

APPENDIX C
SHAKEDOWN RUN F-1
DETAILED DATA ACQUISITION SYSTEM SHEETS

LaPORTE LP METHANOL PROCESS DAILY REPORT
FLUIDIZED MODE
PROCESS VARIABLES & ANALYTICAL SUMMARY

DATE : 12-Mar-84
TIME : 12:19 AM
TIME INTERVAL : FROM: 0000 11-Mar TO: 2400 11-Mar 24
NUMBER OF AVERAGED HOURS : 24
RUN ID NUMBER : F-1A
FEED GAS TYPE : BALANCED GAS
REACTOR FEED GAS INLET TEMP. (deg.C) : 136.3
OIL/SLURRY INLET TEMP. (deg.C) : 247.5
AVE. REACTOR TEMPERATURE (deg.C) : 249.4
REACTOR OUTLET TEMP. (deg.C) : 250.5
GUARD BED FEED PRESSURE (kPa) : 5367
PRIMARY SEPARATOR GAS PRESSURE (kPa) : 5338
GAS SUPERFICIAL VELOCITY (cm/sec) : 2.4
LIQUID SUPERFICIAL VELOCITY (cm/sec) : 6.1
SLURRY CONCENTRATION (wt% oxide) : 7.0
SPACE VELOCITY (1/ks-hr) : 1800
RECYCLE/FRESH FEED RATIO : 0
OIL/SLURRY CIRCULATION RATE (m3/hr) : 56.2
PROD. SEPARATOR GAS FLOWRATE <50> + <55> (ksmol/hr) : 20.99 (4)
PURGE GAS FLOW RATE <50> (ksmol/hr) : 20.99 (4)

CONVERSIONS:
CO 44.2%
CO2 1.2%
H2 26.6%

PRODUCTIVITIES:
6.17 gsmol/hr-ks across reactor
6.01 gsmol/hr-ks overall

STREAM #	1	55	10	15	25*	62	68	
STREAM NAME	FRESH FEED	RECYCLE GAS	GUARD-BED FEED	REACTOR FEED	V/L SEP GAS	FLASH GAS	MEDH PRODUCT	
COMPONENT	<MOL%>	<MOL%>	<MOL%>	<MOL%>	<MOL%>	<MOL%>	<MOL%>	<WT%>
H2	56.95	52.68	56.93	56.85	49.57	22.34	—	—
CO	18.07	12.84	18.06	18.04	11.97	11.08	—	—
CO2	4.85	6.09	4.85	4.84	5.82	44.44	—	—
N2	19.68	26.23	19.68	19.65	24.50	16.56	—	—
CH4	0.16	0.23	0.16	0.15	0.21	0.41	—	—
H2O	0.00	0.35	0.00	0.00	0.35	0.33	3.58	2.01
CH3OH	0.00	0.82	0.00	0.00	9.15 (1)	3.75	95.32	94.96
C2H5OH	—	—	—	—	—	—	0.50	0.71
C3OH'S	—	—	—	—	—	—	0.16	0.30
C4OH'S	—	—	—	—	—	—	0.12	0.27
C5OH'S	—	—	—	—	—	—	0.05	0.14
ALKANES	—	—	—	—	—	—	0.00	0.00
ESTERS	—	—	—	—	—	—	0.15	0.29
ALDEHYDES	—	—	—	—	—	—	0.00	0.00
OIL	—	—	—	—	—	—	0.12	1.32
TOTAL :	99.71	99.23	99.68	99.53	101.57	99.66	100.00	100.00
DENS:g/cc	0.006	0.034	0.022	0.022	0.020	0.003	—	0.800
AV.MOL.WT	13.92	15.16	13.92	13.92	16.55	29.53	32.16	—
M3/hr	627.4	0.0	610.5	610.7	484.2 (2)	0.5	—	—
ksmol/hr	27.99	0.00	27.24	27.24	22.92 (2)	0.02	2.45 (3)	—
l/hr:prod	—	—	—	—	—	—	—	78.92 (3)

* Compositions correspond to STREAM#32

(1) Concentration corrected to give 97.3% selectivity to CO + CO2 across reactor.

(2) Flow increased 6.1% to match reactor feed mass flow.

(3) Corrected using meter calibration of 3/10/84.

(4) Corrected.

LaPORTE LP METHANOL PROCESS DAILY REPORT
MATERIAL BALANCE SUMMARY

0000 11-Mar-84 - 2400 11-Mar-84

COMPONENT BALANCE (IN-OUT)/IN :

STREAMS # STREAMS LOCATION COMPONENT :	[PURE GASES - 11 FRESH FEED GAS	[(1+55)-15] REACTOR FEED	[25 - (50+51+62+68)] REACTOR EFFLUENT
	<Z diff.>	<Z diff.>	<Z diff.>
H2	-24.86370	2.82718	2.63520
CO	30.16620	2.84758	1.68320
CO2	-7.78765	2.91019	3.50530
N2	n.a.	2.81353	1.89450
CH4	89.09720	8.79117	-0.47162
H2O		n.a.	-101.00349
CH3OH		n.a.	2.52780

OVERALL ELEMENTAL BALANCE (Ks-atoms/hr) :

	INPUTS		OUTPUTS				(IN-OUT)/IN
STREAM # STREAM NAME	15 REACTOR FEED	55 RECYCLE	50 PURGE GAS	62 FLASH GAS	68 MeOH PRODUCT	TOTAL	%
CARBON:							
CO	4.9139	0.0000	2.6935	0.0024	—	2.6959	45.1373
CO2	1.3184	0.0000	1.2781	0.0098	—	1.2879	2.3134
CH3OH	0.0000	0.0000	0.1720	0.0008	1.8712	2.0440	n.a.
OTHERS	0.0404	0.0000	0.0475	0.0001	0.0495	0.0971	-140.3470
TOTAL C	6.2727	0.0000	4.1912	0.0131	1.9207	6.1250	2.3546
HYDROGEN:							
H2	30.9768	0.0000	22.1104	0.0098	—	22.1202	28.5911
H2O	0.0007	0.0000	0.1472	0.0001	0.1406	0.2879	n.a.
OTHERS	0.1615	0.0000	0.8780	0.0037	7.6165	8.4982	-5162.0400
TOTAL H	31.1390	0.0000	23.1356	0.0136	7.7571	30.9063	0.7473
OXYGEN:							
TOTAL O	7.5512	0.0000	5.4953	0.0229	1.9638	7.4820	0.9164
NITROGEN:							
TOTAL N	10.7080	0.0000	11.0082	0.0072	—	11.0154	-2.8708
TOTAL MASS FLOW (ks/hr)	379.3120	0.0000	318.2044	0.6499	63.1360	381.9903	-0.7961

REACTOR GAS BALANCE (OUT/IN) :

ACROSS REACTOR

MASS BALANCE, (Z) :	100.000
ELEMENTAL BALANCE, (Z) :	
CARBON	99.194
HYDROGEN	101.058
OXYGEN	99.501

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
ENTRAINED MODE
PROCESS VARIABLES & ANALYTICAL SUMMARY

DATE : 17-May-84
TIME : 05:53 PM
TIME INTERVAL: FROM: 0600 13-Mar
TO: 1400 13-Mar
NUMBER OF AVERAGED HOURS : 8
RUN ID NUMBER : F-1B
FEED GAS TYPE: BALANCED GAS
REACTOR FEED GAS INLET TEMP. (des.C) : 144.4
OIL/SLURRY INLET TEMP. (des.C) : 245.0
AVE. REACTOR TEMPERATURE (des.C) : 250.0
REACTOR OUTLET TEMP. (des.C) : 251.1
GUARD BED INLET PRESSURE (kPa) : 6362
PRIMARY SEPARATOR GAS PRESSURE (kPa) : 6378
GAS SUPERFICIAL VELOCITY (cm/sec) : 2.2
LIQUID SUPERFICIAL VELOCITY (cm/sec) : 4.0
SLURRY CONCENTRATION (wt%): 9.7
SPACE VELOCITY (1/ks-hr) : 2140
RECYCLE/FRESH FEED RATIO : 0
OIL/SLURRY CIRCULATION RATE (m3/hr) : 36.6
PROD. SEPARATOR GAS FLOWRATE <S0> + <S5> (ksmol/hr) : 21.12 (3)
PURGE GAS FLOW RATE <S0> (ksmol/hr) : 21.12 (3)

CONVERSIONS:
CO 49.0%
H2 35.0%

PRODUCTIVITY:
8.6 smol/hr-ks across reactor

STREAM #	1	55	10	15	25*	62	68	
STREAM NAME	FRESH FEED	RECYCLE GAS	GUARD-BED FEED	REACTOR FEED	V/L SEP GAS	FLASH GAS	METH PRODUCT	
COMPONENT	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<WTZ>
H2	55.82	49.97	55.34	54.85	44.72	18.67	—	—
CO	19.83	14.09	19.61	19.48	12.44	10.74	—	—
CO2	5.10	6.66	5.04	4.97	5.94 (4)	47.69	—	—
N2	20.19	28.30	20.01	19.84	25.06	16.20	—	—
CH4	0.14	0.20	0.13	0.14	0.18	0.35	—	—
H2O	0.00	0.00	0.00	0.00	0.69	0.71	3.58	2.01
CH3OH	0.00	0.54	0.00	0.00	11.61 (4)	6.57	95.32	94.96
DME	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00
C2H5OH	—	—	—	—	—	—	0.50	0.71
C3OH'S	—	—	—	—	—	—	0.16	0.30
C4OH'S	—	—	—	—	—	—	0.12	0.27
C5OH'S	—	—	—	—	—	—	0.05	0.14
ALKANES	—	—	—	—	—	—	0.00	0.00
ESTERS	—	—	—	—	—	—	0.15	0.29
ALDEHYDES	—	—	—	—	—	—	0.00	0.00
OIL	—	—	—	—	—	—	0.12	1.32
TOTAL :	101.06	99.76	100.13	99.28	100.64	101.78	100.00	100.00
DENSrs/cc	0.004	0.042	0.026	0.026	0.026	0.003	—	0.800
AV. MOL. WT	14.45	16.06	14.43	14.43	17.89	31.04	32.16	—
Nm3/hr	665.5 (1)	0.0	662.8	666.0	537.2 (2)	0.9	—	—
ksmol/hr	29.69 (1)	0.00	29.57	29.71	23.97 (2)	0.04	2.80	—
1/hrprod	—	—	—	—	—	—	—	112.47

* Compositions correspond to STREAM#32

(1) Flow reduced 3.06% to match reactor feed mass flow.

(2) Flow reduced 3.02% to match reactor feed mass flow.

(3) Flow increased 22.7% (unsteady) to match reactor effluent methanol-free mass flow.

(4) Adjusted to match back-end component balance.

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
MATERIAL BALANCE SUMMARY

COMPONENT BALANCE (IN-OUT)/IN :

STREAMS # STREAMS LOCATION COMPONENT :	[PURE GASES - 13 FRESH FEED GAS	[(1+55)-153 REACTOR FEED	[25 - (50+51+62+68)] REACTOR EFFLUENT
	<Z diff.>	<Z diff.>	<Z diff.>
H2	-20.53050	1.66461	1.46049
CO	-4.92088	1.69112	0.09412
CO2	-22.23290	2.40446	0.00045
N2	n.a.	1.65985	0.39401
CH4	31.60120	-1.84172	0.12423
H2O	-----	n.a.	39.62940
CH3OH	-----	n.a.	0.00142

OVERALL ELEMENTAL BALANCE (Ks-atoms/hr) :

STREAM # STREAM NAME	INPUTS		OUTPUTS				(IN-OUT)/IN
	15 REACTOR FEED	55 RECYCLE	50 PURGE GAS	62 FLASH GAS	68 MeOH PRODUCT	TOTAL	Z
CARBON:							
CO	5.7889	0.0000	2.9746	0.0042	-----	2.9787	48.5434
CO2	1.4774	0.0000	1.4063	0.0185	-----	1.4248	3.5620
CH3OH	0.0000	0.0000	0.1140	0.0026	2.6667	2.7833	n.a.
OTHERS	0.0408	0.0000	0.0425	0.0001	0.0705	0.1132	-177.2670
TOTAL C	7.3071	0.0000	4.5374	0.0254	2.7372	7.3000	0.0968
HYDROGEN:							
H2	32.5953	0.0000	21.1072	0.0145	-----	21.1217	35.2003
H2O	0.0000	0.0000	0.0000	0.0006	0.2004	0.2009	n.a.
OTHERS	0.1633	0.0000	0.6262	0.0108	10.8542	11.4911	-6937.9400
TOTAL H	32.7586	0.0000	21.7333	0.0258	11.0545	32.8137	-0.1681
OXYGEN:							
TOTAL O	8.7437	0.0000	5.9012	0.0440	2.7986	8.7438	-0.0008
NITROGEN:							
TOTAL N	11.7895	0.0000	11.9532	0.0126	-----	11.9658	-1.4957
TOTAL MASS FLOW (ks/hr)	428.8970	0.0000	339.0830	1.2051	89.9745	430.2620	-0.3183

REACTOR GAS BALANCE (OUT/IN) :

ACROSS REACTOR

MASS BALANCE, (Z) :	100.000
ELEMENTAL BALANCE, (Z) :	
CARBON	98.978
HYDROGEN	100.956
OXYGEN	100.425

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
ENTRAINED MODE
PROCESS VARIABLES & ANALYTICAL SUMMARY

DATE : 19-May-84
TIME : 03:26 PM
TIME INTERVAL : FROM: 2200 13-Mar
TO: 0400 14-Mar
NUMBER OF AVERAGED HOURS : 6
RUN ID NUMBER : F-1C
FEED GAS TYPE: BALANCED GAS
REACTOR FEED GAS INLET TEMP. (deg.C) : 136.4
OIL/SLURRY INLET TEMP. (deg.C) : 222.0
AVE. REACTOR TEMPERATURE (deg.C) : 224.8
REACTOR OUTLET TEMP. (deg.C) : 226.4
GUARD BED FEED PRESSURE (kPa) : 6474
PRIMARY SEPARATOR GAS PRESSURE (kPa) : 6378
GAS SUPERFICIAL VELOCITY (cm/sec) : 2.2
LIQUID SUPERFICIAL VELOCITY (cm/sec) : 4.6
SLURRY CONCENTRATION (wt%): 9.9
SPACE VELOCITY (1/ks-hr) : 2190
RECYCLE/FRESH FEED RATIO : 0
OIL/SLURRY CIRCULATION RATE (m3/hr) : 42.5
PROD.SEPARATOR GAS FLOWRATE <50> + <55> (ksmol/hr) : 21.00 (3)
PURGE GAS FLOW RATE <50> (ksmol/hr) : 21.00 (3)

STREAM #	1	55	10	15	25*	62	69	
STREAM NAME	FRESH FEED	RECYCLE GAS	GUARD-BED FEED	REACTOR FEED	V/L SEP GAS	FLASH GAS	METH PRODUCT	
COMPONENT	<MOL%>	<MOL%>	<MOL%>	<MOL%>	<MOL%>	<MOL%>	<MOL%>	<WT%>
H2	55.99	49.93	55.63	55.52	44.77	19.87	—	—
CO	19.79	14.00	19.59	19.56	12.34	11.25	—	—
CO2	5.09	6.49	5.04	5.03	5.95	47.12	—	—
N2	20.08	28.33	19.86	19.83	25.08	16.56	—	—
CH4	0.13	0.20	0.13	0.13	0.16	0.35	—	—
H2O	0.00	0.00	0.00	0.00	0.39	0.39	3.59	2.01
CH3OH	0.00	0.80	0.00	0.00	12.71	4.35	95.28	94.96
DME	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00
C2H5OH	—	—	—	—	—	—	0.50	0.72
C3OH'S	—	—	—	—	—	—	0.19	0.36
C4OH'S	—	—	—	—	—	—	0.11	0.26
C5OH'S	—	—	—	—	—	—	0.05	0.14
ALKAHENES	—	—	—	—	—	—	0.00	0.00
ESTERS	—	—	—	—	—	—	0.16	0.30
ALDEHYDES	—	—	—	—	—	—	0.00	0.00
OIL	—	—	—	—	—	—	0.12	1.32
TOTAL :	101.08	99.75	100.25	100.07	101.39	100.07	100.00	100.00
DENS,g/cc	0.004	0.043	0.026	0.027	0.028	0.002	—	0.800
AV.MOL.WT	14.40	16.05	14.37	14.38	17.92	30.51	32.15	—
M3/hr	686.8	0.0	679.3 (1)	679.2 (1)	530.9 (4)	0.8	—	—
ksmol/hr	30.64	0.00	30.31 (1)	30.30 (1)	23.69 (4)	0.04	3.05 (2)	—
L/hr:prod	—	—	—	—	—	—	—	121.85 (2)

* Compositions correspond to STREAM#32

(1) Mass flow corresponds to average of original reactor feed and effluent flows; net reduction was 3.93%.

(2) Corrected with meter calibration curve.

(3) Flow increased 7.85% to close overall mass balance.

(4) Flow increased 1.59% to minimize component balance differences in plant back-end.

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
CONVERSION-SELECTIVITY-PRODUCTIVITY

2200 13-Mar-84 - 0400 14-Mar-84

CONVERSIONS ACROSS REACTOR :

		<u>GC#1</u>	<u>GC#2</u>
HYDROGEN CONVERSION	(Z) :	37.1	37.0
CARBON MONOXIDE CONVERSION	(Z) :	50.8	50.7
CARBON DIOXIDE CONVERSION	(Z) :	7.7	7.6

*** See next page for conversions as calc. by overall bal.

SELECTIVITIES :

	<u>ACROSS REACTOR</u> <u>GC Average</u>	<u>OVERALL</u> <u>%</u>
CO (+CO ₂) SELECTIVITY TO METHANOL (Z) :	96.5	97.3
CO (+CO ₂) SELECTIVITY TO ETHANOL (Z) :		0.5

* Methanol in flashed gas not measured
 Ethanol only measured in product flow

METHANOL PRODUCTIVITIES & YIELDS

<u>NEOH SOURCE</u>	<u>smol/hr-ks cat</u>	<u>ks/1000 Nm3 fresh feed</u>	<u>ks/1000 Nm3 reactor feed</u>
As calculated ACROSS REACTOR	9.7	140.4	142.0
As Net MeOH produced, OVERALL balance	9.9	142.6	144.2

REACTOR FEED $\{H_2/(CO+1.5CO_2)\}$:	2.05
REACTOR FEED $\{(H_2-CO_2)/(CO+CO_2)\}$:	2.05
APPROACH TO METHANOL EQUILIBRIUM (des.C) :	39.2
APPROACH TO WATER-GAS EQUILIBRIUM (des.C) :	38.7
METHANOL COLLECTED AS % OF CALCULATED :	96.0
CALCULATED METHANOL PRODUCTION RATE (Ksmol/hr) :	3.01

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
MATERIAL BALANCE SUMMARY

COMPONENT BALANCE (IN-OUT)/IN :

STREAMS # STREAMS LOCATION COMPONENT :	[PURE GASES - 13] FRESH FEED GAS	[(1+55)-15] REACTOR FEED	[25 - (50+51+62+68)] REACTOR EFFLUENT
	<Z diff.>	<Z diff.>	<Z diff.>
H2	-31.42230	1.93692	1.04286
CO	-8.13956	2.28614	-0.77576
CO2	-26.04840	2.18940	2.07360
N2	n.a.	2.34382	-0.28938
CH4	43.24560	4.30186	-9.39832
H2O	—	n.a.	-17.88810
CH3OH	—	n.a.	-2.05136

OVERALL ELEMENTAL BALANCE (Ks-atoms/hr) :

	INPUTS		-OUTPUTS				(IN-OUT)/IN
STREAM # STREAM NAME	15 REACTOR FEED	55 RECYCLE	50 PURGE GAS	62 FLASH GAS	68 MeOH PRODUCT	TOTAL	Z
CARBON:							
CO	5.9260	0.0000	2.9401	0.0042	—	2.9443	50.3153
CO2	1.5247	0.0000	1.3621	0.0175	—	1.3796	9.5195
CH3OH	0.0000	0.0000	0.1680	0.0016	2.9022	3.0718	n.a.
OTHERS	0.0393	0.0000	0.0421	0.0001	0.0799	0.1221	-210.7620
TOTAL C	7.4900	0.0000	4.5123	0.0235	2.9821	7.5178	-0.3711
HYDROGEN:							
H2	33.6481	0.0000	20.9709	0.0148	—	20.9857	37.6320
H2O	0.0000	0.0000	0.0000	0.0003	0.2185	0.2188	n.a.
OTHERS	0.1572	0.0000	0.8405	0.0070	11.8209	12.6683	-7960.4900
TOTAL H	33.8053	0.0000	21.8113	0.0221	12.0394	33.8728	-0.1998
OXYGEN:							
TOTAL O	8.9755	0.0000	5.8323	0.0410	3.0471	8.9204	0.6141
NITROGEN:							
TOTAL N	12.0146	0.0000	11.9005	0.0124	—	11.9129	0.8471
TOTAL MASS FLOW (ks/hr)	435.6420	0.0000	337.0300	1.1351	97.4750	435.6400	0.0005

REACTOR GAS BALANCE (OUT/IN) :

ACROSS REACTOR

MASS BALANCE, (Z) :	97.429
ELEMENTAL BALANCE, (Z) :	
CARBON	98.519
HYDROGEN	99.355
OXYGEN	98.514

LaPORTE LP METHANOL PROCESS DAILY REPORT
ENTRAINED MODE
PROCESS VARIABLES & ANALYTICAL SUMMARY

DATE : 12-Jul-84
TIME : 12:19 PM
TIME INTERVAL: FROM: 0400 15-Mar
TO: 1600 15-Mar
NUMBER OF AVERAGED HOURS : 12
RUN ID NUMBER : F-1E
FEED GAS TYPE: UNBALANCED GAS
REACTOR FEED GAS INLET TEMP. (des.C) : 116.0
OIL/SLURRY INLET TEMP. (des.C) : 250.4
AVE. REACTOR TEMPERATURE (des.C) : 249.4
REACTOR OUTLET TEMP. (des.C) : 250.4
GUARD BED FEED PRESSURE (kPa) : 5381
PRIMARY SEPARATOR GAS PRESSURE (kPa) : 5317
GAS SUPERFICIAL VELOCITY (cm/sec) : 2.4
LIQUID SUPERFICIAL VELOCITY (cm/sec) : 4.1
SLURRY CONCENTRATION (wt% oxide) : 11.9
SPACE VELOCITY (1/kg-hr) : 2050¹
RECYCLE/FRESH FEED RATIO : 0
OIL/SLURRY CIRCULATION RATE (m3/hr) : 38.2
PROD. SEPARATOR GAS FLOWRATE <S0> + <S5> (ksmol/hr) : 19.95 (3)
PURGE GAS FLOW RATE <S0> (ksmol/hr) : 19.95 (3)

CONVERSIONS:
CO 18.8%
H2 43.7%

PRODUCTIVITY:
7.5 smol/hr-kg across reactor

STREAM #	1	55	10	15	25*	62	68	
STREAM NAME	FRESH FEED	RECYCLE GAS	GUARD-BED FEED	REACTOR FEED	V/L SEP GAS	FLASH GAS	MEDH PRODUCT	
COMPONENT	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<WTZ>
H2	37.16	27.89	37.56	37.53	25.34	5.71 (4)	—	—
CO	47.44	51.08	47.59	47.51	46.30	19.04	—	—
CO2	13.09	17.56	13.17	13.15	16.31	66.84	—	—
N2	1.54	2.16	1.59	1.58	1.95	0.61	—	—
CH4	0.10	0.13	0.11	0.11	0.12	0.11	—	—
H2O	0.00	0.05	0.00	0.00	0.05	0.04	2.47	1.37
CH3OH	0.00	0.96	0.00	0.00	9.88	7.65 (4)	95.99	94.72
C2H5OH	—	—	—	—	—	—	0.46	0.65
C3OH'S	—	—	—	—	—	—	0.16	0.29
C4OH'S	—	—	—	—	—	—	0.14	0.31
C5OH'S	—	—	—	—	—	—	0.07	0.19
ALKANES	—	—	—	—	—	—	0.00	0.00
ESTERS	—	—	—	—	—	—	0.31	0.61
ALDEHYDES	—	—	—	—	—	—	0.00	0.00
OIL	—	—	—	—	—	—	0.40	1.86
TOTAL :	99.34	99.83 (4)	100.02	99.89	99.95	100.00	100.00	100.00
DENS _{g/cc}	0.006	0.052	0.031	0.034	0.030	0.004	—	0.792
AV. MOL. WT	20.38	23.54	20.34	20.34	24.41	37.50	32.49	—
M ₃ /hr	601.2	0.0	597.9	587.9 (1)	490.0 (2)	2.0	—	—
ksmol/hr	26.82	0.00	26.68	26.23 (1)	21.86 (2)	0.09	2.42	—
l/hr:prod	—	—	—	—	—	—	—	99.29

* Compositions correspond to STREAM#32

(1) Flow reduced 4.65% to match fresh feed flow plus a leak of 0.59 ksmol/hr (500 SCFH).

(2) Flow increased 4.54% to match corrected reactor feed mass flow.

(3) Flow increased 11.1% to close back-end mass balance.

(4) Compositions from gas chromatograph central processor printout.

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
ENTRAINED MODE
PROCESS VARIABLES & ANALYTICAL SUMMARY

DATE : 15-Jul-84
TIME : 05:04 PM
TIME INTERVAL: FROM: 1000 17-Mar
TO: 2200 17-Mar
NUMBER OF AVERAGED HOURS : 12
RUN ID NUMBER : F-1F-1
FEED GAS TYPE: UNBALANCED GAS
REACTOR FEED GAS INLET TEMP. (des.C) : 132.1
OIL/SLURRY INLET TEMP. (des.C) : 245.5
AVE. REACTOR TEMPERATURE (des.C) : 250.0
REACTOR OUTLET TEMP. (des.C) : 251.3
GUARD BED FEED PRESSURE (kPa) : 5431
PRIMARY SEPARATOR GAS PRESSURE (kPa) : 5312
GAS SUPERFICIAL VELOCITY (cm/sec) : 5.3
LIQUID SUPERFICIAL VELOCITY (cm/sec) : 4.0
SLURRY CONCENTRATION (wt%): 15.6
SPACE VELOCITY (1/ks-hr) : 5840
RECYCLE/FRESH FEED RATIO : 2.51244
OIL/SLURRY CIRCULATION RATE (m3/hr) : 37.3
PROD. SEPARATOR GAS FLOWRATE <S0> + <S5> (ksmol/hr) : 48.67
PURGE GAS FLOW RATE <S0> (ksmol/hr) : 5.00

STREAM #	1	55	10	15	25	62	68	
STREAM NAME	FRESH FEED	RECYCLE GAS	GUARD-BED FEED	REACTOR FEED	V/L SEP GAS	FLASH GAS	MECH PRODUCT	
COMPONENT	(MOL%)	(MOL%)	(MOL%)	(MOL%)	(MOL%)	(MOL%)	(MOL%)	(WT%)
H2	51.69	29.25	35.49	35.73	27.29	6.41	—	—
CO	39.84	54.96	50.88	51.32	51.02	24.83	—	—
CO2	4.15	13.27	11.20	11.29	12.44	59.60	—	—
N2	0.38	1.49	1.20	1.21	1.38	0.51	—	—
CH4	0.13	0.61	0.41	0.37	0.57	0.56	—	—
H2O	0.00	0.07	0.00	0.01	0.06	0.20	2.23	1.23
CH3OH	0.00	0.32	0.40	0.43	7.07 (1)	6.69	95.55	93.27
DME	0.00	0.09	0.09	0.09	0.06	1.22	0.00	0.00
C2H5OH	—	—	—	—	—	—	0.87	1.22
C3OH'S	—	—	—	—	—	—	0.30	0.55
C4OH'S	—	—	—	—	—	—	0.26	0.58
C5OH'S	—	—	—	—	—	—	0.14	0.38
ALKANES	—	—	—	—	—	—	0.00	0.00
ESTERS	—	—	—	—	—	—	0.46	0.89
ALDEHYDES	—	—	—	—	—	—	0.00	0.00
OIL	—	—	—	—	—	—	0.19	2.00
TOTAL :	96.20	100.06	99.68	100.45	99.89	100.02	100.00	100.00
DENS, g/cc	0.004	0.046	0.032	0.033	0.028	0.003	—	0.800
AV. MOL. WT	14.72	22.50	20.54	20.55	23.16	36.29	32.83	—
M3/hr	389.6	978.9	1343.6 (4)	1342.5 (3)	1191.4 (2)	2.7	—	—
ksmol/hr	17.38	43.67	59.94 (4)	59.90 (3)	53.15 (2)	0.12	3.70 (5)	—
L/hr prod	—	—	—	—	—	—	—	152.17 (5)

* Compositions correspond to STREAM#32

- (1) Composition reduced 3.55% to optimize reactor elemental gas balance.
(2) Flow reduced 4.94% to optimize reactor effluent and reactor feed component balances.
(3) Flow reduced 1.95% to match reactor effluent mass flow.
(4) Flow reduced 1.92% to match reactor effluent mass flow.
(5) Flow rate corresponds to period 17:00 → 22:00 and meter calibration curve.

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LaPORTE LP METHANOL PROCESS AVERAGE REPORT
CONVERSION-SELECTIVITY-PRODUCTIVITY

1000 17-Mar-84 - 2200 17-Mar-84

CONVERSIONS ACROSS REACTOR :

		GC#1	GC#2
HYDROGEN CONVERSION	(Z) :	31.8	32.2
CARBON MONOXIDE CONVERSION	(Z) :	11.1	11.9
CARBON DIOXIDE CONVERSION	(Z) :	1.5	2.2

*** See next page for conversions as calc. by overall bal.

SELECTIVITIES :

	ACROSS REACTOR GC Average	OVERALL %
CO (+CO2) SELECTIVITY TO METHANOL (Z) :	96.7	83.0
CO (+CO2) SELECTIVITY TO ETHANOL (Z) :		0.8

* Methanol in flashed gas not measured
Ethanol only measured in product flow

METHANOL PRODUCTIVITIES & YIELDS

METH SOURCE	gmoL/hr-kg cat	kg/1000 Na3 fresh feed	kg/1000 Na3 reactor feed
As calculated ACROSS REACTOR	15.3	298.4	83.7
As Net MeOH produced, OVERALL balance	15.5	292.7	85.0

REACTOR FEED $\{H_2/(CO+1.5CO_2)\}$:	0.52
REACTOR FEED $\{(H_2-CO_2)/(CO+CO_2)\}$:	0.39
APPROACH TO METHANOL EQUILIBRIUM (des.C) :	26.4
APPROACH TO WATER-GAS EQUILIBRIUM (des.C) :	-25.7
METHANOL COLLECTED AS % OF CALCULATED :	101.0
CALCULATED METHANOL PRODUCTION RATE (Kgmol/hr) :	3.51

PAGE : 3

1000 17-Mar-84 - 2200 17-Mar-84

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
MATERIAL BALANCE SUMMARY

COMPONENT BALANCE (IN-OUT)/IN :

STREAMS # STREAMS LOCATION COMPONENT :	PURE GASES - 13 FRESH FEED GAS	[(1+55)-15] REACTOR FEED	[25 - (50+51+62+68)] REACTOR EFFLUENT
	<Z diff.>	<Z diff.>	<Z diff.>
H2	-16.04040	1.65392	1.79505
CO	-13.83220	0.62187	1.24178
CO2	-180.05300	-3.79474	1.28936
N2	-552.07300	-1.27261	1.15697
CH4	77.74420	22.64980	1.29039
H2O	—	89.61030	-269.42400
CH3OH	—	-82.28120	1.41012

OVERALL ELEMENTAL BALANCE (Ks-atoms/hr) :

STREAM # STREAM NAME	INPUTS		OUTPUTS				(IN-OUT)/IN
	15 REACTOR FEED	55 RECYCLE	50 PURGE GAS	62 FLASH GAS	68 MeOH PRODUCT	TOTAL	Z
CARBON:							
CO	30.7372	24.0036	2.7455	0.0294	—	26.7785	12.8791
CO2	6.7641	5.7958	0.6629	0.0706	—	6.5293	3.4717
CH3OH	0.2576	0.1413	0.0162	0.0079	3.5388	3.7042	-1337.9600
OTHERS	0.2229	0.2657	0.0304	0.0007	0.1993	0.4961	-122.5920
TOTAL C	37.9818	30.2064	3.4550	0.1086	3.7381	37.5081	1.2472
HYDROGEN:							
H2	42.8011	25.5496	2.9223	0.0152	—	28.4871	33.4450
H2O	0.0060	0.0576	0.0066	0.0005	0.1653	0.2301	-5741.0200
OTHERS	1.9218	1.6280	0.1862	0.0344	14.6695	16.5190	-759.4930
TOTAL H	44.7289	27.2353	3.1151	0.0500	14.8348	45.2352	-1.1319
OXYGEN:							
TOTAL O	44.5261	35.7654	4.0908	0.1788	3.7136	43.7485	1.7464
NITROGEN:							
TOTAL N	1.4552	1.3031	0.1491	0.0012	—	1.4534	0.1270
TOTAL MASS FLOW (ks/hr)	1230.9500	982.5630	112.3840	4.2983	121.7340	1220.9800	0.8102

REACTOR GAS BALANCE (OUT/IN) :

	GC#2
MASS BALANCE, (Z) :	100.000
ELEMENTAL BALANCE, (Z) :	
CARBON	99.379
HYDROGEN	100.988
OXYGEN	99.070

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
ENTRAINED MODE
PROCESS VARIABLES & ANALYTICAL SUMMARY

DATE : 16-Jul-84
TIME : 11:22 AM
TIME INTERVAL: FROM: 0000 18-Mar
TO: 0900 18-Mar
9
NUMBER OF AVERAGED HOURS :
RUN ID NUMBER : F-1F-2
FEED GAS TYPE: UNBALANCED GAS
REACTOR FEED GAS INLET TEMP. (des.C) : 129.8
OIL/SLURRY INLET TEMP. (des.C) : 245.7
AVE. REACTOR TEMPERATURE (des.C) : 250.1
REACTOR OUTLET TEMP. (des.C) : 251.3
GUARD BED FEED PRESSURE (kPa) : 5427
PRIMARY SEPARATOR GAS PRESSURE (kPa) : 5312
GAS SUPERFICIAL VELOCITY (cm/sec) : 5.1
LIQUID SUPERFICIAL VELOCITY (cm/sec) : 4.2
SLURRY CONCENTRATION (wt%) : 16.7
SPACE VELOCITY (1/ks-hr) : 5900
RECYCLE/FRESH FEED RATIO : 2.43306
OIL/SLURRY CIRCULATION RATE (m3/hr) : 39.3
PROD. SEPARATOR GAS FLOWRATE <S0> + <S5> (ksmol/hr) : 46.84
PURGE GAS FLOW RATE <S0> (ksmol/hr) : 4.55

STREAM #	1	55	10	15	25*	62	68	
STREAM NAME	FRESH FEED	RECYCLE GAS	GUARD-BED FEED	REACTOR FEED	U/L SEP GAS	FLASH GAS	MEDH PRODUCT	
COMPONENT	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<MOLZ>	<WTS>
H2	51.79	29.77	35.72	35.99	27.56	6.42	—	—
CO	39.79	55.17	51.04	51.38	51.22	24.90	—	—
CO2	4.14	13.19	11.08	11.16	12.48	60.59	—	—
N2	0.39	1.46	1.17	1.18	1.35	0.49	—	—
CH4	0.16	0.62	0.53	0.53	0.57	0.57	—	—
H2O	0.00	0.06	0.00	0.00	0.05	0.19	2.09	1.15
CH3OH	0.00	0.26	0.35	0.36	7.29	5.86	96.13	94.07
BME	0.00	0.08	0.09	0.08	0.02	1.15	0.00	0.00
C2H5OH	—	—	—	—	—	—	0.71	1.00
C3OH'S	—	—	—	—	—	—	0.22	0.41
C4OH'S	—	—	—	—	—	—	0.18	0.40
C5OH'S	—	—	—	—	—	—	0.09	0.25
ALKANES	—	—	—	—	—	—	0.00	0.00
ESTERS	—	—	—	—	—	—	0.39	0.75
ALDEHYDES	—	—	—	—	—	—	0.00	0.00
OIL	—	—	—	—	—	—	0.19	1.97
TOTAL :	96.26	100.61	99.99	100.69	100.53	100.17	100.00	100.00
DENS, g/cc	0.004	0.046	0.032	0.033	0.028	0.003	—	0.800
AV. MOL. WT	14.69	22.36	20.46	20.46	23.09	36.44	32.74	—
m3/hr	389.6	947.8	1296.8 (3)	1297.1 (2)	1149.1 (1)	2.6	—	—
ksmol/hr	17.38	42.29	57.86 (3)	57.87 (2)	51.27 (1)	0.12	3.44 (4)	—
l/hr, prod	—	—	—	—	—	—	—	140.81 (4)

* Compositions correspond to STREAM#32

- (1) Flow reduced 7.24% to optimize reactor feed and reactor effluent component balances.
- (2) Flow reduced 5.56% to match reactor effluent mass flow.
- (3) Flow reduced 5.48% to match reactor effluent mass flow.
- (4) Flow rate corrected per meter calibration curve.

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
CONVERSION-SELECTIVITY-PRODUCTIVITY

CONVERSIONS ACROSS REACTOR :

		<u>GC#1</u>	<u>GC#2</u>
HYDROGEN CONVERSION	(Z) :	31.6	32.2
CARBON MONOXIDE CONVERSION	(Z) :	11.1	11.7
CARBON DIOXIDE CONVERSION	(Z) :	0.2	1.0

*** See next page for conversions as calc. by overall bal.

SELECTIVITIES :

	<u>ACROSS REACTOR</u> <u>GC Average</u>	<u>OVERALL</u> <u>%</u>
CO (+CO2) SELECTIVITY TO METHANOL (Z) :	103.5	79.5
CO (+CO2) SELECTIVITY TO ETHANOL (Z) :		0.6

* Methanol in flashed gas not measured
 Ethanol only measured in product flow

METHANOL PRODUCTIVITIES & YIELDS

<u>MEDN SOURCE</u>	<u>mol/hr-kg cat</u>	<u>kg/1000 Na3 fresh feed</u>	<u>kg/1000 Na3 reactor feed</u>
As calculated ACROSS REACTOR	16.05	290.4	87.2
As Net MeOH produced, OVERALL balance	15.09	273.0	82.0

REACTOR FEED $\{O_2/(CO+1.5CO_2)\}$:	0.53
REACTOR FEED $\{(H_2-CO_2)/(CO+CO_2)\}$:	0.40
APPROACH TO METHANOL EQUILIBRIUM (des.C) :	27.4
APPROACH TO WATER-GAS EQUILIBRIUM (des.C) :	-30.9
METHANOL COLLECTED AS % OF CALCULATED :	93.7
CALCULATED METHANOL PRODUCTION RATE (Kmol/hr) :	3.53

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
MATERIAL BALANCE SUMMARY

COMPONENT BALANCE (IN-OUT)/IN :

STREAMS # STREAMS LOCATION COMPONENT :	[PURE GASES - 13 FRESH FEED GAS	[(1+55)-15] REACTOR FEED	[25 - (50+51+62+68)] REACTOR EFFLUENT
	<Z diff.>	<Z diff.>	<Z diff.>
H2	-15.30110	3.53252	1.25493
CO	-13.57190	1.68770	1.48253
CO2	-181.03700	-2.58120	2.32493
N2	-555.51800	0.29705	0.91729
CH4	73.46370	-7.15508	1.05766
H2O	—	100.00000	-261.30600
CH3OH	—	-91.76630	8.07410

OVERALL ELEMENTAL BALANCE (Ks-atoms/hr) :

	INPUTS		OUTPUTS				(IN-OUT)/IN
STREAM # STREAM NAME	15 REACTOR FEED	55 RECYCLE	50 PURGE GAS	62 FLASH GAS	68 MeOH PRODUCT	TOTAL	%
CARBON:							
CO	29.7310	23.3269	2.5115	0.0287	————	25.8672	12.9961
CO2	6.4604	5.5787	0.6006	0.0699	————	6.2492	3.2691
CH3OH	0.2099	0.1095	0.0118	0.0068	3.3073	3.4353	-1536.4300
OTHERS	0.3091	0.2604	0.0280	0.0007	0.1417	0.4308	-39.3542
TOTAL C	36.7105	29.2755	3.1520	0.1060	3.4489	35.9825	1.9832
HYDROGEN:							
H2	41.6509	25.1752	2.7105	0.0148	————	27.9006	35.0132
H2O	0.0000	0.0504	0.0054	0.0004	0.1438	0.2000	n.a.
OTHERS	2.0762	1.4796	0.1593	0.0297	13.5953	15.2639	-635.1690
TOTAL H	43.7271	26.7052	2.8753	0.0449	13.7392	43.3645	0.8293
OXYGEN:							
TOTAL O	42.8618	34.6190	3.7273	0.1754	3.4476	41.9694	2.0822
NITROGEN:							
TOTAL N	1.3653	1.2356	0.1330	0.0012	————	1.3698	-0.3158
TOTAL MASS FLOW (ks/hr)	1183.9300	945.6320	101.8130	4.2021	112.6500	1164.3000	1.6584

REACTOR GAS BALANCE (OUT/IN) :

GC#2

MASS BALANCE, (Z) :	100.000
ELEMENTAL BALANCE, (Z) :	
CARBON	99.718
HYDROGEN	101.068
OXYGEN	99.806

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
ENTRAINED MODE
PROCESS VARIABLES & ANALYTICAL SUMMARY

DATE : 16-Jul-84
TIME : 02:58 PM
TIME INTERVAL: FROM: 1300 18-Mar
TO: 2400 18-Mar
NUMBER OF AVERAGED HOURS : 9
RUN ID NUMBER : F-1DR
FEED GAS TYPE: UNBALANCED GAS
REACTOR FEED GAS INLET TEMP. (des.C) : 116.6
OIL/SLURRY INLET TEMP. (des.C) : 220.5
AVE. REACTOR TEMPERATURE (des.C) : 225.1
REACTOR OUTLET TEMP. (des.C) : 226.4
GUARD BED FEED PRESSURE (kPa) : 5425
PRIMARY SEPARATOR GAS PRESSURE (kPa) : 5312
GAS SUPERFICIAL VELOCITY (cm/sec) : 4.5
LIQUID SUPERFICIAL VELOCITY (cm/sec) : 4.3
SLURRY CONCENTRATION (wt%) : 17.4
SPACE VELOCITY (L/kg-hr) : 5906
RECYCLE/FRESH FEED RATIO : 2.92756
OIL/SLURRY CIRCULATION RATE (m3/hr) : 39.6
PROD.SEPARATOR GAS FLOWRATE <SO> + <SS> (ksmol/hr) : 46.88
PURGE GAS FLOW RATE <SO> (ksmol/hr) : 4.13

STREAM #	1	55	10	15	25*	62	68	
STREAM NAME	FRESH FEED	RECYCLE GAS	GUARD-BED FEED	REACTOR FEED	V/L SEP GAS	FLASH GAS	METH PRODUCT	
COMPONENT	<MOL>	<MOL>	<MOL>	<MOL>	<MOL>	<MOL>	<MOL>	<WT>
H2	n.a.	31.07	n.a.	36.34	29.19	n.a.	—	—
CO	n.a.	54.03	n.a.	50.33	50.73	n.a.	—	—
CO2	n.a.	12.66	n.a.	11.10	12.08	n.a.	—	—
N2	n.a.	1.47	n.a.	1.22	1.38	n.a.	—	—
CH4	n.a.	0.49	n.a.	0.42	0.46	n.a.	—	—
H2O	n.a.	0.00	n.a.	0.00	0.01	n.a.	2.09	1.15
CH3OH	n.a.	0.30	n.a.	0.25	6.37	n.a.	96.13	94.07
DME	n.a.	0.00	n.a.	0.01	0.00	n.a.	0.00	0.00
C2H5OH	—	—	—	—	—	—	0.71	1.00
C3OH'S	—	—	—	—	—	—	0.22	0.41
C4OH'S	—	—	—	—	—	—	0.18	0.40
C5OH'S	—	—	—	—	—	—	0.09	0.25
ALKANES	—	—	—	—	—	—	0.00	0.00
ESTERS	—	—	—	—	—	—	0.39	0.75
ALDEHYDES	—	—	—	—	—	—	0.00	0.00
OIL	—	—	—	—	—	—	0.19	1.97
TOTAL :	n.a.	100.03	n.a.	99.67	100.23	n.a.	100.00	100.00
DENS,g/cc	n.a.	0.045	n.a.	0.034	0.029	n.a.	—	0.796
AV.MOL.WT	n.a.	21.92	n.a.	20.28	22.62	n.a.	32.74	—
Na3/hr	327.3	958.2	n.a.	1261.9 (2)	1131.3 (1)	1.9	—	—
ksmol/hr	14.60	42.75	n.a.	56.30 (2)	50.47 (1)	0.08	2.38	—
L/hr:prod	—	—	—	—	—	—	—	97.66

* Compositions correspond to STREAM#32

- (1) Flow reduced 3.85% to optimize reactor effluent and reactor feed using correlation.
- (2) Flow increased 0.79% to match reactor effluent mass flow.
- (3) Concentrations corrected after introduction of analytical data for 14:00 hr period.
- (4) Computer outage during the period 18:00 → 20:00.

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
CONVERSION-SELECTIVITY-PRODUCTIVITY

1300 18-Mar-84 - 2400 18-Mar-84

CONVERSIONS ACROSS REACTOR :

		<u>GC#1</u>	<u>GC#2</u>
HYDROGEN CONVERSION	(Z) :	28.0	29.0
CARBON MONOXIDE CONVERSION	(Z) :	10.3	9.6
CARBON DIOXIDE CONVERSION	(Z) :	2.4	2.4

*** See next page for conversions as calc. by overall bal.

SELECTIVITIES :

		<u>ACROSS REACTOR</u> <u>GC Average</u>	<u>OVERALL</u> <u>%</u>
CO (+CO ₂) SELECTIVITY TO METHANOL	(Z) :	103.4	68.8
CO (+CO ₂) SELECTIVITY TO ETHANOL	(Z) :		0.5

* Methanol in flashed gas not measured
 Ethanol only measured in product flow

METHANOL PRODUCTIVITIES & YIELDS

<u>MEOH SOURCE</u>	<u>mmol/hr-kg cat</u>	<u>kg/1000 Na3 fresh feed</u>	<u>kg/1000 Na3 reactor feed</u>
As calculated ACROSS REACTOR	14.37	301.1	78.1
As Net MeOH produced, OVERALL balance	10.73	224.8	58.3

REACTOR FEED (H₂/(CO+1.5CO₂)) : 0.54
 REACTOR FEED ((H₂-CO₂)/(CO+CO₂)) : 0.41

APPROACH TO METHANOL EQUILIBRIUM (des.C) : 59.5
 APPROACH TO WATER-GAS EQUILIBRIUM (des.C) : -33.9

METHANOL COLLECTED AS % OF CALCULATED : 74.3

CALCULATED METHANOL PRODUCTION RATE (Kmmol/hr) : 3.08

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
MATERIAL BALANCE SUMMARY

COMPONENT BALANCE (IN-OUT)/IN :

STREAMS # STREAMS LOCATION COMPONENT :	PURE GASES - 13 FRESH FEED GAS	[(1+55)-15] REACTOR FEED	[25 - (50+51+62+68)] REACTOR EFFLUENT
	<Z diff.>	<Z diff.>	<Z diff.>
H2	n.a.	n.a.	n.a.
CO	n.a.	n.a.	n.a.
CO2	n.a.	n.a.	n.a.
N2	n.a.	n.a.	n.a.
CH4	n.a.	n.a.	n.a.
H2O	—	n.a.	n.a.
CH3OH	—	n.a.	n.a.

OVERALL ELEMENTAL BALANCE (Ks-atoms/hr) :

STREAM # STREAM NAME	INPUTS		OUTPUTS				(IN-OUT)/IN
	15 REACTOR FEED	55 RECYCLE	50 PURGE GAS	62 FLASH GAS	68 MeOH PRODUCT	TOTAL	%
CARBON:							
CO	28.3346	23.0989	2.2314	n.a.	—	25.3303	10.6029
CO2	6.2517	5.4132	0.5229	n.a.	—	5.9361	5.0482
CH3OH	0.1408	0.1291	0.0125	n.a.	2.2836	2.4252	-1622.4400
OTHERS	0.2345	0.2095	0.0202	n.a.	0.0978	0.3275	-39.6588
TOTAL C	34.9615	28.8506	2.7870	n.a.	2.3814	34.0190	2.6958
HYDROGEN:							
H2	40.9133	26.5645	2.5661	n.a.	—	29.1306	28.7992
H2O	0.0036	0.0034	0.0003	n.a.	0.0993	0.1030	-2761.1100
OTHERS	1.5009	1.3543	0.1308	n.a.	9.3871	10.8722	-624.3790
TOTAL H	42.4178	27.9221	2.6973	n.a.	9.4864	40.1056	5.4505
OXYGEN:							
TOTAL O	40.9805	34.0560	3.2898	n.a.	2.3805	39.7263	3.0605
NITROGEN:							
TOTAL N	1.3790	1.2542	0.1211	n.a.	—	1.3753	0.2683
TOTAL MASS FLOW (ks/hr)	1141.6700	936.8230	90.4974	n.a.	77.7808	1105.1000	3.2032

REACTOR GAS BALANCE (OUT/IN) :

	6C12
MASS BALANCE, (Z) :	100.000
ELEMENTAL BALANCE, (Z) :	
CARBON	100.513
HYDROGEN	101.938
OXYGEN	100.092

LaPORTE LP METHANOL PROCESS HOURLY REPORT
ENTRAINED MODE
PROCESS VARIABLES & ANALYTICAL SUMMARY

DATE : 19-Mar-84
TIME : 06:59 AM
HOURS ON STREAM : 224.9
RUN ID NUMBER : F-16
FEED GAS TYPE: UNBALANCED GAS
REACTOR FEED GAS INLET TEMP. (des.C) : 140.9
OIL/SLURRY INLET TEMP. (des.C) : 252.1
AVE. REACTOR TEMPERATURE (des.C) : 250.6
REACTOR OUTLET TEMP. (des.C) : 252.1
GUARD BED FEED PRESSURE (kPa) : 5601
PRIMARY SEPARATOR GAS PRESSURE (kPa) : 5309
GAS SUPERFICIAL VELOCITY (cm/sec) : 10.7
LIQUID SUPERFICIAL VELOCITY (cm/sec) : 5.9
SLURRY CONCENTRATION (wt%): 19.3
SPACE VELOCITY (1/ks-hr) : 15070
RECYCLE/FRESH FEED RATIO : 5.83919
OIL/SLURRY CIRCULATION RATE (m3/hr) : 54.5
PROD. SEPARATOR GAS FLOWRATE <S0> + <S5> (ksmol/hr) : 95.64
PURGE GAS FLOW RATE <S0> (ksmol/hr) : 2.54

CONVERSIONS:
CO 8.5Z
H2 26.4Z

PRODUCTIVITY:
30.7 g-mol/hr-ks across reactor

STREAM #	1	55	10	15	25	62	68	
STREAM NAME	FRESH FEED	RECYCLE GAS	GUARD-BED FEED	REACTOR FEED	V/L SEP GAS	FLASH GAS	MECH PRODUCT	
COMPONENT								
	<MOL>	<MOL>	<MOL>	<MOL>	<MOL>	<MOL>	<MOL>	<WT>
H2	n.a.	29.72	n.a.	34.50	27.96	n.a.		
CO	n.a.	53.84	n.a.	50.94	51.34	n.a.		
CO2	n.a.	14.25	n.a.	12.27	13.41	n.a.		
N2	n.a.	1.49	n.a.	1.19	1.23	n.a.		
CH4	n.a.	0.80	n.a.	0.69	0.79	n.a.		
H2O	n.a.	0.03	n.a.	0.02	0.02	n.a.	n.a.	n.a.
CH3OH	n.a.	0.27	n.a.	0.22	5.25	n.a.	96.10	n.a.
C2H5OH							n.a.	n.a.
C3OH'S							n.a.	n.a.
C4OH'S							n.a.	n.a.
C5OH'S							n.a.	n.a.
ALKANES							n.a.	n.a.
ESTERS							n.a.	n.a.
ALDEHYDES							n.a.	n.a.
OIL							n.a.	n.a.
TOTAL :	n.a.	100.40	n.a.	99.83	100.00	n.a.	n.a.	n.a.
DENSr/cc	n.a.	0.048	n.a.	0.034	0.028	n.a.		0.776
AV.MOL.WT	n.a.	22.59	n.a.	20.88	23.00	n.a.	32.74	
M3/hr	357.4	2087.0	n.a.	2712.9	2462.7 (2)	5.2		
ksmol/hr	15.95	93.11	n.a.	121.03	109.87 (2)	0.23	5.74 (3)	
1/hr:prod								236.21 (3)

* Compositions correspond to STREAM#32

(1) Compositions are averages over interval 04:30 to 11:10 3/19/84.

(2) Flow reduced 2.78Z to match reactor feed mass flow.

(3) Product meter average over interval = 1.64 gms.

(4) Average flows unavailable due to computer outage.

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
ENTRAINED MODE
PROCESS VARIABLES & ANALYTICAL SUMMARY

DATE : 17-Jul-84
TIME : 02:35 PM
TIME INTERVAL: FROM: 2200 19-Mar
TO: 0500 20-Mar
7
NUMBER OF AVERAGED HOURS :
RUN ID NUMBER : F-1H
FEED GAS TYPE: BALANCED GAS
REACTOR FEED GAS INLET TEMP. (deg.C) : 143.6
OIL/SLURRY INLET TEMP. (deg.C) : 246.1
AVE. REACTOR TEMPERATURE (deg.C) : 250.7
REACTOR OUTLET TEMP. (deg.C) : 252.4
GUARD BED FEED PRESSURE (kPa) : 6659
PRIMARY SEPARATOR GAS PRESSURE (kPa) : 6364
GAS SUPERFICIAL VELOCITY (cm/sec) : 12.5
LIQUID SUPERFICIAL VELOCITY (cm/sec) : 6.0
SLURRY CONCENTRATION (wt%): 20.3
SPACE VELOCITY (1/ks-hr) : 20642
RECYCLE/FRESH FEED RATIO : 3.78985
OIL/SLURRY CIRCULATION RATE (m3/hr) : 55.7
PROD.SEPARATOR GAS FLOWRATE <S0> + <S5> (ksmol/hr) : n.a.
PURGE GAS FLOW RATE <S0> (ksmol/hr) : n.a.

STREAM #	1	55	10	15	252	62	68	
STREAM NAME	FRESH FEED	RECYCLE GAS	GUARD-BED FEED	REACTOR FEED	V/L SEP GAS	FLASH GAS	METH PRODUCT	
COMPONENT								
	<MOL>	<MOL>	<MOL>	<MOL>	<MOL>	<MOL>	<MOL>	<WT>
H2	62.87	52.86	n.a.	55.54	49.59	33.40	—	—
CO	27.97	18.46	n.a.	20.30	17.21	21.04	—	—
CO2	3.30	5.42	n.a.	5.06	5.25	30.22	—	—
N2	4.84	21.53	n.a.	18.32	20.93	16.54	—	—
CH4	0.17	0.91	n.a.	0.76	0.87	2.51	—	—
H2O	0.00	0.02	n.a.	0.00	0.02	0.16	3.59	2.01
CH3OH	0.00	0.18	n.a.	0.22	6.45	4.45	95.28	94.76
DME	0.00	0.00	n.a.	0.00	0.00	0.25	0.00	0.00
C2H5OH	—	—	—	—	—	—	0.50	0.72
C3OH'S	—	—	—	—	—	—	0.19	0.36
C4OH'S	—	—	—	—	—	—	0.11	0.26
C5OH'S	—	—	—	—	—	—	0.05	0.14
ALKANES	—	—	—	—	—	—	0.00	0.00
ESTERS	—	—	—	—	—	—	0.16	0.30
ALDEHYDES	—	—	—	—	—	—	0.00	0.00
OIL	—	—	—	—	—	—	0.12	1.32
TOTAL :	99.15	99.38	n.a.	100.21	100.32	108.59	100.00	100.00
DENS(g/cc)	0.004	0.038	n.a.	0.028	0.024	0.002	—	0.800
AV.MOL.WT	11.94	14.86	n.a.	14.36	16.20	24.39	32.15	—
M3/hr	768.8	2913.7	n.a.	3633.0	3218.9 (3)	3.5	—	—
ksmol/hr	34.30	129.99	n.a.	162.08	143.61 (3)	0.16	8.33 (4)	—
l/hr:prod	—	—	—	—	—	—	—	333.29 (4)

* Compositions correspond to STREAM#32

- (1) Gas compositions are averages from gas chromatograph printout due to difficulty with computer data link.
(2) Available flows corrected for molecular weight changes.
(3) Flow unavailable in computer database; number shown is from reactor mass balance.
(4) Uncorrected flow.

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LaPORTE LP METHANOL PROCESS AVERAGE REPORT
CONVERSION-SELECTIVITY-PRODUCTIVITY

2200 19-Mar-84 - 0500 20-Mar-84

CONVERSIONS ACROSS REACTOR :

		<u>GC#1</u>	<u>GC#2</u>
HYDROGEN CONVERSION	(Z) :	20.9	20.9
CARBON MONOXIDE CONVERSION	(Z) :	24.9	24.9
CARBON DIOXIDE CONVERSION	(Z) :	8.1	8.1

*** See next page for conversions as calc. by overall bal.

SELECTIVITIES :

		<u>ACROSS REACTOR</u> <u>GC Average</u>	<u>OVERALL</u> <u>%</u>
CO (+CO2) SELECTIVITY TO METHANOL	(Z) :	100.6	95.1
CO (+CO2) SELECTIVITY TO ETHANOL	(Z) :		0.5

* Methanol in flashed gas not measured
Ethanol only measured in product flow

METHANOL PRODUCTIVITIES & YIELDS

<u>METH SOURCE</u>	<u>mol/hr-kg cat</u>	<u>kg/1000 Nm3 fresh feed</u>	<u>kg/1000 Nm3 reactor feed</u>
As calculated ACROSS REACTOR	50.60	371.2	78.6
As Net MeOH produced, OVERALL balance	44.98	329.9	69.8

REACTOR FEED (H2/(CO+1.5CO2)) :	1.99
REACTOR FEED ((H2-CO2)/(CO+CO2)) :	1.99
APPROACH TO METHANOL EQUILIBRIUM (des.C) :	47.6
APPROACH TO WATER-GAS EQUILIBRIUM (des.C) :	-98.6
METHANOL COLLECTED AS % OF CALCULATED :	88.7
CALCULATED METHANOL PRODUCTION RATE (Kmol/hr) :	8.91

LaPORTE LP METHANOL PROCESS AVERAGE REPORT
MATERIAL BALANCE SUMMARY

COMPONENT BALANCE (IN-OUT)/IN :

STREAMS # STREAMS LOCATION COMPONENT :	CPURE GASES - 13 FRESH FEED GAS	[(1+55)-15] REACTOR FEED	[25 - (50+51+62+68)] REACTOR EFFLUENT
	<Z diff.>	<Z diff.>	<Z diff.>
H2	-22.64060	0.28629	-2.35317
CO	-6.46503	2.04766	-3.05513
CO2	-109.62700	-0.29137	0.31256
N2	-20.96740	-0.15456	1.21059
CH4	53.28370	0.75910	-0.67921
H2O	-----	100.00000	n.a.
CH3OH	-----	-52.39310	11.54120

OVERALL ELEMENTAL BALANCE (Ks-atoms/hr) :

STREAM # STREAM NAME	INPUTS		OUTPUTS				(IN-OUT)/IN Z
	15 REACTOR FEED	55 RECYCLE	50 PURGE GAS	62 FLASH GAS	68 MeOH PRODUCT	TOTAL	
CARBON:			(1)				
CO	32.9021	23.9963	1.4406	0.0330	-----	25.4698	22.5891
CO2	8.2012	7.0455	0.4230	0.0473	-----	7.5158	8.3575
CH3OH	0.3564	0.2340	0.0140	0.0070	7.9386	8.1936	-2197.8700
OTHERS	1.2318	1.1829	0.0710	0.0039	0.2185	1.4763	-19.3511
TOTAL C	42.6917	32.4587	1.9486	0.0912	8.1571	42.6556	0.0847
HYDROGEN:							
H2	180.0380	137.4260	8.2501	0.1046	-----	145.7810	19.0276
H2O	0.0000	0.0520	0.0031	0.0005	0.5978	0.6534	n.a.
OTHERS	6.3535	5.6676	0.3402	0.0436	32.3346	38.3860	-504.1700
TOTAL H	186.3910	143.1460	8.5934	0.1488	32.9323	184.8200	0.8428
OXYGEN:							
TOTAL O	49.6612	38.3473	2.3021	0.1349	8.3350	49.1192	1.0912
NITROGEN:							
TOTAL N	59.3860	55.9740	3.3602	0.0518	-----	59.3862	-0.0004
TOTAL MASS FLOW (ks/hr)	2327.0100	1931.2200	115.9360	3.8198	266.6310	2317.6100	0.4039

REACTOR GAS BALANCE (OUT/IN) :

	GC#2
MASS BALANCE, (Z) :	100.000
ELEMENTAL BALANCE, (Z) :	
CARBON	100.174
HYDROGEN	99.004
OXYGEN	98.840

(1) Purge flow from N2 overall balance.