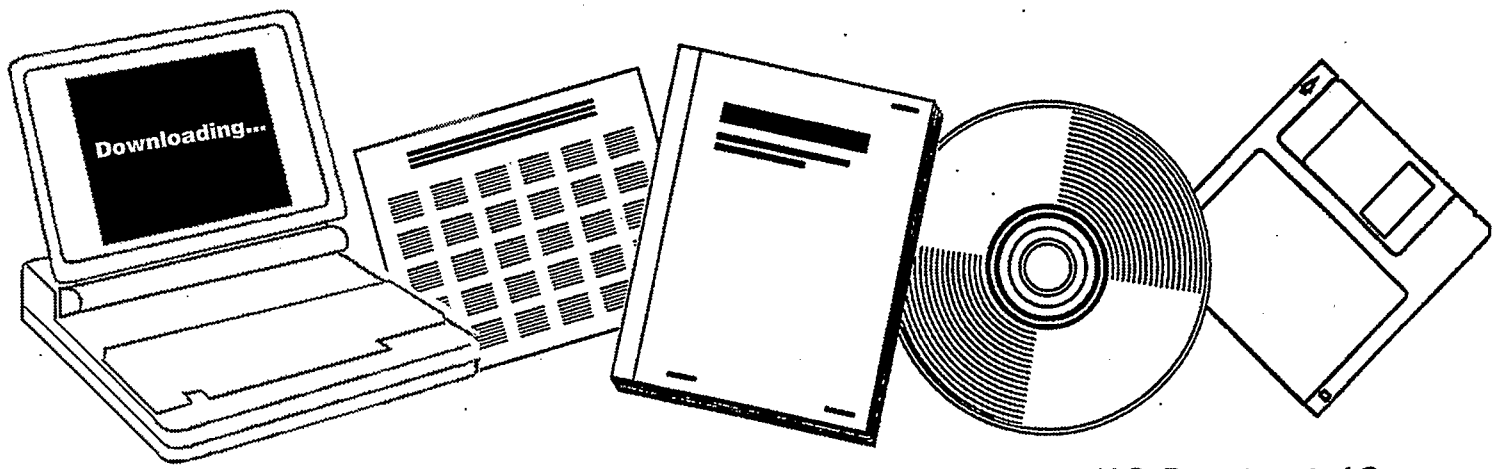
TWO-STAGE PROCESS FOR CONVERSION OF SYNTHESIS GAS TO HIGH QUALITY TRANSPORTATION FUELS. QUARTERLY REPORT, 1 JANUARY-31 MARCH 1985

MOBIL RESEARCH AND DEVELOPMENT CORP.
PAULSBORO, NJ

MAY 1985



U.S. Department of Commerce
National Technical Information Service

One Source. One Search. One Solution.

NTIS

Providing Permanent, Easy Access to U.S. Government Information

National Technical Information Service is the nation's largest repository and disseminator of government-initiated scientific, technical, engineering, and related business information. The NTIS collection includes almost 3,000,000 information products in a variety of formats: electronic download, online access, CD-ROM, magnetic tape, diskette, multimedia, microfiche and paper.

Search the NTIS Database from 1990 forward

NTIS has upgraded its bibliographic database system and has made all entries since 1990 searchable on **www.ntis.gov.** You now have access to information on more than 600,000 government research information products from this web site.

Link to Full Text Documents at Government Web Sites

Because many Government agencies have their most recent reports available on their own web site, we have added links directly to these reports. When available, you will see a link on the right side of the bibliographic screen.

Download Publications (1997 - Present)

NTIS can now provides the full text of reports as downloadable PDF files. This means that when an agency stops maintaining a report on the web, NTIS will offer a downloadable version. There is a nominal fee for each download for most publications.

For more information visit our website:

www.ntis.gov

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Technical Information Service
Springfield, VA 22161

DE86004571

DOE/PC/60019--7

DE86 004571

DOE/PC/60019-7
Dist. Category UC-90D

TWO-STAGE PROCESS FOR CONVERSION OF SYNTHESIS GAS TO HIGH QUALITY TRANSPORTATION FUELS

QUARTERLY REPORT FOR THE PERIOD
1 JANUARY - 31 MARCH, 1985

REPORT PREPARED BY: J. C. W. KUO

CONTRIBUTORS:

W. E. GARWOOD
K. M. GUPTE
T. M. LEIB
J. SMITH

MOBIL RESEARCH AND DEVELOPMENT CORPORATION
PAULSBORO, NEW JERSEY 08066

MAY 1985

PREPARED FOR THE UNITED STATES
DEPARTMENT OF ENERGY
UNDER CONTRACT NO. DE-AC22-83PC60019

DISCLAIMER

TABLE OF CONTENTS

I. Abstract

This Quarterly Report describes the conclusion of the eighth run of the Two-Stage Fischer-Tropsch/ZSM-5 pilot plant, as well as the startup and early operation of the ninth run. The latter run uses Catalyst I-B to produce high C_3^+ yield. Also in this report are results of hydrodynamic studies performed in our 5.1 and 10.2 cm ID hot-flow bubble-columns, determining the effect of column diameter on gas holdup. The Appendix-Restrictive Distribution describes new studies on hydrocracking and thermal cracking of a Fischer-Tropsch reactor-wax. The Task 2, Scoping Studies of Fischer-Tropsch Reactor-Wax Upgrading, is now complete.

II. Objective and Scope of Work

The general objective of this work is to develop a slurry Fischer-Tropsch/ZSM-5 process for converting low H_2/CO ratio synthesis gas, of the type produced in a coal gasification system, into maximum yield of transportation fuels. To accomplish this objective, the following tasks will be undertaken.

Task 1 - Process Studies in Two-Stage Bench-Scale Unit

Operation of the bench-scale unit will be directed toward production of hydrocarbons containing less than 8 wt % of methane plus ethane with high throughput, high conversion, and good catalyst stability. Together with Task 2, high quality liquid fuels, particularly the distillate, will be maximized. At least two tests shall be conducted using at least two different catalysts. One of these catalysts may be provided by DOE's alternate catalyst development projects.

Task 2 - Scoping Studies of Fischer-Tropsch Reactor-Wax Upgrading

The methods for upgrading the reactor-wax which is withdrawn from the slurry Fischer-Tropsch reactor will be evaluated. These methods should include conventional refinery processes, such as Fluidized Catalytic Cracking, Hydrocracking, Catalytic Selective Cracking, Thermal Cracking, and Hydrodewaxing. Proprietary mathematical models and open literature information will be used to the extent possible for these process evaluations.

Means for separating the reactor-wax from the catalyst fines, if such a separation is needed prior to reactor-wax upgrading, shall be investigated.

Task 3 - Product Evaluation

The quality of the hydrocarbon liquid products from the two-stage unit and the reactor-wax upgrading processes shall be evaluated. Gasoline octane and distillate cetane quality, as well as pour points should also be determined.

Task 4 - Slurry Fischer-Tropsch Reactor Hydrodynamic Studies

The effect of different feed-gas distributor designs on the slurry Fischer-Tropsch reactor performance will be investigated. Tests will be conducted in the BSU slurry reactor, or other bubble-column reactors, to provide guidance for subsequent runs in Task 1 as well as for design and operation of

the non-reacting models. For hydrodynamic studies, the design, construction, and operation of hot, non-reacting bubble-column models will be required.

Task 5 - Development of Conceptual Process Schemes

A conceptual process scheme to maximize gasoline and distillate yield using a combined system of slurry Fischer-Tropsch/ZSM-5 reactor plus reactor-wax upgrading will be developed. Scoping costs of the plant will be estimated.

III. Summary of Progress to Date

This quarter, Run CT-256-8 of the two-stage pilot plant was ended after 70 days on-stream. This run demonstrated that Catalyst I-C, which was activated without a separate pretreatment step, aged at a more rapid rate than any previous catalyst, even at mild operating conditions. Fresh catalyst, when added on-stream, failed to activate. However, on-stream catalyst makeup with previously activated catalyst was demonstrated during the run.

The unit was then modified, including the installation of new steam-jacketed DP-cells for gas holdup measurement. Run CT-256-9 was then started, using Catalyst I-B to obtain high conversion and low methane + ethane selectivity. This was done, but only for ten days. At that point, an accidental electrical power shutdown occurred. Following this, it appears that the catalyst settled in the first-stage bubble-column reactor, causing low conversion and a steep reactor temperature profile. At the end of this quarter, we were trying to remedy this problem.

Bubble-column hydrodynamic studies continued, to determine the effect of column diameter on gas holdup using the paraffinic FT-200 wax as the liquid medium. It was found that our 10.2 cm ID column gave 17-28% lower gas holdups than the 5.1 cm ID column, using single-orifice gas distributors exhibiting identical gas-jet velocities. In addition, the smaller column was modified to eliminate glass-column breakage problems.

Finally, the concluding work on upgrading of reactor-wax is described in the Appendix-Restrictive Distribution.

IV. Detailed Description of Technical Progress

A. Task 1 - Process Studies in Two-Stage Bench-Scale Unit

1. Run CT-256-8 - Conclusion

The eighth run of the two-stage Fischer-Tropsch/ZSM-5 pilot plant was voluntarily ended on February 15 after 70 days on-stream. The main objective of this run was to evaluate Catalyst I-C ($Fe/Cu/K_2CO_3$) for long-term low methane + ethane mode operation. Another objective was the first complete test of the 1 mm orifice distributor in the first-stage bubble-column reactor.

The October-December 1984 Quarterly Report summarized the first 25 days on-stream of this run. The major highlights of the run, including those reported in the last Quarterly Report are:

- The catalyst activated in an identical fashion to Run CT-256-5 (also an evaluation of Catalyst I-C), indicating no adverse influence of the orifice distributor.
- Unacceptable aging rates were observed, on the order of 1-2 mol % drop in H_2+CO conversion per day, at 250-255°C and 1.8-2.2 MPa.
- Additions of fresh Catalyst I-C were unsuccessful in raising the H_2+CO conversion.
- Both Catalyst I-C and a new batch of Catalyst I-B raised the conversion when added to the first stage, after being activated in a small bubble-column reactor.
- Catalyst which was reloaded into the reactor after being accidently removed regained a significant portion of its activity, the first time this had been observed.
- Despite the high aging rate, the methane + ethane selectivity stayed very low throughout the run (2.3-4.3 wt %).
- Stopping the circulation of the slurry through the catalyst/settling vessel did not lessen the catalyst aging rate.

What follows is a description of the run, with emphasis on the last 45 days on-stream.

a. First-Stage Fischer-Tropsch Reactor Operation

As described in the last Quarterly Report (QR), the catalyst was activated successfully without a separate pretreatment step, verifying that the 1 mm single-orifice distributor was not producing any rate-limiting hydrodynamic effects. Also, virtually no liquid was needed to be removed from below the distributor plate during the entire run, which showed that no "weeping" through the orifice was present. The pressure drop across the orifice throughout the run was in agreement with our correlation (see July-September 1984 QR). Slurry samples taken throughout the run also indicated that the catalyst was being suspended nearly uniformly over the column length, another sign that the orifice distributor is applicable to this system (see Figure 1).

The range of operating conditions for the entire run were:

Temperature, °C	250-255
Pressure, MPa	1.48-2.17
Feed H_2/CO Ratio, Molar	0.67
Superficial Feed-Gas Velocity, cm/s	2.3-8.0
Space Velocity, NL/gFe-hr	1.1-3.5
H_2+CO Conversion, mol %	35-80
Methane + Ethane Yield, wt % of HC	2.3-4.2
Reactor-Wax Yield, wt % of HC	40-70

Figure 2 shows the conversion and methane and ethane selectivities for the run. A summary of the major events appears in Table 1. Material balance data is presented in Appendix A.

Also as outlined in the last Quarterly Report, difficulties with the wax withdrawal system were encountered early in the run, and roughly one-third of the catalyst inventory was accidently removed from the reactor. When this catalyst was reloaded into the reactor, the H_2+CO conversion rose fom 37 to 65 mol %, indicating that a large portion of the catalyst activity was still present. The methane + ethane selectivity also remained low.

In an attempt to increase conversion, 300 g of fresh Catalyst I-C was added to the reactor at 12 DOS. This amount represented close to 20 % of the catalyst inventory in the reactor at the time. No change was observed in either the conversion or the methane + ethane selectivity. Since the catalyst had activated under similar conditions at the start of the run, it was felt that high partial pressures of H_2 or CO may be needed for activation. Consequently, the superficial gas velocity was increased from 4.4 to 8.0 cm/s, dropping the

conversion from 53 to 36 mol % for 18 hours. After this, a 3:1 H_2/CO feed gas at 7.0 cm/s was used for 17 hours. When operating conditions were re-established, however, the conversion and selectivity showed no improvement.

At 17 DOS, the temperature was raised to 255°C, and the pressure was increased to 1.82 MPa, then to 2.17 MPa. This increased the conversion to 67 mol %. At these conditions, though, the conversion dropped steadily over the next five days to 60 mol %. The pressure was then dropped back to 1.82 MPa, but the decline continued, with the conversion reaching 45 mol % by 30 DOS. The space velocity throughout this period was maintained constant (~2.2 NL/gFe-hr).

At this time, 200 g of fresh Catalyst I-C was activated in a small bubble-column reactor (Unit CT-225). Activation conditions were identical to those used at the start of the run. The entire slurry from the small reactor was then drained and transferred to the BSU, where it was loaded into the first-stage bubble-column reactor one hour later. As seen on the run plot, the catalyst addition increased the H_2+CO conversion to 55 mol % almost immediately. The methane + ethane selectivity declined slightly at the same time. The activity decline, however, continued at the same rate, as the conversion proceeded to fall to 48 mol % over the next five days. This was the first time that catalyst had been successfully activated in one reactor and then transferred to another.

To increase the conversion, conditions were made milder -- 250°C, 1.48 MPa and the space velocity was reduced to 1.1 NL/gFe-hr. This increased the conversion to 59 mol %. At this point, another load of catalyst was activated in Unit CT-225. This time, the catalyst was a new batch of Catalyst I-B ($Fe/Cu/K_2CO_3$). The addition increased the conversion to 80 mol %, again dropping the methane + ethane selectivity slightly. The conditions then remained constant over the next twenty-five days. The activity decline continued, however, though at a slightly reduced rate. The conversion dropped to 55 mol % over this time.

During this period, the slurry circulation to the catalyst settling pot was shut off for long stretches of time in an effort to determine whether this was contributing to the aging. Four times, the circulation was stopped and the system flushed, with the reactor-wax product allowed to build up in the reactor for a three-day period. No change on the conversion decline could be detected, however, and this practice was discontinued. Reactor-wax yield ranged between 35 and 50 wt % for the run.

At 62 DOS, the pressure was increased for the last time, to 1.82 MPa, while the feed-gas throughput was increased proportionately, maintaining the same superficial gas velocity in the column (2.3 cm/s). The H_2+CO conversion remained constant (54-55 mol %), indicating no adverse effect of pressure in this range. The run was then ended after 70 DOS, the evaluation of Catalyst I-C being completed.

b. Second-Stage ZSM-5 Fixed-Bed Operation

Operation of the second-stage ZSM-5 reactor did not begin until 54 DOS. This was because the focus of attention was on the declining first-stage catalyst activity and ways of improving it. The second-stage catalyst was the same which was run for 25 days in Run CT-256-7 before being regenerated, so this was the start of the catalyst's second cycle. Second-stage material balances are shown in Appendix A. Over the final 14 days of the run, the feed temperature to the bed was increased from 260 to 299°C in an effort to maintain the severity index (molar i-butane/(propene + butenes) ratio) at approximately 1.0. The actual severity index ranged from .76 to 1.5.

2. Run CT-256-9 - Startup

The ninth run of the two-stage pilot plant was started on March 18. The main objective of this run is to demonstrate long-term low methane + ethane operation with high H_2+CO conversion using Catalyst I-B. This is the same catalyst which was used in Run CT-256-3 (Kuo, 1983), which was a long-term demonstration of high conversion, gasoline mode operation. It is felt that this catalyst can produce high wax yields if the pressure is increased when necessary to reduce the methane + ethane selectivity. The temperature which was 260°C in Run 3, would be kept slightly lower (257°C) to also help reduce the methane + ethane yield. The conditions are similar to those used in Run CT-256-7 (see October-December 1984 Quarterly Report), but with one exception. In Run 7, the pressure was increased to 2.51 MPa immediately after pretreatment. In this run, however, the pressure at the start of the run would be held at 1.48 MPa, and then increased when required.

By the end of this quarter, 13 days on-stream had been accumulated. The highlights of the run to date are:

- High conversion (85-91 mol %), low methane + ethane selectivity (5.4 wt %) were achieved at 257°C and 1.48 MPa. The pressure did not have to be increased to produce the low methane + ethane yields.

- The H_2+CO conversion dropped to 40 mol % following a three-hour interruption in electrical power after ten DOS. Slurry samples and DP readings indicate that the catalyst is more heavily concentrated at the reactor bottom following the interruption. We are currently attempting to remedy the problem.

A detailed account of this run will be presented upon its completion.

a. Fischer-Tropsch Slurry-Catalyst Loading and Pretreatment

Run CT-256-9 was initially loaded with 2,300 g of Catalyst I-B ($Fe/Cu/K_2CO_3$) containing 1,534 g of a newly prepared batch. The wax medium at the start consisted of reactor-wax from Run CT-256-7. Pretreatment was then started at the following conditions:

Temperature, °C	280
Pressure, MPa	1.14
Feed H_2/CO Ratio, Molar	0.67
Space Velocity, NL/gFe-hr	1.7
Superficial Feed Gas Velocity, cm/s	6.0
Initial Catalyst Loading, wt %	25

After 5.5 hours, the volume contraction had reached 50%, which is our usual target for the end of pretreatment. A plot of the contraction during pretreatment is shown in Figure 3.

b. Brief Description of Fischer-Tropsch Reactor Operation

Following pretreatment, the temperature was dropped gradually down to 257°C while the pressure was increased to 1.48 MPa. The space velocity was adjusted to 2.0 NL/gFe-hr, and the H_2+CO conversion climbed to 91 mol % in 2.5 days. During this time, the reactor-wax removal system was started, and the second-stage ZSM-5 fixed-bed reactor was put on-line, converting the overhead product to gasoline. The inlet temperature to the bed was initially 310°C. The methane + ethane selectivity stayed low through the first ten days, averaging 5.4 wt % of hydrocarbons produced. Hydrocarbon production averaged 8-10 g/gFe per day.

At four DOS, the hydrocarbon production rate was increased by raising the pressure to 1.82 MPa and the space velocity to 2.4 NL/gFe-hr. At the same time, the average first-stage reactor temperature was lowered to 256°C. The H_2+CO conversion then declined slowly to 82 mol % before leveling off.

Reactor-wax selectivity was averaging about 50 wt %, and the wax removal had an average solids content of only 0.03 wt %.

At ten DOS, all electrical power to the unit was accidently interrupted for three hours. During that period, we depressured the reactor so that any water would be removed. The unit was kept under nitrogen overnight (17 hours) at low temperature. Still under N_2, the reactor was pressured back to 1.82 MPa and heated to 256°C, and the H_2/CO feed kicked in at 4.4 cm/ superficial gas velocity. Volume contraction and reactor temperature profile looked normal for ~1.5 hours, but then the temperatures in the upper section (3-7.6 m) began to drop. After a short time, there was a temperature difference of 8.3°C between the top and bottom of the reactor. The H_2+CO conversion dropped to 40 mol %, and slurry samples taken from the 30 cm level showed a 30% increase in solids (see Table 2).

Over the next three days, several attempts to resuspend the catalyst were made. High velocity N_2 (8 cm/s) managed to accomplish this, but the settling re-occurred when the H_2 and CO were introduced. When nitrogen was added to the H_2/CO flow, so that the combined velocity was 8 cm/s, the catalyst profile also flattened out, but again re-occurred when the nitrogen was shut off.

DP-readings were being taken during the run by a new system of steam-jacketed DP-cells. The average gas holdup calculated from readings before the catalyst settling was 26 vol % and readings taken before and after the settling show dramatic differences (see Figure 4). The increased solids loading at the reactor bottom apparently caused very low gas holdup in that zone, whereas the consequently low concentrations in the upper section resulted in a higher holdup.

3. Future Work

- Continue Run CT-256-9; attempt to remedy catalyst settling using high velocity and/or ball-milling of slurry.

B. Task 2 - Scoping Studies of Fischer-Tropsch Reactor-Wax Upgrading

1. Hydrocracking and Thermal Cracking of a Fischer-Tropsch Reactor-Wax

Results from hydrocracking and thermal cracking studies to upgrade F-T reactor-wax are described in the Appendix-Restrictive Distribution. This completes our contract work for this task.

C. Task 3 - Product Evaluation

1. Product Analyses

Product analyses to support other tasks were carried out.

2. Future Work

- Continue evaluation of Field-Ionization-Mass-Spectrometry (FIMS) technique.
- Continue providing product analyses to support other tasks.

D. Task 4 - Slurry Fischer-Tropsch Reactor Hydrodynamic Studies

1. Hydrodynamic Studies Using Tall Hot-Flow Bubble-Columns

In this quarter we have studied the effect of column diameter on the hydrodynamic behavior of FT-200, a F-T derived paraffinic wax, using the 10.2 cm ID tall hot-flow bubble-column. The distributor used was a 2 mm single-orifice distributor, which gives identical jet velocities to those given by a 1 mm single-orifice distributor in the 5.1 cm ID hot-flow column at the same superficial gas velocities. The results were compared to those obtained in the 5.1 cm ID column (and reported earlier in January-March, 1984 Quarterly Report).

Also, water and hexadecane were studied as liquid mediums at ambient temperature. These liquid mediums were studied as base cases to compare with FT-200 wax.

a. Effect of Liquid Mediums

Figure 5 depicts the gas holdups obtained with the three liquid mediums. Both water and hexadecane behaved very similarly at 32°C. Table 3 summarizes the relevant physical properties of these liquids. Since the viscosity of hexadecane is higher than that of water, the gas holdup with hexadecane is expected to be lower. On the other hand, the lower surface

tension of hexadecane is expected to cause higher gas holdups. This may explain why the gas holdup was similar for both liquids. The gas holdup correlation of Akita and Yoshida (1973) predicts the observed gas holdups reasonably well.

In contrast to the behavior of water and hexadecane, FT-200 wax gave gas holdups twice as high. The surface tension of FT-200 at 260°C is very similar to that of hexadecane at 32°C, while the viscosity is about 55% lower. In agreement with previous conclusions (Quarterly Report, January-March, 1984) this difference in gas holdup cannot be accounted for by the difference in the viscosities using the existing literature correlations. Furthermore, FT-200 wax gave smaller bubbles (2-4 mm) than those given by water and hexadecane (3-8 mm). A small amount of foam (1-15 cm in height) at the top was observed for the FT-200 wax while no foam was observed with either water or hexadecane.

b. Effect of Column Diameter

Figure 6 compares the gas holdups obtained in the 5.1 and 10.2 cm ID columns using FT-200 wax at 200°C. Clearly, the gas holdups in the 5.1 cm ID column were about 20 to 38 % higher. In general, the bubbles in the larger diameter column were larger (2-4 mm) than those seen in the smaller diameter column (1-3 mm). Similar to behavior in the 5.1 cm ID column, large bubbles occupied large part of the column diameter were observed in the 10.2 cm ID column. However, as expected, it occurred at a higher superficial gas velocity (about 3 cm/s compared to 1.5 cm/s). At ~3 cm/s these slug-like bubbles were not large enough to occupy the whole column diameter. At ~4 cm/s, however, they were observed to occupy ~80-90 % of the column cross-section; but the length of these bubbles was small relative to those in the 5.1 cm ID column. The smaller bubbles around these slug-like bubbles were always larger than the corresponding bubbles observed in the 5.1 cm ID column. The frequency of these slug-like bubbles was similar in both columns.

2. Modifications of Hot-Flow Bubble-Columns

The 5.1 cm ID x 9 m tall hot-flow bubble-column was modified to eliminate any breakage problems associated with the bottom 1.5 m glass section. This glass section was replaced by a steel section. Thus, the bottom two glass-to-metal flange connections (at the distributor and 1.5 m level) have been eliminated. The modified metal-to-metal flange connection can generally be made leak proof without any difficulty. The top 3 m long glass section (which did not give any glass breakage problem) was not replaced. Hence, the gas holdup can still be measured by visual observation of expanded liquid level.

3. Future Work

Continue to study the effect of column diameter on the hydrodynamic behavior of actual reactor-waxes using 5.1 and 10.2 cm ID hot-flow bubble-columns.

V. Nomenclature

u_g	Superficial velocity, (cm/s)

Acronyms

BSU	Bench-Scale Unit
DOE	Department of Engergy
DOS	Days on Stream
DP	Differential Pressure
FIMS	Field-Ionization-Mass-Spectrometry
F-T	Fischer-Tropsch
HC	Hydrocarbons
ID	Inside Diameter

VI. References

Akita, K., and Yoshida, F., Ind. Eng. Chem. Process Des. Dev., 12, 76 (1973)

Kuo, J. C. W., "Slurry Fischer-Tropsch/Mobil Two-Stage Process of Converting Syngas to High Octane Gasoline", Mobil Res. and Dev. Corp., Final Report, DOE Contract No. DE-AC22-80PC30022 (1983)

Table 1

Major Events in Run CT-256-8

DOS	MAJOR EVENTS
0	Start F-T catalyst activation: 250°C, 1.48 MPa, 2.0 NL/gFe-hr
1-4	Approximately 1/3 catalyst inventory lost due to malfunction in wax withdrawal system. Additional catalyst lost through reactor feed line; cold shutdown made for repairs.
6-9	Reloaded wax drains with high solids content into first-stage reactor.
11.8	Added 300 g fresh Catalyst I-C
14.6-15.3	Attempt to activate fresh catalyst in-situ: - High throughput - 8.0 cm/s superficial gas velocity - 3/1 H_2/CO @ 7.0 cm/s
16.6	First-stage temperature ----> 255°C
17.6	1.48 ----> 1.82 MPa
18.6	1.82 ----> 2.17 MPa
21.5	2.17 ----> 1.82 MPa
30.0	Added 200 g activated Catalyst I-C
35.4	First-stage temperature ----> 250°C 1.82 MPa ----> 1.48 MPa
37.6	Added 200 g activated catalyst (a new batch of Catalyst I-B)
53.9	Second-stage in; inlet temperature 312°C
62.6	1.48 ----> 1.82 MPa

Table 2

Evidence for Catalyst Settling, Run CT-256-9

	Slurry Reactor Temperature Profile, °C					Catalyst Concentration
Reactor Location, m	0.3	1.5	3.0	4.6	6.1	0.3
Normal	254.4	256.1	253.9	255.6	255	22.7%
Catalyst Settling	256.7	253.9	247.2	248.9	248.3	29-32%

Table 3

Physical Properties of Liquid Mediums Used in Hot-Flow Studies

	Viscosity, cpoise	Surface Tension dynes/cm
Water	0.82	70
Hexadecane	3.80	26
FT-200 Wax	1.7	24

FIGURE 1

SLURRY BUBBLE-COLUMN CATALYST CONCENTRATION PROFILES (Run CT-256-8)

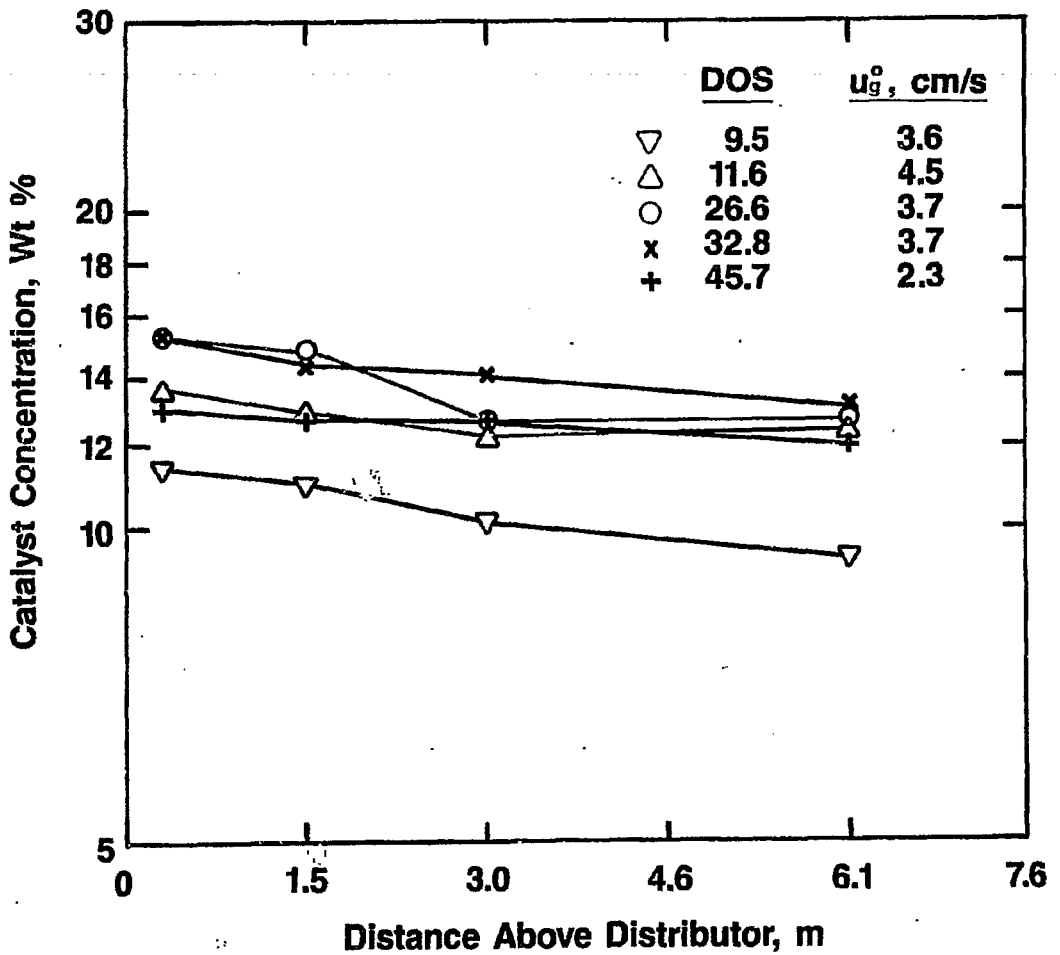
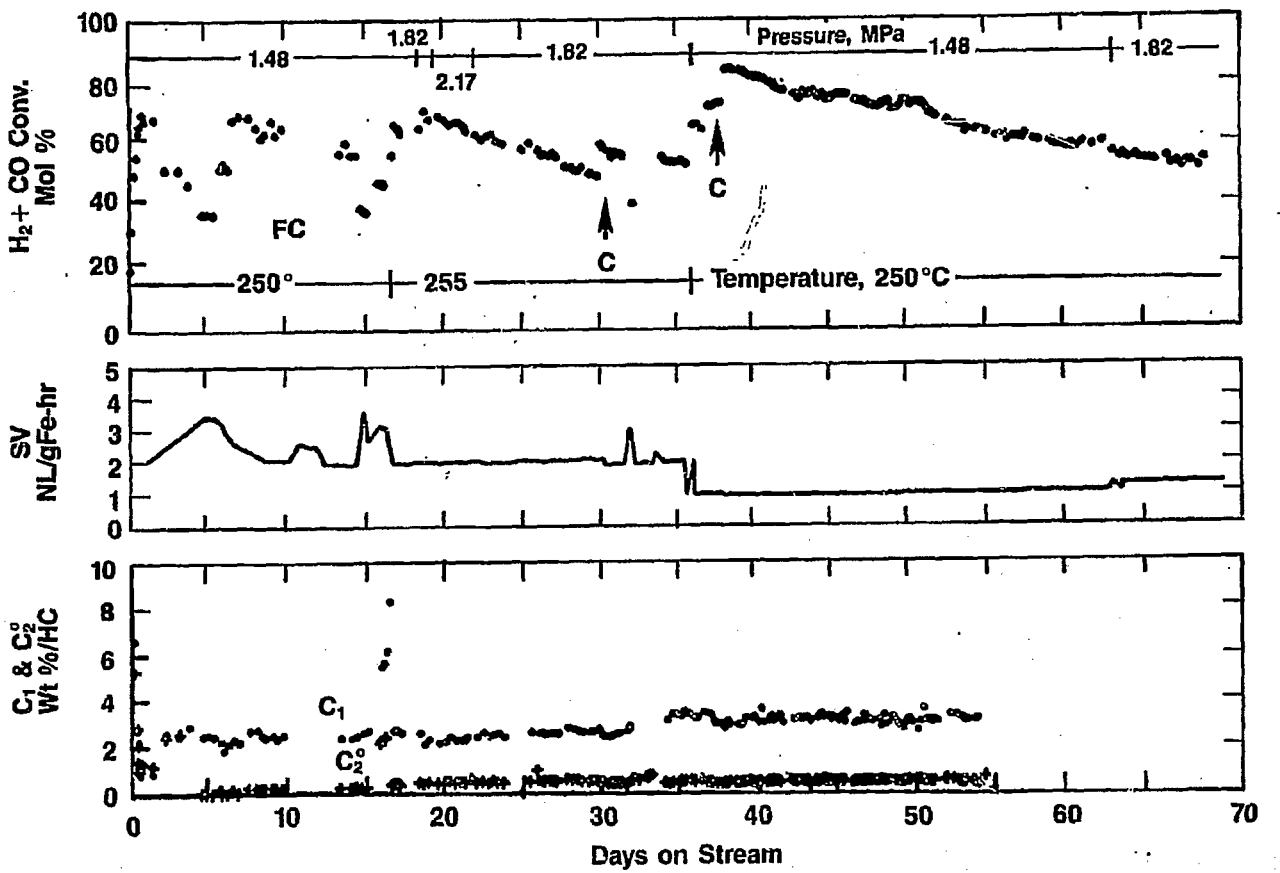


FIGURE 2

SYNTHESIS GAS CONVERSION
AND METHANE & ETHANE YIELD
(Run CT-256-8; 1st-STAGE CATALYST I-C:PPTD Fe/Cu/K_2CO_3)



FC: Fresh Catalyst Addition
C: Activated Catalyst Addition

FIGURE 3

ACTIVATION OF FISCHER-TROPSCH CATALYST I-B (Run CT-256-9)

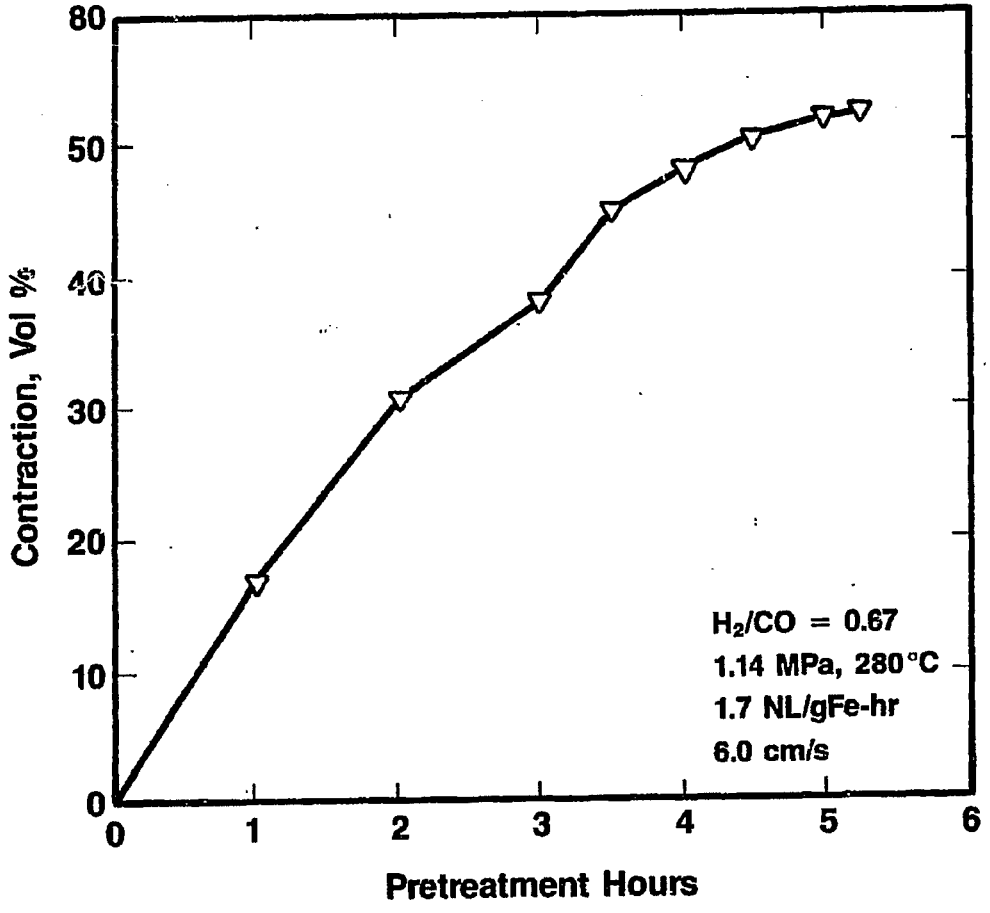


FIGURE 4

GAS HOLDUP PROFILES
(Run CT-256-9)

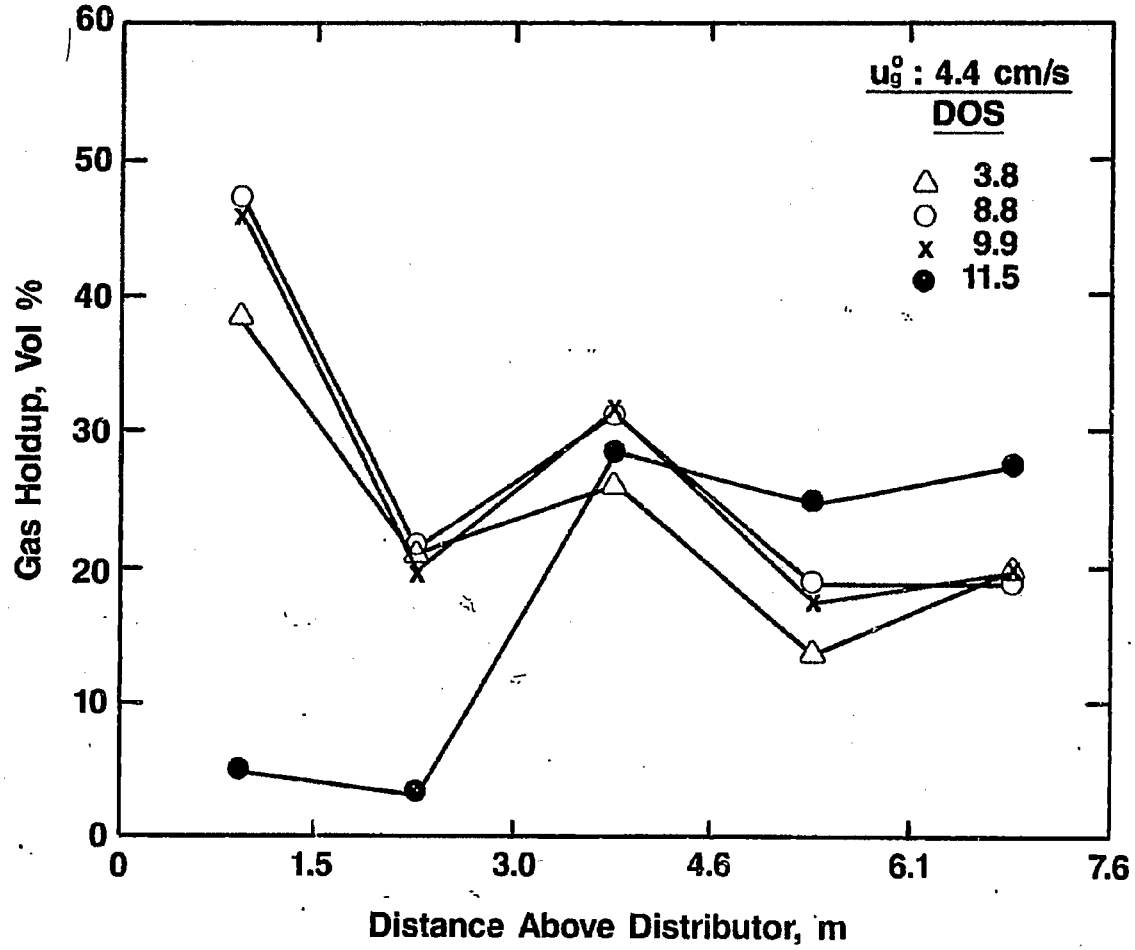


FIGURE 5
EFFECT OF LIQUID MEDIUM
(10.2 cm ID Column)

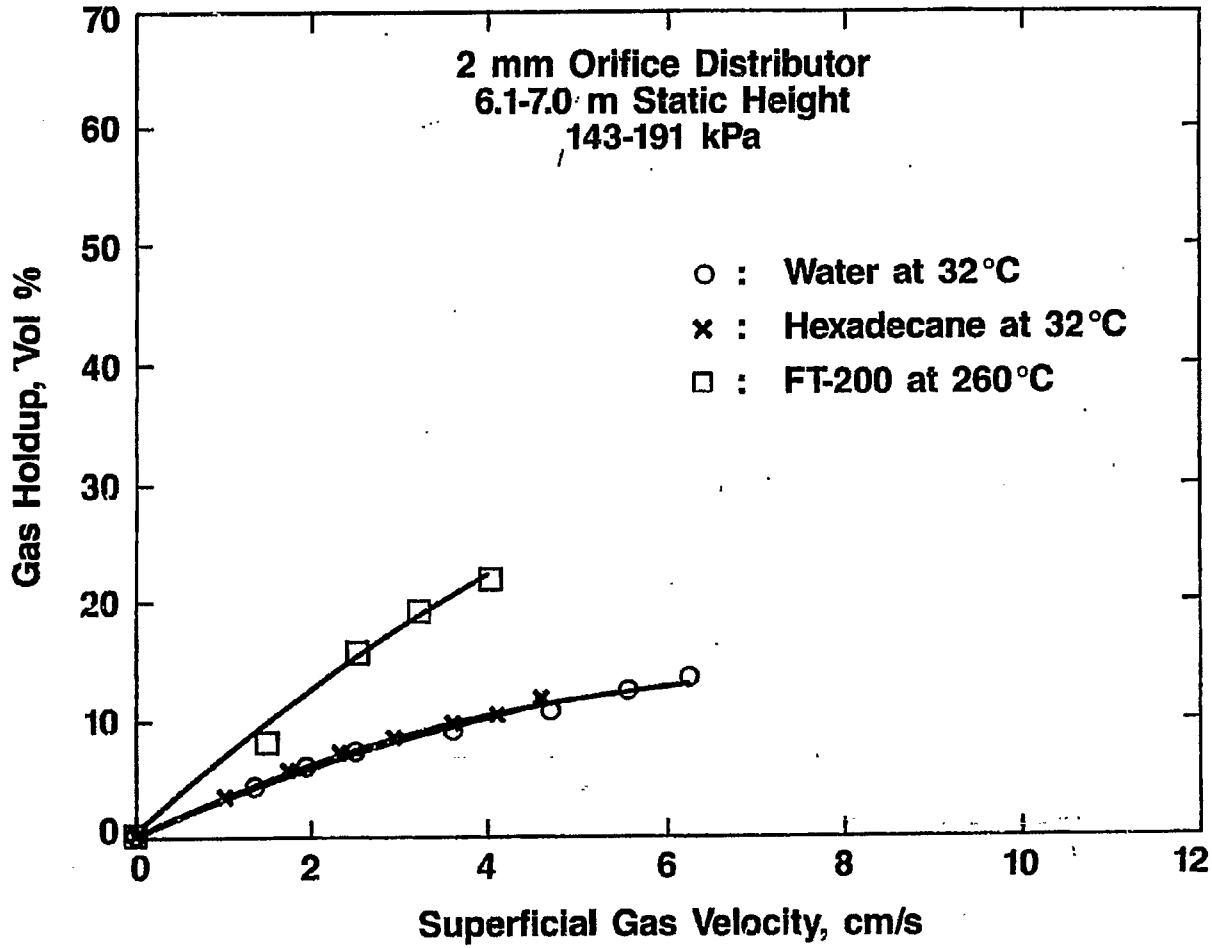
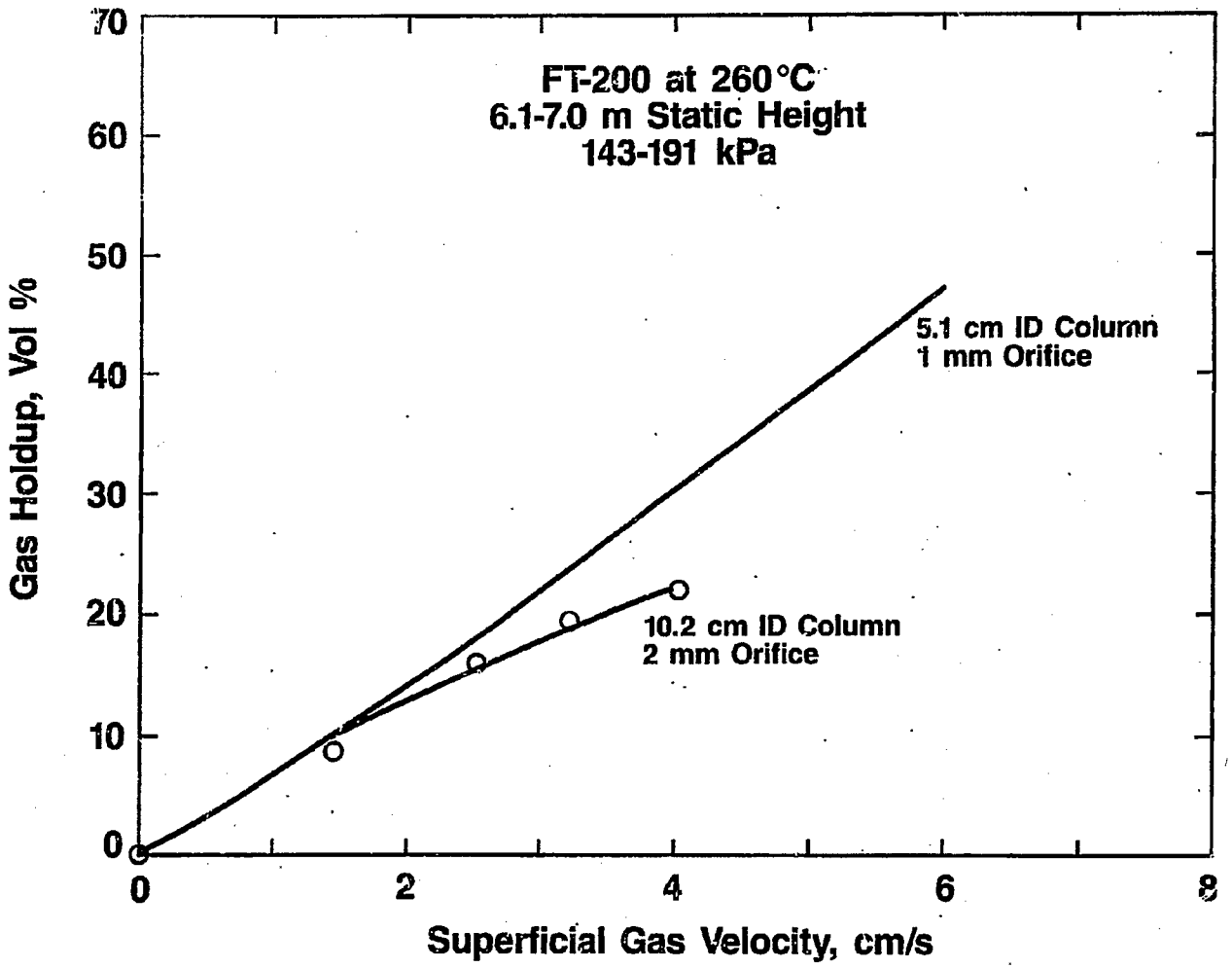


FIGURE 6

EFFECT OF COLUMN DIAMETER



APPENDIX A

SUMMARY OF DATA FROM RUN CT-256-8

Table A-1
First Stage Fischer-Tropsch Slurry Reactor
Operating Conditions and Material Balances
(Second-Stage Not Operative)
(Run CT-256-8)

(Nitrogen-Free Basis)											
M.B. No.	8- 7	8- 8	8- 9	8- 10	8- 11	8- 12	8- 14	8- 15	8- 16	8- 17	8- 18
Days On-stream	19.1	20.1	21.1	22.1	23.1	24.1	26.2	27.2	28.1	29.1	30.1
First-Stage Conditions:											
Charge H2/CO (Molar)	0.676	0.678	0.677	0.674	0.679	0.686	0.675	0.687	0.680	0.659	0.676
Temperature, oC	254	255	254	255	255	255	254	255	255	254	255
Pressure, MPa	2.170	2.163	2.163	1.832	1.839	1.846	1.818	1.818	1.818	1.818	1.818
Feed Sup. Vel., cm/s	3.060	3.056	3.053	3.660	3.574	3.559	3.598	3.630	3.640	3.630	3.602
Space Vel., NL/gFe-hr	2.023	2.020	2.030	2.086	2.034	2.038	2.048	2.079	2.090	2.092	1.929
N2 in Feed, Mol %	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Conversions, Mol % :											
H2	63.54	62.37	62.05	58.06	57.40	56.65	52.66	51.97	45.48	43.85	48.87
CO	66.64	64.90	63.83	60.01	59.72	58.10	53.65	52.81	49.01	47.53	57.71
H2+CO	65.39	63.88	63.11	59.23	58.78	57.51	53.25	52.35	47.58	46.07	54.14
Yields, Wt % of Products :											
Hydrocarbons (1)	15.07	16.00	14.94	14.73	14.27	15.62	13.79	13.63	12.11	12.72	13.38
CO2	49.20	47.74	46.34	43.23	44.12	41.28	38.09	37.49	34.97	33.22	42.01
H2O (1)	2.11	1.36	1.22	1.26	0.89	2.03	1.19	1.25	1.51	1.39	1.33
H2	1.70	1.74	1.83	1.98	2.01	2.00	2.22	2.28	2.56	2.55	2.41
CO	31.91	33.17	35.68	38.81	38.72	39.07	44.70	45.35	48.85	50.12	40.86
Total	100	100	100	100	100	100	100	100	100	100	100
Bal Recovery, Wt % of Charge:	99.61	100.82	96.59	98.20	99.11	102.14	98.83	99.51	99.44	99.87	98.62
(CO2)(H2)/(CO)(H2O) :	7.09	10.57	11.08	9.97	14.72	5.95	9.08	8.81	6.93	6.95	10.60
gHC/Nm3 (H2+CO) conv.:	179	197	178	190	187	215	200	201	196	217	190
(H/C) Atomic Ratio in HC :	2.11	2.11	2.11	2.11	2.12	2.11	2.11	2.11	2.12	2.11	2.11
Selectivities, Wt % of HC :											
Methane	2.15	2.00	2.20	2.21	2.38	1.98	2.07	2.11	2.38	2.04	2.16
Ethene	2.50	2.34	2.53	2.64	2.78	2.60	2.54	2.56	2.92	2.58	2.23
Ethane	0.48	0.45	0.50	0.50	0.53	0.44	0.47	0.48	0.56	0.47	0.42
Propene	3.20	3.02	3.30	3.33	3.52	3.01	3.24	3.25	3.58	3.18	2.83
Propane	0.57	0.50	0.58	0.55	0.59	0.48	0.54	0.44	0.61	0.55	0.50
Butenes	2.41	2.27	2.55	2.51	2.71	2.24	2.45	2.41	2.62	2.35	2.20
i-Butane	0.05	0.04	0.04	0.05	0.05	0.55	0.05	0.04	0.08	0.54	0.04
n-Butane	0.52	0.51	0.57	0.54	0.56	0.47	0.52	0.51	0.57	0.00	0.51
C5 - C11 (2)	5.90	5.46	5.57	6.70	7.40	6.31	5.69	5.69	6.12	5.45	5.88
Light Hydrocarbons (3)	14.91	14.50	14.99	13.98	10.54	19.51	13.15	14.92	23.77	15.99	16.23
Heavy Hydrocarbons (4)	8.61	15.39	8.60	10.31	10.44	11.94	12.11	11.48	0.25	10.20	12.59
Slurry Rx.-Wax	60.38	53.18	58.32	56.23	58.04	50.66	56.70	55.75	56.13	56.23	53.90
Total	100	100	100	100	100	100	100	100	100	100	100

(1) Including Oxygenates
(2) In Gas Phase Only
(3) Collected in Chilled and Ambient Condensers
(4) Collected in Hot Condenser

Table A-1 (Cont'd)
First Stage Fischer-Tropsch Slurry Reactor
Operating Conditions and Material Balances
(Second-Stage Not Operative)
(Run CT-256-8)

(Nitrogen-Free Basis)											
M.B. No.	8- 19	8- 25	8- 26	8- 28	8- 29	8- 30	8- 31	8- 33	8- 34	8- 35	8- 36
Days On-stream	31.1	37.1	38.1	40.1	41.1	42.1	43.1	45.1	46.1	47.1	50.1
First-Stage Conditions:											
Charge H2/CO (Molar)	0.679	0.645	0.678	0.669	0.642	0.671	0.670	0.670	0.671	0.672	0.667
Temperature, oC	255	250	250	250	250	251	251	250	250	250	250
Pressure, MPa	1.825	1.480	1.480	1.487	1.487	1.487	1.494	1.494	1.494	1.494	1.494
Feed Sup. Vel., cm/s	3.603	2.234	2.246	2.221	2.186	2.219	2.212	2.215	2.208	2.208	2.218
Space Vel., NL/gFe-hr	1.948	1.026	0.983	0.964	0.951	0.967	0.973	0.983	0.982	0.986	1.001
N2 in Feed, Mol %	0.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.1
Conversions, Mol % :											
H2	44.98	65.26	73.87	71.56	68.80	67.23	68.14	67.99	68.30	65.57	64.53
CO	57.39	69.91	83.56	80.11	77.16	74.86	75.16	73.80	72.48	70.63	69.80
H2+CO	52.36	68.09	79.84	76.69	73.11	71.80	72.34	71.47	70.00	68.60	67.69
Yields, Wt % of Products :											
Hydrocarbons (1)	13.98	14.52	16.22	15.50	15.72	16.17	15.79	16.15	15.17	16.02	17.82
CO2	41.35	54.80	66.12	63.58	60.43	57.75	58.20	55.84	54.90	52.37	51.84
H2O (1)	1.39	0.76	0.90	0.84	0.89	0.92	0.79	1.06	0.86	0.95	0.73
H2	2.58	1.53	1.21	1.30	1.45	1.49	1.47	1.50	1.63	1.65	1.58
CO	40.71	28.40	15.55	18.78	21.51	23.67	23.75	25.44	27.44	29.00	28.03
Total	100	100	100	100	100	100	100	100	100	100	100
Bal Recovery, Wt % of Charge:	99.73	101.18	100.78	100.95	101.39	101.23	99.71	98.17	95.60	96.53	102.72
(CO2)(H2)/(CO)(H2O) :	10.73	21.99	32.46	29.63	26.05	22.68	25.98	17.69	21.64	17.80	22.87
gHC/Nm3 (H2+CO) conv.:	207	171	160	160	173	178	170	173	162	176	212
(H/C) Atomic Ratio in HC :	2.11	2.13	2.16	2.14	2.14	2.15	2.13	2.14	2.13	2.13	2.12
Selectivities, Wt % of HC :											
Methane	2.17	3.14	4.67	3.53	3.61	4.19	3.29	3.51	3.34	3.16	2.78
Ethene	2.34	2.49	3.54	2.88	2.92	3.49	2.77	2.99	2.90	2.71	2.44
Ethane	0.45	0.47	0.54	0.59	0.60	0.56	0.57	0.56	0.59	0.56	0.52
Propene	2.94	3.19	3.04	3.69	3.76	4.41	3.53	3.69	3.60	3.47	3.08
Propane	0.54	0.28	0.81	0.71	0.71	0.53	0.65	0.69	0.67	0.63	0.58
Butenes	2.18	2.55	3.65	3.02	2.96	3.52	2.78	2.93	2.86	2.68	2.43
i-Butane	0.04	0.04	0.03	0.05	0.04	0.07	0.03	0.03	0.05	0.06	0.05
n-Butane	0.53	0.59	0.83	0.71	0.68	0.29	0.65	0.66	0.67	0.62	0.57
C5 - C11 (2)	5.63	6.83	9.03	7.54	7.56	9.09	7.01	7.33	7.36	7.10	5.97
Light Hydrocarbons (3)	14.80	14.99	14.26	15.02	14.74	14.53	15.83	14.29	15.93	14.73	13.18
Heavy Hydrocarbons (4)	11.02	7.65	7.06	8.14	9.48	7.86	10.14	11.80	5.88	12.01	25.50
Slurry Rx.-Wax	56.90	57.20	51.68	53.40	52.25	50.54	52.13	50.89	55.50	51.71	42.47
Total	100	100	100	100	100	100	100	100	100	100	100

(1) Including Oxygenates
(2) In Gas Phase Only
(3) Collected in Chilled and Ambient Condensers
(4) Collected in Hot Condenser

Table A-1 (Cont'd)
First Stage Fischer-Tropsch Slurry Reactor
Operating Conditions and Material Balances
(Second-Stage Not Operative)
(Run CT-256-8)

(Nitrogen-Free Basis)			
M.B. No.	8- 37	8- 38	8- 39
Days On-stream	51.1	52.1	53.1
First-Stage Conditions:			
Charge H2/CO (Molar)	0.677	0.671	0.680
Temperature, oC	250	249	250
Pressure, MPa	1.494	1.494	1.501
Feed Sup. Vel., cm/s	2.225	2.214	2.247
Space Vel., NL/gFe-hr	1.009	1.007	1.028
N2 in Feed, Mol %	1.0	1.1	1.1
Conversions, Mol % :			
H2	63.10	59.32	57.41
CO	66.84	63.77	61.51
H2+CO	65.33	61.98	59.85
Yields, Wt % of Products :			
Hydrocarbons (1)	15.65	15.03	14.25
CO2	48.47	47.00	45.23
H2O (1)	0.76	1.36	0.96
H2	1.81	1.89	2.04
CO	33.31	34.72	37.52
Total	100	100	100
Bal Recovery, Wt % of Charge:	94.85	99.47	97.73
(CO2)(H2)/(CO)(H2O) :	19.63	10.69	14.60
gHC/Nm3 (H2+CO) conv.:	177	188	181
(H/C) Atomic Ratio in HC :	2.13	2.14	2.13
Selectivities, Wt % of HC :			
Methane	3.17	3.37	3.30
Ethene	2.79	3.01	2.99
Ethane	0.57	0.60	0.57
Propene	3.50	3.74	4.37
Propane	0.66	0.71	0.00
Butenes	2.76	3.17	2.70
i-Butane	0.06	0.07	0.06
n-Butane	0.63	0.77	0.64
C5 - C11 (2)	7.06	8.34	6.72
Light Hydrocarbons (3)	15.60	14.78	15.72
Heavy Hydrocarbons (4)	10.44	9.34	8.22
Slurry Rx.-Wax	52.11	51.44	54.12
Total	100	100	100

(1) Including Oxygenates
(2) In Gas Phase Only
(3) Collected in Chilled and Ambient Condensers
(4) Collected in Hot Condenser

Table A-2
Composition of Hydrocarbon Products from
First-Stage Slurry F-T Reactor
(Run CT-256-8)

M.B. No.	8- 7	8- 8	8- 9	8- 10	8- 11	8- 12	8- 14	8- 15	8- 16	8- 17	8- 18
Days On-stream	19.1	20.1	21.1	22.1	23.1	24.1	26.2	27.2	28.1	29.1	30.1
METHANE	2.15	2.00	2.20	2.21	2.38	1.98	2.07	2.11	2.38	2.04	2.16
ETHENE	2.50	2.34	2.53	2.64	2.78	2.50	2.54	2.56	2.92	2.58	2.23
ETHANE	0.48	0.45	0.50	0.50	0.53	0.44	0.47	0.48	0.56	0.47	0.42
PROPENE	3.20	3.02	3.30	3.33	3.52	3.01	3.24	3.25	3.58	3.18	2.83
PROPANE	0.57	0.50	0.58	0.55	0.59	0.48	0.54	0.44	0.61	0.55	0.50
I-BUTANE	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.04	0.06	0.54	0.04
1-BUTENE+2-METHYLPROPENE	2.38	2.22	2.52	2.48	2.67	2.21	2.40	2.38	2.55	2.32	2.17
N-BUTANE	0.52	0.51	0.57	0.54	0.58	0.47	0.52	0.51	0.57	0.00	0.51
TRANS-2-BUTENE	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00
CIS-2-BUTENE	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.04	0.03	0.03
3-METHYL-1-BUTENE	0.15	0.13	0.16	0.17	0.18	0.15	0.16	0.16	0.19	0.16	0.12
I-PENTANE	0.07	0.06	0.07	0.07	0.07	0.07	0.00	0.07	0.08	0.07	0.05
1-PENTENE	1.70	1.61	1.76	1.84	1.91	1.62	1.72	1.67	1.80	1.62	1.64
2-METHYL-1-BUTENE	0.07	0.06	0.07	0.07	0.08	0.06	0.07	0.07	0.08	0.07	0.06
N-PENTANE	0.41	0.37	0.42	0.41	0.43	0.36	0.38	0.39	0.42	0.37	0.41
TRANS-2-PENTENE	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
CIS-2-PENTENE	0.00	0.02	0.00	0.00	0.00	0.02	0.19	0.00	0.00	0.00	0.02
CYCLOPENTANE	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.02
HEXENES + ISO-HEXANES	0.14	0.14	0.15	0.20	0.22	0.18	0.00	0.18	0.19	0.18	0.15
2,3-DIMETHYLBUTANE	0.02	0.02	0.04	0.03	0.03	0.02	0.02	0.00	0.04	0.04	0.03
2-METHYLPENTANE	0.03	0.03	0.02	0.04	0.04	0.04	0.04	0.04	0.00	0.00	0.04
3-METHYLPENTANE	0.02	0.02	0.00	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.02
1-HEXENE	1.11	1.06	1.19	1.39	1.43	1.20	1.22	1.19	1.23	1.16	1.21
N-HEXANE	0.32	0.29	0.34	0.39	0.40	0.33	0.31	0.35	0.30	0.32	0.36
HEPTENES + ISO-HEPTANES	0.08	0.35	0.13	0.13	0.15	0.23	0.13	0.08	0.00	0.00	0.08
1-HEPTENE	0.19	0.51	0.54	0.80	0.90	0.72	0.63	0.63	0.63	0.32	0.67
N-HEPTANE	0.11	0.13	0.14	0.20	0.23	0.18	0.15	0.16	0.17	0.16	0.18
C8-OLEFINS + ISO-P	0.10	0.02	0.00	0.04	0.06	0.05	0.03	0.00	0.00	0.00	0.03
1-OCTENE	0.52	0.21	0.16	0.31	0.45	0.37	0.26	0.26	0.23	0.26	0.30
N-OCTANE	0.13	0.06	0.04	0.08	0.12	0.10	0.07	0.07	0.06	0.07	0.08
C9-OLEFINS + ISO-P	0.72	0.38	0.34	0.49	0.67	0.59	0.20	0.40	0.70	0.34	0.43
METHANOL	0.14	0.15	0.03	0.16	0.14	0.14	0.15	0.11	0.16	0.16	0.22
ACETONE	0.10	0.08	0.09	0.16	0.16	0.15	0.13	0.13	0.14	0.12	0.14
I-PROPANOL	0.11	0.11	0.12	0.13	0.14	0.12	0.19	0.12	0.13	0.12	0.15
UNKNOWN LITE HYDRO-CARB LIQ (1)	14.91	14.50	14.99	13.98	10.54	19.51	13.15	14.92	23.77	15.99	16.23
UNKNOWN HVY HYDRO-CARB LIQ (2)	6.61	15.39	8.60	10.31	10.44	11.94	12.11	11.48	0.25	10.20	12.59
SLURRY REACTOR-WAX	60.36	53.18	58.32	56.23	58.04	50.66	56.70	55.75	56.13	56.23	53.90

(1) Collected in Ambient and Chilled Condensers
(2) Collected in Hot Condenser

Table A-2 (cont'd)
Composition of Hydrocarbon Products from
First-Stage Slurry F-T Reactor
(Run CT-256-8)

M.B. No.	8- 19	8- 25	8- 26	8- 28	8- 29	8- 30	8- 31	8- 33	8- 34	8- 35	8- 36
Days On-stream	31.1	37.1	38.1	40.1	41.1	42.1	43.1	45.1	46.1	47.1	50.1
METHANE	2.17	3.14	4.87	3.53	3.61	4.19	3.29	3.51	3.34	3.16	2.78
ETHENE	2.34	2.49	3.54	2.88	2.92	3.49	2.77	2.99	2.90	2.71	2.44
ETHANE	0.46	0.47	0.54	0.59	0.60	0.56	0.57	0.58	0.59	0.56	0.52
PROPENE	2.94	3.19	3.04	3.69	3.76	4.41	3.53	3.69	3.60	3.47	3.08
PROPANE	0.54	0.28	0.81	0.71	0.71	0.53	0.65	0.69	0.67	0.63	0.58
I-BUTANE	0.04	0.04	0.03	0.05	0.04	0.07	0.03	0.03	0.05	0.06	0.05
1-BUTENE+2-METHYLPROPENE	2.15	2.55	3.56	2.96	2.90	3.44	2.75	2.87	2.81	2.62	2.39
N-BUTANE	0.53	0.59	0.83	0.71	0.68	0.29	0.65	0.66	0.67	0.62	0.57
TRANS-2-BUTENE	0.00	0.00	0.03	0.02	0.02	0.03	0.00	0.02	0.02	0.02	0.02
CIS-2-BUTENE	0.03	0.00	0.05	0.04	0.04	0.05	0.03	0.03	0.03	0.03	0.03
3-METHYL-1-BUTENE	0.13	0.04	0.19	0.17	0.17	0.21	0.17	0.18	0.18	0.18	0.16
I-PENTANE	0.06	0.21	0.06	0.00	0.00	0.00	0.07	0.08	0.08	0.08	0.08
1-PENTENE	1.59	1.90	2.63	2.20	2.16	2.53	1.98	2.07	2.06	1.94	1.71
2-METHYL-1-BUTENE	0.06	0.07	0.09	0.08	0.08	0.09	0.07	0.08	0.08	0.07	0.06
N-PENTANE	0.41	0.46	0.65	0.55	0.53	0.63	0.50	0.52	0.53	0.49	0.42
TRANS-2-PENTENE	0.00	0.00	0.03	0.02	0.02	0.03	0.00	0.00	0.02	0.00	0.01
CIS-2-PENTENE	0.00	0.02	0.04	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02
CYCLOPENTANE	0.00	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.02	0.02	0.02
HEXENES + ISO-HEXANES	0.16	0.19	0.24	0.21	0.21	0.27	0.21	0.21	0.22	0.21	0.17
2,3-DIMETHYLBUTANE	0.03	0.03	0.03	0.03	0.02	0.04	0.03	0.02	0.03	0.03	0.02
2-METHYLPENTANE	0.04	0.05	0.05	0.04	0.04	0.06	0.05	0.04	0.05	0.04	0.03
3-METHYLPENTANE	0.00	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.02
1-HEXENE	1.17	1.37	1.77	1.51	1.50	1.76	1.36	1.44	1.45	1.36	1.17
N-HEXANE	0.37	0.39	0.54	0.42	0.44	0.53	0.41	0.42	0.43	0.42	0.31
HEPTENES + ISO-HEPTANES	0.03	0.13	0.22	0.21	0.17	0.25	0.14	0.16	0.23	0.14	0.15
1-HEPTENE	0.65	0.74	0.87	0.75	0.78	0.89	0.70	0.71	0.72	0.71	0.60
N-HEPTANE	0.17	0.19	0.26	0.20	0.21	0.23	0.20	0.20	0.21	0.20	0.17
C8-OLEFINS + ISO-P	0.00	0.08	0.14	0.09	0.08	0.14	0.07	0.06	0.08	0.07	0.05
1-OCTENE	0.29	0.33	0.43	0.32	0.33	0.40	0.33	0.32	0.30	0.32	0.26
N-OCTANE	0.08	0.09	0.16	0.10	0.10	0.14	0.10	0.10	0.10	0.10	0.07
C9-OLEFINS + ISO-P	0.40	0.52	0.60	0.58	0.66	0.79	0.57	0.64	0.54	0.68	0.48
METHANOL	0.21	0.21	0.36	0.24	0.22	0.32	0.25	0.27	0.24	0.20	0.15
ACETONE	0.12	0.15	0.28	0.23	0.23	0.31	0.21	0.19	0.22	0.22	0.15
I-PROPANOL	0.14	0.23	0.23	0.25	0.24	0.30	0.16	0.17	0.18	0.16	0.14
UNKNOWN LITE HYDRO-CARB LIQ (1)	14.80	14.99	14.26	15.02	14.74	14.53	15.83	14.29	15.93	14.73	13.18
UNKNOWN HVY HYDRO-CARB LIQ (2)	11.02	7.85	7.08	8.14	9.48	7.86	10.14	11.80	5.88	12.01	25.50
SLURRY REACTOR-WAX	56.90	57.20	51.68	53.40	52.25	50.54	52.13	50.89	55.50	51.71	42.47

(1) Collected in Ambient and Chilled Condensers
(2) Collected in Hot Condenser

Table A-2 (cont'd)
Composition of Hydrocarbon Products from
First-Stage Slurry F-T Reactor
(Run CT-256-8)

M.B. No.	8- 37	8- 38	8- 39
Days On-stream	51.1	52.1	53.1
METHANE	3.17	3.37	3.30
ETHENE	2.79	3.01	2.99
ETHANE	0.57	0.60	0.57
PROPENE	3.50	3.74	4.37
PROPANE	0.66	0.71	0.00
I-BUTANE	0.06	0.07	0.06
1-BUTENE+2-METHYLPROPENE	2.71	3.12	2.64
N-BUTANE	0.63	0.77	0.64
TRANS-2-BUTENE	0.02	0.00	0.02
CIS-2-BUTENE	0.03	0.04	0.03
3-METHYL-1-BUTENE	0.19	0.24	0.20
I-PENTANE	0.00	0.11	0.08
1-PENTENE	1.94	2.39	1.77
2-METHYL-1-BUTENE	0.08	0.10	0.07
N-PENTANE	0.49	0.59	0.44
CIS-2-PENTENE	0.02	0.00	0.00
CYCLOPENTANE	0.03	0.03	0.02
HEXENES + ISO-HEXANES	0.19	0.22	0.14
2,3-DIMETHYLBUTANE	0.02	0.03	0.04
2-METHYLPENTANE	0.04	0.05	0.06
3-METHYLPENTANE	0.03	0.03	0.02
1-HEXENE	1.44	1.55	1.28
N-HEXANE	0.42	0.48	0.42
HEPTENES + ISO-HEPTANES	0.16	0.17	0.12
1-HEPTENE	0.76	0.85	0.75
N-HEPTANE	0.21	0.23	0.20
C8-OLEFINS + ISO-P	0.06	0.07	0.05
1-OCTENE	0.36	0.42	0.34
N-OCTANE	0.11	0.12	0.11
C9-OLEFINS + ISO-P	0.53	0.65	0.60
METHANOL	0.22	0.27	0.21
ACETONE	0.18	0.19	0.23
I-PROPANOL	0.25	0.21	0.17
UNKNOWN LITE HYDRO-CARB LIQ (1)	15.60	14.78	15.72
UNKNOWN HVY HYDRO-CARB LIQ (2)	10.44	9.34	8.22
SLURRY REACTOR-WAX	52.11	51.44	54.12

(1) Collected in Ambient and Chilled Condensers
(2) Collected in Hot Condenser

Table A-3
First Stage Fischer-Tropsch Slurry Reactor
Operating Conditions and Material Balances
(Based on Inter-Reactor Sample)
(Run CT-256-8)

(Nitrogen-Free Basis)									
M.B. No.	8- 41	8- 42	8- 43	8- 44	8- 45	8- 46	8- 47	8- 48	8- 49
Days On-stream	55.1	56.1	57.1	58.1	59.1	60.1	61.1	62.1	63.1
First-Stage Conditions:									
Charge H2/CO (Molar)	0.674	0.668	0.665	0.663	0.663	0.668	0.667	0.663	0.672
Temperature, oC	249	250	251	251	250	250	250	250	251
Pressure, MPa	1.501	1.501	1.501	1.508	1.467	1.480	1.480	1.480	1.825
Feed Sup. Vel., cm/s	2.188	2.224	2.225	2.219	2.273	2.261	2.271	2.250	2.227
Space Vel., NL/gFe-hr	1.008	1.027	1.031	1.036	1.038	1.046	1.049	1.050	1.283
N2 in Feed, Mol %	1.1	1.1	1.1	1.0	1.0	1.1	1.6	0.8	0.7
Conversions, Mol % :									
H2	53.40	50.54	46.61	47.27	45.78	50.16	50.79	44.10	44.73
CO	62.26	59.10	59.43	60.59	59.08	57.27	56.76	59.86	54.94
H2+CO	58.69	55.67	54.31	55.27	53.77	54.42	54.37	52.98	50.83
Yields, Wt % of Products :									
Hydrocarbons (1)	15.13	14.23	14.67	14.67	14.50	13.35	13.72	16.12	12.98
CO2	45.73	44.81	44.52	44.34	42.73	43.16	43.14	40.87	40.75
H2O (1)	1.11	1.08	0.94	0.96	0.86	0.92	0.82	0.84	0.90
H2	2.15	2.20	2.37	2.41	2.50	2.27	2.20	2.57	2.55
CO	35.88	37.69	37.50	37.82	39.41	40.31	40.12	39.60	42.85
Total	100	100	100	100	100	100	100	100	100
Bal Recovery, Wt % of Charge:	100.25	103.47	103.16	99.92	99.03	101.08	102.76	99.09	100.24
(CO2)(H2)/(CO)(H2O) :	14.11	13.79	17.00	16.80	18.08	15.08	16.44	17.97	15.42
gHC/Nm3 (H2+CO) conv.:	202	207	218	208	209	194	203	237	199
(H/C) Atomic Ratio in HC :	2.13	2.14	2.13	2.13	2.14	2.15	2.15	2.14	2.16
Selectivities, Wt % of HC :									
Methane	3.33	3.59	3.29	3.25	3.11	2.17	3.70	3.80	4.66
Ethene	2.97	3.27	2.95	2.95	2.89	0.38	3.02	2.58	3.08
Ethane	0.62	0.53	0.60	0.63	0.56	0.49	0.81	0.54	0.66
Propene	3.69	3.83	3.64	3.67	3.51	1.15	3.82	3.10	3.67
Propane	0.62	0.71	0.70	0.70	0.68	1.84	0.83	0.63	0.81
Butenes	2.82	2.81	2.75	2.90	2.24	1.81	2.99	2.45	2.88
i-Butane	0.05	0.07	0.02	0.04	0.08	3.15	0.16	0.08	0.08
n-Butane	0.66	0.70	0.68	0.72	0.67	1.94	0.82	0.67	0.81
C5 - C11 (2)	8.49	9.17	8.11	8.58	8.37	7.68	7.44	7.54	9.39
Light Hydrocarbons (3)	12.66	12.48	15.16	13.70	13.18	12.58	11.72	18.57	15.48
Heavy Hydrocarbons (4)	13.10	11.52	12.63	12.30	12.77	13.63	13.42	15.08	13.04
Slurry Rx.-Wax	50.09	50.31	48.49	49.58	50.34	53.17	50.45	44.16	44.46
Total	100	100	100	100	100	100	100	100	100

(1) Including Oxygenates
(2) In Gas Phase Only
(3) Collected in Chilled and Ambient Condensers
(4) Collected in Hot Condenser

Table A-3 (Cont'd)
First Stage Fischer-Tropsch Slurry Reactor
Operating Conditions and Material Balances
(Based on Inter-Reactor Sample)
(Run CT-256-8)

(Nitrogen-Free Basis)				
M.B. No.	8- 50	8- 51	8- 52	8- 53
Days On-stream	64.1	65.1	66.1	67.1
First-Stage Conditions:				
Charge H2/CO (Molar)	0.680	0.680	0.685	0.680
Temperature, oC	250	250	249	250
Pressure, MPa	1.825	1.825	1.825	1.825
Feed Sup. Vel., cm/s	2.227	2.226	2.222	2.231
Space Vel., NL/gFe-hr	1.288	1.292	1.296	1.301
N2 in Feed, Mol %	0.8	0.7	0.8	0.9
Conversions, Mol % :				
H2	42.67	45.51	45.49	47.05
CO	53.79	54.04	50.43	52.43
H2+CO	49.29	50.59	48.42	50.25
Yields, Wt % of Products :				
Hydrocarbons (1)	13.09	13.65	12.49	12.38
CO2	39.57	39.27	37.32	38.62
H2O (1)	0.92	0.86	0.97	0.94
H2	2.66	2.54	2.54	2.49
CO	43.76	43.68	46.68	45.56
Total	100	100	100	100
Bal Recovery, Wt % of Charge:	100.61	100.25	101.14	99.46
(CO2)(H2)/(CO)(H2O) :	14.91	15.07	11.87	12.75
gHC/Nm3 (H2+CO) conv.:	208	210	202	190
(H/C) Atomic Ratio in HC :	2.16	2.17	2.16	2.17
Selectivities, Wt % of HC :				
Methane	4.69	5.16	4.77	4.86
Ethene	3.09	3.37	3.11	3.12
Ethane	0.69	0.76	0.66	0.78
Propene	3.70	4.50	3.72	3.83
Propane	0.82	0.46	0.81	0.85
Butenes	2.89	3.23	2.91	3.01
i-Butane	0.18	0.09	0.05	0.07
n-Butane	0.81	0.91	0.82	0.83
C5 - C11 (2)	9.21	10.18	9.42	7.58
Light Hydrocarbons (3)	16.54	15.38	15.08	15.38
Heavy Hydrocarbons (4)	12.89	13.21	12.69	13.29
Slurry Rx.-Wax	43.69	41.69	44.91	45.61
Total	100	100	100	100

(1) Including Oxygenates
(2) In Gas Phase Only
(3) Collected in Chilled and Ambient Condensers
(4) Collected in Hot Condenser

Table A-4
Composition of Hydrocarbon Products from
First-Stage Slurry F-T Reactor
(Based on Inter-Reactor Sample)
(Run CT-256-8)

M.B. No.	8- 41	8- 42	8- 43	8- 44	8- 45	8- 46	8- 47	8- 48	8- 49
Days On-stream	55.1	56.1	57.1	58.1	59.1	60.1	61.1	62.1	63.1
METHANE	3.33	3.59	3.29	3.25	3.11	2.17	3.70	3.80	4.66
ETHENE	2.97	3.27	2.95	2.95	2.89	0.38	3.02	2.58	3.08
ETHANE	0.62	0.53	0.60	0.63	0.56	0.49	0.81	0.54	0.68
PROPENE	3.69	3.83	3.84	3.87	3.51	1.15	3.82	3.10	3.87
PROPANE	0.62	0.71	0.70	0.70	0.68	1.84	0.83	0.63	0.81
I-BUTANE	0.05	0.27	0.02	0.04	0.06	3.15	0.16	0.06	0.08
1-BUTENE+2-METHYLPROPENE	2.76	2.81	2.72	2.85	2.19	1.13	2.78	2.40	2.82
N-BUTANE	0.66	0.70	0.68	0.72	0.67	1.94	0.82	0.67	0.81
TRANS-2-BUTENE	0.02	0.00	0.00	0.02	0.02	0.41	0.11	0.02	0.02
CIS-2-BUTENE	0.04	0.00	0.03	0.04	0.03	0.27	0.10	0.03	0.04
3-METHYL-1-BUTENE	0.20	0.21	0.20	0.20	0.20	0.03	0.22	0.19	0.22
I-PENTANE	0.10	0.09	0.09	0.08	0.30	2.22	0.16	0.08	0.12
1-PENTENE	1.98	2.13	2.02	2.08	1.98	0.03	1.88	1.74	2.08
2-METHYL-1-BUTENE	0.08	0.09	0.08	0.08	0.08	0.22	0.09	0.08	0.09
N-PENTANE	0.54	0.57	0.52	0.54	0.52	1.15	0.63	0.48	0.62
TRANS-2-PENTENE	0.00	0.00	0.00	0.01	0.01	0.14	0.11	0.01	0.02
CIS-2-PENTENE	0.00	0.00	0.02	0.02	0.02	0.07	0.07	0.02	0.02
2-METHYL-2-BUTENE	0.00	0.00	0.00	0.00	0.00	0.63	0.04	0.00	0.00
CYCLOPENTANE	0.03	0.03	0.03	0.00	0.03	0.04	0.06	0.03	0.04
HEXENES + ISO-HEXANES	0.34	0.36	0.31	0.32	0.33	0.07	0.28	0.31	0.35
2,3-DIMETHYLBUTANE	0.05	0.05	0.05	0.05	0.05	0.01	0.05	0.05	0.07
2-METHYLPENTANE	0.08	0.07	0.08	0.09	0.08	0.76	0.05	0.06	0.07
3-METHYLPENTANE	0.03	0.03	0.03	0.03	0.03	0.26	0.04	0.03	0.04
1-HEXENE	1.55	1.67	1.58	1.62	1.53	0.00	1.29	1.36	1.64
N-HEXANE	0.46	0.54	0.46	0.47	0.44	0.45	0.50	0.00	0.58
METHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
HEPTENES + ISO-HEPTANES	0.30	0.31	0.28	0.32	0.31	0.22	0.36	0.31	0.37
1-HEPTENE	1.06	1.12	1.01	1.08	1.02	0.00	0.63	0.93	1.10
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00
3-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00
I-DIMETHYL-N5	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
N-HEPTANE	0.32	0.33	0.28	0.30	0.28	0.16	0.32	0.28	0.35
METHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
C8-OLEFINS + ISO-P	0.08	0.10	0.08	0.16	0.12	0.10	0.16	0.05	0.12
1-OCTENE	0.62	0.64	0.52	0.55	0.54	0.00	0.18	0.51	0.61
T-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.44	0.00
ISO-C8-P + O + N5 + N6	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00
N-OCTANE	0.20	0.19	0.15	0.15	0.15	0.00	0.10	0.16	0.20
C9-OLEFINS + ISO-P	0.49	0.62	0.39	0.42	0.38	0.10	0.20	0.42	0.67
BENZENE	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
TOLUENE	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00
ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
METHANOL	0.25	0.30	0.35	0.34	1.21	0.00	0.35	0.28	0.34
ACETONE	0.45	0.49	0.41	0.42	0.41	0.00	0.27	0.35	0.39
I-PROPANOL	0.20	0.23	0.21	0.22	0.00	0.00	0.21	0.20	0.25
UNKNOWN LITE HYDRO-CARB LIQ (1)	12.66	12.48	15.16	13.70	13.18	12.58	11.72	18.57	15.48
UNKNOWN HVY HYDRO-CARB LIQ (2)	13.10	11.52	12.83	12.30	12.77	13.63	13.42	15.08	13.04
SLURRY REACTOR-WAX	50.09	50.31	48.49	49.58	50.34	53.17	50.45	44.18	44.46

(1) Collected in Ambient and Chilled Condensers
(2) Collected in Hot Condenser

Table A-4 (cont'd)
Composition of Hydrocarbon Products from
First-Stage Slurry F-T Reactor
(Based on Inter-Reactor Sample)
(Run CT-256-8)

M.B. No.	8- 50	8- 51	8- 52	8- 53
Days On-stream	64.1	65.1	66.1	67.1
METHANE	4.69	5.16	4.77	4.86
ETHENE	3.09	3.37	3.11	3.12
ETHANE	0.69	0.76	0.66	0.78
PROPENE	3.70	4.50	3.72	3.83
PROPANE	0.82	0.46	0.81	0.85
I-BUTANE	0.18	0.09	0.05	0.07
1-BUTENE+2-METHYLPROPENE	2.85	3.15	2.85	2.86
N-BUTANE	0.81	0.91	0.82	0.83
TRANS-2-BUTENE	0.00	0.03	0.02	0.07
CIS-2-BUTENE	0.04	0.05	0.04	0.08
3-METHYL-1-BUTENE	0.22	0.25	0.22	0.23
I-PENTANE	0.11	0.13	0.12	0.11
1-PENTENE	2.08	2.31	2.07	1.99
2-METHYL-1-BUTENE	0.10	0.11	0.09	0.10
N-PENTANE	0.62	0.68	0.62	0.66
TRANS-2-PENTENE	0.00	0.00	0.00	0.08
CIS-2-PENTENE	0.02	0.03	0.02	0.06
2-METHYL-2-BUTENE	0.00	0.00	0.00	0.02
CYCLOPENTANE	0.04	0.04	0.04	0.04
HEXENES + ISO-HEXANES	0.34	0.40	0.35	0.23
2,3-DIMETHYLBUTANE	0.06	0.07	0.07	0.05
2-METHYLPENTANE	0.08	0.08	0.08	0.06
3-METHYLPENTANE	0.04	0.04	0.04	0.04
1-HEXENE	1.63	1.80	1.64	1.43
N-HEXANE	0.57	0.63	0.57	0.55
HEPTENES + ISO-HEPTANES	0.35	0.38	0.35	0.35
1-HEPTENE	1.08	1.18	1.12	0.78
N-HEPTANE	0.35	0.38	0.37	0.37
C8-OLEFINS + ISO-P	0.11	0.13	0.12	0.17
1-OCTENE	0.60	0.66	0.65	0.16
N-OCTANE	0.20	0.22	0.22	0.08
C9-OLEFINS + ISO-P	0.61	0.66	0.67	0.05
METHANOL	0.16	0.36	0.40	0.36
ACETONE	0.39	0.45	0.40	0.20
I-PROPANOL	0.25	0.26	0.25	0.23
UNKNOWN LITE HYDRO-CARB LIQ (1)	16.54	15.38	15.08	15.38
UNKNOWN HVY HYDRO-CARB LIQ (2)	12.89	13.21	12.69	13.29
SLURRY REACTOR-WAX	43.69	41.69	44.91	45.61

(1) Collected in Ambient and Chilled Condensers
(2) Collected in Hot Condenser

Table A-5
Second-Stage Fixed-Bed ZSM-5 Reactor
Operating Conditions and Material Balances
(Run CT-256-3)

(Nitrogen-Free Basis)							
M.B. No.	B- 41	B- 42	B- 44	B- 45	B- 46	B- 47	B- 48
Days On-stream	55.1	56.1	58.1	59.1	60.1	61.1	62.1
First-Stage Conditions:							
Charge H2/CO (Molar)	0.674	0.668	0.663	0.663	0.668	0.667	0.663
Temperature, oC	249	250	251	250	250	250	250
Pressure, MPa	1.501	1.501	1.508	1.467	1.480	1.480	1.480
Feed Sup. Vel., cm/s	2.186	2.224	2.220	2.274	2.261	2.276	2.250
Space Vel., NL/gFe-hr	1.008	1.027	1.036	1.038	1.046	1.049	1.050
N2 in Feed, Mol %	1.1	1.1	1.1	1.1	1.1	1.8	0.8
Second-Stage Conditions:							
Temp., Inlet, oC	290	304	306	305	312	312	316
Outlet, oC	313	316	327	327	332	337	343
Pressure, MPa	1.501	1.501	1.508	1.467	1.480	1.480	1.480
GHSV, 1/hr	2241	2320	2283	2324	2388	2390	2322
Days On-stream	1.4	2.4	4.4	5.4	6.4	7.4	8.4
Conversions, Mol % :							
H2	52.60	52.13	51.64	49.20	49.22	52.07	50.66
CO	61.02	59.93	60.79	58.09	57.23	57.63	58.27
H2+CO	57.63	56.80	57.14	54.54	54.02	55.40	55.24
Yields, Wt % of Products :							
Hydrocarbons	13.22	15.62	14.62	12.61	12.85	14.12	14.88
CO2	46.02	44.04	44.30	43.28	43.32	43.02	41.53
H2O	1.50	1.29	1.44	1.40	1.18	1.40	1.16
H2	2.19	2.13	2.21	2.34	2.31	2.14	2.27
CO	37.06	36.92	37.43	40.37	40.34	39.32	40.17
Total	100	100	100	100	100	100	100
Bal Recovery, Wt % of Charge:	100.25	103.47	99.92	99.03	101.08	102.76	99.09
(CO2)(H2)/(CO)(H2O) :	10.33	11.20	10.36	10.23	12.03	9.51	11.57
gHC/Nm3 (H2+CO) conv.:	179	223	201	179	188	205	209
(H/C) Atomic Ratio in HC :	2.08	2.07	2.05	2.02	2.08	2.12	2.14
Selectivities, Wt % of HC :							
Methane	2.16	2.85	1.56	0.86	2.42	3.29	4.17
Ethene	0.51	0.31	1.14	0.25	0.62	0.59	0.77
Ethane	0.25	0.58	0.89	0.15	0.38	0.73	0.52
Propene	0.79	0.87	1.10	0.63	1.27	1.64	1.66
Propane	1.64	2.53	2.29	0.99	2.13	2.43	2.65
Butenes	1.64	1.54	1.77	1.23	2.05	2.82	2.73
i-Butane	2.44	4.11	3.78	1.80	3.59	4.07	4.47
n-Butane	1.79	2.63	2.29	1.21	2.16	2.55	2.67
C5 - C11	29.64	38.78	35.45	34.95	30.15	32.60	32.33
C12+ (Excl. Rx.-Wax)	1.80	0.00	0.00	0.00	0.00	0.26	0.17
Slurry Rx.-Wax	57.34	45.81	49.73	57.93	55.24	49.02	47.86
Total	100	100	100	100	100	100	100
i-C4/(C3= + C4=) Molar :	0.87	1.47	1.13	0.84	0.93	0.78	0.87
(C3/C3=) Molar Ratio :	1.98	2.76	1.99	1.51	1.60	1.41	1.52
Alkylate, Wt % of HC :	4.61	5.21	6.21	3.42	6.70	7.72	8.39
Cat-Poly,Wt % of HC :	0.26	0.00	0.00	0.24	0.21	0.81	0.47
C5 - C11 PONA, Wt % :							
Paraffins	(1)	(1)	(1)	35.76	(1)	(1)	(1)
Olefins	(1)	(1)	(1)	16.85	(1)	(1)	(1)
Naphthenes	(1)	(1)	(1)	7.97	(1)	(1)	(1)
Aromatics	(1)	(1)	(1)	39.42	(1)	(1)	(1)

(1) Not Available

Table A-5 (Cont'd)
Second-Stage Fixed-Bed ZSM-5 Reactor
Operating Conditions and Material Balances
(Run CT-256-8)

(Nitrogen-Free Basis)					
M.B. No.	8- 49	8- 50	8- 51	8- 52	8- 53
Days On-stream	63.1	64.1	65.1	66.1	67.1
First-Stage Conditions:					
Charge H2/CO (Molar)	0.672	0.680	0.680	0.685	0.680
Temperature, oC	251	250	250	249	250
Pressure, MPa	1.825	1.825	1.825	1.825	1.825
Feed Sup. Vel., cm/s	2.227	2.227	2.227	2.227	2.226
Space Vel., NL/gFe-hr	1.283	1.288	1.292	1.296	1.301
N2 in Feed, Mol %	0.7	0.8	0.8	1.0	0.7
Second-Stage Conditions:					
Temp., Inlet, oC	319	321	324	328	338
Outlet, oC	342	342	346	349	357
Pressure, MPa	1.825	1.825	1.825	1.825	1.825
GHSV, 1/hr	2909	2957	2935	2999	2990
Days On-stream	9.4	10.4	11.4	12.4	13.4
Conversions, Mol % :					
H2	49.40	47.22	48.45	48.08	45.24
CO	55.42	54.70	54.05	51.49	53.20
H2+CO	53.00	51.87	51.78	50.11	49.98
Yields, Wt % of Products :					
Hydrocarbons	13.55	13.53	13.10	12.24	12.86
CO2	40.32	39.58	39.31	38.13	38.23
H2O	1.40	1.54	1.52	1.54	1.51
H2	2.33	2.45	2.40	2.42	2.57
CO	42.39	42.90	43.66	45.67	44.83
Total	100	100	100	100	100
Bal Recovery, Wt % of Charge:	100.24	100.61	100.25	101.14	99.46
(CO2)(H2)/(CO)(H2O) :	9.01	8.37	8.14	7.47	8.29
gHC/Nm3 (H2+CO) conv.:	200	205	197	191	199
(H/C) Atomic Ratio in HC :	2.15	2.16	2.14	2.15	2.14
Selectivities, Wt % of HC :					
Methane	4.93	4.98	4.43	4.80	4.55
Ethene	0.68	0.74	0.69	0.69	0.78
Ethane	0.81	0.84	0.79	0.83	0.81
Propene	1.92	2.03	1.92	1.98	2.05
Propane	3.04	3.01	2.83	2.95	2.99
Butenes	3.39	3.55	3.31	3.14	3.29
i-Butane	5.00	4.93	4.63	4.76	4.85
n-Butane	3.14	3.08	2.66	2.82	2.89
C5 - C11	34.06	34.32	35.02	31.89	33.69
C12+ (Excl. Rx.-Wax)	0.52	0.26	0.07	0.30	0.18
Slurry Rx.-Wax	42.52	42.25	43.44	45.85	43.93
Total	100	100	100	100	100
i-C4/(C3= + C4=) Molar :	0.81	0.76	0.76	0.80	0.78
(C3/C3=) Molar Ratio :	1.51	1.41	1.40	1.42	1.39
Alkylate, Wt % of HC :	9.46	9.39	8.82	9.00	9.19
Cat-Poly,Wt % of HC :	0.84	1.13	1.05	0.89	1.01
C5 - C11 PONA, Wt % :					
Paraffins	41.11	44.53	40.70	37.31	39.78
Olefins	17.59	19.23	20.02	23.72	18.95
Naphthenes	8.47	7.60	7.68	8.07	8.30
Aromatics	32.83	28.65	31.59	30.90	32.96

Table A-6
Composition of Hydrocarbon Products from
Two-Stage Slurry F-T/ZSM-5 Syngas Conversion
(Run CT-256-8)

M.B. No.	8- 41	8- 42	8- 44	8- 45	8- 46	8- 47	8- 48
Days On-stream	55.1	56.1	58.1	59.1	60.1	61.1	62.1
METHANE	2.16	2.85	1.56	0.86	2.42	3.29	4.17
ETHENE	0.51	0.31	1.14	0.25	0.62	0.59	0.77
ETHANE	0.25	0.58	0.89	0.15	0.38	0.73	0.52
PROPENE	0.79	0.87	1.10	0.63	1.27	1.64	1.66
PROPANE	1.64	2.53	2.29	0.99	2.13	2.43	2.65
I-BUTANE	2.44	4.11	3.78	1.80	3.59	4.07	4.47
1-BUTENE+2-METHYLPROPENE	1.03	0.96	1.11	0.75	1.27	1.75	1.68
N-BUTANE	1.79	2.63	2.29	1.21	2.16	2.55	2.67
TRANS-2-BUTENE	0.37	0.35	0.40	0.29	0.48	0.64	0.63
CIS-2-BUTENE	0.24	0.23	0.26	0.19	0.30	0.43	0.42
3-METHYL-1-BUTENE	0.03	0.02	0.03	0.02	0.03	0.06	0.05
I-PENTANE	1.97	3.07	2.68	1.86	2.48	3.16	3.27
1-PENTENE	0.03	0.03	0.03	0.03	0.04	0.10	0.08
2-METHYL-1-BUTENE	0.23	0.17	0.20	0.22	0.25	0.37	0.35
N-PENTANE	1.29	1.64	1.38	1.19	1.28	1.73	1.69
TRANS-2-PENTENE	0.14	0.11	0.13	0.15	0.15	0.24	0.23
CIS-2-PENTENE	0.06	0.05	0.06	0.07	0.07	0.11	0.11
2-METHYL-2-BUTENE	0.65	0.50	0.57	0.72	0.69	1.02	0.95
2,2-DIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.01	0.02	0.02
CYCLOPENTANE	0.00	0.02	0.02	0.04	0.05	0.03	0.03
HEXENES + ISO-HEXANES	0.00	0.02	0.03	0.02	0.07	0.17	0.11
2,3-DIMETHYLBUTANE	0.04	0.07	0.07	0.05	0.01	0.09	0.08
2-METHYLPENTANE	0.02	1.05	0.89	1.37	0.85	1.39	1.30
3-METHYLPENTANE	0.86	0.36	0.31	0.53	0.29	0.51	0.48
HEXENES	0.00	0.00	0.00	0.42	0.00	0.00	0.00
1-HEXENE	0.30	0.00	0.00	0.00	0.00	0.00	0.00
N-HEXANE	0.55	0.58	0.50	1.10	0.50	0.90	0.85
2,2-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLPENTANE	0.00	0.00	0.00	0.01	0.00	0.00	0.00
METHYLCYCLOPENTANE	0.07	0.14	0.13	0.27	0.11	0.23	0.00
CYCLOHEXANE	0.00	0.00	0.03	0.01	0.00	0.00	0.00
HEPTENES + ISO-HEPTANES	0.23	0.16	0.18	0.12	0.24	0.47	0.69
2-METHYLHEXANE	0.21	0.24	0.19	0.83	0.18	0.42	0.45
2,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.10	0.02	0.04	0.04
3-METHYLHEXANE	0.14	0.17	0.14	0.74	0.13	0.31	0.35
1-CIS-3-DIMETHYL-N5	0.05	0.05	0.04	0.18	0.04	0.09	0.10
1-TRANS-3-DIMETHYL-N5	0.02	0.04	0.04	0.17	0.03	0.08	0.10
1-TRANS-2-DIMETHYL-N5	0.00	0.03	0.03	0.12	0.03	0.10	0.08
N-HEPTANE	0.19	0.16	0.14	0.81	0.18	0.43	0.52
C7-OLEFINS	0.00	0.00	0.00	0.89	0.00	0.00	0.00
METHYLCYCLOHEXANE	0.10	0.08	0.06	0.25	0.05	0.12	0.15
C8-OLEFINS + ISO-P	0.23	0.10	0.06	0.03	0.11	0.30	0.43
ISO-C8-P + O + N5 + N6	0.00	0.13	0.12	0.07	0.17	0.56	1.19
MONOMETHYL-ISO-C8-P	0.00	0.00	0.00	0.95	0.00	0.00	0.00
OTHER ISO-C8-P	0.00	0.00	0.00	0.12	0.00	0.00	0.00
C8-OLEFINS	0.00	0.00	0.00	1.61	0.00	0.00	0.00
C8-NAPHTHENES (N5+N6)	0.00	0.00	0.00	1.19	0.00	0.00	0.00
N-OCTANE	0.00	0.00	0.00	0.45	0.00	0.00	0.00
C9-OLEFINS + ISO-P	0.09	0.05	0.03	0.05	0.12	0.14	1.26
MONOMETHYL-ISO-C9-P	0.00	0.00	0.00	0.51	0.00	0.00	0.00
OTHER ISO-C9-P	0.00	0.00	0.00	0.19	0.00	0.00	0.00
C9-OLEFINS	0.00	0.00	0.00	1.54	0.00	0.00	0.00
C9-NAPHTHENES (N5+N6)	0.00	0.00	0.00	0.55	0.00	0.00	0.00
N-NONANE	0.00	0.00	0.00	0.16	0.00	0.00	0.00
ISO-C10-P + O + N5 + N6	0.00	0.00	0.00	0.98	0.00	0.00	0.00
N-DECANE	0.00	0.00	0.00	0.08	0.00	0.00	0.00
C11-P + O + N5 + N6	0.00	0.00	0.00	0.38	0.00	0.00	0.00
BENZENE	0.07	0.09	0.09	0.25	0.09	0.18	0.22
TOLUENE	0.04	0.19	0.17	1.33	0.13	0.20	0.44
ETHYLBENZENE	0.08	0.23	0.22	0.74	0.12	0.13	0.89
M-XYLENE	0.00	0.00	0.00	2.54	0.00	0.00	0.00
O-XYLENE	0.00	0.00	0.00	0.49	0.00	0.00	0.00
N-PROPYLBENZENE	0.00	0.00	0.00	0.20	0.00	0.00	0.00
1-METHYL-3-ETHYL-BENZENE	0.00	0.00	0.00	1.94	0.00	0.00	0.00
1-METHYL-4-ETHYL-BENZENE	0.00	0.00	0.00	0.93	0.00	0.00	0.00
1,3,5-TRIMETHYL-BENZENE	0.00	0.00	0.00	0.04	0.00	0.00	0.00
1-METHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.06	0.00	0.00	0.00
1,2,4-TRIMETHYLBENZENE	0.00	0.00	0.00	1.43	0.00	0.00	0.00
1-METHYL-2-ISO-C3-BENZENE	0.00	0.00	0.00	0.02	0.00	0.00	0.00
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.77	0.00	0.00	0.00
N-C4-BENZENE	0.00	0.00	0.00	0.43	0.00	0.00	0.00
1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.04	0.00	0.00	0.00
C10-ALKYLBENZENES	0.00	0.00	0.00	1.24	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.13	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.01	0.00	0.00	0.00
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.07	0.00	0.00	0.00
UNKNOWNS (HC AROMATICS)	0.00	0.00	0.00	1.10	0.00	0.00	0.00
UNKNOWN LITE HYDRO-CARB LIQ (1)	21.94	29.22	26.91	0.00	21.62	18.91	15.83
UNKNOWN HVY HYDRO-CARB LIQ (2)	1.80	0.00	0.00	0.00	0.00	0.26	0.17
SLURRY REACTOR-WAX	57.34	45.81	49.73	57.93	55.24	49.02	47.86

(1) Collected in Chilled and Ambient Condensors
(2) Collected in Hot Condenser

Table A-6 (cont'd)
Composition of Hydrocarbon Products from
Two-Stage Slurry F-T/ZSM-5 Syngas Conversion
(Run CT-256-8)

M.B. No.	8- 49	8- 50	8- 51	8- 52	8- 53
Days On-stream	63.1	64.1	65.1	66.1	67.1
METHANE	4.95	4.98	4.43	4.80	4.55
ETHENE	0.68	0.74	0.69	0.69	0.76
ETHANE	0.81	0.84	0.79	0.83	0.81
PROPENE	1.92	2.03	1.92	1.98	2.05
PROPANE	3.04	3.01	2.83	2.95	2.39
I-BUTANE	5.00	4.93	4.63	4.76	4.55
1-BUTENE+2-METHYLPROPENE	2.09	2.18	2.01	1.93	2.00
N-BUTANE	3.14	3.08	2.86	2.82	2.89
TRANS-2-BUTENE	0.78	0.82	0.78	0.73	0.77
CIS-2-BUTENE	0.53	0.55	0.52	0.49	0.52
3-METHYL-1-BUTENE	0.06	0.06	0.06	0.06	0.06
I-PENTANE	3.83	3.87	3.62	2.92	3.71
1-PENTENE	0.07	0.08	0.07	0.62	0.07
2-METHYL-1-BUTENE	0.45	0.50	0.47	0.31	0.44
N-PENTANE	2.04	2.13	1.97	1.48	1.89
TRANS-2-PENTENE	0.29	0.33	0.31	0.62	0.29
CIS-2-PENTENE	0.14	0.16	0.15	0.16	0.14
2-METHYL-2-BUTENE	1.23	1.39	1.29	0.81	1.20
UNKNOWN C5-MONOOLEFINS	0.00	0.00	0.00	0.34	0.00
2,2-DIMETHYLBUTANE	0.02	0.03	0.02	0.00	0.03
CYCLOPENTANE	0.09	0.10	0.09	0.05	0.10
HEXENES + ISO-HEXANES	0.08	0.11	0.09	0.04	0.09
2,3-DIMETHYLBUTANE	0.06	0.07	0.07	0.14	0.06
2-METHYLPENTANE	1.68	1.78	1.66	1.51	1.52
3-METHYLPENTANE	0.67	0.72	0.70	0.67	0.68
HEXENES	0.38	0.43	0.50	0.98	0.43
N-HEXANE	1.20	1.27	1.20	0.56	1.09
2,2-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00
METHYLCYCLOPENTANE	0.36	0.38	0.40	0.41	0.46
3,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00
CYCLOHEXANE	0.01	0.01	0.01	0.01	0.01
HEPTENES + ISO-HEPTANES	0.30	0.36	0.31	0.24	0.28
2-METHYLHEXANE	0.67	0.68	0.66	0.60	0.57
2,3-DIMETHYLPENTANE	0.11	0.12	0.12	0.10	0.13
3-METHYLHEXANE	0.61	0.62	0.61	0.55	0.55
1-CIS-3-DIMETHYL-N5	0.18	0.20	0.20	0.21	0.22
1-TRANS-3-DIMETHYL-N5	0.18	0.18	0.19	0.19	0.20
1-TRANS-2-DIMETHYL-N5	0.13	0.13	0.13	0.13	0.14
N-HEPTANE	0.72	0.74	0.72	0.62	0.65
C7-OLEFINS	0.43	0.81	0.79	0.92	0.88
METHYLCYCLOHEXANE	0.25	0.26	0.26	0.18	0.27
C8-OLEFINS + ISO-P	0.14	0.15	0.13	0.07	0.14
ISO-C8-P + O + N5 + N6	0.18	0.23	0.17	0.00	0.14
MONOMETHYL-ISO-C8-P	0.64	0.62	0.62	0.55	0.52
OTHER ISO-C8-P	0.09	0.09	0.10	0.10	0.10
C8-OLEFINS	1.11	1.10	1.01	1.25	1.31
C8-NAPHTHENES (N5+N6)	0.94	0.93	0.98	0.99	0.98
N-OCTANE	0.33	0.33	0.33	0.30	0.29
C9-OLEFINS + ISO-P	0.24	0.18	0.17	0.16	0.17
MONOMETHYL-ISO-C9-P	0.00	0.29	0.30	0.27	0.25
OTHER ISO-C9-P	0.14	0.14	0.14	0.14	0.13
C9-OLEFINS	1.17	1.05	1.15	1.02	0.96
C9-NAPHTHENES (N5+N6)	0.75	0.41	0.43	0.41	0.40
N-NONANE	0.00	0.13	0.13	0.12	0.12
ISO-C10-P + O + N5 + N6	0.72	0.67	0.73	0.64	0.61
N-DECANE	0.03	0.03	0.04	0.03	0.03
C11-P + O + N5 + N6	0.17	0.59	0.28	0.56	0.23
BENZENE	0.30	0.33	0.34	0.31	0.35
TOLUENE	1.23	1.19	1.30	1.20	1.58
ETHYLBENZENE	0.74	0.70	0.74	0.53	0.79
M-XYLENE	2.00	1.83	2.01	1.95	2.01
O-XYLENE	0.42	0.39	0.44	0.45	0.47
N-PROPYLBENZENE	0.15	0.19	0.16	0.14	0.14
1-METHYL-3-ETHYL-BENZENE	1.53	1.35	1.47	1.39	1.41
1-METHYL-4-ETHYL-BENZENE	0.72	0.65	0.70	0.66	0.67
1,3,5-TRIMETHYL-BENZENE	0.03	0.03	0.03	0.03	0.03
1-METHYL-2-ETHYLBENZENE	0.05	0.05	0.05	0.05	0.05
1,2,4-TRIMETHYLBENZENE	1.17	1.05	1.14	1.10	1.15
1-METHYL-2-ISO-C3-BENZENE	0.01	0.00	0.02	0.02	0.02
1,3-DIETHYLBENZENE	0.54	0.48	0.53	0.46	0.46
1-METHYL-3-N-C3-BENZENE	0.00	0.00	0.00	0.00	0.02
N-C4-BENZENE	0.30	0.27	0.29	0.26	0.26
1,2,3-TRIMETHYLBENZENE	0.03	0.03	0.03	0.02	0.03
C10-ALKYLBENZENES	0.94	0.83	0.90	0.79	0.81
1,2,4,5-TETRAMETHYLBENZENE	0.10	0.09	0.10	0.09	0.09
1,2,3,5-TETRAMETHYLBENZENE	0.01	0.01	0.01	0.01	0.01
1,2,3,4-TETRAMETHYLBENZENE	0.05	0.04	0.05	0.04	0.00
C11-ALKYLBENZENES	0.08	0.00	0.00	0.00	0.00
NAPHTHALENE	0.08	0.00	0.00	0.00	0.00
UNKNOWNS (HC AROMATICS)	0.69	0.33	0.78	0.39	0.77
UNKNOWN HVY HYDRO-CARB LIQ (2)	0.52	0.26	0.07	0.30	0.18
SLURRY REACTOR-WAX	42.52	42.25	43.44	45.85	43.93

(1) Collected in Chilled and Ambient Condensers
(2) Collected in Hot Condenser

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Technical Information Service
Springfield, VA 22161 (703) 605-6000