MASTER

FLASH HYDROLYSIS OF COAL

QUARTERLY REPORT NO. 6
APRIL 1 - JUNE 30, 1978

November 1978

PROCESS SCIENCES DIVISION
DEPARTMENT OF ENERGY & ENVIRONMENT

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MEYER STEINBERG, Head
PETER FALLON, Project Leader

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Printed in the United States of America

Available from

National Technical Information Service

U.S. Department of Commerce

5285 Port Royal Road

Springfield, VA 22161

Price: Printed Copy \$7.25; Microfiche \$3.00

March 1979

390 copies

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SUMMARY

During this report period, thirty experimental runs were conducted between pressures of 500 and 2500 psig and temperatures of 850° and 900°C for the purpose of studying the production of gaseous hydrocarbons from lignite. Yields as high as 90% conversion of the available carbon to methane and ethane have been observed at 2500 psig and 875°C, with only 1.5% of the carbon appearing as CO and the remainder as char. It was observed that significant decomposition of the gaseous hydrocarbon products occurred as the coal residence time in the reactor increased from the maximum yields at 2.4 sec to 7 seconds.

Hydrogen pressure was shown to have a significant effect on the production of the gaseous hydrocarbons at 875-900°C, the yield increasing linearly at a rate of 18% in absolute conversion of the available carbon for each 500 psi increase in pressure.

Direct measurement of coal particle residence times are now possible. Initial comparison of the first five runs in which accurate measurements were made shows the calculated value to be within 26% of the measured value and in some cases to be in very good agreement.

A comparison was made of the coal hydrogenation data from IGT (The Institute of Gas Technology), CSRD (Cities Service Research and Development Company), PERC (The Pittsburgh Energy Research Center, and BNL. Both the IGT and CSRD data were from coal liquefaction studies while PERC data concentrates on coal gasification. In comparing the liquefaction data, the BNL results appears to give slightly better liquid yields under similar conditions than either IGT or CSRD. At the same conditions, the BNL data also show slightly greater gaseous yields than IGT and about the same gaseous yields as CSRD.

Since the conditions of hydrogen to coal feed ratio was considerably different for the BNL and PERC data, a direct comparison was not possible. By correlating the data from both groups, it was shown the gaseous hydrocarbon yield to be a function of the hydrogen to coal feed ratio to the one-fifth power. It was also shown that at even the lowest ratio (most concentrated gas stream) the methane concentration is not more than 75% of the equilibrium value (for the reaction $C+2H_2=CH_4$) and therefore, the reaction is not being equilibrium limited.

In order to operate the experimental equipment in a region of temperature and pressure needed to study the formation of gaseous hydrocarbons mainly, the experimental limits of the reactor were changed from 4000 psig and 800°C to 2500 psig and 900°C. Both these limits are within the 10,000 hour life expectancy of the Inconel 617 material of the reactor tube.

I. OBJECTIVE AND SCOPE OF WORK

The program objective is to obtain process chemistry and design information on the Flash Hydropyrolysis Process (FHP), a rapid gas-phase, non-catalytic coal hydrogenation technique being investigated at BNL.^(1,2) The work includes the design, construction and operation of a 1 lb/hr down-flow entrained tubular reactor system capable of operating at up to 900°C and 4000 psi and incorporating on-line product analysis. The experimental unit is used to study the effect of such process variables as temperature, pressure, feed rates, residence time, and coal type to maximize liquid and/or gaseous yields and to complete mass balances of feed to product.

II. TUBULAR REACTOR EXPERIMENTAL RESULTS

Work Accomplished

a) Maximizing Gaseous Hydrocarbon Yields

The major effort during the last report period was to investigate the hydrogasification by Flash Hydropyrolysis (FHP) of the same North Dakota lignite being used in liquefaction studies. In order to accomplish this, new experimental limits of 2500 psi and 900°C were placed on the reactor system. Thirty experimental runs were conducted between 850 and 900°C at pressures between 500 psig and 2500 psig. Figures 1 to 10 give the results of those runs which produced significant yields and for which information on the effect of coal particle residence time was obtained. Figure 1 shows the results of a run conducted at 500 psig and 850°C. Less than 20% methane and a maximum of only about 3% ethane which decomposed rapidly was obtained. More than 10% of the available carbon went to the production of CO and CO₂. CO and CO₂ constitutes the

difference between the total hydrocarbon and total yields. Both the relatively significant yield of BTX (5%) and the stability of the BTX at 850°C were not expected at these conditions.

As the pressure is increased to 1000 psig and the reactor temperature increases slightly from 850° to 875°C (Figure 2), the maximum methane yield is seen to increase substantially to approximately 34% conversion, decomposing to 26% as the residence time goes from 3 to 6 seconds. Again the maximum ethane yield was low, approximately 4% while the maximum BTX yield remains about the same at 5%. In this experiment, the CO-CO₂ yield was less than 5% at the point of maximum methane yield.

Figure 3 shows the results of another run conducted at 1000 psig but at 900°C. Again, the maximum methane yield seems to increase substantially to approximately 47% conversion and to decrease with increased residence time. The maximum ethane and BTX yields remains about the same. In this run, the hydrogen flow rate was increased after the initial samples were collected from the four sample taps along the length of the reactor. This was done to decrease the residence time in the upper portion of the reactor in order to gather more data at shorter residence times (< 2 seconds). Since the coal particle residence is controlled mainly by the free fall velocity, the gas velocity does not have a significant effect on the residence time. Thus, when the gas velocity was approximately doubled, the coal particle residence time was only decreased by approximately 20% from 1.75 to 1.4 seconds.

Figures 4, 5, and 6 shows the results of three runs conducted at 1500 psig. In Figure 4, the reactor was at 875°C and in Figures 5 and 6 it was at 900°C. In comparing these results, the 25°C increase in

temperature appears to have produced a 35% increase in methane (37% vs. 48 and 52% respectively). Furthermore, at 900°C the yields of all other products (BTX, ethane, CO and CO₂) totaled to only about 5%. The slight difference in residence time at which the maximum yields are observed (4 sec vs 6 sec) may be due to slight differences in reactor temperature profiles from run to run. This may also be the reason for the slightly higher methane yields observed at the shorter residence time since the hydrocarbon yield is observed to deteriorate with increased residence time.

In Figures 7 and 8, for runs conducted at 2000 psig and 875°C and 900°C, the methane yield is again seen to increase substantially due to the increase in pressure and the total yield of all other products tends to remain at less than 5% at 900°C.

At 2500 psig, (Figures 9 and 10) the maximum methane yield is observed at 875°C rather than at 900°C as in most of the previous experiments. This fact was substantiated by three experiments conducted at 875°C giving an average methane yield of 88.7%.

In Figure 11, all the runs in this series (30 runs) are summarized to show the effect of temperature and pressure on maximum observed gaseous hydrocarbon yields. On an average, the yield of hydrocarbons and oxides of carbon is seen to increase at the rate of approximately 18% additional carbon converted for each 500 psi increase in operating pressure.

From Figures 1 to 10, aside from the above mentioned increase in gaseous hydrocarbon yields, a sharp decrease in CO-CO₂ is also observed coinciding with the increased gasified carbon yield. Also, the yields of both BTX and ethane are seen to decrease sharply again coinciding with the aforementioned increasing yields.

As shown in Figure 12, the maximum gaseous yields occurred at residence times of from 2.4 to 7 seconds. For time periods less than 2.4 sec, the yields had not yet reached their maximum and for time periods greater than 7 seconds decomposition had started this decreasing the yield.

In some of these experiments, particularly those which produced high methane yields, it became difficult to control the internal temperature of the reactor. Normal operating procedure has always been to establish constant and uniform temperatures in both the hydrogen preheater and the reactor before starting the coal feed and then adjusting these temperatures if necessary to maintain a uniform temperature in the reactor. In the high gaseous yield experiments, the temperature in the upper portion of the reactor would increase considerably soon after starting of the coal feed, necessitating either a sharp reduction or a complete cut-off of heat inputs to the upper part of the reactor. In one experiment, the heaters to the whole upper half of the reactor had to be shut off and the run was almost terminated before the temperature was brought under control. This indicates and confirms that the methane producing reaction is highly exothermic.

b) Comparison of Coal Hydrogenation Data

A comparison was made of the coal hydrogenation data from BNL and three other organizations performing similar research, ⁽¹⁾ the Institute of Gas Technology (IGT), ⁽²⁾ the Cities Service Company (CSR) and the Pittsburgh Energy Research Center (PERC). Analyses of the coals used is given in Table I and the results are shown in Tables II, III, and IV.

Table II is a comparison of data from the Institute of Gas Technology's (IGT) riser cracking of coal experiments and BNL's Flash Hydropyrolysis (FHP)

experiments, both using North Dakota lignite. The two IGT runs reported were conducted at 802 and 815°C and a hydrogen pressure of 2000 psi. When compared to a BNL run conducted at 800°C and the same hydrogen pressure, the methane yield is seen to be approximately 50% greater than that obtained by IGT and the total gaseous hydrocarbon yield only 10 to 20% greater, the latter being caused by the larger C₂ to C₅ yield reported by IGT. The IGT experiments produced approximately the same amount of liquids, 10.6% and 15.6% as compared to 15% for the BNL run. However, the temperature of the BNL run reported is not optimum either for maximum liquid yields or gaseous yield. For a better comparison, a BNL run designed to optimize liquid yields is also included in the table. The temperature used was 750°C and the hydrogen pressure was 2500 psi. A total liquid yield of 18.1% was obtained in this run, over half of this being BTX. This is an almost 50% increase in liquid yield than that reported by IGT (10.6 and 15.6%). The methane yield of 22.7% is almost 50% greater than that obtained by IGT (15%) while the ethane yields are approximately the same. However, the IGT feed hydrogen contained some CO, so a comparison of these yields is not strictly valid.

Some of the increased yields reported in the BNL data could be attributed to the 500 psi higher hydrogen pressure (2000 psi vs. 2500 psi) but it is not likely this increase at temperatures of 828°C or less would produce such significant differences. Other possible causes could be reactor materials being used (IGT-stainless steel, BNL-Inconel 617) and the IGT surface to volume ratios being 8 times greater than BNL's (1/8" I.D. for IGT vs. 1" I.D. for BNL).

Table III shows a comparison of one run by Cities Services (CSR_D) and three by BNL. This particular Cities Service run was chosen because it is the only run reported in recent months where all the results were given and no catalyst was used. The pressure used was slightly higher (2500 psi vs. 2000 psi) than the BNL runs and the coal used was a Montana Rosebud sub-bituminous where the BNL runs were conducted using a New Mexico sub-bituminous. The first two BNL runs shown, No. 109 and No. 110, span the temperature of the CSR_D run. As with the first run compared to the IGT data (BNL No. 98) these were not the conditions found to give maximum liquid yields. However, when BNL No. 110 is compared to CSR_D/B-10, a greater similarity of results are observed. The major differences appear in the BTX or gasoline yield and in the CO_x. When this same CSR_D run is compared to BNL No. 111, conducted at a temperature considered to give higher liquid yields, the BNL gaseous yield are seen to be considerably lower, by approximately 25% and the liquid yield greater by approximately the same amount.

In Table IV, a comparison of the Pittsburgh Energy Research Center (PERC) data with that of BNL is made. The PERC work emphasized the production of gaseous hydrocarbons and not liquids as in the previously reported results (Tables II and III). In this case, a direct and accurate comparison of the data is made difficult by the fact that the PERC runs were made at a hydrogen to coal feed ratio of less than 0.1 while the lowest ratio obtained to date in the BNL equipment was approximately 0.3. However, a number of interesting observations can be made from the four runs shown in Table IV. First, the gaseous hydrocarbon yield shows a strong dependency on the hydrogen to coal feed ratio, going from 47.6% to 29.1%,

a 49% decrease, as this ratio decreases from 0.75 to 0.06. While recognizing the fact that only four experimental runs are shown, an attempt was made to correlate the gaseous hydrocarbon yields to the hydrogen to coal feed ratio. The results are shown in Figure 13 and the expression developed was:

$$Y = 48.5 R^{1/5}$$

where $R = H_2/\text{coal}$ ratio and $Y = \% \text{ carbon converted to gaseous HC}$ and indicates a one-fifth power dependency of yield on H_2/coal feed ratio.

Examination of the yields of the oxides of carbon (CO_x) shows an almost inverse linear relationship decreasing yield with increasing hydrogen to coal feed ratio.

Figure 14 shows the equilibrium concentration of methane for the carbon-hydrogen reaction as a function of both hydrogen pressure and system temperature. Also indicated are the maximum methane concentrations from both the PERC and BNL data. At the experimental conditions used for these runs, 1000 psig and 900°C , the equilibrium concentration is seen to be approximately 44% methane. The maximum concentration obtained by PERC was 33.3% which is 75% of equilibrium while the maximum obtained by BNL was only 10% or 23% of equilibrium. Thus far, the reaction is not equilibrium limited.

In one recent experiment (which is to be part of a series of experiments) designed to study the effect of hydrogen to coal feed ratio at conditions other than 1000 psig and 900°C , methane concentrations as high as those reported by PERC ($\approx 33\%$) were obtained at BNL. The conditions used were 2500 psig and 875°C with 70% of the available carbon going to methane at a hydrogen to coal feed ratio of 0.2.

c) Effect of High Heat-up Rate and Short Residence Time

Since the data show the production of gaseous hydrocarbons to be extremely rapid, it was decided to attempt an experiment contacting the coal particles with hot hydrogen ($\approx 1000^{\circ}\text{C}$) without any extended residence time at this temperature. To accomplish this, the reactor was operated at 1000 psi with the first 2 ft. section at 400°C and the preheater at 1000°C . Initially, very little product was observed at the first sample tap located 2 ft. down the reactor only approximately 7.5% total conversion, more than half being oxides of carbon. As the temperature of this first section was slowly increased, the yields also increase until a maximum of approximately 29% was observed at 825°C at which time the experiment was terminated. This maximum yield was less than half the yields normally obtained at these same conditions when the preheater and reactor are operated isothermally. The most probable reason for what appears to be a failure of the experiment would be the great difference in heat capacity of the hydrogen and heavy walled reactor causing a quenching effect of the hot hydrogen reducing both the rate of heating and final temperature of the coal being fed.

d) Coal Particle Residence Time Measurements

Direct measurement of the residence time of the coal particles in the reactor are now possible. The method used is to measure the time required for the first coal at the beginning of an experiment to travel from the coal feeder at the top of the reactor when first activated to a thermocouple placed in the path of this coal as it enters the char trap at the base of the reactor. It had been previously noted that at the beginning of each experiment, the thermocouple used to monitor the internal

temperature of the char trap would indicate a slight increase in this temperature shortly after the flow of coal was started even though the hydrogen had been flowing for some period and all temperatures had equilibrated. It appeared that the only possible cause for this increase in temperature could be the hot char particles entering the char trap and coming in contact with this thermocouple. The thermocouple was then placed directly in the path of the particles and attached to a high response recorder. Table V shows the results of the first 5 measurements using this technique. The measured value is assumed to be the correct value. As can be seen, the greatest difference between the measured and calculated values occurred in the second experiment using this new technique and the error was about 26%. The next largest error was 15% and two measurements agreed to within 2% or less.

Work Forecast

Emphasis will be placed on the continued study of the gasification of lignite particularly with regard to production of more concentrated product streams, approaching thermodynamic equilibrium. After some slight modifications to the experimental equipment such as the addition of more insulation, more experiments will be conducted of the type described to study high heat-up rates.

III. EXPERIMENTAL EQUIPMENT AND MODIFICATIONS

Work Accomplished

The experimental equipment continues to operate with complete satisfaction. As previously mentioned, the reactor experimental limits were changed from the previous limits of 4000 psig and 800°C to 2500 psig and 900°C. Both these limits are within the 10,000 hr life expectancy

of the 1 in. I.D. reactor as summarized in Table VI. Considering the fact that this is an experimental facility in operation in excess of 150 experimental runs and has had only approximately 30 hours use at the maximum limits, these limits are extremely conservative.

Modifications were made to the coal feeder to improve the feeding of coal particles of less than 50 microns particle size. Future studies will include the use of smaller coal particles in order to determine the possible effect of diffusional mechanisms on the yields.

Work Forecast

No further changes in the experimental equipment is anticipated at this time. Modifications will be made as deemed either necessary or desirable for increased efficiency of operation of the facility.

IV. PRODUCT ANALYSIS AND MATERIAL BALANCES

Work Accomplished

a) Liquid Hydrocarbon Product Analysis

Routine analyses are now made of all liquid hydrocarbon products formed, even in those experiments designed to maximize gaseous yields. Approximately 90 to 98% of these liquids can consistently be identified as aromatics and no phenols are ever found. As previously reported, at those conditions at which maximum liquids are produced using North Dakota lignite the distribution of products is almost 50% BTX and 50% $\geq C_9$ PNA's. Recently, there has been some indication that the small quantity of liquids ($\approx 1\%$) still remaining at conditions which maximize gases (875-900°C) may be almost exclusively PNA's with very little BTX. Previous analyses of liquids formed at temperatures up to 825°C indicated a trend for the ratio of BTX to heavier liquids to increase with temperature.

It was thought, that these heavier liquids were decomposing to BTX and would eventually be destroyed at elevated temperatures. It now appears that this is not completely true and some of these heavier products remain as a tar like material even at 900°C.

b) On-line Gas Chromatograph

The standardized gas samples used to calibrate the on-line gas chromatograph were analyzed on the BNL Gas Chromatograph/Mass Spectrophotometer (GC/MS). The purpose was to increase the degree of confidence in the results from this instrument. The GC/MS analysis agreed to within $\pm 0.5\%$ of that reported by the supplier of the gases for all the major constituents of FHP process stream (CO, CH₄, C₂H₆ and C₆H₆). There was some greater discrepancy in some of the lesser constituents particularly toluene but considering how infrequently this is found in the process stream and small concentrations in which it is found, the total error is negligible.

c) Sulfur Balance

The majority of the sulfur continues to be found in the char remaining after each experiment using lignite. A crude experiment in which the char was separated into one portion containing a high percentage of the magnetic char and another containing less magnetic char showed sulfur content of the total char sample to increase from a value of 1.6% sulfur to a value of 2.3% sulfur in the sample containing the more magnetic portion. This is probably due to the sulfur being in the form of pyrites. The curious aspect of this observation is that the sulfur is reported to be exclusively in the organic form in the feed lignite.

d) Trace Constituents

For environmental reasons, an interest has developed in some compound such as H_2S , NH_3 , COS , HCN and phenols that may be present in the process stream.

If present, they were either previously undetected due to instrumentation limitations or unreported because of such small concentrations as to have a negligible effect on the material balance. The results from numerous gas samples analyzed on the mass spectrophotometer has not shown any indication of any of these compounds. Considering the fact that the atmosphere in the reactor is almost pure hydrogen, it is curious that some H_2S and NH_3 are not present in the process stream particularly since NH_3 is found in the water produced. These may be reacting to form other compounds which are in a solid state and therefore not detected in the gas phase.

Work Forecast

Further investigation of the small quantities of liquids produced at high temperature is anticipated, particularly since these compounds could become a problem in a larger scale unit.

A detailed analysis is being conducted of the mineral matter of both the North Dakota lignite and New Mexico sub-bituminous coals being used in these experiments, since the sulfur in the lignite which is originally in the organic form, eventually forms with some constituent in the mineral matter during the hydrogenation reaction. This does not occur with the sub-bituminous coal.

V. CONCLUSIONS

Approximately 90% of the carbon in lignite can be converted to methane in 2 to 7 seconds at conditions no greater than 2,500 psig and 900°C. The gas formed would almost be pure methane, containing about 1.5% CO and hydrogen. The heat of reaction of methane, is highly exothermic as evidenced by the heat removal and control problems in maintaining the experimental reactor operating conditions. In the series of runs designed to maximize gaseous yields, no attempt was made to measure the heavier liquid hydrocarbons ($\geq C_9$) since they appeared to be present only in small quantities.

When operating the experimental equipment in a mode designed to maximize liquid yields, the yields were found to be stable at temperatures below approximately 750°C and to reach a maximum of 18 to 20% at residence times in the order of 4 to 5 seconds residence time. When operating for maximizing gaseous yields, the maximum yields are observed to occur under conditions which have also been shown experimentally to cause rapid decomposition of the gaseous products. Therefore, it appears that rapid product formation by such methods as high heat-up rates, and rapid termination of the reaction by quenching should product maximum gaseous yields. The maintenance of proper reactor conditions may be difficult due to the exothermic heat of formation of methane as previously mentioned.

Since the feed ratio of hydrogen to coal was usually in the order of 1 lb of hydrogen to 1 lb of coal for most of the BNL experiments, product concentrations in the process gas stream are far below thermodynamic equilibrium usually no more than about 15% of this value. However, with recent experiments in which gaseous hydrocarbon yield have been maximized

it has been possible to exceed 50% of the equilibrium value with little effort and it is conceivable that higher values could be obtained. At these conditions, the partial pressure of hydrogen is greatly reduced, which tends to reduce conversions.

VII PUBLISHED REPORTS

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Table I
ULTIMATE ANALYSIS (WT PCT DRY) OF COALS USED IN
COMPARISON OF COAL HYDROGENATION DATA

	Montana Rosebud Sub-Bituminous	New Mexico Sub-Bituminous	North Dakota Lignite		
			BNL	IGT	PERC
Carbon	64.2	64.2	62.1	60.3	56.9
Hydrogen	4.7	4.9	3.7	4.0	4.9
Oxygen *	18.4	12.3	22.5	22.2	25.7
Nitrogen	1.4	1.4	0.9	0.8	0.7
Sulfur	1.4	0.6	0.5	0.9	1.2
Ash	9.9	16.6	10.3	11.8	10.6

* By difference.

Table II
COMPARISON OF COAL HYDROGENATION DATA
IGT AND BNL

	IGT	IGT	BNL	BNL
Run No.	TP-1	P-28	98	115
Date	10/26/77	10/12/77	12/14/77	2/28/78
Coal Type	N.D. Lignite	N.D. Lignite	N.D. Lignite	N.D. Lignite
Temp. (°C)	802	815	800	750
H ₂ Press. (psig)	2000	2000	2000	2500
% C Converted				
CH ₄	17.7	16.0	24.3	22.7
≥ C ₂ ≤ C ₅	10.3	9.5	7.0	9.6
Total Gas H.C.	28.0	25.5	31.3	32.3
BTX	4.0	5.9	11.0	9.8
≥ C ₉	6.6	9.7	4.0	8.3
Total Liq. H.C.	10.6	15.6	15.0	18.1
Total H.C.	38.6	41.1	46.3	50.4
CO _x	9.4	7.8	4.3	4.3
Total	48.0	48.9	50.6	54.7

Table III

COMPARISON OF COAL HYDROGENATION DATA
CSRD AND BNL

	CSRD	BNL	BNL	BNL
Run No.	1B-10	109	110	111
Date	3/1/78	2/14/78	2/15/78	2/16/78
Coal Type	M.R. Sub-Bit.	N.M. Sub-Bit.	N.M. Sub-Bit.	N.M. Sub-Bit.
Temp. (°C)	787	800	775	725
H ₂ Press. (psig)	2500	2000	2000	2000
% C Converted				
CH ₄	20.7	35.3	20.8	14.2
$\geq C_2 \leq C_5$	11.9	10.8	10.1	10.9
Total Gas H.C.	32.6	46.3	30.9	25.1
BTX	10.0 ¹⁾	7.0	8.2	5.6
$\geq C_9$	6.4	3.0	6.1	15.9
Total Liq. H.C.	16.4	10.0	14.3	21.1
Total H.C.	49.0	56.3	45.2	46.2
CO _x	5.3	4.2	3.2	2.8
Total	54.3	60.5	48.4	49.0

1) Gasoline Boiling Range

Table IV
COMPARISON OF COAL HYDROGENATION DATA
PERC AND BNL

	PERC	PERC	BNL	BNL
Run No.	134	135B	141	164
Date			5/16/78	7/26/78
Coal Type	N.D. Lignite	N.D. Lignite	N.D. Lignite	N.D. Lignite
Temp. (°C)	900	900	900	900
H ₂ Press. (psig)	1000	1000	1000	1000
H ₂ /Coal Ratio (lb/lb)	0.09	0.06	0.75	0.31
% C Converted				
CH ₄	30.0	29.1	46.6	35.2
≥ C ₂ ≤ C ₅	0	0	1.0	0.2
Total Gas H.C.	30.0	29.1	47.6	35.4
BTX	0	0	1.8	3.5
≥ C ₉	0	0	0	0
Total Liq. H.C.	0	0	1.8	3.5
Total H.C.	30.0	29.1	49.4	38.9
CO _X	14.1	21.6	2.4	8.2
Total	44.1	50.7	51.8	47.1

Table V
RESIDENCE TIME OF COAL PARTICLES IN 8" REACTOR

Run No.	Pressure (psi)	Temperature (°C)	Calculated (sec)	Measure (sec)	% Difference
173	2000	750	8.4	7.5	12
174	1500	750	6.7	9.0	26
175	1000	750	6.1	7.2	15
176	2500	875	9.3	9.3	0
177	2500	875	9.3	9.5	2

Table VI

10,000 HOUR RUPTURE LIFE
1 IN. I.D. X 0.25 IN. WALL INCONEL TUBULAR REACTOR

Operating Pressure (psig)	Temperature (°C)
4000	815
3000	850
2500	900

Figure 1. Flash hydrolysis of lignite fraction carbon converted vs. residence time pressure 500 psi, reactor temperature 850°C, preheater temperature 850°C.

Figure 2. Flash hydropyrolysis of lignite fraction carbon converted vs. residence time pressure 1000 psi, reactor temperature 875°C, preheater temperature 875°C.

Figure 3. Flash hydropyrolysis of lignite fraction carbon converted vs. residence time pressure 1000 psi, reactor temperature 900°C, preheater temperature 900°C.

Figure 4. Flash hydrolysis of lignite fraction carbon converted vs. residence time pressure 1500 psi, reactor temperature 875°C, preheater temperature 875°C.

Figure 5. Flash hydrolysis of lignite fraction carbon converted vs. residence time pressure 1500 psi, reactor temperature 900°C, preheater temperature 900°C.

Figure 6. Flash hydrolysis of lignite fraction carbon converted vs. residence time pressure 1500 psi, reactor temperature 900°C, preheater temperature 900°C.

Figure 7. Flash hydrolysis of lignite fraction carbon converted vs. residence time pressure 2000 psi, reactor temperature 875°C, preheater temperature 875°C.

Figure 8. Flash hydrolysis of lignite fraction carbon converted vs. residence time pressure 2000 psi, reactor temperature 900°C, preheater temperature 900°C.

Figure 9. Flash hydrolysis of lignite fraction carbon converted vs. residence time pressure 2500 psi, reactor temperature 875°C, preheater temperature 875°C.

Figure 10. Flash hydrolysis of lignite fraction carbon converted vs. residence time pressure 2500 psi, reactor temperature 900°C, preheater temperature 900°C.

Figure 11. Flash hydrolysis of lignite maximum gaseous hydrocarbon yield ($CH_4 + C_2H_6$) vs. temperature, pressure 500 to 2500 psi, residence time 2.4-7.0 sec.

Figure 12. Flash hydrolysis of lignite gaseous hydrocarbon yields vs. pressure, temperature 850-900°C, residence time 1.2-9.4 sec.

Figure 13. Flash hydrolysis of lignite gaseous hydrocarbon yield vs. hydrogen to coal feed ratio pressure 1000 psi, temperature 900°C.

Figure 14. Thermodynamic equilibrium of methane mole fraction of methane vs. temperature, pressure 500-4000 psi.

RUN NO. 130 SAMPLE NO. 1 DATE 4 -12 -1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.360 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	1.034	LB/HR	COAL FED	938.0	GRAMS
HYDROGEN FLOW RATE	.8000	LB/HR	CHAR	315.0	GRAMS
HYDROGEN VELOCITY	.1845	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	30.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1900E-03	1.917	3.094
CARBON DIOXIDE	0.	0.	0.
METHANE	.4044E-02	71.22	65.86
ETHYLENE	0.	0.	0.
ETHANE	.3400E-04	.6390	.5537
BENZENE	.5000E-04	1.085	.8143
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		74.87	70.32

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.09	1.53	0.	0.	0.	.814
HYDROCARBON GASES	71.9	404.	0.	0.	0.	66.4
CARBON OXIDES	1.92	0.	7.07	0.	0.	3.09
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.9
TOTAL	74.9	412.	7.07	100.	100.	98.2

HYDROGEN CONSUMPTION- .1154 LB HYDROGEN/LB COAL
2.230 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 60.51 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 95.65 PERCENT

RUN NO. 130

SAMPLE NO. 2

DATE 4 -12 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
 CALCULATED 4.710 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.034	LB/HR	COAL FED	938.0	GRAMS
HYDROGEN FLOW RATE	.8000	LB/HR	CHAR	315.0	GRAMS
HYDROGEN VELOCITY	.1845	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED MTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	30.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1550E-03	1.563	2.524
CARBON DIOXIDE	0.	0.	0.
METHANE	.3840E-02	67.63	62.54
ETHYLENE	0.	0.	0.
ETHANE	.3600E-04	.6766	.5863
BENZENE	.1000E-04	.2170	.1629
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2600E-04	0.	.4234
TOTAL		70.09	66.23

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.217	.306	0.	0.	0.	.163
HYDROCARBON GASES	68.3	384.	0.	0.	0.	63.1
CARBON OXIDES	1.56	0.	5.76	0.	0.	2.52
WATER	0.	1.14	1.50	0.	0.	.423
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.9
TOTAL	70.1	392.	7.27	100.	100.	94.1

HYDROGEN CONSUMPTION- .1079 LB HYDROGEN/LB COAL
 2.085 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 59.79 PERCENT
 EFFECTIVE ENERGY EFFICIENCY- 95.20 PERCENT

RUN NO. 130 SAMPLE NO. 3 DATE 4 -12 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 7.070 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	1.034	LB/HR	COAL FED	938.0	GRAMS
HYDROGEN FLOW RATE	.8000	LB/HR	CHAR	315.0	GRAMS
HYDROGEN VELOCITY	.1845	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	30.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2130E-03	2.149	3.469
CARBON DIOXIDE	0.	0.	0.
METHANE	.3583E-02	63.41	58.35
ETHYLENE	0.	0.	0.
ETHANE	.1100E-04	.2067	.1791
BENZENE	.4000E-05	.8681E-01	.6514E-01
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2550E-03	0.	4.153
TOTAL		65.55	66.22

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.868E-01	.122	0.	0.	0.	.651E-01
HYDROCARBON GASES	63.3	356.	0.	0.	0.	58.5
CARBON OXIDES	2.15	0.	7.92	0.	0.	3.47
WATER	0.	11.2	14.8	0.	0.	4.15
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.9
TOTAL	65.5	374.	22.7	100.	100.	94.1

HYDROGEN CONSUMPTION- .1014 LB HYDROGEN/LB COAL
1.959 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 59.03 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 93.12 PERCENT

RUN NO. 130 SAMPLE NO. 4 DATE 4 -12 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 9.420 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	1.034	LB/HR	COAL FED	938.0	GRAMS
HYDROGEN FLOW RATE	.8000	LB/HR	CHAR	315.0	GRAMS
HYDROGEN VELOCITY	.1845	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	30.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3060E-03	3.087	4.983
CARBON DIOXIDE	0.	0.	0.
METHANE	.3397E-02	59.83	55.32
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	.2000E-05	.4341E-01	.3257E-01
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1150E-03	0.	1.873

TOTAL 62.96 62.21

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.434E-01	.611E-01	0.	0.	0.	.326E-01
HYDROCARBON GASES	59.8	337.	0.	0.	0.	55.3
CARBON OXIDES	3.09	0.	11.4	0.	0.	4.98
WATER	0.	5.04	6.65	0.	0.	1.87
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.9
TOTAL	63.0	349.	18.0	100.	100.	90.0

HYDROGEN CONSUMPTION- .9195E-01 LB HYDROGEN/LB COAL
1.777 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 58.55 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 90.89 PERCENT

RUN NO. 131 SAMPLE NO. 1 DATE 4 -14 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE CHAR

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.210 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED MTS.		
COAL FEED RATE	.3002	LB/HR	COAL FED	201.5	GRAMS
HYDROGEN FLOW RATE	1.040	LB/HR	CHAR	168.7	GRAMS
HYDROGEN VELOCITY	.2399	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	69.30	0.
HYDROGEN	1.410	0.
OXYGEN	.1000	0.
NITROGEN	.4100	0.
SULFUR	1.200	0.
ASH	27.58	32.94

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	0.	0.	0.
CARBON DIOXIDE	0.	0.	0.
METHANE	.3490E-03	24.67	31.53
ETHYLENE	0.	0.	0.
ETHANE	.1300E-04	.9805	1.174
BENZENE	0.	0.	0.
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1500E-04	0.	1.355
TOTAL		25.65	34.06

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	0.	0.	0.	0.	0.	0.
HYDROCARBON GASES	25.6	419.	0.	0.	0.	32.7
CARBON OXIDES	0.	0.	0.	0.	0.	0.
WATER	0.	7.73	872.	0.	0.	1.36
AMMONIA	0.	6.23	0.	100.	0.	.687
HYDROGEN SULFIDE	0.	5.32	0.	0.	100.	1.76
CHAR	0.	0.	0.	0.	0.	77.5
TOTAL	25.6	438.	872.	100.	100.	114.

HYDROGEN CONSUMPTION- .4771E-01 LB HYDROGEN/LB COAL
.8261 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 25.65 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 46.48 PERCENT

RUN NO. 131 SAMPLE NO. 2 DATE 4 -14 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE CHAR

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 4.420 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED MTS.		
COAL FEED RATE	.3002	LB/HR	COAL FED	201.5	GRAMS
HYDROGEN FLOW RATE	1.040	LB/HR	CHAR	168.7	GRAMS
HYDROGEN VELOCITY	.2399	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	69.30	0.
HYDROGEN	1.410	0.
OXYGEN	.1000	0.
NITROGEN	.4100	0.
SULFUR	1.200	0.
ASH	27.58	32.94

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	0.	0.	0.
CARBON DIOXIDE	0.	0.	0.
METHANE	.2860E-03	20.21	25.84
ETHYLENE	0.	0.	0.
ETHANE	.8000E-05	.6034	.7227
BENZENE	0.	0.	0.
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1500E-04	0.	1.355
TOTAL		20.82	27.91

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	0.	0.	0.	0.	0.	0.
HYDROCARBON GASES	20.8	341.	0.	0.	0.	26.6
CARBON OXIDES	0.	0.	0.	0.	0.	0.
WATER	0.	7.73	872.	0.	0.	1.36
AMMONIA	0.	6.23	0.	100.	0.	.687
HYDROGEN SULFIDE	0.	5.32	0.	0.	100.	1.76
CHAR	0.	0.	0.	0.	0.	77.5
TOTAL	20.8	360.	872.	100.	100.	108.

HYDROGEN CONSUMPTION- .3669E-01 LB HYDROGEN/LB COAL
 .6354 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 20.82 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 37.77 PERCENT

RUN NO. 131

SAMPLE NO. 3

DATE 4 -14 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE CHAR

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 6.630 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.3002	LB/HR	COAL FED	201.5	GRAMS
HYDROGEN FLOW RATE	1.040	LB/HR	CHAR	168.7	GRAMS
HYDROGEN VELOCITY	.2399	FT/SEC	LIGHT OILS	0.0	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.0	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.0	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	69.30	0.
HYDROGEN	1.410	0.
OXYGEN	.1000	0.
NITROGEN	.4100	0.
SULFUR	1.200	0.
ASH	27.58	32.94

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	0.	0.	0.
CARBON DIOXIDE	0.	0.	0.
METHANE	.1590E-03	11.24	14.36
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	0.	0.	0.
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1400E-04	0.	1.265
TOTAL		11.24	15.63

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	0.	0.	0.	0.	0.	0.
HYDROCARBON GASES	11.2	185.	0.	0.	0.	14.4
CARBON OXIDES	0.	0.	0.	0.	0.	0.
WATER	0.	7.22	814.	0.	0.	1.26
AMMONIA	0.	6.23	0.	100.	0.	.687
HYDROGEN SULFIDE	0.	5.32	0.	0.	100.	1.76
CHAR	0.	0.	0.	0.	0.	77.5
TOTAL	11.2	204.	814.	100.	100.	95.6

HYDROGEN CONSUMPTION- .1469E-01 LB HYDROGEN/LB COAL
.2543 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 11.24 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 20.47 PERCENT

RUN NO. 131 SAMPLE NO. 4 DATE 4 -14 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE CHAR

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 8.840 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.3002	LB/HR	COAL FED	201.5	GRAMS
HYDROGEN FLOW RATE	1.040	LB/HR	CHAR	168.7	GRAMS
HYDROGEN VELOCITY	.2399	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	69.30	0.
HYDROGEN	1.410	0.
OXYGEN	.1000	0.
NITROGEN	.4100	0.
SULFUR	1.200	0.
ASH	27.58	32.94

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	0.	0.	0.
CARBON DIOXIDE	0.	0.	0.
METHANE	.1540E-03	10.88	13.91
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	0.	0.	0.
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1300E-04	0.	1.174
TOTAL		10.88	15.09

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	0.	0.	0.	0.	0.	0.
HYDROCARBON GASES	10.9	180.	0.	0.	0.	13.9
CARBON OXIDES	0.	0.	0.	0.	0.	0.
WATER	0.	6.70	756.	0.	0.	1.17
AMMONIA	0.	6.23	0.	100.	0.	.687
HYDROGEN SULFIDE	0.	5.32	0.	0.	100.	1.76
CHAR	0.	0.	0.	0.	0.	77.5
TOTAL	10.9	198.	756.	100.	100.	95.1

HYDROGEN CONSUMPTION- .1379E-01 LB HYDROGEN/LB COAL
.2388 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 10.88 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 19.83 PERCENT

RUN NO. 132 SAMPLE NO. 1 DATE 4 -18 -1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.240 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.	
COAL FEED RATE	.8450	LB/HR	COAL FED	762.0 GRAMS
HYDROGEN FLOW RATE	.9900	LB/HR	CHAR	257.0 GRAMS
HYDROGEN VELOCITY	.2235	FT/SEC	LIGHT OILS	0. GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0. GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0. GRAMS
HYDROGEN PRESSURE	2500.	PSI		

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	30.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1000E-03	1.528	2.466
CARBON DIOXIDE	0.	0.	0.
METHANE	.3350E-02	89.35	82.62
ETHYLENE	0.	0.	0.
ETHANE	.1340E-03	3.814	3.305
BENZENE	.1440E-03	4.733	3.552
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2500E-04	0.	.6166
TOTAL		99.43	92.56

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.73	6.66	0.	0.	0.	3.55
HYDROCARBON GASES	93.2	519.	0.	0.	0.	85.9
CARBON OXIDES	1.53	0.	5.63	0.	0.	2.47
WATER	0.	1.66	2.19	0.	0.	.617
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.9
TOTAL	99.4	534.	7.82	100.	100.	120.

HYDROGEN CONSUMPTION- .1606 LB HYDROGEN/LB COAL
3.104 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 63.28 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 99.46 PERCENT

RUN NO. 132 SAMPLE NO. 2 DATE 4 -18 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 4.480 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.8450	LB/HR	COAL FED	767.0	GRAMS
HYDROGEN FLOW RATE	.9900	LB/HR	CHAR	257.0	GRAMS
HYDROGEN VELOCITY	.2235	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	30.70

	PRODUCT CONC. IN GAS, LB/CU FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1000E-03	1.528	2.466
CARBON DIOXIDE	0.	0.	0.
METHANE	.2982E-02	79.54	73.55
ETHYLENE	0.	0.	0.
ETHANE	.5000E-04	1.423	1.233
BENZENE	.2500E-04	.8217	.6166
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2240E-03	0.	5.525
TOTAL		83.31	83.39

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.822	1.16	0.	0.	0.	.617
HYDROCARBON GASES	81.0	454.	0.	0.	0.	74.8
CARBON OXIDES	1.53	0.	5.63	0.	0.	2.47
WATER	0.	14.9	19.6	0.	0.	5.52
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.9
TOTAL	83.3	476.	25.3	100.	100.	111.

HYDROGEN CONSUMPTION- .1393 LB HYDROGEN/LB COAL
 2.692 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 61.62 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 98.17 PERCENT

RUN NO. 132 SAMPLE NO. 3 DATE 4 -18 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 6.720 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.8450	LB/HR	COAL FED	767.0	GRAMS
HYDROGEN FLOW RATE	.9900	LB/HR	CHAR	257.0	GRAMS
HYDROGEN VELOCITY	.2235	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	30.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1000E-03	1.528	2.466
CARBON DIOXIDE	0.	0.	0.
METHANE	.2840E-02	75.75	70.05
ETHYLENE	0.	0.	0.
ETHANE	.2400E-04	.6831	.5919
BENZENE	.1000E-04	.3287	.2466
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.3730E-03	0.	9.200
TOTAL		78.29	82.55

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.329	.463	0.	0.	0.	.247
HYDROCARBON GASES	76.4	430.	0.	0.	0.	70.6
CARBON OXIDES	1.53	0.	5.63	0.	0.	2.47
WATER	0.	24.8	32.7	0.	0.	9.20
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.9
TOTAL	78.3	461.	38.3	100.	100.	110.

HYDROGEN CONSUMPTION- .1337 LB HYDROGEN/LB COAL
2.583 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 60.99 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 97.36 PERCENT

RUN NO. 132 SAMPLE NO. 4 DATE 4 -18 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 8.960 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.	
COAL FEED RATE	.8450	LB/HR	COAL FED	767.0 GRAMS
HYDROGEN FLOW RATE	.9900	LB/HR	CHAR	257.0 GRAMS
HYDROGEN VELOCITY	.2235	FT/SEC	LIGHT OILS	0. GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0. GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0. GRAMS
HYDROGEN PRESSURE	2500.	PSI		

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	30.70

	PRODUCT CONC. IN GAS, LB/CU FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1310E+03	2.001	3.231
CARBON DIOXIDE	0.	0.	0.
METHANE	.2724E-02	72.66	67.18
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	.7000E-05	.2301	.1726
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1600E-03	0.	3.946
TOTAL		74.89	74.53

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.230	.324	0.	0.	0.	.173
HYDROCARBON GASES	72.7	409.	0.	0.	0.	67.2
CARBON OXIDES	2.00	0.	7.38	0.	0.	3.23
WATER	0.	10.6	14.0	0.	0.	3.95
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.9
TOTAL	74.9	427.	21.4	100.	100.	102.

HYDROGEN CONSUMPTION-	.1209	LB HYDROGEN/LB COAL
	2.335	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	60.52	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	96.05	PERCENT

RUN NO. 133 SAMPLE NO. 1 DATE 4 -19 -1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.320 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9958	LB/HR	COAL FED	986.0	GRAMS
HYDROGEN FLOW RATE	.9750	LB/HR	CHAR	264.0	GRAMS
HYDROGEN VELOCITY	.2008	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	825.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	825.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	38.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1050E-03	1.341	2.164
CARBON DIOXIDE	0.	0.	0.
METHANE	.1620E-02	36.11	33.39
ETHYLENE	0.	0.	0.
ETHANE	.3820E-03	9.086	7.874
BENZENE	.3040E-03	8.351	6.266
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.4800E-04	0.	.9894
TOTAL		54.89	50.69

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	8.35	11.8	0.	0.	0.	6.27
HYDROCARBON GASES	45.2	242.	0.	0.	0.	41.3
CARBON OXIDES	1.34	0.	4.94	0.	0.	2.16
WATER	0.	2.66	3.52	0.	0.	.989
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	18.4
TOTAL	54.9	263.	8.46	100.	100.	70.9

HYDROGEN CONSUMPTION- .6017E+01 LB HYDROGEN/LB COAL
1.163 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 54.89 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 80.60 PERCENT

RUN NO. 133 SAMPLE NO. 2 DATE 4 -19 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 4.620 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9958	LB/HR	COAL FED	986.0	GRAMS
HYDROGEN FLOW RATE	.9650	LB/HR	CHAR	264.0	GRAMS
HYDROGEN VELOCITY	.2008	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	825.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	825.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	38.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1490E-03	1.883	3.040
CARBON DIOXIDE	0.	0.	0.
METHANE	.4030E-02	88.91	82.22
ETHYLENE	0.	0.	0.
ETHANE	.1640E-03	3.861	3.346
BENZENE	.1460E-03	3.969	2.979
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.6200E-04	0.	1.265
TOTAL		98.63	92.85

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	3.97	5.59	0.	0.	0.	2.98
HYDROCARBON GASES	92.8	517.	0.	0.	0.	85.6
CARBON OXIDES	1.88	0.	6.94	0.	0.	3.04
WATER	0.	3.41	4.49	0.	0.	1.26
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	18.4
TOTAL	98.6	533.	11.4	100.	100.	113.

HYDROGEN CONSUMPTION- .1600 LB HYDROGEN/LB COAL
 3.093 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 63.21 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 99.21 PERCENT

RUN NO. 133

SAMPLE NO. 3

DATE 4 -19 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	6.960	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9958	LB/HR	COAL FED	986.0	GRAMS
HYDROGEN FLOW RATE	.9100	LB/HR	CHAR	264.0	GRAMS
HYDROGEN VELOCITY	.2008	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	825.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	825.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	82.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	38.50

	PRODUCT CONC. IN GAS, LB/C. FT:	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1220E-03	1.454	2.347
CARBON DIOXIDE	0.	0.	0.
METHANE	.3620E-02	75.32	69.64
ETHYLENE	0.	0.	0.
ETHANE	.2480E-03	5.506	4.771
BENZENE	.1300E-03	3.333	2.501
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1530E-03	0.	2.944
TOTAL		85.61	82.21

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	3.33	4.69	0.	0.	0.	2.50
HYDROCARBON GASES	80.8	448.	0.	0.	0.	74.4
CARBON OXIDES	1.45	0.	5.36	0.	0.	2.35
WATER	0.	7.93	10.5	0.	0.	2.94
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	18.4
TOTAL	85.6	467.	15.8	100.	100.	102.

HYDROGEN CONSUMPTION-	.1356	LB HYDROGEN/LB COAL
	2.621	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	61.89	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	97.04	PERCENT

RUN NO. 133

SAMPLE NO. 4

DATE 4 -19 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 9.280 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9958	LB/HR	COAL FED	986.0	GRAMS
HYDROGEN FLOW RATE	.8800	LB/HR	CHAR	264.0	GRAMS
HYDROGEN VELOCITY	.2008	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	825.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	825.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED MTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	38.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1750E-03	2.017	3.256
CARBON DIOXIDE	0.	0.	0.
METHANE	.3429E-02	68.99	63.79
ETHYLENE	0.	0.	0.
ETHANE	.1690E-03	3.628	3.144
BENZENE	.7000E-04	1.736	1.302
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1030E-03	0.	1.916
TOTAL		76.37	73.41

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.74	2.44	0.	0.	0.	1.30
HYDROCARBON GASES	72.6	404.	0.	0.	0.	66.9
CARBON OXIDES	2.02	0.	7.43	0.	0.	3.26
WATER	0.	5.16	6.81	0.	0.	1.92
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	18.4
TOTAL	76.4	418.	14.2	100.	100.	93.7

HYDROGEN CONSUMPTION- .1176 LB HYDROGEN/LB COAL
2.273 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 60.73 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 95.08 PERCENT

RUN NO. 134 SAMPLE NO. 1 DATE 4 -20 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.380 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9799	LB/HR	COAL FED	890.6	GRAMS
HYDROGEN FLOW RATE	.8200	LB/HR	CHAR	309.4	GRAMS
HYDROGEN VELOCITY	.1690	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	775.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	775.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	29.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1480E-03	1.615	2.607
CARBON DIOXIDE	0.	0.	0.
METHANE	.1253E-02	23.97	22.07
ETHYLENE	0.	0.	0.
ETHANE	.5130E-03	10.43	9.037
BENZENE	.3170E-03	7.442	5.584
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2400E-04	0.	.4228
TOTAL		43.36	39.73

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	7.44	10.5	0.	0.	0.	5.58
HYDROCARBON GASES	34.3	179.	0.	0.	0.	31.1
CARBON OXIDES	1.61	0.	5.95	0.	0.	2.61
WATER	0.	1.14	1.50	0.	0.	.423
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	27.2
TOTAL	43.4	197.	7.46	100.	100.	68.8

HYDROGEN CONSUMPTION- .3571E-01 LB HYDROGEN/LB COAL
.6901 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 43.36 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 61.53 PERCENT

RUN NO. 134

SAMPLE NO. 2

DATE 4 -20 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	4.770	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9799	LB/HR	COAL FED	890.6	GRAMS
HYDROGEN FLOW RATE	.8200	LB/HR	CHAR	309.4	GRAMS
HYDROGEN VELOCITY	.1690	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	775.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	775.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	29.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1450E-03	1.582	2.554
CARBON DIOXIDE	0.	0.	0.
METHANE	.1388E-02	26.44	24.45
ETHYLENE	0.	0.	0.
ETHANE	.4960E-03	10.08	8.738
BENZENE	.3880E-03	9.109	6.835
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2000E-04	0.	.3523
TOTAL		47.22	42.93

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	9.11	12.8	0.	0.	0.	6.84
HYDROCARBON GASES	36.5	192.	0.	0.	0.	33.2
CARBON OXIDES	1.58	0.	5.83	0.	0.	2.55
WATER	0.	.949	1.25	0.	0.	.352
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	27.2
TOTAL	47.2	212.	7.08	100.	100.	72.0

HYDROGEN CONSUMPTION-	.4133E-01	LB HYDROGEN/LB COAL
	.7987	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	47.22	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	67.02	PERCENT

RUN NO. 134

SAMPLE NO. 3

DATE 4 -20 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	7.150	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9799	LB/HR	COAL FED	890.6	GRAMS
HYDROGEN FLOW RATE	.8200	LB/HR	CHAR	309.4	GRAMS
HYDROGEN VELOCITY	.1690	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	775.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	775.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	59.30	65.90
HYDROGEN	4.200	1.800
OXYGEN	23.60	0.
NITROGEN	1.000	.6000
SULFUR	.6000	1.200
ASH	11.30	30.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3010E-03	3.439	5.362
CARBON DIOXIDE	0.	0.	0.
METHANE	.1548E-02	30.88	27.58
ETHYLENE	0.	0.	0.
ETHANE	.4820E-03	10.26	8.587
BENZENE	.4160E-03	10.23	7.411
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	.3960E-03	9.741	7.055
WATER	.1407E-02	0.	25.07

TOTAL	64.55	81.06
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	20.0	23.6	0.	0.	0.	14.5
HYDROCARBON GASES	41.1	183.	0.	0.	0.	36.2
CARBON OXIDES	3.44	0.	11.5	0.	0.	5.36
WATER	0.	58.8	83.7	0.	0.	25.1
AMMONIA	0.	4.04	0.	79.2	0.	1.08
HYDROGEN SULFIDE	0.	.272	0.	0.	30.5	.219
CHAR	38.6	14.9	0.	20.8	69.5	27.2
TOTAL	103.	284.	95.3	100.	100.	110.

HYDROGEN CONSUMPTION-	.7745E-01	LB HYDROGEN/LB COAL
	1.567	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-1.7021	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	58.85	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	75.92	PERCENT

RUN NO. 134

SAMPLE NO. 3

DATE 4 -20 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	7.150	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9799	LB/HR	TOTAL ACCUMULATED WTS.	
HYDROGEN FLOW RATE	.8200	LB/HR	COAL FED	890.6 GRAMS
HYDROGEN VELOCITY	.1690	FT/SEC	CHAR	309.4 GRAMS
REACTOR TEMP.	775.0	DEG C	LIGHT OILS	0. GRAMS
PREHEAT TEMP.	775.0	DEG C	BTX	0. GRAMS
HYDROGEN PRESSURE	2500.	PSI	WATER	0. GRAMS

COAL ANALYSIS, %

CHAR ANALYSIS, %

CARBON	62.10	
HYDROGEN	3.700	
OXYGEN	22.44	
NITROGEN	.9500	
SULFUR	.3100	
ASH	10.30	

PRODUCT CONC. IN
GAS, LB/C. FT% CARBON CONV.
TO PRODUCT% MAF COAL CONV.
TO PRODUCT

CARBON MONOXIDE	.3010E-03	3.284	5.303
CARBON DIOXIDE	0.	0.	0.
METHANE	.1548E-02	29.49	27.27
ETHYLENE	0.	0.	0.
ETHANE	.4820E-03	9.799	8.491
BENZENE	.4160E-03	9.766	7.329
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2290E-03	0.	4.034

TOTAL

52.34

52.43

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	9.77	13.8	0.	0.	0.	7.33
HYDROCARBON GASES	39.3	209.	0.	0.	0.	35.8
CARBON OXIDES	3.28	0.	12.1	0.	0.	5.30
WATER	0.	10.9	14.3	0.	0.	4.03
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	27.2
TOTAL	52.3	239.	26.4	100.	100.	81.5

HYDROGEN CONSUMPTION-

.5125E-01
.9904LB HYDROGEN/LB COAL
MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-

52.34

PERCENT

EFFECTIVE ENERGY EFFICIENCY-

72.30

PERCENT

RUN NO. 134

SAMPLE NO. 4

DATE 4 -20 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	9.530	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9799	LB/HR	COAL FED	890.6	GRAMS
HYDROGEN FLOW RATE	.8200	LB/HR	CHAR	309.4	GRAMS
HYDROGEN VELOCITY	.1690	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	775.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	775.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	29.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3520E-03	3.841	6.201
CARBON DIOXIDE	0.	0.	0.
METHANE	.1560E-02	29.72	27.48
ETHYLENE	0.	0.	0.
ETHANE	.4620E-03	9.392	8.139
BENZENE	.3850E-03	9.039	6.782
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.3200E-04	0.	.5637
TOTAL		51.99	49.17

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	9.04	12.7	0.	0.	0.	6.78
HYDROCARBON GASES	39.1	207.	0.	0.	0.	35.6
CARBON OXIDES	3.84	0.	14.2	0.	0.	6.20
WATER	0.	1.52	2.00	0.	0.	.564
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	27.2
TOTAL	52.0	228.	16.2	100.	100.	78.3

HYDROGEN CONSUMPTION-	.4726E-01	LB HYDROGEN/LB COAL
	.9131	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	51.99	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	71.33	PERCENT

RUN NO. 135

SAMPLE NO. 1

DATE 4 -25 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 4.690 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9468	LB/HR	COAL FED	766.0	GRAMS
HYDROGEN FLOW RATE	.8800	LB/HR	CHAR	217.0	GRAMS
HYDROGEN VELOCITY	.1986	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED MTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	36.40

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1060E-03	1.285	2.074
CARBON DIOXIDE	0.	0.	0.
METHANE	.4160E-02	88.02	81.39
ETHYLENE	0.	0.	0.
ETHANE	.2200E-04	.4967	.4304
BENZENE	.2500E-04	.6519	.4891
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1110E-03	0.	2.172
TOTAL		90.46	86.56

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.652	.918	0.	0.	0.	.489
HYDROCARBON GASES	88.5	498.	0.	0.	0.	81.8
CARBON OXIDES	1.28	0.	4.74	0.	0.	2.07
WATER	0.	5.85	7.72	0.	0.	2.17
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	20.1
TOTAL	90.5	511.	12.5	100.	100.	109.

HYDROGEN CONSUMPTION- .1521 LB HYDROGEN/LB COAL
2.939 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 62.42 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 100.1 PERCENT

RUN NO. 135

SAMPLE NO. 2

DATE 4 -25 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	7.030	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9468	LB/HR	COAL FED	766.0	GRAMS
HYDROGEN FLOW RATE	.8800	LB/HR	CHAR	217.0	GRAMS
HYDROGEN VELOCITY	.1986	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED MTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	36.40

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1100E-03	1.333	2.152
CARBON DIOXIDE	0.	0.	0.
METHANE	.3973E-02	84.07	77.73
ETHYLENE	0.	0.	0.
ETHANE	.1200E-04	.2709	.2348
BENZENE	.1100E-04	.2868	.2152
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1570E-03	0.	3.072
TOTAL		85.96	83.41

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.287	.404	0.	0.	0.	.215
HYDROCARBON GASES	84.3	475.	0.	0.	0.	78.0
CARBON OXIDES	1.33	0.	4.91	0.	0.	2.15
WATER	0.	8.27	10.9	0.	0.	3.07
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	20.1
TOTAL	86.0	490.	15.8	100.	100.	105.

HYDROGEN CONSUMPTION-	.1442	LB HYDROGEN/LB COAL
	2.787	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	61.93	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	99.37	PERCENT

RUN NO. 135 SAMPLE NO. 3 DATE 4 -25 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 9.370 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9468	LB/HR	COAL FED	766.0	GRAMS
HYDROGEN FLOW RATE	.8800	LB/HR	CHAR	217.0	GRAMS
HYDROGEN VELOCITY	.1986	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	36.40

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1660E-03	2.012	3.248
CARBON DIOXIDE	0.	0.	0.
METHANE	.3887E-02	82.25	76.05
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	.9000E-05	.2347	.1761
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2200E-04	0.	.4304
TOTAL		84.49	79.91

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.235	.330	0.	0.	0.	.176
HYDROCARBON GASES	82.2	463.	0.	0.	0.	76.1
CARBON OXIDES	2.01	0.	7.42	0.	0.	3.25
WATER	0.	1.16	1.53	0.	0.	.430
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR.	0.	0.	0.	0.	0.	20.1
TOTAL	84.5	471.	8.95	100.	100.	102.

HYDROGEN CONSUMPTION- .1373 LB HYDROGEN/LB COAL
 2.654 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 61.76 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 98.33 PERCENT

RUN NO. 136

SAMPLE NO. 1

DATE 4 -26 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	2.220	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.065	LB/HR	COAL FED	966.0	GRAMS
HYDROGEN FLOW RATE	1.060	LB/HR	CHAR	367.0	GRAMS
HYDROGEN VELOCITY	.2080	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	725.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	725.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	27.10

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1740E-03	2.259	3.647
CARBON DIOXIDE	0.	0.	0.
METHANE	.7390E-03	16.75	15.49
ETHYLENE	0.	0.	0.
ETHANE	.4060E-03	9.821	8.511
BENZENE	.1530E-03	4.274	3.207
TOLUENE	.3000E-04	.8289	.6289
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2300E-04	0.	.4821
TOTAL		33.94	31.97

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	5.10	7.35	0.	0.	0.	3.84
HYDROCARBON GASES	26.6	136.	0.	0.	0.	24.0
CARBON OXIDES	2.26	0.	8.33	0.	0.	3.65
WATER	0.	1.30	1.71	0.	0.	.482
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	30.9
TOTAL	33.9	151.	10.0	100.	100.	64.7

HYDROGEN CONSUMPTION-	.1883E-01	LB HYDROGEN/LB COAL
	.3638	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	33.94	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	45.67	PERCENT

RUN NO. 136 SAMPLE NO. 2 DATE 4 -26 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 4.440 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	1.065	LB/HR	COAL FED	966.0	GRAMS
HYDROGEN FLOW RATE	1.060	LB/HR	CHAR	367.0	GRAMS
HYDROGEN VELOCITY	.2080	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	725.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	725.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	27.10

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2020E-03	2.623	4.234
CARBON DIOXIDE	0.	0.	0.
METHANE	.1125E-02	25.50	23.58
ETHYLENE	0.	0.	0.
ETHANE	.5160E-03	12.48	10.82
BENZENE	.2520E-03	7.040	5.282
TOLUENE	.1000E-04	.2763	.2096
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		47.92	44.13

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	7.32	10.4	0.	0.	0.	5.49
HYDROCARBON GASES	38.0	196.	0.	0.	0.	34.4
CARBON OXIDES	2.62	0.	9.67	0.	0.	4.23
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	30.9
TOTAL	47.9	213.	9.67	100.	100.	76.9

HYDROGEN CONSUMPTION- .4186E-01 LB HYDROGEN/LB COAL
.8088 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 47.92 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 66.64 PERCENT

RUN NO. 136 SAMPLE NO. 3 DATE 4 -26 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 6.660 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	1.065	LB/HR	COAL FED	966.0	GRAMS
HYDROGEN FLOW RATE	1.060	LB/HR	CHAR	367.0	GRAMS
HYDROGEN VELOCITY	1.2080	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	725.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	725.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	82.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	27.10

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3600E-03	4.674	7.546
CARBON DIOXIDE	0.	0.	0.
METHANE	.8540E-03	19.36	17.90
ETHYLENE	0.	0.	0.
ETHANE	.4640E-03	11.22	9.726
BENZENE	.3000E-03	8.381	6.289
TOLUENE	.1000E-04	.2763	.2096
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.7500E-04	0.	1.572
TOTAL		43.91	43.24

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	8.66	12.2	0.	0.	0.	6.50
HYDROCARBON GASES	30.6	156.	0.	0.	0.	27.6
CARBON OXIDES	4.67	0.	17.2	0.	0.	7.55
WATER	0.	4.23	5.59	0.	0.	1.57
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	30.9
TOTAL	43.9	179.	22.8	100.	100.	76.0

HYDROGEN CONSUMPTION- .2935E-01 LB-HYDROGEN/LB COAL
.5672 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 43.91 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 56.28 PERCENT

RUN NO. 136

SAMPLE NO. 4

DATE 4 -26 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	8.870	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.065	LB/HR	COAL FED	966.0	GRAMS
HYDROGEN FLOW RATE	1.060	LB/HR	CHAR	367.0	GRAMS
HYDROGEN VELOCITY	.2080	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	725.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	725.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

COAL ANALYSIS, %

CARBON	62.10
HYDROGEN	3.700
OXYGEN	22.44
NITROGEN	.9500
SULFUR	.5100
ASH	10.30

CHAR ANALYSIS, %

0.
0.
0.
0.
0.
27.10

PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
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CARBON MONOXIDE	.3740E-03	4.856	7.840
CARBON DIOXIDE	0.	0.	0.
METHANE	.8730E-03	19.79	18.30
ETHYLENE	0.	0.	0.
ETHANE	.4820E-03	11.66	10.10
BENZENE	.3050E-03	8.520	6.393
TOLUENE	.7000E-05	.1934	.1467
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2300E-04	0.	.4821

TOTAL	45.02	43.27
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	8.71	12.3	0.	0.	0.	6.54
HYDROCARBON GASES	31.5	161.	0.	0.	0.	28.4
CARBON OXIDES	4.86	0.	17.9	0.	0.	7.84
WATER	0.	1.30	1.71	0.	0.	.482
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	30.9
TOTAL	45.0	181.	19.6	100.	100.	76.0

HYDROGEN CONSUMPTION-	.2987E-01	LB HYDROGEN/LB COAL
	.5771	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	45.02	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	57.74	PERCENT

RUN NO. 137

SAMPLE NO. 1

DATE 4 -27 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	2.260	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.010	LB/HR	COAL FED	878.0	GRAMS
HYDROGEN FLOW RATE	1.020	LB/HR	CHAR	304.0	GRAMS
HYDROGEN VELOCITY	.2252	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	29.80

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1000E-03	1.316	2.125
CARBON DIOXIDE	0.	0.	0.
METHANE	.1755E-02	40.34	37.30
ETHYLENE	0.	0.	0.
ETHANE	.3530E-03	8.658	7.503
BENZENE	.2590E-03	7.336	5.505
TOLUENE	.2400E-05	.6723E-01	.5101E-01
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1800E-04	0.	.3826
TOTAL		57.72	52.87

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	7.40	10.4	0.	0.	0.	5.56
HYDROCARBON GASES	49.0	264.	0.	0.	0.	44.8
CARBON OXIDES	1.32	0.	4.85	0.	0.	2.13
WATER	0.	1.03	1.36	0.	0.	.383
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	27.1
TOTAL	57.7	282.	6.21	100.	100.	81.9

HYDROGEN CONSUMPTION-	.6721E-01	LB HYDROGEN/LB COAL
	1.299	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	57.49	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	85.48	PERCENT

RUN NO. 137

SAMPLE NO. 2

DATE 4 -27 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
 CALCULATED 4.750 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.010	LB/HR	COAL FED	878.0	GRAMS
HYDROGEN FLOW RATE	.8320	LB/HR	CHAR	304.0	GRAMS
HYDROGEN VELOCITY	.1837	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

COAL ANALYSIS, %

CARBON	62.10
HYDROGEN	3.700
OXYGEN	22.44
NITROGEN	.9500
SULFUR	.5100
ASH	10.20

CHAR ANALYSIS, %

	0.
	0.
	0.
	0.
	0.
	29.80

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
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CARBON MONOXIDE	.1220E-03	1.310	2.115
CARBON DIOXIDE	0.	0.	0.
METHANE	.3240E-02	60.74	56.17
ETHYLENE	0.	0.	0.
ETHANE	.1520E-03	3.041	2.635
BENZENE	.6500E-04	1.502	1.127
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL		66.60	62.05
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.50	2.11	0.	0.	0.	1.13
HYDROCARBON GASES	63.8	355.	0.	0.	0.	58.8
CARBON OXIDES	1.31	0.	4.83	0.	0.	2.12
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	27.1
TOTAL	66.6	364.	4.83	100.	100.	91.0

HYDROGEN CONSUMPTION-	.9751E-01	LB HYDROGEN/LB COAL
	1.884	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	59.21	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	93.39	PERCENT

RUN NO. 137 SAMPLE NO. 3 DATE 4 -27 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 7.130 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED MTS.		
COAL FEED RATE	1.010	LB/HR	COAL FED	878.0	GRAMS
HYDROGEN FLOW RATE	.8320	LB/HR	CHAR	304.0	GRAMS
HYDROGEN VELOCITY	.1837	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	29.80

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONVE. TO PRODUCT	% MAF COAL CONVE. TO PRODUCT
CARBON MONOXIDE	.1840E-03	1.976	3.190
CARBON DIOXIDE	0.	0.	0.
METHANE	.3057E-02	57.31	53.00
ETHYLENE	0.	0.	0.
ETHANE	.6100E-04	1.220	1.058
BENZENE	.2700E-04	.6238	.4681
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.9500E-04	0.	1.647
TOTAL		61.13	59.36

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.624	.878	0.	0.	0.	.468
HYDROCARBON GASES	58.5	328.	0.	0.	0.	54.1
CARBON OXIDES	1.98	0.	7.28	0.	0.	3.19
WATER	0.	4.44	5.85	0.	0.	1.65
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	27.1
TOTAL	61.1	340.	13.1	100.	100.	88.3

HYDROGEN CONSUMPTION- .8869E-01 LB HYDROGEN/LB COAL
1.714 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 58.20 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 91.34 PERCENT

RUN NO. 137

SAMPLE NO. 4

DATE 4 -27 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	9.500	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.010	LB/HR	COAL FED	878.0	GRAMS
HYDROGEN FLOW RATE	.8320	LB/HR	CHAR	304.0	GRAMS
HYDROGEN VELOCITY	.1837	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

TOTAL ACCUMULATED WTS.

COAL ANALYSIS, %

CARBON	62.10
HYDROGEN	3.700
OXYGEN	22.44
NITROGEN	.9500
SULFUR	.5100
ASH	10.30

CHAR ANALYSIS, %

0.
0.
0.
0.
0.
29.80

PRODUCT CONC. IN
GAS, LB/C. FT% CARBON CONV.
TO PRODUCT% MAF COAL CONV.
TO PRODUCT

CARBON MONOXIDE	.3100E-03	3.329	5.374
CARBON DIOXIDE	0.	0.	0.
METHANE	.3048E-02	57.15	52.84
ETHYLENE	0.	0.	0.
ETHANE	.2600E-04	.5201	.4507
BENZENE	.1300E-04	.3003	.2254
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1600E-04	0.	.2774

TOTAL

61.29

59.17

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
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LIQUIDS	.300	.423	0.	0.	0.	.225
HYDROCARBON GASES	57.7	324.	0.	0.	0.	53.3
CARBON OXIDES	3.33	0.	12.3	0.	0.	5.37
WATER	0.	.747	.986	0.	0.	.277
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	27.1
TOTAL	61.3	332.	13.3	100.	100.	88.2

HYDROGEN CONSUMPTION-

.8571E-01
1.656

LB HYDROGEN/LB COAL
MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-

58.23

PERCENT

EFFECTIVE ENERGY EFFICIENCY-

89.63

PERCENT

RUN NO. 138

SAMPLE NO. 1

DATE 5 -9 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	1.900	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.070	LB/HR
HYDROGEN FLOW RATE	.9400	LB/HR
HYDROGEN VELOCITY	.3671	FT/SEC
REACTOR TEMP.	900.0	DEG C
PREHEAT TEMP.	900.0	DEG C
HYDROGEN PRESSURE	1500.	PSI

TOTAL ACCUMULATED WTS.

COAL FED	847.0	GRAMS
CHAR	276.0	GRAMS
LIGHT OILS	0.	GRAMS
BTX	0.	GRAMS
WATER	0.	GRAMS

COAL ANALYSIS, %

CARBON	62.10
HYDROGEN	3.700
OXYGEN	22.44
NITROGEN	.9500
SULFUR	.5100
ASH	10.30

CHAR ANALYSIS, %

0.
0.
0.
0.
0.
31.60

PRODUCT CONC. IN
GAS, LB/C. FT% CARBON CONV.
TO PRODUCT% MAF COAL CONV.
TO PRODUCT

CARBON MONOXIDE	.5300E-04	.6759	1.091
CARBON DIOXIDE	0.	0.	0.
METHANE	.2280E-02	45.61	42.17
ETHYLENE	0.	0.	0.
ETHANE	.6200E-04	1.323	1.147
BENZENE	.1020E-03	2.514	1.887
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL

50.12

46.30

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	2.51	3.54	0.	0.	0.	1.89
HYDROCARBON GASES	46.9	263.	0.	0.	0.	43.3
CARBON OXIDES	.676	0.	2.49	0.	0.	1.09
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	24.8
TOTAL	50.1	272.	2.49	100.	100.	73.0

HYDROGEN CONSUMPTION-

.6390E-01
1.233

LB HYDROGEN/LB COAL
MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-

50.12

PERCENT

EFFECTIVE ENERGY EFFICIENCY-

79.00

PERCENT

RUN NO. 138

SAMPLE NO. 2

DATE 5 -9 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.1	SECONDS
CALCULATED	3.800	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.070	LB/HR	TOTAL ACCUMULATED WTS.	
HYDROGEN FLOW RATE	.9400	LB/HR	COAL FED	847.0 GRAMS
HYDROGEN VELOCITY	.3671	FT/SEC	CHAR	276.0 GRAMS
REACTOR TEMP.	900.0	DEG C	LIGHT OILS	0. GRAMS
PREHEAT TEMP.	900.0	DEG C	BTX	0. GRAMS
HYDROGEN PRESSURE	1500.	PSI	WATER	0. GRAMS

COAL ANALYSIS, %

CHAR ANALYSIS, %

CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.60

PRODUCT CONC. IN	% CARBON CONV.	% MAF COAL CONV.
GAS, LB/C. FT	TO PRODUCT	TO PRODUCT

CARBON MONOXIDE	.5500E-04	.6301	1.017
CARBON DIOXIDE	0.	0.	0.
METHANE	.2620E-02	52.41	48.46
ETHYLENE	0.	0.	0.
ETHANE	.3400E-04	.7257	.6289
BENZENE	.3800E-04	.9367	.7029
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	54.70	50.81
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.937	1.32	0.	0.	0.	.703
HYDROCARBON GASES	53.1	298.	0.	0.	0.	49.1
CARBON OXIDES	.630	0.	2.32	0.	0.	1.02
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	24.8
TOTAL	54.7	306.	2.32	100.	100.	77.5

HYDROGEN CONSUMPTION-	.7632E-01	LB HYDROGEN/LB COAL
	1.473	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	54.70	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	87.58	PERCENT

RUN NO. 138

SAMPLE NO. 3

DATE 5 -9 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	5.710	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.070	LB/HR	COAL FED	847.0	GRAMS
HYDROGEN FLOW RATE	.9750	LB/HR	CHAR	276.0	GRAMS
HYDROGEN VELOCITY	.3671	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.60

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.5700E-04	.6774	1.094
CARBON DIOXIDE	0.	0.	0.
METHANE	.2370E-02	49.17	45.47
ETHYLENE	0.	0.	0.
ETHANE	.2900E-04	.6421	.5564
BENZENE	.2900E-04	.7415	.5564
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		51.24	47.68

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.741	1.04	0.	0.	0.	.556
HYDROCARBON GASES	49.8	280.	0.	0.	0.	46.0
CARBON OXIDES	.677	0.	2.50	0.	0.	1.09
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	24.8
TOTAL	51.2	287.	2.50	100.	100.	74.4

HYDROGEN CONSUMPTION-	.6924E-01	LB HYDROGEN/LB COAL
	1.338	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	51.24	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	81.97	PERCENT

RUN NO. 138

SAMPLE NO. 4

DATE 5 -9 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	7.610	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.070	LB/HR	TOTAL ACCUMULATED MTS.	
HYDROGEN FLOW RATE	1.9750	LB/HR	COAL FED	847.0 GRAMS
HYDROGEN VELOCITY	.3671	FT/SEC	CHAR	276.0 GRAMS
REACTOR TEMP.	900.0	DEG C	LIGHT OILS	0. GRAMS
PREHEAT TEMP.	900.0	DEG C	BTX	0. GRAMS
HYDROGEN PRESSURE	1500.	PSI	WATER	0. GRAMS

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	82.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.60

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1400E-03	1.664	2.686
CARBON DIOXIDE	0.	0.	0.
METHANE	.1998E-02	41.33	38.22
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	.2700E-04	.6903	.5180
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		43.69	41.42

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.690	.972	0.	0.	0.	.518
HYDROCARBON GASES	41.3	233.	0.	0.	0.	38.2
CARBON OXIDES	1.66	0.	6.13	0.	0.	2.69
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.961	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	24.8
TOTAL	43.7	240.	6.13	100.	100.	68.2

HYDROGEN CONSUMPTION-	.5186E-01	LB HYDROGEN/LB COAL
	1.002	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	43.69	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	68.21	PERCENT

RUN NO. 139

SAMPLE NO. 1

DATE 5 -10 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	2.000	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9495	LB/HR	COAL FED	681.0	GRAMS
HYDROGEN FLOW RATE	1.005	LB/HR	CHAR	225.0	GRAMS
HYDROGEN VELOCITY	.2897	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.20

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3800E-04	.5245	.8467
CARBON DIOXIDE	0.	0.	0.
METHANE	.2712E-02	65.35	60.43
ETHYLENE	0.	0.	0.
ETHANE	.5200E-04	1.337	1.159
BENZENE	.1020E-03	3.029	2.273
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		70.24	64.71

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	3.03	4.26	0.	0.	0.	2.27
HYDROCARBON GASES	66.7	374.	0.	0.	0.	61.6
CARBON OXIDES	.524	0.	1.93	0.	0.	.847
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.3
TOTAL	70.2	384.	1.93	100.	100.	91.9

HYDROGEN CONSUMPTION-	.1052	LB HYDROGEN/LB COAL
	2.034	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	59.82	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	95.21	PERCENT

RUN NO. 139

SAMPLE NO. 2

DATE 5 -10 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 4.010 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9495	LB/HR	COAL FED	681.0	GRAMS
HYDROGEN FLOW RATE	1.005	LB/HR	CHAR	225.0	GRAMS
HYDROGEN VELOCITY	.2897	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.20

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.4600E-04	.6349	1.025
CARBON DIOXIDE	0.	0.	0.
METHANE	.2963E-02	71.40	66.02
ETHYLENE	0.	0.	0.
ETHANE	.2500E-04	.6428	.5571
BENZENE	.1400E-04	.4157	.3120
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		73.10	67.92

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.416	.585	0.	0.	0.	.312
HYDROCARBON GASES	72.0	405.	0.	0.	0.	66.6
CARBON OXIDES	.635	0.	2.34	0.	0.	1.03
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.3
TOTAL	73.1	412.	2.34	100.	100.	95.1

HYDROGEN CONSUMPTION- .1154 LB HYDROGEN/LB COAL
2.230 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 60.26 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 97.20 PERCENT

RUN NO. 139 SAMPLE NO. 3 DATE 5 -10 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 6.020 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9495	LB/HR	COAL FED	681.0	GRAMS
HYDROGEN FLOW RATE	1.005	LB/HR	CHAR	225.0	GRAMS
HYDROGEN VELOCITY	.2897	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.20

	PRODUCT, CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3500E-04	.4830	.7799
CARBON DIOXIDE	0.	0.	0.
METHANE	.2701E-02	65.09	60.19
ETHYLENE	0.	0.	0.
ETHANE	.2400E-04	.6171	.5348
BENZENE	.8000E-05	.2376	.1783
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL 66.43 61.68

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.238	.334	0.	0.	0.	.178
HYDROCARBON GASES	65.7	369.	0.	0.	0.	60.7
CARBON OXIDES	.483	0.	1.78	0.	0.	.780
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.3
TOTAL	66.4	376.	1.78	100.	100.	88.9

HYDROGEN CONSUMPTION- .1021 LB HYDROGEN/LB COAL
1.973 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 59.18 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 95.67 PERCENT

RUN NO. 139

SAMPLE NO. 4

DATE 5 -10 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	8.030	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9495	LB/HR	TOTAL ACCUMULATED WTS.	
HYDROGEN FLOW RATE	1.005	LD/HR	COAL FED	681.0 GRAMS
HYDROGEN VELOCITY	.2897	FT/SEC	CHAR	225.0 GRAMS
REACTOR TEMP.	900.0	DEG C	LIGHT OILS	0. GRAMS
PREHEAT TEMP.	900.0	DEG C	BTX	0. GRAMS
HYDROGEN PRESSURE	2000.	PSI	WATER	0. GRAMS

COAL ANALYSIS, %

CHAR ANALYSIS, %

CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.20

PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
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CARBON MONOXIDE	.9000E-04	1.242	2.005
CARBON DIOXIDE	0.	0.	0.
METHANE	.2467E-02	59.45	54.97
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	0.	0.	0.
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	60.69	56.98
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	0.	0.	0.	0.	0.	0.
HYDROCARBON GASES	59.4	335.	0.	0.	0.	55.0
CARBON OXIDES	1.24	0.	4.58	0.	0.	2.01
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.3
TOTAL	60.7	341.	4.58	100.	100.	84.2

HYDROGEN CONSUMPTION-	.8927E-01	LB HYDROGEN/LB COAL
	1.725	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	58.11	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	92.93	PERCENT

RUN NO. 140

SAMPLE NO. 1

DATE 5 -11 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 1.980 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9799	LB/HR	COAL FED	755.0	GRAMS
HYDROGEN FLOW RATE	1.045	LB/HR	CHAR	232.0	GRAMS
HYDROGEN VELOCITY	.12948	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	33.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.5800E-04	.8065	1.302
CARBON DIOXIDE	0.	0.	0.
METHANE	.2100E-02	50.99	47.15
ETHYLENE	0.	0.	0.
ETHANE	.1330E-03	3.446	2.986
BENZENE	.1250E-03	3.740	2.806
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	58.98	54.24
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	3.74	5.27	0.	0.	0.	2.81
HYDROCARBON GASES	54.4	302.	0.	0.	0.	50.1
CARBON OXIDES	.807	0.	2.97	0.	0.	1.30
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	22.8
TOTAL	59.0	313.	2.97	100.	100.	78.9

HYDROGEN CONSUMPTION- .7896E-01 LB HYDROGEN/LB COAL
1.526 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 57.76 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 90.16 PERCENT

RUN NO. 140 SAMPLE NO. 2 DATE 5 -11 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 3.870 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9799	LB/HR	COAL FED	755.0	GRAMS
HYDROGEN FLOW RATE	1.045	LB/HR	CHAR	232.0	GRAMS
HYDROGEN VELOCITY	.2948	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	33.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3100E-04	.4311	.6960
CARBON DIOXIDE	0.	0.	0.
METHANE	.2655E-02	64.46	59.61
ETHYLENE	0.	0.	0.
ETHANE	.7300E-04	1.891	1.639
BENZENE	.4500E-04	1.346	1.010
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL 68.13 62.95

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.35	1.90	0.	0.	0.	1.01
HYDROCARBON GASES	66.4	371.	0.	0.	0.	61.2
CARBON OXIDES	.431	0.	1.59	0.	0.	.696
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	22.8
TOTAL	68.1	379.	1.59	100.	100.	87.6

HYDROGEN CONSUMPTION- .1034 LB HYDROGEN/LB COAL
1.998 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 59.47 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 95.43 PERCENT

RUN NO. 140 SAMPLE NO. 3 DATE 5 -11 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 5.950 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9799	LB/HR	COAL FED	755.0	GRAMS
HYDROGEN FLOW RATE	1.045	LB/HR	CHAR	232.0	GRAMS
HYDROGEN VELOCITY	.2948	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	33.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1150E-03	1.599	2.582
CARBON DIOXIDE	0.	0.	0.
METHANE	.2615E-02	63.49	58.71
ETHYLENE	0.	0.	0.
ETHANE	.3000E-04	.7772	.6735
BENZENE	.2500E-04	.7480	.5613
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL 66.61 62.52

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.748	1.05	0.	0.	0.	.561
HYDROCARBON GASES	64.3	361.	0.	0.	0.	59.4
CARBON OXIDES	1.60	0.	5.89	0.	0.	2.58
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	22.8
TOTAL	66.6	368.	5.89	100.	100.	87.2

HYDROGEN CONSUMPTION- .9930E-01 LB HYDROGEN/LB COAL
1.919 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 59.22 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 93.82 PERCENT,

RUN NO. 140

SAMPLE NO. 4

DATE 5 -11 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 7.940 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9799	LB/HR	COAL FED	755.0	GRAMS
HYDROGEN FLOW RATE	1.045	LB/HR	CHAR	232.0	GRAMS
HYDROGEN VELOCITY	.2948	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	33.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1420E-03	1.975	3.188
CARBON DIOXIDE	0.	0.	0.
METHANE	.2550E-02	61.91	57.25
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	.1200E-04	.3590	.2694
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		64.25	60.71

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.359	.506	0.	0.	0.	.269
HYDROCARBON GASES	61.9	349.	0.	0.	0.	57.2
CARBON OXIDES	1.97	0.	7.28	0.	0.	3.19
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	22.8
TOTAL	64.2	356.	7.28	100.	100.	85.4

HYDROGEN CONSUMPTION- .9459E-01 LB HYDROGEN/LB COAL
1.828 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 58.79 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 92.85 PERCENT

RUN NO. 141

SAMPLE NO. 1

DATE 5 -16 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
 CALCULATED 1.740 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9839	LB/HR	COAL FED	1012.	GRAMS
HYDROGEN FLOW RATE	.7350	LB/HR	CHAR	175.0	GRAMS
HYDROGEN VELOCITY	.4238	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	68.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	59.60

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3460E-03	3.370	5.441
CARBON DIOXIDE	0.	0.	0.
METHANE	.2190E-02	37.25	34.44
ETHYLENE	0.	0.	0.
ETHANE	.5600E-04	1.016	.8807
BENZENE	.1550E-03	3.249	2.438
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL 44.88 43.20

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	3.25	4.57	0.	0.	0.	2.44
HYDROCARBON GASES	38.3	214.	0.	0.	0.	35.3
CARBON OXIDES	3.37	0.	12.4	0.	0.	5.44
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	7.79
TOTAL	44.9	225.	12.4	100.	100.	52.9

HYDROGEN CONSUMPTION- .4627E-01 LB HYDROGEN/LB COAL
 .8942 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 44.88 PERCENT
 EFFECTIVE ENERGY EFFICIENCY- 65.70 PERCENT

RUN NO. 141 SAMPLE NO. 2 DATE 5 -16 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 3.490 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9839	LB/HR	COAL FED	1012.	GRAMS
HYDROGEN FLOW RATE	.7350	LB/HR	CHAR	175.0	GRAMS
HYDROGEN VELOCITY	.4238	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	59.60

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2510E-03	2.445	3.947
CARBON DIOXIDE	0.	0.	0.
METHANE	.2740E-02	46.60	43.09
ETHYLENE	0.	0.	0.
ETHANE	.5700E-04	1.034	.8964
BENZENE	.8200E-04	1.719	1.290
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		51.80	49.22

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.72	2.42	0.	0.	0.	1.29
HYDROCARBON GASES	47.6	267.	0.	0.	0.	44.0
CARBON OXIDES	2.44	0.	9.01	0.	0.	3.95
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	7.79
TOTAL	51.8	276.	9.01	100.	100.	58.9

HYDROGEN CONSUMPTION- .6500E-01 LB HYDROGEN/LB COAL
1.256 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 51.80 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 79.37 PERCENT

RUN NO. 141

SAMPLE NO. 3

DATE 5 -16 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	5.230	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9839	LB/HR	COAL FED	1012.	GRAMS
HYDROGEN FLOW RATE	.7350	LB/HR	CHAR	175.0	GRAMS
HYDROGEN VELOCITY	.4238	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED MTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	59.60

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3700E-03	3.604	5.819
CARBON DIOXIDE	0.	0.	0.
METHANE	.2610E-02	44.39	41.05
ETHYLENE	0.	0.	0.
ETHANE	.3700E-04	.6715	.5819
BENZENE	.8000E-04	1.677	1.258
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	50.34	48.71
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.68	2.36	0.	0.	0.	1.26
HYDROCARBON GASES	45.1	253.	0.	0.	0.	41.6
CARBON OXIDES	3.60	0.	13.3	0.	0.	5.82
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	7.79
TOTAL	50.3	262.	13.3	100.	100.	58.4

HYDROGEN CONSUMPTION-	.5980E-01	LB HYDROGEN/LB COAL
	1.156	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	50.34	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	75.20	PERCENT

RUN NO. 141 SAMPLE NO. 4 DATE 5 -16 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 6.970 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9839	LB/HR	COAL FED	1012.	GRAMS
HYDROGEN FLOW RATE	.7350	LB/HR	CHAR	175.0	GRAMS
HYDROGEN VELOCITY	.4238	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	59.60

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.5300E-03	5.163	8.335
CARBON DIOXIDE	0.	0.	0.
METHANE	.2270E-02	38.61	35.70
ETHYLENE	0.	0.	0.
ETHANE	.1300E-04	.2359	.2044
BENZENE	.6300E-04	1.320	.9908
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		45.33	45.23

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.32	1.86	0.	0.	0.	.991
HYDROCARBON GASES	38.8	218.	0.	0.	0.	35.9
CARBON OXIDES	5.16	0.	19.0	0.	0.	8.34
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	7.79
TOTAL	45.3	227.	19.0	100.	100.	54.9

HYDROGEN CONSUMPTION- .4688E-01 LB HYDROGEN/LB COAL
 .9060 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 45.33 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 64.77 PERCENT

RUN NO. 141 SAMPLE NO. 5 DATE 5 -16 -1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 1.390 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9889	LB/HR	COAL FED	1012.	GRAMS
HYDROGEN FLOW RATE	1.240	LB/HR	CHAR	175.0	GRAMS
HYDROGEN VELOCITY	.7150	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	59.60

	PRODUCT CONC. IN GAS, LB/CU FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1250E-03	2.054	3.317
CARBON DIOXIDE	0.	0.	0.
METHANE	.9970E-03	28.61	26.45
ETHYLENE	0.	0.	0.
ETHANE	.9600E-04	2.939	2.547
BENZENE	.1350E-03	4.773	3.582
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		38.37	35.90

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.77	6.72	0.	0.	0.	3.58
HYDROCARBON GASES	31.5	174.	0.	0.	0.	29.0
CARBON OXIDES	2.05	0.	7.57	0.	0.	3.32
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	7.79
TOTAL	38.4	187.	7.57	100.	100.	45.6

HYDROGEN CONSUMPTION- .3206E-01 LB HYDROGEN/LB COAL
 .6196 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 38.37 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 55.92 PERCENT

RUN-NO. 141 SAMPLE NO. 6 DATE 5 -16 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.780 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9839	LB/HR	COAL FED	1012.	GRAMS
HYDROGEN FLOW RATE	1.340	LB/HR	CHAR.	175.0	GRAMS
HYDROGEN VELOCITY	.7150	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	59.60

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1170E-03	1.923	3.104
CARBON DIOXIDE	0.	0.	0.
METHANE	.1435E-02	41.18	38.07
ETHYLENE	0.	0.	0.
ETHANE	.3500E-04	1.072	.9286
BENZENE	.7100E-04	2.510	1.884
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		46.68	43.99

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	2.51	3.53	0.	0.	0.	1.88
HYDROCARBON GASES	42.2	236.	0.	0.	0.	39.0
CARBON OXIDES	1.92	0.	7.09	0.	0.	3.10
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	7.79
TOTAL	46.7	246.	7.09	100.	100.	53.7

HYDROGEN CONSUMPTION- .5416E-01 LB HYDROGEN/LB COAL
 1.047 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 46.68 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 71.40 PERCENT

RUN NO. 142

SAMPLE NO. 1

DATE 5 -17 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	2.040	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.210	LB/HR	COAL FED	914.0	GRAMS
HYDROGEN FLOW RATE	.7700	LB/HR	CHAR	486.0	GRAMS
HYDROGEN VELOCITY	.2960	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

TOTAL ACCUMULATED WTS.

COAL ANALYSIS, %

CARBON	62.10
HYDROGEN	3.700
OXYGEN	22.44
NITROGEN	.9500
SULFUR	.5100
ASH	10.30

CHAR ANALYSIS, %

0.
0.
0.
0.
0.
19.40

PRODUCT CONC. IN
GAS, LB/C. FT% CARBON CONV.
TO PRODUCT% MAF COAL CONV.
TO PRODUCT

CARBON MONOXIDE	.1640E-03	1.361	2.197
CARBON DIOXIDE	0.	0.	0.
METHANE	.2518E-02	36.48	33.73
ETHYLENE	0.	0.	0.
ETHANE	.5500E-04	.8503	.7368
BENZENE	.1090E-03	1.946	1.460
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	40.64	38.13
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.95	2.74	0.	0.	0.	1.46
HYDROCARBON GASES	37.3	209.	0.	0.	0.	34.5
CARBON OXIDES	1.36	0.	5.02	0.	0.	2.20
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	47.8
TOTAL	40.6	218.	5.02	100.	100.	87.8

HYDROGEN CONSUMPTION-	.4374E-01	LB HYDROGEN/LB COAL
	.8451	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	40.64	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	62.83	PERCENT

RUN NO. 142 SAMPLE NO. 2 DATE 5 -17 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 4.080 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	1.210	LB/HR	COAL FED	914.0	GRAMS
HYDROGEN FLOW RATE	.7700	LB/HR	CHAR	486.0	GRAMS
HYDROGEN VELOCITY	.2960	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	19.40

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1230E-03	1.021	1.648
CARBON DIOXIDE	0.	0.	0.
METHANE	.3282E-02	47.55	43.97
ETHYLENE	0.	0.	0.
ETHANE	.4500E-04	.6957	.6028
BENZENE	.4500E-04	.8034	.6028
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL 50.07 46.82

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.803	1.13	0.	0.	0.	.603
HYDROCARBON GASES	48.2	271.	0.	0.	0.	44.6
CARBON OXIDES	1.02	0.	3.76	0.	0.	1.65
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	47.8
TOTAL	50.1	278.	3.76	100.	100.	96.5

HYDROGEN CONSUMPTION- .6597E-01 LB HYDROGEN/LB COAL
1.275 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 50.07 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 79.46 PERCENT

RUN NO. 142 SAMPLE NO. 3 DATE 5 -17 -1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 6.120 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	1.210	LB/HR	COAL FED	914.0	GRAMS
HYDROGEN FLOW RATE	.7700	LB/HR	CHAR	486.0	GRAMS
HYDROGEN VELOCITY	.2960	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.130	19.40

	PRODUCT CONC. IN GAS, LB/C: FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2700E-03	2.240	3.617
CARBON DIOXIDE	0.	0.	0.
METHANE	.3310E-02	47.95	44.34
ETHYLENE	0.	0.	0.
ETHANE	.2500E-04	.3865	.3349
BENZENE	.2800E-04	.4999	.3751
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL 51.08 48.67

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.500	.704	0.	0.	0.	.375
HYDROCARBON GASES	48.3	272.	0.	0.	0.	44.7
CARBON OXIDES	2.24	0.	8.26	0.	0.	3.62
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	47.8
TOTAL	51.1	279.	8.26	100.	100.	98.3

HYDROGEN CONSUMPTION- .6618E-01 LB HYDROGEN/LB COAL
1.279 MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION- 51.08 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 79.37 PERCENT

RUN NO. 142

SAMPLE NO. 4

DATE 5 -17 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0.7 SECONDS
CALCULATED 8.160 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	1.210	LB/HR	COAL FED	914.0	GRAMS
HYDROGEN FLOW RATE	.7700	LB/HR	CHAR	486.0	GRAMS
HYDROGEN VELOCITY	.2960	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	19.40

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3000E-03	2.489	4.019
CARBON DIOXIDE	0.	0.	0.
METHANE	.3050E-02	44.19	40.86
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	.1400E-04	.2499	.1876
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	46.93	45.07
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.250	.352	0.	0.	0.	.188
HYDROCARBON GASES	44.2	249.	0.	0.	0.	40.9
CARBON OXIDES	2.49	0.	9.18	0.	0.	4.02
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	47.8
TOTAL	46.9	256.	9.18	100.	100.	94.7

HYDROGEN CONSUMPTION-	.5759E-01	LB HYDROGEN/LB COAL
	1.113	MOLE HYDROGEN/MOLE CARBON

EFFECTIVE CARBON CONVERSION-	46.93	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	72.41	PERCENT

RUN NO. 143

SAMPLE NO. 2

DATE 5 -18 - 1978

COAL TYPE- NEW MEXICO SUB-BITUMINOUS

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 4.040 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.8582	LB/HR	COAL FED	629.0	GRAMS
HYDROGEN FLOW RATE	.9450	LB/HR	CHAR	272.0	GRAMS
HYDROGEN VELOCITY	.2608	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	64.21	0.
HYDROGEN	4.860	0.
OXYGEN	12.26	0.
NITROGEN	1.410	0.
SULFUR	.6100	0.
ASH	16.65	38.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1350E-03	1.875	3.368
CARBON DIOXIDE	0.	0.	0.
METHANE	.1949E-02	47.25	48.62
ETHYLENE	0.	0.	0.
ETHANE	.1280E-03	3.311	3.193
BENZENE	.7000E-04	2.091	1.746
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		54.53	56.93

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	2.09	2.32	0.	0.	0.	1.75
HYDROCARBON GASES	50.6	221.	0.	0.	0.	51.8
CARBON OXIDES	1.87	0.	13.1	0.	0.	3.37
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	6.22	0.	100.	0.	2.05
HYDROGEN SULFIDE	0.	.784	0.	0.	100.	.778
CHAR	0.	0.	0.	0.	0.	31.9
TOTAL	54.5	230.	13.1	100.	100.	91.7

HYDROGEN CONSUMPTION- .6312E-01 LB HYDROGEN/LB COAL
1.180 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5282 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 54.53 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 86.87 PERCENT

RUN NO. 143

SAMPLE NO. 3

DATE 5 -18 - 1978

COAL TYPE- NEW MEXICO SUB-BITUMINOUS

COAL RESIDENCE TIME-MEASURED 0. SECONDS
 CALCULATED 6.060 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.8582	LB/HR	COAL FED	629.0	GRAMS
HYDROGEN FLOW RATE	.9450	LB/HR	CHAR	272.0	GRAMS
HYDROGEN VELOCITY	.2608	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	64.21	0.
HYDROGEN	4.860	0.
OXYGEN	12.26	0.
NITROGEN	1.410	0.
SULFUR	.6100	0.
ASH	16.65	38.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2270E-03	3.152	5.663
CARBON DIOXIDE	0.	0.	0.
METHANE	.2130E-02	51.64	53.13
ETHYLENE	0.	0.	0.
ETHANE	.5700E-04	1.475	1.422
BENZENE	.3100E-04	.9261	.7733
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		57.19	60.99

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.926	1.03	0.	0.	0.	.773
HYDROCARBON GASES	53.1	234.	0.	0.	0.	54.6
CARBON OXIDES	3.15	0.	22.0	0.	0.	5.66
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	6.22	0.	100.	0.	2.05
HYDROGEN SULFIDE	0.	.784	0.	0.	100.	.778
CHAR	0.	0.	0.	0.	0.	31.9
TOTAL	57.2	242.	22.0	100.	100.	95.7

HYDROGEN CONSUMPTION- .6898E-01 LB HYDROGEN/LB COAL
 1.289 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5399 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 57.19 PERCENT
 EFFECTIVE ENERGY EFFICIENCY- 90.33 PERCENT

RUN NO. 143 SAMPLE NO. 4 DATE 5 -18 -1978

COAL TYPE- NEW MEXICO SUB-BITUMINOUS

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 8.090 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.8582	LB/HR	COAL FED	629.0	GRAMS
HYDROGEN FLOW RATE	.9450	LB/HR	CHAR	272.0	GRAMS
HYDROGEN VELOCITY	.2608	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	64.21	0.
HYDROGEN	4.860	0.
OXYGEN	12.26	0.
NITROGEN	1.410	0.
SULFUR	.6100	0.
ASH	16.65	38.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2600E-03	3.610	6.486
CARBON DIOXIDE	0.	0.	0.
METHANE	.2130E-02	51.64	53.13
ETHYLENE	0.	0.	0.
ETHANE	.5400E-04	1.397	1.347
BENZENE	.2100E-04	.6274	.5239
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
 TOTAL		57.28	61.49

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.627	.695	0.	0.	0.	.524
HYDROCARBON GASES	53.0	234.	0.	0.	0.	54.5
CARBON OXIDES	3.61	0.	25.2	0.	0.	6.49
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	6.22	0.	100.	0.	2.05
HYDROGEN SULFIDE	0.	.784	0.	0.	100.	.778
CHAR	0.	0.	0.	0.	0.	31.9
 TOTAL	57.3	241.	25.2	100.	100.	96.2

HYDROGEN CONSUMPTION- .6869E-01 LB HYDROGEN/LB COAL
1.284 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5330 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 57.28 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 89.89 PERCENT

RUN NO. 144

SAMPLE NO. 1

DATE 5 -24 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE + FE-TI HYDRIDE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	1.520	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.2222	LB/HR	COAL FED	121.0	GRAMS
HYDROGEN FLOW RATE	1.170	LB/HR	CHAR	73.70	GRAMS
HYDROGEN VELOCITY	.5883	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	750.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	750.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED MTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	16.90

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3200E-04	2.197	3.548
CARBON DIOXIDE	0.	0.	0.
METHANE	.7900E-04	9.472	8.759
ETHYLENE	0.	0.	0.
ETHANE	.3300E-04	4.222	3.659
BENZENE	.1500E-04	2.216	1.663
TOLUENE	.5000E-05	.7306	.5543
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		18.84	18.18

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	2.95	4.30	0.	0.	0.	2.22
HYDROCARBON GASES	13.7	71.2	0.	0.	0.	12.4
CARBON OXIDES	2.20	0.	8.10	0.	0.	3.55
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	56.4
TOTAL	18.8	81.9	8.10	100.	100.	76.5

HYDROGEN CONSUMPTION-	-.6713E-02	LB HYDROGEN/LB COAL
	-.1297	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.5666	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	18.84	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	23.74	PERCENT

RUN NO. 144

SAMPLE NO. 2

DATE 5 -24 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE + FE-TI HYDRIDE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 3.050 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.2222	LB/HR	COAL FED	121.0	GRAMS
HYDROGEN FLOW RATE	1.170	LB/HR	CHAR	73.70	GRAMS
HYDROGEN VELOCITY	.5883	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	750.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	750.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED WTS.

COAL ANALYSIS, %

CARBON	62.10
HYDROGEN	3.700
OXYGEN	22.44
NITROGEN	.9500
SULFUR	.5100
ASH	10.30

CHAR ANALYSIS, %

0.
0.
0.
0.
0.
16.90

PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
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CARBON MONOXIDE	.5900E-04	4.051	6.541
CARBON DIOXIDE	0.	0.	0.
METHANE	.8700E-04	10.43	9.645
ETHYLENE	0.	0.	0.
ETHANE	.3800E-04	4.862	4.213
BENZENE	.2500E-04	3.694	2.772
TOLUENE	.3000E-05	.4384	.3326
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	23.48	23.50
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.13	5.91	0.	0.	0.	3.10
HYDROCARBON GASES	15.3	79.3	0.	0.	0.	13.9
CARBON OXIDES	4.05	0.	14.9	0.	0.	6.54
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	56.4
TOTAL	23.5	91.6	14.9	100.	100.	81.8

HYDROGEN CONSUMPTION- -.3118E-02 LB HYDROGEN/LB COAL
-.6025E-01 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5355 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 23.48 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 27.78 PERCENT

RUN NO. 144

SAMPLE NO. 3

DATE 5 -24 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE + FE-TI HYDRIDE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	4.570	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.2222	LB/HR	COAL FED	121.0	GRAMS
HYDROGEN FLOW RATE	1.170	LB/HR	CHAR	73.70	GRAMS
HYDROGEN VELOCITY	.5883	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	750.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	750.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED MTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	16.90

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.5000E-04	3.433	5.543
CARBON DIOXIDE	0.	0.	0.
METHANE	.9500E-04	11.39	10.53
ETHYLENE	0.	0.	0.
ETHANE	.4400E-04	5.629	4.878
BENZENE	.3000E-04	4.432	3.326
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	24.89	24.28
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.43	6.24	0.	0.	0.	3.33
HYDROCARBON GASES	17.0	87.9	0.	0.	0.	15.4
CARBON OXIDES	3.43	0.	12.7	0.	0.	5.54
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	56.4
TOTAL	24.9	101.	12.7	100.	100.	82.6

HYDROGEN CONSUMPTION-	.2049E-03	LB HYDROGEN/LB COAL
	.3959E-02	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.5524	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	24.89	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	31.21	PERCENT

RUN NO. 145

SAMPLE NO. 1

DATE 5 -25 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.040 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.8305	LB/HR	COAL FED	828.0	GRAMS
HYDROGEN FLOW RATE	.9450	LB/HR	CHAR	275.0	GRAMS
HYDROGEN VELOCITY	.2724	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.00

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	0.	0.	0.
CARBON DIOXIDE	0.	0.	0.
METHANE	.1890E-02	48.96	45.28
ETHYLENE	0.	0.	0.
ETHANE	.4300E-04	1.189	1.030
BENZENE	.6900E-04	2.203	1.653
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		52.35	47.96

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	2.20	3.10	0.	0.	0.	1.65
HYDROCARBON GASES	50.2	281.	0.	0.	0.	46.3
CARBON OXIDES	0.	0.	0.	0.	0.	0.
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.5
TOTAL	52.4	290.	0.	100.	100.	75.4

HYDROGEN CONSUMPTION- .7042E-01 LB HYDROGEN/LB COAL
1.361 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.8648 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 52.35 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 83.95 PERCENT

RUN NO. 145

SAMPLE NO. 2

DATE 5 -25 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	4.090	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.8305	LB/HR	COAL FED	828.0	GRAMS
HYDROGEN FLOW RATE	.9450	LB/HR	CHAR	275.0	GRAMS
HYDROGEN VELOCITY	.2724	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.00

	PRODUCT CONC. IN GAS, LB/C. FT.	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2500E-04	.3709	.5989
CARBON DIOXIDE	0.	0.	0.
METHANE	.2150E-02	55.70	51.50
ETHYLENE	0.	0.	0.
ETHANE	.2400E-04	.6634	.5749
BENZENE	.1500E-04	.4789	.3593
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		57.21	53.04

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.479	.674	0.	0.	0.	.359
HYDROCARBON GASES	56.4	317.	0.	0.	0.	52.1
CARBON OXIDES	.371	0.	1.37	0.	0.	.599
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.5
TOTAL	57.2	324.	1.37	100.	100.	80.5

HYDROGEN CONSUMPTION-	.8274E-01	LB HYDROGEN/LB COAL
	1.599	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.9162	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	57.21	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	92.38	PERCENT

RUN NO. 145 SAMPLE NO. 3 DATE 5 -25 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 6.130 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.8305	LB/HR	COAL FED	828.0	GRAMS
HYDROGEN FLOW RATE	.9450	LB/HR	CHAR	275.0	GRAMS
HYDROGEN VELOCITY	.2724	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.00	31.00

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3600E-04	.5341	.8624
CARBON DIOXIDE	0.	0.	0.
METHANE	.1950E-02	50.52	46.71
ETHYLENE	0.	0.	0.
ETHANE	.2000E-04	.5529	.4791
BENZENE	.1100E-04	.3512	.2635
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		51.96	48.32

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.351	.494	0.	0.	0.	.264
HYDROCARBON GASES	51.1	287.	0.	0.	0.	47.2
CARBON OXIDES	.534	0.	1.97	0.	0.	.862
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.5
TOTAL	52.0	294.	1.97	100.	100.	75.8

HYDROGEN CONSUMPTION- .7170E-01 LB HYDROGEN/LB COAL
1.385 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.8748 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 51.96 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 83.62 PERCENT

RUN NO. 145

SAMPLE NO. 4

DATE 5 -25 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
 CALCULATED 8.170 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.8305	LB/HR	COAL FED	828.0	GRAMS
HYDROGEN FLOW RATE	.9450	LB/HR	CHAR	275.0	GRAMS
HYDROGEN VELOCITY	.2724	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	31.00

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1150E-03	1.706	2.755
CARBON DIOXIDE	0.	0.	0.
METHANE	.1700E-02	44.04	40.72
ETHYLENE	0.	0.	0.
ETHANE	0.	0.	0.
BENZENE	.7000E-05	.2235	.1677
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		45.97	43.65

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.223	.315	0.	0.	0.	.168
HYDROCARBON GASES	44.0	248.	0.	0.	0.	40.7
CARBON OXIDES	1.71	0.	6.29	0.	0.	2.75
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	25.5
TOTAL	46.0	255.	6.29	100.	100.	71.1

HYDROGEN CONSUMPTION- .5727E-01 LB HYDROGEN/LB COAL
 1.107 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.8050 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 45.97 PERCENT
 EFFECTIVE ENERGY EFFICIENCY- 72.14 PERCENT

RUN NO. 146 SAMPLE NO. 1 DATE 6 -2 - 1978

COAL TYPE- NORTH DAKOTA. LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.470 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.	
COAL FEED RATE	.8172	LB/HR	COAL FED	235.0 GRAMS
HYDROGEN FLOW RATE	1.680	LB/HR	CHAR	98.00 GRAMS
HYDROGEN VELOCITY	.2062	FT/SEC	LIGHT OILS	0. GRAMS
REACTOR TEMP.	750.0	DEG C	BTX	0. GRAMS
PREHEAT TEMP.	750.0	DEG C	WATER	0. GRAMS
HYDROGEN PRESSURE	4000.	PSI		

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	24.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.6000E-04	1.608	2.597
CARBON DIOXIDE	0.	0.	0.
METHANE	.8660E-03	40.53	37.48
ETHYLENE	0.	0.	0.
ETHANE	.3750E-03	18.73	16.23
BENZENE	.1470E-03	8.478	6.362
TOLUENE	.4000E-05	.2282	.1731
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		69.57	62.84

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	8.71	12.3	0.	0.	0.	6.53
HYDROCARBON GASES	59.3	307.	0.	0.	0.	53.7
CARBON OXIDES	1.61	0.	5.93	0.	0.	2.60
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	35.0
TOTAL	69.6	326.	5.93	100.	100.	99.7

HYDROGEN CONSUMPTION- .8366E-01 LB HYDROGEN/LB COAL
1.617 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.8190 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 59.71 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 87.08 PERCENT

RUN NO. 146

SAMPLE NO. 2

DATE 6 -2. - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	2.470	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.8172	LB/HR	COAL FED	235.0	GRAMS
HYDROGEN FLOW RATE	1.600	LB/HR	CHAR	98.00	GRAMS
HYDROGEN VELOCITY	.2062	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	750.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	750.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	4000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	24.70

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.6200E-04	1.583	2.555
CARBON DIOXIDE	0.	0.	0.
METHANE	.7400E-03	32.98	30.50
ETHYLENE	0.	0.	0.
ETHANE	.4000E-03	19.02	16.49
BENZENE	.1500E-03	8.239	6.182
TOLUENE	.2000E-05	.1086	.8243E-01
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		61.94	55.81

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	8.35	11.8	0.	0.	0.	6.26
HYDROCARBON GASES	52.0	266.	0.	0.	0.	47.0
CARBON OXIDES	1.58	0.	5.83	0.	0.	2.56
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	35.0
TOTAL	61.9	284.	5.83	100.	100.	92.7

HYDROGEN CONSUMPTION-	.6820E-01	LB HYDROGEN/LB COAL
	1.318	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.7654	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	58.36	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	84.14	PERCENT

RUN NO. 147

SAMPLE NO. 1

DATE 6 -6 -1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	3.620	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9918	LB/HR	COAL FED	757.3	GRAMS
HYDROGEN FLOW RATE	.5700	LB/HR	CHAR	363.3	GRAMS
HYDROGEN VELOCITY	.3287	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	21.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.9750E-03	7.306	11.80
CARBON DIOXIDE	.6780E-04	.3234	.8203
METHANE	.2123E-02	27.78	25.69
ETHYLENE	0.	0.	0.
ETHANE	.4590E-04	.6408	.5553
BENZENE	.2580E-03	4.160	3.121
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1100E-04	0.	.1331
TOTAL		40.21	42.11

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.16	5.86	0.	0.	0.	3.12
HYDROCARBON GASES	28.4	155.	0.	0.	0.	26.2
CARBON OXIDES	7.63	0.	29.3	0.	0.	12.6
WATER	0.	.358	.473	0.	0.	.133
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	42.0
TOTAL	40.2	172.	29.8	100.	100.	86.0

HYDROGEN CONSUMPTION-	.2656E-01	LB HYDROGEN/LB COAL
	.5132	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.5980	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	40.21	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	50.69	PERCENT

RUN NO. 147 SAMPLE NO. 2 DATE 6 -6 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 7.240 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9918	LB/HR	COAL FED	757.3	GRAMS
HYDROGEN FLOW RATE	.5700	LB/HR	CHAR	363.3	GRAMS
HYDROGEN VELOCITY	.3287	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	900.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	900.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	21.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1015E-02	7.606	12.28
CARBON DIOXIDE	0.	0.	0.
METHANE	.2154E-02	28.18	26.06
ETHYLENE	0.	0.	0.
ETHANE	.4060E-04	.5668	.4912
BENZENE	.1944E-03	3.134	2.352
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1690E-03	0.	2.045
TOTAL		39.49	43.23

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	3.13	4.41	0.	0.	0.	2.35
HYDROCARBON GASES	28.8	161.	0.	0.	0.	26.6
CARBON OXIDES	7.61	0.	28.0	0.	0.	12.3
WATER	0.	5.51	7.27	0.	0.	2.04
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	42.0
TOTAL	39.5	177.	35.3	100.	100.	87.1

HYDROGEN CONSUMPTION- .2866E-01 LB HYDROGEN/LB COAL
.5537 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5710 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 39.49 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 50.15 PERCENT

RUN NO. 148

SAMPLE NO. 1

DATE 6 -7 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	2.000	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9389	LB/HR	COAL FED	875.9	GRAMS
HYDROGEN FLOW RATE	.6800	LB/HR	CHAR	377.1	GRAMS
HYDROGEN VELOCITY	.2558	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	23.90

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2390E-03	2.257	3.644
CARBON DIOXIDE	0.	0.	0.
METHANE	.2080E-02	34.30	31.71
ETHYLENE	0.	0.	0.
ETHANE	.1800E-03	3.167	2.744
BENZENE	0.	0.	0.
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.3930E-02	0.	59.92
TOTAL		39.72	98.02

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	0.	0.	0.	0.	0.	0.
HYDROCARBON GASES	37.5	207.	0.	0.	0.	34.5
CARBON OXIDES	2.26	0.	8.32	0.	0.	3.64
WATER	0.	161.	213.	0.	0.	59.9
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	36.5
TOTAL	39.7	374.	221.	100.	100.	136.

HYDROGEN CONSUMPTION-	.1015	LB HYDROGEN/LB COAL
	1.961	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-7.7371	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	39.72	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	60.43	PERCENT

RUN NO. 148 SAMPLE NO. 2 DATE 6 -7 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 3.990 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9389	LB/HR	COAL FED	875.9	GRAMS
HYDROGEN FLOW RATE	.6800	LB/HR	CHAR	377.1	GRAMS
HYDROGEN VELOCITY	.2558	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	23.90

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.5900E-03	5.572	8.996
CARBON DIOXIDE	0.	0.	0.
METHANE	.2240E-02	36.93	34.15
ETHYLENE	0.	0.	0.
ETHANE	.1000E-03	1.759	1.525
BENZENE	0.	0.	0.
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1180E-02	0.	17.99

TOTAL 44.27 62.66

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	0.	0.	0.	0.	0.	0.
HYDROCARBON GASES	38.7	216.	0.	0.	0.	35.7
CARBON OXIDES	5.57	0.	20.5	0.	0.	9.00
WATER	0.	48.5	63.9	0.	0.	18.0
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	36.5

TOTAL 44.3 270. 84.5 100. 100. 101.

HYDROGEN CONSUMPTION- .6302E-01 LB HYDROGEN/LB COAL
1.218 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.6955 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 44.27 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 62.77 PERCENT

RUN NO. 148 SAMPLE NO. 3 DATE 6 -7 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 5.990 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.	
COAL FEED RATE	.9389	LB/HR	COAL FED	875.9 GRAMS
HYDROGEN FLOW RATE	.6800	LB/HR	CHAR	377.1 GRAMS
HYDROGEN VELOCITY	.2558	FT/SEC	LIGHT OILS	0. GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0. GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0. GRAMS
HYDROGEN PRESSURE	1500.	PSI		

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	23.90

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.5700E-03	5.383	8.691
CARBON DIOXIDE	0.	0.	0.
METHANE	.1920E-02	31.66	29.27
ETHYLENE	0.	0.	0.
ETHANE	.1070E-03	1.883	1.631
BENZENE	0.	0.	0.
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1740E-03	0.	2.653
TOTAL		38.92	42.25

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	0.	0.	0.	0.	0.	0.
HYDROCARBON GASES	33.5	186.	0.	0.	0.	30.9
CARBON OXIDES	5.38	0.	19.8	0.	0.	8.69
WATER	0.	7.15	9.43	0.	0.	2.65
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	36.5
TOTAL	38.9	200.	29.3	100.	100.	80.7

HYDROGEN CONSUMPTION- .3693E-01 LB HYDROGEN/LB COAL
.7136 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.6595 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 38.92 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 54.32 PERCENT

RUN NO. 148

SAMPLE NO. 4

DATE 6 -7 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	7.980	SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9389	LB/HR	COAL FED	875.9	GRAMS
HYDROGEN FLOW RATE	.6800	LB/HR	CHAR	377.1	GRAMS
HYDROGEN VELOCITY	.2558	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	23.90

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.6260E-03	5.912	9.544
CARBON DIOXIDE	0.	0.	0.
METHANE	.2136E-02	35.22	32.57
ETHYLENE	0.	0.	0.
ETHANE	.1090E-03	1.918	1.662
BENZENE	0.	0.	0.
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.1580E-03	0.	2.409
TOTAL		43.05	46.18

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	0.	0.	0.	0.	0.	0.
HYDROCARBON GASES	37.1	207.	0.	0.	0.	34.2
CARBON OXIDES	5.91	0.	21.8	0.	0.	9.54
WATER	0.	6.49	8.56	0.	0.	2.41
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	36.5
TOTAL	43.0	219.	30.4	100.	100.	84.6

HYDROGEN CONSUMPTION-	.4416E-01	LB HYDROGEN/LB COAL
	.8534	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -1.6772 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION-	43.05	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	60.19	PERCENT

RUN NO. 149 SAMPLE NO. 1 DATE 6 -8 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 1.640 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.	
COAL FEED RATE	.9601	LB/HR	COAL FED	831.7 GRAMS
HYDROGEN FLOW RATE	1.000	LB/HR	CHAR	412.3 GRAMS
HYDROGEN VELOCITY	.5029	FT/SEC	LIGHT OILS	0. GRAMS
REACTOR TEMP.	700.0	DEG C	BTX	0. GRAMS
PREHEAT TEMP.	1000.	DEG C	WATER	0. GRAMS
HYDROGEN PRESSURE	1000.	PSI		

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	20.80

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.1350E-03	1.833	2.960
CARBON DIOXIDE	.3160E-03	2.731	6.929
METHANE	.7090E-04	1.681	1.555
ETHYLENE	0.	0.	0.
ETHANE	.4530E-04	1.146	.9933
BENZENE	.2500E-05	.7305E-01	.5482E-01
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.2330E-03	0.	5.109
TOTAL		7.465	17.60

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.731E-01	.103	0.	0.	0.	.548E-01
HYDROCARBON GASES	2.83	14.3	0.	0.	0.	2.55
CARBON OXIDES	4.56	0.	26.9	0.	0.	9.89
WATER	0.	13.8	18.2	0.	0.	5.11
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	43.8
TOTAL	7.47	34.5	45.1	100.	100.	63.3

HYDROGEN CONSUMPTION- -.2422E-01 LB HYDROGEN/LB COAL
-.4680 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.7882 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 7.465 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 4.429 PERCENT

RUN NO. 149

SAMPLE NO. 2

DATE 6 -8 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	1.640	SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9601	LB/HR	COAL FED	831.7	GRAMS
HYDROGEN FLOW RATE	1.000	LB/HR	CHAR	412.3	GRAMS
HYDROGEN VELOCITY	.5029	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	700.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	1000.	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	20.80

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2140E-03	2.906	4.692
CARBON DIOXIDE	.3060E-03	2.645	6.710
METHANE	.1350E-03	3.201	2.960
ETHYLENE	0.	0.	0.
ETHANE	.8390E-04	2.123	1.840
BENZENE	.1060E-04	.3097	.2324
TOLUENE	.9200E-05	.2659	.2017
XYLENE	0.	0.	0.
LIGHT OIL	.1900E-05	.5555E-01	.4166E-01
WATER	.5351E-02	0.	117.3

TOTAL	11.51	134.0
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.631	.942	0.	0.	0.	.476
HYDROCARBON GASES	5.32	27.0	0.	0.	0.	4.80
CARBON OXIDES	5.55	0.	30.2	0.	0.	11.4
WATER	0.	316.	417.	0.	0.	117.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	43.8
TOTAL	11.5	350.	447.	100.	100.	180.

HYDROGEN CONSUMPTION-	.9263E-01	LB HYDROGEN/LB COAL
	1.790	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.7734	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	11.51	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	8.598	PERCENT

RUN NO. 149

SAMPLE NO. 3

DATE 6 -8 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	1.640	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9601	LB/HR	COAL FED	831.7	GRAMS
HYDROGEN FLOW RATE	1.000	LB/HR	CHAR	412.3	GRAMS
HYDROGEN VELOCITY	.5029	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	700.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	1000.	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED MTS.

COAL ANALYSIS, %

CARBON	62.10
HYDROGEN	3.700
OXYGEN	22.44
NITROGEN	.9500
SULFUR	.5100
ASH	10.30

CHAR ANALYSIS, %

	0.
	0.
	0.
	0.
	0.
	20.80

PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
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CARBON MONOXIDE	.3260E-03	4.428	7.148
CARBON DIOXIDE	.1350E-03	1.167	2.960
METHANE	.2180E-03	5.170	4.780
ETHYLENE	0.	0.	0.
ETHANE	.1370E-03	3.467	3.004
BENZENE	.2520E-04	.7364	.5526
TOLUENE	.1990E-04	.5751	.4364
XYLENE	0.	0.	0.
LIGHT OIL	.1340E-04	.3918	.2938
WATER	.5451E-02	0.	119.5

TOTAL	15.93	138.7
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.70	2.51	0.	0.	0.	1.28
HYDROCARBON GASES	8.64	43.8	0.	0.	0.	7.78
CARBON OXIDES	5.59	0.	24.9	0.	0.	10.1
WATER	0.	322.	425.	0.	0.	120.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	43.8
TOTAL	15.9	375.	450.	100.	100.	184.

HYDROGEN CONSUMPTION-	.1016	LB HYDROGEN/LB COAL
	1.963	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.6206	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	15.93	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	14.55	PERCENT

RUN NO. 149

SAMPLE NO. 4

DATE 6 -8 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	1.640	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.9601	LB/HR	TOTAL ACCUMULATED WTS.	
HYDROGEN FLOW RATE	1.000	LB/HR	COAL FED	831.7 GRAMS
HYDROGEN VELOCITY	1.5029	FT/SEC	CHAR	412.3 GRAMS
REACTOR TEMP.	700.0	DEG C	LIGHT OILS	0. GRAMS
PREHEAT TEMP.	1000.	DEG C	BTX	0. GRAMS
HYDROGEN PRESSURE	1000.	PSI	WATER	0. GRAMS

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	20.80

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.4350E-03	5.908	9.538
CARBON DIOXIDE	0.	0.	0.
METHANE	.4150E-03	9.841	9.100
ETHYLENE	0.	0.	0.
ETHANE	.2060E-03	5.213	4.517
BENZENE	.1000E-03	2.922	2.193
TOLUENE	.2630E-04	.7601	.5767
XYLENE	0.	0.	0.
LIGHT OIL	.1730E-04	.5058	.3793
WATER	.8430E-03	0.	18.48

TOTAL	25.15	44.79
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.19	6.05	0.	0.	0.	3.15
HYDROCARBON GASES	15.1	77.5	0.	0.	0.	13.6
CARBON OXIDES	5.91	0.	21.8	0.	0.	9.54
WATER	0.	49.8	65.7	0.	0.	18.5
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	43.8

TOTAL	25.1	140.	87.5	100.	100.	90.4
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HYDROGEN CONSUMPTION-	.1467E-01	LB HYDROGEN/LB COAL
	.2835	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.5109	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	25.15	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	27.09	PERCENT

RUN NO. 149 SAMPLE NO. 5 DATE 6 -8 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 1.640 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9601	LB/HR	COAL FED	831.7	GRAMS
HYDROGEN FLOW RATE	1.000	LB/HR	CHAR	412.3	GRAMS
HYDROGEN VELOCITY	.5020	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	700.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	1000.	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	20.80

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3960E-03	5.378	8.683
CARBON DIOXIDE	0.	0.	0.
METHANE	.4850E-03	11.50	10.63
ETHYLENE	0.	0.	0.
ETHANE	.2350E-03	5.946	5.153
BENZENE	.1330E-03	3.886	2.916
TOLUENE	.1640E-04	.4740	.3596
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.4650E-03	0.	10.20

TOTAL 27.19 37.94

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.36	6.24	0.	0.	0.	3.28
HYDROCARBON GASES	17.4	89.9	0.	0.	0.	15.8
CARBON OXIDES	5.38	0.	19.8	0.	0.	8.68
WATER	0.	27.5	36.2	0.	0.	10.2
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	43.8

TOTAL 27.2 130. 56.1 100. 100. 83.6

HYDROGEN CONSUMPTION- .1109E-01 LB HYDROGEN/LB COAL
 .2143 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5306 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 27.19 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 31.26 PERCENT

RUN NO. 149

SAMPLE NO. 6

DATE 6 -8. -1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
 CALCULATED 1.640 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9601	LB/HR	COAL FED	831.7	GRAMS
HYDROGEN FLOW RATE	1.000	LB/HR	CHAR	412.3	GRAMS
HYDROGEN VELOCITY	.5029	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	700.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	1000.	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	20.80

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3800E-03	5.161	8.332
CARBON DIOXIDE	0.	0.	0.
METHANE	.5560E-03	13.18	12.19
ETHYLENE	0.	0.	0.
ETHANE	.2150E-03	5.440	4.714
BENZENE	.1650E-03	4.822	3.618
TOLUENE	.5000E-05	.1445	.1096
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.4480E-03	0.	9.824
TOTAL		28.75	38.79

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.97	7.02	0.	0.	0.	3.73
HYDROCARBON GASES	18.6	97.3	0.	0.	0.	16.9
CARBON OXIDES	5.16	0.	19.0	0.	0.	8.33
WATER	0.	26.5	34.9	0.	0.	9.82
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	43.8
TOTAL	28.8	137.	53.9	100.	100.	84.5

HYDROGEN CONSUMPTION- .1373E-01 LB HYDROGEN/LB COAL
 .2653 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5411 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 28.75 PERCENT
 EFFECTIVE ENERGY EFFICIENCY- 34.29 PERCENT

RUN NO. 149

SAMPLE NO. 7

DATE 6 -8 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	1.640	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9601	LB/HR	COAL FED	831.7	GRAMS
HYDROGEN FLOW RATE	1.000	LB/HR	CHAR	412.3	GRAMS
HYDROGEN VELOCITY	.5029	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	700.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	1000.	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	20.80

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3620E-03	4.916	7.938
CARBON DIOXIDE	0.	0.	0.
METHANE	.5330E-03	12.64	11.69
ETHYLENE	0.	0.	0.
ETHANE	.2090E-03	5.288	4.583
BENZENE	.1310E-03	3.828	2.873
TOLUENE	.1190E-04	.3439	.2609
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.4650E-03	0.	10.20
TOTAL		27.02	37.54

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.17	5.94	0.	0.	0.	3.13
HYDROCARBON GASES	17.9	93.5	0.	0.	0.	16.3
CARBON OXIDES	4.92	0.	18.1	0.	0.	7.94
WATER	0.	27.5	36.2	0.	0.	10.2
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	43.8
TOTAL	27.0	133.	54.4	100.	100.	83.2

HYDROGEN CONSUMPTION-	.1233E-01	LB HYDROGEN/LB COAL
	.2382	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.5458	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	27.02	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	32.13	PERCENT

RUN NO. 150

SAMPLE NO. 1

DATE 6 -13 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	2.300	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9786	LB/HR	TOTAL ACCUMULATED WTS.	
HYDROGEN FLOW RATE	.9450	LB/HR	COAL FED	947.0 GRAMS
HYDROGEN VELOCITY	.1901	FT/SEC	CHAR	415.0 GRAMS
REACTOR TEMP.	750.0	DEG C	LIGHT OILS	0. GRAMS
PREHEAT TEMP.	750.0	DEG C	BTX	0. GRAMS
HYDROGEN PRESSURE	2500.	PSI	WATER	0. GRAMS

COAL ANALYSIS, %

CHAR ANALYSIS, %

CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	23.50

PRODUCT CONC. IN
GAS, LB/C. FT

% CARBON CONV.
TO PRODUCT

% MAF COAL CONV.
TO PRODUCT

CARBON MONOXIDE	.3960E-03	4.986	8.050
CARBON DIOXIDE	0.	0.	0.
METHANE	.5100E-03	11.21	10.37
ETHYLENE	0.	0.	0.
ETHANE	.2920E-03	6.850	5.936
BENZENE	.1150E-03	3.116	2.338
TOLUENE	.3260E-04	.8735	.6627
XYLENE	0.	0.	0.
LIGHT OIL	.9300E-05	.2521	.1891
WATER	.2140E-03	0.	4.351

TOTAL

27.29

31.89

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.24	6.15	0.	0.	0.	3.19
HYDROCARBON GASES	18.1	92.1	0.	0.	0.	16.3
CARBON OXIDES	4.99	0.	18.4	0.	0.	8.05
WATER	0.	11.7	15.5	0.	0.	4.35
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	37.4
TOTAL	27.3	116.	33.8	100.	100.	71.2

HYDROGEN CONSUMPTION-	.6043E-02	LB HYDROGEN/LB COAL
	.1168	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.5330	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	27.29	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	31.53	PERCENT

RUN NO. 150 SAMPLE NO. 2 DATE 6 -13 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 9.180 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9786	LB/HR	COAL FED	947.0	GRAMS
HYDROGEN FLOW RATE	.9450	LB/HR	CHAR	415.0	GRAMS
HYDROGEN VELOCITY	.1901	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	750.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	750.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	2500.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	23.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.4760E-03	5.994	9.677
CARBON DIOXIDE	.3770E-04	.3021	.7664
METHANE	.6320E-03	13.89	12.85
ETHYLENE	0.	0.	0.
ETHANE	.3680E-03	8.633	7.481
BENZENE	.2170E-03	5.879	4.412
TOLUENE	.1560E-04	.4180	.3171
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	.5560E-04	0.	1.130
TOTAL		35.12	36.63

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	6.30	8.95	0.	0.	0.	4.73
HYDROCARBON GASES	22.5	115.	0.	0.	0.	20.3
CARBON OXIDES	6.30	0.	24.3	0.	0.	10.4
WATER	0.	3.04	4.02	0.	0.	1.13
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	37.4
TOTAL	35.1	133.	28.3	100.	100.	75.9

HYDROGEN CONSUMPTION- .1225E-01 LB HYDROGEN/LB COAL
.2367 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5555 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 35.12 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 41.05 PERCENT

RUN NO. 152

SAMPLE NO. 1

DATE 6 -20 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	1.460	SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9508	LB/HR	COAL FED	1043.	GRAMS
HYDROGEN FLOW RATE	1.060	LB/HR	CHAR	499.0	GRAMS
HYDROGEN VELOCITY	.5982	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	21.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2000E-03	2.907	4.694
CARBON DIOXIDE	0.	0.	0.
METHANE	.8800E-03	22.34	20.65
ETHYLENE	0.	0.	0.
ETHANE	.1500E-03	4.062	3.520
BENZENE	.1600E-03	5.004	3.755
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		34.31	32.62

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	5.00	7.05	0.	0.	0.	3.76
HYDROCARBON GASES	26.4	143.	0.	0.	0.	24.2
CARBON OXIDES	2.91	0.	10.7	0.	0.	4.69
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	41.9
TOTAL	34.3	156.	10.7	100.	100.	76.4

HYDROGEN CONSUMPTION-	.2087E-01	LB HYDROGEN/LB COAL
	.4032	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.6132	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	34.31	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	47.50	PERCENT

RUN NO. 152 SAMPLE NO. 2 DATE 6 -20 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.910 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9508	LB/HR	COAL FED	1043.	GRAMS
HYDROGEN FLOW RATE	1.060	LB/HR	CHAR	499.0	GRAMS
HYDROGEN VELOCITY	.5982	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	21.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.4000E-03	5.815	9.388
CARBON DIOXIDE	0.	0.	0.
METHANE	.8800E-03	22.34	20.65
ETHYLENE	0.	0.	0.
ETHANE	.9800E-04	2.654	2.300
BENZENE	.1800E-03	5.630	4.225
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		36.43	36.57

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	5.63	7.93	0.	0.	0.	4.22
HYDROCARBON GASES	25.0	137.	0.	0.	0.	23.0
CARBON OXIDES	5.81	0.	21.4	0.	0.	9.39
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	41.9
TOTAL	36.4	151.	21.4	100.	100.	80.3

HYDROGEN CONSUMPTION- .1899E-01 LB HYDROGEN/LB COAL
 .3670 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5557 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 36.43 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 46.19 PERCENT

RUN NO. 152

SAMPLE NO. 3

DATE 6 -20 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	5.820	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9508	LB/HR	COAL FED	1043.	GRAMS
HYDROGEN FLOW RATE	1.060	LB/HR	CHAR	499.0	GRAMS
HYDROGEN VELOCITY	.5982	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	875.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	875.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	21.50

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.4800E-03	6.978	11.27
CARBON DIOXIDE	0.	0.	0.
METHANE	.7500E-03	19.04	17.60
ETHYLENE	0.	0.	0.
ETHANE	.8400E-04	2.275	1.971
BENZENE	.1600E-03	5.004	3.755
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		33.29	34.59

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	5.00	7.05	0.	0.	0.	3.76
HYDROCARBON GASES	21.3	117.	0.	0.	0.	19.6
CARBON OXIDES	6.98	0.	25.7	0.	0.	11.3
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	41.9
TOTAL	33.3	130.	25.7	100.	100.	78.4

HYDROGEN CONSUMPTION-	.1120E-01	LB HYDROGEN/LB COAL
	.2163	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -5.5128 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION-	33.29	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	39.60	PERCENT

RUN NO. 153 SAMPLE NO. 1 DATE 6 -21 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 1.500 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9587	LB/HR	COAL FED	747.0	GRAMS
HYDROGEN FLOW RATE	1.020	LB/HR	CHAR	346.0	GRAMS
HYDROGEN VELOCITY	.5630	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	22.20

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2800E-03	3.884	6.271
CARBON DIOXIDE	0.	0.	0.
METHANE	.7700E-03	18.65	17.25
ETHYLENE	0.	0.	0.
ETHANE	.2100E-03	5.428	4.703
BENZENE	.1620E-03	4.835	3.628
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		32.80	31.85

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.84	6.81	0.	0.	0.	3.63
HYDROCARBON GASES	24.1	128.	0.	0.	0.	21.9
CARBON OXIDES	3.88	0.	14.3	0.	0.	6.27
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	40.2
TOTAL	32.8	141.	14.3	100.	100.	73.9

HYDROGEN CONSUMPTION- .1523E-01 LB HYDROGEN/LB COAL
.2943 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -5.5780 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 32.80 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 43.21 PERCENT

RUN NO. 153

SAMPLE NO. 2

DATE 6 -21 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS.
CALCULATED 3.000 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9587	LB/HR	COAL FED	747.0	GRAMS
HYDROGEN FLOW RATE	1.020	LB/HR	CHAR	346.0	GRAMS
HYDROGEN VELOCITY	.5630	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	82.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	22.20

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.4400E-03	6.104	9.855
CARBON DIOXIDE	0.	0.	0.
METHANE	.6900E-03	16.71	15.45
ETHYLENE	0.	0.	0.
ETHANE	.1900E-03	4.911	4.255
BENZENE	.1900E-03	5.671	4.255
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		33.40	33.82

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	5.67	7.98	0.	0.	0.	4.26
HYDROCARBON GASES	21.6	115.	0.	0.	0.	19.7
CARBON OXIDES	6.10	0.	22.5	0.	0.	9.85
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	40.2
TOTAL	33.4	129.	22.5	100.	100.	75.9

HYDROGEN CONSUMPTION- .1082E-01 LB HYDROGEN/LB COAL
.2091 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.5192 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 33.40 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 40.22 PERCENT

RUN NO. 153

SAMPLE NO. 3

DATE 6 -21 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	6.010	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9587	LB/HR	COAL FED	747.0	GRAMS
HYDROGEN FLOW RATE	1.020	LB/HR	CHAR	346.0	GRAMS
HYDROGEN VELOCITY	.5630	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1000.	PSI			

TOTAL ACCUMULATED WTS.

COAL ANALYSIS, %

CARBON	62.10
HYDROGEN	3.700
OXYGEN	22.44
NITROGEN	.9500
SULFUR	.5100
ASH	10.30

CHAR ANALYSIS, %

	0.
	0.
	0.
	0.
	0.
	22.20

PRODUCT CONC. IN
GAS, LB/C. FT% CARBON CONV.
TO PRODUCT% MAF COAL CONV.
TO PRODUCT

CARBON MONOXIDE	.4700E-03	6.520	10.53
CARBON DIOXIDE	0.	0.	0.
METHANE	.6000E-03	14.53	13.44
ETHYLENE	0.	0.	0.
ETHANE	.1700E-03	4.394	3.807
BENZENE	.1620E-03	4.835	3.628
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL

30.28

31.40

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.84	6.81	0.	0.	0.	3.63
HYDROCARBON GASES	18.9	100.	0.	0.	0.	17.2
CARBON OXIDES	6.52	0.	24.0	0.	0.	10.5
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	40.2
TOTAL	30.3	114.	24.0	100.	100.	73.5

HYDROGEN CONSUMPTION-	.5033E-02	LB HYDROGEN/LB COAL
	.9727E-01	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.4983 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION-	30.28	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	35.04	PERCENT

RUN NO. 154

SAMPLE NO. 1

DATE 6 -22 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 3.640 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9693	LB/HR	COAL FED	873.0	GRAMS
HYDROGEN FLOW RATE	1.000	LB/HR	CHAR	442.0	GRAMS
HYDROGEN VELOCITY	.3680	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	82.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	20.30

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.5300E-03	7.129	11.51
CARBON DIOXIDE	0.	0.	0.
METHANE	.1160E-02	27.25	25.19
ETHYLENE	0.	0.	0.
ETHANE	.1900E-03	4.762	4.126
BENZENE	.2500E-03	7.236	5.430
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	46.37	46.26
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	7.24	10.2	0.	0.	0.	5.43
HYDROCARBON GASES	32.0	174.	0.	0.	0.	29.3
CARBON OXIDES	7.13	0.	26.3	0.	0.	11.5
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	45.0

TOTAL	46.4	190.	26.3	100.	100.	93.1
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HYDROGEN CONSUMPTION-	.3336E-01	LB HYDROGEN/LB COAL
	.6446	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -5.720 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION-	46.37	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	58.87	PERCENT

RUN NO. 154

SAMPLE NO. 2

DATE 6 -22 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	7.280	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9693	LB/HR	COAL FED	873.0	GRAMS
HYDROGEN FLOW RATE	1.000	LB/HR	CHAR	442.0	GRAMS
HYDROGEN VELOCITY	.3680	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	850.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	850.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	1500.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	20.30

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.6200E-03	8.340	13.47
CARBON DIOXIDE	0.	0.	0.
METHANE	.1100E-02	25.84	23.89
ETHYLENE	0.	0.	0.
ETHANE	.1800E-03	4.511	3.909
BENZENE	.2250E-03	6.512	4.887
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		45.20	46.15

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	6.51	9.17	0.	0.	0.	4.89
HYDROCARBON GASES	30.3	165.	0.	0.	0.	27.8
CARBON OXIDES	8.34	0.	30.7	0.	0.	13.5
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	45.0
TOTAL	45.2	180.	30.7	100.	100.	93.0

HYDROGEN CONSUMPTION-	.2965E-01	LB HYDROGEN/LB COAL
	.5730	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION-	-.5433	KCAL/GRAM OF COAL FED
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EFFECTIVE CARBON CONVERSION-	45.20	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	55.45	PERCENT

RUN NO. 155

SAMPLE NO. 1

DATE 6 -27 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	2.430	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	.9997	LB/HR	COAL FED	899.0	GRAMS
HYDROGEN FLOW RATE	1.060	LB/HR	CHAR	215.0	GRAMS
HYDROGEN VELOCITY	.1688	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	800.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	800.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	3000.	PSI			

TOTAL ACCUMULATED MTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	43.10

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2000E-03	2.765	4.464
CARBON DIOXIDE	0.	0.	0.
METHANE	.7900E-03	19.07	17.63
ETHYLENE	0.	0.	0.
ETHANE	.3600E-03	9.273	8.036
BENZENE	.2100E-03	6.247	4.687
TOLUENE	.1300E-04	.3825	.2902
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL	37.74	35.11
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TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	6.63	9.41	0.	0.	0.	4.98
HYDROCARBON GASES	28.3	147.	0.	0.	0.	25.7
CARBON OXIDES	2.77	0.	10.2	0.	0.	4.46
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	15.2
TOTAL	37.7	162.	10.2	100.	100.	52.2

HYDROGEN CONSUMPTION-	.2302E-01	LB HYDROGEN/LB COAL
	.4460	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.6137 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION-	37.74	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	50.79	PERCENT

RUN NO. 155

SAMPLE NO. 2

DATE 6 -27 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE :

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 4.850 SECONDS

NOMINAL CONDITIONS

			TOTAL ACCUMULATED WTS.	
COAL FEED RATE	.9997	LB/HR	COAL FED	899.0 GRAMS
HYDROGEN FLOW RATE	.9050	LB/HR	CHAR	215.0 GRAMS
HYDROGEN VELOCITY	.1688	FT/SEC	LIGHT OILS	0. GRAMS
REACTOR TEMP.	800.0	DEG C	BTX	0. GRAMS
PREHEAT TEMP.	800.0	DEG C	WATER	0. GRAMS
HYDROGEN PRESSURE	3000.	PSI		

COAL ANALYSIS, %

CHAR ANALYSIS, %

CARBON	62.10		0.
HYDROGEN	3.700		0.
OXYGEN	22.44		0.
NITROGEN	.9500		0.
SULFUR	.9100		0.
ASH	10.30		43.10

PRODUCT CONC. IN
GAS, LB/C. FT

% CARBON CONV.
TO PRODUCT

% MAF COAL CONV.
TO PRODUCT

CARBON MONOXIDE	.6000E-04	.7082	1.143
CARBON DIOXIDE	0.	0.	0.
METHANE	.5000E-02	103.0	95.28
ETHYLENE	0.	0.	0.
ETHANE	.2600E-03	5.718	4.955
BENZENE	.1600E-03	4.063	3.049
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.

TOTAL

113.5

104.4

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	4.06	5.72	0.	0.	0.	3.05
HYDROCARBON GASES	109.	605.	0.	0.	0.	100.
CARBON OXIDES	.708	0.	2.61	0.	0.	1.14
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	15.2
TOTAL	114.	617.	2.61	100.	100.	121.

HYDROGEN CONSUMPTION-

.1912
3.695

LB HYDROGEN/LB COAL
MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -1.279

KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION-
EFFECTIVE ENERGY EFFICIENCY-

64.40
102.4

PERCENT
PERCENT

RUN NO. 155 SAMPLE NO. 3 DATE 6 -27 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 9.700 SECONDS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.		
COAL FEED RATE	.9997	LB/HR	COAL FED	899.0	GRAMS
HYDROGEN FLOW RATE	.9050	LB/HR	CHAR	215.0	GRAMS
HYDROGEN VELOCITY	.1688	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	800.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	800.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	3000.	PSI			

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	43.10

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.5500E-04	.6492	1.048
CARBON DIOXIDE	0.	0.	0.
METHANE	.5220E-02	107.6	99.48
ETHYLENE	0.	0.	0.
ETHANE	.8300E-04	1.825	1.582
BENZENE	.5600E-04	1.422	1.067
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		111.5	103.2

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	1.42	2.00	0.	0.	0.	1.07
HYDROCARBON GASES	109.	614.	0.	0.	0.	101.
CARBON OXIDES	.649	0.	2.39	0.	0.	1.05
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	15.2
TOTAL	111.	622.	2.39	100.	100.	120.

HYDROGEN CONSUMPTION- .1932 LB HYDROGEN/LB COAL
 3.733 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -1.316 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 64.25 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 103.6 PERCENT

RUN NO. 156

SAMPLE NO. 1

DATE 6 -29 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
CALCULATED 2.420 SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.018	LB/HR	COAL FED	929.0	GRAMS
HYDROGEN FLOW RATE	1.060	LB/HR	CHAR	156.0	GRAMS
HYDROGEN VELOCITY	.1723	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	800.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	800.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	3000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	82.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	61.30

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.2300E-03	3.122	.5.040
CARBON DIOXIDE	0.	0.	0.
METHANE	.9030E-03	21.40	19.79
ETHYLENE	0.	0.	0.
ETHANE	.3970E-03	10.04	8.700
BENZENE	.2660E-03	7.769	5.829
TOLUENE	.9000E-05	.2600	.1972
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		42.59	39.56

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	8.03	11.4	0.	0.	0.	6.03
HYDROCARBON GASES	31.4	163.	0.	0.	0.	28.5
CARBON OXIDES	3.12	0.	11.5	0.	0.	5.04
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	7.24
TOTAL	42.6	181.	11.5	100.	100.	48.7

HYDROGEN CONSUMPTION- .2986E-01 LB HYDROGEN/LB COAL
.5770 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -.6194 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 42.59 PERCENT
EFFECTIVE ENERGY EFFICIENCY- 57.30 PERCENT

RUN NO. 156

SAMPLE NO. 2

DATE 6 -29 - 1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED	0.	SECONDS
CALCULATED	7.250	SECONDS

NOMINAL CONDITIONS

COAL FEED RATE	1.018	LB/HR	COAL FED	929.0	GRAMS
HYDROGEN FLOW RATE	.9600	LB/HR	CHAR	156.0	GRAMS
HYDROGEN VELOCITY	.1723	FT/SEC	LIGHT OILS	0.	GRAMS
REACTOR TEMP.	800.0	DEG C	BTX	0.	GRAMS
PREHEAT TEMP.	800.0	DEG C	WATER	0.	GRAMS
HYDROGEN PRESSURE	3000.	PSI			

TOTAL ACCUMULATED WTS.

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	61.30

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.9000E-04	1.106	1.786
CARBON DIOXIDE	0.	0.	0.
METHANE	.4900E-02	105.2	97.25
ETHYLENE	0.	0.	0.
ETHANE	.4300E-04	.9848	.8534
BENZENE	.3200E-04	.8464	.6351
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		108.1	100.5

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.846	1.19	0.	0.	0.	.635
HYDROCARBON GASES	106.	597.	0.	0.	0.	98.1
CARBON OXIDES	1.11	0.	4.08	0.	0.	1.79
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	7.24
TOTAL	108.	604.	4.08	100.	100.	110.

HYDROGEN CONSUMPTION-	.1866	LB HYDROGEN/LB COAL
	3.605	MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -1.290 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION-	64.00	PERCENT
EFFECTIVE ENERGY EFFICIENCY-	103.0	PERCENT

RUN NO. 156

SAMPLE NO. 3

DATE 6 -29 -1978

COAL TYPE- NORTH DAKOTA LIGNITE

COAL RESIDENCE TIME-MEASURED 0. SECONDS
 CALCULATED 9.660 SECONDS

NOMINAL CONDITIONS

NOMINAL CONDITIONS			TOTAL ACCUMULATED WTS.	
COAL FEED RATE	1.018	LB/HR	COAL FED	929.0 GRAMS
HYDROGEN FLOW RATE	.9200	LB/HR	CHAR	156.0 GRAMS
HYDROGEN VELOCITY	.1723	FT/SEC	LIGHT OILS	0. GRAMS
REACTOR TEMP.	800.0	DEG C	BTX	0. GRAMS
PREHEAT TEMP.	800.0	DEG C	WATER	0. GRAMS
HYDROGEN PRESSURE	3000.	PSI		

	COAL ANALYSIS, %	CHAR ANALYSIS, %
CARBON	62.10	0.
HYDROGEN	3.700	0.
OXYGEN	22.44	0.
NITROGEN	.9500	0.
SULFUR	.5100	0.
ASH	10.30	61.30

	PRODUCT CONC. IN GAS, LB/C. FT	% CARBON CONV. TO PRODUCT	% MAF COAL CONV. TO PRODUCT
CARBON MONOXIDE	.3700E-04	.4359	.7038
CARBON DIOXIDE	0.	0.	0.
METHANE	.5340E-02	109.8	101.6
ETHYLENE	0.	0.	0.
ETHANE	.1060E-03	2.327	2.016
BENZENE	.2400E-04	.6083	.4565
TOLUENE	0.	0.	0.
XYLENE	0.	0.	0.
LIGHT OIL	0.	0.	0.
WATER	0.	0.	0.
TOTAL		113.2	104.7

TOTAL MATERIAL BALANCE, %

	CARBON	HYDROGEN	OXYGEN	NITROGEN	SULFUR	MAF COAL
LIQUIDS	.608	.857	0.	0.	0.	.456
HYDROCARBON GASES	112.	629.	0.	0.	0.	104.
CARBON OXIDES	.436	0.	1.61	0.	0.	.704
WATER	0.	0.	0.	0.	0.	0.
AMMONIA	0.	5.50	0.	100.	0.	1.29
HYDROGEN SULFIDE	0.	.861	0.	0.	100.	.604
CHAR	0.	0.	0.	0.	0.	7.24
TOTAL	113.	636.	1.61	100.	100.	114.

HYDROGEN CONSUMPTION- .1983 LB HYDROGEN/LB COAL
 3.831 MOLE HYDROGEN/MOLE CARBON

HEAT OF REACTION- -1.342 KCAL/GRAM OF COAL FED

EFFECTIVE CARBON CONVERSION- 64.37 PERCENT
 EFFECTIVE ENERGY EFFICIENCY- 104.2 PERCENT

DISTRIBUTION LIST

Dr. G. Alexander Mills, Acting Director
Office of the Senior Staff for Fossil Energy
U.S. Department of Energy
Mail Stop 4128
20 Massachusetts Avenue, N.W.
Washington, D.C. 20545

Dr. Harold Podall
Division of Coal Conversion
U.S. Department of Energy
20 Massachusetts Avenue, N.W.
Washington, D.C. 20545

Mr. Edward Schmetz, Program Manager
Energy Technology
Division of Coal Conversion
U.S. Department of Energy
20 Massachusetts Avenue, N.W.
Washington, D.C. 20545

Mr. Ezekial L. Clark
Assistant Director for Gasification Development
U.S. Department of Energy
400 First Street, N.W.
Washington, D.C. 20545

Mr. Louis Jablansky, Program Manager
Division of Coal Conversion and Gasification
Directorate
U.S. Department of Energy
400 First Street, N.W.
Washington, D.C. 20545

Dr. Lowell Miller, Senior Program Manager
Division of Coal Conversion and Gasification
Directorate
U.S. Department of Energy
400 First Street, N.W.
Washington, D.C. 20545

Dr. Lee Kindley
Division of Coal Conversion
Room 4206
U.S. Department of Energy
20 Massachusetts Avenue, N.W.
Washington, D.C. 20545

Mr. Marvin Greene
Program Manager
Cities Service Research and
Development Company
Drawer No. 7
Cranbury, New Jersey 08512

Mr. Dennis A. Duncan
Institute of Gas Technology
IIT Center
3424 State Street
Chicago, Illinois 60616

Mr. W.A. Peters
Room 66-460
Energy Laboratory
Massachusetts Institute Tech.
Cambridge, Mass. 02139

BNL

A. Albanese
V. Dang
M. Greene
J. Smith
M. Sansone