APPENDIX E

Fischer-Tropsch IV Mass Balance

Start Date / Time	10/21/1998	0.00
End Date / Time	10/21/1998	6.00

On-stream Time From Start-up (hr)

Start	106.00
End	112.00

Reaction Conditions:

Temperature	average	deg F	495.5	deg C	257.6
Pressure	PIC-201	psig	710.0	bara	49.96
Space Velocity		sL/kg-hr	15487		
Superficial Gas Vel. - Inlet (based on average reactor temp)		ft/sec	0.42	cm/sec	12.91
Recycle Ratio			1.23		

Slurry Data:

Catalyst Oxide Wt (Reactor)	lbs	390	kg	176.9
Slurry Concentration by NDG	wt%	28.5		
Slurry Concentration by DP	wt%	28.0		
Slurry Level by NDG	% NDG Span	96.5		
Slurry Height	ft	20.76	meters	6.33
Average Gas Holdup by NDG	Vol%	50.3		
Average Gas Holdup by DP	Vol%	48.1		

Performance Results

CO Conversion per pass, mole %	29.6
H2 Conversion per pass, mole %	59.7
CO + H2 Conversion per pass, mole %	45.7
Plant CO Conversion, mole%	75.6
Plant H2 Conversion, mole%	91.4
Plant CO+H2 Conversion, mole%	85.9
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	78.2
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1088.1
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	131.21
H2/CO in Fresh Feed, mole/mole	1.87
H2/CO in Reactor Feed, mole/mole	1.15
H2/CO Usage Ratio, mole/mole	2.32
H2/CO in Outlet, mole/mole	0.66
CO2 Selectivity, mole %	1.33
HC Selectivity (CO2 free) wt%:	
CH4	13.14
C2H6	2.19
C2H4	0.23
C3H8	2.38
C3H6	1.53
SUM C4H10	1.88
SUM C4H8	1.11

Reactor Heat Balance

	Btu/hr	kW
Chemical Heat Production by Reaction	746477	218.77
Sensible Gas Heat	-102535	-30.05
Sensible Oil Heat	-502539	-147.28
Sensible Wax Heat	-85097	-24.94
Estimate of Heat Loss from Catalyst Drying Data	-35000	-10.26
% Heat Balance based on Reaction Heat	97.15	

Mass Balance	Reactor lb/hr	Plant lb/hr	Feed lb/hr	Prod Gas lb/hr
Fresh Feed		1293	1293	
HP H2 Feed				
Recycle Feed		89	89	
Reactor Feed			3064	3064
Total In	4443		4443	
Prod Gas	4443	1383		
Main Purge		496		496
22.11 Purge	0.0	0.0		
HC Phase	292.4	292.4		
AQ Phase	562.9	562.9		
Heavy Wax	59.2	59.2		
Light Wax				
Total Out	4478	1411		
Mass Balance, %	100.8	102.0	99.9	99.9

SUM C5H11	1.38		

RUN NO.: AF-R16.1A **TITLE: LIQUID PHASE FISCHER-TROPSCH (IV) SYNTHESIS IN LAPORTE AFDU**

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	43.17	100.00	27.62	44.00	27.62	27.62	10.89	23.34
2	N2	3.12	0.00	9.97	6.41	9.97	9.97	5.76	8.43
3	CO	53.71	0.00	41.82	38.19	41.82	41.82	32.26	35.34
4	CH4	0.00	0.00	14.08	7.73	14.08	14.08	22.20	11.90
5	CO2	0.00	0.00	1.68	0.93	1.68	1.68	7.34	1.42
6	ETHANE	0.00	0.00	1.29	0.71	1.29	1.29	4.41	1.09
7	ETHYLENE	0.00	0.00	0.02	0.00	0.02	0.02	0.06	0.02
8	PROPANE	0.00	0.00	0.99	0.55	0.99	0.99	5.10	0.83
9	PROPYLENE	0.00	0.00	0.66	0.36	0.66	0.66	3.35	0.56
10	ISOBUATNE	0.00	0.00	0.01	0.00	0.01	0.01	0.06	0.01
11	N-BUTANE	0.00	0.00	0.47	0.26	0.47	0.47	2.71	0.40
12	T-BUTENE-2	0.00	0.00	0.04	0.02	0.04	0.04	0.21	0.03
13	BUTENE-1	0.00	0.00	0.26	0.14	0.26	0.26	1.51	0.22
14	ISOBUTYLENE	0.00	0.00	0.03	0.02	0.03	0.03	0.16	0.03
15	C-BUTENE-2	0.00	0.00	0.05	0.03	0.05	0.05	0.28	0.04
16	SUM C5	0.00	0.00	0.35	0.19	0.35	0.35	1.86	0.29
17	SUM C6	0.00	0.00	0.12	0.08	0.12	0.12	0.60	0.10
18	SUM C7	0.00	0.00	0.34	0.24	0.34	0.34	0.97	0.29
19	SUM C8	0.00	0.00	0.21	0.13	0.21	0.21	0.25	0.18
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								14.49
	HC								1.01
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.79	2.02	20.59	16.50	20.59	20.59	28.59	21.44
Flows	SCFH	29784.74	17095.50	57552.93	104137.00	66922.63	9316.93	0.00	79198.31
	lb mole/hr	77.03	44.21	148.85	269.33	173.09	24.10	0.00	204.83
	lb/hr	1293.32	89.31	3064.42	4443.17	3563.31	496.08	0.00	4391.97
	Nm3/hr	783.82	449.89	1514.57	2740.49	1761.15	245.19	0.00	2084.20
	kgmoVhr	34.94	20.06	67.52	122.17	78.51	10.93	0.00	92.91
	kg/hr	586.65	40.51	1390.01	2015.41	1616.31	225.02	0.00	1992.19
Temperature	deg F	278.2	81.8	109.9	257.0	88.4	84.9	69.7	
	deg C	136.8	27.6	43.3	125.0	31.3	29.4	20.9	
Pressure	psig	771.8	806.0	766.2	737.9	674.3	670.4	33.3	
	bara	54.23	56.59	53.84	51.89	47.50	47.23	3.31	

Reactor Heat Balance

		deg F	deg C			lb/hr	kg/hr		Btu/lb-deg F	J/gm-deg C			
Gas:													
Inlet Temp	TI-1-12A	442.0	227.8	Inlet Flow	RXT FEED	4443	2015.4	Inlet Ht Cap.	0.486	2.033			
Outlet Temp	RXT AVG	495.5	257.5	Outlet Flow	RXT FEED-WAXPROD	4384	1988.6	Outlet Ht Cap.	0.433	1,810			
Oil:												**lb/ft3**	**kg/m3**
Inlet Temp	TI-1-14B	406.1	207.9	Inlet Flow	*FI-619	66472	30151.3	Inlet Ht Cap.	0.542	2.268	Inlet Density	51.98	832.62
Outlet Temp	TI-1780	457.3	236.3	Outlet Flow	*FI-619	66472	30151.3	Outlet Ht Cap.	0.564	2.361			
Slurry:													
Inlet Temp	TI-1783	458.9	237.2	Inlet Flow	*FI-1768-61	10843	4918.2	Inlet Ht Cap.	0.606	2.537			
Outlet Temp	RXT AVG	495.5	257.5	Outlet Flow	*FI-1768	10902	4945.0	Outlet Ht Cap.	0.606	2.537			
					*based on								

Reactor Differential Pressures

	DP NOZZLES		Differential Pressures:		Heights:		Density - 3 Phase:		Gas Hold-up
			psi	**mbar**	**ft** (based on flange loc.)	**meters**	**lb/ft3**	**kg/m3**	**vol%**
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.84	58.2	4.56	1.391	26.64	426.7	48.1
9.25 ft to 4.33 ft	K3-K5	PDI-1779	0.94	64.7	5.08	1.549	26.60	426.0	48.10
Total Reactor	K6-OUT	PDI-631	3.94	271.5	96.47	29.404	6.81	109.0	88.72
Sparger	K6-IN	PDI-633	1.36	93.5					

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	388.1	197.8		
3.5 ft Height	TI-1763	432.6	222.6		
0.5 ft Height	TI-1764	497.8	258.8		
Liquid Level:					
% Level	LI-1765				
Slurry Height		ft 3.32		meters	1.013

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	465.7	240.9
	Seal Oil Outlet	TI-1 795	109.7	43.2
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	743.5	52.28
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10901.8	4945.3
			g/cc	
Density:	Slurry Outlet	DI-1768	0.824	

SLURRY COOLER

Temperatures:		**deg F**	**deg C**
Slurry Outlet	TIC-1754	461.3	238.5

Oil Inlet	TI-1780	457.3	236.3

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	458.9	237.2	Flow Rate:	Wax	FI-1761	59.166	26.837
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	728.8	51.26	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	9.3	638	Linear Vel.:	Slurry thru	Calculated	10.80	3.291
	Thru B & A	PDI-1773	0.2	14		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	0.9	0	Superfic. Vel.:	Liquid Upflow	Calculated	0.023	7.144
	Membrane B	PDI-1775	1.3	92		thru Reactor			
	Membrane C	PDI-1776	-0.9	-62					
	Membrane D	PDI-1777	0.9	65					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	478.0	247.8
Nozzle N2	20.25	TI-626-2	493.2	256.2
Nozzle N3	18.25	TI-190-2A	493.3	256.3
Nozzle N4	16.25	TI-626-3	492.0	255.6
Nozzle N5	14.25	TI-190-3	491.1	255.1
Nozzle N7	10.25	TI-1781A	497.8	258.8
		TI-1781B	496.6	258.1
		TI-1781C	498.3	259.1
		TI-1781D	497.0	258.3
Nozzle N8	8.083	TI-626-5	493.2	256.2
Nozzle K4	7.75	TI-190-4	500.8	260.5
Nozzle O	4.792	TI-626-6	494.8	257.1
Reactor Temp. Avg. (Noz N3 thru Noz O)				495.5
	257.5			

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	461.0	238.3
	22.14 Out	TIC-725	325.5	163.0
	21.65 Out	TIC-1-11A	87.2	30.7
	27.13 Lt Wax	TI-744	119.8	48.8
	28.30 Hv Wax	TI-515	210.8	99.3
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	142.4	
	22.10	LIC-220	18.9	
	22.15	LIC-242	32.8	
	27.13	LI-203	19.5	
	28.30	LI-1792	105.0	
			psig	**bara**
Pressure	27.13	PIC-202	-0.15	1.00

Miscellaneous Data

Overall Plant Material Balance	%	102.2
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)		
Reactor GHSV Nm3 Rxt Feed/m3 3-phase slurry volume/hr		1867
Catalyst GHSV Nm3 Rxt Feed/m3	particle volume/hr	14279
Catalyst Volume in the Reactor	litres particle volume	191.9
Inlet Superfic. Vel. based on Avg Reactor Temp.	cm/sec	12.91
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)	cm/sec	12.19
CO Conversion Rate, gmole CO converted AR particl volume/hr		72.11
grams of HC (CH2.1) produced/lft particle volume/hr		1003.24

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
99.96	99.95	100.11 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
105.38		99.92

Wax/Liquid Production Rates

	lbs/hr	**kg/hr**
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	59.17	26.84
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	292.44	132.65
Water (22.10/22.16, 100 deg F Cut)	562.90	255.33

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	24.22
	catalyst wt%	27.12

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.:		**Based on Water Production:**	
	psia	**mbara**	**psia**	**mbara**
Calculated Water Partial Pressure @ Reactor Outlet	102.86	70.92	107.56	7416
Saturated Water Pressure @ Reactor Outlet	655.2	45173	655.2	45173
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	15.70%		16.42%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	329.6	165.3		167.1

Start Date / Time	04/03/1998	12.00
End Date / Time	04/04/1998	8.00

On-stream Time From Start-up (hr)	
Start	142.00
End	162.00

Reaction Conditions:					
Temperature	average	deg F	498.1	deg C	259.0
Pressure	PIC-201	psig	710.0	bara	49.97
Space Velocity		sL/kg-hr	14925		
Superficial Gas Vel. - Inlet (based on average reactor temp)		ft/sec	0.41	cm/sec	12.48
Recycle Ratio			1.14		

Slurry Data:				
Catalyst Oxide Wt (Reactor)	lbs	390	kg	176.9
Slurry Concentration by NDG	wt%	28.8		
Slurry Concentration by DP	wt%	27.7		
Slurry Level by NDG % NDG Span		96.5		
Slurry Height	ft	20.77	meters	6.33
Average Gas Holdup by NDG	Vol%	50.5		
Average Gas Holdup by DP	Vol%	47.3		

Performance Results	
CO Conversion per pass, mole %	33.1
H2 Conversion per pass, mole %	59.9
CO + H2 Conversion per pass, mole %	47.6
Plant CO Conversion, mole%	76.8
Plant H2 Conversion, mole%	91.3
Plant CO+H2 Conversion, mole%	86.3
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	83.0
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1155.1
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	139.23
H2/CO in Fresh Feed, mole/mole	1.88
H2/CO in Reactor Feed, mole/mole	1.17
H2/CO Usage Ratio, mole/mole	2.13
H2/CO in Outlet, mole/mole	0.70
CO2 Selectivity, mole %	1.33
HC Selectivity (CO2 free) wt%:	
CH4	13.95
C2H6	2.05
C2H4	0.08
C3H8	2.40
C3H6	1.46
SUM C4H10	1.89
SUM C4H8	1.24

Reactor Heat Balance	**Btu/hr**	**kW**
Chemical Heat Production by Reaction	2277851	667.57
Sensible Gas Heat	-118507	-34.73
Sensible Oil Heat	-1781173	-522.01
Sensible Wax Heat	-244482	-71.65
Estimate of Heat Loss from Catalyst Drying Data	-50000	-14.65
% Heat Balance based on Reaction Heat	96.33	

Mass Balance	**Reactor lb/hr**	**Plant lb/hr**	**Feed lb/hr**	**Prod Gas lb/hr**
Fresh Feed		1300	1300	
HP H2 Feed		89	89	
Recycle Feed			2790	2790
Reactor Feed	4202		4202	
Total In	4202	1390		
Prod Gas	3266			3266
Main Purge		481		481
22.11 Purge	0.0	0.0		
HC Phase	287.8	287.8		
AQ Phase	554.0	554.0		
Heavy Wax	59.2	59.2		
Light Wax				
Total Out	4167	1382		
Mass Balance, %	99.2	99.5	100.5	100.2

SUM C5H11	1.06		

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	43.59	100.00	28.14	44.25	28.14	28.14	8.18	23.35
2	N2	3.04	0.00	9.83	6.20	9.83	9.83	4.82	8.15
3	CO	53.37	0.00	40.06	37.72	40.06	40.G6	24.11	33.24
4	CH4	0.00	0.00	15.62	8.33	15.62	15.62	23.27	12.96
5	CO2	0.00	0.00	1.83	0.99	1.83	1.83	7.57	1.52
6	ETHANE	0.00	0.00	1.39	0.76	1.39	1.39	7.11	1.16
7	ETHYLENE	0.00	0.00	0.02	0.01	0.02	0.02	0.10	0.02
8	PROPANE	0.00	0.00	1.02	0.55	1.02	1.02	7.96	0.84
9	PROPYLENE	0.00	0.00	0.67	0.36	0.67	0.67	5.27	0.56
10	ISOBUATNE	0.00	0.00	0.01	0.00	0.01	0.01	0.09	0.01
11	N-BUTANE	0.00	0.00	0.46	0.24	0.46	0.46	4.03	0.38
12	T-BUTENE-2	0.00	0.00	0.04	0.02	0.04	0.04	0.31	0.03
13	BUTENE-1	0.00	0.00	0.26	0.12	0.26	0.26	2.33	0.22
14	ISOBUTYLENE	0.00	0.00	0.03	0.04	0.03	0.03	0.26	0.02
15	C-BUTENE-2	0.00	0.00	0.05	0.02	0.05	0.05	0.40	0.04
16	SUM C5	0.00	0.00	0.32	0.18	0.32	0.32	2.69	0.27
17	SUM C6	0.00	0.00	0.11	0.06	0.11	0.11	0.85	0.09
18	SUM C7	0.00	0.00	0.11	0.12	0.11	0.11	0.62	0.09
19	SUM C8	0.00	0.00	0.04	0.04	0.04	0.04	0.01	0.03
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								15.98
	HC								1.04
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.68	2.02	19.97	16.19	19.97	19.97	30.75	20.92
Flows	SCFH	30138.70	17101.00	54031.22	100355.33	63249.80	9314.22	0.00	76219.29
	lb mole/hr	77.95	44.23	139.74	259.55	163.59	24.09	0.00	197.13
	lb/hr	1300.26	89.34	2790.32	4201.68	3266.39	481.01	0.00	4123.30
	Nm3/hr	793.14	450.03	1421.90	2640.97	1664.49	245.11	0.00	2005.80
	kgmol/hr	35.36	20.06	63.39	117.73	74.20	10.93	0.00	89.42
	kg/hr	589.79	40.53	1265.68	1905.87	1481.62	218.19	0.00	1870.32
Temperature	deg F	266.7	82.5	98.2	238.1	75.5	74.4	73.4	
	deg C	130.4	28.0	36.8	114.5	24.2	23.5	23.0	
Pressure	psig	768.1	779.2	760.3	734.4	686.4	682.3	33.5	
	bara	53.97	54.74	53.43	51.65	48.34	48.06	3.32	

Reactor Heat Balance

		deg F	deg C			lb/hr	kg/hr		Btu/lb-deg F	J/gm-deg C			
Gas:													
Inlet Temp	TI-1-12A	440.7	227.0	Inlet Flow	RXT FEED	4202	1905.9	Inlet Ht Cap.	0.491	2.054			
Outlet Temp	RXT AVG	498.1	259.9	Outlet Flow	RXT FEED-WAXPROD	4143	1879.0	Outlet Ht Cap.	0.443	1.853			
Oil:												**lb/ft3**	**kg/m3**
Inlet Temp	TI-1-14B	409.4	207.7	Inlet Flow	*FI-619	66218	30036.7	Inlet Ht Cap.	0.543	2.274	Inlet Density	51.89	831.14
Outlet Temp	TI-1780	460.5	238.0	Outlet Flow	*FI-619	66218	30036.7	Outlet Ht Cap.	0.566	2.366			
Slurry:													
Inlet Temp	TI-1783	461.6	238.7	Inlet Flow	*FI-1768-61	11011	4994.5	Inlet Ht Cap.	0.608	2.544			
Outlet Temp	RXT AVG	498.1	259.0	Outlet Flow	*FI-1768	11070	5021.4	Outlet Ht Cap.	0.608	2.544			
					*based on								

Reactor Differential Pressures

	DP NOZZLES		Differential Pressures:		Heights:		Density - 3 Phase:		Gas Hold-up
			psi	mbar	ft (based on flange loc.)	meters	lb/ft3	kg/m3	vol%
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.85	58.4	4.56	1.391	26.75	428.5	47.56
9.25 ft to 4.33 ft	K3-K5	PDI-1779	0.95	65.7	5.08	1.549	27.01	432.6	47.03
Total Reactor	K6-OUT	PDI-631	3.94	271.5	20.77	6.331	26.83	429.7	47.40
Sparger	K6-IN	PDI-633	1.15	79.5					

DEGASSER

Temperatures:		**deg F**	**deg C**
6.5 ft Height	TI-1762	397.2	202.9
3.5 ft Height	TI-1763	455.6	235.3
0.5 ft Height	TI-1764	502.8	261.6

Liquid Level:					
% Level	LI-1765	2.9			
Slurry Height		ft 0.75		meters	0.229

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	469.1	242.8
	Seal Oil Outlet	TI-1 795	98.9	37.2
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	762.7	53.60
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	11070.1	5021.6
			g/cc	
Density:	Slurry Outlet	DI-1768	0.820	

SLURRY COOLER

Temperatures:	**deg F**	**deg C**

Slurry Outlet	TIC-1754	464.3	240.2
Oil Inlet	TI-1780	460.5	238.0

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	461.6	238.7	Flow Rate:	Wax	FI-1761	59.173	26.841
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	717.4	50.47	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	6.8	467	Linear Vel.:	Slurry thru	Calculated	11.01	3.356
	Thru B & A	PDI-1773	0.2	13		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	-0.6	-41	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.285
	Membrane B	PDI-1775	1.3	90		thru Reactor			
	Membrane C	PDI-1776	-1.3	-87					
	Membrane D	PDI-1777	0.2	15					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	480.3	249.0
Nozzle N2	20.25	TI-626-2	497.1	258.4
Nozzle N3	18.25	TI-190-2A	496.7	258.1
Nozzle N4	16.25	TI-626-3	495.4	257.5
Nozzle N5	14.25	TI-190-3	494.0	256.7
Nozzle N7	10.25	TI-1781A	500.7	260.4
		TI-1781B	499.5	259.7
		TI-1781C	501.0	260.6
		TI-1781D	499.7	259.9
Nozzle N8	8.083	TI-626-5	493.3	256.3
Nozzle K4	7.75	TI-190-4	503.7	262.1
Nozzle O	4.792	TI-626-6	497.4	258.6
Reactor Temp. Avg. (Noz N3 thru Noz O)				498.1
	259.0			

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	460.6	238.1
	22.14 Out	TIC-725	335.4	168.5
	21.65 Out	TIC-1-11A	74.1	23.4
	27.13 Lt Wax	TI-744	102.7	39.3
	28.30 Hv Wax	TI-515	217.9	103.3
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	90/6	
	22.10	LIC-220	30.0	
	22.15	LIC-242	27.8	
	27.13	LI-203	26.8	
	28.30	LI-1792	33.4	
			psig	**bara**
Pressure	27.13	PIC-202	12.41	1.87

Miscellaneous Data

Overall Plant Material Balance	%	99.46
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)		
Reactor GHSV Nm3 Rxt Feed/m3 3-phase slurry volume/hr		1799
Catalyst GHSV Nm3 Rxt Feed/m3	particle volume/hr	13761
Catalyst Volume in the Reactor	litres particle volume	191.9
Inlet Superfic. Vel. based on Avg Reactor Temp.	cm/sec	12.48
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)	cm/sec	11.73
CO Conversion Rate, gmole CO converted AR particle volume/hr		76.55
grams of HC (CH2.1) produced/Ift particle volume/hr		1065

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
99.94	100.01	99.91 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
97.71		100.15

Wax/Liquid Production Rates

	lbs/hr	**kg/hr**
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	59.17	26.84
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	287.84	130.56
Water (22.10/22.16, 100 deg F Cut)	554.05	251.31

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	22.90
	catalyst wt%	25.75

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.:		**Based on Water Production:**	
	psia	**mbara**	**psia**	**mbara**
Calculated Water Partial Pressure @ Reactor Outlet	113.47	7823	111.27	7672
Saturated Water Pressure @ Reactor Outlet	671.1	46273	671.1	46273
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	16.91%		16.58%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	336.8	169.3	335.4	168.5

Start Date / Time	04/04/1998	8.00
End Date / Time	04/05/1998	4.00

On-stream Time From Start-up (hr)

Start	162.00
End	182.00

Reaction Conditions:

Temperature	average	deg F	498.0	deg C	258.9
Pressure	PIC-201	psig	710.0	bara	49.97
Space Velocity		sL/kg-hr	14975		
Superficial Gas Vel. - Inlet		ft/sec	0.41	cm/sec	12.45
(based on average reactor temp)					
Recycle Ratio			1.11		

Slurry Data:

Catalyst Oxide Wt (Reactor)		lbs	388	kg	176.0
Slurry Concentration by NDG		wt%	28.6		
Slurry Concentration by DP		wt%	27.6		
Slurry Level by NDG	% NDG Span		96.5		
Slurry Height		ft	20.77	meters	6.33
Average Gas Holdup by NDG		Vol%	50.1		
Average Gas Holdup by DP		Vol%	47.3		

Performance Results

CO Conversion per pass, mole %	33.2
H2 Conversion per pass, mole %	60.5
CO + H2 Conversion per pass, mole %	48.4
Plant CO Conversion, mole%	75.7
Plant H2 Conversion, mole%	90.4
Plant CO+H2 Conversion, mole%	85.3
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	81.5
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1132.6
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	135.79
H2/CO in Fresh Feed, mole/mole	1.88
H2/CO in Reactor Feed, mole/mole	1.26
H2/CO Usage Ratio, mole/mole	2.30
H2/CO in Outlet, mole/mole	0.75
CO2 Selectivity, mole %	1.41
HC Selectivity (CO2 free) wt%:	
CH4	14.61
C2H6	2.42
C2H4	0.15
C3H8	2.51
C3H6	1.69
SUM C4H10	1.90
SUM C4H8	1.21

Reactor Heat Balance

	Btu/hr	kW
Chemical Heat Production by Reaction		
Sensible Gas Heat		
Sensible Oil Heat		
Sensible Wax Heat		
Estimate of Heat Loss from Catalyst Drying Data		
% Heat Balance based on Reaction Heat		

Mass Balance	Reactor lb/hr	Plant lb/hr	Feed lb/hr	Prod Gas lb/hr
Fresh Feed		1301	1301	
HP H2 Feed		89	89	
Recycle Feed			2641	2641
Reactor Feed	4039		4039	
Total In	4039	1390		
Prod Gas	3138			3138
Main Purge		498		498
22.11 Purge	0.0	0.0		
HC Phase	275.8	275.8		
AQ Phase	531.0	531.0		
Heavy Wax	52.7	52.7		
Light Wax				
Total Out	3997	1357		
Mass Balance, %	99.0	97.6	100.2	100.0

SUM C5H11	1.02		

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	43.54	100.00	29.59	46.37	29.59	29.59	9.41	24.58
2	N2	3.07	0.00	9.39	5.82	9.39	9.39	4.57	7.80
3	CO	53.39	0.00	39.71	36.78	39.71	39.71	25.39	32.99
4	CH4	0.00	0.00	15.15	7.81	15.15	15.15	21.44	12.59
5	CO2	0.00	0.00	1.73	0.90	1.73	1.73	6.67	1.44
6	ETHANE	0.00	0.00	1.38	0.71	1.38	1.38	7.24	1.15
7	ETHYLENE	0.00	0.00	0.02	0.00	0.02	0.02	0.11	0.02
8	PROPANE	0.00	0.00	1.01	0.53	1.01	1.01	8.18	0.84
9	PROPYLENE	0.00	0.00	0.67	0.34	0.67	0.67	5.28	0.55
10	ISOBUATNE	0.00	0.00	0.01	0.00	0.01	0.01	0.10	0.01
11	N-BUTANE	0.00	0.00	0.47	0.24	0.47	0.47	4.31	0.39
12	T-BUTENE-2	0.00	0.00	0.04	0.02	0.04	0.04	0.31	0.03
13	BUTENE-1	0.00	0.00	0.26	0.13	0.26	0.26	2.38	0.22
14	ISOBUTYLENE	0.00	0.00	0.03	0.02	0.03	0.03	0.28	0.03
15	C-BUTENE-2	0.00	0.00	0.05	0.02	0.05	0.05	0.41	0.04
16	sum C5	0.00	0.00	0.33	0.18	0.33	0.33	2.88	0.28
17	SUM C6	0.00	0.00	0.12	0.07	0.12	0.12	0.90	0.10
18	SUM C7	0.00	0.00	0.02	0.02	0.02	0.02	0.14	0.02
19	SUM C8	0.00	0.00	0.01	0.02	0.01	0.01	0.02	0.01
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								15.90
	HC								1.01
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.69	2.02	19.56	15.59	19.56	19.56	30.43	20.55
Flows	SCFH	30132.03	17104.10	52207.22	100178.56	62030.75	9842.83	0.00	74659.86
	lb mole/hr	77.93	44.24	135.03	259.10	160.43	25.46	0.00	193.10
	lb/hr	1301.01	89.36	2640.99	4039.26	3137.93	497.92	0.00	3968.45
	Nm3/hr	792.96	450.12	1373.90	2636.32	1632.41	259.03	0.00	1964.76
	kgmol/hr	35.35	20.07	61.25	117.53	72.77	11.55	0.00	87.59
	kg/hr	590.13	40.53	1197.94	1832.20	1423.36	225.85	0.00	1800.08
Temperature	deg F	272.0	85.2	104.2	238.7	83.8	81.3	69.3	
	deg C	133.4	29.6	40.1	114.8	28.8	27.4	20.7	
Pressure	psig	766.0	792.3	758.4	733.1	685.8	682.0	33.4	

bara	53.82	55.64	53.30	51.56	48.30	48.03	3.31	

RUN NO.: AF-R16.1C **TITLE: LIQUID PHASE FISCHER-TROPSCH (IV) SYNTHESIS IN LAPORTE AFDU**

Reactor Heat Balance

Gas:		**deg F**	**deg C**			**lb/hr**	**kg/hr**		**Btu/lb-deg F**	**J/gm-deg C**			
Inlet Temp	TI-1-12A	440.3	226.8	Inlet Flow	RXT FEED	4039	1832.2	Inlet Ht Cap.	0.505	2.112			
Outlet Temp	RXT AVG	498.0	258.9	Outlet Flow	RXT FEED-WAXPROD	3987	1808.3	Outlet Ht Cap.	0.448	1.875			
Oil:												**lb/ft3**	**kg/m3**
Inlet Temp	TI-1-14B	410.5	210.3	Inlet Flow	*FI-619	66226	30040.1	Inlet Ht Cap.	0.544	2.276	Inlet Density	51.86	830.65
Outlet Temp	TI-1780	461.0	238.3	Outlet Flow	*FI-619	66226	30040.1	Outlet Ht Cap.	0.566	2.367			
Slurry:													
Inlet Temp	TI-1783	462.3	239.0	Inlet Flow	*FI-1768-61	11011	4994.7	Inlet Ht Cap.	0.609	2.546			
Outlet Temp	RXT AVG	498.0	258.9	Outlet Flow	*FI-1768 *based on	11064	5018.6	Outlet Ht Cap.	0.609	2.546			

Reactor Differential Pressures

	DP NOZZLES		**Differential Pressures:**		**Heights:**		**Density - 3 Phase:**		**Gas Hold-up**
			psi	**mbar**	**ft** (based on flange loc.)	**meters**	**lb/ft3**	**kg/m3**	**vol%**
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.85	58.6	4.56	1.391	26.83	429.7	47.34
9.25 ft to 4.33 ft	K3-K5	PDI-1779	0.95	65.3	5.08	1.549	26.85	430.0	47.30
Total Reactor	K6-OUT	PDI-631	3.93	271.0	20.77	6.332	26.78	429.0	47.43
Sparger	K6-IN	PDI-633	1.12	77.2					

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	403.4	206.4		
3.5 ft Height	TI-1763	457.8	236.5		
0.5 ft Height	TI-1764	502.7	261.5		
Liquid Level:					
% Level	LI-1765	4.3			
Slurry Height	ft	1.01	meters	0.307	

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	469.7	243.2
	Seal Oil Outlet	TI-1 795	104.0	40.0
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	762.7	53.60
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	11064.1	5018.9
			g/cc	
Density:	Slurry Outlet	DI-1768	0.821	

SLURRY COOLER

Temperatures:		**deg F**	**deg C**
Slurry Outlet	TIC-1754	465.1	240.6
Oil Inlet	TI-1780	461.0	238.3

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	462.3	239.0	Flow Rate:	Wax	FI-1761	52.672	23.892
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	721.7	50.77	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	8.7	598	Linear Vel.:	Slurry thru	Calculated	11.00	3.353
	Thru B & A	PDI-1773	0.2	14		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	-0.1	-10	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.283
	Membrane B	PDI-1775	1.3	87		thru Reactor			
	Membrane C	PDI-1776	-1.1	-74					
	Membrane D	PDI-1777	0.5	33					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	480.2	249.0
Nozzle N2	20.25	TI-626-2	497.5	258.6
Nozzle N3	18.25	TI-190-2A	496.9	258.3
Nozzle N4	16.25	TI-626-3	495.7	257.6
Nozzle N5	14.25	TI-190-3	494.0	256.7
Nozzle N7	10.25	TI-1781A	500.4	260.2
		TI-1781B	499.3	259.6
		TI-1781C	500.9	260.5
		TI-1781D	499.6	259.8
Nozzle N8	8.083	TI-626-5	492.9	256.1
Nozzle K4	7.75	TI-190-4	503.4	261.9
Nozzle O	4.792	TI-626-6	497.0	258.4
Reactor Temp. Avg. (Noz N3 thru Noz O)			498.0	258.9

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.9
	2138 Tube In	TI-723	457.1	236.1
	22.14 Out	TIC-725	335.3	168.5
	21.65 Out	TIC-1-11A	82.5	28.0
	27.13 Lt Wax	TI-744	96.2	35.6
	28.30 Hv Wax	TI-515	240.8	116.0
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	57.4	
	22.10	LIC-220	30.0	
	22.15	LIC-242	31.5	
	27.13	LI-203	38.9	
	28.30	LI-1792	42.6	
			psig	**bara**
Pressure	27.13	PIC-202	10.84	1.76

Miscellaneous Data

Overall Plant Material Balance	%	97.63
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)		
Reactor GHSV Nm3 Rxt Feed/m3 3-phase slurry volume/hr		1795
Catalyst GHSV Nm3 Rxt Feed/m3	particle volume/hr	13807
Catalyst Volume in the Reactor	litres particle volume	190.9
Inlet Superfic. Vel. based on Avg Reactor Temp.	cm/sec	12.45
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)	cm/sec	11.70
CO Conversion Rate, gmole CO converted AR particle volume/hr		75.12
grams of HC (CH2.1) produced/Ift particle volume/hr		1044.25

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
99.98	100.04	99.99 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
96.06		100.03

Wax/Liquid Production Rates

	lbs/hr	kg/hr
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	52.67	23.89
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	275.84	125.12
Water (22.10/22.16, 100 deg F Cut)	530.96	240.84

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	23.00
	catalyst wt%	25.84

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.: psia	Based on CO, CO2 Meas.: mbara	Based on Water Production: psia	Based on Water Production: mbara
Calculated Water Partial Pressure @ Reactor Outlet	112.91	7785	109.14	7525
Saturated Water Pressure @ Reactor Outlet	670.4	46224	670.4	46224
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet			16.28%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	336.4	169.1	333.9	167.7

	Compositions, wt%			Light HC Phase		
Carbon No.	**1-Alcohols**	**2-Olefins**	**n-Paraffins**	**1-Olefins**	**iso-Parafins**	**Total**
	wt%	**wt%**	**wt%**	**wt%**	**wt%**	**wt%**
1						0.00
2						0.00
3	0.04	0.00	0.22	0.07	0.00	0.33
4	0.24	0.31	1.55	0.74	0.00	2.83
5	0.43	0.52	3.08	1.87	0.24	6.14
6	0.57	0.63	3.85	2.68	0.49	8.21
7	0.56	0.64	4.32	2.77	0.39	8.68
8	0.52	0.67	4.73	2.48	0.43	8.84
9	0.49	0.68	4.77	1.98	0.53	8.45
10	0.49	0.65	4.72	1.46	0.57	7.89
11	0.40	0.54	4.60	1.10	0.50	7.13
12	0.36	0.53	4.79	0.96	0.49	7.12
13	0.26	0.43	4.09	0.60	0.46	5.85
14	0.22	0.34	3.62	0.41	0.45	5.03
15	0.17	0.25	3.12	0.28	0.48	4.30
16	0.12	0.19	2.68	0.23	0.47	3.69
17	0.03	0.12	2.22	0.28	0.48	3.13
18	0.00	0.10	1.98	0.18	0.34	2.61
19	0.00	0.09	1.71	0.12	0.26	2.18
20	0.00	0.03	1.47	0.07	0.30	1.88
21			1.39			1.39
22			1.09			1.09
23			0.82			0.82
24			0.64			0.64
25			0.47			0.47
26			0.38			0.38
27			0.37			0.37
28			0.23			0.23
29			0.11			0.11
30			0.07			0.07
> 30			0.13			013
Total	4.91	6.71	63.22	18.28	6.88	100.00

Composition, Wt% Compound	**Aqueous Phase**
Ethanol	3.20
Water by diff.	96.80
Total	100.0

Composition, wt%	
Carbon No.	**Reactor Wax**
12	0.19
13	0.35
14	0.61
15	0.65
16	1.03
17	1.23
18	1.54
19	1.90
20	2.31
21	2.75
22	3.21
23	3.67
24	4.07
25	4.40
26	4.67
27	4.89
28	4.88
29	4.70
30	4.53
31	4.33
32	4.16
33	3.82
34	3.52
35	3.21
36	2.94
37	2.71
38	2.45
39	2.20
40	2.03
41	1.84
42	1.68
43	1.51
44	1.38
45	1.24
46	1.11
47	1.00
48	0.90
49	0.80
50	0.72
> 50	4.85
Total	100.00

Elemental Balance:

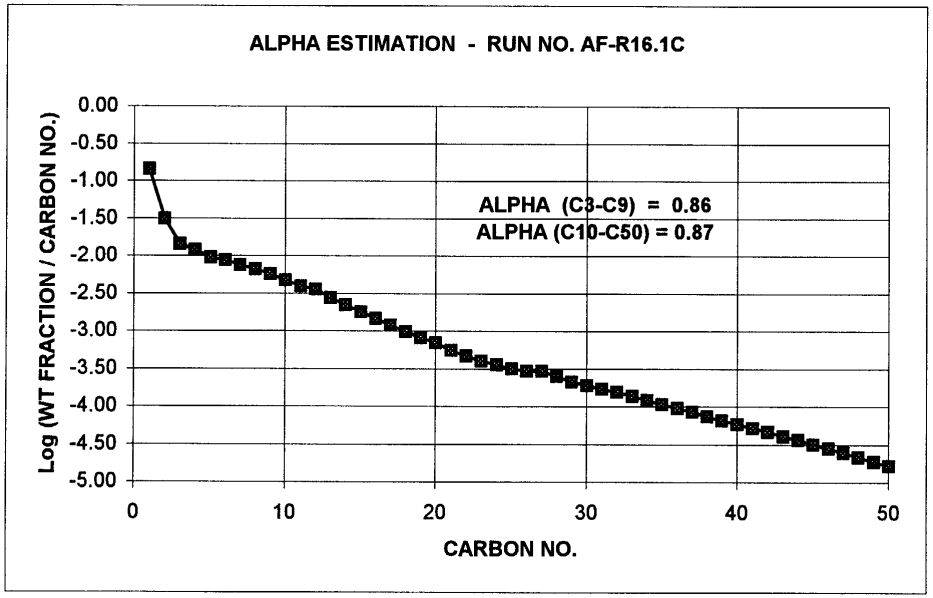
	Total lb/hr	C lb/hr	H lb/hr	O lb/hr	N lb/hr
Reactor Feed Gas	4039.54	1645.97	371.71	1599.69	422.17
Main Gas Outlet	3137.88	1358.64	248.78	1108.38	422.08
27.10 Reactor Wax	52.67	44.92	7.75	0.00	0.00
22.14 Light Wax	0.00	0.00	0.00	0.00	0.00
22.18 HC Phase	275.84	232.51	41.67	1.66	0.00
22.18 AQ Phase	530.96	8.85	59.32	462.78	0.00
Total Out	3997.35	1644.93	357.51	1572.84	422.08
% Balance	99.0	99.9	96.2	98.3	100.0

Product Distribution: Selectivity (wt%)

Methane (C1)	14.2
Gas (C2 - C4)	15.2
Gasoline (C5 - C11)	34.4
Diesel (C122 - C18)	19.6
Wax (C19+)	16.6
Total	100.0
HC Production Rate based on Liquid Data, grams HC produced/kg-cat oxide hr	1187.4

Alpha Estimate:

C3 - C9	1	0.86
C10-C50	2	0.87



Start Date / Time	0/06/1998	23.00
End Date / Time	04/07/1998	8.00

On-stream Time From Start-up (hr)

Start	225.00
End	234.00

Reaction Conditions:

Temperature	average	deg F	502.2	deg C	261.2
Pressure	PIC-201	psig	710.1	bara	49.98
Space Velocity		sL/kg-hr	22223		
Superficial Gas Vel. - Inlet (based on average reactor temp)		ft/sec	0.60	cm/sec	18.32
Recycle Ratio			2.12		

Slurry Data:

Catalyst Oxide Wt (Reactor)	lbs	383	kg	173.7
Slurry Concentration by NDG	wt%	28.6		
Slurry Concentration by DP	wt%	27.3		
Slurry Level by NDG % NDG Span		96.8		
Slurry Height	ft	20.81	meters	6.34
Average Gas Holdup by NDG	Vol%	50.2		
Average Gas Holdup by DP	Vol%	47.2		

Performance Results

CO Conversion per pass, mole %	20.2
H2 Conversion per pass, mole %	43.0
CO + H2 Conversion per pass, mole %	32.2
Plant CO Conversion, mole%	70.2
Plant H2 Conversion, mole%	87.2
Plant CO+H2 Conversion, mole%	81.2
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	76.9
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1067.3
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	126.07
H2/CO in Fresh Feed, mole/mole	1.82
H2/CO in Reactor Feed, mole/mole	1.10
H2/CO Usage Ratio, mole/mole	2.34
H2/CO in Outlet, mole/mole	0.78
CO2 Selectivity, mole %	1.55
HC Selectivity (CO2 free) wt%:	
CH4	17.67
C2H6	2.48
C2H4	-0.05
C3H8	2.64
C3H6	1.73
SUM C4H10	1.55
SUM C4H8	1.45

Reactor Heat Balance

	Btu/hr	kW
Chemical Heat Production by Reaction	2068071	606.09
Sensible Gas Heat	-178235	-52.24
Sensible Oil Heat	-1608608	-471.43
Sensible Wax Heat	-222668	-65.26
Estimate of Heat Loss from Catalyst Drying Data	-50000	-14.65
% Heat Balance based on Reaction Heat	99.59	

Mass Balance	Reactor lb/hr	Plant lb/hr	Feed lb/hr	Prod Gas lb/hr
Fresh Feed		1312	1312	
HP H2 Feed		86	86	
Recycle Feed			4882	4882
Reactor Feed	6296		6296	
Total In	6296	1398		
Prod Gas	5472			5472
Main Purge		590		590
22.11 Purge	0.0	0.0		
HC Phase	274.0	274.0		
AQ Phase	527.4	527.4		
Heavy Wax	8.6	8.6		
Light Wax				
Total Out	6282	1400		
Mass Balance, %	99.8	100.1	100.3	100.0

SUM C5H11	1.63		

RUN NO.: AF-R16.3A **TITLE: LIQUID PHASE FISCHER-TROPSCH (IV) SYNTHESIS IN LAPORTE AFDU**

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	43.25	100.00	31.65	42.08	31.65	31.65	10.91	28.62
2	N2	3.06	0.00	7.73	5.86	7.73	7.73	4.08	6.99
3	CO	53.69	0.00	40.33	38.30	40.33	40.33	27.97	36.47
4	CH4	0.00	0.00	14.57	9.83	14.57	14.57	19.11	13.18
5	CO2	0.00	0.00	1.45	0.98	1.45	1.45	5.05	1.31
6	ETHANE	0.00	0.00	1.30	0.90	1.30	1.30	7.26	1.18
7	ETHYLENE	0.00	0.00	0.02	0.02	0.02	0.02	0.10	0.02
8	PROPANE	0.00	0.00	0.98	0.88	0.98	0.98	8.24	0.89
9	PROPYLENE	0.00	0.00	0.59	0.40	0.59	0.59	4.84	0.54
10	ISOBUATNE	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.01
11	N-BUTANE	0.00	0.00	0.48	0.33	0.48	0.48	4.53	0.44
12	T-BUTENE-2	0.00	0.00	0.05	0.03	0.05	0.05	0.42	0.04
13	BUTENE-1	0.00	0.00	0.24	0.16	0.24	0.24	2.20	0.22
14	ISOBUTYLENE	0.00	0.00	0.03	0.02	0.03	0.03	0.30	0.03
15	C-BUTENE-2	0.00	0.00	0.08	0.04	0.06	0.06	0.52	0.05
16	SUM C5	0.00	0.00	0.36	0.25	0.36	0.36	3.16	0.33
17	SUM C6	0.00	0.00	0.13	0.09	0.13	0.13	1.05	0.11
18	SUM C7	0.00	0.00	0.02	0.01	0.02	0.02	0.15	0.01
19	SUM C8	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								8.97
	HC								0.61
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.77	2.02	19.04	16.59	19.04	19.04	30.30	19.69
Flows	SCFH	30245.09	16504.40	99154.37	148743.26	111147.37	11978.68	0.00	122926.70
	lb mole/hr	78.22	42.69	256.45	379.53	287.47	30.98	0.00	317.93
	lb/hr	1311.76	86.23	4881.66	6296.36	5472.11	589.75	0.00	6261.44
	Nm3/hr	795.94	434.33	2609.37	3861.73	2924.98	315.23	0.00	3234.96
	kgmol/hr	35.48	19.36	116.32	172.15	130.39	14.05	0.00	144.21
	kg/hr	595.01	39.11	2214.31	2856.01	2482.13	267.51	0.00	2840.17
Temperature	deg F	279.1	80.1	122.8	295.2	85.2	82.7	73.2	
	deg C	137.3	26.7	50.4	146.2	29.6	28.2	22.9	
Pressure	psig	815.1	812.4	824.8	770.9	640.5	633.4	33.3	
	bara	57.21	57.02	57.88	54.17	45.17	44.68	3.31	

Reactor Heat Balance

									Btu/lb-deg F	J/gm-deg C			
Gas:		**deg F**	**deg C**			**lb/hr**	**kg/hr**						
Inlet Temp	TI-1-12A	443.8	228.8	Inlet Flow	RXT FEED	6296	2856.0	Inlet Ht Cap.	0.485	2.030			
Outlet Temp	RXT AVG	502.2	261.2	Outlet Flow	RXT FEED-WAXPROD	6288	2852.1	Outlet Ht Cap.	0.458	1.918			
Oil:												**lb/ft3**	**kg/m3**
Inlet Temp	TI-1-14B	422.8	217.1	Inlet Flow	*FI-619	65579	29746.6	Inlet Ht Cap.	0.549	2.298	Inlet Density	51.51	825.12
Outlet Temp	TI-1780	468.7	242.6	Outlet Flow	*FI-619	65579	29746.6	Outlet Ht Cap.	0.569	2.381			
Slurry:													
Inlet Temp	TI-1783	469.0	242.8	Inlet Flow	*FI-1768-61	10978	4979.7	Inlet Ht Cap.	0.610	2.554			
Outlet Temp	RXT AVG	502.2	261.2	Outlet Flow	*FI-1768	20987	4983.5	Outlet Ht Cap.	0.610	2.554			
					*based on								

Reactor Differential Pressures

	DP NOZZLES		Differential Pressures:		Heights:		Density - 3 Phase:		Gas Hold-up
			psi	**mbar**	**ft** (based on flange loc.)	**meters**	**lb/ft3**	**kg/m3**	**vol%**
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.84	57.9	4.56	1.391	26.52	424.9	47.66
9.25 ft to 4.33 ft	K3-K5	PDI-1779	0.95	65.7	5.08	1.549	26.97	432.1	46.73
Total Reactor	K6-OUT	PDI-631	3.77	259.9	20.81	6.344	25.63	410.5	49.51
Sparger	K6-IN	PDI-633	2.57	177.2					

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	397.0	202.8		
3.5 ft Height	TI-1763	444.1	228.9		
0.5 ft Height	TI-1764	507.2	264.0		
Liquid Level:					
% Level	LI-1765	52.0			
Slurry Height		ft 9.36		meters	2.851

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	476.3	246.8
	Seal Oil Outlet	TI-1 795	103.8	39.9
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	766.6	53.87
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10986.7	4983.8
			g/cc	
Density:	Slurry Outlet	DI-1768	0.826	

SLURRY COOLER

Temperatures:		**deg F**	**deg C**
Slurry Outlet	TIC-1754	471.5	244.2
Oil Inlet	TI-1780	468.7	242.6

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	469.0	242.8	Flow Rate:	Wax	FI-1761	8.574	3.889
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	729.6	51.31	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	10.0	690	Linear Vel.:	Slurry thru	Calculated	10.85	3.308
	Thru B & A	PDI-1773	0.2	15		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	0.0	-2	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.221
	Membrane B	PDI-1775	1.3	89		thru Reactor			
	Membrane C	PDI-1776	-1.1	-77					
	Membrane D	PDI-1777	-0.3	-21					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	494.3	256.8
Nozzle N2	20.25	TI-626-2	502.1	261.2
Nozzle N3	18.25	TI-190-2A	501.5	260.8
Nozzle N4	16.25	TI-626-3	500.2	260.1
Nozzle N5	14.25	TI-190-3	500.1	260.1
Nozzle N7	10.25	TI-1781A	504.4	262.5
		TI-1781B	503.7	262.0
		TI-1781C	504.5	262.5
		TI-1781D	503.6	262.0
Nozzle N8	8.083	TI-626-5	497.6	258.7
Nozzle K4	7.75	TI-190-4	506.3	263.5
Nozzle O	4.792	TI-626-6	500.1	260.1
Reactor Temp. Avg. (Noz N3 thru Noz O)				502.2
	261.2			

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	472.5	244.7
	22.14 Out	TIC-725	310.0	154.5
	21.65 Out	TIC-1-11A	84.0	28.9
	27.13 Lt Wax	TI-744	97.3	36.3
	28.30 Hv Wax	TI-515	214.3	101.3
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	80.6	
	22.10	LIC-220	30.0	
	22.15	LIC-242	27.9	
	27.13	LI-203	-7.1	
	28.30	LI-1792	53.7	
			psig	**bara**
Pressure	27.13	PIC-202	18.12	2.26

Miscellaneous Data

Overall Plant Material Balance		%	100.12
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)			
Reactor GHSV	Nm3 Rxt Feed/m3 3-phase	slurry volume/hr	2625
Catalyst GHSV	Nm3 Rxt Feed/m3	particle volume/hr	20489
Catalyst Volume in the Reactor		litres particle volume	188.4
Inlet Superfic. Vel. based on Avg Reactor Temp.		cm/sec	18.32
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)		cm/sec	17.21
CO Conversion Rate, gmole CO converted AR particle volume/hr			70.89
grams of HC (CH2.1) produced/Ift particle volume/hr			984.07

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
100.00	100.01	100.02 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
102.72		99.99

Wax/Liquid Production Rates

	lbs/hr	**kg/hr**
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	8.57	3.89
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	273.98	124.28
Water (22.10/22.16, 100 deg F Cut)	527.37	239.21

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	24.17
	catalyst wt%	26.98

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.:		**Based on Water Production:**	
	psia	**mbara**	**psia**	**mbara**
Calculated Water Partial Pressure @ Reactor Outlet	63.71	4392	65.28	4501
Saturated Water Pressure @ Reactor Outlet	696.2	47999	696.2	47999
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	9.15%		9.38%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	296.3	146.8	297.9	147.7

Start Date / Time	04/07/1998	8.00
End Date / Time	04/07/1998	15.00

On-stream Time From Start-up (hr)

Start	234.00
End	241.00

Reaction Conditions:

Temperature	average	deg F	502.01	deg C	261.2
Pressure	PIC-201	psig	710.1	bara	49.97
Space Velocity		sL/kg-hr	22115		
Superficial Gas Vel. - Inlet (based on average reactor temp)		ft/sec	0.60	cm/sec	18.23
Recycle Ratio			2.08		

Slurry Data:

Catalyst Oxide Wt (Reactor)	lbs	383	kg	173.7
Slurry Concentration by NDG	wt%	28.6		
Slurry Concentration by DP	wt%	27.0		
Slurry Level by NDG % NDG Span		96.6		
Slurry Height	ft	20.78	meters	6.33
Average Gas Holdup by NDG	Vol%	50.7		
Average Gas Holdup by DP	Vol%	46.4		

Performance Results

CO Conversion per pass, mole %	20.9
H2 Conversion per pass, mole %	43.5
CO + H2 Conversion per pass, mole %	32.8
Plant CO Conversion, mole%	70.6
Plant H2 Conversion, mole%	87.2
Plant CO+H2 Conversion, mole%	81.4
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	78.6
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1093.1
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	129.30
H2/CO in Fresh Feed, mole/mole	1.83
H2/CO in Reactor Feed, mole/mole	1.11
H2/CO Usage Ratio, mole/mole	2.31
H2/CO in Outlet, mole/mole	0.79
CO2 Selectivity, mole %	1.37
HC Selectivity (CO2 free) wt%:	
CH4	16.63
C2H6	2.62
C2H4	0.13
C3H8	2.62
C3H6	1.69
SUM C4H10	1.27
SUM C4H8	1.83
SUM C5H11	0.57

Reactor Heat Balance

	Btu/hr	kW
Chemical Heat Production by Reaction	2117056	620.45
Sensible Gas Heat	-176759	-51.80
Sensible Oil Heat	-1604523	-470.24
Sensible Wax Heat	-223114	-65.39
Estimate of Heat Loss from Catalyst Drying Data	-50000	-14.65
% Heat Balance based on Reaction Heat	97.04	

Mass Balance	Reactor lb/hr	Plant lb/hr	Feed lb/hr	Prod Gas lb/hr
Fresh Feed		1318	1318	
HP H2 Feed		86	86	
Recycle Feed			4808	4808
Reactor Feed	6242		6242	
Total In	6242	1404		
Prod Gas	5396			5396
Main Purge		587		587
22.11 Purge	0.0	0.0		
HC Phase	268.2	268.2		
AQ Phase	516.2	516.2		
Heavy Wax	8.6	8.6		
Light Wax				
Total Out	6189	1380		
Mass Balance, %	99.2	98.3	100.5	100.0

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	43.60	100.00	31.84	42.36	31.84	31.84	10.24	28.69
2	N2	2.90	0.00	7.40	5.56	7.40	7.40	3.66	6.67
3	CO	53.50	0.00	40.18	38.18	40.18	40.18	25.95	36.21
4	CH4	0.00	0.00	14.75	9.92	14.75	14.75	22.87	13.29
5	CO2	0.00	0.00	1.45	0.98	1.45	1.45	5.17	1.30
6	ETHANE	0.00	0.00	1.32	0.90	1.32	1.32	6.79	1.19
7	ETHYLENE	0.00	0.00	0.02	0.01	0.02	0.02	0.09	0.02
8	PROPANE	0.00	0.00	1.00	0.69	1.00	1.00	7.93	0.90
9	PROPYLENE	0.00	0.00	0.60	0.40	0.60	0.60	4.62	0.54
10	ISOBUATNE	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.01
11	N-BUTANE	0.00	0.00	0.51	0.35	0.51	0.51	4.57	0.46
12	T-BUTENE-2	0.00	0.00	0.05	0.03	0.05	0.05	0.42	0.05
13	BUTENE-1	0.00	0.00	0.24	0.16	0.24	0.24	2.17	0.22
14	ISOBUTYLENE	0.00	0.00	0.03	0.02	0.03	0.03	0.31	0.03
15	C-BUTENE-2	0.00	0.00	0.06	0.04	0.06	0.06	0.51	0.05
16	SUM C5	0.00	0.00	0.37	0.27	0.37	0.37	3.26	0.34
17	SUM C6	0.00	0.00	0.14	0.09	0.14	0.14	1.13	0.13
18	SUM C7	0.00	0.00	0.01	0.03	0.01	0.01	0.17	0.01
19	SUM C8	0.00	0.00	0.02	0.00	0.02	0.02	0.01	0.02
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								9.29
	HC								0.60
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.68	2.02	19.00	16.53	19.00	19.00	30.07	19.65
Flows	SCFH	30559.08	16521.20	97828.01	146035.34	109796.36	11953.76	0.00	121847.00
	lb mole/hr	79.04	42.73	253.02	377.70	283.97	30.92	0.00	315.14
	lb/hr	1318.18	86.31	4807.98	6242.01	5396.19	587.50	0.00	6193.04
	Nm3/hr	804.20	434.78	2574.46	3843.10	2889.42	314.58	0.00	3206.55
	kgmol/hr	35.85	19.38	114.77	171.32	128.81	14.02	0.00	142.95
	kg/hr	597.92	39.15	2180.89	2831.36	2447.70	266.49	0.00	2809.14
Temperature	deg F	286.6	95.6	128.5	303.6	86.8	85.7	84.7	
	deg C	141.4	35.3	53.6	150.9	30.5	29.9	29.3	
Pressure	psig	817.8	796.2	824.8	770.0	642.7	634.8	33.5	
	bara	57.40	55.91	57.88	54.10	45.33	44.78	3.32	

Reactor Heat Balance

Gas:		**deg F**	**deg C**			**lb/hr**	**kg/hr**		**Btu/lb-deg F**	**J/gm-deg C**			
Inlet Temp	TI-1-12A	444.1	229.0	Inlet Flow	RXT FEED	6242	2831.4	Inlet Ht Cap.	0.488	2.042			
Outlet Temp	RXT AVG	502.1	261.2	Outlet Flow	RXT FEED-WAXPROD	6233	2827.5	Outlet Ht Cap.	0.461	1.929			
Oil:												**lb/ft3**	**kg/m3**
Inlet Temp	TI-1-14B	422.7	217.0	Inlet Flow	*FI-619	65443	29684.7	Inlet Ht Cap.	0.549	2.298	Inlet Density	51.52	825.19
Outlet Temp	TI-1780	468.6	242.5	Outlet Flow	*FI-619	65443	29684.7	Outlet Ht Cap.	0.569	2.381			
Slurry:													
Inlet Temp	TI-1783	468.9	242.7	Inlet Flow	*FI-1768-61	10957	4970.0	Inlet Ht Cap.	0.612	2.561			
Outlet Temp	RXT AVG	502.1	261.2	Outlet Flow	*FI-1768	10966	4973.9	Outlet Ht Cap.	0.612	2.561			
					*based on								

Reactor Differential Pressures

	DP NOZZLES		**Differential Pressures:**		**Heights:** (based on flange loc.)		**Density - 3 Phase:**		**Gas Hold-up**
			psi	**mbar**	**ft**	**meters**	**lb/ft3**	**kg/m3**	**vol%**
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.85	58.4	4.56	1.391	26.72	428.0	47.12
9.25 ft to 4.33 ft	K3-K5	PDI-1779	0.97	66.7	5.08	1.549	27.42	439.2	45.68
Total Reactor	K6-OUT	PDI-631	3.93	271.1	20.78	6.335	26.79	429.2	46.97
Sparger	K6-IN	PDI-633	2.65	182.9					

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	395.4	201.9		
3.5 ft Height	TI-1763	450.9	232.7		
0.5 ft Height	TI-1764	506.5	263.6		
Liquid Level:					
% Level	LI-1765	37.4			
Slurry Height	ft	6.73	meters	2.050	

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	476.3	246.8
	Seal Oil Outlet	TI-1 795	107.9	42.2
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	764.0	53.69
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10965.5	4974.2
			g/cc	
Density:	Slurry Outlet	DI-1768	0.824	

SLURRY COOLER

Temperatures:	**deg F**	**deg C**

Slurry Outlet	TIC-1754	471.7	244.3
Oil Inlet	TI-1780	468.6	242.5

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	468.9	242.7	Flow Rate:	Wax	FI-1761	8.578	2.891
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	729.3	51.30	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	10.0	687	Linear Vel.:	Slurry thru	Calculated	10.85	3.307
	Thru B & A	PDI-1773	0.2	13		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	0.0	-2	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.220
	Membrane B	PDI-1775	1.3	90		thru Reactor			
	Membrane C	PDI-1776	-1.0	-69					
	Membrane D	PDI-1777	-0.4	-29					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	494.6	257.0
Nozzle N2	20.25	TI-626-2	502.7	261.5
Nozzle N3	18.25	TI-190-2A	501.5	260.8
Nozzle N4	16.25	TI-626-3	500.2	260.1
Nozzle N5	14.25	TI-190-3	500.0	260.0
Nozzle N7	10.25	TI-1781A	504.4	262.5
		TI-1781B	503.7	262.1
		TI-1781C	504.4	262.4
		TI-1781D	503.5	262.0
Nozzle N8	8.083	TI-626-5	497.5	258.6
Nozzle K4	7.75	TI-190-4	506.2	263.4
Nozzle O	4.792	TI-626-6	500.0	260.0
Reactor Temp. Avg. (Noz N3 thru Noz O)			502.1	261.2

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	474.5	245.8
	22.14 Out	TIC-725	310.00	154.5
	21.65 Out	TIC-1-11A	85.6	29.8
	27.13 Lt Wax	TI-744	100.8	38.2
	28.30 Hv Wax	TI-515	199.6	93.1
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	85.2	
	22.10	LIC-220	30.0	
	22.15	LIC-242	40.0	
	27.13	LI-203	0.0	
	28.30	LI-1792	-0.6	
			psig	**bara**
Pressure	27.13	PIC-202	19.73	2.37

Miscellaneous Data

Overall Plant Material Balance		%	98.29
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)			
Reactor GHSV	Nm3 Rxt Feed/m3 3-phase	slurry volume/hr	2616
Catalyst GHSV	Nm3 Rxt Feed/m3	particle volume/hr	20390
Catalyst Volume in the Reactor		litres particle volume	0.0
Inlet Superfic. Vel. based on Avg Reactor Temp.		cm/sec	18.23
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)		cm/sec	17.13
CO Conversion Rate, gmole CO converted AR particle volume/hr			72.47
grams of HC (CH2.1) produced/Ift particle volume/hr			1007.82

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
99.97	99.97	100.4 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
97.99		99.99

Wax/Liquid Production Rates

	lbs/hr	**kg/hr**
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	8.58	3.89
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	268.17	121.64
Water (22.10/22.16, 100 deg F Cut)	516.18	234.14

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	23.93
	catalyst wt%	26.76

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.:		**Based on Water Production:**	
	psia	**mbara**	**psia**	**mbara**
Calculated Water Partial Pressure @ Reactor Outlet	65.94	4547	64.74	4463
Saturated Water Pressure @ Reactor Outlet	695.9	47980	695.9	47980
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	9.48%		9.30%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	298.6	148.1	297.4	147.4

RUN NO.: AF-R16.3C **TITLE: LIQUID PHASE FISCHER-TROPSCH (IV) SYNTHESIS IN LAPORTE AFDU**

Start Date / Time	04/07/1998	18.00
End Date / Time	04/07/1998	24.00

On-stream Time From Start-up (hr)	
Start	244.00
End	250.00

Reaction Conditions:

Temperature	average	deg F	502.1	deg C	261.1
Pressure	PIC-201	psig	710.2	bara	49.98
Space Velocity		sL/kg-hr	22210		
Superficial Gas Vel. - Inlet		ft/sec	0.60	cm/sec	18.31
(based on average reactor temp)					
Recycle Ratio			2.13		

Slurry Data:

Catalyst Oxide Wt (Reactor)		lbs	383	kg	173.7
Slurry Concentration by NDG		wt%	28.7		
Slurry Concentration by DP		wt%	27.3		
Slurry Level by NDG	% NDG Span		96.4		
Slurry Height		ft	20.74	meters	6.32
Average Gas Holdup by NDG		Vol%	50.7		
Average Gas Holdup by DP		Vol%	47.2		

Performance Results

CO Conversion per pass, mole %	20.1
H2 Conversion per pass, mole %	42.3
CO + H2 Conversion per pass, mole %	31.7
Plant CO Conversion, mole%	69.3
Plant H2 Conversion, mole%	86.5
Plant CO+H2 Conversion, mole%	80.4
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	76.6
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1063.5
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	126.05
H2/CO in Fresh Feed, mole/mole	1.82
H2/CO in Reactor Feed, mole/mole	1.11
H2/CO Usage Ratio, mole/mole	2.33
H2/CO in Outlet, mole/mole	0.80
CO2 Selectivity, mole %	1.47
HC Selectivity (CO2 free) wt%:	
CH4	18.89
C2H6	3.16
C2H4	-0.12
C3H8	3.97
C3H6	1.94
SUM C4H10	2.76
SUM C4H8	1.67
SUM C5H11	2.27

Reactor Heat Balance

	Btu/hr	**kW**
Chemical Heat Production by Reaction	2060303	603.81
Sensible Gas Heat	-178849	-52.42
Sensible Oil Heat	-1572237	-460.78
Sensible Wax Heat	-222491	-65.21
Estimate of Heat Loss from Catalyst Drying Data	-50000	014.65
% Heat Balance based on Reaction Heat	98.22	

Mass Balance	**Reactor lb/hr**	**Plant lb/hr**	**Feed lb/hr**	**Prod Gas lb/hr**
Fresh Feed		1310	1310	
HP H2 Feed		86	86	
Recycle Feed			4859	4859
Reactor Feed	6246		6246	
Total In	6246	1396		
Prod Gas	5463			5463
Main Purge		605		605
22.11 Purge	0.0	0.0		
HC Phase	263.6	263.6		
AQ Phase	507.5	507.5		
Heavy Wax	8.6	8.6		
Light Wax				
Total Out	6243	1385		
Mass Balance, %	100.0	99.2	99.8	100.0

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	43.16	100.00	32.26	42.52	32.26	32.26	10.77	29.19
2	N2	2.96	0.00	7.21	5.48	7.21	7.21	3.67	6.52
3	CO	53.89	0.00	40.34	38.44	40.34	40.34	27.33	36.51
4	CH4	0.00	0.00	14.45	9.71	14.45	14.45	23.67	13.08
5	CO2	0.00	0.00	1.40	0.95	1.40	1.40	2.34	1.27
6	ETHANE	0.00	0.00	1.31	0.88	1.31	1.31	7.11	1.18
7	ETHYLENE	0.00	0.00	0.02	0.02	0.02	0.02	0.09	0.02
8	PROPANE	0.00	0.00	0.99	0.66	0.99	0.99	8.01	0.90
9	PROPYLENE	0.00	0.00	0.60	0.40	0.60	0.60	4.77	0.54
10	ISOBUATNE	0.00	0.00	0.01	0.01	0.01	0.01	0.11	0.01
11	N-BUTANE	0.00	0.00	0.50	0.32	0.50	0.50	4.47	0.45
12	T-BUTENE-2	0.00	0.00	0.05	0.03	0.05	0.05	0.41	0.05
13	BUTENE-1	0.00	0.00	0.24	0.16	0.24	0.24	2.18	0.22
14	ISOBUTYLENE	0.00	0.00	0.03	0.02	0.03	0.03	0.29	0.03
15	C-BUTENE-2	0.00	0.00	0.05	0.04	0.05	0.05	0.49	0.05
16	SUM C5	0.00	0.00	0.36	0.24	0.36	0.36	3.13	0.33
17	SUM C6	0.00	0.00	0.13	0.08	0.13	0.13	1.01	0.12
18	SUM C7	0.00	0.00	0.04	0.02	0.04	0.04	0.14	0.04
19	SUM C8	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								8.91
	HC								0.59
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	I GO.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.79	2.02	18.92	16.47	18.92	18.92	29.22	19.56
Flows	SCFH	30164.22	16492.80	99297.87	146661.90	111644.67	12369.23	0.00	123365.10
	lb mole/hr	78.02	42.66	256.82	379.32	288.75	31.99	0.00	319.07
	lb/hr	1310.17	86.17	4858.93	6245.74	5463.09	605.26	0.00	6240.58
	Nm3/hr	793.81	434.03	2613.14	3859.58	2938.06	325.51	0.00	3246.50
	kgmol/hr	35.39	19.35	116.49	172.06	130.98	14.51	0.00	144.73
	kg/hr	594.29	39.08	2203.99	2833.05	2478.04	274.54	0.00	2830.71
Temperature	deg F	281.0	84.3	124.2	295.4	84.4	82.2	75.6	
	deg C	138.3	29.0	51.2	146.4	29.1	27.9	24.2	
Pressure	psig	815.4	749.1	824.3	770.5	641.3	634.0	33.4	
	bara	57.23	52.66	57.85	54.14	45.23	44.72	3.32	

Reactor Heat Balance

Gas:		**deg F**	**deg C**			**lb/hr**	**kg/hr**		**Btu/lb-deg F**	**J/gm-deg C**		
Inlet Temp	TI-1-12A	443.3	228.5	Inlet Flow	RXT FEED	6246	2833.0	Inlet Ht Cap.	0.488	2.041		
Outlet Temp	RXT AVG	502.1	261.1	Outlet Flow	RXT FEED-WAXPROD	6237	2829.2	Outlet Ht Cap.	0.462	1.932		
Oil:												**lb/ft3** **kg/m3**
Inlet Temp	TI-1-14B	424.1	217.9	Inlet Flow	*FI-619	65420	29674.2	Inlet Ht Cap.	0.550	2.300	Inlet Density	51.48 824.53
Outlet Temp	TI-1780	469.0	242.8	Outlet Flow	*FI-619	65420	29674.2	Outlet Ht Cap.	0.569	2.382		
Slurry:												
Inlet Temp	TI-1783	468.8	242.7	Inlet Flow	*FI-1768-61	10981	4980.8	Inlet Ht Cap.	0.610	2.552		
Outlet Temp	RXT AVG	502.1	261.1	Outlet Flow	*FI-1768	10989	4984.7	Outlet Ht Cap.	0.610	2.552		
					*based on							

Reactor Differential Pressures

	DP NOZZLES		**Differential Pressures:**		**Heights:**		**Density -3 Phase:**		**Gas Hold-up**
			psi	**mbar**	**ft** (based on flange loc.)	**meters**	**lb/ft3**	**kg/m3**	**vol%**
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.84	58.0	4.56	1.391	26.54	425.2	47.65
9.25 ft to 4.33 ft	K3-K5	PDI-1779	0.95	65.6	5.08	1.549	26.97	431.9	46.77
Total Reactor	K6-OUT	PDI-631	1.49	102.6	20.74	6.323	9.89	158.4	82.08
Sparger	K6-IN	PDI-633	272	187.4					

DEGASSER

Temperatures:		**deg F**	**deg C**	
6.5 ft Height	TI-1762	389.4	198.5	
3.5 ft Height	TI-1763	437.4	225.2	
0.5 ft Height	TI-1764	505.6	263.1	
Liquid Level:				
% Level	LI-1765	26.8		
Slurry Height	ft	4.93	meters	1.503

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	476.5	247.0
	Seal Oil Outlet	TI-1 795	106.6	41.4
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	761.0	53.48
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10989.2	4984.9
			g/cc	
Density:	Slurry Outlet	DI-1768	0.825	

SLURRY COOLER

Temperatures:		**deg F**	**deg C**
Slurry Outlet	TIC-1754	471.2	244.0

Oil Inlet	TI-1780	469.0	242.8

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	468.8	242.7	Flow Rate:	Wax	FI-1761	8.574	3.889
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	729.7	51.32	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	10.0	693	Linear Vel.:	Slurry thru	Calculated	10.86	3.311
	Thru B & A	PDI-1773	0.3	20		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	-1.1	-73	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.228
	Membrane B	PDI-1775	1.2	82		thru Reactor			
	Membrane C	PDI-1776	-1.0	-70					
	Membrane D	PDI-1777	-1.8	-122					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	494.4	256.9
Nozzle N2	20.25	TI-626-2	502.5	261.4
Nozzle N3	18.25	TI-190-2A	501.7	261.0
Nozzle N4	16.25	TI-626-3	500.3	260.2
Nozzle N5	14.25	TI-190-3	500.0	260.0
Nozzle N7	10.25	TI-1781A	504.3	262.4
		TI-1781B	503.6	262.0
		TI-1781C	504.2	262.4
		TI-1781D	503.3	261.9
Nozzle N8	8.083	TI-626-5	497.5	258.6
Nozzle K4	7.75	TI-190-4	506.0	263.3
Nozzle O	4.792	TI-626-6	499.7	259.8
Reactor Temp. Avg. (Noz N3 thru Noz O)			502.1	261.1

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	471.5	244.2
	22.14 Out	TIC-725	310.0	154.4
	21.65 Out	TIC-1-11A	82.9	28.3
	27.13 Lt Wax	TI-744	105.1	40.6
	28.30 Hv Wax	TI-515	201.0	93.9
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	102.9	
	22.10	LIC-220	30.0	
	22.15	LIC-242	26.6	
	27.13	LI-203	-7.0	
	28.30	LI-1792	-0.6	
			psig	**bara**
Pressure	27.13	PIC-202	18.84	2.31

Miscellaneous Data

Overall Plant Material Balance		%	99.19
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)			
Reactor GHSV	Nm3 Rxt Feed/m3 3-phase	slurry volume/hr	2632
Catalyst GHSV	Nm3 Rxt Feed/m3	particle volume/hr	20478
Catalyst Volume in the Reactor		litres particle volume	188.4
Inlet Superfic. Vel. based on Avg Reactor Temp.		cm/sec	18.31
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)		cm/sec	17.19
CO Conversion Rate, gmole CO converted AR particle volume/hr			70.58
grams of HC (CH2.1) produced/Ift particle volume/hr			980.56

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
100.02	99.98	99.96 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
99.12		100.02

Wax/Liquid Production Rates

	lbs/hr	**kg/hr**
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	8.57	3.89
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	263.64	119.59
Water (22.10/22.16, 100 deg F Cut)	507.48	230.19

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	24.07
	catalyst wt%	26.89

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.:		**Based on Water Production:**	
	psia	**mbara**	**psia**	**mbara**
Calculated Water Partial Pressure @ Reactor Outlet	63.31	4365	62.80	4330
Saturated Water Pressure @ Reactor Outlet	695.3	47939	695.3	47939
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	9.11%		9.03%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	295.9	146.6	295.4	146.3

Start Date / Time	04/08/1998	2.00
End Date / Time	04/08/1998	13.00

On-stream Time From Start-up (hr)

Start	252.00
End	263.00

Reaction Conditions:

Temperature	average	deg F	502.01	deg C	261.2
Pressure	PIC-201	psig	710.0	bara	49.97
Space Velocity		sL/kg-hr	22364		
Superficial Gas Vel. - Inlet		ft/sec	0.60	cm/sec	18.29
(based on average reactor temp)					
Recycle Ratio			2.12		

Slurry Data:

Catalyst Oxide Wt (Reactor)		lbs	380	kg	172.4
Slurry Concentration by NDG		wt%	28.3		
Slurry Concentration by DP		wt%	25.3		
Slurry Level by NDG	% NDG Span		96.7		
Slurry Height		ft	20.79	meters	6.34
Average Gas Holdup by NDG		Vol%	49.9		
Average Gas Holdup by DP		Vol%	45.3		

Performance Results

CO Conversion per pass, mole %	20.1
H2 Conversion per pass, mole %	41.9
CO + H2 Conversion per pass, mole %	31.6
Plant CO Conversion, mole%	69.1
Plant H2 Conversion, mole%	86.2
Plant CO+H2 Conversion, mole%	80.1
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	77/1
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1070.1
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	125.54
H2/CO in Fresh Feed, mole/mole	1.81
H2/CO in Reactor Feed, mole/mole	1.12
H2/CO Usage Ratio, mole/mole	2.33
H2/CO in Outlet, mole/mole	0.81
CO2 Selectivity, mole %	1.54
HC Selectivity (CO2 free) wt%:	
CH4	20.43
C2H6	3.31
C2H4	-0.12
C3H8	3.53
C3H6	2.12
SUM C4H10	2.21
SUM C4H8	1.59
SUM C5H11	1.88

Reactor Heat Balance

	Btu/hr	kW
Chemical Heat Production by Reaction	2057135	602.88
Sensible Gas Heat	-176262	-51.66
Sensible Oil Heat	-1584541	-464.38
Sensible Wax Heat	-224140	-65.69
Estimate of Heat Loss from Catalyst Drying Data	-50000	-14.65
% Heat Balance based on Reaction Heat	98.92	

Mass Balance	Reactor lb/hr	Plant lb/hr	Feed lb/hr	Prod Gas lb/hr
Fresh Feed		1312	1312	
HP H2 Feed		86	86	
Recycle Feed			4834	4834
Reactor Feed	6225		6225	
Total In	6225	1339		
Prod Gas	5438			5438
Main Purge		607		607
22.11 Purge	0.0	0.0		
HC Phase	266.6	266.6		
AQ Phase	513.2	513.2		
Heavy Wax	8.6	8.6		
Light Wax				
Total Out	6227	1396		
Mass Balance, %	100.0	99.8	99.9	100.1

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	43.15	100.00	32.69	42.88	32.69	32.69	11.90	29.59
2	N2	3.01	0.00	7.30	5.56	7.30	7.30	4.03	6.61
3	CO	53.83	0.00	40.32	38.45	40.32	40.32	29.62	36.50
4	CH4	0.00	0.00	14.01	9.28	14.01	14.01	25.54	12.68
5	CO2	0.00	0.00	1.39	0.94	1.39	1.39	6.50	1.26
6	ETHANE	0.00	0.00	1.30	0.87	1.30	1.30	5.07	1.18
7	ETHYLENE	0.00	0.00	0.02	0.02	0.02	0.02	0.07	0.02
8	PROPANE	0.00	0.00	0.97	0.65	0.97	0.97	5.46	0.88
9	PROPYLENE	0.00	0.00	0.60	0.40	0.60	0.60	3.32	0.54
10	ISOBUATNE	0.00	0.00	0.01	0.01	0.01	0.01	0.07	0.01
11	N-BUTANE	0.00	0.00	0.48	0.32	0.48	0.48	3.05	0.44
12	T-BUTENE-2	0.00	0.00	0.05	0.03	0.05	0.05	0.28	0.04
13	BUTENE-1	0.00	0.00	0.24	0.16	0.24	0.24	1.51	0.22
14	ISOBUTYLENE	0.00	0.00	0.03	0.02	0.03	0.03	0.20	0.03
15	C-BUTENE-2	0.00	0.00	0.06	0.04	0.06	0.06	0.34	0.05
16	SUM C5	0.00	0.00	0.36	0.24	0.36	0.36	2.18	0.32
17	SUM C6	0.00	0.00	0.12	0.09	0.12	0.12	0.73	0.11
18	SUM C7	0.00	0.00	0.03	0.02	0.03	0.03	0.11	0.02
19	SUM C8	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								8.90
	HC								0.59
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.79	2.02	18.84	16.43	18.84	18.84	27.40	19.49
Flows	SCFH	30217.14	16478.40	99215.79	146517.65	111625.67	12468.27	0.00	123327.62
	lb mole/hr	78.15	42.62	256.61	378.95	288.70	32.25	0.00	318.97
	lb/hr	1312.50	86.09	4833.65	6225.23	5438.24	607.44	0.00	6217.48
	Nm3/hr	795.20	433.65	2610.98	3855.79	2937.56	328.12	0.00	3245.52
	kgmol/hr	35.45	19.33	116.40	171.89	130.95	14.63	0.00	144.68
	kg/hr	595.35	39.05	2192.53	2823.75	2466.77	275.53	0.00	2820.23
Temperature	deg F	282.9	88.0	124.8	299.8	84.0	82.2	78.8	
	deg C	139.4	31.1	51.6	148.8	28.9	27.9	26.0	
Pressure	psig	815.4	738.6	823.9	769.8	640.7	633.2	33.4	
	bara	57.23	51.94	57.82	54.09	45.19	44.67	3.32	

Reactor Heat Balance

Gas:		**deg F**	**deg C**			**lb/hr**	**kg/hr**		**Btu/lb-deg F**	**J/gm-deg C**			
Inlet Temp	TI-1-12A	444.1	228.9	Inlet Flow	RXT FEED	6225	2823.7	Inlet Ht Cap.	0.488	2.041			
Outlet Temp	RXT AVG	502.1	261.2	Outlet Flow	RXT FEED-WAXPROD	6217	2819.9	Outlet Ht Cap.	0.462	1.933			
Oil:												**lb/ft3**	**kg/m3**
Inlet Temp	TI-1-14B	423.7	217.6	Inlet Flow	*FI-619	65465	29694.9	Inlet Ht Cap.	0.550	2.299	Inlet Density	51.49	824.74
Outlet Temp	TI-1780	468.9	242.7	Outlet Flow	*FI-619	65465	29694.9	Outlet Ht Cap.	0.569	2.382			
Slurry:													
Inlet Temp	TI-1783	469.3	242.9	Inlet Flow	*FI-1768-61	10984	4982.5	Inlet Ht Cap.	0.622	2.601			
Outlet Temp	RXT AVG	502.1	261.2	Outlet Flow	*FI-1768	10993	2986.4	Outlet Ht Cap.	0.622	2.601			
					*based on								

Reactor Differential Pressures

	DP NOZZLES		**Differential Pressures:**		**Heights:**		**Density - 3 Phase:**		**Gas Hold-up**
			psi	**mbar**	**ft**	**meters**	**lb/ft3**	**kg/m3**	**vol%**
					(based on flange loc.)				
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.85	58.8	4.56	1.391	26.92	431.1	45.97
9.25 ft to 4.33 ft	K3-K5	PDI-1779	0.97	67.1	5.08	1.549	27.58	441.7	44.58
Total Reactor	K6-OUT	PDI-631	3.78	260.5	20.79	6.337	25.73	412.2	48.47
Sparger	K6-IN	PDI-633	2.68	184.8					

5

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	401.5	205.3		
3.5 ft Height	TI-1763	439.4	226.3		
0.5 ft Height	TI-1764	504.9	262.7		
Liquid Level:					
% Level	LI-1765	33.3			
Slurry Height	ft	5.98	meters	1.821	

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	476.6	247.0
	Seal Oil Outlet	TI-1 795	105.8	41.0
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	764.3	53.71
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10993.0	4986.6
			g/cc	
Density:	Slurry Outlet	DI-1768	0.826	

SLURRY COOLER

Temperatures:		**deg F**	**deg C**
Slurry Outlet	TIC-1754	471.9	244.4
Oil Inlet	TI-1780	468.9	242.7

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	469.3	242.9	Flow Rate:	Wax	FI-1761	8.575	3.890
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	729.3	51.30	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	10.0	690	Linear Vel.:	Slurry thru	Calculated	10.86	3.311
	Thru B & A	PDI-1773	0.2	16		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	-0.5	-32	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.227
	Membrane B	PDI-1775	1.0	67		thru Reactor			
	Membrane C	PDI-1776	-1.0	-70					
	Membrane D	PDI-1777	-0.5	-35					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	493.8	256.6
Nozzle N2	20.25	TI-626-2	501.8	261.0
Nozzle N3	18.25	TI-190-2A	501.4	260.8
Nozzle N4	16.25	TI-626-3	500.1	260.0
Nozzle N5	14.25	TI-190-3	500.1	260.0
Nozzle N7	10.25	TI-1781A	504.3	262.4
		TI-1781B	503.7	262.0
		TI-1781C	504.4	262.4
		TI-1781D	503.6	262.0
Nozzle N8	8.083	TI-626-5	497.7	258.7
Nozzle K4	7.75	TI-190-4	506.1	263.4
Nozzle O	4.792	TI-626-6	500.1	260.0
Reactor Temp. Avg. (Noz N3 thru Noz O)			502.1	261.2

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	474.2	245.7
	22.14 Out	TIC-725	310.0	154.5
	21.65 Out	TIC-1-11A	82.9	28.3
	27.13 Lt Wax	TI-744	101.9	28.8
	28.30 Hv Wax	TI-515	201.3	94.1
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	92.8	
	22.10	LIC-220	30.0	
	22.15	LIC-242	28.4	
	27.13	LI-203	-7.0	
	28.30	LI-1792	46.5	
			psig	**bara**
Pressure	27.13	PIC-202	13.82	1.97

Miscellaneous Data

Overall Plant Material Balance		%	99.80
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)			
Reactor GHSV	Nm3 Rxt Feed/m3 3-phase	slurry volume/hr	2623
Catalyst GHSV	Nm3 Rxt Feed/m3	particle volume/hr	20619
Catalyst Volume in the Reactor		litres particle volume	186.9
Inlet Superfic. Vel. based on Avg Reactor Temp.		cm/sec	18.29
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)		cm/sec	17.19
CO Conversion Rate, gmole CO converted AR particle volume/hr			71.07
grams of HC (CH2.1) produced/Ift particle volume/hr			986.61

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
99.97	100.0	99.98 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
100.48		100.05

Wax/Liquid Production Rates

	lbs/hr	**kg/hr**
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	8.57	3.89
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	266.61	120.93
Water (22.10/22.16, 100 deg F Cut)	513.18	232.78

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	24.13
	catalyst wt%	26.95

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.:		**Based on Water Production:**	
	psia	**mbara**	**psia**	**mbara**
Calculated Water Partial Pressure @ Reactor Outlet	61.16	4355	63.44	4374
Saturated Water Pressure @ Reactor Outlet	695.7	47969	695.7	47969
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	9.08%		9.12%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	295.7	146.5	296.0	146.7

Light HC Phase

Carbon No.	1-Alcohols wt%	2-Olefins wt%	n-Paraffins wt%	1-Olefins wt%	iso-Parafins wt%	Total wt%
1						0.00
2						0.00
3	0.04	0.00	0.20	0.06	0.00	0.31
4	0.22	0.29	1.44	0.69	0.00	2.64
5	0.40	0.49	2.87	1.74	0.23	5.72
6	0.53	0.58	3.59	2.49	0.45	7.64
7	0.52	0.59	4.02	2.58	0.36	8.08
8	0.49	0.63	4.40	2.31	0.40	8.23
9	0.45	0.63	4.44	1.84	0.49	7.87
10	0.46	0.60	4.39	1.36	0.53	7.35
11	0.37	0.51	4.31	1.03	0.47	6.69
12	0.34	0.49	4.48	0.89	0.46	6.67
13	0.25	0.40	3.87	0.57	0.43	5.53
14	0.21	0.33	3.50	0.39	0.43	4.86
15	0.17	0.25	3.09	0.28	0.47	4.26
16	0.12	0.19	2.69	0.23	0.47	3.70
17	0.03	0.13	2.30	0.29	0.50	3.24
18	0.00	0.11	2.13	0.20	0.37	2.81
19	0.00	0.10	1.89	0.13	0.29	2.41
20	0.00	0.04	1.63	0.08	0.34	2.08
21			1.90			1.90
22			1.52			1.52
23			1.29			1.29
24			1.10			1.10
25			0.92			0.92
26			0.77			0.77
27			0.73			0.73
28			0.52			0.52
29			0.43			0.43
30			0.29			0.29
> 30			0.44			0.44
Total	4.61	6.35	65.17	17.17	6.70	100.00

Composition, Wt% Compound	Aqueous Phase
Ethanol	3.20
Water by diff.	96.80
Total	100.00

Composition, wt%

Carbon No.	Reactor Wax
12	0.09
13	0.22
14	0.26
15	0.33
16	0.41
17	0.51
18	0.62
19	0.77
20	0.92
21	1.12
22	1.35
23	1.62
24	1.92
25	2.28
26	2.84
27	3.74
28	3.88
29	3.97
30	4.33
31	4.61
32	5.14
33	4.82
34	4.79
35	4.50
36	4.23
37	3.92
38	3.64
39	3.40
40	2.94
41	2.81
42	2.55
43	2.23
44	2.07
45	1.86
46	1.64
47	1.50
48	1.34
49	1.18
50	1.06
> 50	8.62
Total	100.00

Elemental Balance:

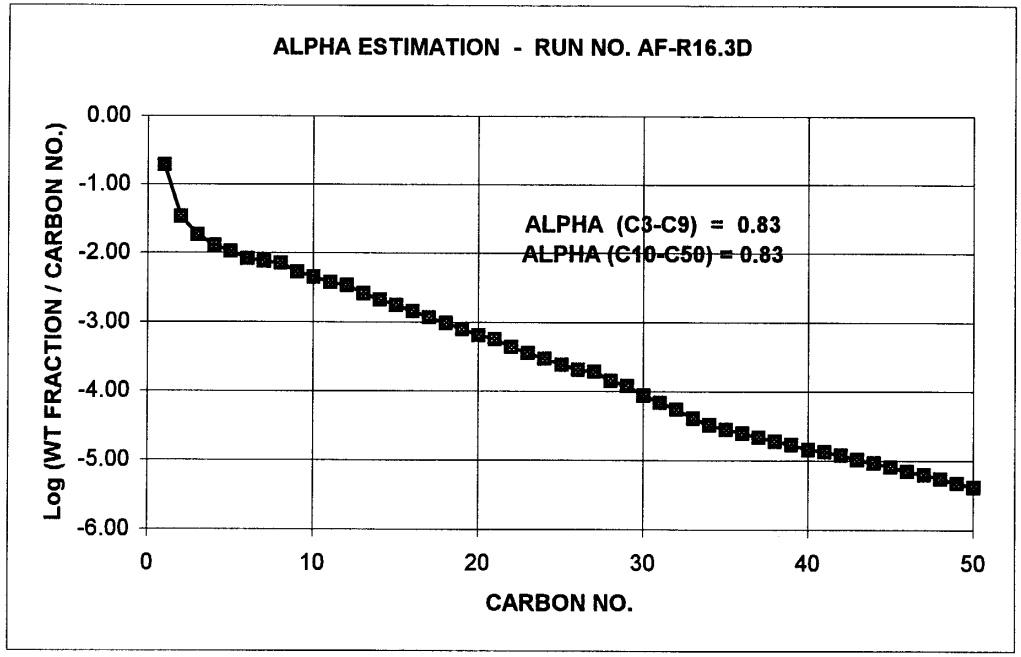
	Total lb/hr	C lb/hr	H lb/hr	O lb/hr	N lb/hr
Reactor Feed Gas	6225.72	2633.57	556.30	2445.18	590.67
Main Gas Outlet	5438.10	2405.95	450.46	1991.19	590.50
27.10 Reactor Wax	8.57	7.32	1.26	0.00	0.00
22.14 Light Wax	0.00	0.00	0.00	0.00	0.00
22.18 HC Phase	266.61	224.88	40.22	1.51	0.00
22.18 AQ Phase	513.18	8.56	57.34	447.29	0.00
Total Out	6226.47	2646.71	549.28	2439.98	590.50
% Balance	100.0	100.5	98.7	99.8	100.0

Product Distribution: Selectivity (wt%)

Methane (C1)	19.1
Gas (C2 - C4)	17.3
Gasoline (C5 - C11)	34.2
Diesel (C122 - C18)	18.8
Wax (C19+)	10.6
Total	100.0
HC Production Rate based on Liquid Data, grams HC produced/kg-cat oxide hr	1164.5

Alpha Estimate:

C3 - C9	1	0.83
C10-C50	2	0.83


ALPHA ESTIMATION - RUN NO. AF-R16.3D
Log (WT FRACTION / CARBON NO.)
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
0
10
20
30
40
50
CARBON NO.
ALPHA (C3-C9) = 0.83
ALPHA (C10-C50) = 0.83

RUN NO.: AF-R16.4A **TITLE: LIQUID PHASE FISCHER-TROPSCH (IV) SYNTHESIS IN LAPORTE AFDU**

Start Date / Time	04/09/98	8.00
End Date / Time	04/09/98	13.00

On-stream Time From Start-up (hr)

Start	282.00
End	287.00

Reaction Conditions:

Temperature	average	deg F	479.8	deg C	248.8
Pressure	PIC-201	psig	709.9	bara	49.96
Space Velocity		sL/kg-hr	17594		
Superficial Gas Vel. - Inlet		ft/sec	0.46	cm/sec	13.95
(based on average reactor temp)					
Recycle Ratio					

Slurry Data:

Catalyst Oxide Wt (Reactor)	lbs	377	kg	171.0
Slurry Concentration by NDG	wt%	26.0		
Slurry Concentration by DP	wt%	24,6		
Slurry Level by NDG % NDG Span		96.2		
Slurry Height	ft	20.72	meters	6.31
Average Gas Holdup by NDG	Vol%	45.1		
Average Gas Holdup by DP	Vol%	41.4		

Performance Results

CO Conversion per pass, mole %	34.5
H2 Conversion per pass, mole %	39.6
CO + H2 Conversion per pass, mole %	38.0
Plant CO Conversion, mole%	78.8
Plant H2 Conversion, mole%	81.7
Plant CO+H2 Conversion, mole%	80.8
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	69.5
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	971.0
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	113.42
H2/CO in Fresh Feed, mole/mole	2.27
H2/CO in Reactor Feed, mole/mole	2.12
H2/CO Usage Ratio, mole/mole	2.44
H2/CO in Outlet, mole/mole	1.96
CO2 Selectivity, mole %	0.96
HC Selectivity (CO2 free) wt%:	
CH4	25.12
C2H6	3.70
C2H4	0.10
C3H8	4.51
C3H6	1.52
SUM C4H10	2.94
SUM C4H8	0.84
SUM C5H11	2.00

Reactor Heat Balance

	Btu/hr	kW
Chemical Heat Production by Reaction	1849190	541.94
Sensible Gas Heat	-94614	-28.02
Sensible Oil Heat	-1532948	-449.26
Sensible Wax Heat	-215625	-63.19
Estimate of Heat Loss from Catalyst Drying Data	-50000	-14.65
% Heat Balance based on Reaction Heat	102.43	

Mass Balance	Reactor lb/hr	Plant lb/hr	Feed lb/hr	Prod Gas lb/hr
Fresh Feed		1070	1070	
HP H2 Feed		83	83	
Recycle Feed			2746	2746
Reactor Feed	3905		3905	
Total In	3905	1153		
Prod Gas	3199			3199
Main Purge		454		454
22.11 Purge	0.0	0.0		
HC Phase	240.3	240.3		
AQ Phase	462.5	462.5		
Heavy Wax	15.0	15.0		
Light Wax				
Total Out	3916	1172		
Mass Balance, %	1--/3	101.6	100.1	100.0

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	48.90	100.00	45.74	54.57	45.74	45.74	13.37	40.53
2	N2	3.45	0.00	7.97	5.74	7.97	7.97	3.65	7.07
3	CO	47.66	0.00	23.37	25.69	23.37	23.37	20.71	20.70
4	CH4	0.00	0.00	17.38	10.53	17.38	17.38	25.34	15.40
5	CO2	0.00	0.00	0.82	0.50	0.82	0.82	3.38	0.72
6	ETHANE	0.00	0.00	1.48	0.91	1.48	1.48	7.43	1.31
7	ETHYLENE	0.00	0.00	0.01	0.00	0.01	0.01	0.06	0.01
8	PROPANE	0.00	0.00	1.31	0.81	1.31	1.31	10.13	1.16
9	PROPYLENE	0.00	0.00	0.45	0.28	0.45	0.45	3.38	0.40
10	ISOBUATNE	0.00	0.00	0.01	0.01	0.01	0.01	0.11	0.01
11	N-BUTANE	0.00	0.00	0.66	0.41	0.66	0.66	5.76	0.58
12	T-BUTENE-2	0.00	0.00	0.03	0.02	0.03	0.03	0.26	0.03
13	BUTENE-1	0.00	0.00	0.17	0.11	0.17	0.17	1.55	0.15
14	ISOBUTYLENE	0.00	0.00	0.03	0.02	0.03	0.03	0.27	0.03
15	C-BUTENE-2	0.00	0.00	0.04	0.03	0.04	0.04	0.35	0.04
16	SUM C5	0.00	0.00	0.37	0.23	0.37	0.37	3.08	0.33
17	SUM C6	0.00	0.00	0.13	0.09	0.13	0.13	0.98	0.11
18	SUM C7	0.00	0.00	0.03	0.02	0.03	0.03	0.16	0.03
19	SUM C8	0.00	0.00	0.01	0.03	0.01	0.01	0.02	0.01
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								10.69
	HC								0.71
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	15.30	2.02	15.02	13.20	15.02	15.02	28.78	16.24
Flows	SCFH	27030.60	15980.00	70701.18	114357.35	82357.27	11686.45	0.00	92951.97
	lb mole/hr	69.91	41.33	182.86	295.77	213.00	30.23	0.00	240.41
	lb/hr	1069.78	83.49	2745.96	3904.90	3198.67	453.89	0.00	3903.22
	Nm3/hr	711.34	420.53	1860.59	3009.45	2167.33	307.54	0.00	2446.14
	kgmol/hr	31.71	18.75	82.94	134.16	96.62	13.71	0.00	109.05
	kg/hr	485.25	37.87	1245.56	1771.25	1450.91	205.88	0.00	1770.49
Temperature	deg F	270.3	89.0	109.1	255.2	86.7	84.7	69.5	
	deg C	132.4	31.7	42.8	124.0	30.4	29.3	20.8	
Pressure	psig	767.8	757.0	765.8	735.5	671.9	667.1	33.3	
	bara	53.95	53.20	53.82	51.72	47.34	47.01	3.31	

Reactor Heat Balance

Gas:		**deg F**	**deg C**			**lb/hr**	**kg/hr**		**Btu/lb-deg F**	**J/gm-deg C**		
Inlet Temp	TI-1-12A	440.4	226.9	Inlet Flow	RXT FEED	3906	1771.2	Inlet Ht Cap.	0.622	2.604		
Outlet Temp	RXT AVG	479.8	248.8	Outlet Flow	RXT FEED-WAXPROD	3890	1764.5	Outlet Ht Cap.	0.579	2.424		
Oil:												**lb/ft3** **kg/m3**
Inlet Temp	TI-1-14B	403.5	206.4	Inlet Flow	*FI-619	66886	30339.3	Inlet Ht Cap.	0.541	2.263	Inlet Density	52.06 833.82
Outlet Temp	TI-1780	447.0	230.5	Outlet Flow	*FI-619	66886	30339.3	Outlet Ht Cap.	0.560	2.342		
Slurry:												
Inlet Temp	TI-1783	448.1	231.2	Inlet Flow	*FI-1768-61	10884	4937.0	Inlet Ht Cap.	0.626	2.617		
Outlet Temp	RXT AVG	479.8	248.8	Outlet Flow	*FI-1768	10899	4943.8	Outlet Ht Cap.	0.626	2.617		
					*based on							

Reactor Differential Pressures

	DP NOZZLES		**Differential Pressures:**		**Heights:**		**Density - 3 Phase:**		**Gas Hold-up**
			psi	**mbar**	**ft** (based on flange loc.)	**meters**	**lb/ft3**	**kg/m3**	**vol%**
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.91	63.0	4.56	1.391	28.83	461.7	42.15
9.25 ft to 4.33 ft	K3-K5	PDI-1779	1.04	71.9	5.08	1.549	29.55	473.4	40.64
Total Reactor	K6-OUT	PDI-631	4.17	287.3	20.72	6.314	28.60	458.1	42.62
Sparger	K6-IN	PDI-633	1.32	90.9					

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	380.5	193.6		
3.5 ft Height	TI-1763	442.7	228.2		
0.5 ft Height	TI-1764	483.8	251.0		
Liquid Level:					
% Level	LI-1765	7.0			
Slurry Height	ft	1.37	meters	0.418	

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	455.3	235.2
	Seal Oil Outlet	TI-1 795	102.2	39.0
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	761.8	53.53
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10899.1	4944.0
			g/cc	
Density:	Slurry Outlet	DI-1768	0.820	

SLURRY COOLER

Temperatures:		**deg F**	**deg C**
Slurry Outlet	TIC-1754	450.4	232.4
Oil Inlet	TI-1780	447.0	230.5

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	448.1	231.2	Flow Rate:	Wax	FI-1761	14.959	6.785
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	728.3	51.23	Density:	Wax	DI-1761	0.68	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	9.8	676	Linear Vel.:	Slurry thru	Calculated	10.85	3.307
	Thru B & A	PDI-1773	0.2	17		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	-1.4	-100	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.213
	Membrane B	PDI-1775	0.7	45		thru Reactor			
	Membrane C	PDI-1776	-1.0	-67					
	Membrane D	PDI-1777	0.1	4					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	469.2	242.9
Nozzle N2	20.25	TI-626-2	479.4	248.6
Nozzle N3	18.25	TI-190-2A	478.4	248.0
Nozzle N4	16.25	TI-626-3	477.2	247.4
Nozzle N5	14.25	TI-190-3	477.1	247.3
Nozzle N7	10.25	TI-1781A	482.0	250.0
		TI-1781B	481.2	249.6
		TI-1781C	482.0	250.0
		TI-1781D	481.2	249.6
Nozzle N8	8.083	TI-626-5	475.5	246.4
Nozzle K4	7.75	TI-190-4	484.4	251.3
Nozzle O	4.792	TI-626-6	478.6	248.1
Reactor Temp. Avg. (Noz N3 thru Noz O)			479.8	248.8

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	447.4	230.8
	22.14 Out	TIC-725	310.1	154.5
	21.65 Out	TIC-1-11A	85.1	29.5
	27.13 Lt Wax	TI-744	93.4	34.1
	28.30 Hv Wax	TI-515	205.3	96.3
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	62.1	
	22.10	LIC-220	30.0	
	22.15	LIC-242	25.0	
	27.13	LI-203	-7.0	
	28.30	LI-1792	99.7	
			psig	**bara**
Pressure	27.13	PIC-202	7.41	1.52

Miscellaneous Data

Overall Plant Material Balance	%	101.60
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)		
Reactor GHSV Nm3 Rxt Feed/m3 3-phase slurry volume/hr		2055
Catalyst GHSV Nm3 Rxt Feed/m3	particle volume/hr	16221
Catalyst Volume in the Reactor	litres particle volume	185.5
Inlet Superfic. Vel. based on Avg Reactor Temp.	cm/sec	13.95
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)	cm/sec	13.36
CO Conversion Rate, gmole CO converted AR particle volume/hr		64.10
grams of HC (CH2.1) produced/Ift particle volume/hr		895.22

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
100.00	100.00	99.96 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
100.00		100.04

Wax/Liquid Production Rates

	lbs/hr	**kg/hr**
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	14.96	6.79
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	240.29	109.00
Water (22.10/22.16, 100 deg F Cut)	462.53	209.80

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	22.10
	catalyst wt%	24.86

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.:		**Based on Water Production:**	
	psia	**mbara**	**psia**	**mbara**
Calculated Water Partial Pressure @ Reactor Outlet	75.89	52.32	75.88	52.32
Saturated Water Pressure @ Reactor Outlet	566.1	39031	566.1	39031
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	13.40%		13.40%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	308.1	153.4	308.1	153.4

Carbon No.	Compositions, wt% 1-Alcohols wt%	2-Olefins wt%	n-Paraffins wt%	Light HC Phase 1-Olefins wt%	iso-Parafins wt%	Total wt%
1						0.00
2						0.00
3	0.04	0.00	0.20	0.06	0.00	0.31
4	0.22	0.29	1.44	0.69	0.00	2.64
5	0.40	0.49	2.87	1.74	0.23	5.72
6	0.53	0.58	3.59	2.49	0.45	7.64
7	0.52	0.59	4.02	2.58	0.36	8.08
8	0.49	0.63	4.40	2.31	0.40	8.23
9	0.45	0.63	4.44	1.84	0.49	7.87
10	0.46	0.60	4.39	1.36	0.53	7.35
11	0.37	0.51	4.31	1.03	0.47	6.69
12	0.34	0.49	4.48	0.89	0.46	6.67
13	0.25	0.40	3.87	0.57	0.43	5.53
14	0.21	0.33	3.50	0.39	0.43	4.86
15	0.17	0.25	3.09	0.28	0.47	4.26
16	0.12	0.19	2.69	0.23	0.47	3.70
17	0.03	0.13	2.30	0.29	0.50	3.24
18	0.00	0.11	2.13	0.20	0.37	2.81
19	0.00	0.10	1.89	0.13	0.29	2.41
20	0.00	0.04	1.63	0.08	0.34	2.08
21			1.90			1.90
22			1.52			1.52
23			1.29			1.29
24			1.10			1.10
25			0.92			0.92
26			0.77			0.77
27			0.73			0.73
28			0.52			0.52
29			0.43			0.43
30			0.29			0.29
> 30			0.44			0.44
Total	4.61	6.35	65.17	17.17	6.70	100.00

Composition, Wt% Compound	Aqueous Phase
Ethanol	3.20
Water by diff.	96.80
Total	100.00

Carbon No.	Composition, wt% Reactor Wax
12	0.22
13	0.21
14	0.37
15	0.48
16	0.54
17	0.68
18	0.85
19	1.05
20	1.29
21	1.56
22	1.85
23	2.14
24	2.45
25	2.74
26	3.08
27	3.45
28	3.72
29	3.96
30	4.22
31	4.40
32	4.41
33	4.39
34	4.63
35	4.09
36	3.87
37	3.74
38	3.28
39	3.00
40	2.76
41	2.48
42	2.23
43	2.05
44	1.84
45	1.65
46	1.47
47	1.30
48	1.15
49	1.05
50	0.92
> 50	10.46
Total	100.00

Elemental Balance:

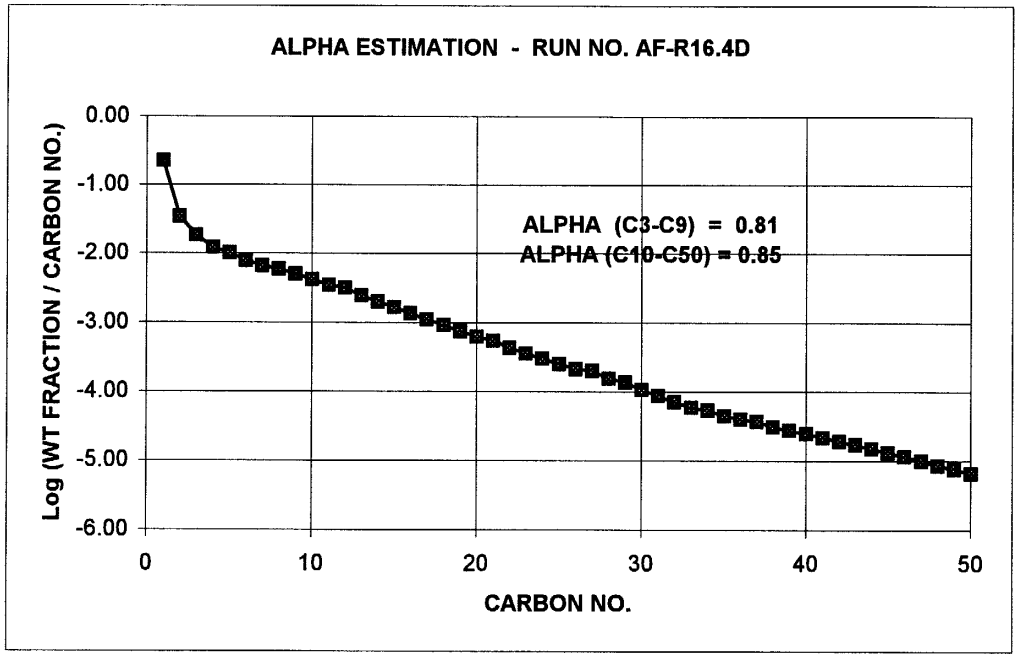
	Total lb/hr	C lb/hr	H lb/hr	O lb/hr	N lb/hr
Reactor Feed Gas	3905.32	1643.53	522.79	1263.25	475.75
Main Gas Outlet	3198.44	1444.90	425.70	852.09	475.75
27.10 Reactor Wax	14.96	12.76	2.19	0.00	0.00
22.14 Light Wax	0.00	0.00	0.00	0.00	0.00
22.18 HC Phase	240.29	202.69	36.25	1.36	0.00
22.18 AQ Phase	462.53	7.71	51.68	403.14	0.00
Total Out	3916.23	1668.06	515.82	1256.59	475.75
% Balance	100.3	101.5	98.7	99.5	100.0

Product Distribution: Selectivity (wt%)

Methane (C1)	22.2
Gas (C2 - C4)	17,2
Gasoline (C5 - C11)	31.3
Diesel (C122 - C18)	17.7
Wax (C19+)	11.6
Total	100.0
HC Production Rate based on Liquid Data, grams HC produced/kg-cat oxide hr	1125.4

Alpha Estimate:

C3 - C9	1	0.81
C10-C50	2	0.85


ALPHA ESTIMATION - RUN NO. AF-R16.4D
Log (WT FRACTION / CARBON NO.)
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
0
10
20
30
40
50
CARBON NO.
ALPHA (C3-C9) = 0.81
ALPHA (C10-C50) = 0.85

Start Date / Time	04/09/1998	18.00
End Date / Time	04/10/1998	7.00

On-stream Time From Start-up (hr)	
Start	292.00
End	305.00

Reaction Conditions:

Temperature	average	deg F	480.0	deg C	248.9
Pressure	PIC-201	psig	710.0	bara	49.97
Space Velocity		sL/kg-hr	18278		
Superficial Gas Vel. - Inlet		ft/sec	0.48	cm/sec	14.49
(based on average reactor temp)					
Recycle Ratio			1.79		

Slurry Data:

Catalyst Oxide Wt (Reactor)		lbs	377	kg	171.0
Slurry Concentration by NDG		wt%	26.4		
Slurry Concentration by DP		wt%	24.9		
Slurry Level by NDG	% NDG Span		96.3		
Slurry Height		ft	20.73	meters	6.32
Average Gas Holdup by NDG		Vol%	46.6		
Average Gas Holdup by DP		Vol%	42.4		

Performance Results

CO Conversion per pass, mole %	32.1
H2 Conversion per pass, mole %	39.7
CO + H2 Conversion per pass, mole %	37.2
Plant CO Conversion, mole%	79.1
Plant H2 Conversion, mole%	83.5
Plant CO+H2 Conversion, mole%	82.2
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	69.6
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	972.3
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	113.50
H2/CO in Fresh Feed, mole/mole	2.23
H2/CO in Reactor Feed, mole/mole	1.98
H2/CO Usage Ratio, mole/mole	2.45
H2/CO in Outlet, mole/mole	1.76
CO2 Selectivity, mole %	0.89
HC Selectivity (CO2 free) wt%:	
CH4	23.21
C2H6	5.86
C2H4	0.32
C3H8	7.73
C3H6	2.31
SUM C4H10	4.60
SUM C4H8	1.82
SUM C5H11	2.67

Reactor Heat Balance

	Btu/hr	**kW**
Chemical Heat Production by Reaction	1851479	542.61
Sensible Gas Heat	-96722	-28.35
Sensible Oil Heat	-1522261	-446.13
Sensible Wax Heat	-210654	-61.74
Estimate of Heat Loss from Catalyst Drying Data	-50000	-14.65
% Heat Balance based on Reaction Heat	101.52	

Mass Balance	**Reactor lb/hr**	**Plant lb/hr**	**Feed lb/hr**	**Prod Gas lb/hr**
Fresh Feed		1063	1063	
HP H2 Feed		81	81	
Recycle Feed			3083	3083
Reactor Feed	4198		4198	
Total In	4198	1144		
Prod Gas	3525			3525
Main Purge		441		441
22.11 Purge	0.0	0.0		
HC Phase	231.0	231.0		
AQ Phase	444.6	444.6		
Heavy Wax	15.0	15.0		
Light Wax				
Total Out	4216	1132		
Mass Balance, %	100.4	98.9	99.3	100.0

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	48.93	100.00	43.45	52.67	43.45	43.45	12.76	38.73
2	N2	3.36	0.00	8.31	6.08	8.31	8.31	3.73	7.41
3	CO	47.71	0.00	24.64	26.55	24.64	24.64	19.77	21.96
4	CH4	0.00	0.00	17.52	11.04	17.52	17.52	25.32	15.62
5	CO2	0.00	0.00	0.82	0.53	0.82	0.82	3.06	0.73
6	ETHANE	0.00	0.00	1.65	0.97	1.65	1.65	7.81	1.47
7	ETHYLENE	0.00	0.00	0.02	0.00	0.02	0.02	0.06	0.02
8	PROPANE	0.00	0.00	1.45	0.85	1.45	1.45	10.82	1.29
9	PROPYLENE	0.00	0.00	0.52	0.32	0.52	0.52	3.63	0.47
10	ISOBUATNE	0.00	0.00	0.02	0.01	0.02	0.02	0.13	0.02
11	N-BUTANE	0.00	0.00	0.70	0.42	0.70	0.70	5.95	0.62
12	T-BUTENE-2	0.00	0.00	0.03	0.02	0.03	0.03	0.27	0.03
13	BUTENE-1	0.00	0.00	0.20	0.12	0.20	0.20	1.67	0.18
14	ISOBUTYLENE	0.00	0.00	0.04	0.02	0.04	0.04	0.30	0.03
15	C-BUTENE-2	0.00	0.00	0.04	0.03	0.04	0.04	0.36	0.04
16	SUM C5	0.00	0.00	0.40	0.24	0.40	0.40	3.19	0.35
17	SUM C6	0.00	0.00	0.14	0.09	0.14	0.14	1.01	0.13
18	SUM C7	0.00	0.00	0.03	0.03	0.03	0.03	0.15	0.02
19	SUM C8	0.00	0.00	0.02	0.02	0.02	0.02	0.01	0.02
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								10.21
	HC								0.65
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	15.29	2.02	15.69	13.66	15.69	15.69	29.20	16.74
Flows	SCFH	26875.19	15501.80	75980.21	118806.83	86884.17	10872.37	0.00	97473.96
	lb mole/hr	69.51	40.09	196.51	307.28	224.71	28.12	0.00	252.10
	lb/hr	1062.98	80.99	3082.62	4197.72	3525.01	441.11	0.00	4221.16
	Nm3/hr	707.25	407.95	1999.51	3126.55	2286.46	286.12	0.00	2565.14
	kgmol/hr	31.53	18.19	89.14	139.38	101.93	12.76	0.00	114.35
	kg/hr	482.17	36.74	1398.27	1904.07	1598.94	200.08	0.00	1914.71
Temperature	deg F	273.3	83.0	110.0	261.1	86.8	84.1	71.0	
	deg C	134.1	28.3	43.3	127.3	30.4	28.9	21.7	
Pressure	psig	772.9	776.6	772.2	740.0	668.7	663.9	33.5	
	bara	54.30	54.56	54.25	52.03	47.12	46.79	3.32	

Reactor Heat Balance

Gas:		**deg F**	**deg C**			**lb/hr**	**kg/hr**		**Btu/lb-deg F**	**J/gm-deg C**		
Inlet Temp	TI-1-12A	441.8	227.7	Inlet Flow	RXT FEED	4198	1904.1	Inlet Ht Cap.	0.604	2.526		
Outlet Temp	RXT AVG	480.0	248.9	Outlet Flow	RXT FEED-WAXPROD	4183	1897.3	Outlet Ht Cap.	0.562	2.352		
Oil:												**lb/ft3** **kg/m3**
Inlet Temp	TI-1-14B	404.3	206.8	Inlet Flow	*FI-619	66849	30322.5	Inlet Ht Cap.	0.541	2.264	Inlet Density	52.03 833.44
Outlet Temp	TI-1780	447.5	230.8	Outlet Flow	*FI-619	66849	30322.5	Outlet Ht Cap.	0.560	2.343		
Slurry:												
Inlet Temp	TI-1783	449.0	231.7	Inlet Flow	*FI-1768-61	10902	4945.2	Inlet Ht Cap.	0.624	2.610		
Outlet Temp	RXT AVG	480.0	248.9	Outlet Flow	*FI-1768 *based on	10917	4952.0	Outlet Ht Cap.	0.624	2.610		

Reactor Differential Pressures

	DP NOZZLES		**Differential Pressures:**		**Heights:**		**Density - 3 Phase:**		**Gas Hold-up**
			psi	**mbar**	**ft** (based on flange loc.)	**meters**	**lb/ft3**	**kg/m3**	**vol%**
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.90	61.7	4.56	1.391	28.25	452.5	43.52
9.25 ft to 4.33 ft	K3-K5	PDI-1779	1.04	71.4	5.08	1.549	29.33	469.9	41.27
Total Reactor	K6-OUT	PDI-631	4.11	283.5	20.73	6.319	28.19	451.5	43.65
Sparger	K6-IN	PDI-633	1.50	103.3					

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	392.7	200.4		
3.5 ft Height	TI-1763	444.7	229.3		
0.5 ft Height	TI-1764	484.9	251.6		
Liquid Level:					
% Level	LI-1765	-5.5			
Slurry Height	ft	-0.64	meters	-0.194	

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	455.8	235.4
	Seal Oil Outlet	TI-1 795	104.6	40.3
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	744.1	52.32
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10917.2	4952.2
			g/cc	
Density:	Slurry Outlet	DI-1768	0.821	

SLURRY COOLER

Temperatures:	**deg F**	**deg C**

Slurry Outlet	TIC-1754	450.7	232.6
Oil Inlet	TI-1780	447.5	230.8

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	449.0	231.7	Flow Rate:	Wax	FI-1761	14.955	6.783
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	729.3	51.30	Density:	Wax	DI-1761	0.68	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	9.9	685	Linear Vel.:	Slurry thru	Calculated	10.85	3.308
	Thru B & A	PDI-1773	0.3	19		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	-1.6	-108	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.217
	Membrane B	PDI-1775	0.4	26		thru Reactor			
	Membrane C	PDI-1776	-1.0	-70					
	Membrane D	PDI-1777	-0.3	-24					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	470.3	243.5
Nozzle N2	20.25	TI-626-2	479.4	248.6
Nozzle N3	18.25	TI-190-2A	478.5	248.1
Nozzle N4	16.25	TI-626-3	477.2	247.4
Nozzle N5	14.25	TI-190-3	477.0	247.2
Nozzle N7	10.25	TI-1781A	481.8	249.9
		TI-1781B	481.0	249.4
		TI-1781C	481.9	249.9
		TI-1781D	481.0	249.5
Nozzle N8	8.083	TI-626-5	478.2	247.9
Nozzle K4	7.75	TI-190-4	484.3	251.3
Nozzle O	4.792	TI-626-6	478.7	248.2
Reactor Temp. Avg. (Noz N3 thru Noz O)			480.0	248.9

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	450.1	232.3
	22.14 Out	TIC-725	310.0	154.4
	21.65 Out	TIC-1-11A	85.0	29.4
	27.13 Lt Wax	TI-744	100.5	38.1
	28.30 Hv Wax	TI-515	231.0	110.5
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	59.3	
	22.10	LIC-220	30.0	
	22.15	LIC-242	21.1	
	27.13	LI-203	-7.0	
	28.30	LI-1792	-0.6	
			psig	**bara**
Pressure	27.13	PIC-202	5.82	1.41

Miscellaneous Data

Overall Plant Material Balance	%	98.93
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)		
Reactor GHSV Nm3 Rxt Feed/m3 3-phase slurry volume/hr		2133
Catalyst GHSV Nm3 Rxt Feed/m3	particle volume/hr	16853
Catalyst Volume in the Reactor	litres particle volume	185.5
Inlet Superfic. Vel. based on Avg Reactor Temp.	cm/sec	1449
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)	cm/sec	13.90
CO Conversion Rate, gmole CO converted AR particle	volume/hr	64.15
grams of HC (CH2.1) produced/Ift particle volume/hr	896.47	

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
100.02	99.96	100.01 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
95.93		99.96

Wax/Liquid Production Rates

	lbs/hr	kg/hr
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	14.95	6.78
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	231.00	104.78
Water (22.10/22.16, 100 deg F Cut)	444.65	201.69

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	22.27
	catalyst wt%	25.02

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.: psia	Based on CO, CO2 Meas.: mbara	Based on Water Production: psia	Based on Water Production: mbara
Calculated Water Partial Pressure @ Reactor Outlet	72.52	5000	69.86	4817
Saturated Water Pressure @ Reactor Outlet	567.1	39098	567.1	39098
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	12.79%		12.32%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	305.0	151.7	302.5	150.3

Start Date / Time	04/10/1998	14.00
End Date / Time	04/11/1998	12.00

On-stream Time From Start-up (hr)

Start	312.00
End	334.00

Reaction Conditions:

Temperature	average	deg F	498.3	deg C	259.1
Pressure	PIC-201	psig	710.1	bara	49.97
Space Velocity		sL/kg-hr	15530		
Superficial Gas Vel. - Inlet		ft/sec	0.41	cm/sec	12.52
(based on average reactor temp)					
Recycle Ratio			1.11		

Slurry Data:

Catalyst Oxide Wt (Reactor)		lbs	376	kg	170.6
Slurry Concentration by NDG		wt%	26.8		
Slurry Concentration by DP		wt%	25.6		
Slurry Level by NDG	% NDG Span		95.8		
Slurry Height		ft	20.65	meters	629
Average Gas Holdup by NDG		Vol%	47.2		
Average Gas Holdup by DP		Vol%	43.6		

Performance Results

CO Conversion per pass, mole %	31.7
H2 Conversion per pass, mole %	56.4
CO + H2 Conversion per pass, mole %	45.8
Plant CO Conversion, mole%	71.3
Plant H2 Conversion, mole%	87.1
Plant CO+H2 Conversion, mole%	81.6
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	79.8
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1109.9
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	129.72
H2/CO in Fresh Feed, mole/mole	1.88
H2/CO in Reactor Feed, mole/mole	1.33
H2/CO Usage Ratio, mole/mole	2.37
H2/CO in Outlet, mole/mole	0.85
CO2 Selectivity, mole %	1.37
HC Selectivity (CO2 free) wt%:	
CH4	22.22
C2H6	3.16
C2H4	0.17
C3H8	3.44
C3H6	2.27
SUM C4H10	2.28
SUM C4H8	1.55
SUM C5H11	1.40

Reactor Heat Balance

	Btu/hr	kW
Chemical Heat Production by Reaction	2110254	618.45
Sensible Gas Heat	-113445	-33.25
Sensible Oil Heat	-1691725	-495.79
Sensible Wax Heat	-238515	-69.90
Estimate of Heat Loss from Catalyst Drying Data	-50000	-14.65
% Heat Balance based on Reaction Heat	99.21	

Mass Balance	Reactor lb/hr	Plant lb/hr	Feed lb/hr	Prod Gas lb/hr
Fresh Feed		1301	1301	
HP H2 Feed		89	89	
Recycle Feed			2560	2560
Reactor Feed	3946		3946	
Total In	3946	1391		
Prod Gas	3138			3138
Main Purge		580		580
22.11 Purge	0.0	0.0		
HC Phase	270.1	270.1		
AQ Phase	519.8	519.8		
Heavy Wax	31.2	31.2		
Light Wax				
Total Out	3959	1401		
Mass Balance, %	100.3	100.7	99.9	

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	43.73	100.00	32.78	48.29	32.78	32.78	10.20	27.64
2	N2	2.98	0.00	7.53	4.84	7.53	7.53	3.55	6.35
3	CO	53.29	0.00	38.68	36.36	38.68	38.68	24.06	32.62
4	CH4	0.00	0.00	14.94	7.32	14.94	14.94	23.32	12.59
5	CO2	0.00	0.00	1.32	0.69	1.32	1.32	5.12	1.12
6	ETHANE	0.00	0.00	1.44	0.75	1.44	1.44	7.31	1.21
7	ETHYLENE	0.00	0.00	0.03	0.01	0.03	0.03	0.11	0.03
8	PROPANE	0.00	0.00	1.05	0.54	1.05	1.05	8.17	0.88
9	PROPYLENE	0.00	0.00	0.71	0.37	0.71	0.71	5.40	0.60
10	ISOBUATNE	0.00	0.00	0.01	0.00	0.01	0.01	0.11	0.01
11	N-BUTANE	0.00	0.00	0.53	0.28	0.53	0.53	4.67	0.45
12	T-BUTENE-2	0.00	0.00	0.04	0.02	0.04	0.04	0.31	0.03
13	BUTENE-1	0.00	0.00	0.29	0.15	0.29	0.29	2.51	0.24
14	ISOBUTYLENE	0.00	0.00	0.04	0.02	0.04	0.04	0.32	0.03
15	C-BUTENE-2	0.00	0.00	0.05	0.03	0.05	0.05	0.42	0.04
16	SUM C5	0.00	0.00	0.38	0.21	0.38	0.38	3.21	0.32
17	SUM C6	0.00	0.00	0.14	0.07	0.14	0.14	1.04	0.12
18	SUM C7	0.00	0.00	0.03	0.01	0.03	0.03	0.16	0.03
19	SUM C8	0.00	0.00	0.01	0.02	0.01	0.01	0.02	0.01
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								14.71
	HC								0.97
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.64	2.02	18.77	15.15	18.77	18.77	30.16	19.85
Flows	SCFH	30231.00	17105.90	52737.92	100677.29	64645.94	11945.18	0.00	76665.25
	lb mole/hr	78.19	44.24	136.40	260.39	167.20	30.89	0.00	198.28
	lb/hr	1301.32	89.37	2560.19	3945.70	3138.28	579.89	0.00	3935.32
	Nm3/hr	795.57	450.16	1387.86	2649.44	1701.24	314.35	0.00	2017.54
	kgmol/hr	35.47	20.07	61.87	118.11	75.84	14.01	0.00	89.94
	kg/hr	590.27	40.54	1161.30	1789.76	1423.51	263.03	0.00	1785.05
Temperature	deg F	273.0	86.5	109.4	327.3	88.7	86.1	74.4	
	deg C	133.9	30.3	43.0	164.0	31.5	30.0	23.5	
Pressure	psig	768.9	780.7	761.3	733.3	677.3	673.2	33.5	
	bara	54.03	54.84	53.50	51.57	47.71	47.43	3.32	

Reactor Heat Balance

Gas:		**deg F**	**deg C**			**lb/hr**	**kg/hr**		**Btu/lb-deg F**	**J/gm-deg C**			
Inlet Temp	TI-1-12A	443.1	228.4	Inlet Flow	RXT FEED	3946	1789.8	Inlet Ht Cap.	0.521	2.178			
Outlet Temp	RXT AVG	498.3	259.1	Outlet Flow	RXT FEED-WAXPROD	3915	1775.6	Outlet Ht Cap.	0.466	1.949			
Oil:												**lb/ft3**	**kg/m3**
Inlet Temp	TI-1-14B	413.7	212.0	Inlet Flow	*FI-619	66080	29973.7	Inlet Ht Cap.	0.545	2.281	Inlet Density	51.77	829.24
Outlet Temp	TI-1780	462.0	238.9	Outlet Flow	*FI-619	66080	29973.7	Outlet Ht Cap.	0.566	2.369			
Slurry:													
Inlet Temp	TI-1783	462.9	239.4	Inlet Flow	*FI-1768-61	10853	4922.8	Inlet Ht Cap.	0.620	2.594			
Outlet Temp	RXT AVG	498.3	259.1	Outlet Flow	*FI-1768	10884	4937.0	Outlet Ht Cap.	0.620	2.594			
					*based on								

Reactor Differential Pressures

	DP NOZZLES		Differential Pressures: psi	mbar	Heights: ft (based on flange loc.)	meters	Density - 3 Phase: lb/ft3	kg/m3	Gas Hold-up vol%
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.88	60.8	4.56	1.391	27.83	445.9	44.30
9.25 ft to 4.33 ft	K3-K5	PDI-1779	1.01	59.4	5.08	1.549	28.51	456.6	42.89
Total Reactor	K6-OUT	PDI-631	3.98	274.5	20.65	6.294	27.31	437.4	45.40
Sparger	K6-IN	PDI-633	1.11	76.7					

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	393.7	201.0		
3.5 ft Height	TI-1763	440.2	226.8		
0.5 ft Height	TI-1764	498.2	259.0		
Liquid Level:					
% Level	LI-1765	-2.4			
Slurry Height	ft	-0.16	meters	-0.047	

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	470.0	243.3
	Seal Oil Outlet	TI-1 795	107.2	41.8
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	755.7	53.12
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10884.1	4937.2
			g/cc	
Density:	Slurry Outlet	DI-1768	0.814	

SLURRY COOLER

Temperatures:		**deg F**	**deg C**
Slurry Outlet	TIC-1754	465.3	240.7

Oil Inlet	TI-1780	462.0	238.9

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	462.9	239.4	Flow Rate:	Wax	FI-1761	31.189	14.147
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	729.1	51.28	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	9.7	667	Linear Vel.:	Slurry thru	Calculated	10.91	3.326
	Thru B & A	PDI-1773	0.2	13		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	-0.5	-32	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.241
	Membrane B	PDI-1775	0.6	44		thru Reactor			
	Membrane C	PDI-1776	-0.9	-65					
	Membrane D	PDI-1777	0.1	3					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	480.8	249.3
Nozzle N2	20.25	TI-626-2	494.8	257.1
Nozzle N3	18.25	TI-190-2A	495.3	257.4
Nozzle N4	16.25	TI-626-3	494.0	256.7
Nozzle N5	14.25	TI-190-3	494.1	256.7
Nozzle N7	10.25	TI-1781A	500.9	260.5
		TI-1781B	499.8	259.9
		TI-1781C	500.8	260.4
		TI-1781D	500.3	260.2
Nozzle N8	8.083	TI-626-5	405.3	257.4
Nozzle K4	7.75	TI-190-4	504.4	262.4
Nozzle O	4.792	TI-626-6	498.4	259.1
Reactor Temp. Avg. (Noz N3 thru Noz O)				498.3
259.1				

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	456.6	235.9
	22.14 Out	TIC-725	310.0	154.4
	21.65 Out	TIC-1-11A	87.1	30.6
	27.13 Lt Wax	TI-744	102.1	38.9
	28.30 Hv Wax	TI-515	233.9	112.2
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	85.6	
	22.10	LIC-220	30.0	
	22.15	LIC-242	24.7	
	27.13	LI-203	-7.0	
	28.30	LI-1792	-0.3	
			psig	**bara**
Pressure	27.13	PIC-202	3.64	1.26

Miscellaneous Data

Overall Plant Material Balance	%	100.74
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)		
Reactor GHSV Nm3 Rxt Feed/m3 3-phase slurry volume/hr		1815
Catalyst GHSV Nm3 Rxt Feed/m3	particle volume/hr	14319
Catalyst Volume in the Reactor	litres particle volume	185.0
Inlet Superfic. Vel. based on Avg Reactor Temp.	cm/sec	12.52
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)	cm/sec	11.80
CO Conversion Rate, gmole CO converted AR particle volume/hr		73.58
grams of HC (CH2.1) produced/lft particle volume/hr		1023.28

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
99.94	99.96	99.99 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
99.00		100.06

Wax/Liquid Production Rates

	lbs/hr	kg/hr
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	31.19	14.15
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	270.06	122.50
Water (22.10/22.16, 100 deg F Cut)	519.82	235.79

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	21.94
	catalyst wt%	24.86

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.: psia	Based on CO, CO2 Meas.: mbara	Based on Water Production: psia	Based on Water Production: mbara
Calculated Water Partial Pressure @ Reactor Outlet	104.46	7272	103.47	7141
Saturated Water Pressure @ Reactor Outlet	672.2	46344	672.2	46344
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	15.54%		15.41%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	330.7	166.0	330.1	165.6

RUN NO.: AF-R16.5B **TITLE: LIQUID PHASE FISCHER-TROPSCH (IV) SYNTHESIS IN LAPORTE AFDU**

Start Date / Time	04/11/1998	12.00
End Date / Time	04/11/1998	23.00

On-stream Time From Start-up (hr)	
Start	334.00
End	345.00

Reaction Conditions:

Temperature	average	deg F	497.7	deg C	258.7
Pressure	PIC-201	psig	710.0	bara	49.96
Space Velocity		sL/kg-hr	15601		
Superficial Gas Vel. - Inlet		ft/sec	0.41	cm/sec	12.47
(based on average reactor temp)					
Recycle Ratio			1.10		

Slurry Data:

Catalyst Oxide Wt (Reactor)		lbs	373	kg	169.2
Slurry Concentration by NDG		wt%	26.5		
Slurry Concentration by DP		wt%	25.5		
Slurry Level by NDG	% NDG Span		96.8		
Slurry Height		ft	20.82	meters	6.35
Average Gas Holdup by NDG		Vol%	46.8		
Average Gas Holdup by DP		Vol%	44.4		

Performance Results

CO Conversion per pass, mole %	31.2
H2 Conversion per pass, mole %	54.1
CO + H2 Conversion per pass, mole %	44.5
Plant CO Conversion, mole%	69.4
Plant H2 Conversion, mole%	85.1
Plant CO+H2 Conversion, mole%	79.6
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	78.3
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1088.9
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	125.23
H2/CO in Fresh Feed, mole/mole	1.88
H2/CO in Reactor Feed, mole/mole	1.38
H2/CO Usage Ratio, mole/mole	2.39
H2/CO in Outlet, mole/mole	0.92
CO2 Selectivity, mole %	1.35
HC Selectivity (CO2 free) wt%:	
CH4	23.06
C2H6	3.40
C2H4	0.17
C3H8	3.63
C3H6	2.32
SUM C4H10	2.55
SUM C4H8	1.76
SUM C5H11	2.06

Reactor Heat Balance

	Btu/hr	**kW**
Chemical Heat Production by Reaction	2053707	601.88
Sensible Gas Heat	-115946	-33.98
Sensible Oil Heat	-1626599	-476.71
Sensible Wax Heat	-241330	-70.73
Estimate of Heat Loss from Catalyst Drying Data	-50000	-14.65
% Heat Balance based on Reaction Heat	99.03	

Mass Balance	**Reactor lb/hr**	**Plant lb/hr**	**Feed lb/hr**	**Prod Gas lb/hr**
Fresh Feed		1303	1303	
HP H2 Feed		89	89	
Recycle Feed			2470	2470
Reactor Feed	3854		3854	
Total In	3854	1392		
Prod Gas	3081			3081
Main Purge		611		611
22.11 Purge	0.0	0.0		
HC Phase	264.8	264.8		
AQ Phase	509.6	509.6		
Heavy Wax	31.2	31.2		
Light Wax				
Total Out	3886	1417		
Mass Balance, %	100.8	101.8	99.8	100.0

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	43.77	100.00	35.01	49.60	35.01	35.01	11.28	29.68
2	N2	2.98	0.00	6.99	4.54	6.99	6.99	3.44	5.92
3	CO	53.25	0.00	38.17	36.04	38.17	38.17	24.73	32.35
4	CH4	0.00	0.00	14.02	6.80	14.02	14.02	22.74	11.88
5	CO2	0.00	0.00	1.17	0.61	1.17	1.17	4.70	0.99
6	ETHANE	0.00	0.00	1.37	0.71	1.37	1.37	6.92	1.17
7	ETHYLENE	0.00	0.00	0.03	0.01	0.03	0.03	0.10	0.03
8	PROPANE	0.00	0.00	1.01	0.52	1.01	1.01	7.84	0.86
9	PROPYLENE	0.00	0.00	0.69	0.36	0.69	0.69	5.24	0.58
10	ISOBUATNE	0.00	0.00	0.01	0.00	0.01	0.01	0.11	0.01
11	N-BUTANE	0.00	0.00	0.53	0.28	0.53	0.53	4.72	0.45
12	T-BUTENE-2	0.00	0.00	0.03	0.02	0.03	0.03	0.30	0.03
13	BUTENE-1	0.00	0.00	0.28	0.15	0.28	0.28	2.49	0.24
14	ISOBUTYLENE	0.00	0.00	0.03	0.02	0.03	0.03	0.32	0.03
15	C-BUTENE-2	0.00	0.00	0.05	0.02	0.05	0.05	0.41	0.04
16	SUM C5	0.00	0.00	0.40	0.21	0.40	0.40	3.34	0.34
17	SUM C6	0.00	0.00	0.14	0.08	0.14	0.14	1.11	0.12
18	SUM C7	0.00	0.00	0.03	0.01	0.03	0.03	0.16	0.03
19	SUM C8	0.00	0.00	0.02	0.01	0.02	0.02	0.02	0.02
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								14.28
	HC								0.94
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.64	2.02	18.28	14.85	18.28	18.28	29.91	19.41
Flows	SCFH	30276.13	17113.20	52249.90	100329.21	65165.37	12933.28	0.00	76871.22
	lb mole/hr	78.30	44.26	135.14	259.49	168.54	33.45	0.00	198.82
	lb/hr	1302.60	89.41	2470.14	3854.02	3080.72	611.43	0.00	3858.51
	Nm3/hr	796.75	450.35	1375.02	2640.28	1714.91	340.35	0.00	2022.96
	kgmol/hr	35.52	20.08	61.30	117.70	76.45	15.17	0.00	90.18
	kg/hr	590.86	40.55	1120.45	1748.17	1397.40	277.34	0.00	1750.21
Temperature	deg F	272.2	87.7	109.3	307.0	88.6	85.7	72.8	
	deg C	133.4	30.9	43.0	152.8	31.4	29.8	22.7	
Pressure	psig	767.5	761.6	759.4	732.5	677.0	672.9	33.5	
	bara	53.93	53.53	53.37	51.52	47.69	47.41	3.32	

Reactor Heat Balance

		deg F	deg C			lb/hr	kg/hr		Btu/lb-deg F	J/gm-deg C			
Gas:													
Inlet Temp	TI-1-12A	440.8	227.1	Inlet Flow	RXT FEED	38.54	1748.2	Inlet Ht Cap.	0.529	2.213			
Outlet Temp	RXT AVG	497.7	258.7	Outlet Flow	RXT FEED-WAXPROD	3823	1734.0	Outlet Ht Cap.	0.474	1.984			
Oil:												**lb/ft3**	**kg/m3**
Inlet Temp	TI-1-14B	416.2	213.4	Inlet Flow	*FI-619	66004	29939.2	Inlet Ht Cap.	0.546	2.286	Inlet Density	51.70	828.12
Outlet Temp	TI-1780	462.6	239.2	Outlet Flow	*FI-619	66004	29939.2	Outlet Ht Cap.	0.566	2.370			
Slurry:													
Inlet Temp	TI-1783	461.8	238.8	Inlet Flow	*FI-1768-61	10834	4914.4	Inlet Ht Cap.	0.620	2.595			
Outlet Temp	RXT AVG	297.7	258.7	Outlet Flow	*FI-1768	10865	4928.5	Outlet Ht Cap.	0.620	2.595			
					*based on								

Reactor Differential Pressures

	DP NOZZLES		Differential Pressures:		Heights:		Density - 3 Phase:		Gas Hold-up
			psi	**mbar**	**ft** (based on flange loc.)	**meters**	**lb/ft3**	**kg/m3**	**vol%**
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.88	60.4	4.56	1.391	27.66	443.1	44.63
9.25 ft to 4.33 ft	K3-K5	PDI-1779	0.99	67.9	5.08	1.549	27.91	447.1	44.10
Total Reactor	K6-OUT	PDI-631	0.76	52.3	20.82	6.346	4.82	77.1	92.41
Sparger	K6-IN	PDI-633	3.32	228.6					

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	343.7	173.2		
3.5 ft Height	TI-1763	313.5	156.4		
0.5 ft Height	TI-1764	494.1	256.7		
Liquid Level:					
% Level	LI-1765	-7.4			
Slurry Height		ft -0.99		meters	-0.302

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	469.4	243.0
	Seal Oil Outlet	TI-1 795	107.9	42.2
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	749.6	52.70
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10865.4	4928.7
			g/cc	
Density:	Slurry Outlet	DI-1768	0.812	

SLURRY COOLER

Temperatures:	**deg F**	**deg C**

Slurry Outlet	TIC-1754	464.2	240.1
Oil Inlet	TI-1780	462.6	239.2

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	461.8	238.8	Flow Rate:	Wax	FI-1761	31.191	14.148
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	729.2	51.29	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	9.7	667	Linear Vel.:	Slurry thru	Calculated	10.92	3.328
	Thru B & A	PDI-1773	0.3	20		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	-0.4	025	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.246
	Membrane B	PDI-1775	0.0	63		thru Reactor			
	Membrane C	PDI-1776	-1.0	-66					
	Membrane D	PDI-1777	-2.8	-190					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	466.5	241.4
Nozzle N2	20.25	TI-626-2	495.8	257.7
Nozzle N3	18.25	TI-190-2A	495.7	257.6
Nozzle N4	16.25	TI-626-3	494.3	256.8
Nozzle N5	14.25	TI-190-3	494.9	256.7
Nozzle N7	10.25	TI-1781A	500.3	260.1
		TI-1781B	499.2	259.6
		TI-1781C	500.0	260.0
		TI-1781D	499.5	259.7
Nozzle N8	8.083	TI-626-5	493.5	256.4
Nozzle K4	7.75	TI-190-4	503.3	261.9
Nozzle O	4.792	TI-626-6	496.9	258.3
Reactor Temp. Avg. (Noz N3 thru Noz O)				497.7
258.7				

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	446.4	230.2
	22.14 Out	TIC-725	309.9	154.4
	21.65 Out	TIC-1-11A	86.7	30.4
	27.13 Lt Wax	TI-744	97.6	36.4
	28.30 Hv Wax	TI-515	210.1	99.0
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	44.2	
	22.10	LIC-220	30.0	
	22.15	LIC-242	24.2	
	27.13	LI-203	-7.0	
	28.30	LI-1792	-0.6	
			psig	**bara**
Pressure	27.13	PIC-202	2.40	1.18

Miscellaneous Data

Overall Plant Material Balance		%	101.80
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)			
Reactor GHSV	Nm3 Rxt Feed/m3 3-phase	slurry volume/hr	1794
Catalyst GHSV	Nm3 Rxt Feed/m3	particle volume/hr	14384
Catalyst Volume in the Reactor		litres particle volume	183.5
Inlet Superfic. Vel. based on Avg Reactor Temp.		cm/sec	12.47
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)		cm/sec	11.73
CO Conversion Rate, gmole CO converted AR particle volume/hr			72.17
grams of HC (CH2.1) produced/Ift particle volume/hr			1003.93

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
99.99	100.03	99.99 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
99.70		100.03

Wax/Liquid Production Rates

	lbs/hr	**kg/hr**
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	31.19	14.15
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	264.76	120.09
Water (22.10/22.16, 100 deg F Cut)	509.62	231.16

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	21.61
	catalyst wt%	24.54

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.:		**Based on Water Production:**	
	psia	**mbara**	**psia**	**mbara**
Calculated Water Partial Pressure @ Reactor Outlet	101.41	6992	101.15	6974
Saturated Water Pressure @ Reactor Outlet	668.2	46072	668.2	46072
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	15.18%		15.14%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	328.6	164.8	328.4	164.6

Start Date / Time	04/13/1998	9.00
End Date / Time	04/14/1998	11.00

On-stream Time From Start-up (hr)	
Start	379.00
End	405.00

Reaction Conditions:

Temperature	average	deg F	498.2	deg C	259.0
Pressure	PIC-201	psig	710.0	bara	49.96
Space Velocity		sL/kg-hr	17567		
Superficial Gas Vel. - Inlet		ft/sec	0.42	cm/sec	12.81
(based on average reactor temp)					
Recycle Ratio			1.15		

Slurry Data:

Catalyst Oxide Wt (Reactor)	lbs	340	kg	154.2
Slurry Concentration by NDG	wt%	27.0		
Slurry Concentration by DP	wt%	25.7		
Slurry Level by NDG % NDG Span		96.1		
Slurry Height	ft	20.70	meters	6.31
Average Gas Holdup by NDG	Vol%	52.9		
Average Gas Holdup by DP	Vol%	49.2		

Performance Results

CO Conversion per pass, mole %	30.1
H2 Conversion per pass, mole %	52.2
CO + H2 Conversion per pass, mole %	43.0
Plant CO Conversion, mole%	68.7
Plant H2 Conversion, mole%	84.2
Plant CO+H2 Conversion, mole%	78.8
CO Conversion Rate, gmole CO converted/kg cat oxide-hr	84.1
HC Production Rate, grams of HC (CH2.1) produced/kg cat oxide-hr	1172.0
Reactor Productivity (STY) grams of H C (CH2.1)/lit of reactor vol. - hr	123.57
H2/CO in Fresh Feed, mole/mole	1.90
H2/CO in Reactor Feed, mole/mole	1.40
H2/CO Usage Ratio, mole/mole	2.43
H2/CO in Outlet, mole/mole	0.96
CO2 Selectivity, mole %	1.15
HC Selectivity (CO2 free) wt%:	
CH4	22.30
C2H6	3.54
C2H4	0.15
C3H8	4.07
C3H6	2.57
SUM C4H10	3.11
SUM C4H8	2.06
SUM C5H11	2.72

Reactor Heat Balance

	Btu/hr	**kW**
Chemical Heat Production by Reaction	2014029	590.25
Sensible Gas Heat	-111837	-32.78
Sensible Oil Heat	-1611597	-472.31
Sensible Wax Heat	-205269	-60.16
Estimate of Heat Loss from Catalyst Drying Data	-60000	-14.65
% Heat Balance based on Reaction Heat	98.25	

Mass Balance	**Reactor lb/hr**	**Plant lb/hr**	**Feed lb/hr**	**Prod Gas lb/hr**
Fresh Feed		1299	1299	
HP H2 Feed		89	89	
Recycle Feed			2559	2559
Reactor Feed	3941		3941	
Total In	3941	1388		
Prod Gas	3185			3185
Main Purge		625		625
22.11 Purge	0.1	0.1		
HC Phase	255.8	255.8		
AQ Phase	492.4	492.4		
Heavy Wax	31.2	31.2		
Light Wax				
Total Out	3964	1405		
Mass Balance, %	100.6	101.2	99.8	100.0

Compositions (mole%):		**LP FRESH FEED**	**HP FRESH FEED (H2)**	**RECYCLE FEED**	**REACTOR FEED GAS**	**PRODUCT GAS**	**MAIN (22.10) PURGE**	**22.11 PURGE**	**REACTOR OUTLET (estimated)**
Components									
1	H2	44.10	100.00	36.13	49.97	36.13	36.13	11.70	30.91
2	N2	3.04	0.00	6.90	4.56	6.90	6.90	16.85	5.90
3	CO	52.86	0.00	37.63	35.59	37.63	37.63	22.81	32.19
4	CH4	0.00	0.00	13.52	6.80	13.52	13.52	19.60	11.57
5	CO2	0.00	0.00	0.94	0.50	0.94	0.94	3.32	0.80
6	ETHANE	0.00	0.00	1.38	0.73	1.38	1.38	4.95	1.18
7	ETHYLENE	0.00	0.00	0.03	0.01	0.03	0.03	0.08	0.02
8	PROPANE	0.00	0.00	1.06	0.56	1.06	1.06	6.06	0.91
9	PROPYLENE	0.00	0.00	0.69	0.36	0.69	0.69	3.80	0.59
10	ISOBUATNE	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.01
11	N-BUTANE	0.00	0.00	0.60	0.31	0.60	0.60	3.95	0.51
12	T-BUTENE-2	0.00	0.00	0.04	0.02	0.04	0.04	0.25	0.03
13	BUTENE-1	0.00	0.00	0.28	0.13	0.28	0.28	1.84	0.24
14	ISOBUTYLENE	0.00	0.00	0.04	0.04	0.04	0.04	0.27	0.03
15	C-BUTENE-2	0.00	0.00	0.05	0.03	0.05	0.05	0.34	0.04
16	SUM C5	0.00	0.00	0.46	0.24	0.46	0.46	2.86	0.39
17	SUM C6	0.00	0.00	0.18	0.10	0.18	0.18	1.01	0.15
18	SUM C7	0.00	0.00	0.04	0.03	0.04	0.04	0.17	0.03
19	SUM C8	0.00	0.00	0.03	0.01	0.03	0.03	0.01	0.02
20	SUM C9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	SUM C10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	H2O								13.57
	HC								0.88
	LIGHT WAX								0.000
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mole Wt	lb/lb mole	16.55	2.02	18.10	14.80	18.10	18.10	28.70	19.18
Flows	SCFH	30340.69	17101.90	54684.69	102978.82	68044.68	13356.27	1.47	79541.69
	lb mole/hr	78.47	44.23	141.43	266.34	175.99	34.54	0.00	205.72
	lb/hr	1298.57	89.35	2559.34	3941.01	3184.61	625.10	0.11	3944.81
	Nm3/hr	798.45	450.06	1439.09	2710.01	1790.68	351.49	0.04	2093.24
	kgmoVhr	35.59	20.06	64.15	120.81	79.83	15.67	0.00	93.32
	kg/hr	589.03	40.53	1160.91	1787.63	1444.53	283.54	0.05	1789.35
Temperature	deg F	272.5	84.4	119.7	399.3	102.3	97.7	75.7	
	deg C	133.6	29.1	48.7	204.0	39.1	36.5	24.3	
Pressure	psig	772.2	791.8	765.3	734.3	632.4	627.9	33.8	
	bara	54.25	55.60	53.78	51.64	44.61	44.31	3.35	

Reactor Heat Balance

Gas:		**deg F**	**deg C**			**lb/hr**	**kg/hr**		**Btu/lb-deg F**	**J/gm-deg C**		
Inlet Temp	TI-1-12A	445.1	229.5	Inlet Flow	RXT FEED	3941	1787.6	Inlet Ht Cap.	0.534	2.235		
Outlet Temp	RXT AVG	498.2	259.0	Outlet Flow	RXT FEED-WAXPROD	3910	1773.5	Outlet Ht Cap.	0.480	2.007		
Oil:												**lb/ft3** **kg/m3**
Inlet Temp	TI-1-14B	418.4	214.7	Inlet Flow	*FI-619	65812	29852.1	Inlet Ht Cap.	0.547	2.290	Inlet Density	51.64 827.11
Outlet Temp	TI-1780	464.4	240.2	Outlet Flow	*FI-619	65812	29852.1	Outlet Ht Cap.	0.567	2.374		
Slurry:												
Inlet Temp	TI-1783	467.1	241.7	Inlet Flow	*FI-1768-61	10647	4829.5	Inlet Ht Cap.	0.619	2.592		
Outlet Temp	RXT AVG	498.2	259.0	Outlet Flow	*FI-1768	10678	4843.6	Outlet Ht Cap.	0.619	2.592		
					*based on							

Reactor Differential Pressures

	DP NOZZLES		**Differential Pressures:**		**Heights:**		**Density - 3 Phase:**		**Gas Hold-up**
			psi	**mbar**	**ft** (based on flange loc.)	**meters**	**lb/ft3**	**kg/m3**	**vol%**
Reactor Height:									
13.75 to 9.25 ft	Kl -K3	PDI-1778	0.80	55.1	4.56	1.391	25.23	404.1	49.74
9.25 ft to 4.33 ft	K3-K5	PDI-1779	0.90	62.3	5.08	1.549	25.59	409.9	48.98
Total Reactor	K6-OUT	PDI-631	3.77	260.2	20.70	6.309	25.83	413.7	48.49
Sparger	K6-IN	PDI-633	1.33	92.0					

DEGASSER

Temperatures:		**deg F**	**deg C**		
6.5 ft Height	TI-1762	346.7	174.8		
3.5 ft Height	TI-1763	450.5	232.5		
0.5 ft Height	TI-1764	499.8	259.9		
Liquid Level:					
% Level	LI-1765	-7.4			
Slurry Height	ft	-1.11	meters	-0.340	

SLURRY PUMP

			deg F	**deg C**
Temperature:	Slurry Inlet	TI-1755	474.2	245.7
	Seal Oil Outlet	TI-1 795	110.9	43.8
			psig	**bara**
Pressure:	Seal Oil Outlet	PI-1794	757.9	53.27
			lb/hr	**kg/hr**
Flow Rate:	Slurry Outlet	FI-1768	10678.2	4843.8
			g/cc	
Density:	Slurry Outlet	DI-1768	0.795	

SLURRY COOLER

Temperatures:		**deg F**	**deg C**
Slurry Outlet	TIC-1754	468.7	242.6

Oil Inlet	TI-1780	464.4	240.2

FILTERS

			deg F	deg C				lb/hr	kg/hr
Temperature:	Slurry Outlet	TI-1783	467.1	241.7	Flow Rate:	Wax	FI-1761	31.88	14.147
			psig	**bara**				**g/cc**	
Pressure:	Slurry Inlet	PI-1756	728.7	51.25	Density:	Wax	DI-1761	0.67	
Diff. Press.:	Longitudinal		**psi**	**mbar**				**ft/sec**	**msec**
	Thru D & C	PDI-1772	8.0	554	Linear Vel.:	Slurry thru	Calculated	10.95	3.338
	Thru B & A	PDI-1773	0.1	7		Each Element			
	rans-membrane							**ft/sec**	**msec**
	Membrane A	PDI-1774	-0.3	-18	Superfic. Vel.:	Liquid Upflow	Calculated	0.024	7.269
	Membrane B	PDI-1775	1.1	76		thru Reactor			
	Membrane C	PDI-1776	-1.0	-72					
	Membrane D	PDI-1777	0.2	11					

Reactor Temperatures

	Reactor Ht, Ft		Deg F	Deg C
Nozzle N1	24.25	TI-626-1	467.4	241.9
Nozzle N2	20.25	TI-626-2	499.5	259.7
Nozzle N3	18.25	TI-190-2A	497.1	258.4
Nozzle N4	16.25	TI-626-3	495.2	257.4
Nozzle N5	14.25	TI-190-3	494.0	256.6
Nozzle N7	10.25	TI-1781A	500.5	260.3
		TI-1781B	499.2	259.6
		TI-1781C	500.7	260.4
		TI-1781D	499.5	259.7
Nozzle N8	8.083	TI-626-5	495.6	257.6
Nozzle K4	7.75	TI-190-4	503.5	262.0
Nozzle O	4.792	TI-626-6	497.0	258.3
Reactor Temp. Avg. (Noz N3 thru Noz O)				498.2
259.0				

Product Separation

			deg F	deg C
Temperatures	27.11 In	TI-1-08	-25.0	-31.7
	2138 Tube In	TI-723	469.2	242.9
	22.14 Out	TIC-725	290.0	143.3
	21.65 Out	TIC-1-11A	99.0	37.2
	27.13 Lt Wax	TI-744	97.6	36.5
	28.30 Hv Wax	TI-515	201.8	94.4
			%	
Levels	27.12	LIC-639	0.0	
	22.14	LIC-688	35.9	
	22.10	LIC-220	30.1	
	22.15	LIC-242	25.6	
	27.13	LI-203	-6.0	
	28.30	LI-1792	14.5	
			psig	**bara**
Pressure	27.13	PIC-202	0.49	1.05

Miscellaneous Data

Overall Plant Material Balance	%		101.20
100*(22.10 Purge 22.11 Purge+Heavy Wax+Light Wax+Light HC+Water)/ (LP Fresh Feed+HP H2)			
Reactor GHSV	Nm3 Rxt Feed/m3 3-phase slurry volume/hr		1852
Catalyst GHSV	Nm3 Rxt Feed/m3	particle volume/hr	16197
Catalyst Volume in the Reactor		litres particle volume	167.3
Inlet Superfic. Vel. based on Avg Reactor Temp.	cm/sec		12.81
Inlet Sup. Vel. based on Rxt Inlet Temp (TI-1-12A)	cm/sec		12.10
CO Conversion Rate, gmole CO converted AR particle volume/hr			77.53
grams of HC (CH2.1) produced/Ift particle volume/hr			1080.62

N2 Balance Across Reactor (vary prod gas flow factor-step1)	**Plant N2 Balance** (vary purgel flow factor-step2)	**Feed N2 Balance** (vary 01.20 discharge flow factor-step3)
99.98	99.98	100.02 (Redundancy converges both to 100%)
Water/Oxygen Balance		**Prod. Gas N2 Balance** (vary 01.20 discharge flow factor-step3)
97.97		99.99

Wax/Liquid Production Rates

	lbs/hr	**kg/hr**
Heavy Wax (27.10/28.30, Reactor Temp. Cut)	31.19	14.15
Light Wax (22.14/27.13, 392 deg F Cut)	0.00	0.00
Light HCs (22.10/22.16, 100 deg F Cut)	255.80	116.03
Water (22.10/22.16, 100 deg F Cut)	492.38	223.34

Slurry Conc. Based on Density Measurements

2-Phase Slurry Concentration reduced	particle vol %	
	catalyst wt%	

Water Saturation Calculations for the Reactor

	Based on CO, CO2 Meas.:		**Based on Water Production:**	
	psia	**mbara**	**psia**	**mbara**
Calculated Water Partial Pressure @ Reactor Outlet	96.36	6644	94.67	6527
Saturated Water Pressure @ Reactor Outlet	671.7	46310	671.7	46310
Water Partial Pressure as % of Sat. Pressure @ Reactor Outlet	14.35%		14.09%	
	deg F	**deg C**	**deg F**	**deg C**
Saturated Water Temperature @ Reactor Outlet	324.9	162.7	323.6	162.0

Carbon No.	Compositions, wt% 1-Alcohols wt%	2-Olefins wt%	n-Paraffins wt%	Light HC Phase 1-Olefins wt%	iso-Parafins wt%	Total wt%
1						0.00
2						0.00
3	0.04	0.00	0.21	0.07	0.00	0.32
4	0.23	0.30	1.48	0.70	0.00	2.71
5	0.41	0.50	2.95	1.79	0.23	5.88
6	0.55	0.60	3.69	2.56	0.47	7.86
7	0.54	0.61	4.14	2.66	0.37	8.31
8	0.50	0.65	4.53	2.38	0.41	8.47
9	0.47	0.65	4.57	1.90	0.51	8.09
10	0.47	0.62	4.52	1.40	0.55	7.56
11	0.40	0.54	4.61	1.10	0.50	7.15
12	0.31	0.45	4.08	0.81	0.42	6.08
13	0.25	0.40	3.80	0.56	0.43	5.43
14	0.20	0.32	3.38	0.38	0.42	4.69
15	0.16	0.24	2.96	0.26	0.45	4.07
16	0.12	0.18	2.61	0.23	0.46	3.60
17	0.03	0.12	2.23	0.28	0.49	3.14
18	0.00	0.11	2.07	0.19	0.36	2.73
19	0.00	0.10	2.02	0.14	0.31	2.57
20	0.00	0.04	1.54	0.07	0.32	1.96
21			1.67			1.67
22			1.41			1.41
23			1.16			1.16
24			0.94			0.94
25			0.73			0.73
26			0.62			0.62
27			1.11			1.11
28			0.79			0.79
29			0.26			0.26
30			0.19			0.19
> 30			0.49			0.49
Total	4.67	6.41	64.74	17.48	6.68	99.98

Composition, Wt% Compound	Aqueous Phase
Ethanol	3.20
Water by diff.	96.80
Total	100.00

Composition, wt% Carbon No.	Reactor Wax
12	0.03
13	0.24
14	0.42
15	0.59
16	0.70
17	0.88
18	1.08
19	1.33
20	1.61
21	1.93
22	2.28
23	2.66
24	3.02
25	3.36
26	3.66
27	3.93
28	4.08
29	4.17
30	4.23
31	4.51
32	4.17
33	4.03
34	3.86
35	3.60
36	3.35
37	3.08
38	2.83
39	2.59
40	2.41
41	2.12
42	1.93
43	1.76
44	1.61
45	1.45
46	1.32
47	1.21
48	1.11
49	0.99
50	0.91
> 50	10.92
Total	100.00

Elemental Balance:

	Total lb/hr	C lb/hr	H lb/hr	O lb/hr	N lb/hr
Reactor Feed Gas	3941.28	1644.49	297.56	1558.91	340.32
Main Gas Outlet	3184.50	1439.11	292.98	1112.18	340.24
27.10 Reactor Wax	31.19	26.61	4.58	0.00	0.00
22.14 Light Wax	0.00	0.00	0.00	0.00	0.00
22.18 HC Phase	255.80	215.73	38.60	1.47	0.00
22.18 AQ Phase	492.38	8.21	55.01	429.16	0.00
Total Out	3963.87	1689.66	391.17	1542.80	340.24
% Balance	100.6	102.7	98.4	99.0	100.0

Product Distribution: Selectivity (wt%)

Methane (C1)	19.2
Gas (C2 - C4)	18.3
Gasoline (C5 - C11)	32.3
Diesel (C122 - C18)	16.3
Wax (C19+)	13.8
Total	100.0
HC Production Rate based on Liquid Data, grams HC produced/kg-cat oxide hr	1393.0

Alpha Estimate:

C3 - C9	1	0.79
C10-C50	2	0.87