## A. COMPOSITE PERIOD DATA FOR RUN 51

51-1
RUN NO. 51 F/M
HOURS 104-226
CATALYST AGE 174

# THE TEXAS COMPANY — MONTEBELLO LABORATORY
## YIELD CALCULATIONS

| | FRESH FEED | | | WET GAS | | | RECYCLE | COMBINED FEED | EFFLUENT | NET CHANGE | | YIELD BASIS $H_2+CO$ FED | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | At Wt. Balance | | | | | | | CONDENSATE | | | |
| | % | m/hr | #/hr | % | m/hr | #/hr | m/hr | m/hr | m/hr | m/hr | #/hr | #/MCF | #/gal | gal/hr | gal/MCF |
| CO 28.010 | 37.835 | 10.238 | 286.77 | 8.473 | 0.712 | 19.94 | 2.454 | 12.692 | 3.166 | - 9.526 | -266.83 | | | | |
| $H_2$ 2.016 | 57.583 | 15.582 | 31.41 | 35.879 | 3.016 | 6.08 | 10.392 | 25.974 | 13.408 | -12.566 | -25.33 | | | | |
| $CO_2$ 44.010 | 3.440 | 0.931 | 40.97 | 34.296 | 2.883 | 126.88 | 9.934 | 10.865 | 12.817 | 1.952 | 85.91 | 8.779 | | | |
| $N_2$ 28.016 | 0.753 | 0.204 | 5.72 | 2.420 | 0.203 | 5.69 | 0.701 | 0.905 | 0.904 | | | | | | |
| $CH_4$ 16.043 | 0.389 | 0.105 | 1.68 | 8.168 | 0.687 | 11.02 | 2.366 | 2.471 | 3.053 | 0.582 | 9.34 | 0.954 | | | |
| $C_2H_4$ 28.052 | | | | 2.799 | 0.235 | 6.59 | 0.811 | 0.811 | 1.046 | 0.235 | 6.59 | 0.673 | | | |
| $C_2H_6$ 30.068 | | | | 1.293 | 0.109 | 3.28 | 0.375 | 0.375 | 0.484 | 0.109 | 3.28 | 0.335 | | | |
| $C_1+C_2$ | | | | | | | | | | | 19.21 | 1.963 | | | |
| $C_3H_6$ 42.078 | | | | 3.242 | 0.273 | 11.49 | 0.939 | 0.939 | 1.212 | 0.273 | 11.49 | 1.174 | 4.32 | 2.660 | 0.272 |
| $C_3H_8$ 44.094 | | | | 0.418 | 0.035 | 1.54 | 0.121 | 0.121 | 0.156 | 0.035 | 1.54 | 0.157 | 4.24 | 0.363 | 0.037 |
| $C_4H_8$ 56.104 | | | | 1.762 | 0.148 | 8.30 | 0.510 | 0.510 | 0.658 | 0.148 | 8.30 | 0.484 | 5.00 | 1.660 | 0.170 |
| $C_4H_{10}$ 58.120 | | | | 0.396 | 0.033 | 1.92 | 0.115 | 0.115 | 0.148 | 0.033 | 1.92 | 0.196 | 4.86 | 0.395 | 0.040 |
| $C_5H_{10}$ 70.130 | | | | 0.610 | 0.051 | 3.58 | 0.177 | 0.177 | 0.228 | 0.051 | 3.58 | 0.366 | 5.45 | 0.657 | 0.067 |
| $C_5H_{12}$ 72.146 | | | | 0.091 | 0.008 | 0.58 | 0.026 | 0.026 | 0.034 | 0.008 | 0.58 | 0.059 | 5.25 | 0.110 | 0.011 |
| $C_6H_{12}$ 84.156 | | | | 0.153 | 0.013 | 1.09 | 0.044 | 0.044 | 0.057 | 0.013 | 1.09 | 0.111 | 5.54 | 0.197 | 0.020 |
| $C_3$-$C_6$ | | | | | | | | | | | 28.50 | 2.912 | | 6.042 | 0.617 |
| TOTAL | | 27.060 | 366.55 | | 8.406 | 207.98 | 28.965 | 56.025 | 43.180 | | | | | | |
| $H_2+CO$ | | 25.820 | 9785.78 SCFH | | 3.728 | | 12.846 | 38.666 | 16.574 | 22.092 | | | | | |
| $H_2/CO$ | | 1.52 | Factor 102189 | | 4.24 | | 4.24 | 2.05 | 4.24 | 1.32 | | | | | |

| YIELDS BASIS BROWNSVILLE DESIGN FEED RATE* | | | | |
|---|---|---|---|---|
| | CORRECTED HEMPEL, % | gal/hr | TREATING RECOVERY,% | gal/hr |
| 400 EP | 76.8 | 6.320 | 98.0 | 6.194 |
| 400-550 | 13.4 | 1.103 | 91.4 | 1.008 |
| 550 + | 9.8 | 0.806 | 114.6 | 0.924 |
| | | 8.229 | | |
| | RECOVERY % | #/hr | gal/hr | |
| PROPYLENE | 46.1 | 5.30 | | |
| $C_3$ POLY GASO. | 87.5 | 4.64 | 0.776 | |
| $C_3$ POLY TAR | 12.5 | 0.66 | 0.088 | |
| | | | | |
| | #/gal | #/hr | gal/hr | RVP |
| $C_4H_8$ | 5.00 | 1.31 | 0.262 | 68.0 |
| $C_4$ POLY GASO. | 5.98 | 6.12 | 1.023 | 1.5 |
| $C_4H_{10}$ | 4.86 | 1.92 | 0.395 | 68.0 |
| $C_4$ FREE GASO. | | | 7.934 | 5.8 |
| $C_4$ POLY TAR | 7.53 | 0.87 | 0.116 | |
| | gal/hr | gal/MCF | Bbl/Day | |
| 10 # RVP 400 EP GASOLINE | 9.219 | 0.9421 | 5108 | |
| GAS OIL | 1.008 | 0.1030 | 558 | |
| FUEL OIL | 0.924 | 0.0944 | 512 | |
| POLY TAR | 0.204 | 0.0208 | 113 | |
| TOTAL | 11.355 | 1.1604 | 6291 | |
| W. S. CHEM. | 1.512 | 0.1545 | 838 | |
| TOTAL | 12.867 | 1.3149 | 7129 | |

| OPERATING DATA | | | | | |
|---|---|---|---|---|---|
| Pressure, psig | 414 | Inlet Velocity, Ft/sec | 0.65 | Catalyst | |
| Temperature, °F | | Bed Depth, Ft | 21.70 | Weight, # | 2085 |
| Recycle Ratio | 1.07 | Bed Density, # C F | 146 | Volume, Cu ft | 14.33 |

| | RECOVERED OIL | TOTAL OIL | WATER SOLUBLE CHEMICALS | TOTAL LIQUID PRODUCTS $C_3$+ | NET WATER | GROSS WATER | HYDROCARBON TOTAL—$C_1$+ |
|---|---|---|---|---|---|---|---|
| | 0.377* | 52.91 | 0.223* | 11.85 | 5.209* | 93.84 | 112.47 |
| | 5.407 | 6.43 | 8.229 | 0.841 | | 105.69 | 11.493 |
| | 8.319 | | 14.271 | 1.458 | | | |
| | 1.211 | 7.837 | 1.512 | 0.155 | | | |
| | 9.530 | | 15.783 | 1.613 | 9.589 | 8.321 | 11.277 |

| FRESH FEED CONVERSION — % | | | | TOTAL FEED CONVERSION — % | | | SELECTIVITY |
|---|---|---|---|---|---|---|---|
| Contraction | CO | $H_2$ | $H_2+CO$ | CO | $H_2$ | $CO+H_2$ | $C_3$ + / $C_1$ + |
| 68.94 | 93.04 | 80.64 | 85.56 | 75.06 | 48.38 | 57.14 | 82.92 |

Form ML-11

*Included in Reactor Effluent Total

g/NCM = 16.91 × #/MCF  .80488 MCFH $H_2$ + CO, Bbl/Day = 5421.6 × gal/MCF

## DATA SUMMARY

HOURS 104-266

| OPERATING CONDITIONS | | | | PRODUCT TESTS | | |
|---|---|---|---|---|---|---|
| PRESSURES PSIG | | RATES S.C.F.H. | | | OIL | WATER |
| Oxygen | | Fresh Feed | 10,256 | ° API | 51.7 | 10.7 |
| Natural Gas | | Recycle | 10,978 | Neut. No. | 41.9 | 40.1 |
| Generator Outlet | | Combined Feed | 21,234 | Sap. No. | 52.1 | 42.1 |
| Reactor Inlet | 414 | Wet Gas—Measured | | Hydrox. No. | | |
| Condenser Inlet | | Adjusted | 3,186 | Bromine No. | 87 | |
| Product Accumulator | 390 | Loss | | Pour °F. | | |
| | | | | Chemicals, % by $K_2CO_3$ | | 11.6 |
| | | | | | | |
| TEMPERATURES—°F. | | Recycle/Fresh Feed | 1.07 | | | |
| Oxygen | | Inlet Velocity—ft./sec. | 0.65 | | | |
| Natural Gas | | Fresh Feed Rate—S.C.F.H. $H_2+CO$ | 9,786 | HEMPEL. DIST. % | | |
| Generator | | per Cu. Ft. Dense Bed | 683 | 205 °F. | | |
| Quench Accumulator | | per Lb. Catalyst | 4.39 | 400 | 75.8 | 57.0 |
| Reactor Inlet | 612 | per sq. ft. | 14,327 | 400-550 | 13.4 | 37.0 |
| Condenser Inlet | | | | 550+ | 10.8 | |
| Product Accumulator | 62 | | | | | |
| Catalyst No. Height | | | | A. S. T. M. DIST. ON | | |
| 1 Inches 12 | 646 | | | Naphtha °F. | | |
| 2 43.2 | 649 | | | IBP | 96 | |
| 3 74.4 | 660 | | | 10% | 132 | |
| 5 136.8 | 643 | | | 50% | 223 | |
| 7 199.2 | 628 | | | 90% | 348 | |
| 8 230.4 | 621 | Avg. Bed Temp., °F. | 639 | EP | 401 | |
| 9 261.6 | 619 | dT, °F. | 121 | Rec. | 97.6 | |
| 10 292.8 | 610 | K, BTU/hr/sq.ft/°F. | 113.3 | | | |
| 11 323.0 | 588 | Steam Rate, #/hr. | 411.7 | | | |
| 12 342.0 | 582 | | | | | |

| CATALYST DATA | | | | | |
|---|---|---|---|---|---|
| INVENTORY DATA | | PARTICLE SIZE | | | |
| In Reactor at Start of Period | | Screen Analysis | | | Sedimentation |
| Fresh Catalyst Added | | Mesh | Microns | % | Microns % |
| Total | | On 40 | 419+ | 12.2 | 80+ |
| Catalyst Recovered | | 100 | 150 | 63.7 | 40—80 |
| In Reactor at End of Period | | 150 | 105 | 12.4 | 20—40 |
| | | 200 | 74 | 7.6 | 10—20 |
| REACTOR d-p, Inches $H_2O$ | | 250 | 62 | 1.6 | 0—20 |
| No. Height | | 325 | 44 | 1.6 | |
| | | <325 | | 0.9 | |
| | | CATALYST | | | |
| | | Bulk Density, Lbs./Cu.Ft. | | | |
| | | Aerated | | 144 | |
| | | Settled | | 146 | |
| | | Compacted | | 160 | |
| | | Particle Density, gm./cc. | | 4.4 | |
| CALCULATED FROM dp | | $NH_3$ Value, ml./gm. | | 7.6 | |
| Density, Lbs./Cu.Ft. | 146 | $N_2$ Surface, $m^2$/gm. | | | |
| Inventory, Lbs. | 2085 | | | | |
| Bed Depth, Ft. | 21.70 | CHEMICAL ANALYSIS | | | |
| Vol., cu. ft. | 14.33 | Fe | | | |
| | | C | | 5.7 | |
| | | O | | | |
| | | H | | | |
| | | $K_2O$, W+, % basis Fe | | | |
| | | X-Ray Analysis— | | | |
| | | $Fe_{20}C_9$ | | | |
| | | $Fe_3O_4$ | | | |
| | | Fe | | | |

RUN NO. 51-2 / 51 N/U
HOURS 266-450
CATALYST AGE 272

# THE TEXAS COMPANY — MONTEBELLO LABORATORY
## YIELD CALCULATIONS

| | FRESH FEED | | | WET GAS | At. Wt. Balance | | RECYCLE | COMBINED FEED | EFFLUENT | NET CHANGE | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | m/hr | #/hr | % | m/hr | #/hr | m/hr | m/hr | m/hr | m/hr | #/hr |
| CO 28.010 | 37.622 | 10.301 | 288.53 | 9.831 | 0.910 | 25.49 | 2.924 | 13.225 | 3.834 | - 9.391 | -263.04 |
| $H_2$ 2.016 | 57.787 | 15.823 | 31.90 | 38.299 | 3.543 | 7.14 | 11.392 | 27.215 | 14.935 | -12.280 | - 24.76 |
| $CO_2$ 44.010 | 2.923 | 0.800 | 35.21 | 29.580 | 2.736 | 120.41 | 8.799 | 9.599 | 11.535 | 1.936 | 85.20 |
| $N_2$ 28.016 | 0.722 | 0.198 | 5.55 | 2.303 | 0.213 | 5.97 | 0.685 | 0.883 | 0.898 | | |
| $CH_4$ 16.042 | 0.946 | 0.259 | 4.15 | 9.969 | 0.922 | 14.79 | 2.965 | 3.224 | 3.887 | 0.663 | 10.64 |
| $C_2H_4$ 28.052 | | | | 2.569 | 0.238 | 6.68 | 0.764 | 0.764 | 1.002 | 0.238 | 6.68 |
| $C_2H_6$ 30.068 | | | | 1.366 | 0.126 | 3.79 | 0.406 | 0.406 | 0.532 | 0.126 | 3.79 |
| $C_1+C_2$ | | | | | | | | | | | 21.11 |
| $C_3H_6$ 42.078 | | | | 2.891 | 0.267 | 11.23 | 0.860 | 0.860 | 1.127 | 0.267 | 11.23 |
| $C_3H_8$ 44.094 | | | | 0.384 | 0.036 | 1.59 | 0.114 | 0.114 | 0.150 | 0.036 | 1.59 |
| $C_4H_8$ 56.104 | | | | 1.592 | 0.147 | 8.25 | 0.474 | 0.474 | 0.621 | 0.147 | 8.25 |
| $C_4H_{10}$ 58.120 | | | | 0.393 | 0.036 | 2.09 | 0.117 | 0.117 | 0.153 | 0.036 | 2.09 |
| $C_5H_{10}$ 70.130 | | | | 0.567 | 0.053 | 3.72 | 0.169 | 0.169 | 0.222 | 0.053 | 3.72 |
| $C_5H_{12}$ 72.146 | | | | 0.108 | 0.010 | 0.72 | 0.032 | 0.032 | 0.042 | 0.010 | 0.72 |
| $C_6H_{12}$ 84.156 | | | | 0.148 | 0.014 | 1.18 | 0.044 | 0.044 | 0.058 | 0.014 | 1.18 |
| $C_3$-$C_6$ | | | | | | | | | | | 28.78 |
| TOTAL | | 27.381 | 365.34 | | 9.251 | 213.05 | 29.746 | 57.127 | 44.650 | | |
| $H_2$+CO | | 26.124 | 9901 S.C.F.H. | | 4.453 | | 14.316 | 40.440 | 18.769 | -21.671 | |
| $H_2$/CO | | 1.54 | 1010 | | 3.89 | | 3.89 | 2.06 | 3.89 | 1.31 | |

| OPERATING DATA | | | | | |
|---|---|---|---|---|---|
| Pressure, psig | 411 | Inlet Velocity, Ft/sec | 0.67 | Catalyst | |
| Temperature, °F | 601 | Bed Depth, Ft | 22.60 | Weight, # | 1963 |
| Recycle Ratio | 1.09 | Bed Density, #/C.F | 132 | Volume, Cu ft | 14.91 |

| FRESH FEED CONVERSION — % | | | | TOTAL FEED CONVERSION — % | | | SELECTIVITY |
|---|---|---|---|---|---|---|---|
| Contraction | CO | $H_2$ | $H_2$+CO | CO | $H_2$ | CO+$H_2$ | $C_3$+ /$C_1$+ |
| 66.21 | 91.17 | 77.61 | 82.95 | 71.01 | 45.12 | 53.59 | 80.98 |

| | RECOVERED OIL | TOTAL OIL | WATER SOLUBLE CHEMICALS | TOTAL LIQUID PRODUCTS $C_3$+ | NET WATER | GROSS WATER | HYDROCARBON TOTAL—$C_1$+ |
|---|---|---|---|---|---|---|---|
| m/hr | 0.339* | | 0.255* | | 5.059* | | |
| #/hr | 47.54 | 76.32 | 13.53 | 89.85 | 91.14 | 104.67 | 110.96 |

YIELD BASIS $H_2$+CO FED

| | CONDENSATE #/MCF | #/gal | gal/hr | gal/MCF |
|---|---|---|---|---|
| | 8.605 | | | |
| | 1.075 | | | |
| | 0.675 | | | |
| | 0.383 | | | |
| | 2.132 | | | |
| | 1.134 | 4.32 | 2.600 | 0.263 |
| | 0.161 | 4.24 | 0.375 | 0.038 |
| | 0.833 | 5.00 | 1.650 | 0.167 |
| | 0.211 | 4.86 | 0.430 | 0.043 |
| | 0.376 | 5.45 | 0.683 | 0.069 |
| | 0.073 | 5.25 | 0.137 | 0.014 |
| | 0.119 | 5.54 | 0.213 | 0.022 |
| | 2.907 | | 6.088 | 0.615 |
| | 4.802 | 6.406 | 7.421 | 0.750 |
| | 7.708 | | 13.509 | 1.365 |
| | 1.367 | 7.898 | 1.713 | 0.173 |
| | 9.075 | | 15.222 | 1.537 |
| | 9.205 | 8.321 | 10.953 | |
| | 10.572 | 8.264 | 12.666 | |
| | 11.207 | | | |

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

| | CORRECTED HEMPEL, % | gal/hr | TREATING RECOVERY,% | gal/hr |
|---|---|---|---|---|
| 400 EP | 79.0 | 5.863 | 98.0 | 5.746 |
| 400-550 | 12.2 | 0.905 | 91.4 | 0.827 |
| 550 + | 8.8 | 0.653 | 114.6 | 0.748 |
| | | 7.421 | | |

| | RECOVERY % | #/hr | gal/hr |
|---|---|---|---|
| PROPYLENE | 42.8 | 4.81 | |
| $C_3$ POLY GASO. | 87.5 | 4.21 | 0.704 |
| $C_3$ POLY TAR | 12.5 | 0.60 | 0.080 |

| | #/gal | #/hr | gal/hr | RVP |
|---|---|---|---|---|
| $C_4H_8$ | 5.00 | | 0.262 | 68.0 |
| $C_4$ POLY GASO. | 5.98 | | 1.015 | 1.5 |
| $C_4H_{10}$ | 4.86 | | 0.430 | 68.0 |
| $C_4$-FREE GASO. | | | 7.483 | 5.8 |
| $C_4$ POLY TAR | 7.53 | | 0.116 | * |

| | gal/hr | gal/MCF | Bbl/Day |
|---|---|---|---|
| 10 # RVP 400 EP GASOLINE | 9.190 | 0.9282 | 5032 |
| GAS OIL | 0.827 | 0.0835 | 453 |
| FUEL OIL | 0.748 | 0.0755 | 409 |
| POLY TAR | 0.196 | 0.0198 | 107 |
| TOTAL | 10.961 | 1.1071 | 6002 |
| W. S. CHEM. | 1.713 | 0.1730 | 938 |
| TOTAL | 12.674 | 1.2801 | 6940 |

g/NCM = 16.91 × #/MCF

*9488 MCFH $H_2$ + CO, Bbl/Day = 5421.6 × gal/MCF

## DATA SUMMARY

HOURS 266-450

| OPERATING CONDITIONS | | | |
|---|---|---|---|
| PRESSURES PSIG | | RATES S.C.F.H. | |
| Oxygen | | Fresh Feed | 10,377 |
| Natural Gas | | Recycle | 11,274 |
| Generator Outlet | | Combined Feed | 21,651 |
| Reactor Inlet | 411 | Wet Gas—Measured | |
| Condenser Inlet | | Adjusted | 3,506 |
| Product Accumulator | 391 | Loss | |
| Steam | 821 | | |
| | | | |
| TEMPERATURES—°F. | | Recycle/Fresh Feed | 1.09 |
| Oxygen | | Inlet Velocity—ft./sec. | 0.67 |
| Natural Gas | | Fresh Feed Rate—S.C.F.H. $H_2$ + CO | 9,901 |
| Generator | | per Cu. Ft. Dense Bed | 664 |
| Quench Accumulator | | per Lb. Catalyst | 5.04 |
| Reactor Inlet | 601 | per sq. ft. | 15,002 |
| Condenser Inlet | | | |
| Product Accumulator | 59 | | |
| Catalyst No. Height | | | |
| 1 | 646 | | |
| 2 | 650 | | |
| 3 | 658 | | |
| 4 | 645 | | |
| 5 | 631 | | |
| 6 | 624 | Avg. Bed Temp. °F. | 639 |
| 7 | 620 | dT, °F. | 118 |
| 8 | 610 | K, BTU/hr/sq.ft/°F. | 113.3 |
| 9 | 587 | | |
| 10 | 580 | | |
| | | | |

| PRODUCT TESTS | OIL | WATER |
|---|---|---|
| ° API | 52.4 | 11.1 |
| Neut. No. | 41.0 | 37.9 |
| Sap. No. | 50.2 | 38.9 |
| Hydrox. No. | | |
| Bromine No. | 88 | |
| Pour °F. | | |
| Chemicals, % by $K_2CO_3$ | | 13.6 |
| | | |
| | | |
| HEMPEL, DIST. % | | |
| 205 °F. | | °API |
| 400 | 78.0 | 57.1 |
| 400-550 | 12.2 | 36.9 |
| 550+ | 9.8 | |
| | | |
| A. S. T. M. DIST. ON | | |
| Naphtha °F. | | |
| IBP | 95 | |
| 10% | 130 | |
| 50% | 220 | |
| 90% | 349 | |
| EP | 402 | |
| Recovered | 97.5 | |

| CATALYST DATA | | | | | | |
|---|---|---|---|---|---|---|
| INVENTORY DATA | | PARTICLE SIZE | | | | |
| In Reactor at Start of Period | | Screen Analysis | | | Sedimentation | |
| Fresh Catalyst Added | 456 | Mesh | Microns | % | Microns | % |
| Total = | 57#/Day | On 40 | 419+ | 9.1 | 80+ | |
| Catalyst Recovered | | 100 | 150 | 59.9 | 40—80 | |
| In Reactor at End of Period | | 150 | 105 | 14.2 | 20—40 | |
| | | 200 | 74 | 9.8 | 10—20 | |
| REACTOR d-p, Inches $H_2O$ | | 250 | 62 | 2.4 | 0—20 | |
| No. Height | | 325 | 44 | 2.8 | | |
| | | <325 | | 1.3 | | |
| | | CATALYST | | | | |
| | | Bulk Density, Lbs./Cu.Ft. | | | | |
| | | Aerated | | | 150 | |
| | | Settled | | | 151 | |
| | | Compacted | | | 167 | |
| | | Particle Density, gm./cc. | | | 4.4 | |
| CALCULATED FROM dp | | $NH_3$ Value, ml./gm. | | | 9.4 | |
| Density, Lbs./Cu.Ft. | 132 | $N_2$ Surface, $m^2$/gm. | | | | |
| Inventory, Lbs. | 1963 | | | | | |
| Bed Depth, Ft. | 22.60 | CHEMICAL ANALYSIS | | | | |
| Vol., cu. ft. | 14.91 | Fe | | | | |
| | | C | | | | |
| | | O | | | | |
| | | H | | | | |
| | | $K_2O$, W+, % basis Fe | | | | |
| | | X-Ray Analysis— | | | | |
| | | $Fe_{20}C_9$ | | | | |
| | | $Fe_3O_4$ | | | | |
| | | Fe | | | | |

51-3
RUN NO. 51 V/EE
HOURS 474-643
CATALYST AGE 377

# THE TEXAS COMPANY — MONTEBELLO LABORATORY
## YIELD CALCULATIONS

| | FRESH FEED % | m/hr | #/hr | WET GAS % | At. Wt. Balance m/hr | #/hr | RECYCLE m/hr | COMBINED FEED m/hr | EFFLUENT m/hr | NET CHANGE m/hr | #/hr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 28.010 | 37.141 | 9.502 | 266.15 | 7.934 | 0.659 | 18.46 | 2.265 | 11.767 | 2.924 | - 8.843 | -247.69 |
| $H_2$ 2.016 | 58.137 | 14.874 | 29.99 | 37.230 | 3.094 | 6.24 | 10.627 | 25.501 | 13.721 | -11.780 | - 23.75 |
| $CO_2$ 44.010 | 2.076 | 0.692 | 30.45 | 30.206 | 2.510 | 110.46 | 8.622 | 9.314 | 11.132 | 1.818 | 80.01 |
| $N_2$ 28.016 | 0.808 | 0.207 | 5.80 | 2.473 | 0.206 | 5.77 | 0.706 | 0.913 | 0.912 | | |
| $CH_4$ 16.042 | 1.208 | 0.309 | 4.96 | 11.708 | 0.973 | 15.61 | 3.342 | 3.651 | 4.315 | 0.664 | 10.65 |
| $C_2H_4$ 28.052 | | | | 2.549 | 0.212 | 5.95 | 0.728 | 0.728 | 0.940 | 0.212 | 5.95 |
| $C_2H_6$ 30.068 | | | | 1.737 | 0.144 | 4.33 | 0.496 | 0.496 | 0.640 | 0.144 | 4.33 |
| $C_1+C_2$ | | | | | | | | | | | 20.93 |
| $C_3H_6$ 42.078 | | | | 3.148 | 0.262 | 11.02 | 0.898 | 0.898 | 1.160 | 0.262 | 11.02 |
| $C_3H_8$ 44.094 | | | | 0.548 | 0.046 | 2.03 | 0.156 | 0.156 | 0.202 | 0.046 | 2.03 |
| $C_4H_8$ 56.104 | | | | 1.466 | 0.122 | 6.84 | 0.418 | 0.418 | 0.540 | 0.122 | 6.84 |
| $C_4H_{10}$ 58.120 | | | | 0.349 | 0.029 | 1.68 | 0.100 | 0.100 | 0.129 | 0.029 | 1.68 |
| $C_5H_{10}$ 70.130 | | | | 0.471 | 0.039 | 2.73 | 0.134 | 0.134 | 0.173 | 0.039 | 2.73 |
| $C_5H_{12}$ 72.146 | | | | 0.079 | 0.007 | 0.50 | 0.023 | 0.023 | 0.030 | 0.007 | 0.50 |
| $C_6H_{12}$ 84.156 | | | | 0.102 | 0.008 | 0.67 | 0.029 | 0.029 | 0.037 | 0.008 | 0.67 |
| $C_3$-$C_6$ | | | | | | | | | | | 25.47 |
| TOTAL | | 25.584 | 337.10 | | 8.311 | 192.29 | 28.543 | 54.127 | 42.258 | | |
| $H_2$+CO | | 24.376 | 9238.5 S.C.F.H. | | 3.753 | | 12.892 | 37.268 | 16.645 | -20.623 | |
| $H_2$ CO | | 1.57 | 1082426 | | 4.69 | | 4.69 | 2.17 | 4.69 | 1.33 | |

| YIELD BASIS $H_2$+CO FED — CONDENSATE | #/MCF | #/gal | gal/hr | gal/MCF |
|---|---|---|---|---|
| RECOVERED OIL | 0.322* | 45.15 | 4.887 | 6.420 | 7.033 | 0.761 |
| TOTAL OIL | | 70.62 | 7.644 | | 12.494 | 1.352 |
| WATER SOLUBLE CHEMICALS | 0.251* | 13.33 | 1.443 | 7.911 | 1.685 | 0.182 |
| TOTAL LIQUID PRODUCTS $C_5$+ | | 83.95 | 9.087 | | 14.179 | 1.535 |
| NET WATER | 4.831* | 87.04 | 9.421 | 8.321 | 10.460 | |
| GROSS WATER | | 100.37 | 10.864 | 8.264 | 12.145 | |
| HYDROCARBON TOTAL—$C_1$+ | | 104.88 | 11.352 | | | |

| YIELDS BASIS BROWNSVILLE DESIGN FEED RATE* | CORRECTED HEMPEL. % | gal/hr | TREATING RECOVERY.% | gal/hr |
|---|---|---|---|---|
| 400 EP | 78.0 | 5.486 | 98.0 | 5.376 |
| 400-550 | 11.5 | 0.809 | 91.4 | 0.739 |
| 550 + | 10.5 | 0.738 | 114.6 | 0.846 |
| | | 7.033 | | |

| | RECOVERY % | #/hr | gal/hr |
|---|---|---|---|
| PROPYLENE | 44.4 | 4.89 | |
| $C_3$ POLY GASO. | 87.5 | 4.28 | 0.716 |
| $C_3$ POLY TAR | 12.5 | 0.61 | 0.081 |

| | #/gal | #/hr | gal/hr | RVP |
|---|---|---|---|---|
| $C_4H_8$ | 5.00 | | 0.266 | 68.0 |
| $C_4$ POLY GASO. | 5.98 | | 0.806 | 1.5 |
| $C_4H_{10}$ | 4.86 | | 0.346 | 68.0 |
| $C_4$-FREE GASO. | | | 6.809 | 5.8 |
| $C_4$ POLY TAR | 7.53 | | 0.092 | |

| | gal/hr | gal/MCF | Bbl/Day |
|---|---|---|---|
| 10 # RVP 400 EP GASOLINE | 8.227 | 0.8905 | 4828 |
| GAS OIL | 0.739 | 0.0800 | 434 |
| FUEL OIL | 0.846 | 0.0916 | 497 |
| POLY TAR | 0.173 | 0.0187 | 101 |
| TOTAL | 9.985 | 1.0808 | 5860 |
| W.S.CHEM. | 1.685 | 0.1824 | 989 |
| TOTAL | 11.670 | 1.2632 | 6849 |

| OPERATING DATA | | | | | |
|---|---|---|---|---|---|
| Pressure, psig | 416 | Inlet Velocity, Ft/sec | 0.62 | Catalyst | |
| Temperature, °F | 659 | Bed Depth, Ft | 24.23 | Weight, # | 2123 |
| Recycle Ratio | 1.12 | Bed Density, #/C.F | 133 | Volume, Cu ft | 15.99 |

| FRESH FEED CONVERSION — % | | | | TOTAL FEED CONVERSION — % | | | SELECTIVITY |
|---|---|---|---|---|---|---|---|
| Contraction | CO | $H_2$ | $H_2$+CO | CO | $H_2$ | CO+$H_2$ | $C_3$+ / $C_1$+ |
| 67.51 | 93.06 | 79.20 | 84.60 | 75.15 | 43.45 | 55.34 | 80.04 |

g/NCM = 16.91 × #/MCF

*9488 MCFH $H_2$ + CO, Bbl/Day = 5421.6 × gal/MCF

## DATA SUMMARY

HOURS 474-643

| OPERATING CONDITIONS | | | |
|---|---|---|---|
| PRESSURES PSIG | | RATES S.C.F.H. | |
| Oxygen | | Fresh Feed | 9,696 |
| Natural Gas | | Recycle | 10,818 |
| Generator Outlet | | Combined Feed | 20,514 |
| Reactor Inlet | 416 | Wet Gas—Measured | |
| Condenser Inlet | | Adjusted | 3,150 |
| Product Accumulator | 391 | Loss | |
| Steam | 807 | | |
| | | | |
| TEMPERATURES—°F. | | Recycle/Fresh Feed | 1.12 |
| Oxygen | | Inlet Velocity—ft./sec. | 0.62 |
| Natural Gas | | Fresh Feed Rate—S.C.F.H. $H_2$ + CO | 9,238 |
| Generator | | per Cu. Ft. Dense Bed | 578 |
| Quench Accumulator | | per Lb. Catalyst | 4.35 |
| Reactor Inlet | 659 | per sq. ft. | 13,997 |
| Condenser Inlet | | | |
| Product Accumulator | 54 | | |
| Catalyst No. Height | | | |
| 1 | 626 | | |
| 2 | 649 | | |
| 3 | 658 | | |
| 5 | 643 | | |
| 7 | 629 | | |
| 8 | 626 | Avg., Bed Temp, °F. | 637 |
| 9 | 625 | dT, °F. | 118 |
| 10 | 617 | K, BTU/hr/sq.ft/°F. | 105.7 |
| 11 | 595 | | |
| 12 | 581 | | |

| PRODUCT TESTS | OIL | WATER |
|---|---|---|
| °API | 52.0 | 11.2 |
| Neut. No. | 40.0 | 37.7 |
| Sap. No. | 50.3 | 39.4 |
| Hydrox. No. | | |
| Bromine No. | 81 | |
| Pour °F. | | |
| Chemicals, % by $K_2CO_3$ | | 14.1 |
| | | |
| HEMPEL. DIST. % | | |
| 205 °F. | | °API |
| 400 | 77.0 | 56.9 |
| 400-550 | 11.5 | 36.8 |
| 550+ | 11.5 | |
| | | |
| A. S. T. M. DIST. ON | | |
| Naphtha °F. | | |
| IBP | 93 | |
| 10% | 128 | |
| 50% | 220 | |
| 90% | 348 | |
| EP | 400 | |
| Recovered | 97.8 | |

| CATALYST DATA — INVENTORY DATA | | PARTICLE SIZE |
|---|---|---|
| In Reactor at Start of Period | | Screen Analysis / Sedimentation |
| Fresh Catalyst Added | 407 | Mesh / Microns / % / Microns / % |
| Total = | 45#/Day | On 40 / 419+ / 11.5 / 80+ |
| Catalyst Recovered | | 100 / 150 / 60.1 / 40—80 |
| In Reactor at End of Period | | 150 / 105 / 14.5 / 20—40 |
| | | 200 / 74 / 9.2 / 10—20 |
| REACTOR d-p, Inches $H_2O$ | | 250 / 62 / 1.7 / 0—20 |
| No. Height | | 325 / 44 / 1.9 |
| | | <325 / / 1.1 |
| | | CATALYST |
| | | Bulk Density, Lbs./Cu.Ft. |
| | | Aerated 150 |
| | | Settled 152 |
| | | Compacted 168 |
| | | Particle Density, gm./cc. 4.45 |
| CALCULATED FROM dp | | $NH_3$ Value, ml./gm. |
| Density, Lbs./Cu.Ft. | 133 | $N_2$ Surface, $m^2$/gm. |
| Inventory, Lbs. | 2,123 | |
| Bed Depth, Ft. | 24.23 | CHEMICAL ANALYSIS |
| Vol., cu. ft. | 15.99 | Fe |
| | | C |
| | | O |
| | | H |
| | | $K_2O$, W+, % basis Fe |
| | | X-Ray Analysis— |
| | | $Fe_{20}C_9$ |
| | | $Fe_3O_4$ |
| | | Fe |

$H_2O$ Injection

RUN NO. 51-4
HOURS 51 FF/KK
CATALYST AGE 643-782
438

# THE TEXAS COMPANY — MONTEBELLO LABORATORY
## YIELD CALCULATIONS

| | FRESH FEED % | FRESH FEED m/hr | FRESH FEED #/hr | WET GAS % | WET GAS At. Wt. Balance m/hr | WET GAS At. Wt. Balance #/hr | RECYCLE m/hr | COMBINED FEED m/hr | EFFLUENT m/hr | NET CHANGE m/hr | NET CHANGE #/hr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 28.010 | 37.885 | 10.098 | 282.84 | 9.263 | 1.040 | 29.13 | 3.012 | 13.110 | 4.052 | - 9.058 | -253.71 |
| $H_2$ 2.016 | 58.292 | 15.538 | 31.33 | 45.873 | 5.150 | 10.38 | 14.914 | 30.452 | 20.064 | -10.388 | - 20.95 |
| $CO_2$ 44.010 | 2.731 | 0.728 | 32.04 | 27.891 | 3.132 | 137.84 | 9.068 | 9.796 | 12.200 | 2.404 | 105.80 |
| $N_2$ 28.016 | 0.718 | 0.191 | 5.35 | 2.166 | 0.243 | 6.81 | 0.704 | 0.895 | 0.947 | | |
| $CH_4$ 16.042 | 0.374 | 0.100 | 1.60 | 6.710 | 0.753 | 12.08 | 2.181 | 2.281 | 2.934 | 0.653 | 10.48 |
| $C_2H_4$ 28.052 | | | | 2.037 | 0.229 | 6.42 | 0.662 | 0.662 | 0.891 | 0.229 | 6.42 |
| $C_2H_6$ 30.068 | | | | 1.202 | 0.135 | 4.06 | 0.391 | 0.391 | 0.526 | 0.135 | 4.06 |
| ~~xxxxx~~ | H20 | 1.679 | 30.25 | | | | | 1.679 | | | 20.96 |
| $C_3H_6$ 42.079 | | | | 2.333 | 0.262 | 11.02 | 0.758 | 0.758 | 1.020 | 0.262 | 11.02 |
| $C_3H_8$ 44.094 | | | | 0.334 | 0.037 | 1.63 | 0.108 | 0.108 | 0.145 | 0.037 | 1.63 |
| $C_4H_8$ 56.104 | | | | 1.238 | 0.139 | 7.80 | 0.403 | 0.403 | 0.542 | 0.139 | 7.80 |
| $C_4H_{10}$ 58.120 | | | | 0.299 | 0.034 | 1.98 | 0.097 | 0.097 | 0.131 | 0.034 | 1.98 |
| $C_5H_{10}$ 70.130 | | | | 0.452 | 0.051 | 3.58 | 0.147 | 0.147 | 0.198 | 0.051 | 3.58 |
| $C_6H_{12}$ 72.146 | | | | 0.086 | 0.010 | 0.72 | 0.028 | 0.028 | 0.038 | 0.010 | 0.72 |
| $C_6H_{12}$ 84.156 | | | | 0.115 | 0.013 | 1.09 | 0.037 | 0.037 | 0.050 | 0.013 | 1.09 |
| $C_3$-$C_6$ | | (26.655) | | | | | | | | | 27.82 |
| TOTAL | | 28.334 | 386.89 | | 11.228 | 234.54 | 32.511 | 60.845 | 49.833 | | |
| $H_2$+CO | | 25.636 | 9716 S.C.F.H. | | 6.190 | | 17.926 | 43.562 | 24.116 | -19.446 | |
| $H_2$/CO | | 1.54 | 1029230 | | 4.95 | | 4.95 | 2.32 | 4.95 | 1.15 | |

| YIELD BASIS $H_2$+CO FED — CONDENSATE | #/MCF | #/gal | gal/hr | gal/MCF |
|---|---|---|---|---|
| | 1.078 | | | |
| | 0.661 | | | |
| | 0.418 | | | |
| | 2.157 | | | |
| | 1.134 | 4.32 | 2.551 | 0.263 |
| | 0.168 | 4.24 | 0.384 | 0.040 |
| | 0.803 | 5.00 | 1.560 | 0.160 |
| | 0.204 | 4.86 | 0.407 | 0.042 |
| | 0.369 | 5.45 | 0.657 | 0.068 |
| | 0.074 | 5.25 | 0.137 | 0.014 |
| | 0.112 | 5.54 | 0.197 | 0.020 |
| | 2.863 | | 5.893 | 0.607 |
| | | | | |
| | 3.864 | 6.423 | 5.845 | 0.601 |
| | 6.727 | | 11.738 | 1.208 |
| | 1.575 | 7.911 | 1.934 | 0.199 |
| | 8.302 | | 13.672 | 1.407 |
| | 10.270 | 8.321 | 11.991 | |
| | 11.844 | 8.264 | 13.925 | |
| | 10.459 | | | |

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

| | CORRECTED HEMPEL. % | gal/hr | TREATING RECOVERY.% | gal/hr |
|---|---|---|---|---|
| 400 EP | 77.1 | 4.507 | 98.0 | 4.417 |
| 400-550 | 11.4 | 0.666 | 91.4 | 0.609 |
| 550 + | 11.5 | 0.672 | 114.6 | 0.770 |
| | | 5.845 | | |

| | RECOVERY % | #/hr | gal/hr |
|---|---|---|---|
| PROPYLENE | 33.8 | 3.72 | |
| $C_3$ POLY GASO. | 87.5 | 3.26 | 0.544 |
| $C_3$ POLY TAR | 12.5 | 0.46 | 0.061 |

| | #/gal | #/hr | gal/hr | RVP |
|---|---|---|---|---|
| $C_4H_8$ | 5.00 | | 0.172 | 68.0 |
| $C_4$ POLY GASO. | 5.98 | | 1.015 | 1.5 |
| $C_4H_{10}$ | 4.86 | | 0.407 | 68.0 |
| $C_4$-FREE GASO. | | | 5.952 | 5.8 |
| $C_4$ POLY TAR | 7.53 | | 0.116 | |

| | gal/hr | gal/MCF | Bbl/Day |
|---|---|---|---|
| 10 # RVP 400 EP GASOLINE | 7.546 | 0.7767 | 4211 |
| GAS OIL | 0.609 | 0.0627 | 334 |
| FUEL OIL | 0.770 | 0.0793 | 430 |
| POLY TAR | 0.177 | 0.0182 | 99 |
| TOTAL | 9.102 | 0.9368 | 5079 |
| W. S. CHEM. | 1.934 | 0.1991 | 1079 |
| TOTAL | 11.036 | 1.1359 | 6158 |

| OPERATING DATA | | | | | |
|---|---|---|---|---|---|
| Pressure, psig | 415 | Inlet Velocity, Ft/sec | 0.68 | Catalyst | |
| Temperature, °F | 831 | Bed Depth, Ft | 23.60 | Weight, # | 2003 |
| Recycle Ratio | 1.22 | Bed Density, #/C F | 129 | Volume, Cu ft | 15.57 |

| | RECOVERED OIL | | | | | |
|---|---|---|---|---|---|---|
| | 0.268* | 37.54 | 3.864 | 6.423 | 5.845 | 0.601 |
| | TOTAL OIL | | 65.36 | 6.727 | | 11.738 | 1.208 |
| | WATER SOLUBLE CHEMICALS | 0.288* | 15.30 | 1.575 | 7.911 | 1.934 | 0.199 |
| | TOTAL LIQUID PRODUCTS $C_5$+ | | 80.66 | 8.302 | | 13.672 | 1.407 |
| | NET WATER | 5.538* | 99.78 | 10.270 | 8.321 | 11.991 | |
| | GROSS WATER | | 115.08 | 11.844 | 8.264 | 13.925 | |
| | HYDROCARBON TOTAL—$C_1$+ | | 101.62 | 10.459 | | | |

| FRESH FEED CONVERSION — % | | | | TOTAL FEED CONVERSION — % | | | SELECTIVITY |
|---|---|---|---|---|---|---|---|
| Contraction | CO | $H_2$ | $H_2$+CO | CO | $H_2$ | CO+$H_2$ | $C_3^+/C_1^+$ |
| 57.88 | 89.70 | 66.86 | 75.35 | 59.09 | 34.11 | 44.64 | 79.37 |

Form ML-11

g/NCM = 16.91 × #/MCF

*9488 MCFH $H_2$ + CO, Bbl/Day = 5421.6 × gal/MCF

## DATA SUMMARY

HOURS 643-782

| OPERATING CONDITIONS | | | |
|---|---|---|---|
| PRESSURES PSIG | | RATES S.C.F.H. | |
| Oxygen | | Fresh Feed | 10,102 |
| Natural Gas | | Recycle | 12,322 |
| Generator Outlet | | Combined Feed | 22,424 |
| Reactor Inlet | 415 | Wet Gas—Measured | |
| Condenser Inlet | | Adjusted | 4,255 |
| Product Accumulator | 387 | Loss | |
| Steam | 765 | | |
| | | | |
| TEMPERATURES—°F. | | Recycle/Fresh Feed | 1.22 |
| Oxygen | | Inlet Velocity—ft./sec. | 0.68 |
| Natural Gas | | Fresh Feed Rate—S.C.F.H. | 9,716 |
| Generator | | per Cu. Ft. Dense Bed | 624 |
| Quench Accumulator | | per Lb. Catalyst | 4.85 |
| Reactor Inlet | 831 | per sq. ft. | 14,721 |
| Condenser Inlet | | | |
| Product Accumulator | 60 | | |
| Catalyst No. Height | | | |
| 1 | 535 | | |
| 2 | 635 | | |
| 3 | 635 | | |
| ~~4~~ 5 | 625 | | |
| ~~6~~ 7 | 613 | Avg.Bed. Temp., °F. | 610 |
| ~~9~~ 8 | 608 | dT, °F. | 98 |
| 9 | 606 | K,BTU/hr./sq.ft./°F. | 156 |
| 10 | 600 | | |
| 11 | 576 | | |
| 12 | 570 | | |
| | | | |

| PRODUCT TESTS | | |
|---|---|---|
| | OIL | WATER |
| ° API | 51.9 | 11.2 |
| Neut. No. | 45.5 | 39.1 |
| Sap. No. | 54.8 | 41.9 |
| Hydrox. No. | | |
| Bromine No. | 79 | |
| Pour °F. | | |
| Chemicals, % by $K_2CO_3$ | | 13.8 |
| | | |
| HEMPEL, DIST. % | | |
| 205 °F. | | °API |
| 400 | 76.1 | 56.6 |
| 400-550 | 11.4 | 38.1 |
| 550+ | 12.5 | |
| | | |
| A. S. T. M. DIST. ON | | |
| Naphtha °F. | | |
| IBP | 100 | |
| 10% | 135 | |
| 50% | 227 | |
| 90% | 350 | |
| EP | 400 | |
| Recovered | 98.0 | |

| CATALYST DATA | | | | | | |
|---|---|---|---|---|---|---|
| INVENTORY DATA | | PARTICLE SIZE | | | | |
| In Reactor at Start of Period | | Screen Analysis | | | Sedimentation | |
| Fresh Catalyst Added | 307 | Mesh | Microns | % | Microns | % |
| Total | | On 40 | 419+ | 9.0 | 80+ | |
| Catalyst Recovered | | 100 | 150 | 50.7<br>59.7 | 40—80 | |
| In Reactor at End of Period | | 150 | 105 | 16.1<br>75.8 | 20—40 | |
| | | 200 | 74 | 10.2<br>86.0 | 10—20 | |
| REACTOR d-p, Inches $H_2O$ | | 250 | 62 | 2.6<br>88.6 | 0—20 | |
| No. Height | | 325 | 44 | 4.0<br>92.6 | | |
| | | <325 | | 7.4 | | |
| | | CATALYST | | | | |
| | | Bulk Density, Lbs./Cu.Ft. | | | | |
| | | Aerated | | | 154 | |
| | | Settled | | | 157 | |
| | | Compacted | | | 177 | |
| | | Particle Density, gm./cc. | | | 4.4 | |
| CALCULATED FROM dp | | $NH_3$ Value, ml./gm. | | | | |
| Density, Lbs./Cu.Ft. | 129 | $N_2$ Surface, $m^2$/gm. | | | | |
| Inventory, Lbs. | 2,003 | | | | | |
| Bed Depth, Ft. | 23.60 | CHEMICAL ANALYSIS | | | | |
| Vol., cu. ft. | 15.57 | Fe | | | | |
| | | C | | | | |
| | | O | | | | |
| | | H | | | | |
| | | $K_2O$, W+, % basis Fe | | | | |
| | | X-Ray Analysis— | | | | |
| | | $Fe_{20}C_9$ | | | | |
| | | $Fe_3O_4$ | | | | |
| | | Fe | | | | |

51-5
RUN NO. 51 LL/NN
HOURS 782-854
CATALYST AGE 470

## THE TEXAS COMPANY — MONTEBELLO LABORATORY
## YIELD CALCULATIONS

| | FRESH FEED % | FRESH FEED m/hr | FRESH FEED #/hr | WET GAS % | WET GAS At. Wt. Balance m/hr | WET GAS At. Wt. Balance #/hr | RECYCLE m/hr | COMBINED FEED m/hr | EFFLUENT m/hr | NET CHANGE m/hr | NET CHANGE #/hr |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 28.010 | 37.461 | 9.980 | 279 54 | 9.368 | 0.859 | 24.06 | 2.940 | 12.920 | 3.799 | - 9.121 | -255.48 |
| $H_2$ 2.016 | 58.988 | 15.715 | 31.68 | 40.873 | 3.749 | 7.56 | 12.829 | 28.544 | 16.578 | -11.966 | - 24.12 |
| $CO_2$ 44.010 | 2.840 | 0.757 | 33.32 | 29.904 | 2.742 | 120.68 | 9.386 | 10.143 | 12.128 | 1.985 | 87.36 |
| $N_2$ 28.016 | 0.512 | 0.136 | 3.81 | 2.361 | 0.216 | 6.05 | 0.741 | 0.877 | 0.957 | | |
| $CH_4$ 16.042 | 0.199 | 0.053 | 0.85 | 7.895 | 0.724 | 11.61 | 2.478 | 2.531 | 3.202 | 0.671 | 10.76 |
| $C_2H_4$ 28.052 | | | | 2.342 | 0.215 | 6.03 | 0.735 | 0.735 | 0.950 | 0.215 | 6.03 |
| $C_2H_6$ 30.068 | | | | 1.469 | 0.135 | 4.06 | 0.461 | 0.461 | 0.596 | 0.135 | 4.06 |
| $C_1+C_2$ | | | | | | | | | | | 20.85 |
| $C_3H_6$ 42.078 | | | | 2.792 | 0.256 | 10.77 | 0.876 | 0.876 | 1.132 | 0.256 | 10.77 |
| $C_3H_8$ 44.094 | | | | 0.446 | 0.041 | 1.81 | 0.140 | 0.140 | 0.181 | 0.041 | 1.81 |
| $C_4H_8$ 56.104 | | | | 1.451 | 0.133 | 7.46 | 0.455 | 0.455 | 0.588 | 0.133 | 7.46 |
| $C_4H_{10}$ 58.120 | | | | 0.356 | 0.033 | 1.92 | 0.112 | 0.112 | 0.145 | 0.033 | 1.92 |
| $C_5H_{10}$ 70.130 | | | | 0.513 | 0.047 | 3.30 | 0.161 | 0.161 | 0.208 | 0.047 | 3.30 |
| $C_5H_{12}$ 72.146 | | | | 0.100 | 0.009 | 0.65 | 0.031 | 0.031 | 0.040 | 0.009 | 0.65 |
| $C_6H_{12}$ 84.156 | | | | 0.130 | 0.012 | 1.01 | 0.041 | 0.041 | 0.053 | 0.012 | 1.01 |
| $C_3$-$C_6$ | | | | | | | | | | | 26.92 |
| TOTAL | | 26.641 | 349.20 | | 9.171 | 206.97 | 31.388 | 58.029 | 45.799 | | |
| $H_2$+CO | | 25.695 | 9738.4 S.C.F.H. | | 4.608 | | 15.769 | 41.464 | 20.377 | - 21.087 | |
| $H_2$/CO | | 1.57 | 102686 | | 4.36 | | 4.36 | 2.21 | 4.36 | 1.31 | |

| YIELD BASIS $H_2$+CO FED — CONDENSATE | #/MCF | #/gal | gal/hr | gal/MCF |
|---|---|---|---|---|
| | 1.105 | | | |
| | 0.619 | | | |
| | 0.417 | | | |
| | 2.141 | | | |
| | 1.106 | 4.32 | 2.493 | 0.256 |
| | 0.186 | 4.24 | 0.427 | 0.044 |
| | 0.766 | 5.00 | 1.492 | 0.153 |
| | 0.197 | 4.86 | 0.395 | 0.040 |
| | 0.339 | 5.45 | 0.606 | 0.062 |
| | 0.067 | 5.25 | 0.124 | 0.013 |
| | 0.104 | 5.54 | 0.182 | 0.019 |
| | 2.764 | | 5.719 | 0.587 |
| | | | | |
| | 8.971 | | | |

YIELDS BASIS BROWNSVILLE DESIGN FEED RATE*

| | CORRECTED HEMPEL. % | gal/hr | TREATING RECOVERY.% | gal/hr |
|---|---|---|---|---|
| 400 EP | 77.7 | 5.445 | 98.0 | 5.336 |
| 400-550 | 12.0 | 0.841 | 91.4 | 0.769 |
| 550 + | 10.3 | 0.722 | 114.6 | 0.827 |
| | | 7.008 | | |

| | RECOVERY % | #/hr | gal/hr |
|---|---|---|---|
| PROPYLENE | 41.7 | 4.49 | |
| $C_3$ POLY GASO. | 87.5 | 3.93 | 0.657 |
| $C_3$ POLY TAR | 12.5 | 0.55 | 0.073 |

| | #/gal | #/hr | gal/hr | RVP |
|---|---|---|---|---|
| $C_4H_8$ | 5.00 | | 0.240 | 68.0 |
| $C_4$ POLY GASO. | 5.98 | | 0.916 | 1.5 |
| $C_4H_{10}$ | 4.86 | | 0.395 | 68.0 |
| $C_4$-FREE GASO. | | | 6.905 | 5.8 |
| $C_4$ POLY TAR | 7.53 | | 0.104 | |

| | gal/hr | gal/MCF | Bbl/Day |
|---|---|---|---|
| 10 # RVP 400 EP GASOLINE | 8.456 | 0.8683 | 4708 |
| GAS OIL | 0.769 | 0.0790 | 428 |
| FUEL OIL | 0.827 | 0.0849 | 460 |
| POLY TAR | 0.177 | 0.0182 | 99 |
| TOTAL | 10.229 | 1.0504 | 5695 |
| W. S. CHEM. | 1.640 | 0.1684 | 913 |
| TOTAL | 11.869 | 1.2188 | 6608 |

OPERATING DATA

| | | | | | |
|---|---|---|---|---|---|
| Pressure, psig | 417 | Inlet Velocity, Ft/sec | 0.66 | Catalyst | |
| Temperature, °F | 832 | Bed Depth, Ft | 22.91 | Weight, # | 2011 |
| Recycle Ratio | 1.18 | Bed Density, #/CF | 133 | Volume, Cu ft | 15.12 |

| | RECOVERED OIL | TOTAL OIL | WATER SOLUBLE CHEMICALS | TOTAL LIQUID PRODUCTS $C_3$+ | NET WATER | GROSS WATER | HYDROCARBON TOTAL—$C_1$+ |
|---|---|---|---|---|---|---|---|
| | 0.321* | 45.06 | 4.627 | 6.43 | 7.008 | 0.720 | |
| | | 71.98 | 7.391 | | 12.727 | 1.307 | |
| | 0.245* | 12.98 | 1.333 | 7.915 | 1.640 | 0.168 | |
| | | 84.96 | 8.724 | | 14.367 | 1.475 | |
| | 4.674* | 84.20 | 8.646 | 8.321 | 10.119 | | |
| | | 97.18 | 9.979 | 8.264 | 11.759 | | |
| | | 105.81 | 10.865 | | | | |

| FRESH FEED CONVERSION — % | | | | TOTAL FEED CONVERSION — % | | | SELECTIVITY |
|---|---|---|---|---|---|---|---|
| Contraction | CO | $H_2$ | $H_2$+CO | CO | $H_2$ | CO+$H_2$ | $C_3$+ /$C_1$+ |
| 65.58 | 91.39 | 76.14 | 82.07 | 70.60 | 41.92 | 50.86 | 80.29 |

g/NCM = 16.91 × #/MCF  *9488 MCFH $H_2$ + CO, Bbl/Day = 5421.6 × gal/MCF

## DATA SUMMARY

HOURS 782-854

| OPERATING CONDITIONS | | | |
|---|---|---|---|
| PRESSURES PSIG | | RATES S.C.F.H. | |
| Oxygen | | Fresh Feed | 10,097 |
| Natural Gas | | Recycle | 11,896 |
| Generator Outlet | | Combined Feed | 21,993 |
| Reactor Inlet | 417 | Wet Gas—Measured | |
| Condenser Inlet | | Adjusted | 3,476 |
| Product Accumulator | 388 | Loss | |
| Steam | 795 | | |
| | | | |
| TEMPERATURES—°F. | | Recycle/Fresh Feed | 1.18 |
| Oxygen | | Inlet Velocity—ft./sec. | 0.66 |
| Natural Gas | | Fresh Feed Rate—S.C.F.H. $H_2$ + CO | 9,738 |
| Generator | | per Cu.Ft. Dense Bed | 644 |
| Quench Accumulator | | per Lb. Catalyst | 4.84 |
| Reactor Inlet | 832 | per sq. ft. | 14,754 |
| Condenser Inlet | | | |
| Product Accumulator | 62 | | |
| Catalyst No. Height | | | |
| 1 | 542 | | |
| 2 | 654 | | |
| 3 | 658 | | |
| # 5 | 639 | | |
| # 7 | 625 | Avg., Bed Temp. °F. | 622 |
| # 8 | 622 | dT, °F. | 105 |
| 9 | 616 | K, BTU/hr/sq.ft/°F. | 160 |
| 10 | 611 | | |
| 11 | 592 | | |
| 12 | 579 | | |
| | | | |

| PRODUCT TESTS | OIL | WATER |
|---|---|---|
| | OIL | WATER |
| °API | 51.7 | 11.1 |
| Neut. No. | 42.7 | 41.4 |
| Sap. No. | 54.9 | 43.1 |
| Hydrox. No. | | |
| Bromine No. | 77 | |
| Pour °F. | | |
| Chemicals, % by $K_2CO_3$ | | 14.0 |
| | | |
| HEMPEL, DIST. % | | |
| 205 °F. | | °API |
| 400 | 76.7 | 56.3 |
| 400-550 | 12.0 | 36.7 |
| 550+ | 11.3 | |
| | | |
| A. S. T. M. DIST. ON | | |
| Naphtha °F. | | |
| IBP | 98 | |
| 10% | 133 | |
| 50% | 225 | |
| 90% | 354 | |
| EP | 403 | |
| Recovered | 98.0 | |

| CATALYST DATA | | PARTICLE SIZE | | | | |
|---|---|---|---|---|---|---|
| INVENTORY DATA | | Screen Analysis | | | Sedimentation | |
| In Reactor at Start of Period | | Mesh | Microns | % | Microns | % |
| Fresh Catalyst Added | | On 40 | 419+ | 11.4 | 80+ | |
| Total | | 100 | 150 | 52.6 64.0 | 40—80 | |
| Catalyst Recovered. | | 150 | 105 | 14.6 78.6 | 20—40 | |
| In Reactor at End of Period | | 200 | 74 | 11.0 89.6 | 10—20 | |
| | | 250 | 62 | 1.1 90.7 | 0—20 | |
| REACTOR d-p, Inches $H_2O$ | | 325 | 44 | 3.4 94.1 | | |
| No. Height | | <325 | | 5.9 | | |
| | | CATALYST | | | | |
| | | Bulk Density, Lbs./Cu.Ft. | | | | |
| | | Aerated | | | 156 | |
| | | Settled | | | 158 | |
| | | Compacted | | | 180 | |
| | | Particle Density, gm./cc. | | | 4.6 | |
| CALCULATED FROM dp | | $NH_3$ Value, ml./gm. | | | 7.3 | |
| Density, Lbs./Cu.Ft. | 133 | $N_2$ Surface, $m^2$/gm. | | | | |
| Inventory, Lbs. | 2011 | | | | | |
| Bed Depth, Ft. | 22.91 | CHEMICAL ANALYSIS | | | | |
| Vol., cu. ft. | 15.12 | Fe | | | | |
| | | C | | | | |
| | | O | | | | |
| | | H | | | | |
| | | $K_2O$, W+, % basis Fe | | | | |
| | | X-Ray Analysis— | | | | |
| | | $Fe_{20}C_9$ | | | | |
| | | $Fe_3O_4$ | | | | |
| | | Fe | | | | |