	1.329	1.329		1.315	0.014	0.012	0.002	0.001	0.0005	0.0005	1.3275	
H_2O		0.0102	--	0.0102	0.0102		0.0101	0.0001	0.0001	--	--	--	--	0.0102	10.55
Ether		0.0239	--	0.0239	0.0239		0.0217	0.0022	0.0006	0.0016	--	--	--	0.0274	
Ethanol		0.0212	-	0.0212	0.0212		0.0165	0.0046	0.0004	0.0042	--	--	--	0.017	
C1		0.052	--	0.052	0.052		0.0518	0.0002	0.0002	--	--	--	--	0.052	
C2		0.024	--	0.024	0.024		0.0237	0.0003	0.0003	--	--	--	--	0.024	
C3		0.024	--	0.024	0.024		0.0231	0.0009	0.0005	0.0004	--	--	--	0.0236	
C4		0.017	--	0.017	0.017		0.0151	0.0019	0.0005	0.0014	--	--	--	0.0156	
C5		0.013	--	0.0136	0.0136		0.0094	0.0042	0.0003	0.0039	--	--	--	0.0097	
C6		0.0071	--	0.0071	0.0071		0.0035	0.0036	0.0001	0.0035	0.00006	--	0.00006	0.0036	
C7		0.0053	--	0.0053	0.0053		0.0014	0.0039	--	0.0039	0.00006	--	0.00006	0.0015	
C8		0.0046	--	0.0046	0.0046		0.0005	0.0041	--	0.0041	0.00008	--	0.00008	0.0005	
C9		0.0042	--	0.0042	0.0042		0.00025	0.0039	--	0.0039	0.00011	--	0.00011	0.0003	
C10		0.0037	--	0.0037	0.0037		0.00007	0.00355	--	0.00355	0.00014	--	0.00018	0.0008	
C11		0.0031	0.0001	0.0030	0.0030		0.00003	0.0030	--	0.0030	0.00017	--	0.00017	0.00003	
C12		0.0030	0.0001	0.0030	0.0030		0.00001	0.00295	--	0.00295	0.00024	--	0.00024	0.00001	
C13		0.0025	0.0001	0.0024	0.0024		0.00001	0.00242	--	0.00242	0.00028	--	0.00028	0.00001	
C14		0.0024	0.0001	0.0023	0.0023		--	0.00229	--	0.00229	0.00040	--	0.00040	--	
C15		0.0020	0.0001	0.0019	0.0019		--	0.00192	--	0.00192	0.00048	--	0.00048	--	
C16		0.0016	0.0001	0.0016	0.0016		--	0.00155	--	0.00155	0.00055	--	0.00055	--	
C17,18		0.0027	0.0002	0.0025	0.0025		--	0.00252	--	0.00252	0.00128	--	0.00128	--	
C19,20		0.0022	0.0002	0.0020	0.0020		--	0.00198	--	0.00198	0.00172	--	0.00172	--	
C21,22		0.0016	0.0004	0.0012	0.0012		--	0.00120	--	0.00120	0.0025	--	0.0025	--	
C23,24		0.0012	0.0005	0.00074	0.00074		--	0.00074	--	0.00074	0.00296	--	0.00296	--	
C25,26		0.0008	0.0004	0.00043	0.00043		--	0.00043	--	0.00043	0.00297	--	0.00297	--	
C27+		0.0002	0.0002	0.00004	0.00004		--	0.00004	--	0.00004	0.00776	--	0.007757	--	
Total Moles/Hr	3.63	2.026	0.002	2.024	2.024		1.955	0.0692	0.0155	0.0538	0.0230	0.0006	0.0222	1.9708	
Enthalpy, BTU/Hr			18,608		7,837		7,845	-1	68	-69	2,219	4	1,205	7,917	

TABLE 5

Heat and Material Balance - Case 2

BALANCE POINT	1	2	3	4	5	6	7	8	9	10-Org.	10AQ	11	12	13	14	15
PSIA/ F Phase	320/70 Gas	317/476 Gas	317/400 Liquid	317/400 Gas	317/100 Mixed	317/42 Mixed	317/42 Gas	317/42 Liquid	45/42 Gas	45/42 Organic Liquid	 Aqueous Liquid	317/482 Liquid	45/300 Gas	45/300 Liquid	45/100 Gas	650/70 Water
H	1.553	0.795		0.795	0.795	0.795	0.79495	0.00005	0.00005	--	--	--	--	--	0.795	
CO	3.077	2.607	.002	2.605	2.605	2.605	2.6065	0.00045	0.00039	0.00006	--	--	.00019	0.00001	2.607	
CO2		0.075	--	0.075	0.075	0.075	0.0748	0.0002	0.00005	0.00015	--	0.00018	--	--	0.07485	
H2O		0.323	--	0 321	0.321	0.321	0.0032	0.3198	--	--	0.3197	--	--	--	0.0031	0.5
Ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Ethanol		0.00172	--	0.00172	0.00172	0.00172	0.00008	0.00164	--	0.00002	0.00162				0.00008	
C1		0.0192	--	0.192	0.192	0.192	0.0192	--	--	--	--	--	--	--	0.0192	
C2		0.0017	--	0.0017	0.0017	0.0017	--	--	--	--	--	--	--	--	0.0017	
C3		0.0032	--	0.0032	0.0032	0.0032	0.00316	0.00004	--	0.00004	--	--	--	--	0.00316	
C4		0.0028	--	0.0028	0.0028	0.0028	0.00262	0.00013	--	0.00014	--	--	--	--	0.00261	
C5		0.0025	--	0.0025	0.0025	0.0025		0.00044	--	0.00049	--	--	--	--	0.00201	
C6		0.0019	--	0.0019	0.0019	0.0019	0.00114	0.00076	--	0.00076	--	--	--	--	0.00115	
C7		0.00140	0.00001	0.00139	0.00139	0.00139	0.00045	0.00094	--	0.00094	--	--	--	--	0.00045	
C8		0.00128	0.00001	0.00127	0.00127	0.00127	0.00014	0.00113	--	0.00113	--	--	--	--	0.00014	
C9		0.00155	0.00003	0.00152	0.00152	0.00152	0.00009	0.00144	--	0.00143	--	--	--	--	0.00009	
C10		0.00174	0.00005	0.00168	0.00168	0.00168	0.00003	0.00166	--	0.00166	--	--	--	--	0.00003	
C11		0.00170	0.00009	0.00161	0.00161	0.00161	0.00001	0.00160	--	0.00160	--	0.00001	--	--	0.00001	
C12		0.00152	0.00008	0.00144	0.00144	0.00144	--	0.00144	--	0.00144	--	0.00001	--	--	--	
C13		0.00145	0.00011	0.00134	0.00134	0.00134	--	0.00134	--	0.00134	---	0.00001	--	0.00001	--	
C14		0.00137	0.00017	0.00120	0.00120	0.00120	--	0.00120	--	0.00120	--	0.00002	--	0.00002	--	
C15		0.00134	0.00036	0.00098	0.00098	0.00098	--	0.00109	--	0.00109	--	0.00003	--	0.00003	--	
C16		0.00137	0.00035	0.00102	0.00102	0.00102	--	0.00102	--	0.00102	--	0.00004	--	0.00004	--	
C17,18		0.00275	0.00096	0.00179	0.00179	0.00179	--	0.00179	--	0.00179	--	0.00009	--	0.00009	--	
C19,20		0.00276	0.00136	0.00140	0.00140	0.00140	--	0.00140	--	0.00140	--	0.00013	--	0.00013	--	
C21,22		0.00370	0.00275	0.00095	0.00095	0.00095	--	0.00095	--	0.00095	--	0.00027	--	0.00027	--	
C23,24		0.00370	0.00275	0.00095	0.00095	0.00095	--	0.00043	--	0.00043	--	0.00047	--	0.00047	--	
C25,26		0.00696	0.00086	0.00010	0.00010	0.00010	--	0.00010	--	0.00010	--	0.00059	--	0.00059	--	
C27+		--	--	--	--	--	--	--	--	---	--	0.00137	--	0.00137	--	
Total Moles/Hr	4.63	3.851	0.008	3.851	3.851	3.851	3.510	0.341	0.0005	0.00192	0.321	0.00322	0.00019	0.00305	3.511	
Enthalpy, BTU/Hr				29,295	10,225	7,575	12,047	-5,237	2	-70	-5169	319	1	180		

TABLE 6

Heat and Material Balance - Case 2A

BALANCE POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PSIA/ F	325/70	322/499	322/480	322/480	322/100		322/100	322/100	45/100	45/100	322/500	45/296	45/300	45/100	311/70
Phase	Gas	Gas	Liquid	Gas	Mixed		Gas	Liquid	Gas	Liquid	Liquid	Gas	Liquid	Gas	Water
H2	1.66	0.166	--	0.166	0.166		0.1659	0.0001	0.0001	--	--	--	--	0.166	
CO	2.97	0.297	--	0.297	0.297		0.2966	0.0004	0.0004	--	--	--	--	0.297	
CO2		1.329	--	1.329	1.329		1.3128	0.0162	0.0135	0.0027	0.0010	0.0006	0.0004	1.3269	
H2O		0.0102	--	0.0102	0.0102		0.0100	0.00017	0.00012	0.00005	--	--	--	0.0102	10.5
Ether		--	--	--	--		--	--	--	--	--	--	--	--	
Ethanol		0.0059	--	0.0059	0.0059		0.0044	0.0015	0.00015	0.00132	--	--	--	--	
C1		0.0656	--	0.0656	0.0656		0.0653	0.0003	0.0003	--	--	--	--	0.0656	
C2		0.0058	--	0.0058	0.0058		0.0051	0.0001	0.0001	--	--	--	--	0.0058	
C3		0.0109	--	0.0109	0.0109		0.0104	0.0005	0.0003	0.0002	--	--	--	0.0107	
C4		0.0094	--	0.0094	0.0094		0.0082	0.0012	0.0003	0.0009	--	--	--	0.00847	
C5		0.0085	--	0.0085	0.0085		0.0055	0.0030	0.0002	0.0027	--	--	--	0.00575	
C6		0.0065	--	0.00645	0.00645		0.0029	0.0036	0.0001	0.0035	0.00005	--	0.00005	0.00300	
C7		0.0047	--	0.00465	0.00465		0.0011	0.00355	--	0.0035	0.00005	--	0.00005	0.00115	
C8		0.0042	--	0.00423	0.00423		0.00038	0.00385	--	0.0038	0.00007	--	0.00007	0.00040	
C9		0.0051	--	0.00508	0.00508		0.00026	0.00482	--	0.0048	0.00012	--	0.00012	0.00027	
C10		0.0056	--	0.0056	0.0056		0.00010	0.0055	--	0.0055	0.00020	--	0.00020	0.00010	
C11		0.0053	--	0.00522	0.00522		0.00004	0.00518	--	0.0052	0.00028	--	0.00028	0.00004	
C12		0.0047	--	0.00464	0.00464		0.00002	0.00462	--	0.0046	0.00036	--	0.00036	0.00002	
C13		0.0041	--	0.00414	0.00414		0.00001	0.00413	--	0.0041	0.00046	--	0.00046	0.00001	
C14		0.0037	--	0.00361	0.00361		--	0.00361	--	0.0036	0.00059	--	0.00059	--	
C15		0.0032	--	0.00308	0.00308		--	0.00308	--	0.0031	0.00072	--	0.00072	--	
C16		0.0028	--	0.0027	0.0027		--	0.00270	--	0.0027	0.00090	--	0.00090	--	
C17,18		0.0046	0.0002	0.00432	0.00432		--	0.0043	--	0.0043	0.00208	--	0.00208	--	
C19,20		0.0032	0.0003	0.00286	0.00286		--	0.0029	--	0.0029	0.00234	--	0.00234	--	
C21,22		0.0018	0.0003	0.001112	0.001112		--	0.00142	--	0.00142	0.00278	--	0.00278	--	
C23,24		0.00095	0.0003	0.001112	0.001112		--	0.00142	--	0.00142	0.00278	--	0.00278	--	
C25,26		0.00049	0.0007	0.00032	0.00032		--	0.00032	--	0.00032	0.00208	--	0.00208	--	
C27+		0.0002	0.0002	--	--		--	0.00003	--	0.00003	0.00467		0.00467	--	
Total Moles/Hr	4.63	1.969	0.0015	1.967	1.967		1.8897	0.00776	0.0155	0.0620	0.0213	0.0006 4	.0209	1.906	
Enthalpy, BTU/Hr				18,123	7,560		7,518	45	67	-21			1,064		

TABLE 7

Summary of Flow Rates
5" Effective Diameter Fischer-Tropsch Reactor

	CASE 1	CASE 1A	CASE 2	CASE 2A
Syn Gas, #-moles/hr	4.63	4.63	4.63	4.63
carbon monoxide	2.81	2.97	3.08	2.97
hydrogen	1.82	1.66	1.55	1.66
Product Gas, #-moles/hr	3.30	1.97	3.51	1.91
Wax, #-moles/hr	0.008	0.022	0.003	0.021
pounds/hr	2.7	7.2	1.1	6.1
Distillate, #-moles/hr	0.024	0.054	0.019	0.062
pounds/hr	3.7	7.4	3.5	9.8
Aqueous Phase, #-moles/hr	0.069	--	0.32	--
pounds/hr	1.5	--	5.8	--

TABLE 8

Summary of Wax Compositions
(units are mole %)

COMPONENT	CASE 1	CASE 1A	CASE 2	CASE 2A
C10-	0.6	4.0	0.5	7.2
C11	0.2	0.8	0.3	1.4
C12	0.3	1.1	0.4	1.7
C13	0.4	1.3	0.5	2.2
C14	0.6	1.8	0.6	2.9
C15	0.7	2.2	0.8	3.5
C16	0.9	2.5	1.1	4.4
C17, 18	2.3	5.8	3.0	10.1
C19, 20	3.6	7.7	4.2	11.4
C21, 22	8.7	11.3	8.8	13.5
C23, 24	16.8	13.3	15.5	11.9
C25, 26	19.2	13.4	19.2	10.1
C27+	45.6	34.9	44.9	22.7

TABLE 9A

Distillate Product Recovery Distribution for Case 1

COMPONENT	% TO WAX	% TO DISTILLATE	% TO GAS
C7	0.2	74.2	25.4
C8	0.4	91.4	8.1
C9	0.5	95.3	4.2
C10	0.8	98.2	1.2
C11	1.2	98.5	0.6
C12	1.8	97.9	--
C13	2.4	97.5	--
C14	3.5	96.6	--
C15	5.0	95.2	--
C16	7.2	92.5	--
C17, 18	10.2	89.8	--
C19, 20	16.8	83.3	--
C21, 22	40.0	60.0	--
C23, 24	77.0	23.0	--
C25, 26	95.3	4.6	--

TABLE 9B

Distillate Product Recovery Distribution for Case 1A

COMPONENT	% TO WAX	% TO DISTILLATE	% TO GAS
C7	1.1	72.2	27.7
C8	1.7	87.2	10.6
C9	2.6	90.7	6.9
C10	4.7	98.4	2.1
C11	5.3	93.8	0.9
C12	7.5	92.2	0.3
C13	10.4	89.6	0.2
C14	14.8	84.8	0.1
C15	20.0	80.0	--
C16	26.2	73.8	--
C17, 18	33.7	66.3	--
C19, 20	46.5	53.5	--
C21, 22	67.6	32.4	--
C23, 24	80.0	20.0	--
C25, 26	87.4	12.6	--

TABLE 9C

Distillate Product Recovery Distribution for Case 2

COMPONENT	% TO WAX	% TO DISTILLATE	% TO GAS
C7	--	67.6	32.4
C8	--	89.0	11.0
C9	--	94.0	5.9
C10	--	98.2	1.8
C11	0.6	98.8	0.6
C12	0.6	99.3	--
C13	0.6	99.3	--
C14	1.6	98.4	--
C15	2.7	97.3	--
C16	3.8	97.1	--
C17, 18	4.8	95.2	--
C19, 20	8.5	91.5	--
C21, 22	22.1	77.9	--
C23, 24	52.2	47.8	--
C25, 26	85.5	14.5	--

TABLE 9D

Distillate Product Recovery Distribution for Case 2A

COMPONENT	% TO WAX	% TO DISTILLATE	% TO GAS
C7	1.1	74.5	24.5
C8	1.6	88.4	9.3
C9	2.3	92.3	5.2
C10	3.5	94.8	1.7
C11	5.1	94.6	0.7
C12	7.2	92.0	0.4
C13	10.0	89.2	0.2
C14	14.1	85.7	--
C15	18.9	81.5	--
C16	25.0	75.0	--
C17, 18	32.5	67.2	--
C19, 20	45.0	55.7	--
C21, 22	66.2	33.8	--
C23, 24	79.0	21.0	--
C25, 26	86.7	13.3	--

TABLE 10

Summary of Heat Exchanger Duties
5" Effective Diameter Fischer-Tropsch Reactor
(units of MBTU/hr)

EXCHANGER	CASE 1	CASE 1A	CASE 2	CASE 2A
E-101 (Reactor)	85	216	10.4	214.8
E-301 (condenser)	4.1	0.85	3.8	0.59
E-601 (wax)	0.38	1.0	0.14	0.45
E-102 (100°F)	10.1	10.7	15.7	10.6
E-202 (42°F)	2.1	--	2.5	--

TABLE 11

Items Assumed Available From LaPorte Methanol System

- Inlet Gases Flow Metering Train
- Feed Gas Compressor
- Heat Transfer Fluid System
- 300# Steam
- Transformer
- Flare
- Control-Room Trailer
- Computer
- In-Ground Distillate Tank
- Cooling Water

Items Assumed Available from Current Program

- GC
- Product Analysis Train

TABLE 12

Major Equipment Costs

Reactor (V-1)		$ 20,300
Sedimentation Vessels (V-501 A & B)		9,200
Other Vessels		21,800
V-101	$1,800	
V-201	800	
V-301	1,000	
V-401	6,000	
V-601	700	
V-701	2,300	
V-801	1,000	
V-2	800	
V-102	600	
V-103	700	
In-Line Filters (3)	5,500	
Heat Exchangers		$ 8,100
E-301	$1,200	
E-111	1,100	
E-102	2,300	
E-202	1,200	
E-401	2,300	
Load Cells (2)		$ 5,200
Refrigerator		2,400
Mixer		1,700
Level Transmitters		5,800
Pumps		3,300
P-3	$2,700	
P-11	600	

Table 12 Continued

Process Controllers		$ 15,740
20 Temperature Controllers	$9,900	
3 Level Controllers LC-1, LC-101, LC-2	1,965	
2 Pressure Controller PC-2, PC-103	1,310	
1 Flow Controller FC-401	665	
4 Manual Lond Stations	1,200	
2 Power Supplies	700	
Heaters		$ 13,580
Reactor, H-1	$7,750	
H-201	1,120	
H-301	790	
H-601	860	
H-701	500	
H-801	860	
Line Heaters, Steam Tracing	1,700	
Control Valves		$ 14,500
Regulators		1,200
Pressure Transmitters		3,000
Jacketed Piping		3,000
Exit Gas Flow Measurement (turbine meter, etc.)		2,000
Feed Gas System Modification		3,000
Computer Boards		8,000
TOTAL		$140,900
Purchasing Overhead		2,300
TOTAL MAJOR EQUIPMENT COST		$143,200

TABLE 13

Labor Costs

FUNCTION	HOURS/$1,000 MAJOR EQUIPMENT	ABSOLUTE HOURS
Design, Specification, Purchasing	20	2,864
Mechanical Fabrication	20	2,864
Electrical/Instrument Fabrication	9	1,289
Calibration/Testing	3	430
Machining	1	143
Supervision	4	573
Instructions/Hazards Review	2	286
Start-Up	6	286
TOTAL HOURS	65	9,308

At current labor rates, Total Labor Cost = $290,000

TABLE 14

Summary of Capital Costs

Major Equipment Cost	$143,200
Additional Equipment Cost	45,100
Labor Cost	290,000
Total Cost Estimate	$478,300
Contingency @ 15%	71,700
TOTAL CAPITAL COST REQUIRED	$550,000

TABLE 15

Projected Annual Operating Costs (August 1985 $)
(assumes 4000 hrs/yr on-stream time)

Maintenance	$100,000
Waste disposal	6,000
Power	23,000
Telephone	6,000
Computer	13,200
Contracted Analytical Services	50,000
Subtotal	$198,200
Materials:	
Carbon Monoxide	$105,100
Hydrogen	17,500
Misc. Chem. and Lube	22,500
Nitrogen	2,400
Cooling Water	4,400
Steam	500
Subtotal	$152,400
Labor:	
Plant Operator (1/shift, 200 days)	$110,400
CRSD Analytical (1 shift, 200 days)	112,000
Engineers (2)	220,000
Plant Supervisor	21,000
Travel and Living Allowance (100 manweeks)	100,000
Subtotal	$563,400
Total Annual Operating Cost	$914,000

TABLE 16

#2 Diesel Fuel

TEST SPECIFICATION	
1. Flash Point, Pensky-Martens Closed Tester	ASTM D93
2. Cloud Point	ASTM D2500
3. Water and Sediment	ASTM D1796
4. Conradsen Carbon, 10%	ASTM D524 (Raush)
5. Ash, %	ASTM D482
6. Distillation	ASTM D86
7. Viscosity, Kin.	ASTM D445
8. Sulfur	ASTM D129
9. Copper Strip Corr.	ASTM D130
10. Cetane No.	ASTM D613
10a. Cetane No. Cal. (1) API Gravity	ASTM D976
11. Density @ 15°C	Fed Spec. VV-F-800B, Df-2 Conus

TABLE 17

Experimental Basis for Design Cases

	Case 1	Case 2
Run Number/Sample	7516-30-1.2-30	7077-75-C48.4-29
Reactor Pressure, psig	307.5	302
Reactor Temperature, °F	500	482
Inlet CO/H_2 Molar Ratio	1.551	1.98
GHSV,* hrs^{-1}	295	348
m^3 gas/Kg cat/hr	1.52	2.58
Impeller, rpm	1200	1600
Catalyst Activity (mol syngas/Kg cat/hr)	31.2	30.6
Usage Ratio ($\frac{\text{moles } H_2 \text{ consumed}}{\text{moles CO consumed}}$)	0.66	1.64
Selectivity, wt %		
C_1	4.3	5.6
C_5-C_{11}	22.0	23.5
C_9-C_{25}	47.5	64.6
C_{26}-C_{40}	20.6	12.5
Carbon Balance+, %	101	121
H_2 Balance++, %	99	119

*Gas hourly space velocity
+Carbon balance = (CO conversion based on products)/(CO conversion based on CO)
++Hydrogen balance = (H_2 conversion based on products)/(H_2 balance based on H_2)