Technical Report

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**Continuous Bench-Scale Slurry Catalyst Testing:
Direct Coal Liquefaction of Rawhide Sub-bituminous Coal**

(Contract Number DE-AC22-94PC94051)

by

**L. A. Coless
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(Covering Operations from July 1995 - December 1995)

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Dispersed catalyst systems for direct coal liquefaction have been tested in the Recycle Coal Liquefaction pilot plant Unit (RCLU) at the Exxon Research and Development Laboratories during 1994 and 1995. Work completed in 1994 has previously been reported. That work focused on liquefaction of a subbituminous Rawhide coal, using molybdenum promoted iron catalysts. Work performed in 1995 focused primarily on liquefaction of a second subbituminous coal, Black Thunder, using molybdenum and molybdenum promoted iron catalyst systems.

These tests showed that dispersed catalyst systems are highly effective in the direct liquefaction of subbituminous coals. Yields of distillable liquids ranged from 55 to 60 wt% of dry ash free coal, depending on operating conditions and catalyst. The highest distillable liquid yields, 60 wt%, were achieved with 100 wppm molybdenum on dry ash free coal. Molybdenum was found to be effective as low as 50 wppm on dry ash free coal with distillable liquid yields of 55 to 58 wt% on dry ash free coal. The combination of 0.25 wt% iron with 50 wppm did not show a measurable improvement in distillable liquid yields compared with 50 wppm molybdenum alone.

Planning studies are needed to evaluate the economic potential for dispersed catalyst in direct coal liquefaction service and to provide focus for future research.

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1. Introduction

In 1994 extensive tests were conducted in the Exxon Research and Engineering Recycle Coal Liquefaction Unit (RCLU) in Baton Rouge, Louisiana.⁽¹⁾ The work conducted in 1994 explored a variety of dispersed iron molybdenum promoted catalyst systems for direct coal liquefaction of Rawhide subbituminous coal. The goal was to identify the preferred iron system⁽²⁾. We learned that among the catalysts tested, all were effective; however, none showed a large process advantage over the others. In 1995, we tested dispersed molybdenum catalysts systems for direct coal liquefaction on a second subbituminous coal, Black Thunder. Catalyst properties are shown in Table 1. We also checked a molybdenum promoted iron case, as well as the impact of process variables, such as sulfur type, hydrogen treat rate, and catalyst addition rate, as shown in Table 2. In 1995, we ran 18 material balances over a 7 week period, covering 7 conditions. This report covers the 1995 operations and results.

2. Objective

The overall objective of this project, taken from the Statement of Work (DE-AC22-94PC94051), is to test advanced and novel slurry phase catalysts for direct coal liquefaction⁽³⁾. The efficacy and application of dispersed catalysts is expected to be strongly dependent upon the process steps and overall configuration of a particular liquefaction process. Therefore, continuous pilot plant testing at projected commercial conditions provides the most valid test of catalyst effectiveness. The 1995 program builds on and extends the results of the 1994 program.

Two major experimental objectives were met in 1995: 1) extend the 1994 results to a second coal, and 2) test a molybdenum only dispersed catalyst for direct coal liquefaction.

Most of the work done during 1994 focused on testing several molybdenum promoted iron based catalyst systems with a variety of surface areas. It was expected that the higher surface area catalysts would perform better. Instead, they all performed about the same. Since all the tests performed in 1994 included a molybdenum promoter, we thought it possible that molybdenum was acting as the primary catalyst, masking any variation in the activity of the iron. To test this hypothesis, we added tests to the 1995 program aimed at finding out if molybdenum alone in ppm levels would be an effective direct coal liquefaction catalyst. In addition to testing the base molybdenum promoted iron catalyst on a second coal, two sources of sulfur and two levels of hydrogen treat rate were tested.

3. Process Overview and Simplified Process Flow Diagram

The Recycle Coal Liquefaction Unit (RCLU) is located at the Exxon Research and Development Labs in Baton Rouge, Louisiana. RCLU is a highly automated, highly instrumented pilot plant designed to process 34 kg (75 lb.) of coal per day. It has redundant computer control and data acquisition systems allowing for efficient trouble shooting, data analysis and material balance calculations. Over the years, the RCLU has been reconfigured many times to meet specific data requirements for coal and heavy hydrocarbon conversion. Hence, the RCLU is versatile and easy to reconfigure. RCLU has been a very reliable tool in the past, with many runs over 1000 continuous hours. An overview of the process is described below, and a simplified process flow diagram is presented in Figure 1.

Slurry Mixing

In this process, coal, makeup catalysts, recycle solvent and recycle bottoms are prepared in 6 to 8 hour batches in the mix tank to form a homogeneous feed slurry. The equipment in the slurry mix area is the mix tank, spared recirculation pumps, the coal/bottoms bin and the solvent tank. The mix tank is totally enclosed to prevent dust and vapors from entering the process area. The slurry temperature is typically held around 135-143 °C (275-290 °F) to ensure an easily pumpable slurry. The pressure is held at or slightly above, atmospheric during non-charging periods. However, a vacuum can be drawn on the solvent tank to aid during feed charging. The tank is equipped with a mixer to mix the coal, bottoms, solvent and catalyst. The feed slurry is further mixed by the recirculation pump.

Slurry Feed

The slurry feed section is used to provide a continuous slurry flow to the liquefaction reactors. The major equipment in the area includes the feed tank, spared recirculation pumps, and high pressure feed pumps. Periodically, the feed tank is charged with a fresh batch of slurry from the mix tank. The slurry is continuously mixed and recirculated to ensure a homogeneous slurry in the feed tank. The high pressure pumps are used to pump a slipstream of slurry from the recirculation loop to the liquefaction reactors. Typical holding tank operating conditions are 135-143 °C (275-290 °F) and atmospheric pressure.

Liquefaction Reactors

The liquefaction reactor system consists of a pretreater and two reactors in series with their associated sandbaths. The pretreater consists of two 25 mm (1") diameter, 316 stainless steel pipes, and each reactor consists of four 25 mm (1") diameter, 316 stainless steel pipes. The reactor pipes are 1.22 m (4 ft) in length and are connected by 9.5 mm (3/8") diameter, 316 stainless steel tubing. The reactors operate in an upflow mode and are capable of having interstage hydrogen addition. The electrically heated sandbaths are used to control the reactor temperatures.

The slurry is pumped from the feed tank to the pretreater at a rate of 3.6 to 5.5 kg/h (8 to 12 lb/hr). The purpose of the pretreater is to activate the catalyst by sulfiding the iron oxide. The catalyst is activated by treat gas containing 10 volume percent H_2S in H_2 . The activated slurry leaving the pretreater is blended with pure H_2 treat gas before it is fed to the first stage reactor. Most of the coal is converted to liquid hydrocarbons and gas via a combination of thermal and catalytic processes in the two liquefaction reactors.

The residence time within the pretreater and each reactor can be varied by varying slurry feed rate or by varying the number of reactor pipes in each sandbath. The nominal residence time of the pretreater ranges from 20 to 30 minutes, while the nominal residence time of each reactor ranges from 40 to 55 minutes. The pretreater and liquefaction reactors operate at 17.2 MPa (2500 psig). The pretreater operates between 296-302 °C (565-575 °F), while the liquefaction reactors operate between 427-454 °C (800-850 °F). The reactors have a good approach to isothermal operation, and operate with minimal pressure drop.

Separations

The RCLU uses high pressure separation vessels to separate the heaviest fraction of the reactor product from the lighter fraction. The high pressure separations system consists of hot and cold separators operating at slightly below reactor pressure. The hot separator is used to split the reactor effluent into two streams: an overhead stream consisting of gases, water and light oil and an underflow stream consisting of heavy oil and mineral matter. The overhead stream from the hot separator passes through two heat exchangers before entering the cold separator. The exchangers cool the stream, thus condensing some of the light oils which are captured in the cold separator. The offgas from the cold separator goes to on-line gas chromatographs. The hot and cold separator underflow streams then proceed to low pressure separation and fractionation. The products from the low pressure separation and fractionation section are bottoms, solvent, distillate and water. Some of the bottoms and solvent are recycled back to the feed slurry.

Catalyst Types

The catalysts used in this study are presented in Table 1. Bayferrox 5210 was used as the source of iron, and Molyvan A was used as the source of Molybdenum.

Table 1
Properties of Slurry Catalysts

Catalyst	Particle Size, Microns	Surface Area, m ² /g	Bulk Density, g/cm ³	Physical Form	Composition wt %
Bayferrox PK 5210 Technical Iron Oxide	0.020	123	n/a	Reddish-brown powder	100 % Fe ₂ O ₃
MOLYVAN A, Molybdenum containing powder	5 to 10	n/a	1.58	Yellow-orange powder	30.0 % Mo

Figure 1
Simplified Process Flow Plan of RCLU

4. Operations Synopsis

Operations were initiated in July, 1995, following a period of about 1 month of equipment modifications, pressure testing and instrument calibrations. During July and August of 1995 eighteen yield periods were successfully completed. Table 2 is a summary of plant operations. Details are provided in the operator's log book, Exxon Research and Development Laboratories, Laboratory Notebook No. 18662.

5. Results and Discussion

Seven conditions were tested during the 1995 period. Several variables were investigated, including sulfur source, makeup rate of molybdenum catalyst, iron promotion, and hydrogen treat rate as shown in Table 2. A summary of the operating conditions is presented in Table 3. Typically, three 24 hour balances (yield periods) were performed at each condition. A summary of the reconciled yields and overall conversion is presented in Table 4. The values shown in Tables 3 and 4 are the average values at each condition. Table 5 shows the results of statistical analysis used to test the significance of observed differences. Individual yield period values are presented in Appendices A and B.

Table 2
Summary of Experimental Program

Condition	Comment	Yield Periods
1	Initial conditions.	434-435
2	Reduced hydrogen treat from 17 to 11 wt% on dry coal.	436
3	Changed sulfur source from elemental sulfur to H ₂ S.	438-440
4	Increased hydrogen treat back to initial conditions. Reduced molybdenum addition from 100 to 50 wppm on dry coal.	441-443
5	Added 0.25 wt% Bayferrox iron oxide on dry coal.	444-446
6	Reduced hydrogen treat from 17 to 11 wt% on dry coal. Eliminated iron oxide addition.	447-449
7	Increased molybdenum addition from 50 to 750 wppm on dry coal. Increased space velocity from 640 to 800 kg/hr-m ³ -stage	451-453

Table 3
Summary of Test Conditions
(Dry Basis)

Condition	Hydrogen	Fe ₂ O ₃	Mo	Weight Ratio	Wt% S	NRT,	Space Velocity		Reactor Temperature			
	Treat Rate, wt%	wt %	wppm	Sol. to coal : Bot. to coal	(Wt% H ₂ S)	min/stage	lb/hr-ft ³ -st	kg/hr-m ³ -st	First Stage		Second Stage	
									°C	°F	°C	°F
1	16.8	0	100	1.00:1.06	2.16	41.0	40	640	439	823	450	842
2	10.9	0	100	0.98:1.07	2.15	40.0	40	640	440	824	450	842
3	10.7	0	100	1.02:1.06	(2.00)	38.7	40	640	442	827	450	841
4	16.9	0	50	1.01:1.05	2.15	40.3	40	640	440	824	450	842
5	17.0	0.24	50	1.02:1.03	2.24	40.3	40	640	441	826	450	842
6	11.0	0	50	0.97:1.11	2.15	39.0	40	640	441	825	450	842
7	12.0	0	750	1.02:1.05	2.11	34.0	50	800	441	826	450	842

Table 4
Summary of Reconciled Yields and Conversion,
(wt% Based on Dry Ash-Free Coal)

Condition	H ₂	C1-C4	C5-350F	350-650F	650-1000F	C5-1000F	C1/1000	Conversion
1	-5.9	13.1	11.5	32.5	16.1	60.0	73.1	87.1
2	-5.9	13.1	12.2	33.4	14.3	59.9	73.0	86.8
3	-5.9	13.4	12.1	32.9	13.2	58.1	71.5	86.0
4	-5.8	13.0	10.8	31.6	15.2	57.5	70.5	86.7
5	-5.8	13.4	10.8	32.1	14.3	57.2	70.6	85.6
6	-5.9	13.5	10.4	30.3	14.2	54.9	68.3	84.2
7	-5.9	12.7	10.8	32.3	14.1	57.2	69.9	85.0

Conversion is based on wt% of dry ash free coal converted to 1000 °F minus.

Table 5
Summary of Statistical Analysis

Was there a significant change from the previous condition?						
Condition	1 vs 2	2 vs 3	1 vs 4	4 vs 5	4 vs 6	6 vs 7
H ₂	No	No	No	No	No	No
C ₁ -C ₄	No	No	Yes	No	No	Yes
C ₃ -1000 F	No	No	Yes	No	Yes	Yes
C ₅ -1000 F	No	Yes	Yes	No	Yes	Yes
C ₅ -350 F	No	No	Yes	No	No	No
350-650 F	No	No	No	No	No	No
650-1000 F	No	No	No	No	No	No
CONVERSION	No	No	No	No	Yes	No
GAS SELECTIVITY	No	No	No	No	No	Yes
GAS/LIQ SELECT	No	No	No	No	No	Yes

NOTES: Assumed 95% confidence interval and normal distribution.

H₂S vs Elemental Sulfur

The effect of sulfur type is shown by comparison of condition 2 vs 3. As shown in Table 4, liquid yields were slightly lower in the H₂S case than in the elemental sulfur case, 58 vs 60 wt% on dry ash free coal. As indicated in Table 5, this was a significant difference; however, condition 2 may not have been lined out at steady state. Apparently, the elemental sulfur is no worse than H₂S at sulfiding the molybdenum catalyst to the active form. For safety reasons elemental sulfur is preferred to handling H₂S in a pilot plant setting. Commercially, elemental sulfur will be available from the sulfur plant or as an H₂S rich tail gas from the gas treating system. Choosing the sulfur source will be an economic optimization within the constraints of a safe and operable plant.

Decreased Molybdenum Addition Rate

Reducing the catalyst addition rate resulted in a significant drop in liquid yields, as shown in Table 4 by comparing condition 4 to condition 1 and by comparing condition 2 to condition 6. C5/1000F liquid yields dropped by about 2.5 wt%, when the hydrogen treat rate is 17 wt% on dry ash free coal and about 4 wt% when hydrogen treat rate is 11 wt% on dry ash free coal. Apparently, the catalyst and the hydrogen treat interact. One explanation is that, when the combination of hydrogen treat rate and catalyst addition rate is too low, the concentration of activated hydrogen or hydrogen donors drops below the level required to prevent regressive reactions.

Decreased Hydrogen Treat Rate

The effect of changing the hydrogen treat rate from 17 to 11 wt% with 100 wppm molybdenum catalyst addition is shown by comparing condition 1 and condition 2. As shown in Table 4, the yield of C5-1000 F liquids remained at 60 wt% on dry ash free coal. Reducing the treat gas rate shifted the yield slate to lighter products, about 2 wt% more 650°F- and about 2 wt% less 650-1000°F; however, these differences are not statistically significant as shown in Table 5. As previously mentioned, Condition 2 may not have been lined out at steady state, so some caution in interpreting these results is advised. During Conditions 1 and 2 the catalyst addition rate was 100 wppm on dry ash free coal.

Comparison of conditions 4 and 6 shows the impact of changing treat gas rate from 17 to 11 wt% on dry ash free coal with a 50 wppm molybdenum addition rate. As shown in Table 4 liquid yields dropped by about 2.5 wt% on dry ash free coal. As shown in Table 5, this was a statistically significant change.

Another way of presenting the results of the Mo catalyst addition rate test and the hydrogen treat rate is shown in Table 6. Presented in this way, we see that we have a simple 2 by 2 factorial experiment. Table 6 gives a little clarity to the results. As long as the catalyst addition rate was 100 wppm, the treat gas rate did not have an impact over the range tested. When the catalyst addition rate was low (50 wppm), changing the treat gas rate did have an impact. On the other hand, reducing the catalyst addition rate to 50 from 100 wppm always reduced liquid yields.

Table 6

Interaction of Treat Gas and Catalyst on C5-1000°F Liquid Yields

C5-1000°F Yield, Wt% on Dry Ash Free Coal (Condition Number)

Mo wppm wt% H2	11	17
50	55(6)	57.5(4)
100	60(2)	60(1)

Addition of 0.25wt% Iron Oxide Promoter

Adding 0.25wt% Bayferrox iron promoter did not improve liquid yields as seen by comparing condition 4 vs 5 as shown in Table 4. Our strategy for this test included reducing the molybdenum addition rate to 50 from 100 wppm. We believed that a lower molybdenum addition rate would show the impact of iron promotion better than at high Mo ratio, where little observable improvement in yields could be gained by improving the catalyst. Since we saw that C5-1000°F yields dropped when molybdenum catalyst addition rate was decreased, we gave the iron promotion a greater opportunity to show an impact. However we saw no impact for the added iron.

Increased Catalyst Addition Rate and Increased Space Velocity

Increasing the catalyst addition rate from 50 to 750 wppm increased liquid yields by 1.9 wt% on dry ash free coal, as shown by comparing Condition 6 to Condition 7. This improvement was achieved even though the space velocity was increased 25%. As shown in Table 5, this is a statistically significant difference.

Table 7
Impact of Catalyst Addition Rate
Wt% C₅-1000°F on Dry Ash Free Coal

wppm Mo @ 11 - 12 wt% H ₂	Space Velocity lb/hr-ft ₃ -st	Wt% C ₅ - 1000°F Yields
50	40	55(6)
750	50	57.2(7)

6. Data Integrity Systems

The RCLU is a highly instrumented pilot plant that can provide a great deal of process data. Although all the process data is important, not all of it is critical for material balancing. This section identifies the critical process data and current systems in place to ensure data integrity. In addition, analytical data for the coal, bottoms, solvent, distillate and water are also critical for material balancing. The critical process data for material balancing are listed below.

- Feed gas and product gas rates
- Feed and product gas compositions
- Reactor temperatures and pressures
- Addition and removal rates for feed coal, recycle bottoms, recycle solvent, bottoms product, solvent product, distillate and water

There are several critical flow meters that measure the feed gas and product gas rates. The feed gas flowmeters were calibrated before the initial start-up of the RCLU. Similarly, the product off-gas flowmeters were calibrated before the initial start-up. The product off-gas rate is usually calculated from the average of two dry test meters. The dry test meters are recalibrated in the mechanical shop before installation. The Roots meter, which is a backup flowmeter for the product off-gas, is periodically checked against the dry test meters for accuracy. Occasionally, a dry test meter accumulates some liquids during operation, resulting in an erroneous increase in flow rate. When a dry test meter deviates significantly from the Roots meter and the other dry test meter, it is removed from the unit and recalibrated. The Roots meter was not recalibrated during the operation although it was reading approximately 5% lower than the average of the dry test meters. The multiplicity of flowmeters not only provides reliable data but also is a useful means for identifying faulty flowmeters.

The composition of the nominal 10 volume percent H_2S in H_2 treat gas is provided by the vendor. Occasionally, the composition of the treat gas is checked against a certified gas by gas chromatography. The pure hydrogen feed gas is supplied from an Air Products trailer. The composition of the pure hydrogen is guaranteed by contract to be 99.995 volume percent. Therefore, the composition of the pure hydrogen is not monitored. The product off-gas is sampled and sent to five different gas chromatographs for analysis to determine composition. These gas chromatographs were calibrated before start-up of the RCLU with certified gases and periodically checked and re-calibrated as necessary between each set of operating conditions.

The reactor conditions are another set of critical process data. These include the temperature and pressure of the pretreater and the two reactors. The average temperature of the pretreater and reactors is calculated from the average temperature of the reactor tubes, excluding the first tube. The first tube is excluded because a significant temperature rise occurs across this tube. A commercial size reactor will be more nearly isothermal, so excluding the first tube will give a better representation of a commercial reactor.

In the past, a small fraction of new thermocouples were spot checked and calibrated. The thermocouples were found to be very reliable. The thermocouples were not calibrated before they were installed, but were checked to make sure they were not grounded. The thermocouples purchased are of high quality and meet ISA standards for the special limits of error (± 1.1 °C or 0.4%, whichever is greater) on a Type K thermocouple. The circuitry from the thermocouple to the computer was also checked before start-up. The multiplicity of thermocouples provides reliable data and a useful means for identifying faulty thermocouples. Similarly, there are multiple pressure indicators and transducers in series which provide reliable data and a useful means for identifying faulty instruments. ⁽³⁾

The feed and product rates of the solids and liquids are based on scale weights. The feed coal, recycle bottoms and recycle solvent are weighed on a Flex Weigh Co. scale. The catalysts are weighed on a Fisher Scientific balance. The bottoms, solvent, distillate and water products are weighed on the same Flex Weigh Co. scale as the feed. The Flex Weigh Co. scale is not electronically connected to the RCLU computer system. Therefore, the operators manually enter the feed and product weights at the control panel. The feed and mix tank weights provide alternative ways to measure the slurry feed rate. Load cells are used to monitor the feed tank and mix tank weights. These load cells are calibrated with a 22.7 kg (50 lb.) standard for each balance period. Load cells and level transmitters are also placed around the unit to monitor the product accumulator weights and internal vessel levels. ⁽⁴⁾

Samples of coal, bottoms, solvent, distillate, and water are sent to analytical lab for testing. The tests are standard ERDL tests. The data are reviewed by the engineers for reasonableness. Data that do not seem reasonable in the engineer's judgment are resubmitted to the analytical labs for retesting. The ERDL Analytical Established Methods group maintains a quality system based on ISO Guide 25. This system is documented in a series of manuals, including a Quality Assurance Manual (QAM) and a Quality Systems Information Manual (QSIM). These manuals detail the operations of the Quality Control process, including the procedures, maintenance process, and the system for customer complaint resolution, among others. Analytical procedures are documented using a standard format that addresses the quality components, including calibration and training. All analytical procedures are reviewed and approved by the analytical supervisor and by an independent technical expert familiar with the field. ⁽⁵⁾

The current systems for collecting data and ensuring data integrity evolved from the culmination of many years of pilot plant experience. These existing systems have provided very reliable data for the RCLU in the past. However, some additional measures were taken before the 1995 operations to ensure reliable data. A list of these measures is presented below:

- Recalibration of the feed gas and product gas flowmeters.
- Maintenance of all calibration records in the RCLU operations log book.

- Keeping track of the maintenance history for each DTM. Information that should be recorded included the description of the repairs, the date repaired, the person responsible for the work, the serial number and a summary of the calibration information.
- Spot checking of new thermocouples and pressure indicators.
- Checking the Flex Weigh Co. scale with a 22.7 (50 lb.) standard between each set of operating conditions and recalibrate, if necessary.

7. Material Balancing and Analyses Procedures

Material balances are based on a 24 hour operating period at constant conditions. Ideally, the conditions are at or near steady state before a yield period (material balance period) is initiated. There is a compromise between the number of conditions and the approach to steady state for a given amount of operating time. For these experiments, a prudent cost-effective judgment was used to reach a compromise between approach to steady state and maximizing the number of operating conditions as per the DOE recommendations.⁽⁶⁾ The yield periods were initiated when the bottoms conversion started to level off.

From past experience at Exxon, the ash content of recycle bottoms provides a good indication of coal conversion level with known feed coal ash content. In typical bottoms recycle pilot plant operations, the ash content of the recycle bottoms is monitored daily in a screening test. The final ash content in the recycle bottoms is determined by the analytical labs several weeks later. The procedure for both tests is essentially the same. The main difference is that the analytical tests are automated and use a different purge gas. The ash content of the bottoms is measured in duplicate by combustion of small samples of bottoms at 950°C for at least three hours. The average ash content of the bottoms and the known feed coal ash content are input to a computer model with a built in equation assuming 100% ash balance. The model calculates DAF coal conversions, and the data are plotted daily to monitor the trend of new conditions vs. previous conditions. In a typical case, a significant change in coal conversion is observed in the first few days after starting a new condition. The coal conversion gradually levels off in about 3-5 days after the change to the new condition. Yield periods are initiated when the bottoms ash content begins to level off. The ash leads screening tests typically compare well with the results of the analytical lab tests.

Material balances are conducted after a yield period is complete. The RCLU utilizes two levels of material balancing. The first level is on-line material balancing, and the second level is material balancing that utilizes data reconciliation techniques. The on-line material balances are often completed within 24 hours after the end of the yield period. They are used to guide unit operations, identify data acquisition problems, and provide preliminary product yields leading to the determination of subsequent run conditions.

The raw data and process variables for each yield period are stored in the RCLU computer system. The on-line material balancing program retrieves these raw data from the RCLU computer system along with input data from the unit engineers, to calculate the overall material balance, DAF coal conversion, hydrogen consumption, and gaseous and distillate yields for each yield period. The input data from the unit engineers includes moisture and ash contents of the feed coal and percents of 1000°F+ material in the recycle solvent and 1000°F- material in the recycle bottoms. In order to cross-check the data, balances and yields are calculated using three different slurry feed bases. If balances are poor or yields deviate substantially from those expected then the weights and analyses are

re-checked for errors. If no errors are found, an investigation is initiated to determine possible unit material losses and/or errors in data acquisition.

The second level of material balancing utilizes the results of the on-line material balances, as well as elemental analyses of each feed and product stream and simulated distillation by gas chromatography (GCD) of hydrocarbon streams. The reconciled balances are usually not finalized until at least three weeks after the end of a given yield period. Reconciled balances are considered the finalized results and are the results most often reported. Once finalized, reconciled results are used to compare the effects of process variables and/or catalysts on product yields and distribution.

In order to reconcile the data, a mainframe computer program is used to assure that elemental and over all mass balances are consistent. The procedure adjusts measured values according to a protocol which minimizes the sum of the weighted squares as follows: Minimize $\sum \{Z_i - X_i / \sigma_i\}^2$ with constraints such that carbon, hydrogen, sulfur, oxygen, and ash balances are closed to within 99.99%. Z_i and X_i are adjusted and measured stream rates and stream elemental compositions, and σ_i is an estimate of standard deviation made from a series of tests at constant nominal conditions. Although this procedure may seem arbitrary and cumbersome, we believe it is necessary. Without such a procedure the pilot plant data, or any plant data, could not be used to estimate economics for a commercial plant with assurance that critical economic factors such as hydrogen balance would be reliable. Moreover, we have developed and refined this procedure over many years and we share the benefits of this approach in this study. We also provide a complete listing of unadjusted measured stream rates and elemental compositions in Appendix C for the interested reader. In addition the estimated measurements used in the procedure are shown in Appendix H.

Stated another way, the objective of data reconciliation is to legitimately adjust data values to balance elemental weights of feed and product streams. Data are, therefore, adjusted by taking into account the reliability of each data measurement. Those variables which have poor reliability are preferentially changed in order to achieve data consistency. Neither the constraint equations nor variable reliabilities are changed from yield period to yield period.

Data reconciliation is an iterative procedure that is designed to be used only when "as-measured" balances are good. Typically, data reconciliation requires that the total material balances be between 98 and 102%. However, material balances between 95 and 102% are tolerable. If the balances do not meet the above criterion, the data are re-analyzed for obvious errors, and suspect samples are resubmitted for analyses.

Due to operational variations, data from any single reconciled yield period should not be used in data comparisons. Rather, the results from several yield periods (≥ 3) at one condition should be used for comparison purposes.

8. Conclusions and Recommendations

These tests showed that dispersed catalyst systems are highly effective in the direct liquefaction of subbituminous coals. Yields of distillable liquids ranged from 55 to 60 wt% of dry ash free coal, depending on operating conditions and catalyst. The highest distillable liquid yields, 60%, were achieved with 100 wppm molybdenum on dry ash free coal. Molybdenum was found to be effective as low as 50 wppm on dry ash freed coal with distillable liquid yields of 55 to 58 wt% on dry ash free coal. The combination of 0.25 wt% iron with 50 wppm did not show a measurable improvement in distillable liquid yields compared with 50 wppm molybdenum alone.

Planning studies using the process performance data obtained from RCLU, are needed to evaluate the economic potential for dispersed catalyst in direct coal liquefaction service and to provide focus for future research. These studies should cover variation of process variables such as catalyst type, space velocity, temperature, catalyst addition rate, and treat gas rate so that the economic impact of pilot plant results can be measured.

We saw no significant operability problem with any of the test conditions run in RCLU. A pilot plant test covering a longer period, 2 - 4 months, at economically preferred conditions, would be helpful in identify potential operability issues. Any operability issues identified could then be addressed or mitigated through proper commercial process and mechanical design.

9. Acknowledgments

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Appendix A

Detailed Operating Conditions

Table A-1
Detailed Operating Conditions

CONDITION PERIOD	1 YP434	1 YP435	2 YP436	3 YP438	3 YP439	3 YP440	4 YP441	4 YP442	4 YP443	5 YP444	5 YP445	5 YP446
COAL	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder
START DATE	7/22/95	7/23/95	7/24/95	7/28/95	7/29/95	7/30/95	8/4/95	8/5/95	8/7/95	8/11/95	8/12/95	8/13/95
START TIME	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00
LENGTH (HR)	24	24	24	24	24	24	24	24	24	24	24	24
FIRST REACTOR STAGE												
TEMPERATURE (F)	822	823	824	828	826	826	824	825	823	825	826	828
NOMINAL RT (MIN)	41	41	40	38	39	39	40	41	40	40	40	41
PRESSURE (PSIG)	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
H2 TREAT (WT%)	0	0	0	1.07	1.08	1.08	0	0	0	0	0	0
SECOND REACTOR STAGE												
TEMPERATURE (F)	841	842	842	841	841	841	842	842	842	842	842	842
NOMINAL RT (MIN)	41	41	40	38	39	39	40	41	40	40	40	41
PRESSURE (PSIG)	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
H2 TREAT (WT%)	16.80	16.87	10.86	10.63	10.69	10.75	16.90	17.27	16.62	16.82	16.80	17.32
MO MAKEUP (PPM)	100	100	100	100	100	100	50	50	50	50	50	50
FE2O3 MAKEUP (WT%)	0	0	0	0	0	0	0	0	0	0.24	0.24	0.25
ADDED SULFUR (WT%)	2.18	2.14	2.15	1.96	1.95	2.10	2.15	2.15	2.15	2.24	2.24	2.25
TOTAL WATER (WT%)	0.35	0.18	0.37	0.56	1.21	1.16	-1.34	-1.57	-1.10	-0.95	-0.47	0.60
S/C RATIO (DRY BASIS)	1.02	0.98	0.98	1.03	1.00	1.03	0.97	1.04	1.03	1.04	1.03	1.00
B/C RATIO (DRY BASIS)	1.04	1.07	1.07	1.05	1.08	1.04	1.11	1.02	1.03	1.01	1.02	1.06
S/C RATIO (DAF BASIS)	1.08	1.03	1.04	1.09	1.06	1.09	1.02	1.10	1.09	1.10	1.09	1.06
B/C RATIO (DAF BASIS)	0.75	0.79	0.80	0.78	0.81	0.78	0.83	0.75	0.77	0.75	0.76	0.81
ASPHALTS/COAL	0.36	0.37	0.38	0.38	0.39	0.38	0.41	0.34	0.37	0.35	0.35	0.38
PREASPH/COAL	0.10	0.11	0.07	0.08	0.12	0.10	0.10	0.11	0.11	0.10	0.12	0.11
THFSLDS/COAL	0.29	0.31	0.34	0.32	0.30	0.30	0.32	0.30	0.30	0.30	0.30	0.32
650 F- IN SOLVENT	12.70	5.70	6.50	17.65	6.10	5.50	7.30	11.80	10.20	9.30	9.20	6.80
1000 F+ IN SOLVENT	4.40	10.10	8.50	5.25	9.80	9.60	9.50	4.10	4.30	5.60	5.30	7.50
1000 F- IN BOTTOMS	9.37	9.20	10.40	9.71	10.57	11.94	8.29	9.77	8.23	10.23	9.77	8.51
MATERIAL BALANCE (N2 FREE)	94.9	96.5	95.7	97.0	96.0	101.9	97.1	96.0	97.9	97.6	97.1	97.3
ELEMENTAL BALANCES												
ASH	105.9	104.5	108.2	105.0	103.9	103.0	106.4	104.9	103.9	103.1	103.7	102.9
CARBON	102.2	103.0	103.0	102.0	101.7	102.8	102.8	102.8	103.0	102.8	102.4	102.0
HYDROGEN	101.6	99.8	96.9	104.2	105.2	101.2	102.5	103.3	102.5	103.3	103.6	104.7
OXYGEN	79.1	78.6	79.9	78.5	79.6	80.0	74.9	75.0	75.6	76.0	77.2	79.9
NITROGEN	96.7	97.4	109.6	97.7	100.1	102.1	102.4	105.4	104.5	96.7	96.7	96.3
SULFUR	73.3	72.4	70.7	70.1	70.5	67.2	64.4	65.6	64.9	66.6	66.6	66.6

Table A-1 (Cont.)
Detailed Operating Conditions

CONDITION PERIOD	6 YP447	6 YP448	6 YP449	7 YP451	7 YP452	7 YP453
COAL	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder	B. Thunder
START DATE	8/17/95	8/18/95	8/19/95	8/25/95	8/26/95	8/27/95
START TIME	8:00	8:00	8:00	14:00	14:00	14:00
LENGTH (HR)	24	24	24	24	24	24
FIRST REACTOR STAGE						
TEMPERATURE (F)	823	827	826	827	826	826
NOMINAL RT (MIN)	38	40	39	34	34	34
PRESSURE (PSIG)	2500	2500	2500	2500	2499	2499
H2 TREAT (WT%)	0	0	0	0	0	0
SECOND REACTOR STAGE						
TEMPERATURE (F)	842	842	842	842	842	842
NOMINAL RT (MIN)	38	40	39	34	34	34
PRESSURE (PSIG)	2500	2500	2500	2500	2499	2499
H2 TREAT (WT%)	10.77	11.27	11.09	11.96	12.05	11.88
MO MAKEUP (PPM)	50	50	50	750	750	750
FE2O3 MAKEUP (WT%)	0	0	0	0	0	0
ADDED SULFUR (WT%)	2.15	2.15	2.15	2.12	2.11	2.10
TOTAL WATER (WT%)	-1.28	-1.59	-0.90	-0.27	-0.20	-0.33
S/C RATIO (DRY BASIS)	0.99	0.96	0.97	1.03	1.03	0.99
B/C RATIO (DRY BASIS)	1.10	1.12	1.11	1.04	1.03	1.07
S/C RATIO (DAF BASIS)	1.05	1.02	1.03	1.09	1.09	1.05
B/C RATIO (DAF BASIS)	0.84	0.87	0.87	0.81	0.79	0.83
ASPHALTS/COAL	0.40	0.42	0.41	0.40	0.39	0.41
PREASPH/COAL	0.13	0.13	0.13	0.13	0.13	0.13
THFSLDS/COAL	0.31	0.31	0.32	0.27	0.28	0.29
650 F- IN SOLVENT	6.80	5.60	6.00	4.10	3.90	4.10
1000 F+ IN SOLVENT	7.90	8.70	8.30	8.80	8.60	11.90
1000 F- IN BOTTOMS	10.91	8.17	9.54	11.20	11.77	12.11
MATERIAL BALANCE (N2 FREE)	97.2	100.2	97.5	98.0	97.6	96.5
ELEMENTAL BALANCES						
ASH	108.3	106.8	107.3	102.0	102.6	103.5
CARBON	101.7	102.3	101.5	102.6	102.2	101.9
HYDROGEN	106.2	104.6	106.7	105.3	105.6	106.4
OXYGEN	74.6	73.9	76.1	77.6	77.9	78.1
NITROGEN	100.3	102.2	99.1	99.1	102.8	102.3
SULFUR	65.6	65.9	65.6	63.6	63.5	63.1

Table A-2

Mean and Standard Error of the Mean for Operating Conditions

CONDITION STREAM/YP	1		3		4	
	YP434-YP435		YP438-YP440		YP441-YP443	
	Mean	Std. Error of Mean	Mean	Std. Error of Mean	Mean	Std. Error of Mean
FIRST REACTOR STAGE						
TEMPERATURE (F)	823	0.50	827	0.67	824	0.58
NOMINAL RT (MIN)	41.0	0.00	38.7	0.33	40.3	0.33
PRESSURE (PSIG)	2500	0.00	2500	0.00	2500	0.00
H2 TREAT (WT%)	0.0	0.00	1.1	0.00	0.0	0.00
SECOND REACTOR STAGE						
TEMPERATURE (F)	842	0.50	841	0.00	842	0.00
NOMINAL RT (MIN)	41.0	0.00	38.7	0.33	40.3	0.33
PRESSURE (PSIG)	2500	0.00	2500	0.00	2500	0.00
H2 TREAT (WT%)	16.8	0.03	10.7	0.03	16.9	0.19
MO MAKEUP (PPM)	100.0	0.00	100.0	0.00	50.0	0.00
FE2O3 MAKEUP (WT%)	0.00	0.00	0.00	0.00	0.00	0.00
ADDED SULFUR (WT%)	2.16	0.020	2.00	0.048	2.15	0.000
TOTAL WATER (WT%)	0.27	0.085	0.98	0.209	-1.34	0.136
S/C RATIO (DRY BASIS)	1.00	0.020	1.02	0.010	1.01	0.022
B/C RATIO (DRY BASIS)	1.06	0.015	1.06	0.012	1.05	0.028
S/C RATIO (DAF BASIS)	1.06	0.025	1.08	0.010	1.07	0.025
B/C RATIO (DAF BASIS)	0.77	0.020	0.79	0.010	0.78	0.024
ASPHALTS/COAL	0.37	0.005	0.38	0.003	0.37	0.020
PREASPH/COAL	0.11	0.005	0.10	0.012	0.11	0.003
THFSLDS/COAL	0.30	0.010	0.31	0.007	0.31	0.007
650 F- IN SOLVENT	9.20	3.500	9.75	3.954	9.77	1.317
1000 F+ IN SOLVENT	7.25	2.850	8.22	1.484	5.97	1.768
1000 F- IN BOTTOMS	9.29	0.085	10.74	0.649	8.76	0.504
MATERIAL BALANCE (N2 FREE)	95.7	0.80	98.3	1.82	97.0	0.55
ELEMENTAL BALANCES						
ASH	105.2	0.70	104.0	0.58	105.1	0.73
CARBON	102.6	0.40	102.2	0.33	102.9	0.07
HYDROGEN	100.7	0.90	103.5	1.20	102.8	0.27
OXYGEN	78.9	0.25	79.4	0.45	75.2	0.22
NITROGEN	97.1	0.35	100.0	1.27	104.1	0.89
SULFUR	72.9	0.45	69.3	1.04	65.0	0.35

Table A-2 (Cont.)
Mean and Standard Error of the Mean for Operating Conditions

CONDITION STREAM/YP	5		6		7	
	<u>YP444-YP446</u>		<u>YP447-Y449</u>		<u>YP451-YP453</u>	
	<u>Mean</u>	<u>Std. Error of Mean</u>	<u>Mean</u>	<u>Std. Error of Mean</u>	<u>Mean</u>	<u>Std. Error of Mean</u>
FIRST REACTOR STAGE						
TEMPERATURE (F)	826	0.88	825	1.20	826	0.33
NOMINAL RT (MIN)	40.3	0.33	39.0	0.58	34.0	0.00
PRESSURE (PSIG)	2500	0.00	2500	0.00	2499	0.33
H2 TREAT (WT%)	0.0	0.00	0.0	0.00	0.0	0.00
SECOND REACTOR STAGE						
TEMPERATURE (F)	842	0.00	842	0.00	842	0.00
NOMINAL RT (MIN)	40.3	0.33	39.0	0.58	34.0	0.00
PRESSURE (PSIG)	2500	0.00	2500	0.00	2499	0.33
H2 TREAT (WT%)	17.0	0.17	11.0	0.15	12.0	0.05
MO MAKEUP (PPM)	50.0	0.00	50.0	0.00	750.0	0.00
FE2O3 MAKEUP (WT%)	0.24	0.003	0.00	0.000	0.00	0.000
ADDED SULFUR (WT%)	2.24	0.003	2.15	0.000	2.11	0.006
TOTAL WATER (WT%)	-0.27	0.458	-1.26	0.200	-0.27	0.038
S/C RATIO (DRY BASIS)	1.02	0.012	0.97	0.009	1.02	0.013
B/C RATIO (DRY BASIS)	1.03	0.015	1.11	0.006	1.05	0.012
S/C RATIO (DAF BASIS)	1.08	0.012	1.03	0.009	1.08	0.013
B/C RATIO (DAF BASIS)	0.77	0.019	0.86	0.010	0.81	0.012
ASPHALTS/COAL	0.36	0.010	0.41	0.006	0.40	0.006
PREASPH/COAL	0.11	0.006	0.13	0.000	0.13	0.000
THFSLDS/COAL	0.31	0.007	0.31	0.003	0.28	0.006
650 F- IN SOLVENT	8.43	0.817	6.13	0.353	4.03	0.067
1000 F+ IN SOLVENT	6.13	0.689	8.30	0.231	9.77	1.068
1000 F- IN BOTTOMS	9.50	0.514	9.54	0.791	11.69	0.265
MATERIAL BALANCE (N2 FREE)	97.3	0.15	98.3	0.95	97.4	0.45
ELEMENTAL BALANCES						
ASH	103.2	0.24	107.5	0.44	102.7	0.44
CARBON	102.4	0.23	101.8	0.24	102.2	0.20
HYDROGEN	103.9	0.43	105.8	0.63	105.8	0.33
OXYGEN	77.7	1.15	74.9	0.65	77.9	0.15
NITROGEN	96.6	0.13	100.5	0.90	101.4	1.16
SULFUR	66.6	0.00	65.7	0.10	63.4	0.15

Appendix B

Detailed Measured and Reconciled Yields

Table B-1
Detailed Reconciled Yields (DAF Basis)

CONDITION STREAM/YP	1 434	1 435	2 436	3 438	3 439	3 440	4 441	4 442	4 443	5 444	5 445	5 446
MATERIAL BAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
ASH BALANCE	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
H2	-5.85	-5.90	-5.92	-5.89	-5.87	-5.89	-5.91	-5.86	-5.68	-5.82	-5.78	-5.87
H2O	13.29	13.22	12.75	12.62	12.50	12.47	14.84	14.46	13.81	13.61	13.45	13.10
CHEM GAS	6.63	6.65	6.92	7.94	8.00	7.85	7.67	7.85	7.51	7.25	7.44	7.70
COx	6.02	6.00	6.38	7.32	7.36	7.19	6.96	7.11	6.85	6.58	6.76	6.97
CO	2.90	2.96	2.60	2.60	2.66	2.53	3.25	3.43	3.17	3.10	3.16	3.31
CO2	3.12	3.04	3.78	4.72	4.70	4.66	3.72	3.68	3.68	3.48	3.61	3.67
NH3	0.46	0.48	0.37	0.42	0.45	0.46	0.47	0.50	0.44	0.50	0.52	0.54
H2S	0.15	0.17	0.17	0.20	0.19	0.20	0.25	0.24	0.22	0.17	0.16	0.19
C1-C4	13.05	13.11	13.13	13.50	13.33	13.29	13.01	13.39	12.50	13.06	13.31	13.86
C1-C2	6.81	6.87	6.82	7.04	6.97	6.93	6.95	7.20	6.70	7.00	7.15	7.43
C1	3.51	3.54	3.51	3.68	3.64	3.60	3.64	3.76	3.53	3.70	3.78	3.94
C2	3.30	3.33	3.31	3.36	3.32	3.33	3.31	3.44	3.17	3.29	3.38	3.49
C3-1000 F	66.42	66.06	66.22	64.76	64.12	64.57	63.26	63.72	63.63	64.11	63.59	62.56
C3-C4	6.24	6.24	6.31	6.45	6.37	6.36	6.06	6.19	5.80	6.06	6.15	6.43
C3	3.75	3.77	3.81	3.92	3.88	3.88	3.67	3.75	3.50	3.69	3.74	3.91
C4	2.50	2.47	2.51	2.53	2.49	2.48	2.39	2.44	2.30	2.38	2.41	2.52
C5-1000 F	60.18	59.82	59.91	58.31	57.75	58.21	57.20	57.53	57.83	58.05	57.44	56.13
C5-350 F	11.06	11.84	12.19	12.28	11.88	12.05	10.88	10.93	10.55	10.96	10.96	10.53
C5-160 F	3.35	3.45	3.61	3.79	3.75	3.78	3.24	3.31	3.20	3.29	3.32	3.33
160-350 F	7.71	8.40	8.57	8.49	8.13	8.27	7.64	7.62	7.35	7.67	7.64	7.20
350-650 F	31.53	33.43	33.44	33.57	31.92	33.06	31.07	31.50	32.08	32.59	31.65	31.93
350-400 F	4.39	4.91	4.91	4.59	4.55	4.50	4.42	4.46	4.30	4.51	4.42	4.01
400-450 F	5.11	5.67	5.71	5.29	5.27	5.46	5.16	5.19	5.12	5.54	5.27	4.79
450-500 F	5.26	5.91	5.90	5.63	5.43	5.58	5.27	5.33	5.38	5.88	5.46	5.42
500-550 F	5.76	6.30	6.33	6.10	5.83	6.16	5.67	5.85	5.99	6.62	5.87	6.69
550-600 F	6.28	6.53	6.50	6.87	6.29	6.58	6.18	6.22	6.53	6.27	6.30	6.56
600-650 F	4.72	4.12	4.10	5.10	4.55	4.77	4.36	4.45	4.76	3.78	4.33	4.46
650-1000 F	17.60	14.54	14.28	12.45	13.95	13.10	15.26	15.10	15.20	14.49	14.83	13.67
650-700 F	3.33	1.86	1.90	2.61	2.03	1.95	2.37	2.82	2.73	2.26	2.45	2.18
700-800 F	6.09	4.06	4.09	3.92	3.66	3.20	4.63	5.16	5.09	4.46	4.58	3.98
800-1000 F	8.17	8.63	8.30	5.93	8.26	7.96	8.26	7.11	7.38	7.77	7.81	7.51
CONVERSION	87.30	86.89	86.79	86.47	85.71	85.93	86.81	87.35	85.97	86.15	85.85	84.92
1000 F* BTMS	12.71	13.12	13.22	13.54	14.30	14.08	13.20	12.66	14.03	13.86	14.16	15.08
ASPHALTENES	6.11	6.06	6.34	6.62	6.92	6.82	6.51	5.71	6.68	6.50	6.48	7.14
PREASPHALTS	1.66	1.86	1.20	1.34	2.06	1.86	1.67	1.86	1.94	1.90	2.21	1.97
THF SOLIDS	4.94	5.20	5.67	5.57	5.32	5.40	5.02	5.08	5.42	5.46	5.47	5.98
Cs-400 F	15.45	16.75	17.09	16.87	16.42	16.55	15.30	15.39	14.85	15.47	15.38	14.54
400-700 F	30.46	30.38	30.43	31.59	29.41	30.50	29.01	29.86	30.51	30.35	29.68	30.10
700-1000 F	14.27	12.69	12.38	9.85	11.92	11.15	12.89	12.28	12.47	12.23	12.38	11.49
400-650 F	27.13	28.53	28.54	28.99	27.38	28.55	26.64	27.04	27.78	28.08	27.23	27.93
GAS SELECTIVITY	14.95	15.09	15.13	15.61	15.55	15.47	14.99	15.33	14.54	15.16	15.50	16.32
GAS/LIQ SELECT	17.82	17.98	17.98	18.80	18.75	18.59	18.53	18.88	17.77	18.37	18.81	19.80

Table B-1 (Cont.)
Detailed Reconciled Yields (DAF Basis)

CONDITION STREAM/YP	6 447	6 448	6 449	7 451	7 452	7 453
MATERIAL BAL	100.00	100.00	100.00	100.00	100.00	100.00
ASH BALANCE	100.00	100.00	100.00	100.00	100.00	100.00
H2	-5.77	-5.99	-5.86	-5.86	-5.95	-5.84
H2O	13.39	13.59	13.40	13.72	13.53	13.36
CHEM GAS	8.33	8.23	8.45	7.48	7.62	7.37
COx	7.67	7.60	7.86	6.89	6.96	6.74
CO	2.77	2.80	2.84	2.56	2.59	2.51
CO2	4.91	4.80	5.01	4.33	4.37	4.23
NH3	0.47	0.45	0.42	0.43	0.49	0.45
H2S	0.19	0.18	0.17	0.16	0.18	0.18
C1-C4	13.00	13.72	13.68	12.75	12.82	12.37
C1-C2	7.08	7.57	7.53	6.83	6.87	6.64
C1	3.81	4.09	4.07	3.63	3.65	3.53
C2	3.28	3.47	3.46	3.20	3.22	3.11
C3-1000 F	61.68	60.99	60.09	62.57	63.22	63.44
C3-C4	5.91	6.15	6.15	5.92	5.95	5.73
C3	3.60	3.75	3.74	3.54	3.55	3.42
C4	2.31	2.40	2.41	2.38	2.40	2.31
C5-1000 F	55.76	54.84	53.93	56.65	57.27	57.71
C5-350 F	10.13	10.85	10.19	10.84	10.56	10.87
C5-160 F	3.30	3.57	3.46	3.43	3.46	3.38
160-350 F	6.83	7.28	6.74	7.41	7.10	7.49
350-650 F	29.73	32.12	28.98	32.59	32.10	32.24
350-400 F	3.74	4.00	3.64	3.98	3.84	4.00
400-450 F	4.53	4.93	4.47	4.72	4.83	4.70
450-500 F	5.10	5.38	4.97	5.19	4.94	5.16
500-550 F	6.34	6.92	6.22	6.71	6.27	6.54
550-600 F	6.16	6.80	6.08	6.78	7.02	6.68
600-650 F	3.86	4.10	3.59	5.23	5.20	5.15
650-1000 F	15.90	11.87	14.76	13.22	14.60	14.60
650-700 F	2.09	1.71	1.93	2.30	2.22	2.34
700-800 F	4.47	3.27	4.37	3.26	3.58	3.62
800-1000 F	9.34	6.89	8.47	7.66	8.80	8.64
CONVERSION	84.71	84.39	83.60	84.74	85.30	84.97
1000 F* BTMS	15.29	15.62	16.41	15.27	14.72	15.04
ASPHALTENES	7.23	7.62	7.83	7.60	7.26	7.40
PREASPHALTS	2.42	2.41	2.52	2.53	2.33	2.39
THF SOLIDS	5.65	5.59	6.05	5.14	5.12	5.25
C5-400 F	13.87	14.84	13.83	14.82	14.40	14.88
400-700 F	28.08	29.84	27.26	30.92	30.48	30.57
700-1000 F	13.81	10.15	12.84	10.92	12.38	12.27
400-650 F	25.99	28.12	25.34	28.61	28.26	28.23
GAS SELECTIVITY	15.35	16.26	16.36	15.05	15.03	14.56
GAS/LIQ SELECT	18.91	20.01	20.23	18.37	18.29	17.65

Table B-2
Mean and Standard Error of the Mean for Reconciled Yields (DAF Basis)

CONDITION STREAM/YP	1		3		4	
	YP434-YP435		YP438-YP440		YP441-YP443	
	Mean	Std. Error of Mean	Mean	Std. Error of Mean	Mean	Std. Error of Mean
MATERIAL BAL	100.00	0.000	100.00	0.000	100.00	0.000
ASH BALANCE	100.00	0.000	100.00	0.000	100.00	0.000
H ₂	-5.88	0.025	-5.88	0.007	-5.82	0.070
H ₂ O	13.26	0.035	12.53	0.046	14.37	0.301
CHEM GAS	6.64	0.010	7.93	0.044	7.68	0.098
CO _x	6.01	0.010	7.29	0.051	6.97	0.075
CO	2.93	0.030	2.60	0.038	3.28	0.077
CO ₂	3.08	0.040	4.69	0.018	3.69	0.013
NH ₃	0.47	0.010	0.44	0.012	0.47	0.017
H ₂ S	0.16	0.010	0.20	0.003	0.24	0.009
C ₁ -C ₄	13.08	0.030	13.37	0.064	12.97	0.258
C ₁ -C ₂	6.84	0.030	6.98	0.032	6.95	0.144
C ₁	3.53	0.015	3.64	0.023	3.64	0.066
C ₂	3.32	0.015	3.34	0.012	3.31	0.078
C ₃ -1000 F	66.24	0.180	64.48	0.190	63.54	0.141
C ₃ -C ₄	6.24	0.000	6.39	0.028	6.02	0.115
C ₃	3.76	0.010	3.89	0.013	3.64	0.074
C ₄	2.49	0.015	2.50	0.015	2.38	0.041
C ₅ -1000 F	60.00	0.180	58.09	0.172	57.52	0.182
C ₅ -350 F	11.45	0.390	12.07	0.116	10.79	0.119
C ₅ -160 F	3.40	0.050	3.77	0.012	3.25	0.032
160-350 F	8.06	0.345	8.30	0.105	7.54	0.094
350-650 F	32.48	0.950	32.85	0.488	31.55	0.293
350-400 F	4.65	0.260	4.55	0.026	4.39	0.048
400-450 F	5.39	0.280	5.34	0.060	5.16	0.020
450-500 F	5.59	0.325	5.55	0.060	5.33	0.032
500-550 F	6.03	0.270	6.03	0.101	5.84	0.093
550-600 F	6.41	0.125	6.58	0.167	6.31	0.111
600-650 F	4.42	0.300	4.81	0.160	4.52	0.121
650-1000 F	16.07	1.530	13.17	0.434	15.19	0.047
650-700 F	2.60	0.735	2.20	0.208	2.64	0.137
700-800 F	5.08	1.015	3.59	0.211	4.96	0.166
800-1000 F	8.40	0.230	7.38	0.732	7.58	0.347
CONVERSION	87.10	0.205	86.04	0.226	86.71	0.401
1000 F ⁺ BTMS	12.92	0.205	13.97	0.226	13.30	0.398
ASPHALTENES	6.09	0.025	6.79	0.088	6.30	0.299
PREASPHALTS	1.76	0.100	1.75	0.215	1.82	0.080
THF SOLIDS	5.07	0.130	5.43	0.074	5.17	0.125
C ₅ -400 F	16.10	0.650	16.61	0.134	15.18	0.167
400-700 F	30.42	0.040	30.50	0.629	29.79	0.434
700-1000 F	13.48	0.790	10.97	0.604	12.55	0.180
400-650 F	27.83	0.700	28.31	0.480	27.15	0.334
GAS SELECTIVITY	15.02	0.070	15.54	0.041	14.95	0.229
GAS/LIQ SELECT	17.90	0.080	18.71	0.063	18.39	0.328

Table B-2 (Cont.)

Mean and Standard Error of the Mean for Reconciled Yields (DAF Basis)

CONDITION STREAM/YP	5		6		7	
	YP444-YP446		YP447-YP449		YP451-YP453	
	Mean	Std. Error of Mean	Mean	Std. Error of Mean	Mean	Std. Error of Mean
MATERIAL BAL	100.00	0.000	100.00	0.000	100.00	0.000
ASH BALANCE	100.00	0.000	100.00	0.000	100.00	0.000
H ₂	-5.82	0.026	-5.87	0.064	-5.88	0.034
H ₂ O	13.39	0.151	13.46	0.065	13.54	0.104
CHEM GAS	7.46	0.130	8.34	0.064	7.49	0.072
CO _x	6.77	0.113	7.71	0.078	6.86	0.065
CO	3.19	0.062	2.80	0.020	2.55	0.023
CO ₂	3.59	0.056	4.91	0.061	4.31	0.042
NH ₃	0.52	0.012	0.45	0.015	0.46	0.018
H ₂ S	0.17	0.009	0.18	0.006	0.17	0.007
C ₁ -C ₄	13.41	0.236	13.47	0.234	12.65	0.140
C ₁ -C ₂	7.19	0.126	7.39	0.157	6.78	0.071
C ₁	3.81	0.071	3.99	0.090	3.60	0.037
C ₂	3.39	0.058	3.40	0.062	3.18	0.034
C ₃ -1000 F	63.42	0.455	60.92	0.460	63.08	0.261
C ₃ -C ₄	6.21	0.111	6.07	0.080	5.87	0.069
C ₃	3.78	0.067	3.70	0.048	3.50	0.042
C ₄	2.44	0.043	2.37	0.032	2.36	0.027
C ₅ -1000 F	57.21	0.566	54.84	0.528	57.21	0.307
C ₅ -350 F	10.82	0.143	10.39	0.231	10.76	0.099
C ₅ -160 F	3.31	0.012	3.44	0.078	3.42	0.023
160-350 F	7.50	0.152	6.95	0.167	7.33	0.119
350-650 F	32.06	0.279	30.28	0.947	32.31	0.146
350-400 F	4.31	0.154	3.79	0.107	3.94	0.050
400-450 F	5.20	0.219	4.64	0.144	4.75	0.040
450-500 F	5.59	0.147	5.15	0.121	5.10	0.079
500-550 F	6.39	0.262	6.49	0.216	6.51	0.128
550-600 F	6.38	0.092	6.35	0.228	6.83	0.101
600-650 F	4.19	0.208	3.85	0.147	5.19	0.023
650-1000 F	14.33	0.344	14.18	1.199	14.14	0.460
650-700 F	2.30	0.080	1.91	0.110	2.29	0.035
700-800 F	4.34	0.183	4.04	0.384	3.49	0.114
800-1000 F	7.70	0.094	8.23	0.717	8.37	0.356
CONVERSION	85.64	0.370	84.23	0.330	85.00	0.163
1000 F ⁺ BTMS	14.37	0.367	15.77	0.332	15.01	0.159
ASPHALTENES	6.71	0.217	7.56	0.176	7.42	0.099
PREASPHALTS	2.03	0.094	2.45	0.035	2.42	0.059
THF SOLIDS	5.64	0.172	5.76	0.144	5.17	0.040
C ₅ -400 F	15.13	0.296	14.18	0.330	14.70	0.151
400-700 F	30.04	0.195	28.39	0.761	30.66	0.134
700-1000 F	12.03	0.275	12.27	1.095	11.86	0.469
400-650 F	27.75	0.262	26.48	0.840	28.37	0.122
GAS SELECTIVITY	15.66	0.344	15.99	0.321	14.88	0.160
GAS/LIQ SELECT	18.99	0.423	19.72	0.408	18.10	0.228

Appendix C

Measured and Reconciled Element Balances

Table C-1
Measured Elemental Flow Rates for YP434
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8826	0.0584	0.2234	0.0134	0.0061	0.0675	1.2515
H ₂ O in Coal	0.0000	0.0117	0.0926	0.0000	0.0000	0.0000	0.1043
Feed Bottoms	0.7709	0.0432	0.0671	0.0120	0.0229	0.3841	1.3002
Feed Solvent	1.0708	0.0995	0.0197	0.0117	0.0006	0.0000	1.2023
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5642	0.0000	0.0000	0.0000	0.0000	0.5642
N ₂ in	0.0000	0.0000	0.0000	0.7043	0.0000	0.0000	0.7043
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0256	0.0000	0.0272
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.7243	0.7786	0.4028	0.7415	0.0553	0.4516	5.1541
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9105	0.0510	0.0793	0.0142	0.0270	0.4537	1.5357
A-101 Solvent	1.2053	0.1120	0.0221	0.0132	0.0007	0.0000	1.3533
A-102 Naphtha	0.3426	0.0409	0.0209	0.0030	0.0002	0.0000	0.4076
A-103 Sour H ₂ O	0.0002	0.0148	0.1182	0.0014	0.0002	0.0000	0.1348
Off Gas	0.1840	0.5318	0.0617	0.5854	0.0103	0.0000	1.3732
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Total Out	2.6426	0.7506	0.3021	0.6171	0.0384	0.4537	4.8046
Total Mat. Bal.	97.0025	96.4062	75.0012	83.2273	69.5619	100.4463	93.2187
N ₂ Free Mat. Bal.		94.8710		N ₂ Free N Balance			91.7300

Table C-2
Reconciled Elemental Flow Rates for YP434
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8460	0.0560	0.2138	0.0114	0.0058	0.0652	1.1981
H ₂ O in Coal	0.0000	0.0005	0.0037	0.0000	0.0000	0.0000	0.0042
Feed Bottoms	0.7792	0.0436	0.0679	0.0122	0.0231	0.3882	1.3143
Feed Solvent	1.0225	0.0950	0.0188	0.0113	0.0006	0.0000	1.1483
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5644	0.0000	0.0000	0.0000	0.0000	0.5644
N ₂ in	0.0000	0.0000	0.0000	0.6090	0.0000	0.0000	0.6090
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0245	0.0000	0.0261
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.6477	0.7610	0.3041	0.6440	0.0541	0.4535	4.8643
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9101	0.0510	0.0793	0.0143	0.0270	0.4535	1.5351
A-101 Solvent	1.2066	0.1122	0.0221	0.0134	0.0007	0.0000	1.3550
A-102 Naphtha	0.3429	0.0409	0.0209	0.0030	0.0002	0.0000	0.4080
A-103 Sour H ₂ O	0.0002	0.0151	0.1183	0.0014	0.0002	0.0000	0.1353
Off Gas	0.1879	0.5418	0.0635	0.6119	0.0259	0.0000	1.4310
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Total Out	2.6477	0.7610	0.3041	0.6440	0.0541	0.4535	4.8643
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000			N ₂ Free N Balance		100.0000

Table C-3
Measured Elemental Compositions for YP434
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.53	4.66	17.85	1.07	0.49	5.40	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	59.29	3.32	5.16	0.93	1.76	29.54	100.00
Feed Solvent	89.06	8.28	1.63	0.97	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	59.29	3.32	5.16	0.93	1.76	29.54	100.00
A-101 Solvent	89.06	8.28	1.63	0.97	0.05	0.00	100.00
A-102 Naphtha	84.07	10.04	5.12	0.73	0.05	0.00	100.00
A-103 Sour H ₂ O	0.15	11.01	87.66	1.01	0.17	0.00	100.00
Off Gas	13.40	38.73	4.49	42.63	0.75	0.00	100.00

Table C-4
Reconciled Elemental Compositions for YP434
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.61	4.67	17.84	0.95	0.48	5.44	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	59.29	3.32	5.16	0.93	1.76	29.54	100.00
Feed Solvent	89.05	8.28	1.63	0.99	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	59.29	3.32	5.16	0.93	1.76	29.54	100.00
A-101 Solvent	89.05	8.28	1.63	0.99	0.05	0.00	100.00
A-102 Naphtha	84.05	10.03	5.12	0.74	0.05	0.00	100.00
A-103 Sour H ₂ O	0.15	11.20	87.48	1.00	0.17	0.00	100.00
Off Gas	13.13	37.86	4.44	42.76	1.81	0.00	100.00

Table C-5
Measured Elemental Flow Rates for YP435
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8583	0.0568	0.2173	0.0131	0.0059	0.0657	1.2170
H ₂ O in Coal	0.0000	0.0113	0.0901	0.0000	0.0000	0.0000	0.1014
Feed Bottoms	0.7461	0.0422	0.0644	0.0113	0.0216	0.3787	1.2644
Feed Solvent	1.0434	0.0965	0.0185	0.0102	0.0006	0.0000	1.1692
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5638	0.0000	0.0000	0.0000	0.0000	0.5638
N ₂ in	0.0000	0.0000	0.0000	0.7059	0.0000	0.0000	0.7059
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0245	0.0000	0.0261
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	2.6478	0.7722	0.3902	0.7404	0.0527	0.4444	5.0478
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.8823	0.0499	0.0762	0.0133	0.0256	0.4478	1.4952
A-101 Solvent	1.1852	0.1096	0.0210	0.0116	0.0007	0.0000	1.3280
A-102 Naphtha	0.3819	0.0449	0.0229	0.0036	0.0002	0.0000	0.4535
A-103 Sour H ₂ O	0.0002	0.0146	0.1160	0.0015	0.0002	0.0000	0.1324
Off Gas	0.1824	0.5245	0.0600	0.5737	0.0101	0.0000	1.3508
<hr/>							
Total Out	2.6320	0.7436	0.2960	0.6037	0.0368	0.4478	4.7599
Total Mat. Bal.	99.4031	96.2952	75.8573	81.5291	69.8580	100.7759	94.2978
N ₂ Free Mat. Bal.		96.4730		N ₂ Free N Balance			93.9610

Table C-6
Reconciled Elemental Flow Rates for YP435
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8423	0.0557	0.2128	0.0115	0.0058	0.0648	1.1929
H ₂ O in Coal	0.0000	0.0002	0.0019	0.0000	0.0000	0.0000	0.0021
Feed Bottoms	0.7545	0.0427	0.0652	0.0115	0.0219	0.3829	1.2786
Feed Solvent	1.0398	0.0962	0.0184	0.0103	0.0006	0.0000	1.1653
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5614	0.0000	0.0000	0.0000	0.0000	0.5614
N ₂ in	0.0000	0.0000	0.0000	0.5983	0.0000	0.0000	0.5983
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0240	0.0000	0.0256
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	2.6366	0.7577	0.2983	0.6316	0.0523	0.4477	4.8242
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.8821	0.0499	0.0762	0.0134	0.0256	0.4477	1.4949
A-101 Solvent	1.1849	0.1096	0.0210	0.0117	0.0007	0.0000	1.3279
A-102 Naphtha	0.3819	0.0449	0.0229	0.0037	0.0002	0.0000	0.4536
A-103 Sour H ₂ O	0.0002	0.0149	0.1161	0.0014	0.0002	0.0000	0.1329
Off Gas	0.1875	0.5384	0.0621	0.6013	0.0256	0.0000	1.4149
<hr/>							
Total Out	2.6366	0.7577	0.2983	0.6316	0.0523	0.4477	4.8242
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-7
Measured Elemental Compositions for YP435
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.53	4.66	17.85	1.07	0.49	5.40	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	59.01	3.34	5.10	0.89	1.71	29.95	100.00
Feed Solvent	89.24	8.25	1.58	0.87	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	59.01	3.34	5.10	0.89	1.71	29.95	100.00
A-101 Solvent	89.24	8.25	1.58	0.87	0.05	0.00	100.00
A-102 Naphtha	84.21	9.90	5.04	0.80	0.05	0.00	100.00
A-103 Sour H ₂ O	0.16	11.02	87.55	1.10	0.17	0.00	100.00
Off Gas	13.51	38.83	4.44	42.47	0.75	0.00	100.00

Table C-8
Reconciled Elemental Compositions for YP435
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.61	4.67	17.84	0.96	0.48	5.43	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	59.01	3.34	5.10	0.90	1.71	29.95	100.00
Feed Solvent	89.24	8.25	1.58	0.88	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	59.01	3.34	5.10	0.90	1.71	29.95	100.00
A-101 Solvent	89.24	8.25	1.58	0.88	0.05	0.00	100.00
A-102 Naphtha	84.18	9.90	5.05	0.82	0.05	0.00	100.00
A-103 Sour H ₂ O	0.16	11.20	87.38	1.09	0.17	0.00	100.00
Off Gas	13.26	38.05	4.39	42.50	1.81	0.00	100.00

Table C-9
Measured Elemental Flow Rates for YP436
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8897	0.0587	0.2300	0.0106	0.0061	0.0678	1.2629
H ₂ O in Coal	0.0000	0.0120	0.0951	0.0000	0.0000	0.0000	0.1070
Feed Bottoms	0.7824	0.0448	0.0746	0.0125	0.0212	0.3784	1.3138
Feed Solvent	1.0824	0.0999	0.0199	0.0121	0.0006	0.0000	1.2150
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5166	0.0000	0.0000	0.0000	0.0000	0.5166
N ₂ in	0.0000	0.0000	0.0000	0.7058	0.0000	0.0000	0.7058
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0255	0.0000	0.0271
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.7545	0.7335	0.4196	0.7411	0.0534	0.4462	5.1483
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9557	0.0547	0.0911	0.0152	0.0258	0.4623	1.6049
A-101 Solvent	1.1818	0.1090	0.0217	0.0133	0.0007	0.0000	1.3265
A-102 Naphtha	0.3888	0.0463	0.0259	0.0044	0.0002	0.0000	0.4657
A-103 Sour H ₂ O	0.0002	0.0145	0.1182	0.0015	0.0002	0.0000	0.1346
Off Gas	0.1887	0.4557	0.0639	0.5612	0.0092	0.0000	1.2786
<hr/>							
Total Out	2.7152	0.6802	0.3209	0.5956	0.0361	0.4623	4.8103
Total Mat. Bal.	98.5737	92.7386	76.4810	80.3633	67.6643	103.6000	93.4355
N ₂ Free Mat. Bal.		95.7070					
						N ₂ Free N Balance	104.8580

Table C-10
Reconciled Elemental Flow Rates for YP436
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8716	0.0574	0.2238	0.0115	0.0059	0.0668	1.2371
H ₂ O in Coal	0.0000	0.0005	0.0041	0.0000	0.0000	0.0000	0.0046
Feed Bottoms	0.8170	0.0468	0.0779	0.0129	0.0221	0.3951	1.3718
Feed Solvent	1.0411	0.0961	0.0192	0.0115	0.0006	0.0000	1.1685
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5066	0.0000	0.0000	0.0000	0.0000	0.5066
N ₂ in	0.0000	0.0000	0.0000	0.5891	0.0000	0.0000	0.5891
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0250	0.0000	0.0265
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	2.7297	0.7089	0.3250	0.6250	0.0536	0.4620	4.9042
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9551	0.0547	0.0911	0.0151	0.0258	0.4620	1.6039
A-101 Solvent	1.1837	0.1092	0.0218	0.0131	0.0007	0.0000	1.3285
A-102 Naphtha	0.3899	0.0464	0.0260	0.0043	0.0002	0.0000	0.4669
A-103 Sour H ₂ O	0.0002	0.0151	0.1178	0.0014	0.0002	0.0000	0.1348
Off Gas	0.2008	0.4834	0.0683	0.5911	0.0266	0.0000	1.3702
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Total Out	2.7297	0.7089	0.3250	0.6250	0.0536	0.4620	4.9042
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-11
Measured Elemental Compositions for YP436
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.45	4.64	18.21	0.84	0.49	5.37	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	59.55	3.41	5.68	0.95	1.61	28.80	100.00
Feed Solvent	89.09	8.22	1.64	1.00	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	59.55	3.41	5.68	0.95	1.61	28.80	100.00
A-101 Solvent	89.09	8.22	1.64	1.00	0.05	0.00	100.00
A-102 Naphtha	83.50	9.94	5.57	0.94	0.05	0.00	100.00
A-103 Sour H ₂ O	0.16	10.78	87.79	1.11	0.16	0.00	100.00
Off Gas	14.76	35.64	5.00	43.89	0.72	0.00	100.00

Table C-12
Reconciled Elemental Compositions for YP436
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.46	4.64	18.09	0.93	0.48	5.40	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	59.55	3.41	5.68	0.94	1.61	28.80	100.00
Feed Solvent	89.10	8.22	1.64	0.98	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
 <u>Outlets</u>	 <u>Carbon</u>	 <u>Hydrogen</u>	 <u>Oxygen</u>	 <u>Nitrogen</u>	 <u>Sulfur</u>	 <u>Ash</u>	 <u>Total</u>
A-100 Bottoms	59.55	3.41	5.68	0.94	1.61	28.80	100.00
A-101 Solvent	89.10	8.22	1.64	0.98	0.05	0.00	100.00
A-102 Naphtha	83.51	9.95	5.58	0.91	0.05	0.00	100.00
A-103 Sour H ₂ O	0.17	11.20	87.41	1.07	0.15	0.00	100.00
Off Gas	14.65	35.28	4.99	43.14	1.94	0.00	100.00

Table C-13
Measured Elemental Flow Rates for YP438
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.9145	0.0591	0.2389	0.0140	0.0061	0.0730	1.3056
H ₂ O in Coal	0.0000	0.0134	0.1065	0.0000	0.0000	0.0000	0.1199
Feed Bottoms	0.8234	0.0463	0.0751	0.0132	0.0179	0.3912	1.3671
Feed Solvent	1.1276	0.1017	0.0213	0.0127	0.0008	0.0000	1.2641
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.4821	0.0000	0.0000	0.0000	0.0000	0.4821
N ₂ in	0.0000	0.0000	0.0000	0.7186	0.0000	0.0000	0.7186
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0241	0.0000	0.0256
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	2.8656	0.7042	0.4418	0.7586	0.0489	0.4641	5.2831
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9954	0.0560	0.0908	0.0159	0.0217	0.4729	1.6527
A-101 Solvent	1.2309	0.1110	0.0232	0.0139	0.0008	0.0000	1.3799
A-102 Naphtha	0.3923	0.0460	0.0224	0.0042	0.0003	0.0000	0.4651
A-103 Sour H ₂ O	0.0003	0.0151	0.1227	0.0016	0.0002	0.0000	0.1399
Off Gas	0.2184	0.4839	0.0772	0.6252	0.0103	0.0000	1.4150
<hr/>							
Total Out	2.8374	0.7120	0.3363	0.6608	0.0333	0.4729	5.0527
Total Mat. Bal.	99.0172	101.1138	76.1359	87.1074	68.0468	101.8870	95.6388
N ₂ Free Mat. Bal.		97.0490					
				N ₂ Free N Balance			94.8140

Table C-14
Reconciled Elemental Flow Rates for YP438
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8893	0.0576	0.2315	0.0123	0.0059	0.0715	1.2681
H ₂ O in Coal	0.0000	0.0008	0.0063	0.0000	0.0000	0.0000	0.0071
Feed Bottoms	0.8443	0.0475	0.0770	0.0136	0.0184	0.4011	1.4019
Feed Solvent	1.0991	0.0991	0.0207	0.0125	0.0008	0.0000	1.2322
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.4922	0.0000	0.0000	0.0000	0.0000	0.4922
N ₂ in	0.0000	0.0000	0.0000	0.6423	0.0000	0.0000	0.6423
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0234	0.0000	0.0249
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.8327	0.6987	0.3355	0.6807	0.0484	0.4727	5.0686
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9949	0.0560	0.0907	0.0160	0.0216	0.4727	1.6519
A-101 Solvent	1.2316	0.1111	0.0232	0.0140	0.0008	0.0000	1.3807
A-102 Naphtha	0.3925	0.0459	0.0224	0.0043	0.0003	0.0000	0.4653
A-103 Sour H ₂ O	0.0003	0.0157	0.1226	0.0016	0.0002	0.0000	0.1404
Off Gas	0.2135	0.4700	0.0765	0.6448	0.0254	0.0000	1.4302
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Total Out	2.8327	0.6987	0.3355	0.6807	0.0484	0.4727	5.0686
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-15
Measured Elemental Compositions for YP438
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.05	4.52	18.30	1.08	0.47	5.59	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.23	3.39	5.49	0.96	1.31	28.61	100.00
Feed Solvent	89.20	8.05	1.68	1.01	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	60.23	3.39	5.49	0.96	1.31	28.61	100.00
A-101 Solvent	89.20	8.05	1.68	1.01	0.06	0.00	100.00
A-102 Naphtha	84.35	9.89	4.81	0.90	0.06	0.00	100.00
A-103 Sour H ₂ O	0.19	10.81	87.69	1.14	0.17	0.00	100.00
Off Gas	15.44	34.19	5.46	44.18	0.73	0.00	100.00

Table C-16
Reconciled Elemental Compositions for YP438
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.13	4.54	18.25	0.97	0.47	5.64	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.23	3.39	5.49	0.97	1.31	28.61	100.00
Feed Solvent	89.20	8.04	1.68	1.02	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
 <u>Outlets</u>	 <u>Carbon</u>	 <u>Hydrogen</u>	 <u>Oxygen</u>	 <u>Nitrogen</u>	 <u>Sulfur</u>	 <u>Ash</u>	 <u>Total</u>
A-100 Bottoms	60.23	3.39	5.49	0.97	1.31	28.61	100.00
A-101 Solvent	89.20	8.04	1.68	1.02	0.06	0.00	100.00
A-102 Naphtha	84.34	9.87	4.82	0.91	0.06	0.00	100.00
A-103 Sour H ₂ O	0.19	11.19	87.33	1.12	0.17	0.00	100.00
Off Gas	14.93	32.86	5.35	45.09	1.78	0.00	100.00

Table C-17
Measured Elemental Flow Rates for YP439
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.9201	0.0593	0.2394	0.0139	0.0062	0.0749	1.3138
H ₂ O in Coal	0.0000	0.0135	0.1072	0.0000	0.0000	0.0000	0.1207
Feed Bottoms	0.8304	0.0465	0.0754	0.0130	0.0183	0.3922	1.3758
Feed Solvent	1.1345	0.1028	0.0206	0.0134	0.0008	0.0000	1.2721
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.4809	0.0000	0.0000	0.0000	0.0000	0.4809
N ₂ in	0.0000	0.0000	0.0000	0.7321	0.0000	0.0000	0.7321
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0241	0.0000	0.0256
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.8851	0.7045	0.4427	0.7724	0.0493	0.4671	5.3212
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9873	0.0553	0.0897	0.0154	0.0218	0.4663	1.6357
A-101 Solvent	1.2328	0.1117	0.0224	0.0146	0.0009	0.0000	1.3823
A-102 Naphtha	0.3822	0.0451	0.0217	0.0044	0.0003	0.0000	0.4536
A-103 Sour H ₂ O	0.0003	0.0162	0.1282	0.0016	0.0002	0.0000	0.1466
Off Gas	0.2159	0.4837	0.0764	0.6403	0.0103	0.0000	1.4266
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Total Out	2.8184	0.7120	0.3384	0.6763	0.0334	0.4663	5.0448
Total Mat. Bal.	97.6904	101.0559	76.4386	87.5619	67.7064	99.8286	94.8073
N ₂ Free Mat. Bal.		96.0390		N ₂ Free N Balance			96.1400

Table C-18
Reconciled Elemental Flow Rates for YP439
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8837	0.0572	0.2286	0.0129	0.0059	0.0724	1.2607
H ₂ O in Coal	0.0000	0.0017	0.0136	0.0000	0.0000	0.0000	0.0153
Feed Bottoms	0.8336	0.0467	0.0757	0.0130	0.0184	0.3937	1.3811
Feed Solvent	1.0968	0.0994	0.0199	0.0130	0.0008	0.0000	1.2299
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.4911	0.0000	0.0000	0.0000	0.0000	0.4911
N ₂ in	0.0000	0.0000	0.0000	0.6570	0.0000	0.0000	0.6570
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0231	0.0000	0.0246
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.8142	0.6975	0.3378	0.6960	0.0481	0.4661	5.0596
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<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9870	0.0553	0.0897	0.0154	0.0218	0.4661	1.6353
A-101 Solvent	1.2335	0.1117	0.0224	0.0146	0.0009	0.0000	1.3832
A-102 Naphtha	0.3824	0.0451	0.0217	0.0045	0.0003	0.0000	0.4539
A-103 Sour H ₂ O	0.0003	0.0164	0.1284	0.0016	0.0002	0.0000	0.1470
Off Gas	0.2109	0.4689	0.0757	0.6598	0.0250	0.0000	1.4402
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Total Out	2.8142	0.6975	0.3378	0.6960	0.0481	0.4661	5.0596
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000			N ₂ Free N Balance		100.0000

Table C-19
Measured Elemental Compositions for YP439
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.04	4.52	18.22	1.06	0.47	5.70	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.36	3.38	5.48	0.94	1.33	28.51	100.00
Feed Solvent	89.18	8.08	1.62	1.06	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	60.36	3.38	5.48	0.94	1.33	28.51	100.00
A-101 Solvent	89.18	8.08	1.62	1.06	0.06	0.00	100.00
A-102 Naphtha	84.25	9.94	4.78	0.97	0.06	0.00	100.00
A-103 Sour H ₂ O	0.19	11.07	87.46	1.11	0.17	0.00	100.00
Off Gas	15.13	33.90	5.36	44.88	0.72	0.00	100.00

Table C-20
Reconciled Elemental Compositions for YP439
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.10	4.53	18.13	1.02	0.47	5.75	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.36	3.38	5.48	0.94	1.33	28.50	100.00
Feed Solvent	89.18	8.08	1.62	1.06	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	60.36	3.38	5.48	0.94	1.33	28.50	100.00
A-101 Solvent	89.18	8.08	1.62	1.06	0.06	0.00	100.00
A-102 Naphtha	84.24	9.93	4.78	0.98	0.06	0.00	100.00
A-103 Sour H ₂ O	0.19	11.19	87.35	1.10	0.17	0.00	100.00
Off Gas	14.64	32.56	5.25	45.81	1.73	0.00	100.00

Table C-21
Measured Elemental Flow Rates for YP440
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8545	0.0551	0.2223	0.0129	0.0057	0.0696	1.2200
H ₂ O in Coal	0.0000	0.0125	0.0996	0.0000	0.0000	0.0000	0.1121
Feed Bottoms	0.7749	0.0437	0.0716	0.0126	0.0164	0.3584	1.2776
Feed Solvent	1.0542	0.0940	0.0198	0.0126	0.0007	0.0000	1.1813
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.4801	0.0000	0.0000	0.0000	0.0000	0.4801
N ₂ in	0.0000	0.0000	0.0000	0.7362	0.0000	0.0000	0.7362
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0241	0.0000	0.0256
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.6835	0.6869	0.4134	0.7743	0.0469	0.4280	5.0330
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9715	0.0548	0.0898	0.0158	0.0205	0.4494	1.6019
A-101 Solvent	1.2293	0.1096	0.0231	0.0147	0.0009	0.0000	1.3775
A-102 Naphtha	0.3972	0.0468	0.0227	0.0047	0.0003	0.0000	0.4716
A-103 Sour H ₂ O	0.0003	0.0161	0.1270	0.0016	0.0002	0.0000	0.1453
Off Gas	0.2137	0.4815	0.0745	0.6475	0.0103	0.0000	1.4274
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Total Out	2.8120	0.7088	0.3371	0.6843	0.0321	0.4494	5.0238
Total Mat. Bal.	104.7874	103.1850	81.5643	88.3749	68.5088	105.0068	99.8169
N ₂ Free Mat. Bal.		101.9160			N ₂ Free N Balance		104.0140

Table C-22
Reconciled Elemental Flow Rates for YP440
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8781	0.0568	0.2270	0.0131	0.0058	0.0718	1.2526
H ₂ O in Coal	0.0000	0.0016	0.0129	0.0000	0.0000	0.0000	0.0145
Feed Bottoms	0.8158	0.0460	0.0754	0.0133	0.0172	0.3774	1.3452
Feed Solvent	1.1097	0.0989	0.0209	0.0133	0.0008	0.0000	1.2436
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.4896	0.0000	0.0000	0.0000	0.0000	0.4896
N ₂ in	0.0000	0.0000	0.0000	0.6633	0.0000	0.0000	0.6633
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0247	0.0000	0.0263
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.8037	0.6945	0.3362	0.7030	0.0485	0.4492	5.0351
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<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9711	0.0548	0.0898	0.0158	0.0205	0.4492	1.6012
A-101 Solvent	1.2274	0.1094	0.0231	0.0147	0.0009	0.0000	1.3754
A-102 Naphtha	0.3963	0.0467	0.0227	0.0047	0.0003	0.0000	0.4706
A-103 Sour H ₂ O	0.0003	0.0163	0.1271	0.0016	0.0002	0.0000	0.1455
Off Gas	0.2086	0.4674	0.0735	0.6662	0.0267	0.0000	1.4424
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Total Out	2.8037	0.6945	0.3362	0.7030	0.0485	0.4492	5.0351
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-23
Measured Elemental Compositions for YP440
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.04	4.52	18.22	1.06	0.47	5.70	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.65	3.42	5.61	0.99	1.28	28.06	100.00
Feed Solvent	89.24	7.96	1.68	1.06	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	60.65	3.42	5.61	0.99	1.28	28.06	100.00
A-101 Solvent	89.24	7.96	1.68	1.06	0.06	0.00	100.00
A-102 Naphtha	84.21	9.93	4.82	0.99	0.06	0.00	100.00
A-103 Sour H ₂ O	0.18	11.11	87.43	1.11	0.16	0.00	100.00
Off Gas	14.97	33.73	5.22	45.36	0.72	0.00	100.00

Table C-24
Reconciled Elemental Compositions for YP440
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.10	4.53	18.12	1.04	0.47	5.73	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.65	3.42	5.61	0.99	1.28	28.06	100.00
Feed Solvent	89.24	7.95	1.68	1.07	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	60.65	3.42	5.61	0.99	1.28	28.06	100.00
A-101 Solvent	89.24	7.95	1.68	1.07	0.06	0.00	100.00
A-102 Naphtha	84.20	9.92	4.83	0.99	0.06	0.00	100.00
A-103 Sour H ₂ O	0.18	11.19	87.36	1.11	0.16	0.00	100.00
Off Gas	14.47	32.40	5.09	46.19	1.85	0.00	100.00

Table C-25
Measured Elemental Flow Rates for YP441
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8555	0.0559	0.2450	0.0127	0.0057	0.0633	1.2380
H ₂ O in Coal	0.0000	0.0122	0.0970	0.0000	0.0000	0.0000	0.1092
Feed Bottoms	0.7828	0.0439	0.0638	0.0120	0.0143	0.3751	1.2920
Feed Solvent	1.0666	0.0956	0.0197	0.0122	0.0006	0.0000	1.1947
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5602	0.0000	0.0000	0.0000	0.0000	0.5602
N ₂ in	0.0000	0.0000	0.0000	0.7243	0.0000	0.0000	0.7243
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0251	0.0000	0.0267
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.7049	0.7694	0.4255	0.7613	0.0457	0.4384	5.1452
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<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9448	0.0530	0.0770	0.0145	0.0173	0.4528	1.5593
A-101 Solvent	1.2052	0.1080	0.0223	0.0138	0.0007	0.0000	1.3500
A-102 Naphtha	0.3563	0.0418	0.0212	0.0041	0.0003	0.0000	0.4236
A-103 Sour H ₂ O	0.0002	0.0148	0.1194	0.0015	0.0002	0.0000	0.1362
Off Gas	0.1928	0.5479	0.0694	0.6162	0.0100	0.0000	1.4363
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Total Out	2.6994	0.7655	0.3092	0.6501	0.0286	0.4528	4.9055
Total Mat. Bal.	99.7946	99.4858	72.6815	85.3989	62.5377	103.2754	95.3420
N ₂ Free Mat. Bal.		97.0890		N ₂ Free N Balance			99.4580

Table C-26
Reconciled Elemental Flow Rates for YP441
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8388	0.0549	0.2387	0.0123	0.0055	0.0625	1.2127
H ₂ O in Coal	0.0000	-0.0018	-0.0145	0.0000	0.0000	0.0000	-0.0163
Feed Bottoms	0.8139	0.0457	0.0663	0.0125	0.0149	0.3900	1.3433
Feed Solvent	1.0468	0.0938	0.0193	0.0120	0.0006	0.0000	1.1726
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5677	0.0000	0.0000	0.0000	0.0000	0.5677
N ₂ in	0.0000	0.0000	0.0000	0.6364	0.0000	0.0000	0.6364
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0246	0.0000	0.0261
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.6995	0.7617	0.3099	0.6732	0.0456	0.4525	4.9424
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9443	0.0530	0.0769	0.0145	0.0173	0.4525	1.5585
A-101 Solvent	1.2060	0.1080	0.0223	0.0139	0.0007	0.0000	1.3509
A-102 Naphtha	0.3566	0.0418	0.0212	0.0041	0.0003	0.0000	0.4240
A-103 Sour H ₂ O	0.0002	0.0153	0.1193	0.0015	0.0002	0.0000	0.1365
Off Gas	0.1925	0.5436	0.0701	0.6393	0.0270	0.0000	1.4725
<hr/>							
Total Out	2.6995	0.7617	0.3099	0.6732	0.0456	0.4525	4.9424
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-27
Measured Elemental Compositions for YP441
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.10	4.52	19.79	1.03	0.46	5.11	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.59	3.40	4.94	0.93	1.11	29.04	100.00
Feed Solvent	89.27	8.00	1.65	1.02	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	60.59	3.40	4.94	0.93	1.11	29.04	100.00
A-101 Solvent	89.27	8.00	1.65	1.02	0.05	0.00	100.00
A-102 Naphtha	84.10	9.86	5.00	0.96	0.08	0.00	100.00
A-103 Sour H ₂ O	0.16	10.86	87.70	1.12	0.16	0.00	100.00
Off Gas	13.43	38.14	4.83	42.90	0.70	0.00	100.00

Table C-28
Reconciled Elemental Compositions for YP441
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.17	4.53	19.68	1.01	0.45	5.15	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.59	3.40	4.94	0.93	1.11	29.03	100.00
Feed Solvent	89.27	8.00	1.65	1.03	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
 <u>Outlets</u>	 <u>Carbon</u>	 <u>Hydrogen</u>	 <u>Oxygen</u>	 <u>Nitrogen</u>	 <u>Sulfur</u>	 <u>Ash</u>	 <u>Total</u>
A-100 Bottoms	60.59	3.40	4.94	0.93	1.11	29.03	100.00
A-101 Solvent	89.27	8.00	1.65	1.03	0.05	0.00	100.00
A-102 Naphtha	84.09	9.86	5.01	0.96	0.08	0.00	100.00
A-103 Sour H ₂ O	0.16	11.20	87.39	1.09	0.16	0.00	100.00
Off Gas	13.07	36.92	4.76	43.41	1.83	0.00	100.00

Table C-29
Measured Elemental Flow Rates for YP442
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8439	0.0551	0.2417	0.0125	0.0056	0.0624	1.2213
H ₂ O in Coal	0.0000	0.0121	0.0957	0.0000	0.0000	0.0000	0.1077
Feed Bottoms	0.7721	0.0428	0.0755	0.0133	0.0140	0.3569	1.2745
Feed Solvent	1.0536	0.0940	0.0187	0.0117	0.0006	0.0000	1.1786
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5584	0.0000	0.0000	0.0000	0.0000	0.5584
N ₂ in	0.0000	0.0000	0.0000	0.7222	0.0000	0.0000	0.7222
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0247	0.0000	0.0263
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.6696	0.7639	0.4315	0.7597	0.0450	0.4193	5.0890
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9135	0.0507	0.0893	0.0157	0.0166	0.4222	1.5079
A-101 Solvent	1.1826	0.1055	0.0210	0.0132	0.0007	0.0000	1.3230
A-102 Naphtha	0.3455	0.0402	0.0210	0.0041	0.0004	0.0000	0.4112
A-103 Sour H ₂ O	0.0002	0.0135	0.1101	0.0015	0.0002	0.0000	0.1255
Off Gas	0.1936	0.5479	0.0695	0.6181	0.0105	0.0000	1.4397
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Total Out	2.6354	0.7578	0.3109	0.6526	0.0283	0.4222	4.8072
Total Mat. Bal.	98.7195	99.2042	72.0507	85.8960	62.9497	100.6981	94.4635
N ₂ Free Mat. Bal.		96.0110		N ₂ Free N Balance			101.1550

Table C-30
Reconciled Elemental Flow Rates for YP442
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8211	0.0538	0.2333	0.0126	0.0054	0.0610	1.1873
H ₂ O in Coal	0.0000	-0.0021	-0.0165	0.0000	0.0000	0.0000	-0.0186
Feed Bottoms	0.7812	0.0433	0.0764	0.0134	0.0142	0.3611	1.2895
Feed Solvent	1.0335	0.0922	0.0183	0.0115	0.0006	0.0000	1.1561
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5651	0.0000	0.0000	0.0000	0.0000	0.5651
N ₂ in	0.0000	0.0000	0.0000	0.6358	0.0000	0.0000	0.6358
Added H ₂ S (S)	0.0000	0.0015	0.0000	0.0000	0.0240	0.0000	0.0256
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.6359	0.7538	0.3115	0.6733	0.0442	0.4221	4.8408
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9133	0.0506	0.0893	0.0156	0.0166	0.4221	1.5075
A-101 Solvent	1.1833	0.1055	0.0210	0.0131	0.0007	0.0000	1.3237
A-102 Naphtha	0.3458	0.0402	0.0211	0.0041	0.0004	0.0000	0.4115
A-103 Sour H ₂ O	0.0002	0.0141	0.1099	0.0014	0.0002	0.0000	0.1258
Off Gas	0.1933	0.5433	0.0703	0.6390	0.0264	0.0000	1.4723
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Total Out	2.6359	0.7538	0.3115	0.6733	0.0442	0.4221	4.8408
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-31
Measured Elemental Compositions for YP442
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.10	4.52	19.79	1.03	0.46	5.11	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.58	3.36	5.92	1.04	1.10	28.00	100.00
Feed Solvent	89.39	7.97	1.59	1.00	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
 <u>Outlets</u>	 <u>Carbon</u>	 <u>Hydrogen</u>	 <u>Oxygen</u>	 <u>Nitrogen</u>	 <u>Sulfur</u>	 <u>Ash</u>	 <u>Total</u>
A-100 Bottoms	60.58	3.36	5.92	1.04	1.10	28.00	100.00
A-101 Solvent	89.39	7.97	1.59	1.00	0.05	0.00	100.00
A-102 Naphtha	84.03	9.78	5.11	0.99	0.09	0.00	100.00
A-103 Sour H ₂ O	0.16	10.78	87.76	1.17	0.13	0.00	100.00
Off Gas	13.45	38.06	4.83	42.93	0.73	0.00	100.00

Table C-32
Reconciled Elemental Compositions for YP442
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.16	4.53	19.65	1.06	0.45	5.14	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.58	3.36	5.92	1.04	1.10	28.00	100.00
Feed Solvent	89.39	7.97	1.59	0.99	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
 <u>Outlets</u>	 <u>Carbon</u>	 <u>Hydrogen</u>	 <u>Oxygen</u>	 <u>Nitrogen</u>	 <u>Sulfur</u>	 <u>Ash</u>	 <u>Total</u>
A-100 Bottoms	60.58	3.36	5.92	1.04	1.10	28.00	100.00
A-101 Solvent	89.39	7.97	1.59	0.99	0.05	0.00	100.00
A-102 Naphtha	84.04	9.77	5.12	0.99	0.09	0.00	100.00
A-103 Sour H ₂ O	0.16	11.21	87.37	1.14	0.13	0.00	100.00
Off Gas	13.13	36.90	4.78	43.40	1.79	0.00	100.00

Table C-33
Measured Elemental Flow Rates for YP443
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8644	0.0562	0.2367	0.0129	0.0054	0.0679	1.2436
H ₂ O in Coal	0.0000	0.0122	0.0972	0.0000	0.0000	0.0000	0.1094
Feed Bottoms	0.7955	0.0407	0.0725	0.0149	0.0136	0.3603	1.2975
Feed Solvent	1.0708	0.0969	0.0199	0.0116	0.0007	0.0000	1.1999
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5580	0.0000	0.0000	0.0000	0.0000	0.5580
N ₂ in	0.0000	0.0000	0.0000	0.7119	0.0000	0.0000	0.7119
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0252	0.0000	0.0268
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.7308	0.7656	0.4263	0.7513	0.0449	0.4282	5.1470
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9618	0.0493	0.0876	0.0180	0.0165	0.4356	1.5688
A-101 Solvent	1.2361	0.1119	0.0230	0.0133	0.0008	0.0000	1.3851
A-102 Naphtha	0.3636	0.0426	0.0214	0.0045	0.0002	0.0000	0.4325
A-103 Sour H ₂ O	0.0002	0.0130	0.1068	0.0012	0.0002	0.0000	0.1214
Off Gas	0.1914	0.5510	0.0764	0.6115	0.0109	0.0000	1.4412
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Total Out	2.7531	0.7678	0.3152	0.6487	0.0285	0.4356	4.9489
Total Mat. Bal.	100.8191	100.2822	73.9544	86.3365	63.5417	101.7287	96.1510
N ₂ Free Mat. Bal.		97.8680					
				N ₂ Free N Balance			102.2780

Table C-34
Reconciled Elemental Flow Rates for YP443
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8582	0.0559	0.2332	0.0132	0.0053	0.0677	1.2335
H ₂ O in Coal	0.0000	-0.0015	-0.0120	0.0000	0.0000	0.0000	-0.0136
Feed Bottoms	0.8121	0.0416	0.0740	0.0152	0.0139	0.3678	1.3246
Feed Solvent	1.0808	0.0978	0.0201	0.0116	0.0007	0.0000	1.2111
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5657	0.0000	0.0000	0.0000	0.0000	0.5657
N ₂ in	0.0000	0.0000	0.0000	0.6277	0.0000	0.0000	0.6277
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0250	0.0000	0.0265
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.7511	0.7610	0.3153	0.6677	0.0449	0.4355	4.9754
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9616	0.0492	0.0876	0.0180	0.0165	0.4355	1.5685
A-101 Solvent	1.2358	0.1118	0.0230	0.0133	0.0008	0.0000	1.3847
A-102 Naphtha	0.3635	0.0426	0.0215	0.0045	0.0002	0.0000	0.4323
A-103 Sour H ₂ O	0.0002	0.0136	0.1065	0.0012	0.0002	0.0000	0.1216
Off Gas	0.1900	0.5437	0.0767	0.6307	0.0272	0.0000	1.4683
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Total Out	2.7511	0.7610	0.3153	0.6677	0.0449	0.4355	4.9754
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-35
Measured Elemental Compositions for YP443
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.51	4.52	19.04	1.04	0.43	5.46	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	61.31	3.14	5.59	1.15	1.05	27.77	100.00
Feed Solvent	89.24	8.08	1.66	0.96	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	61.31	3.14	5.59	1.15	1.05	27.77	100.00
A-101 Solvent	89.24	8.08	1.66	0.96	0.06	0.00	100.00
A-102 Naphtha	84.08	9.86	4.95	1.05	0.06	0.00	100.00
A-103 Sour H ₂ O	0.15	10.73	87.96	1.03	0.13	0.00	100.00
Off Gas	13.28	38.23	5.30	42.43	0.75	0.00	100.00

Table C-36
Reconciled Elemental Compositions for YP443
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.58	4.53	18.90	1.07	0.43	5.49	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	61.31	3.14	5.59	1.15	1.05	27.76	100.00
Feed Solvent	89.25	8.08	1.66	0.96	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	61.31	3.14	5.59	1.15	1.05	27.76	100.00
A-101 Solvent	89.25	8.08	1.66	0.96	0.06	0.00	100.00
A-102 Naphtha	84.09	9.85	4.96	1.04	0.06	0.00	100.00
A-103 Sour H ₂ O	0.15	11.20	87.52	1.00	0.13	0.00	100.00
Off Gas	12.94	37.03	5.22	42.95	1.85	0.00	100.00

Table C-37
Measured Elemental Flow Rates for YP444
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8690	0.0568	0.2308	0.0155	0.0053	0.0672	1.2444
H ₂ O in Coal	0.0000	0.0114	0.0907	0.0000	0.0000	0.0000	0.1022
Feed Bottoms	0.7896	0.0447	0.0634	0.0136	0.0158	0.3644	1.2914
Feed Solvent	1.0664	0.0961	0.0196	0.0115	0.0007	0.0000	1.1942
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5566	0.0000	0.0000	0.0000	0.0000	0.5566
N ₂ in	0.0000	0.0000	0.0000	0.7257	0.0000	0.0000	0.7257
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0262	0.0000	0.0279
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0030	0.0030
<hr/>							
Total In	2.7249	0.7672	0.4046	0.7662	0.0479	0.4346	5.1454
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9476	0.0536	0.0761	0.0163	0.0189	0.4373	1.5498
A-101 Solvent	1.2184	0.1098	0.0224	0.0131	0.0008	0.0000	1.3644
A-102 Naphtha	0.3680	0.0431	0.0223	0.0045	0.0002	0.0000	0.4382
A-103 Sour H ₂ O	0.0002	0.0129	0.1036	0.0013	0.0002	0.0000	0.1181
Off Gas	0.1977	0.5541	0.0754	0.6330	0.0110	0.0000	1.4713
<hr/>							
Total Out	2.7318	0.7735	0.2999	0.6682	0.0311	0.4373	4.9418
Total Mat. Bal.	100.2535	100.8219	74.1337	87.2063	64.9498	100.6291	96.0447
N ₂ Free Mat. Bal.		97.5610		N ₂ Free N Balance			94.3140

Table C-38
Reconciled Elemental Flow Rates for YP444
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8543	0.0559	0.2263	0.0136	0.0051	0.0664	1.2216
H ₂ O in Coal	0.0000	-0.0013	-0.0104	0.0000	0.0000	0.0000	-0.0117
Feed Bottoms	0.7971	0.0451	0.0640	0.0138	0.0159	0.3679	1.3038
Feed Solvent	1.0764	0.0970	0.0198	0.0117	0.0007	0.0000	1.2056
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5656	0.0000	0.0000	0.0000	0.0000	0.5656
N ₂ in	0.0000	0.0000	0.0000	0.6491	0.0000	0.0000	0.6491
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0257	0.0000	0.0274
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0029	0.0029
<hr/>							
Total In	2.7278	0.7640	0.2998	0.6881	0.0475	0.4372	4.9644
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9473	0.0536	0.0761	0.0164	0.0189	0.4372	1.5496
A-101 Solvent	1.2174	0.1097	0.0224	0.0132	0.0008	0.0000	1.3635
A-102 Naphtha	0.3678	0.0430	0.0224	0.0046	0.0002	0.0000	0.4381
A-103 Sour H ₂ O	0.0002	0.0133	0.1036	0.0013	0.0002	0.0000	0.1185
Off Gas	0.1951	0.5444	0.0753	0.6526	0.0274	0.0000	1.4947
<hr/>							
Total Out	2.7278	0.7640	0.2998	0.6881	0.0475	0.4372	4.9644
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000			N ₂ Free N Balance		100.0000

Table C-39
Measured Elemental Compositions for YP444
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.83	4.56	18.54	1.24	0.42	5.40	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	61.14	3.46	4.91	1.05	1.22	28.22	100.00
Feed Solvent	89.30	8.04	1.64	0.96	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	61.14	3.46	4.91	1.05	1.22	28.22	100.00
A-101 Solvent	89.30	8.04	1.64	0.96	0.06	0.00	100.00
A-102 Naphtha	83.98	9.83	5.10	1.04	0.05	0.00	100.00
A-103 Sour H ₂ O	0.13	10.92	87.70	1.11	0.13	0.00	100.00
Off Gas	13.44	37.66	5.13	43.02	0.75	0.00	100.00

Table C-40
Reconciled Elemental Compositions for YP444
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.93	4.58	18.52	1.11	0.42	5.44	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	61.14	3.46	4.91	1.06	1.22	28.22	100.00
Feed Solvent	89.29	8.04	1.64	0.97	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	61.14	3.46	4.91	1.06	1.22	28.22	100.00
A-101 Solvent	89.29	8.04	1.64	0.97	0.06	0.00	100.00
A-102 Naphtha	83.96	9.82	5.11	1.06	0.05	0.00	100.00
A-103 Sour H ₂ O	0.13	11.22	87.43	1.09	0.13	0.00	100.00
Off Gas	13.05	36.42	5.04	43.66	1.83	0.00	100.00

Table C-41
Measured Elemental Flow Rates for YP445
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8766	0.0573	0.2328	0.0156	0.0053	0.0678	1.2554
H ₂ O in Coal	0.0000	0.0115	0.0915	0.0000	0.0000	0.0000	0.1031
Feed Bottoms	0.8004	0.0456	0.0641	0.0135	0.0159	0.3632	1.3028
Feed Solvent	1.0755	0.0967	0.0196	0.0122	0.0007	0.0000	1.2047
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5569	0.0000	0.0000	0.0000	0.0000	0.5569
N ₂ in	0.0000	0.0000	0.0000	0.7301	0.0000	0.0000	0.7301
Added H ₂ S (S)	0.0000	0.0017	0.0000	0.0000	0.0265	0.0000	0.0281
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0030	0.0030
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Total In	2.7526	0.7697	0.4080	0.7715	0.0483	0.4340	5.1841
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9626	0.0548	0.0771	0.0163	0.0191	0.4368	1.5667
A-101 Solvent	1.2126	0.1090	0.0221	0.0137	0.0008	0.0000	1.3582
A-102 Naphtha	0.3606	0.0419	0.0224	0.0044	0.0002	0.0000	0.4295
A-103 Sour H ₂ O	0.0002	0.0133	0.1075	0.0014	0.0002	0.0000	0.1225
Off Gas	0.2013	0.5555	0.0768	0.6412	0.0110	0.0000	1.4858
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Total Out	2.7372	0.7746	0.3059	0.6770	0.0313	0.4368	4.9628
Total Mat. Bal.	99.4417	100.6305	74.9744	87.7548	64.6771	100.6461	95.7301
N ₂ Free Mat. Bal.		97.0950		N ₂ Free N Balance			93.9360

Table C-42
Reconciled Elemental Flow Rates for YP445
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8553	0.0560	0.2265	0.0136	0.0051	0.0665	1.2232
H ₂ O in Coal	0.0000	-0.0006	-0.0051	0.0000	0.0000	0.0000	-0.0057
Feed Bottoms	0.8092	0.0461	0.0648	0.0138	0.0161	0.3672	1.3172
Feed Solvent	1.0694	0.0962	0.0195	0.0122	0.0007	0.0000	1.1979
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5660	0.0000	0.0000	0.0000	0.0000	0.5660
N ₂ in	0.0000	0.0000	0.0000	0.6574	0.0000	0.0000	0.6574
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0258	0.0000	0.0274
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0029	0.0029
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Total In	2.7339	0.7653	0.3057	0.6971	0.0477	0.4367	4.9863
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9623	0.0548	0.0770	0.0164	0.0191	0.4367	1.5663
A-101 Solvent	1.2122	0.1090	0.0221	0.0139	0.0008	0.0000	1.3579
A-102 Naphtha	0.3605	0.0419	0.0225	0.0045	0.0002	0.0000	0.4296
A-103 Sour H ₂ O	0.0002	0.0138	0.1074	0.0014	0.0002	0.0000	0.1229
Off Gas	0.1987	0.5458	0.0767	0.6610	0.0274	0.0000	1.5096
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Total Out	2.7339	0.7653	0.3057	0.6971	0.0477	0.4367	4.9863
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-43
Measured Elemental Compositions for YP445
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.83	4.56	18.54	1.24	0.42	5.40	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	61.44	3.50	4.92	1.04	1.22	27.88	100.00
Feed Solvent	89.28	8.03	1.63	1.01	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	61.44	3.50	4.92	1.04	1.22	27.88	100.00
A-101 Solvent	89.28	8.03	1.63	1.01	0.06	0.00	100.00
A-102 Naphtha	83.95	9.75	5.22	1.02	0.05	0.00	100.00
A-103 Sour H ₂ O	0.13	10.86	87.73	1.14	0.13	0.00	100.00
Off Gas	13.55	37.39	5.17	43.15	0.74	0.00	100.00

Table C-44
Reconciled Elemental Compositions for YP445
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.93	4.58	18.52	1.11	0.42	5.44	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	61.44	3.50	4.92	1.05	1.22	27.88	100.00
Feed Solvent	89.27	8.03	1.63	1.02	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	61.44	3.50	4.92	1.05	1.22	27.88	100.00
A-101 Solvent	89.27	8.03	1.63	1.02	0.06	0.00	100.00
A-102 Naphtha	83.93	9.74	5.23	1.04	0.05	0.00	100.00
A-103 Sour H ₂ O	0.13	11.22	87.40	1.12	0.13	0.00	100.00
Off Gas	13.16	36.16	5.08	43.78	1.81	0.00	100.00

Table C-45
Measured Elemental Flow Rates for YP446
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8501	0.0553	0.2267	0.0150	0.0055	0.0669	1.2195
H ₂ O in Coal	0.0000	0.0118	0.0939	0.0000	0.0000	0.0000	0.1058
Feed Bottoms	0.7724	0.0423	0.0770	0.0126	0.0159	0.3508	1.2710
Feed Solvent	1.0479	0.0947	0.0194	0.0126	0.0007	0.0000	1.1752
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5558	0.0000	0.0000	0.0000	0.0000	0.5558
N ₂ in	0.0000	0.0000	0.0000	0.7489	0.0000	0.0000	0.7489
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0258	0.0000	0.0274
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0030	0.0030
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Total In	2.6704	0.7615	0.4170	0.7891	0.0479	0.4206	5.1066
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9275	0.0508	0.0925	0.0151	0.0191	0.4212	1.5262
A-101 Solvent	1.1688	0.1056	0.0216	0.0141	0.0007	0.0000	1.3107
A-102 Naphtha	0.3495	0.0410	0.0215	0.0040	0.0002	0.0000	0.4163
A-103 Sour H ₂ O	0.0002	0.0140	0.1113	0.0013	0.0001	0.0000	0.1270
Off Gas	0.2058	0.5643	0.0771	0.6622	0.0109	0.0000	1.5204
<hr/>							
Total Out	2.6517	0.7758	0.3242	0.6967	0.0311	0.4212	4.9006
Total Mat. Bal.	99.2993	101.8687	77.7285	88.2869	64.8458	100.1407	95.9652
N ₂ Free Mat. Bal.		97.3350		N ₂ Free N Balance			93.7270

Table C-46
Reconciled Elemental Flow Rates for YP446
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8282	0.0540	0.2203	0.0131	0.0054	0.0655	1.1865
H ₂ O in Coal	0.0000	0.0008	0.0063	0.0000	0.0000	0.0000	0.0071
Feed Bottoms	0.7766	0.0425	0.0775	0.0127	0.0160	0.3527	1.2780
Feed Solvent	1.0413	0.0941	0.0192	0.0127	0.0007	0.0000	1.1680
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5672	0.0000	0.0000	0.0000	0.0000	0.5672
N ₂ in	0.0000	0.0000	0.0000	0.6768	0.0000	0.0000	0.6768
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0251	0.0000	0.0267
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0029	0.0029
<hr/>							
Total In	2.6462	0.7602	0.3234	0.7153	0.0471	0.4211	4.9131
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	0.9272	0.0508	0.0925	0.0152	0.0191	0.4211	1.5259
A-101 Solvent	1.1684	0.1055	0.0216	0.0142	0.0007	0.0000	1.3104
A-102 Naphtha	0.3493	0.0410	0.0216	0.0041	0.0002	0.0000	0.4161
A-103 Sour H ₂ O	0.0002	0.0143	0.1115	0.0013	0.0001	0.0000	0.1273
Off Gas	0.2011	0.5486	0.0762	0.6805	0.0269	0.0000	1.5333
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Total Out	2.6462	0.7602	0.3234	0.7153	0.0471	0.4211	4.9131
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-47
Measured Elemental Compositions for YP446
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.71	4.53	18.59	1.23	0.46	5.48	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.77	3.33	6.06	0.99	1.25	27.60	100.00
Feed Solvent	89.17	8.05	1.65	1.07	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	60.77	3.33	6.06	0.99	1.25	27.60	100.00
A-101 Solvent	89.17	8.05	1.65	1.07	0.06	0.00	100.00
A-102 Naphtha	83.95	9.86	5.18	0.96	0.05	0.00	100.00
A-103 Sour H ₂ O	0.14	11.06	87.69	1.00	0.11	0.00	100.00
Off Gas	13.54	37.12	5.07	43.56	0.72	0.00	100.00

Table C-48
Reconciled Elemental Compositions for YP446
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.80	4.55	18.57	1.10	0.45	5.52	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	60.77	3.33	6.06	1.00	1.25	27.60	100.00
Feed Solvent	89.16	8.05	1.65	1.09	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	60.77	3.33	6.06	1.00	1.25	27.60	100.00
A-101 Solvent	89.16	8.05	1.65	1.09	0.06	0.00	100.00
A-102 Naphtha	83.94	9.85	5.18	0.98	0.05	0.00	100.00
A-103 Sour H ₂ O	0.14	11.21	87.55	1.00	0.11	0.00	100.00
Off Gas	13.11	35.78	4.97	44.38	1.76	0.00	100.00

Table C-49
Measured Elemental Flow Rates for YP447
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.9255	0.0590	0.2554	0.0148	0.0057	0.0741	1.3344
H ₂ O in Coal	0.0000	0.0130	0.1031	0.0000	0.0000	0.0000	0.1161
Feed Bottoms	0.8767	0.0484	0.0671	0.0152	0.0150	0.3688	1.3911
Feed Solvent	1.1485	0.1023	0.0216	0.0132	0.0008	0.0000	1.2864
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.4890	0.0000	0.0000	0.0000	0.0000	0.4890
N ₂ in	0.0000	0.0000	0.0000	0.7111	0.0000	0.0000	0.7111
Added H ₂ S (S)	0.0000	0.0017	0.0000	0.0000	0.0270	0.0000	0.0287
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.9506	0.7133	0.4471	0.7542	0.0486	0.4429	5.3567
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<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.1078	0.0612	0.0847	0.0192	0.0190	0.4660	1.7579
A-101 Solvent	1.2401	0.1105	0.0233	0.0142	0.0009	0.0000	1.3890
A-102 Naphtha	0.3461	0.0407	0.0215	0.0041	0.0002	0.0000	0.4126
A-103 Sour H ₂ O	0.0002	0.0133	0.1047	0.0014	0.0001	0.0000	0.1197
Off Gas	0.2213	0.5105	0.0897	0.6420	0.0107	0.0000	1.4742
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Total Out	2.9155	0.7361	0.3240	0.6809	0.0309	0.4660	5.1534
Total Mat. Bal.	98.8101	103.1977	72.4522	90.2740	63.7118	105.2199	96.2041
N ₂ Free Mat. Bal.		97.1780			N ₂ Free N Balance		97.4300

Table C-50
Reconciled Elemental Flow Rates for YP447
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8941	0.0573	0.2449	0.0137	0.0054	0.0726	1.2880
H ₂ O in Coal	0.0000	-0.0018	-0.0146	0.0000	0.0000	0.0000	-0.0165
Feed Bottoms	0.9339	0.0516	0.0715	0.0162	0.0160	0.3928	1.4819
Feed Solvent	1.0801	0.0962	0.0203	0.0124	0.0008	0.0000	1.2098
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5052	0.0000	0.0000	0.0000	0.0000	0.5052
N ₂ in	0.0000	0.0000	0.0000	0.6550	0.0000	0.0000	0.6550
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0260	0.0000	0.0277
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.9081	0.7100	0.3220	0.6973	0.0483	0.4654	5.1512
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.1066	0.0611	0.0847	0.0192	0.0190	0.4654	1.7560
A-101 Solvent	1.2425	0.1107	0.0233	0.0143	0.0009	0.0000	1.3917
A-102 Naphtha	0.3468	0.0408	0.0216	0.0041	0.0002	0.0000	0.4135
A-103 Sour H ₂ O	0.0002	0.0135	0.1049	0.0014	0.0001	0.0000	0.1201
Off Gas	0.2121	0.4840	0.0876	0.6583	0.0281	0.0000	1.4701
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Total Out	2.9081	0.7100	0.3220	0.6973	0.0483	0.4654	5.1512
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000			N ₂ Free N Balance		100.0000

Table C-51
Measured Elemental Compositions for YP447
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.35	4.42	19.14	1.11	0.43	5.55	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.02	3.48	4.82	1.09	1.08	26.51	100.00
Feed Solvent	89.28	7.95	1.68	1.02	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.02	3.48	4.82	1.09	1.08	26.51	100.00
A-101 Solvent	89.28	7.95	1.68	1.02	0.06	0.00	100.00
A-102 Naphtha	83.87	9.87	5.21	0.99	0.06	0.00	100.00
A-103 Sour H ₂ O	0.14	11.08	87.48	1.20	0.09	0.00	100.00
Off Gas	15.01	34.63	6.08	43.55	0.73	0.00	100.00

Table C-52
Reconciled Elemental Compositions for YP447
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.42	4.45	19.01	1.06	0.42	5.64	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.02	3.48	4.82	1.09	1.08	26.51	100.00
Feed Solvent	89.28	7.95	1.68	1.03	0.06	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.02	3.48	4.82	1.09	1.08	26.51	100.00
A-101 Solvent	89.28	7.95	1.68	1.03	0.06	0.00	100.00
A-102 Naphtha	83.87	9.86	5.22	1.00	0.06	0.00	100.00
A-103 Sour H ₂ O	0.14	11.22	87.35	1.19	0.09	0.00	100.00
Off Gas	14.43	32.93	5.96	44.78	1.91	0.00	100.00

Table C-53
Measured Elemental Flow Rates for YP448
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8526	0.0541	0.2368	0.0134	0.0051	0.0683	1.2303
H ₂ O in Coal	0.0000	0.0118	0.0939	0.0000	0.0000	0.0000	0.1057
Feed Bottoms	0.8090	0.0441	0.0594	0.0158	0.0136	0.3395	1.2813
Feed Solvent	1.0591	0.0933	0.0193	0.0123	0.0008	0.0000	1.1849
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.4869	0.0000	0.0000	0.0000	0.0000	0.4869
N ₂ in	0.0000	0.0000	0.0000	0.7339	0.0000	0.0000	0.7339
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0249	0.0000	0.0264
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.7208	0.6919	0.4094	0.7753	0.0443	0.4078	5.0495
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<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.0404	0.0567	0.0764	0.0203	0.0175	0.4366	1.6478
A-101 Solvent	1.1607	0.1023	0.0212	0.0135	0.0009	0.0000	1.2985
A-102 Naphtha	0.3647	0.0428	0.0216	0.0043	0.0002	0.0000	0.4337
A-103 Sour H ₂ O	0.0002	0.0128	0.0972	0.0013	0.0001	0.0000	0.1116
Off Gas	0.2223	0.5104	0.0867	0.6651	0.0106	0.0000	1.4951
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Total Out	2.7883	0.7250	0.3031	0.7044	0.0293	0.4366	4.9867
Total Mat. Bal.	102.4804	104.7880	74.0344	90.8511	66.0591	107.0719	98.7558
N ₂ Free Mat. Bal.		100.2110		N ₂ Free N Balance			102.3950

Table C-54
Reconciled Elemental Flow Rates for YP448
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8542	0.0545	0.2352	0.0132	0.0050	0.0692	1.2314
H ₂ O in Coal	0.0000	-0.0022	-0.0174	0.0000	0.0000	0.0000	-0.0196
Feed Bottoms	0.8745	0.0476	0.0642	0.0171	0.0147	0.3670	1.3851
Feed Solvent	1.0493	0.0924	0.0191	0.0122	0.0008	0.0000	1.1739
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5027	0.0000	0.0000	0.0000	0.0000	0.5027
N ₂ in	0.0000	0.0000	0.0000	0.6769	0.0000	0.0000	0.6769
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0249	0.0000	0.0264
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.7781	0.6967	0.3011	0.7193	0.0454	0.4362	4.9768
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.0394	0.0566	0.0763	0.0203	0.0175	0.4362	1.6462
A-101 Solvent	1.1614	0.1023	0.0212	0.0135	0.0009	0.0000	1.2993
A-102 Naphtha	0.3649	0.0428	0.0217	0.0043	0.0002	0.0000	0.4340
A-103 Sour H ₂ O	0.0002	0.0125	0.0977	0.0013	0.0001	0.0000	0.1118
Off Gas	0.2122	0.4824	0.0842	0.6799	0.0267	0.0000	1.4855
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Total Out	2.7781	0.6967	0.3011	0.7193	0.0454	0.4362	4.9768
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-55
Measured Elemental Compositions for YP448
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.30	4.40	19.25	1.09	0.41	5.55	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.14	3.44	4.63	1.23	1.06	26.50	100.00
Feed Solvent	89.39	7.88	1.63	1.04	0.07	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.14	3.44	4.63	1.23	1.06	26.50	100.00
A-101 Solvent	89.39	7.88	1.63	1.04	0.07	0.00	100.00
A-102 Naphtha	84.09	9.88	4.98	0.99	0.06	0.00	100.00
A-103 Sour H ₂ O	0.15	11.47	87.16	1.13	0.09	0.00	100.00
Off Gas	14.87	34.14	5.80	44.48	0.71	0.00	100.00

Table C-56
Reconciled Elemental Compositions for YP448
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.37	4.43	19.10	1.07	0.41	5.62	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.14	3.44	4.64	1.23	1.06	26.49	100.00
Feed Solvent	89.39	7.87	1.63	1.04	0.07	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.14	3.44	4.64	1.23	1.06	26.49	100.00
A-101 Solvent	89.39	7.87	1.63	1.04	0.07	0.00	100.00
A-102 Naphtha	84.09	9.86	5.00	1.00	0.06	0.00	100.00
A-103 Sour H ₂ O	0.15	11.22	87.40	1.15	0.09	0.00	100.00
Off Gas	14.28	32.47	5.67	45.77	1.80	0.00	100.00

Table C-57
Measured Elemental Flow Rates for YP449
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8976	0.0570	0.2494	0.0141	0.0053	0.0719	1.2953
H ₂ O in Coal	0.0000	0.0124	0.0988	0.0000	0.0000	0.0000	0.1112
Feed Bottoms	0.8600	0.0482	0.0692	0.0144	0.0139	0.3432	1.3489
Feed Solvent	1.1129	0.0998	0.0208	0.0130	0.0009	0.0000	1.2474
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.4881	0.0000	0.0000	0.0000	0.0000	0.4881
N ₂ in	0.0000	0.0000	0.0000	0.7197	0.0000	0.0000	0.7197
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0262	0.0000	0.0278
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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Total In	2.8706	0.7071	0.4381	0.7612	0.0463	0.4151	5.2383
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.0881	0.0609	0.0875	0.0183	0.0176	0.4342	1.7066
A-101 Solvent	1.1973	0.1074	0.0223	0.0140	0.0010	0.0000	1.3419
A-102 Naphtha	0.3307	0.0391	0.0199	0.0039	0.0002	0.0000	0.3937
A-103 Sour H ₂ O	0.0002	0.0133	0.1049	0.0013	0.0001	0.0000	0.1199
Off Gas	0.2247	0.5147	0.0903	0.6482	0.0107	0.0000	1.4886
<hr/>							
Total Out	2.8410	0.7353	0.3250	0.6857	0.0296	0.4342	5.0507
Total Mat. Bal.	98.9676	103.9866	74.1748	90.0820	63.9178	104.6122	96.4179
N ₂ Free Mat. Bal.		97.4870			N ₂ Free N Balance		96.6380

Table C-58
Reconciled Elemental Flow Rates for YP449
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	0.8684	0.0554	0.2396	0.0127	0.0051	0.0705	1.2518
H ₂ O in Coal	0.0000	-0.0013	-0.0100	0.0000	0.0000	0.0000	-0.0112
Feed Bottoms	0.9103	0.0510	0.0732	0.0154	0.0147	0.3632	1.4278
Feed Solvent	1.0530	0.0944	0.0197	0.0124	0.0008	0.0000	1.1803
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5049	0.0000	0.0000	0.0000	0.0000	0.5049
N ₂ in	0.0000	0.0000	0.0000	0.6603	0.0000	0.0000	0.6603
Added H ₂ S (S)	0.0000	0.0016	0.0000	0.0000	0.0253	0.0000	0.0269
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	2.8317	0.7060	0.3225	0.7008	0.0460	0.4337	5.0408
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.0870	0.0608	0.0874	0.0183	0.0176	0.4337	1.7049
A-101 Solvent	1.1993	0.1075	0.0224	0.0141	0.0010	0.0000	1.3442
A-102 Naphtha	0.3312	0.0391	0.0199	0.0039	0.0002	0.0000	0.3943
A-103 Sour H ₂ O	0.0002	0.0135	0.1051	0.0013	0.0001	0.0000	0.1202
Off Gas	0.2141	0.4851	0.0877	0.6631	0.0271	0.0000	1.4771
<hr/>							
Total Out	2.8317	0.7060	0.3225	0.7008	0.0460	0.4337	5.0408
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000			N ₂ Free N Balance		100.0000

Table C-59
Measured Elemental Compositions for YP449
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.30	4.40	19.25	1.09	0.41	5.55	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.76	3.57	5.13	1.07	1.03	25.44	100.00
Feed Solvent	89.22	8.00	1.67	1.04	0.07	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.76	3.57	5.13	1.07	1.03	25.44	100.00
A-101 Solvent	89.22	8.00	1.67	1.04	0.07	0.00	100.00
A-102 Naphtha	83.99	9.92	5.04	0.98	0.06	0.00	100.00
A-103 Sour H ₂ O	0.14	11.08	87.55	1.12	0.11	0.00	100.00
Off Gas	15.10	34.57	6.07	43.54	0.72	0.00	100.00

Table C-60
Reconciled Elemental Compositions for YP449
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.37	4.43	19.14	1.02	0.41	5.63	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.76	3.57	5.13	1.08	1.03	25.44	100.00
Feed Solvent	89.22	8.00	1.67	1.05	0.07	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.76	3.57	5.13	1.08	1.03	25.44	100.00
A-101 Solvent	89.22	8.00	1.67	1.05	0.07	0.00	100.00
A-102 Naphtha	83.99	9.91	5.05	0.99	0.06	0.00	100.00
A-103 Sour H ₂ O	0.14	11.21	87.42	1.12	0.11	0.00	100.00
Off Gas	14.49	32.85	5.93	44.89	1.83	0.00	100.00

Table C-61
Measured Elemental Flow Rates for YP451
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	1.0236	0.0670	0.2819	0.0159	0.0059	0.0801	1.4744
H ₂ O in Coal	0.0000	0.0144	0.1141	0.0000	0.0000	0.0000	0.1284
Feed Bottoms	0.9688	0.0569	0.0883	0.0144	0.0166	0.3923	1.5372
Feed Solvent	1.2675	0.1150	0.0240	0.0142	0.0008	0.0000	1.4215
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5111	0.0000	0.0000	0.0000	0.0000	0.5111
N ₂ in	0.0000	0.0000	0.0000	0.7347	0.0000	0.0000	0.7347
Added H ₂ S (S)	0.0000	0.0018	0.0000	0.0000	0.0294	0.0000	0.0312
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	3.2599	0.7662	0.5083	0.7792	0.0526	0.4724	5.8386
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.1657	0.0685	0.1062	0.0173	0.0199	0.4720	1.8497
A-101 Solvent	1.4190	0.1287	0.0269	0.0159	0.0009	0.0000	1.5914
A-102 Naphtha	0.4488	0.0531	0.0255	0.0054	0.0003	0.0000	0.5330
A-103 Sour H ₂ O	0.0003	0.0173	0.1376	0.0010	0.0003	0.0000	0.1565
Off Gas	0.2425	0.5228	0.0901	0.7171	0.0114	0.0000	1.5839
<hr/>							
Total Out	3.2762	0.7904	0.3863	0.7568	0.0328	0.4720	5.7145
Total Mat. Bal.	100.5016	103.1575	75.9910	97.1220	62.2948	99.9212	97.8739
N ₂ Free Mat. Bal.		97.9820		N ₂ Free N Balance			97.0920

Table C-62
Reconciled Elemental Flow Rates for YP451
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	1.0040	0.0660	0.2748	0.0146	0.0057	0.0790	1.4442
H ₂ O in Coal	0.0000	-0.0004	-0.0034	0.0000	0.0000	0.0000	-0.0038
Feed Bottoms	0.9705	0.0570	0.0884	0.0144	0.0166	0.3930	1.5400
Feed Solvent	1.2898	0.1170	0.0245	0.0146	0.0008	0.0000	1.4466
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5255	0.0000	0.0000	0.0000	0.0000	0.5255
N ₂ in	0.0000	0.0000	0.0000	0.7243	0.0000	0.0000	0.7243
Added H ₂ S (S)	0.0000	0.0018	0.0000	0.0000	0.0288	0.0000	0.0306
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	3.2643	0.7669	0.3843	0.7680	0.0519	0.4720	5.7073
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.1656	0.0685	0.1062	0.0173	0.0199	0.4720	1.8495
A-101 Solvent	1.4173	0.1285	0.0269	0.0160	0.0009	0.0000	1.5896
A-102 Naphtha	0.4480	0.0529	0.0255	0.0055	0.0003	0.0000	0.5322
A-103 Sour H ₂ O	0.0003	0.0175	0.1378	0.0010	0.0003	0.0000	0.1569
Off Gas	0.2331	0.4994	0.0880	0.7281	0.0305	0.0000	1.5791
<hr/>							
Total Out	3.2643	0.7669	0.3843	0.7680	0.0519	0.4720	5.7073
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000			N ₂ Free N Balance		100.0000

Table C-63
Measured Elemental Compositions for YP451
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.42	4.54	19.12	1.08	0.40	5.43	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.02	3.70	5.74	0.93	1.08	25.52	100.00
Feed Solvent	89.17	8.09	1.69	1.00	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.02	3.70	5.74	0.93	1.08	25.52	100.00
A-101 Solvent	89.17	8.09	1.69	1.00	0.05	0.00	100.00
A-102 Naphtha	84.20	9.96	4.78	1.02	0.05	0.00	100.00
A-103 Sour H ₂ O	0.16	11.07	87.92	0.66	0.19	0.00	100.00
Off Gas	15.31	33.01	5.69	45.27	0.72	0.00	100.00

Table C-64
Reconciled Elemental Compositions for YP451
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.52	4.57	19.03	1.01	0.40	5.47	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.02	3.70	5.74	0.94	1.08	25.52	100.00
Feed Solvent	89.16	8.09	1.69	1.01	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.02	3.70	5.74	0.94	1.08	25.52	100.00
A-101 Solvent	89.16	8.09	1.69	1.01	0.05	0.00	100.00
A-102 Naphtha	84.19	9.94	4.79	1.03	0.05	0.00	100.00
A-103 Sour H ₂ O	0.16	11.17	87.83	0.66	0.19	0.00	100.00
Off Gas	14.76	31.63	5.57	46.11	1.93	0.00	100.00

Table C-65
Measured Elemental Flow Rates for YP452
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	1.0277	0.0665	0.2778	0.0155	0.0060	0.0792	1.4727
H ₂ O in Coal	0.0000	0.0135	0.1072	0.0000	0.0000	0.0000	0.1207
Feed Bottoms	0.9640	0.0564	0.0780	0.0157	0.0163	0.3977	1.5281
Feed Solvent	1.2571	0.1168	0.0241	0.0143	0.0007	0.0000	1.4131
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5113	0.0000	0.0000	0.0000	0.0000	0.5113
N ₂ in	0.0000	0.0000	0.0000	0.7289	0.0000	0.0000	0.7289
Added H ₂ S (S)	0.0000	0.0018	0.0000	0.0000	0.0292	0.0000	0.0310
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	3.2487	0.7664	0.4872	0.7743	0.0523	0.4769	5.8058
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.1573	0.0677	0.0937	0.0189	0.0196	0.4774	1.8345
A-101 Solvent	1.4051	0.1305	0.0270	0.0160	0.0008	0.0000	1.5794
A-102 Naphtha	0.4348	0.0516	0.0242	0.0052	0.0002	0.0000	0.5161
A-103 Sour H ₂ O	0.0003	0.0172	0.1354	0.0021	0.0003	0.0000	0.1553
Off Gas	0.2428	0.5228	0.0900	0.7170	0.0114	0.0000	1.5840
<hr/>							
Total Out	3.2402	0.7899	0.3703	0.7592	0.0324	0.4774	5.6693
Total Mat. Bal.	99.7361	103.0643	76.0128	98.0379	62.0094	100.1173	97.6501
N ₂ Free Mat. Bal.		97.6160					
				N ₂ Free N Balance			100.3960

Table C-66
Reconciled Elemental Flow Rates for YP452
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	1.0016	0.0652	0.2683	0.0153	0.0058	0.0776	1.4338
H ₂ O in Coal	0.0000	-0.0003	-0.0025	0.0000	0.0000	0.0000	-0.0028
Feed Bottoms	0.9689	0.0567	0.0785	0.0158	0.0164	0.3997	1.5359
Feed Solvent	1.2590	0.1170	0.0242	0.0143	0.0007	0.0000	1.4152
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5258	0.0000	0.0000	0.0000	0.0000	0.5258
N ₂ in	0.0000	0.0000	0.0000	0.7232	0.0000	0.0000	0.7232
Added H ₂ S (S)	0.0000	0.0018	0.0000	0.0000	0.0284	0.0000	0.0302
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	3.2295	0.7661	0.3684	0.7685	0.0513	0.4773	5.6613
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.1570	0.0677	0.0937	0.0188	0.0196	0.4773	1.8342
A-101 Solvent	1.4042	0.1304	0.0270	0.0160	0.0008	0.0000	1.5784
A-102 Naphtha	0.4344	0.0515	0.0243	0.0052	0.0002	0.0000	0.5156
A-103 Sour H ₂ O	0.0003	0.0175	0.1355	0.0021	0.0003	0.0000	0.1556
Off Gas	0.2336	0.4990	0.0880	0.7265	0.0304	0.0000	1.5774
<hr/>							
Total Out	3.2295	0.7661	0.3684	0.7685	0.0513	0.4773	5.6613
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000		N ₂ Free N Balance			100.0000

Table C-67
Measured Elemental Compositions for YP452
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.78	4.52	18.86	1.05	0.41	5.38	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.08	3.69	5.11	1.03	1.07	26.02	100.00
Feed Solvent	88.96	8.27	1.71	1.01	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.08	3.69	5.11	1.03	1.07	26.02	100.00
A-101 Solvent	88.96	8.27	1.71	1.01	0.05	0.00	100.00
A-102 Naphtha	84.25	10.01	4.69	1.00	0.05	0.00	100.00
A-103 Sour H ₂ O	0.17	11.06	87.20	1.37	0.20	0.00	100.00
Off Gas	15.33	33.00	5.68	45.27	0.72	0.00	100.00

Table C-68
Reconciled Elemental Compositions for YP452
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	69.86	4.54	18.71	1.07	0.40	5.41	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	63.08	3.69	5.11	1.03	1.07	26.02	100.00
Feed Solvent	88.96	8.26	1.71	1.01	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	63.08	3.69	5.11	1.03	1.07	26.02	100.00
A-101 Solvent	88.96	8.26	1.71	1.01	0.05	0.00	100.00
A-102 Naphtha	84.26	9.99	4.71	1.00	0.05	0.00	100.00
A-103 Sour H ₂ O	0.17	11.22	87.07	1.35	0.20	0.00	100.00
Off Gas	14.81	31.63	5.58	46.05	1.93	0.00	100.00

Table C-69
Measured Elemental Flow Rates for YP453
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	1.0615	0.0683	0.2836	0.0157	0.0062	0.0810	1.5163
H ₂ O in Coal	0.0000	0.0134	0.1061	0.0000	0.0000	0.0000	0.1195
Feed Bottoms	0.9857	0.0578	0.0843	0.0160	0.0171	0.4080	1.5687
Feed Solvent	1.2939	0.1170	0.0250	0.0140	0.0007	0.0000	1.4507
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5112	0.0000	0.0000	0.0000	0.0000	0.5112
N ₂ in	0.0000	0.0000	0.0000	0.7300	0.0000	0.0000	0.7300
Added H ₂ S (S)	0.0000	0.0019	0.0000	0.0000	0.0300	0.0000	0.0319
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	3.3411	0.7695	0.4989	0.7757	0.0540	0.4890	5.9282
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.1804	0.0692	0.1009	0.0191	0.0204	0.4886	1.8786
A-101 Solvent	1.4198	0.1284	0.0274	0.0154	0.0008	0.0000	1.5917
A-102 Naphtha	0.4463	0.0524	0.0253	0.0054	0.0002	0.0000	0.5296
A-103 Sour H ₂ O	0.0003	0.0172	0.1341	0.0020	0.0003	0.0000	0.1539
Off Gas	0.2383	0.5228	0.0882	0.7024	0.0111	0.0000	1.5628
<hr/>							
Total Out	3.2850	0.7900	0.3760	0.7443	0.0329	0.4886	5.7166
Total Mat. Bal.	98.3195	102.6596	75.3542	95.9496	60.9043	99.9199	96.4314
N ₂ Free Mat. Bal.		96.5240					98.7750

Table C-70
Reconciled Elemental Flow Rates for YP453
(Kg/hr)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	1.0188	0.0659	0.2695	0.0152	0.0059	0.0783	1.4536
H ₂ O in Coal	0.0000	-0.0005	-0.0043	0.0000	0.0000	0.0000	-0.0048
Feed Bottoms	0.9908	0.0580	0.0848	0.0160	0.0172	0.4101	1.5769
Feed Solvent	1.2661	0.1145	0.0244	0.0137	0.0007	0.0000	1.4194
Make-up Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Purge Solvent	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H ₂ in	0.0000	0.5264	0.0000	0.0000	0.0000	0.0000	0.5264
N ₂ in	0.0000	0.0000	0.0000	0.7121	0.0000	0.0000	0.7121
Added H ₂ S (S)	0.0000	0.0018	0.0000	0.0000	0.0287	0.0000	0.0305
Added Fe ₂ O ₃	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<hr/>							
Total In	3.2756	0.7661	0.3745	0.7570	0.0525	0.4884	5.7141
<hr/>							
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	1.1800	0.0691	0.1010	0.0191	0.0204	0.4884	1.8780
A-101 Solvent	1.4198	0.1284	0.0274	0.0154	0.0008	0.0000	1.5918
A-102 Naphtha	0.4462	0.0523	0.0254	0.0053	0.0002	0.0000	0.5294
A-103 Sour H ₂ O	0.0003	0.0173	0.1344	0.0020	0.0003	0.0000	0.1543
Off Gas	0.2294	0.4990	0.0864	0.7152	0.0307	0.0000	1.5606
<hr/>							
Total Out	3.2756	0.7661	0.3745	0.7570	0.0525	0.4884	5.7141
Total Mat. Bal.	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
N ₂ Free Mat. Bal.		100.0000			N ₂ Free N Balance		100.0000

Table C-71
Measured Elemental Compositions for YP453
(Wt%)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.01	4.50	18.70	1.04	0.41	5.34	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	62.83	3.68	5.37	1.02	1.09	26.01	100.00
Feed Solvent	89.20	8.07	1.72	0.97	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	62.83	3.68	5.37	1.02	1.09	26.01	100.00
A-101 Solvent	89.20	8.07	1.72	0.97	0.05	0.00	100.00
A-102 Naphtha	84.27	9.90	4.78	1.01	0.04	0.00	100.00
A-103 Sour H ₂ O	0.18	11.17	87.13	1.33	0.20	0.00	100.00
Off Gas	15.25	33.45	5.65	44.94	0.71	0.00	100.00

Table C-72
Reconciled Elemental Compositions for YP453
(Wt %)

<u>Inlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
Dry Coal	70.09	4.53	18.54	1.05	0.41	5.39	100.00
H ₂ O in Coal	0.00	11.19	88.81	0.00	0.00	0.00	100.00
Feed Bottoms	62.83	3.68	5.38	1.02	1.09	26.01	100.00
Feed Solvent	89.20	8.07	1.72	0.97	0.05	0.00	100.00
Make-up Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Purge Solvent	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H ₂ in	0.00	100.00	0.00	0.00	0.00	0.00	100.00
N ₂ in	0.00	0.00	0.00	100.00	0.00	0.00	100.00
<u>Outlets</u>	<u>Carbon</u>	<u>Hydrogen</u>	<u>Oxygen</u>	<u>Nitrogen</u>	<u>Sulfur</u>	<u>Ash</u>	<u>Total</u>
A-100 Bottoms	62.83	3.68	5.38	1.02	1.09	26.01	100.00
A-101 Solvent	89.20	8.07	1.72	0.97	0.05	0.00	100.00
A-102 Naphtha	84.28	9.88	4.79	1.01	0.04	0.00	100.00
A-103 Sour H ₂ O	0.18	11.21	87.09	1.32	0.20	0.00	100.00
Off Gas	14.70	31.97	5.54	45.82	1.97	0.00	100.00

Appendix D

RCLU Feed Coal Analysis

Table D-1
Measured Feed Coal Analysis

Yield Period	Ash ex. SO ₃ wt %	Carbon wt %	Hydrogen wt %	Oxygen wt %	Nitrogen wt %	Sulfur wt %	H/C Ratio
YP434	5.40	70.53	4.66	17.85	1.073	0.488	0.788
YP435	5.40	70.53	4.66	17.85	1.073	0.488	0.788
YP436	5.37	70.45	4.64	18.21	0.842	0.485	0.786
YP438	5.59	70.05	4.52	18.30	1.076	0.470	0.769
YP439	5.70	70.03	4.51	18.22	1.058	0.470	0.768
YP440	5.70	70.03	4.51	18.22	1.058	0.470	0.768
YP441	5.11	69.10	4.51	19.79	1.026	0.457	0.779
YP442	5.11	69.10	4.51	19.79	1.026	0.457	0.779
YP443	5.46	69.51	4.52	19.03	1.041	0.434	0.774
YP444	5.40	69.83	4.56	18.54	1.244	0.422	0.779
YP445	5.40	69.83	4.56	18.54	1.244	0.422	0.779
YP446	5.48	69.71	4.53	18.59	1.229	0.455	0.775
YP447	5.55	69.35	4.42	19.14	1.109	0.427	0.759
YP448	5.55	69.30	4.40	19.25	1.087	0.413	0.757
YP449	5.55	69.30	4.40	19.25	1.086	0.413	0.756
YP451	5.43	69.42	4.54	19.12	1.076	0.402	0.780
YP452	5.38	69.78	4.52	18.86	1.052	0.407	0.771
YP453	5.34	70.01	4.50	18.70	1.037	0.410	0.766

Table D-2
Reconciled Feed Coal Analysis

Yield Period	Ash ex. SO ₃ wt %	Carbon wt %	Hydrogen wt %	Oxygen wt %	Nitrogen wt %	Sulfur wt %	H/C RATIO
YP434	5.44	70.61	4.67	17.84	0.950	0.484	0.788
YP435	5.43	70.61	4.67	17.84	0.963	0.484	0.788
YP436	5.40	70.46	4.64	18.09	0.933	0.479	0.784
YP438	5.64	70.13	4.54	18.25	0.971	0.466	0.772
YP439	5.75	70.10	4.53	18.13	1.022	0.466	0.771
YP440	5.73	70.10	4.53	18.12	1.045	0.465	0.770
YP441	5.15	69.17	4.53	19.68	1.015	0.453	0.780
YP442	5.14	69.16	4.53	19.65	1.064	0.453	0.780
YP443	5.49	69.58	4.53	18.90	1.068	0.431	0.776
YP444	5.44	69.93	4.58	18.52	1.110	0.419	0.780
YP445	5.44	69.93	4.58	18.52	1.115	0.419	0.780
YP446	5.52	69.80	4.55	18.57	1.105	0.451	0.777
YP447	5.64	69.42	4.45	19.01	1.061	0.423	0.763
YP448	5.62	69.37	4.43	19.10	1.071	0.410	0.760
YP449	5.63	69.37	4.43	19.14	1.018	0.410	0.760
YP451	5.47	69.52	4.57	19.03	1.013	0.398	0.783
YP452	5.41	69.86	4.54	18.71	1.067	0.403	0.775
YP453	5.39	70.09	4.53	18.54	1.046	0.406	0.770

Appendix E

Detailed Statistical Analysis

Table E-1
Detailed Statistical Analysis

<u>STREAM/Y/P</u>	<u>Condition 1</u>		<u>Average</u>	<u>Standard Deviation</u>	<u>Variance</u>	<u>F Statistic</u>	<u>F Dist.</u>	<u>Is F Dist <0.025? (95% Conf.)</u>
	<u>434</u>	<u>435</u>						
MATERIAL BAL	100.00	100.00	100.00	0.00	0.000			
ASH BALANCE	100.00	100.00	100.00	0.00	0.000			
H ₂	-5.85	-5.90	-5.88	0.04	0.001			
H ₂ O	13.29	13.22	13.26	0.05	0.002			
CHEM GAS	6.63	6.65	6.64	0.01	0.000			
CO _x	6.02	6.00	6.01	0.01	0.000			
H ₂ S	0.15	0.17	0.16	0.01	0.000			
C ₁ -C ₄	13.05	13.11	13.08	0.04	0.002			
C ₃ -1000 F	66.42	66.06	66.24	0.25	0.065			
C ₅ -1000 F	60.18	59.82	60.00	0.25	0.065			
C ₅ -350 F	11.06	11.84	11.45	0.55	0.304			
350-650 F	31.53	33.43	32.48	1.34	1.805			
650-1000 F	17.60	14.54	16.07	2.16	4.682			
CONVERSION	87.30	86.89	87.10	0.29	0.084			
1000 F* BTMS	12.71	13.12	12.92	0.29	0.084			
GAS SELECTIVITY	14.95	15.09	15.02	0.10	0.010			
GAS/LIQ SELECT	17.82	17.98	17.90	0.11	0.013			

<u>STREAM/Y/P</u>	<u>Condition 2</u>		<u>Average</u>	<u>Assumed Standard Deviation</u>	<u>Cond2 - Cond1</u>	<u>t Statistic</u>	<u>>2.28 ?</u>
	<u>436</u>						
MATERIAL BAL	100.00		100.00	0.00	0.000		
ASH BALANCE	100.00		100.00	0.00	0.000		
H ₂	-5.92		-5.92	0.11	-0.045	-0.409	No
H ₂ O	12.75		12.75	0.38	-0.505	-1.330	No
CHEM GAS	6.92		6.92	0.20	0.280	1.393	No
CO _x	6.38		6.38	0.13	0.370	2.758	Yes
H ₂ S	0.17		0.17	0.25	0.010	0.040	No
C ₁ -C ₄	13.13		13.13	0.63	0.050	0.080	No
C ₃ -1000 F	66.22		66.22	0.72	-0.020	-0.028	No
C ₅ -1000 F	59.91		59.91	0.64	-0.090	-0.141	No
C ₅ -350 F	12.19		12.19	0.65	0.740	1.131	No
350-650 F	33.44		33.44	1.12	0.960	0.855	No
650-1000 F	14.28		14.28	1.42	-1.790	-1.262	No
CONVERSION	86.79		86.79	0.70	-0.305	-0.438	No
1000 F* BTMS	13.22		13.22	0.66	0.305	0.459	No
GAS SELECTIVITY	15.13		15.13	0.52	0.110	0.211	No
GAS/LIQ SELECT	17.98	19.53	18.76	0.70	0.080	0.114	No

Table E-1
Detailed Statistical Analysis

STREAM/Y/P	Condition 3			Standard		Cond3 - Cond2	t Statistic	> 2.28 ?
	438	439	440	Average	Deviation			
MATERIAL BAL	100.00	100.00	100.00	100.00	0.00	0.000		
ASH BALANCE	100.00	100.00	100.00	100.00	0.00	0.000		
H ₂	-5.89	-5.87	-5.89	-5.88	0.01	0.030	0.289	No
H ₂ O	12.62	12.50	12.47	12.53	0.08	-0.130	-0.363	No
CHEM GAS	7.94	8.00	7.85	7.93	0.08	1.020	5.381	Yes
CO _x	7.32	7.36	7.19	7.29	0.09	0.940	7.431	Yes
H ₂ S	0.20	0.19	0.20	0.20	0.01	0.030	0.127	No
C ₁ -C ₄	13.50	13.33	13.29	13.37	0.11	0.370	0.627	No
C ₃ -1000 F	64.76	64.12	64.57	64.48	0.33	-1.460	-2.148	No
C ₅ -1000 F	58.31	57.75	58.21	58.09	0.30	-1.600	-2.666	Yes
C ₅ -350 F	12.28	11.88	12.05	12.07	0.20	0.090	0.146	No
350-650 F	33.57	31.92	33.06	32.85	0.84	0.130	0.123	No
650-1000 F	12.45	13.95	13.10	13.17	0.75	-1.830	-1.368	No
CONVERSION	86.47	85.71	85.93	86.04	0.39	-0.320	-0.487	No
1000 F* BTMS	13.54	14.30	14.08	13.97	0.39	0.320	0.511	No
GAS SELECTIVITY	15.61	15.55	15.47	15.54	0.07	0.480	0.977	No
GAS/LIQ SELECT	18.80	18.75	18.59	18.71	0.11	0.045	0.068	No

STREAM/Y/P	Condition 4			Standard		Variance	F Statistic vs Cond1	F Dist.	Is F Dist <0.025? (95% Conf.)	T Statistic vs Cond1	T Dist.	Is T Dist <0.025? (95% Conf.)
	441	442	443	Average	Deviation							
MATERIAL BAL	100.00	100.00	100.00	100.00	0.00	0.000						
ASH BALANCE	100.00	100.00	100.00	100.00	0.00	0.000						
H ₂	-5.91	-5.86	-5.68	-5.82	0.12	0.015	11.707	0.079	No	0.62	0.286	No
H ₂ O	14.84	14.46	13.81	14.37	0.52	0.271	110.735	0.009	YES	n/a	n/a	n/a
CHEM GAS	7.67	7.85	7.51	7.68	0.17	0.029	144.667	0.007	YES	n/a	n/a	n/a
CO _x	6.96	7.11	6.85	6.97	0.13	0.017	85.167	0.012	YES	n/a	n/a	n/a
H ₂ S	0.25	0.24	0.22	0.24	0.02	0.000	1.167	0.462	No	4.47	0.006	YES
C ₁ -C ₄	13.01	13.39	12.50	12.97	0.45	0.199	110.796	0.009	YES	n/a	n/a	n/a
C ₃ -1000 F	63.26	63.72	63.63	63.54	0.24	0.059	1.090	0.478	No	8.11	0.001	YES
C ₅ -1000 F	57.20	57.53	57.83	57.52	0.32	0.099	1.532	0.395	No	6.59	0.001	YES
C ₅ -350 F	10.88	10.93	10.55	10.79	0.21	0.043	7.135	0.123	No	1.86	0.069	No
350-650 F	31.07	31.50	32.08	31.55	0.51	0.257	7.026	0.125	No	1.11	0.165	No
650-1000 F	15.26	15.10	15.20	15.19	0.08	0.007	716.602	0.001	YES	n/a	n/a	n/a
CONVERSION	86.81	87.35	85.97	86.71	0.70	0.484	5.754	0.148	No	0.69	0.264	No
1000 F* BTMS	13.20	12.66	14.03	13.30	0.69	0.476	5.666	0.150	No	0.69	0.264	No
GAS SELECTIVITY	14.99	15.33	14.54	14.95	0.40	0.157	16.024	0.059	No	0.22	0.419	No
GAS/LIQ SELECT	18.53	18.88	17.77	18.39	0.57	0.322	25.159	0.038	No	1.10	0.166	No

Table E-1
Detailed Statistical Analysis

STREAM/YP	Condition 5			Average	Standard Deviation	Variance	F Statistic vs Cond4	F Dist.	Is F Dist <0.025? (95% Conf.)	T Statistic vs Cond4	T Dist.	Is T Dist <0.025? (95% Conf.)
	444	445	446									
MATERIAL BAL	100.00	100.00	100.00	100.00	0.00	0.000						
ASH BALANCE	100.00	100.00	100.00	100.00	0.00	0.000						
H ₂	-5.82	-5.78	-5.87	-5.82	0.05	0.002	7.197	0.122	No	0.09	0.467	No
H ₂ O	13.61	13.45	13.10	13.39	0.26	0.068	3.988	0.200	No	2.56	0.031	No
CHEM GAS	7.25	7.44	7.70	7.46	0.23	0.051	1.764	0.362	No	1.31	0.131	No
H ₂ S	0.17	0.16	0.19	0.17	0.02	0.000	1.000	0.500	No	5.08	0.004	YES
C ₁ -C ₄	13.06	13.31	13.86	13.41	0.41	0.167	1.191	0.456	No	1.27	0.137	No
C ₃ -1000 F	64.11	63.59	62.56	63.42	0.79	0.622	10.471	0.087	No	0.24	0.409	No
C ₅ -1000 F	58.05	57.44	56.13	57.21	0.98	0.962	9.692	0.094	No	0.53	0.313	No
C ₅ -350 F	10.96	10.96	10.53	10.82	0.25	0.062	1.446	0.409	No	0.16	0.440	No
350-650 F	32.59	31.65	31.93	32.06	0.48	0.233	1.103	0.476	No	1.25	0.139	No
650-1000 F	14.49	14.83	13.67	14.33	0.60	0.356	54.429	0.018	YES	n/a	n/a	n/a
CONVERSION	86.15	85.85	84.92	85.64	0.64	0.411	1.176	0.460	No	1.96	0.061	No
1000 F* BTMS	13.86	14.16	15.08	14.37	0.64	0.404	1.178	0.459	No	1.98	0.060	No
GAS SELECTIVITY	15.16	15.50	16.32	15.66	0.60	0.356	2.264	0.306	No	1.71	0.081	No
GAS/LIQ SELECT	18.37	18.81	19.80	18.99	0.73	0.536	1.666	0.375	No	1.12	0.162	No

STREAM/YP	Condition 6			Average	Standard Deviation	Variance	F Statistic vs Cond4	F Dist.	Is F Dist <0.025? (95% Conf.)	T Statistic vs Cond4	T Dist.	Is T Dist <0.025? (95% Conf.)
	447	448	449									
MATERIAL BAL	100.00	100.00	100.00	100.00	0.00	0.000						
ASH BALANCE	100.00	100.00	100.00	100.00	0.00	0.000						
H ₂	-5.77	-5.99	-5.86	-5.87	0.11	0.012	1.196	0.455	No	0.60	0.291	No
H ₂ O	13.39	13.59	13.40	13.46	0.11	0.013	21.362	0.045	No	0.43	0.344	No
CHEM GAS	8.33	8.23	8.45	8.34	0.11	0.012	2.385	0.295	No	6.02	0.002	YES
CO _x	7.67	7.60	7.86	7.71	0.13	0.018	1.063	0.485	No	1.62	0.090	No
H ₂ S	0.19	0.18	0.17	0.18	0.01	0.000	2.333	0.300	No	0.63	0.281	No
C ₁ -C ₄	13.00	13.72	13.68	13.47	0.40	0.164	1.218	0.451	No	0.17	0.436	No
C ₅ -350 F	10.13	10.85	10.19	10.39	0.40	0.160	2.685	0.271	No	14.08	0.000	YES
C ₃ -1000 F	61.68	60.99	60.09	60.92	0.80	0.636	6.402	0.135	No	3.86	0.009	YES
C ₅ -1000 F	55.76	54.84	53.93	54.84	0.92	0.837	19.638	0.048	No	3.05	0.019	YES
350-650 F	29.73	32.12	28.98	30.28	1.64	2.689	10.467	0.087	No	1.80	0.073	No
650-1000 F	15.90	11.87	14.76	14.18	2.08	4.315	660.526	0.002	YES	n/a	n/a	n/a
CONVERSION	84.71	84.39	83.60	84.23	0.57	0.326	1.481	0.403	No	2.84	0.024	YES
1000 F* BTMS	15.29	15.62	16.41	15.77	0.58	0.331	1.438	0.410	No	2.84	0.023	YES
GAS SELECTIVITY	15.35	16.26	16.36	15.99	0.56	0.310	1.972	0.336	No	0.70	0.261	No
GAS/LIQ SELECT	18.91	20.01	20.23	19.72	0.71	0.500	1.553	0.392	No	1.23	0.143	No

Table E-1
Detailed Statistical Analysis

STREAM/YP	Condition 7			Average	Standard Deviation	Variance	F Statistic vs Cond 6	F Dist.	Is F Dist ≤0.025? (95% Conf.)	T Statistic vs Cond 6	T Dist.	Is T Dist ≤0.025? (95% Conf.)
	451	452	453									
MATERIAL BAL	100.00	100.00	100.00	100.00	0.00	0.000						
ASH BALANCE	100.00	100.00	100.00	100.00	0.00	0.000						
H ₂	-5.86	-5.95	-5.84	-5.88	0.06	0.003	3.563	0.219	No	0.14	0.448	No
H ₂ O	13.72	13.53	13.36	13.54	0.18	0.032	2.554	0.281	No	0.63	0.283	No
CHEM GAS	7.48	7.62	7.37	7.49	0.13	0.016	1.294	0.436	No	8.79	0.000	YES
CO _x	6.89	6.96	6.74	6.86	0.11	0.013	1.433	0.411	No	8.37	0.001	YES
H ₂ S	0.16	0.18	0.18	0.17	0.01	0.000	1.333	0.429	No	0.76	0.246	No
C1-C ₄	12.75	12.82	12.37	12.65	0.24	0.059	2.792	0.264	No	3.01	0.020	YES
C ₃ -1000 F	62.57	63.22	63.44	63.08	0.45	0.205	3.107	0.244	No	4.07	0.008	YES
C ₅ -1000 F	56.65	57.27	57.71	57.21	0.53	0.284	2.952	0.253	No	3.87	0.009	YES
C ₅ -350 F	10.84	10.56	10.87	10.76	0.17	0.029	91.985	0.011	YES	n/a	n/a	n/a
350-650 F	32.59	32.10	32.24	32.31	0.25	0.064	42.214	0.023	YES	n/a	n/a	n/a
650-1000 F	13.22	14.60	14.60	14.14	0.80	0.635	6.798	0.128	No	0.03	0.489	No
CONVERSION	84.74	85.30	84.97	85.00	0.28	0.079	4.120	0.195	No	2.09	0.052	No
1000 F ⁺ BTMS	15.27	14.72	15.04	15.01	0.28	0.076	4.341	0.187	No	2.07	0.054	No
GAS SELECTIVITY	15.05	15.03	14.56	14.88	0.28	0.077	4.027	0.199	No	3.09	0.018	YES
GAS/LIQ SELECT	18.37	18.29	17.65	18.10	0.39	0.156	3.211	0.237	No	3.45	0.013	YES

Appendix F

List of Laboratory Notebooks

Table F-1
List of Laboratory Notebooks

<u>Number</u>	<u>Title</u>
18662	RCLU Operations
18663	RCLU Instructions
17471	RCLU Feed Coal Inventory

Appendix G

Yield Period Conditions, Compositions and Distillation Data

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YP434

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP434	BLACK THUN	07/22/95	8	24.00	822	841	4	4	39	39	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 COAL	MAKEUP MO PPM COAL	MAKEUP SN PPM COAL	MAKEUP I PPM COAL	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL RETAINED	1000F+ H2O IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	15.00	100	0	0	0.00	1.89	0.00	Y	0.32924	N/A	9.371	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	32.538	5.997	5.397	70.526	4.664	17.852	0.488	1.073	7.693	N/A
BOTTOMS IN	31.205	32.823	29.541	59.290	3.320	5.164	1.760	0.925	0.000	N/A
SOLVENT	28.856	0.000	0.000	89.830	8.350	1.649	0.054	0.981	0.000	N/A
A-100	36.856	32.823	29.541	59.290	3.320	5.164	1.760	0.925	0.000	N/A
A-101	32.480	0.000	0.000	89.830	8.350	1.649	0.054	0.981	0.000	N/A
A-102	9.713	0.000	0.000	83.600	9.980	5.091	0.047	0.727	0.000	N/A
A-103	3.304	0.000	0.000	1.910	10.990	85.934	0.166	1.000	0.000	0.5500

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.80	0.00	0.00
300	0.00	0.00	9.30	0.00	0.00
350	0.00	0.00	17.10	0.00	0.00
400	0.00	0.00	29.30	0.00	0.00
450	0.00	0.00	43.50	0.00	0.00
500	0.00	0.00	58.10	0.00	0.00
550	0.00	0.60	73.80	0.00	0.60
600	0.00	4.00	89.50	0.00	4.00
650	0.00	12.70	98.20	0.00	12.70
700	0.00	27.80	99.80	0.00	27.80
800	0.00	60.80	100.00	0.00	60.80
1000	9.37	95.60	100.00	9.37	95.60
1000UP	100.00	100.00	100.00	100.00	100.00

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YP435

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP435	BLACK THUN	07/23/95	8	24.00	823	842	4	4	40	40	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 COAL	MAKEUP MO COAL	MAKEUP SN PPM COAL	MAKEUP PPM I COAL	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	15.29	100	0	0	0.00	1.86	0.00	Y	0.30818	N/A	9.200	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	31.641	5.997	5.397	70.526	4.664	17.852	0.488	1.073	7.693	N/A
BOTTOMS IN	30.345	33.280	29.952	59.010	3.340	5.097	1.710	0.891	0.000	N/A
SOLVENT	28.061	0.000	0.000	89.110	8.240	1.578	0.052	0.871	0.000	N/A
A-100	35.884	33.280	29.952	59.010	3.340	5.097	1.710	0.891	0.000	N/A
A-101	31.873	0.000	0.000	89.110	8.240	1.578	0.052	0.871	0.000	N/A
A-102	10.817	0.000	0.000	83.260	9.790	4.988	0.048	0.791	0.000	N/A
A-103	3.246	0.000	0.000	1.900	11.000	85.839	0.170	1.091	0.000	0.5600

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.90	0.00	0.00
300	0.00	0.00	9.50	0.00	0.00
350	0.00	0.00	17.30	0.00	0.00
400	0.00	0.00	29.50	0.00	0.00
450	0.00	0.00	43.60	0.00	0.00
500	0.00	0.00	58.30	0.00	0.00
550	0.00	0.20	73.90	0.00	0.20
600	0.00	1.40	89.70	0.00	1.40
650	0.00	5.70	98.40	0.00	5.70
700	0.00	14.40	99.90	0.00	14.40
800	0.00	42.30	100.00	0.00	42.30
1000	9.20	89.90	100.00	9.20	89.90
1000UP	100.00	100.00	100.00	100.00	100.00

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YP436

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL	
YP436	BLACK	THUN	07/24/95	8	24.00	824	842	4	4	38	38	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 ON COAL	MAKEUP MO PPM COAL	MAKEUP SN PPM COAL	MAKEUP I PPM COAL	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	9.75	100	0	0	0.00	1.86	0.00	Y	0.39195	N/A	10.400	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	32.879	5.986	5.366	70.450	4.644	18.213	0.485	0.842	7.813	N/A
BOTTOMS IN	31.532	32.004	28.804	59.550	3.410	5.677	1.610	0.949	0.000	N/A
SOLVENT	29.159	0.000	0.000	89.090	8.220	1.638	0.053	0.999	0.000	N/A
A-100	38.517	32.004	28.804	59.550	3.410	5.677	1.610	0.949	0.000	N/A
A-101	31.837	0.000	0.000	89.090	8.220	1.638	0.053	0.999	0.000	N/A
A-102	11.108	0.000	0.000	83.500	9.940	5.569	0.049	0.942	0.000	N/A
A-103	3.299	0.000	0.000	1.880	10.760	86.096	0.154	1.110	0.000	0.5900

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.70	0.00	0.00
300	0.00	0.00	9.10	0.00	0.00
350	0.00	0.00	16.90	0.00	0.00
400	0.00	0.00	29.20	0.00	0.00
450	0.00	0.00	43.50	0.00	0.00
500	0.00	0.00	58.30	0.00	0.00
550	0.00	0.20	74.10	0.00	0.20
600	0.00	1.60	89.90	0.00	1.60
650	0.00	6.50	98.50	0.00	6.50
700	0.00	16.30	99.90	0.00	16.30
800	0.00	45.90	100.00	0.00	45.90
1000	10.40	91.50	100.00	10.40	91.50
1000UP	100.00	100.00	100.00	100.00	100.00

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VP438

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP438	BLACK THUN	07/28/95	8	24.00	828	841	4	4	37	37	2500	2500	C	D	1/1/1	0.00	1.79

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 TREAT ON COAL	MAKEUP MO COAL	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.95	9.41	100	0	0	0.00	0.00	0.00	Y	0.45240	N/A	9.714	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	34.213	6.239	5.588	70.046	4.523	18.297	0.470	1.076	8.412	N/A
BOTTOMS IN	32.811	31.444	28.614	60.230	3.390	5.493	1.310	0.963	0.000	N/A
SOLVENT	30.338	0.000	0.000	89.360	8.060	1.686	0.061	1.009	0.000	N/A
A-100	39.665	31.444	28.614	60.230	3.390	5.493	1.310	0.963	0.000	N/A
A-101	33.118	0.000	0.000	89.360	8.060	1.686	0.061	1.009	0.000	N/A
A-102	11.097	0.000	0.000	84.310	9.880	4.807	0.055	0.895	0.000	N/A
A-103	3.424	0.000	0.000	1.800	10.790	86.104	0.170	1.136	0.000	0.6700

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.80	0.00	0.00
300	0.00	0.00	9.40	0.00	0.00
350	0.00	0.00	17.10	0.00	0.00
400	0.00	0.00	28.90	0.00	0.00
450	0.00	0.00	42.50	0.00	0.00
500	0.00	0.25	56.90	0.00	0.25
550	0.00	2.05	72.00	0.00	2.05
600	0.00	7.30	88.00	0.00	7.30
650	0.00	17.65	97.80	0.00	17.65
700	0.00	32.40	99.80	0.00	32.40
800	0.00	63.35	100.00	0.00	63.35
1000	9.71	94.75	100.00	9.71	94.75
1000UP	100.00	100.00	100.00	100.00	100.00

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YP439

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP439	BLACK	THUN 07/29/95	8	24.00	826	841	4	4	37	37	2500	2500	C	D	1/1/1	0.00	1.80

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 COAL	MAKEUP MO PPM COAL	MAKEUP SN PPM COAL	MAKEUP I PPM COAL	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.95	9.49	100	0	0	0.00	0.00	0.00	Y	0.39510	N/A	10.571	H		10	H2S/H2 - MCL

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	34.430	6.334	5.701	70.035	4.515	18.221	0.470	1.058	8.417	N/A
BOTTOMS IN	33.019	30.984	28.505	60.360	3.380	5.483	1.330	0.942	0.000	N/A
SOLVENT	30.531	0.000	0.000	89.180	8.080	1.621	0.062	1.055	0.000	N/A
A-100	39.258	30.984	28.505	60.360	3.380	5.483	1.330	0.942	0.000	N/A
A-101	33.175	0.000	0.000	89.180	8.080	1.621	0.062	1.055	0.000	N/A
A-102	10.819	0.000	0.000	83.380	9.840	4.728	0.060	0.963	0.000	N/A
A-103	3.586	0.000	0.000	1.790	11.050	85.887	0.166	1.107	0.000	0.6800

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.80	0.00	0.00
300	0.00	0.00	9.00	0.00	0.00
350	0.00	0.00	16.30	0.00	0.00
400	0.00	0.00	28.20	0.00	0.00
450	0.00	0.00	42.00	0.00	0.00
500	0.00	0.00	56.20	0.00	0.00
550	0.00	0.20	71.40	0.00	0.20
600	0.00	1.60	87.40	0.00	1.60
650	0.00	6.10	97.80	0.00	6.10
700	0.00	15.60	99.90	0.00	15.60
800	0.00	43.70	100.00	0.00	43.70
1000	10.57	90.20	100.00	10.57	90.20
1000UP	100.00	100.00	100.00	100.00	100.00

11/16/95 15:10:38

YP440

YP NO	COAL	YP DATE	BEGIN HOUR	VP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP440	BLACK THUN	07/30/95	8	24.00	826	841	4	4	37	37	2500	2500	C	D	1/1/1	0.00	1.82

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 TREAT ON COAL	MAKEUP MO COAL	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.96	9.56	100	0	0	0.00	0.00	0.00	0.00	Y	0.31551	N/A	11.943	H	10	H2S/H2 - MCL

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	31.972	6.334	5.701	70.035	4.515	18.221	0.470	1.058	8.417	N/A
BOTTOMS IN	30.662	30.831	28.056	60.650	3.420	5.607	1.280	0.987	0.000	N/A
SOLVENT	28.351	0.000	0.000	89.290	7.960	1.680	0.062	1.065	0.000	N/A
A-100	38.445	30.831	28.056	60.650	3.420	5.607	1.280	0.987	0.000	N/A
A-101	33.061	0.000	0.000	89.290	7.960	1.680	0.062	1.065	0.000	N/A
A-102	11.252	0.000	0.000	83.740	9.870	4.791	0.060	0.985	0.000	N/A
A-103	3.554	0.000	0.000	1.780	11.090	85.862	0.159	1.109	0.000	0.6600

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.80	0.00	0.00
300	0.00	0.00	8.90	0.00	0.00
350	0.00	0.00	16.00	0.00	0.00
400	0.00	0.00	27.30	0.00	0.00
450	0.00	0.00	41.00	0.00	0.00
500	0.00	0.00	55.00	0.00	0.00
550	0.00	0.20	70.40	0.00	0.20
600	0.00	1.30	86.60	0.00	1.30
650	0.00	5.50	97.40	0.00	5.50
700	0.00	14.40	99.80	0.00	14.40
800	0.00	42.30	100.00	0.00	42.30
1000	11.94	90.40	100.00	11.94	90.40
1000UP	100.00	100.00	100.00	100.00	100.00

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YP441

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP441	BLACK THUN	08/04/95	8	24.00	824	842	4	4	32	32	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 ON COAL	MAKEUP MO COAL	MAKEUP PPM SN COAL	MAKEUP PPM I COAL	MAKEUP PPM FE2O3 COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	12.58	50	0	0	0.00	1.86	0.00	Y	0.31241	N/A	8.286	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	32.333	6.083	5.110	69.102	4.515	19.790	0.457	1.026	8.107	N/A
BOTTOMS IN	31.008	31.220	29.035	60.590	3.400	4.935	1.110	0.930	0.000	N/A
SOLVENT	28.674	0.000	0.000	88.840	7.960	1.641	0.053	1.019	0.000	N/A
A-100	37.424	31.220	29.035	60.590	3.400	4.935	1.110	0.930	0.000	N/A
A-101	32.401	0.000	0.000	88.840	7.960	1.641	0.053	1.019	0.000	N/A
A-102	10.094	0.000	0.000	83.810	9.830	4.985	0.081	0.955	0.000	N/A
A-103	3.341	0.000	0.000	2.000	10.840	85.887	0.160	1.113	0.000	0.5700

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
1BP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.90	0.00	0.00
300	0.00	0.00	9.10	0.00	0.00
350	0.00	0.00	16.60	0.00	0.00
400	0.00	0.00	28.60	0.00	0.00
450	0.00	0.00	42.60	0.00	0.00
500	0.00	0.00	56.90	0.00	0.00
550	0.00	0.20	72.20	0.00	0.20
600	0.00	2.00	88.20	0.00	2.00
650	0.00	7.30	97.80	0.00	7.30
700	0.00	17.80	99.80	0.00	17.80
800	0.00	47.20	100.00	0.00	47.20
1000	8.29	90.50	100.00	8.29	90.50
1000UP	100.00	100.00	100.00	100.00	100.00

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YP442

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP442	BLACK THUN	08/05/95	8	24.00	825	842	4	4	40	40	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 TREAT ON COAL	MAKEUP MO COAL	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	15.57	50	0	0	0.00	1.86	0.00	Y	0.32941	N/A	9.771	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	31.896	6.083	5.110	69.102	4.515	19.790	0.457	1.026	8.107	N/A
BOTTOMS IN	30.589	30.400	28.000	60.580	3.360	5.920	1.100	1.040	0.000	N/A
SOLVENT	28.287	0.000	0.000	89.350	7.970	1.585	0.054	0.996	0.000	N/A
A-100	36.189	30.400	28.000	60.580	3.360	5.920	1.100	1.040	0.000	N/A
A-101	31.752	0.000	0.000	89.350	7.970	1.585	0.054	0.996	0.000	N/A
A-102	9.814	0.000	0.000	83.620	9.730	5.083	0.086	0.990	0.000	N/A
A-103	3.065	0.000	0.000	1.630	10.760	86.314	0.126	1.170	0.000	0.5800

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	1.00	0.00	0.00
300	0.00	0.00	9.10	0.00	0.00
350	0.00	0.00	16.70	0.00	0.00
400	0.00	0.00	28.90	0.00	0.00
450	0.00	0.00	43.10	0.00	0.00
500	0.00	0.00	57.70	0.00	0.00
550	0.00	0.50	73.50	0.00	0.50
600	0.00	3.50	89.30	0.00	3.50
650	0.00	11.80	98.10	0.00	11.80
700	0.00	26.60	99.80	0.00	26.60
800	0.00	60.80	100.00	0.00	60.80
1000	9.77	95.90	100.00	9.77	95.90
1000UP	100.00	100.00	100.00	100.00	100.00

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YP443

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP443	BLACK THUN	08/07/95	8	24.00	823	842	4	4	38	38	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 COAL	MAKEUP MO COAL	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	15.08	50	0	0	0.00	1.86	0.00	Y	0.38795	N/A	8.229	H		10 H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	32.471	6.288	5.461	69.513	4.516	19.035	0.434	1.041	8.086	N/A
BOTTOMS IN	31.141	30.179	27.765	61.310	3.140	5.585	1.050	1.150	0.000	N/A
SOLVENT	28.797	0.000	0.000	88.630	8.020	1.649	0.056	0.957	0.000	N/A
A-100	37.651	30.179	27.765	61.310	3.140	5.585	1.050	1.150	0.000	N/A
A-101	33.242	0.000	0.000	88.630	8.020	1.649	0.056	0.957	0.000	N/A
A-102	10.312	0.000	0.000	83.860	9.830	4.941	0.055	1.047	0.000	N/A
A-103	2.981	0.000	0.000	2.050	10.710	86.084	0.128	1.028	0.000	0.5400

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.90	0.00	0.00
300	0.00	0.00	8.70	0.00	0.00
350	0.00	0.00	15.60	0.00	0.00
400	0.00	0.00	27.20	0.00	0.00
450	0.00	0.00	41.00	0.00	0.00
500	0.00	0.00	55.50	0.00	0.00
550	0.00	0.40	71.50	0.00	0.40
600	0.00	2.90	88.10	0.00	2.90
650	0.00	10.20	98.00	0.00	10.20
700	0.00	23.80	99.90	0.00	23.80
800	0.00	57.70	100.00	0.00	57.70
1000	8.23	95.70	100.00	8.23	95.70
1000UP	100.00	100.00	100.00	100.00	100.00

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YP444

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP444	BLACK	THUN 08/11/95	8	24.00	825	842	4	4	39	39	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 TREAT ON COAL	MAKEUP MO COAL	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	15.33	50	0	0	0.22	1.95	0.00	Y	0.37439	N/A	10.229	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	32.318	5.999	5.399	69.828	4.563	18.544	0.422	1.244	7.587	N/A
BOTTOMS IN	30.994	30.672	28.218	61.140	3.460	4.912	1.220	1.050	0.000	N/A
SOLVENT	28.661	0.000	0.000	88.800	8.000	1.634	0.057	0.954	0.000	N/A
A-100	37.196	30.672	28.218	61.140	3.460	4.912	1.220	1.050	0.000	N/A
A-101	32.746	0.000	0.000	88.800	8.000	1.634	0.057	0.954	0.000	N/A
A-102	10.454	0.000	0.000	83.710	9.800	5.082	0.053	1.032	0.000	N/A
A-103	2.897	0.000	0.000	1.930	10.900	85.932	0.128	1.110	0.000	0.4800

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.80	0.00	0.00
300	0.00	0.00	8.50	0.00	0.00
350	0.00	0.00	15.60	0.00	0.00
400	0.00	0.00	27.50	0.00	0.00
450	0.00	0.00	42.10	0.00	0.00
500	0.00	0.00	57.60	0.00	0.00
550	0.00	0.40	74.90	0.00	0.40
600	0.00	2.70	90.60	0.00	2.70
650	0.00	9.30	98.20	0.00	9.30
700	0.00	21.70	99.70	0.00	21.70
800	0.00	53.50	100.00	0.00	53.50
1000	10.23	94.40	100.00	10.23	94.40
1000UP	100.00	100.00	100.00	100.00	100.00

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YP445

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP445	BLACK THUN	08/12/95	8	24.00	826	842	4	4	39	39	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 ON COAL	MAKEUP MO COAL	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	15.16	50	0	0	0.22	1.95	0.00	Y	0.36691	N/A	9.771	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	32.603	5.999	5.399	69.828	4.563	18.544	0.422	1.244	7.587	N/A
BOTTOMS IN	31.267	30.305	27.881	61.440	3.500	4.919	1.220	1.040	0.000	N/A
SOLVENT	28.913	0.000	0.000	89.180	8.020	1.624	0.057	1.009	0.000	N/A
A-100	37.601	30.305	27.881	61.440	3.500	4.919	1.220	1.040	0.000	N/A
A-101	32.597	0.000	0.000	89.180	8.020	1.624	0.057	1.009	0.000	N/A
A-102	10.245	0.000	0.000	83.580	9.710	5.198	0.053	1.017	0.000	N/A
A-103	3.004	0.000	0.000	1.910	10.840	85.977	0.133	1.140	0.000	0.4800

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.80	0.00	0.00
300	0.00	0.00	8.60	0.00	0.00
350	0.00	0.00	15.80	0.00	0.00
400	0.00	0.00	27.70	0.00	0.00
450	0.00	0.00	41.90	0.00	0.00
500	0.00	0.00	56.60	0.00	0.00
550	0.00	0.30	72.30	0.00	0.30
600	0.00	2.60	88.40	0.00	2.60
650	0.00	9.20	97.60	0.00	9.20
700	0.00	21.50	99.60	0.00	21.50
800	0.00	53.50	100.00	0.00	53.50
1000	9.77	94.70	100.00	9.77	94.70
1000UP	100.00	100.00	100.00	100.00	100.00

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YP446

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP446	BLACK THUN	08/13/95	8	24.00	828	842	4	4	41	41	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 COAL	MAKEUP MO PPM	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	15.97	50	0	0	0	0.23	1.95	0.00	Y	0.30035	N/A	8.514	H	10	H2S/H2 - MCL

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	31.806	6.058	5.482	69.711	4.534	18.589	0.455	1.229	7.981	N/A
BOTTOMS IN	30.503	30.665	27.598	60.770	3.330	6.062	1.250	0.990	0.000	N/A
SOLVENT	28.206	0.000	0.000	89.340	8.070	1.651	0.056	1.077	0.000	N/A
A-100	36.629	30.665	27.598	60.770	3.330	6.062	1.250	0.990	0.000	N/A
A-101	31.458	0.000	0.000	89.340	8.070	1.651	0.056	1.077	0.000	N/A
A-102	9.924	0.000	0.000	83.300	9.780	5.136	0.049	0.955	0.000	N/A
A-103	3.114	0.000	0.000	1.940	11.030	85.924	0.106	1.000	0.000	0.5100

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.50	0.00	0.00
300	0.00	0.00	7.30	0.00	0.00
350	0.00	0.00	13.90	0.00	0.00
400	0.00	0.00	24.70	0.00	0.00
450	0.00	0.00	37.60	0.00	0.00
500	0.00	0.00	52.20	0.00	0.00
550	0.00	0.10	70.20	0.00	0.10
600	0.00	1.50	87.40	0.00	1.50
650	0.00	6.80	97.60	0.00	6.80
700	0.00	17.50	99.80	0.00	17.50
800	0.00	48.20	100.00	0.00	48.20
1000	8.51	92.50	100.00	8.51	92.50
1000UP	100.00	100.00	100.00	100.00	100.00

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VP447

VP NO	COAL	VP DATE	BEGIN HOUR	LENGTH STAGE	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
VP447	BLACK THUN	08/17/95	8	24.00	823	842	4	4	36	36	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL TREAT ON COAL	H2 TREAT ON COAL	MAKEUP MO COAL	MAKEUP PPM SN COAL	MAKEUP PPM I COAL	MAKEUP PPM FE2O3 COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	9.57	50	0	0	0.00	1.86	0.00	Y	0.29931	N/A	10.914	H	10	H2S/H2 - MCL		

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	34.812	6.103	5.554	69.351	4.418	19.141	0.427	1.109	8.001	N/A
BOTTOMS IN	33.386	28.504	26.509	63.020	3.480	4.821	1.080	1.090	0.000	N/A
SOLVENT	30.873	0.000	0.000	89.580	7.980	1.683	0.065	1.026	0.000	N/A
A-100	42.189	28.504	26.509	63.020	3.480	4.821	1.080	1.090	0.000	N/A
A-101	33.335	0.000	0.000	89.580	7.980	1.683	0.065	1.026	0.000	N/A
A-102	9.837	0.000	0.000	84.020	9.890	5.216	0.058	0.989	0.000	N/A
A-103	2.940	0.000	0.000	2.030	11.050	85.627	0.093	1.200	0.000	0.5100

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.40	0.00	0.00
300	0.00	0.00	7.00	0.00	0.00
350	0.00	0.00	13.60	0.00	0.00
400	0.00	0.00	24.60	0.00	0.00
450	0.00	0.00	37.90	0.00	0.00
500	0.00	0.00	52.90	0.00	0.00
550	0.00	0.10	71.50	0.00	0.10
600	0.00	1.70	88.90	0.00	1.70
650	0.00	6.80	98.00	0.00	6.80
700	0.00	16.70	99.80	0.00	16.70
800	0.00	46.10	100.00	0.00	46.10
1000	10.91	92.10	100.00	10.91	92.10
1000UP	100.00	100.00	100.00	100.00	100.00

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VP448

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP448	BLACK THUN	08/18/95	8	24.00	827	842	4	4	39	39	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 COAL	MAKEUP MO PPM	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	10.39	50	0	0	0.00	1.86	0.00	Y	0.28614	N/A	8.171	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	32.065	6.098	5.549	69.303	4.401	19.247	0.413	1.087	7.913	N/A
BOTTOMS IN	30.752	28.490	26.496	63.140	3.440	4.634	1.060	1.230	0.000	N/A
SOLVENT	28.437	0.000	0.000	89.440	7.880	1.630	0.068	1.039	0.000	N/A
A-100	39.548	28.490	26.496	63.140	3.440	4.634	1.060	1.230	0.000	N/A
A-101	31.164	0.000	0.000	89.440	7.880	1.630	0.068	1.039	0.000	N/A
A-102	10.247	0.000	0.000	83.780	9.840	4.966	0.056	0.990	0.000	N/A
A-103	2.840	0.000	0.000	4.960	11.380	82.454	0.086	1.120	0.000	0.5200

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.50	0.00	0.00
300	0.00	0.00	7.10	0.00	0.00
350	0.00	0.00	13.50	0.00	0.00
400	0.00	0.00	24.20	0.00	0.00
450	0.00	0.00	37.40	0.00	0.00
500	0.00	0.00	51.80	0.00	0.00
550	0.00	0.10	70.30	0.00	0.10
600	0.00	1.20	88.20	0.00	1.20
650	0.00	5.60	97.90	0.00	5.60
700	0.00	14.90	99.80	0.00	14.90
800	0.00	44.50	100.00	0.00	44.50
1000	8.17	91.30	100.00	8.17	91.30
1000UP	100.00	100.00	100.00	100.00	100.00

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VP449

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP449	BLACK THUN	08/19/95	8	24.00	826	842	4	4	38	38	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 ON COAL	MAKEUP MO COAL	MAKEUP PPM SN	MAKEUP PPM I	MAKEUP PPM FE2O3	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	9.98	50	0	0	0.00	1.86	0.00	Y	0.56615	N/A	9.543	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	33.756	6.098	5.549	69.300	4.399	19.253	0.413	1.086	7.907	N/A
BOTTOMS IN	32.373	27.654	25.442	63.760	3.570	5.128	1.030	1.070	0.000	N/A
SOLVENT	29.937	0.000	0.000	89.110	7.990	1.663	0.071	1.040	0.000	N/A
A-100	40.959	27.654	25.442	63.760	3.570	5.128	1.030	1.070	0.000	N/A
A-101	32.205	0.000	0.000	89.110	7.990	1.663	0.071	1.040	0.000	N/A
A-102	9.384	0.000	0.000	83.720	9.890	5.027	0.058	0.979	0.000	N/A
A-103	2.941	0.000	0.000	1.980	11.050	85.743	0.107	1.120	0.000	0.5100

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.50	0.00	0.00
300	0.00	0.00	7.40	0.00	0.00
350	0.00	0.00	13.80	0.00	0.00
400	0.00	0.00	24.70	0.00	0.00
450	0.00	0.00	38.10	0.00	0.00
500	0.00	0.00	53.00	0.00	0.00
550	0.00	0.10	71.60	0.00	0.10
600	0.00	1.30	89.30	0.00	1.30
650	0.00	6.00	98.10	0.00	6.00
700	0.00	15.80	99.80	0.00	15.80
800	0.00	46.80	100.00	0.00	46.80
1000	9.54	91.70	100.00	9.54	91.70
1000UP	100.00	100.00	100.00	100.00	100.00

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YP451

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP451	BLACK THUN	08/25/95	14	24.00	827	842	4	4	33	33	2500	2500	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 TREAT ON COAL	MAKEUP MO COAL	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	10.74	750	0	0	0.00	1.83	0.00	Y	0.37680	N/A	11.200	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	38.469	6.038	5.434	69.423	4.544	19.121	0.402	1.076	8.013	N/A
BOTTOMS IN	36.893	28.096	25.567	63.140	3.710	5.753	1.080	0.936	0.000	N/A
SOLVENT	34.116	0.000	0.000	89.080	8.080	1.689	0.054	1.000	0.000	N/A
A-100	44.393	28.096	25.567	63.140	3.710	5.753	1.080	0.936	0.000	N/A
A-101	38.194	0.000	0.000	89.080	8.080	1.689	0.054	1.000	0.000	N/A
A-102	12.716	0.000	0.000	83.770	9.910	4.754	0.047	1.011	0.000	N/A
A-103	3.831	0.000	0.000	1.830	11.050	86.267	0.188	0.665	0.000	0.5800

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.40	0.00	0.00
300	0.00	0.00	7.20	0.00	0.00
350	0.00	0.00	13.50	0.00	0.00
400	0.00	0.00	23.70	0.00	0.00
450	0.00	0.00	35.80	0.00	0.00
500	0.00	0.00	49.10	0.00	0.00
550	0.00	0.00	66.30	0.00	0.00
600	0.00	0.70	83.50	0.00	0.70
650	0.00	4.10	96.00	0.00	4.10
700	0.00	12.70	99.60	0.00	12.70
800	0.00	42.30	100.00	0.00	42.30
1000	11.20	91.20	100.00	11.20	91.20
1000UP	100.00	100.00	100.00	100.00	100.00

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YP452

YP NO	COAL	YP DATE	BEGIN HOUR	VP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL
YP452	BLACK THUN	08/26/95	14	24.00	826	842	4	4	33	33	2499	2499	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 COAL	MAKEUP MO PPM	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	10.84	750	0	0	0.00	1.83	0.00	Y	0.35562	N/A	11.771	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	38.241	5.936	5.377	69.783	4.518	18.863	0.407	1.052	7.576	N/A
BOTTOMS IN	36.675	28.350	26.082	63.220	3.700	5.118	1.070	1.030	0.000	N/A
SOLVENT	33.914	0.000	0.000	88.260	8.200	1.694	0.052	1.004	0.000	N/A
A-100	44.029	28.350	26.082	63.220	3.700	5.118	1.070	1.030	0.000	N/A
A-101	37.905	0.000	0.000	88.260	8.200	1.694	0.052	1.004	0.000	N/A
A-102	12.311	0.000	0.000	84.200	10.000	4.692	0.046	1.002	0.000	N/A
A-103	3.802	0.000	0.000	1.840	11.040	85.565	0.195	1.360	0.000	0.6100

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.40	0.00	0.00
300	0.00	0.00	6.80	0.00	0.00
350	0.00	0.00	12.90	0.00	0.00
400	0.00	0.00	23.00	0.00	0.00
450	0.00	0.00	35.70	0.00	0.00
500	0.00	0.00	48.70	0.00	0.00
550	0.00	0.00	65.20	0.00	0.00
600	0.00	0.80	83.40	0.00	0.80
650	0.00	3.90	96.10	0.00	3.90
700	0.00	11.60	99.50	0.00	11.60
800	0.00	39.80	100.00	0.00	39.80
1000	11.77	91.40	100.00	11.77	91.40
1000UP	100.00	100.00	100.00	100.00	100.00

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YP453

YP NO	COAL	YP DATE	BEGIN HOUR	YP LENGTH HOURS	1ST STAGE TEMP F	2ND STAGE TEMP F	# TUBES 1ST STAGE	# TUBES 2ND STAGE	1ST NRT MIN	2ND NRT MIN	PRESS 1ST PSIG	PRESS 2ND PSIG	HEAP SAND BATH	MCL SAND BATH	S/C/B WT. RATIO	HEAP CO TREAT ON COAL	H2S TREAT ON COAL	
YP453	BLACK	THUN	08/27/95	14	24.00	826	842	4	4	32	32	2499	2499	C	D	1/1/1	0.00	0.00

HEAP TREAT ON COAL	H2 TREAT ON COAL	MCL H2 TREAT ON COAL	MAKEUP MO COAL	MAKEUP SN PPM	MAKEUP I PPM	MAKEUP FE2O3 WT COAL	SULFUR ADDED WT COAL	WATER ADDED WT COAL	IN EQ OUT ?	FRAC. COAL H2O RETAINED	1000F+ IN A100 BY MLD	1000F+ IN A100 BY HV	USE MLD OR HV	OP MODE	DESCRIPTION
0.00	10.56	750	0	0	0.00	1.83	0.00	Y	0.40219	N/A	12.114	H	10	H2S/H2 - MCL	

NAME	WT KG	ASH (WT%)	XS03 ASH	C (WT%)	H (WT%)	O (WT%)	S (WT%)	N (WT%)	MOISTURE	CO2 (WT%)
COAL	39.258	5.873	5.341	70.008	4.503	18.701	0.410	1.037	7.305	N/A
BOTTOMS IN	37.650	28.336	26.069	62.980	3.690	5.386	1.090	1.020	0.000	N/A
SOLVENT	34.816	0.000	0.000	89.220	8.070	1.721	0.049	0.968	0.000	N/A
A-100	45.087	28.336	26.069	62.980	3.690	5.386	1.090	1.020	0.000	N/A
A-101	38.202	0.000	0.000	89.220	8.070	1.721	0.049	0.968	0.000	N/A
A-102	12.637	0.000	0.000	84.140	9.880	4.772	0.043	1.009	0.000	N/A
A-103	3.766	0.000	0.000	1.800	11.150	85.536	0.194	1.320	0.000	0.6300

% OFF AT DEGF	A-100 FIRST CUM WT%	A-101 FIRST CUM WT%	A-102 FIRST CUM WT%	BOTTOMS IN FIRST CUM WT%	SOLVENT FIRST CUM WT%
IBP	0.00	0.00	0.00	0.00	0.00
150	0.00	0.00	0.40	0.00	0.00
300	0.00	0.00	7.40	0.00	0.00
350	0.00	0.00	13.90	0.00	0.00
400	0.00	0.00	24.30	0.00	0.00
450	0.00	0.00	36.50	0.00	0.00
500	0.00	0.00	49.90	0.00	0.00
550	0.00	0.00	66.90	0.00	0.00
600	0.00	0.80	84.00	0.00	0.80
650	0.00	4.10	96.30	0.00	4.10
700	0.00	12.30	99.70	0.00	12.30
800	0.00	40.30	100.00	0.00	40.30
1000	12.11	88.10	100.00	12.11	88.10
1000UP	100.00	100.00	100.00	100.00	100.00

Appendix H

Example of Data Reconciliation Results for YP446

RECONCILIATION RESULTS FOR RUN YP446

CONSTRAINT EQUATION	INITIAL	1	2	3	4	ITERATION 5	6	7	8	9
1	1.9E-02	-2.2E-03	8.7E-06	-6.5E-10	-1.2E-14	3.9E-16	5.3E-16	2.2E-15	-1.1E-16	-1.6E-15
2	-1.4E-02	1.1E-04	-5.4E-07	1.1E-09	-5.2E-14	-3.6E-17	-1.4E-16	-1.1E-16	-3.6E-17	-3.1E-35
3	9.3E-02	2.5E-03	-9.8E-06	5.7E-10	1.7E-14	1.4E-16	1.5E-16	3.4E-16	1.4E-16	8.0E-17
4	9.2E-02	8.8E-04	-7.4E-06	-1.4E-08	6.8E-13	-1.1E-14	-3.6E-14	-1.1E-14	-3.5E-14	-2.3E-14
5	1.7E-02	4.1E-04	-1.1E-06	2.4E-10	3.0E-15	2.2E-18	-1.1E-17	6.0E-17	-1.3E-17	1.1E-17
6	-5.9E-04	-4.8E-04	1.3E-06	-3.1E-10	-1.8E-16	-7.1E-17	0.0E+00	2.8E-16	0.0E+00	5.0E-16
7	2.7E+00	2.5E-02	-2.2E-04	-4.1E-07	2.1E-11	1.6E-14	-6.5E-13	4.6E-14	-5.4E-13	-1.3E-13
8	8.0E-17	-5.2E-13	-8.2E-14	3.4E-15	2.7E-17	5.3E-17	1.8E-17	1.6E-17	3.8E-17	3.6E-17
9	7.4E-17	8.1E-13	-8.1E-15	9.0E-15	3.8E-17	3.8E-17	3.8E-17	3.8E-17	3.8E-17	7.7E-17
10	1.1E-16	-2.1E-15	9.6E-18	2.4E-17	8.3E-18	3.3E-17	3.0E-17	2.5E-17	3.4E-17	3.4E-17
11	1.0E-08	5.0E-18	4.1E-24	1.7E-24	4.1E-24	1.7E-24	4.1E-24	1.7E-24	4.1E-24	1.7E-24
12	1.0E-08	5.0E-18	4.1E-24	1.7E-24	4.1E-24	1.7E-24	4.1E-24	1.7E-24	4.1E-24	1.7E-24
13	7.1E-17	7.6E-13	5.3E-14	8.3E-15	3.6E-17	3.6E-17	0.0E+00	7.1E-17	3.6E-17	7.1E-17
14	1.2E-16	2.1E-15	1.9E-17	2.2E-17	8.4E-18	3.6E-17	3.2E-17	2.7E-17	3.3E-17	3.0E-17
15	1.1E-16	2.8E-16	1.1E-17	1.3E-17	1.3E-17	1.9E-17	4.6E-18	2.3E-17	3.6E-17	2.3E-17
16	2.2E-17	4.6E-12	5.3E-15	3.2E-18	-5.8E-18	-3.9E-18	6.0E-18	3.2E-17	2.3E-17	8.0E-18
17	1.0E-08	5.0E-18	8.3E-25	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24
18	1.0E-08	5.0E-18	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24
19	-2.0E-10	8.6E-14	4.8E-13	-2.4E-15	-5.8E-17	2.8E-16	-2.8E-16	-6.3E-17	-2.4E-16	-1.4E-16
20	1.0E-08	7.5E-18	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24	1.7E-24
21	9.0E-02	8.5E-04	-7.3E-06	-1.4E-08	6.9E-13	5.5E-16	-2.2E-14	1.5E-15	-1.8E-14	-4.5E-15
22	-1.9E-03	3.2E-06	-3.6E-12	-9.0E-16	-2.8E-17	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
23	-5.6E-01	-3.1E-01	-1.6E-01	2.7E-02	1.3E-01	5.1E-02	3.1E-03	-6.3E-04	1.6E-05	6.1E-08
24	1.0E-08	5.0E-18	2.5E-24	2.5E-24	2.5E-24	2.5E-24	2.5E-24	2.5E-24	2.5E-24	2.5E-24
25	0.0E+00	-3.6E-17	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
26	0.0E+00	4.0E-16	-2.2E-18	-2.2E-18	0.0E+00	0.0E+00	0.0E+00	0.0E+00	-2.2E-18	-2.2E-18
27	0.0E+00	3.0E-15	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E-18	0.0E+00	0.0E+00
28	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.7E-21
29	0.0E+00	-1.8E-16	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
30	0.0E+00	1.3E-16	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
31	0.0E+00	1.6E-15	0.0E+00	2.8E-19	8.3E-19	4.2E-19	0.0E+00	1.4E-19	4.2E-19	6.9E-19
32	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
33	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

NAME	DESCRIPTION	MEASURED	RECONCILED	RELIABILITY	%CHANGE	CONTRIBUTION
R(1)	SLURRY FEED RATE (KG/HR)	3.802	3.669	8.000	3.490	0.761
R(2)	COAL H2O/DRY COAL RATIO (WT/WT)	0.087	0.006	100.000	93.093	3.467
R(3)	C IN DRY COAL (WT%)	69.711	69.802	0.930	0.131	0.079
R(4)	H IN DRY COAL (WT%)	4.534	4.551	4.300	0.375	0.030
R(5)	O (EX. ASH O) IN DRY COAL (WT%)	18.589	18.571	19.400	0.096	0.000
R(6)	N IN DRY COAL (WT%)	1.229	1.105	13.400	10.124	2.283
R(7)	S IN DRY COAL (WT%)	0.455	0.451	10.600	0.782	0.022
R(8)	SO3 FREE ASH IN DRY COAL (WT%)	5.482	5.520	5.700	0.689	0.058
R(9)	BOTTOMS/DRY COAL RATIO (WT/WT)	1.042	1.077	10.000	3.350	0.449
R(10)	C IN BOTTOMS FEED (WT%)	60.770	60.766	0.600	0.006	0.000
R(11)	H IN BOTTOMS FEED (WT%)	3.330	3.329	3.800	0.024	0.000
R(12)	O (EX. ASH O) IN BOTTOMSD (WT%)	6.062	6.061	7.600	0.013	0.000
R(13)	N IN BOTTOMS FEED (WT%)	0.990	0.996	11.400	0.612	0.012
R(14)	S IN BOTTOMS FEED (WT%)	1.250	1.250	3.800	0.028	0.000
R(15)	SO3 FREE ASH IN BOTTOMS (WT%)	27.598	27.597	0.630	0.005	0.000
R(16)	SOLVENT/DRY COAL RATIO (WT/WT)	0.964	0.984	10.000	2.143	0.184
R(17)	C IN SOLVENT FEED (WT%)	89.167	89.159	0.710	0.009	0.001
R(18)	H IN SOLVENT FEED (WT%)	8.054	8.053	2.650	0.019	0.000
R(19)	O (EX. ASH O) IN SOLVENT (WT%)	1.648	1.647	16.000	0.029	0.000
R(20)	N IN SOLVENT FEED (WT%)	1.075	1.085	18.000	0.935	0.011
R(21)	S IN SOLVENT FEED (WT%)	0.056	0.056	7.200	0.002	0.000
R(22)	MAKEUP SOLVENT/DRY COAL (WT/WT)	0.000	0.000	10.000	0.000	0.000
R(23)	C IN MAKEUP SOLVENT (WT%)	0.000	0.000	0.710	0.000	0.000
R(24)	H IN MAKEUP SOLVENT (WT%)	0.000	0.000	2.650	0.000	0.000
R(25)	O (EX. ASH O) IN MAKEUP (WT%)	0.000	0.000	16.000	0.000	0.000
R(26)	N IN MAKEUP SOLVENT (WT%)	0.000	0.000	18.000	0.000	0.000
R(27)	S IN MAKEUP SOLVENT (WT%)	0.000	0.000	7.200	0.000	0.000
R(28)	PURGE SOLVENT/DRY COAL (WT/WT)	0.000	0.000	10.000	0.000	0.000
R(29)	C IN PURGE SOLVENT (WT%)	0.000	0.000	0.710	0.000	0.000
R(30)	H IN PURGE SOLVENT (WT%)	0.000	0.000	2.650	0.000	0.000
R(31)	O (EX. ASH O) IN PURGE (WT%)	0.000	0.000	16.000	0.000	0.000
R(32)	N IN PURGE SOLVENT (WT%)	0.000	0.000	18.000	0.000	0.000
R(33)	S IN PURGE SOLVENT (WT%)	0.000	0.000	7.200	0.000	0.000
R(34)	H2 INFLOW RATE (SCFH)	230.261	234.985	4.000	2.051	1.052
R(35)	N2 INFLOW RATE (SCFH)	22.329	20.177	40.000	9.639	0.232
R(36)	CO INFLOW RATE (SCFH)	0.000	0.000	4.000	0.000	0.000
R(37)	A-100 PRODUCTION RATE (KG/HR)	1.526	1.526	1.000	0.019	0.002
R(38)	C IN A-100 (WT%)	60.770	60.766	0.600	0.006	0.000
R(39)	H IN A-100 (WT%)	3.330	3.329	3.800	0.024	0.000
R(40)	O (EX. ASH O) IN A-100 (WT%)	6.062	6.061	7.600	0.013	0.000
R(41)	N IN A-100 (WT%)	0.990	0.996	11.400	0.612	0.012
R(42)	S IN A-100 (WT%)	1.250	1.250	3.800	0.028	0.000
R(43)	SO3 FREE ASH IN A-100 (WT%)	27.598	27.597	0.630	0.005	0.000
R(44)	A-101 PRODUCTION RATE (KG/HR)	1.311	1.310	2.000	0.023	0.001
R(45)	C IN A-101 (WT%)	89.167	89.159	0.710	0.009	0.001
R(46)	H IN A-101 (WT%)	8.054	8.053	2.650	0.019	0.000
R(47)	O IN A-101 (WT%)	1.648	1.647	16.000	0.029	0.000
R(48)	N IN A-101 (WT%)	1.075	1.085	18.000	0.935	0.011
R(49)	S IN A-101 (WT%)	0.056	0.056	7.200	0.002	0.000
R(50)	A-102 PRODUCTION RATE (KG/HR)	0.416	0.416	4.000	0.038	0.000
R(51)	C IN A-102 (WT%)	83.955	83.939	0.770	0.019	0.002
R(52)	H IN A-102 (WT%)	9.857	9.847	2.900	0.099	0.005
R(53)	O IN A-102 (WT%)	5.176	5.183	8.200	0.133	0.001
R(54)	N IN A-102 (WT%)	0.963	0.981	11.100	1.953	0.124
R(55)	S IN A-102 (WT%)	0.049	0.049	4.100	0.005	0.000
R(56)	A-103 PRODUCTION RATE (KG/HR)	0.127	0.127	4.000	0.293	0.021

OBJECTIVE FUNCTION = 8.8217

NAME	DESCRIPTION	MEASURED	RECONCILED	RELIABILITY	%CHANGE	CONTRIBUTION
R(57)	C IN A-103 (WT%)	0.142	0.142	11.000	0.109	0.000
R(58)	H IN A-103 (WT%)	11.056	11.205	2.100	1.353	1.660
R(59)	O IN A-103 (WT%)	87.694	87.550	0.470	0.164	0.489
R(60)	N IN A-103 (WT%)	1.001	0.996	9.000	0.526	0.014
R(61)	S IN A-103 (WT%)	0.107	0.107	26.000	0.347	0.001
R(62)	MCL GAS EXIT RATE (SCFH)	242.932	237.239	6.000	2.344	0.610
R(63)	CO IN MCL GAS (MOLE%)	0.457	0.466	24.700	1.852	0.022
R(64)	CO2 IN MCL GAS (MOLE%)	0.320	0.324	17.100	1.245	0.021
R(65)	H2 IN MCL GAS (MOLE%)	88.187	87.562	8.200	0.708	0.030
R(66)	H2S IN MCL GAS (MOLE%)	0.117	0.296	100.000	152.810	9.340
R(67)	N2 IN MCL GAS (MOLE%)	8.088	8.505	18.600	5.153	0.307
R(68)	O2 IN MCL GAS (MOLE%)	0.000	0.000	25.800	0.000	0.000
R(69)	C1 IN MCL GAS (MOLE%)	0.970	0.970	4.400	0.050	0.001
R(70)	C2 IN MCL GAS (MOLE%)	0.445	0.445	4.000	0.037	0.000
R(71)	C2-IN MCL GAS (MOLE%)	0.014	0.014	3.800	0.001	0.000
R(72)	C3 IN MCL GAS (MOLE%)	0.325	0.325	4.200	0.045	0.000
R(73)	C3- IN MCL GAS (MOLE%)	0.026	0.026	5.000	0.004	0.000
R(74)	B1 IN MCL GAS (MOLE%)	0.005	0.005	9.100	0.004	0.000
R(75)	1,3BD IN MCL GAS (MOLE%)	0.000	0.000	14.200	0.000	0.000
R(76)	IC4 IN MCL GAS (MOLE%)	0.024	0.024	9.500	0.022	0.000
R(77)	NC4 IN MCL GAS (MOLE%)	0.133	0.132	15.900	0.349	0.002
R(78)	IC4- IN MCL GAS (MOLE%)	0.002	0.002	11.100	0.002	0.000
R(79)	T-B2 IN MCL GAS (MOLE%)	0.005	0.005	11.100	0.005	0.000
R(80)	C-B2 IN MCL GAS (MOLE%)	0.004	0.004	16.300	0.009	0.000
R(81)	C5 IN MCL GAS (MOLE%)	0.086	0.085	16.800	0.313	0.001
R(82)	C6 IN MCL GAS (MOLE%)	0.073	0.073	11.600	0.152	0.001
R(83)	C7 IN MCL GAS (MOLE%)	0.026	0.026	10.100	0.047	0.000
R(84)	C8+ IN MCL GAS (MOLE%)	0.055	0.054	30.500	1.058	0.005
R(85)	H2O IN MCL GAS (MOLE%)	0.561	0.565	12.600	0.585	0.009
R(86)	NH3 IN MCL GAS (MOLE%)	0.079	0.094	39.500	19.496	0.974
R(87)	A-201 PRODUCTION RATE (KG/HR)	0.000	0.000	4.000	0.000	0.000
R(88)	C IN A-201 (WT%)	0.000	0.000	11.000	0.000	0.000
R(89)	H IN A-201 (WT%)	0.000	0.000	2.100	0.000	0.000
R(90)	O IN A-201 (WT%)	0.000	0.000	0.470	0.000	0.000
R(91)	N IN A-201 (WT%)	0.000	0.000	9.000	0.000	0.000
R(92)	S IN A-201 (WT%)	0.000	0.000	26.000	0.000	0.000
R(93)	A-202 PRODUCTION RATE (KG/HR)	0.000	0.000	4.000	0.000	0.000
R(94)	C IN A-202 (WT%)	0.000	0.000	0.770	0.000	0.000
R(95)	H IN A-202 (WT%)	0.000	0.000	2.900	0.000	0.000
R(96)	O IN A-202 (WT%)	0.000	0.000	8.200	0.000	0.000
R(97)	N IN A-202 (WT%)	0.000	0.000	11.100	0.000	0.000
R(98)	S IN A-202 (WT%)	0.000	0.000	4.100	0.000	0.000
R(99)	SULFUR/DRY COAL RATIO (WT/WT)	0.022	0.022	1.000	0.035	0.005
R(100)	WATER ADDITION RATE (KG/HR)	0.000	0.000	10.000	0.000	0.000
R(101)	HEAP GAS EXIT RATE (SCFH)	0.000	0.000	6.000	0.000	0.000
R(102)	CO IN HEAP GAS (MOLE%)	0.000	0.000	4.000	0.000	0.000
R(103)	CO2 IN HEAP GAS (MOLE%)	0.000	0.000	4.000	0.000	0.000
R(104)	H2 IN HEAP GAS (MOLE%)	0.000	0.000	8.200	0.000	0.000
R(105)	H2S IN HEAP GAS (MOLE%)	0.000	0.000	100.000	0.000	0.000
R(106)	N2 IN HEAP GAS (MOLE%)	0.000	0.000	18.600	0.000	0.000
R(107)	O2 IN HEAP GAS (MOLE%)	0.000	0.000	25.800	0.000	0.000
R(108)	C1 IN HEAP GAS (MOLE%)	0.000	0.000	4.400	0.000	0.000
R(109)	C2 IN HEAP GAS (MOLE%)	0.000	0.000	4.000	0.000	0.000
R(110)	C2-IN HEAP GAS (MOLE%)	0.000	0.000	3.800	0.000	0.000
R(111)	C3 IN HEAP GAS (MOLE%)	0.000	0.000	4.200	0.000	0.000
R(112)	C3- IN HEAP GAS (MOLE%)	0.000	0.000	5.000	0.000	0.000

OBJECTIVE FUNCTION = 22.3146

NAME	DESCRIPTION	MEASURED	RECONCILED	RELIABILITY	%CHANGE	CONTRIBUTION
R(113)	B1 IN HEAP GAS (MOLE%)	0.000	0.000	9.100	0.000	0.000
R(114)	1,3BD IN HEAP GAS (MOLE%)	0.000	0.000	14.200	0.000	0.000
R(115)	IC4 IN HEAP GAS (MOLE%)	0.000	0.000	9.500	0.000	0.000
R(116)	NC4 IN HEAP GAS (MOLE%)	0.000	0.000	15.900	0.000	0.000
R(117)	IC4- IN HEAP GAS (MOLE%)	0.000	0.000	11.100	0.000	0.000
R(118)	T-B2 IN HEAP GAS (MOLE%)	0.000	0.000	11.100	0.000	0.000
R(119)	C-B2 IN HEAP GAS (MOLE%)	0.000	0.000	16.300	0.000	0.000
R(120)	C5 IN HEAP GAS (MOLE%)	0.000	0.000	16.800	0.000	0.000
R(121)	C6 IN HEAP GAS (MOLE%)	0.000	0.000	11.600	0.000	0.000
R(122)	C7 IN HEAP GAS (MOLE%)	0.000	0.000	10.100	0.000	0.000
R(123)	C8+ IN HEAP GAS (MOLE%)	0.000	0.000	30.500	0.000	0.000
R(124)	H2O IN HEAP GAS (MOLE%)	0.000	0.000	162.400	0.000	0.000
R(125)	NH3 IN HEAP GAS (MOLE%)	0.000	0.000	39.500	0.000	0.000
R(126)	IGS LIQ FEED RATE (KG/HR)	0.000	0.000	2.000	0.000	0.000
R(127)	C IN IGS LIQ (WT%)	0.000	0.000	0.770	0.000	0.000
R(128)	H IN IGS LIQ (WT%)	0.000	0.000	2.900	0.000	0.000
R(129)	O IN IGS LIQ (WT%)	0.000	0.000	8.200	0.000	0.000
R(130)	N IN IGS LIQ (WT%)	0.000	0.000	11.100	0.000	0.000
R(131)	S IN IGS LIQ (WT%)	0.000	0.000	4.100	0.000	0.000
R(132)	FE2O3/DRY COAL RATIO (WT/WT)	0.002	0.002	1.000	0.001	0.000
OBJECTIVE FUNCTION = 22.3146						