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EXPANDED BED HYDROPROCESSING OF SOLVENT REFINED COAL (SRC) EXTRACT

Interim
Technical Progress Report
on
Total Reactor Pressure and Space Velocity Parameters
and
Short Contact Time Coal Extract Feedstocks (Deashed & Non-deashed)

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ABSTRACT

The feasibility of utilizing an expanded bed reactor (LC-Fining Process) for upgrading coal extracts has been expanded to include not only SRC-I feedstock, but also non-deashed/deashed short contact time (SCT) coal extract feedstocks. Another objective of this work was to extend the range of operating variables in the LC-Finer to include operation at higher space velocity and higher total reactor pressure.

A given 850°F+ conversion could be attained at various combinations of the operating variables. It was then shown that this 850°F+ conversion became a correlating parameter for gas and liquid product distribution. The expanded range of the operating variables correlated well with data which was previously accumulated at a constant set of operating conditions.

Non-deashed SCT PDU runs in the LC-Finer show a different product distribution than PDU runs made with SRC-I. However, deashed SCT showed a similar product distribuiton at milder operating conditions. SCT PDU runs in the LC-Finer exhibit a higher level of denitrogenation in the total liquid product.

TABLE OF CONTENTS

APPENDIX FIGURES

The following Figures describe the data interpretation for the runs presented in this report.

APPENDIX TABLES

The following tables describe the data for the runs presented in this report and may be summarized as follows:

Tables I - VI	Feed Properties
Tables VII - LII	Liquid Product Yields (by period)
Tables LIII - LVIII	Yield Data as a Percentage of Feed

The specific table descriptions are as follows:

INTERIM
TECHNICAL PROGRESS REPORT
ON
TOTAL REACTOR PRESSURE AND SPACE VELOCITY PARAMETERS
AND
SHORT CONTACT TIME COAL EXTRACT FEEDSTOCKS (DEASHED & NON-DEASHED)

Introduction

Several years ago discussions were initiated between Cities Service Company and the Energy Research and Development Administration (ERDA), now a part of the Department of Energy (DOE), which resulted in a government sponsored development contract. The original contract with ERDA involved process development unit (PDU) operation to determine the feasibility of operating an LC-Fining expanded bed hydroprocessing unit (LCF) to process solvent refined coal (SRC-I), and also to determine the optimum operating conditions for conversion and desulfurization. C-E Lummus, with laboratory process development units for LC-Fining located in New Brunswick, New Jersey, was chosen as the subcontractor for this project with Cities Service being the prime contractor. The choice of subcontractor was especially judicious as C-E Lummus is the exclusive worldwide licensor of the proprietary LC-Fining process and has an excellent perspective of the operating parameters.

The success of the original contract in determining the feasibility of utilizing an LC-Finer for upgrading SRC-I stimulated further interest in this method of operation by DOE. A greater emphasis was placed on nitrogen removal since good conversion and desulfurization had been adequately demonstrated. Consequently, a contract extension was granted.

Special effort was placed on the use of commercially available catalysts. It should be emphasized that the success achieved in this contract was obtained by use of a commercial petroleum refining process (LC-Fining) and commercial off-the-shelf-catalysts.

The PDU work on the original and extended DOE contracts for upgrading coal extracts has been completed. The LC-Fining PDU program is now being continued under a new contract, again sponsored by DOE, but with C-E Lummus as

the prime contractor. The ultimate objective of this work is to optimize the Two-Stage Liquefaction (TSL) concept for coal conversion. The catalytic expanded bed hydroprocessing portion of the new contract is being managed by Cities Service. This program will study a wider range of process conditions and help to identify catalyst and process improvements.

Conclusions Derived from Prior Studies

Three DOE Interim Technical Progress Reports (FE-2038-17[1], FE-2038-25[2], and FE-2038-34[3]), which describe in detail the results of the initial studies involved in expanded bed hydroprocessing of SRC-I, have been published and are available for distribution from NTIS.

This previously reported work is categorically subdivided into the following areas.

a) Preliminary 10-day operating periods to investigate the effects of solvent type and feasibility of operation;

b) First 30-day Aging Study (Co/Mo catalyst);

c) Catalyst screening;

d) 33-day operation - once-through mode, non-recycle (Ni/Mo catalyst);

e) 41-day operation - once-through, recycle, once-through modes (Ni/Mo catalyst).

From these data it was concluded that:

a) Expanded bed LC-Finer processing for upgrading SRC-I is feasible at a conversion of 60+ weight percent 850°F+ and a denitrogenation of 70+ percent in the 850°F+ fraction (60+ percent in the TLP);

b) Proprietary LC-Fining correlations for residuum processing of petroleum are applicable to coal liquids processing;

c) Stable operation at 62 weight percent 850°F+ conversion has been achieved in once-through operation for up to 33 days using a Ni/Mo catalyst;

d) Recycle processing of SRC-I coal extract in the LC-Finer produced an equilibrium recycle solvent containing 9 weight percent hydrogen after two recycle passes in the PDU;

e) No "refractory" 850°F+ material was detected when recycling 500°F+ material;

f) A 850°F+ conversion of approximately 87 weight percent (based on fresh SRC-I feed) was obtained during recycle processing;

g) A distillate product (390-850°F) containing <0.3 weight percent nitrogen was routinely obtained during recycle processing at the above noted high conversion;

h) In the recycle mode of processing coal extract in the LC-Finer, a catalyst addition rate of one pound of catalyst per ton of moisture free coal gave an 850°F+ conversion of 62 weight percent (based on fresh SRC-I feed) and a nitrogen content in the distillate fraction (390-850°F) of 0.36 weight percent. A similar correlation for once-through operation showed 48.5 weight percent 850°F+ conversion and 0.42 weight percent nitrogen in the distillate fraction.

Objective

The primary objective of this work was to determine the effect of higher reactor pressure and space velocity on conversion and product quality in the

LC-Finer. Heretofore, only temperature had been used to adjust or maintain conversion and product quality. Two different coal extract types were used in this study - namely, whole filter feeds obtained from Wilsonville short contact time coal extract (SCT) operations (Wilsonville run numbers 145 and 146 with 287 and 580 pounds of Indiana V coal feed per hour, respectively), and a conventional solvent refined coal (SRC-I)/ Koppers heavy residue creosote oil (KC-Oil) feed blend. The SRC-I was obtained from the Fort Lewis, Washington SRC-I facility.

A secondary objective was to determine whether product differences were obtained with the two feedstocks and also to correlate the higher pressure/ space velocity results with previous data.

Equipment and Unit Operation

The LC-Fining PDU consisted of three expanded bed reactors in series with adequate process piping to operate in either a two- or three-reactor upflow mode. The desired feed blend and hydrogen passed through separate preheaters before entering the bottom of the first reactor. The catalyst bed was maintained in an expanded state in each reactor by the external circulation of process liquids around each reactor. The size constraints of the PDU reactor necessitated the external circulation which simulates the internal circulation of a commercial reactor system. The unit operation was on a once-through basis with no continuous recycle of liquid product or gas from the separators.

The product streams pass through a series of high and low pressure separators and scrubbers to provide a light and heavy oil liquid product plus a gas stream. Light oil, a minor fraction of the total product, is the condensate from the unit's recovery section and has an average end point of 600°F. The heavy oil is the liquid product from the unit and generally is composed of material boiling above 400°F. The end point of the light oil and the initial boiling point of the heavy oil overlap due to the simple condenser type separation of the two product fractions. No total product fractionation was employed. Detailed analyses of the feed and heavy liquid products include

CHONS, ash, density, melting or pour point, viscosity, metals, and weight/volume fractions. A PONA analysis was run on the 500°F minus fractions of the liquid product. The used catalyst was examined for metals content and a screen analysis.

A commercially available catalyst was charged into the reactors. A run consisted of lining out the PDU on solvent with the catalyst bed in an expanded state until a temperature was reached approximately 50°F lower than the desired operating temperature. The appropriate feed blend was then introduced and operation was continued on a 24-hour basis, gradually increasing temperature to the run condition. Each 24-hour day of operation constituted a period during which at least one set of samples was removed for analysis. The analyses for a given period represent equilibrium operation for that period.

This report will present the results of several alternate processing modes utilizing the expanded catalyst bed (LC-Finer) for hydroprocessing coal extracts. Neither distillate yield nor C_1-C_4 gas yield from either the SRC unit or the SCT thermal step of the TSL process have been included in this analysis. A summary of the nominal process parameter characteristics for the PDU runs described in this report may be found in Table LVIX. The specific PDU runs are as follows:

PDU Run 2LCF-10 (31 days operation with catalyst activity check points)
- 50/50 Volume% SRC-I/KC-Oil
- Cool Zone Operation

PDU Run 2LCF-12 (19 days operation)
- 50/50 Volume % SRC-I/KC-Oil
- SRC-I contained 1 Wt% Ash

PDU Run 2LCF-13 (8 days operation)
- Non-deashed SCT (Wilsonville Run 146)

PDU Run 2LCF-14 (11 days operation)
- Deashed SCT (Wilsonville Run 146)

PDU Run 2LCF-15 (15 days operation)
50/50 Volume % SRC-I/KC-Oil
Verification run, new lot of Shell 324 Ni/Mo catalyst

PDU Run 2LCF-16 (25 days operation with catalyst activity check points)
Non-deashed SCT (Wilsonville Run 145)
Higher pressure and space velocity

PDU Run 2LCF-17 (32 days operation with catalyst activity check points)
70/30 Volume % SRC-I/KC-Oil
Higher pressure and space velocity

Since total reactor pressure and space velocity are proprietary operating parameters within this contract, relative total reactor pressures (P_{rel}) of 1.0 and 1.35 together with relative volumetric space velocities (SV_{rel}) between 1.0 and 3.0 will be used. All runs prior to PDU Run 2LCF-16 were made at a nominal total reactor pressure of $P_{rel} = 1.0$ and a nominal volumetric space velocity of $SV_{rel} = 1.0$.

The SCT coal extract obtained from Wilsonville was topped before use to correspond to the 500°F-680°F IBP KC-Oils employed previously as a solvent for SRC-I operation. The topped SCT simulates the recycle of a 500-850°F or 600-850°F solvent fraction. Wilsonville Run 146 was topped to a nominal 500°F IBP and Wilsonville Run 145 was topped to a nominal 600°F IBP. The deashed SCT coal extract used for PDU Run 2LCF-14 was deashed in the Lummus Engineering Development Center at Bloomfield, New Jersey using the Lummus Antisolvent Deashing Process.

The detailed tables of data used in the compilation of this report will be found in the Appendix.

Several terms used in this report are defined as follows:

a) Heavy oil basis - The PDU has three product streams, namely: Heavy Oil (H.O.), Light Oil (L.O.), and Product Gas. Rapid and representative heavy oil analyses for conversion of 850°F+ product fraction and total liquid product denitrogenation can be made on a daily basis in order to monitor unit operations.

b) Feed Basis - A more detailed analysis of the PDU product is made by combining the H.O. and L.O. together with the product gas and calculating fractional product yields and a conversion of 850°F+ based upon the feed charge. Heteroatom contents, viscosities, pour points, and PONA analyses are run on the combined H.O. and L.O. product fractions.

c) Once-through Mode of Operation - This term defined PDU operation wherein only fresh SRC-I and prehydrogenated KC-Oil or SCT coal extract containing its own native solvent constitute the feed blend.

d) Recycle Mode of Operation - This term defined PDU operation wherein fresh SRC-I is added to a recycle fraction consisting of 500°F+ product. The amount of fresh SRC-I is adjusted to provide the desired SRC-I/solvent ratio in the recycle feed blend.

e) Short Contact Time Coal Extract - A short contact time (SCT) coal extract, as prepared at Wilsonville, is obtained by allowing the coal slurry feed to have a residence time only in the slurry preheater and transfer lines. The conventional solvent refined coal has a residence time in the slurry preheater, transfer lines, and dissolver. The SCT coal extract must, consequently, be reacted at a higher temperature to produce a fluid product at very high flow rates. The SCT coal extract used for this study was received as non-deashed material which would have been used as a feedstock for the U.S. Filter or Kerr-McGee Critical Solvent Deashing at Wilsonville.

f) Conversion is defined as the disappearance of a particular product fraction compared to the feed composition. For example:

$$\% \text{ conversion} = \frac{X_{feed} - X_{prod}}{X_{feed}} \times 100$$

The percent denitrogenation for the total liquid product is calculated in the same fashion.

Results and Discussion

Catalyst Activity

As discussed previously, the major objective of this work was to determine the effect of varying the operating parameters of volumetric space rate and total reactor pressure. Since catalyst activity effects the relative comparisons of the data, it must first be established whether catalyst deactivation is also a correlating factor and to what extent.

Some catalyst activity loss was noted for the two life runs previously reported - PDU Run LCF-36 (once-through operation)[2] and PDU Run 2LCF-3 (once-through/recycle/once-through operation)[3]. The loss in catalytic activity was determined by operating the PDU under identical conditions at the beginning and end of a specific run (i.e., catalyst activity check points). A similar operating technique was used for PDU Runs 2LCF-10, -16, and -17 which are included in this report. The catalyst activity relationship at the beginning and end of a run was applied as a proration to the intermediate data to remove the catalyst deactivation factor. Thus, the intermediate data would then reflect the data only as a function of temperature or other operating variable change.

However, several assumptions are inherent in this interpretation of the data. First, it is assumed that the change in the observed effect (such as conversion of 850°F+, percentage denitrogenation, etc.) is linear with respect to time. Thus a linear delta-effect per period of time could be established and intermediate data could be adjusted to a "fresh" activity corresponding to that observed at the reference period and at any desired temperature. Second, it is assumed that the intermediate process parameter variations had no adverse effect on the catalyst deactivation function. For example, operation at constant temperature for a given interval of time would produce the same catalyst deactivation as varying temperatures (within limits) over the same interval of time.

With the advent of PDU Runs 2LCF-16 and -17, total reactor pressure and volumetric space velocity were introduced as process parameters. Two separate and distinct data interpretations were considered with respect to catalyst activity for PDU Runs 2LCF-16 and -17.

Figures 1 and 2 show the weight percent 850°F+ conversion as a function of the relative space velocity for PDU Run 2LCF-16 (SCT feedstock) and PDU Run 2LCF-17 (SRC-I feedstock), respectively. The 780°F check points used to measure catalyst activity are defined by the symbols C_B and C_E, where the subscripts B and E refer to the beginning and end of the run. For PDU Run 2LCF-17 (70/30 SRC-I/KC-Oil), the relative space velocities for C_B and C_E were 1.00 and 0.94, respectively, and both C_B and C_E fall very close to a line for relative space velocity at P_{rel} = 1.0 and 780°F (Figure 2). For PDU Run 2LCF-16 (SCT coal extract, non-deashed, Wilsonville Run 145), the relative space velocities for C_B and C_E were 0.94 and 1.31, respectively (Figure 1). It was assumed that point C_E did not appreciably diverge from the smooth space velocity line at P_{rel}=1.35 and 780°F. PDU Runs 2LCF-16 and -17 were the first two runs made during this contract where the total reactor pressure had deviated from P_{rel}=1.0. It was concluded that higher pressure was significantly contributing to a reduction in catalyst deactivation and both PDU Runs 2LCF-16 and 2LCF-17 were assumed to have a neglible catalyst deactivation.

In the second interpretation, the proprietary LC-Fining correlations also consider the effects of space velocity on 850°F+ coversion. Factors are available which delineate the change in 850°F+ conversion resulting from a change in space velocity. Thus, for PDU Run 2LCF-16, the 850°F+ conversion data for points C_B and C_E were adjusted by a space velocity factor to correspond to SV_{rel}=1.0. This adjustment resulted in a decline in the weight percent 850°F+ conversion from 81.6 to 79.2 at C_B and an increase of 64.3 to 73.9 at C_E. By analogy, PDU Run LCF-36 showed a decline in weight percent 850°F+ conversion from 55.0 at C_B to 46.7 at C_E and PDU Run 2LCF-10 showed a decline in weight percent 850°F+ conversion from 47.4 at C_B to 38.1 at C_E. PDU Run LCF-36 was a 33-day, once-through life run and PDU Run 2LCF-10 was a 31-day, once-through life run (cool zone operation). Both of these runs also included 780°F catalyst activity check points. In summary:

PDU Run	Δ-Conversion Weight % 850°F+
2LCF-10 (SRC-I)	-9.3
LCF-36 (SRC-I)	-8.3
2LCF-16 (SCT)	-5.3
2LCF-17 (SRC-I)	Nil

The PDU runs at the higher pressure (2LCF-16 and -17) show a reduced catalyst deactivation.

The space velocity adjustment for the liquid product fractions lighter than 850°F becomes more complex and increases the uncertainty associated with adjusting data to a common basis. The PDU data prior to PDU Run 2LCF-16 was obtained through operations at a nearly constant SV_{rel}=1.0 and the more simplified linear approach to data adjustment will suffice. Therefore, it was assumed that the Δ-conversion noted above was not sufficiently large to negate the interpretation of no activity decline for higher pressure operation (PDU Runs 2LCF-16 and -17). Two other SCT runs (PDU Runs 2LCF-13 and -14) were evaluated with no activity decline measured due to their shorter run length.

Space Velocity and Total Reactor Pressure

In order to minimize process parameter perturbations, PDU runs prior to PDU 2LCF-16 were conducted at a nominally constant relative volumetric space velocity (SV_{rel}=1.0) and a constant relative total reactor pressure (P_{rel}= 1.0). The main objective of PDU Run 2LCF-16 and -17 was to determine the effect of higher space velocity and higher total reactor pressure on SCT and SRC-I coal extracts, respectively.

Referring to Figures 1 and 2, it will be noted that several different sets of operating conditions may be employed for a given 850°F+ conversion. For example, the data for PDU Run 2LCF-17 (Figure 2) show that 45.0 weight percent 850°F+ conversion may be attained at the following combinations of process parameters:

SV_{rel}	P_{rel}	T °F
2.1	1.35	780
1.34	1.0	780
0.75	1.0	750

Conversely, the data for PDU Run 2LCF-16 (Figure 1) show that at SV_{rel}=3.0, the 850°F+ conversion will be 43.0 at 780°F, 58.6 at 800°F, and 66.3 at 810°F, all at P_{rel}=1.35. It became apparent that the weight percent 850°F+ conversion could be used as a correlating factor for the lighter liquid and gas product fractional distributions. Inherent in this corollary is the fact that for a given weight percent 850°F+ conversion, the light product fractional distribution is relatively constant.

Product Distribution (Short Contact Time Coal Extracts)

Two different short contact time (SCT) coal extracts were used as feedstocks for the PDU. PDU Runs 2LCF-13 and -14 used SCT coal extract from Wilsonville Run 146 (topped to nominal 500°F) and PDU Run 2LCF-16 used SCT coal extract from Wilsonville Run 145 (topped to nominal 600°F). Wilsonville Run 145 was made with 287 pounds/hour coal feed rate and Run 146 was made with 580 pounds/hour coal feed rate. Details for the two Wilsonville runs may be found in Catalytic's Quarterly Technical Progress Report issued by Southern Company Services[4]. PDU Run 2LCF-14 used deashed SCT coal extract which had been deashed in the Lummus Engineering Development Center anti-solvent deasher located in Bloomfield, New Jersey[5]. All process results described in this report for PDU Runs 2LCF-12, -13, and -16 have been calculated on a deashed basis.

Previously, it had been shown that negligible catalyst deactivation had occurred for PDU Run 2LCF-16 (P_{rel}=1.35). Due to the short run length, insufficient data was available for PDU Runs 2LCF-13 and -14 (P_{rel}=1.0) to allow for catalyst deactivation to be assigned to these two runs. Therefore, a product distribution analysis for the three runs made using the two SRT coal extracts will be compared assuming no catalyst deactivation. Figures 3 through 6 present product distribution data for the runs just described.

Figure 3 presents a plot of the 650°F+ conversion versus the 850°F+ conversion, based on ash-free feed, for PDU Runs 2LCF-13, -14, and -16. No significant difference is observed among the three runs although a linear regression through the data points of PDU Run 2LCF-14 and the origin did show that it is slightly lower in 650°F+ conversion for a given 850°F+ conversion.

Figure 4 presents a plot of the 500°F+ conversion versus the 850°F+ conversion, based on ash-free feed, for PDU Runs 2LCF-13, -14, and -16. Again, no significant difference is observed among the three runs although PDU Run 2LCF-14 showed slightly less 500°F+ conversion as before.

In Figure 5, the C_5-500°F yield (weight percent) is plotted versus the 850°F+ conversion. In this instance, PDU Run 2LCF-14 which was made with deashed SCT coal extract (Wilsonville Run 146), showed a significantly lower C_5-500°F yield than PDU Run 2LCF-13 which was made with non-deashed SCT coal extract (Wilsonville Run 146). No difference was noted between the runs made with non-deashed SCT coal extract obtained from the two different Wilsonville runs (PDU Runs 2LCF-13 and -16).

The C_1-C_4 yield is plotted against the 850°F+ conversion in Figure 6 for PDU Runs 2LCF-13, -14, and -16.

In a recent EPRI Journal[8], it was reported that " — SRC deashed with CSD (Critical Solvent Deashing) does not contain some of the heavier liquids that filtered SRC contains, as a result, hydrotreating this material has been demonstrated to be much easier than treating the filtered SRC —— that is, substantially milder conditions are used ——". This information is applicable to the deashed coal extracts used in this study when PDU Run 2LCF-14 (SCT coal extract deashed by Lummus Anti-Solvent Deashing Process) is compared with two runs made on SRC-I obtained from Fort Lewis filtration.

Run No.	Wt. Extract/Solvent	SV_{rel}	P_{rel}	t °F	850°F+ Conversion
PDU Run 2LCF-14 (deashed SCT)	58/42	1.31	1.0	810	81.17
PDU Run 2LCF-12 (1% Ash SRC-I)	57/43	1.0	1.0	810	79.17
PDU Run 2LCF-15 (0.1 % Ash SRC-I)	58/42	0.88	1.0	810	77.38

At the same coal extract to solvent ratio, relative total reactor pressure, and temperature, PDU Run 2LCF-14 provided a slightly higher conversion at a 30 percent higher space velocity. Also, PDU Run 2LCF-12 contained one weight percent ash which is reported to have some catalytic activity in the SRC-II processing mode.

Product Distribution (SRC-I Coal Extracts)

Two previously described long-term runs made with SRC-I coal extract will be used as a comparison with PDU Run 2LCF-17 (high space velocity and pressure). PDU Run 2LCF-10[6] was made with the non-catalytic zones maintained at a maximum temperature of ≅650°F. This run was made with a temperature program similar to that used for the once-through catalyst aging run, PDU LCF-36. PDU Run 2LCF-12[7] was made with a one weight percent ash SRC-I, again with a temperature program modelled after PDU Run LCF-36. Figures 7 through 10 present product distribution data for the runs, PDU 2LCF-10, -12, and -17. The curves representing the data from a particular PDU run were obtained from a linear regression of the individual data points and the origin (0, 0). As discussed previously, PDU Run 2LCF-10 was adjusted for the activity decline measured for this run, whereas PDU Run 2LCF-12 was adjusted for an activity decline using the data from PDU Run LCF-36. PDU Run 2LCF-17 did not have a measurable activity decline.

One observation encountered when analyzing this data is the great similarity among the three runs. The data is clustered within a rather narrow

range for each product characteristic which is plotted. Some differences do exist, however, but only to a minor degree. For instance, in Figure 7 (650°F+ versus 850°F+ conversion), PDU Run 2LCF-10 appears to have a higher 650°F+ conversion than PDU Runs 2LCF-12 and -17 at a given 850°F+ conversion level. However, in Figure 8 (500°F+ versus 850°F+ conversion), PDU Run 2LCF-17 yields the highest 500°F+ conversion at a given 850°F+ conversion level. Similar minor dissimilarities in the data comparisons may be noted in Figures 9 and 10 (C_5-500°F and C_1-C_4 yields versus 850°F+ conversion, respectively).

During the extended PDU operation, two different catalyst lots of the Shell 324 nickel-molybdenum extrudate were obtained from the Shell Chemical Company, Houston, Texas. The break point between the two catalyst lots occurred following PDU Run 2LCF-12. Recognizing that catalytic differences can sometimes be attributed to manufacturing anomalies, PDU Run 2LCF-15 was made to test the new catalyst lot. For reference, it is also plotted on Figures 7 through 10. No significant differences between catalyst lots were noted as was verified by the similarities just discussed for PDU Runs 2LCF-10, -12, and -17.

Product Distribution (Comparison - SRC-I and SCT Coal Extracts)

Sufficient data has been accumulated and analyzed in the previous two sections concerning the product distribution for LC-Fining of SRC-I and SCT coal extracts to allow a comparison to be made between the two types of coal extract. Figures 11 through 14 present the comparisons of product distribution for PDU Runs 2LCF-10, -12 and -17 on SRC-I coal extract and PDU Runs 2LCF-13, -14, and -16 on SCT coal extract.

The non-deashed SCT coal extracts (PDU Runs 2LCF-13 and -16), when compared to deashed SCT coal extract (PDU Run 2LCF-14), show the greatest 500°F+ and 650°F+ conversion together with the highest C_5-500°F weight percent yield for a given 850°F+ conversion. This observation is also applicable to a comparison between non-deashed SCT and SRC-I. The de-ashed SCT (PDU Run 2LCF-14) product distribution very closely resembles the SRC-I product distribution.

With respect to the SRC-I runs, the cool non-catalytic zone run (PDU 2LCF-10) shows the greatest 500°F+ and 650°F+ conversion together with the highest C_5-500°F weight percent yield for a given 850°F+ conversion. The SRC-I run made with one weight percent ash (PDU Run 2LCF-12) was uniformily low in 500°F+ and 650°F+ conversion and also C_5 -500°F weight percent yield.

Since relatively less conversion to distillates occurs in the first stage SCT thermal step of the TSL process, it is not surprising that the SCT distillate produced in the LC-Finer is greater than that obtained from conventional SRC. However, these results do not imply that the total distillate yield for the overall TSL process has been optimized.

A comparison of the C_1-C_4 weight percent yield from the LC-Finer (Figure 14) shows that the SCT runs (PDU 2LCF-13, -14, and -16) produce less C_1-C_4 gas yield than the SRC-I runs (PDU 2LCF-10, -12, and -17) at a given 850°F+ conversion.

Denitrogenation (Comparison - SRC-I and SCT Coal Extracts)

Figure 15 shows a comparison between the SRC-I and SCT coal extract runs in the LC-Finer with respect to percentage denitrogenation for the total liquid product. This plot also indicates the relative rate of loss in denitrogenation activity when the normalized specific run data is plotted against time as equivalent periods of operation at SV_{rel}=1.0. It will be recalled that PDU Runs 2LCF-16 and -17 were made to evaluate the effect of increased space velocity.

In preparation for making a denitrogenation comparison, the nitrogen content of the total liquid product was normalized to 780°F, SV_{rel}=1.0, and P_{rel}=1.0 using proprietary LC-Fining correlations. The normalizing procedure also resulted in a change in the 850°F+ conversion which in turn resulted in a change in the amount of total liquid product produced. The normalized results incorporating the above noted procedure are plotted in Figure 15.

The LC-Finer runs made with SCT feedstock (PDU Runs 2LCF-13, -14, and -16) show a higher percentage feedstock denitrogenation than the runs made with SRC-I/KC-Oil solvent feed blends (PDU Run 2LCF-10, -12, and -15). It should be emphasized that the excellent denitrogenation observed in the LC-Finer is representative of the total liquid product which contains an unconverted 850°F+ fraction.

These results are not meant to suggest that the percentage denitrogenation for the overall TSL process will necessarily be the same as obtained in the LC-Finer.

Conclusions

The following conclusions do not imply that the C_1-C_4 gas yield, C_5-500°F liquid yield, 500°F+ conversion, and 650°F+ conversion have been optimized for the TSL process which contains a first stage coal dissolution (SRC-I or SCT) followed by LC-Finer hydrotreating. The conclusions are directly applicable only to the LC-Finer.

1) Short contact time coal extracts show a greater precentage denitrogenation in the total liquid product than SRC-I coal extracts when processed by LC-Fining. Also, short contact time coal extracts show a lower C_1-C_4 gas yield.

2) The 850°F+ conversion is a correlating parameter for comparing C_1-C_4 gas yield, C_5-500°F liquid yield, 500°F+ conversion, and 650°F+ conversion. Various combinations of the operating parameters of space velocity, total reactor pressure, and temperature achieve the same 850°F+ conversion. Thus, the product distribution can then be related to 850°F+ conversion with only minor variations between specific experimental runs. No difference in product distribution (at a given 850°F+ conversion) was noted for runs made with SRC-I/prehydrogenated KC-Oil at 70/30 and 50/50 nominal weight ratio feed blends.

3) Higher pressure operation tends to a decrease in the catalyst deactivation rate for conversion.

4) Non-deashed short contact time coal extracts show a higher 500°F+ and 650°F+ conversion than SRC-I coal extracts at a given 850°F+ conversion in the LC-Finer. Deashed short contact time coal extracts very closely resemble SRC-I coal extract in liquid product distribution.

5) The data obtained from higher pressure and higher space velocity operations in the LC-Finer correlate well with the previously reported data at SV_{rel}=1.0 and P_{rel}=1.0. The space velocity and pressure data presented in this report have expanded the operability of LC-Fining to produce a product with a given 850°F+ conversion and level of nitrogen removal. Judicious selection of space velocity, pressure, and temperature allow the upgrading of coal extracts by LC-Fining to be more closely integrated with the operation of the coal liquefaction portion of TSL.

LITERATURE CITED

1. Potts, J. D., Hastings, K. E., Wysocki, E. D., DOE FE-2038-17, Interim Report, November, 1977.

2. Potts, J. D., Hastings, K. E., Unger, H., DOE FE-2038-25, Interim Report, August, 1978.

3. Potts, J. D., Hastings, K. E., Unger, H., Chillingworth, R. S. DOE FE-2038-34, Interim Report, May, 1979.

4. Lewis, H. E., et al, DOE FE-2270-39, Quarterly Technical Progress Report, July-September, 1978.

5. Puzio, J. F., Stavropoulos, N., "Preparation of LC-Fining Feedstocks from a Low Severity SRC Filter Feed from Wilsonville," Personal Communication from C-E Lummus to Cities Service, December, 1979.

6. Chillingworth, R. S., Hastings, K. E., Potts, J. D., "Alternative Modes of Processing SRC in an Expanded Bed LC-Finer to Produce Low Nitrogen Distillates," I&EC Products, Vol. 19, p 34, March, 1980.

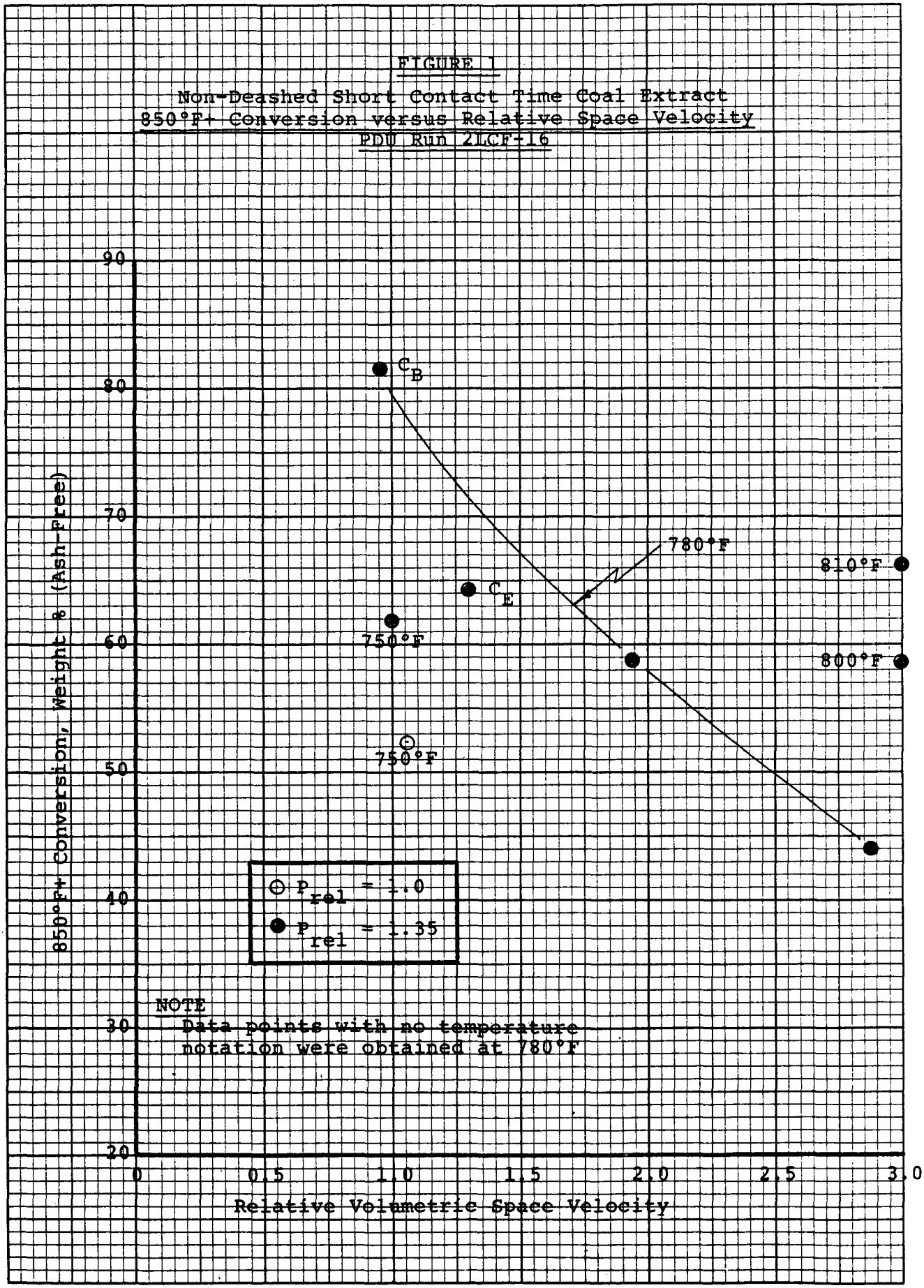
7. DOE Review Meeting, "Refining of Syncrudes," May 7-8, 1979.

8. R&D Status Report, Fossil Fuel and Advanced Systems Division, EPRI Journal, p 39, September, 1979.

APPENDIX

FIGURE 1

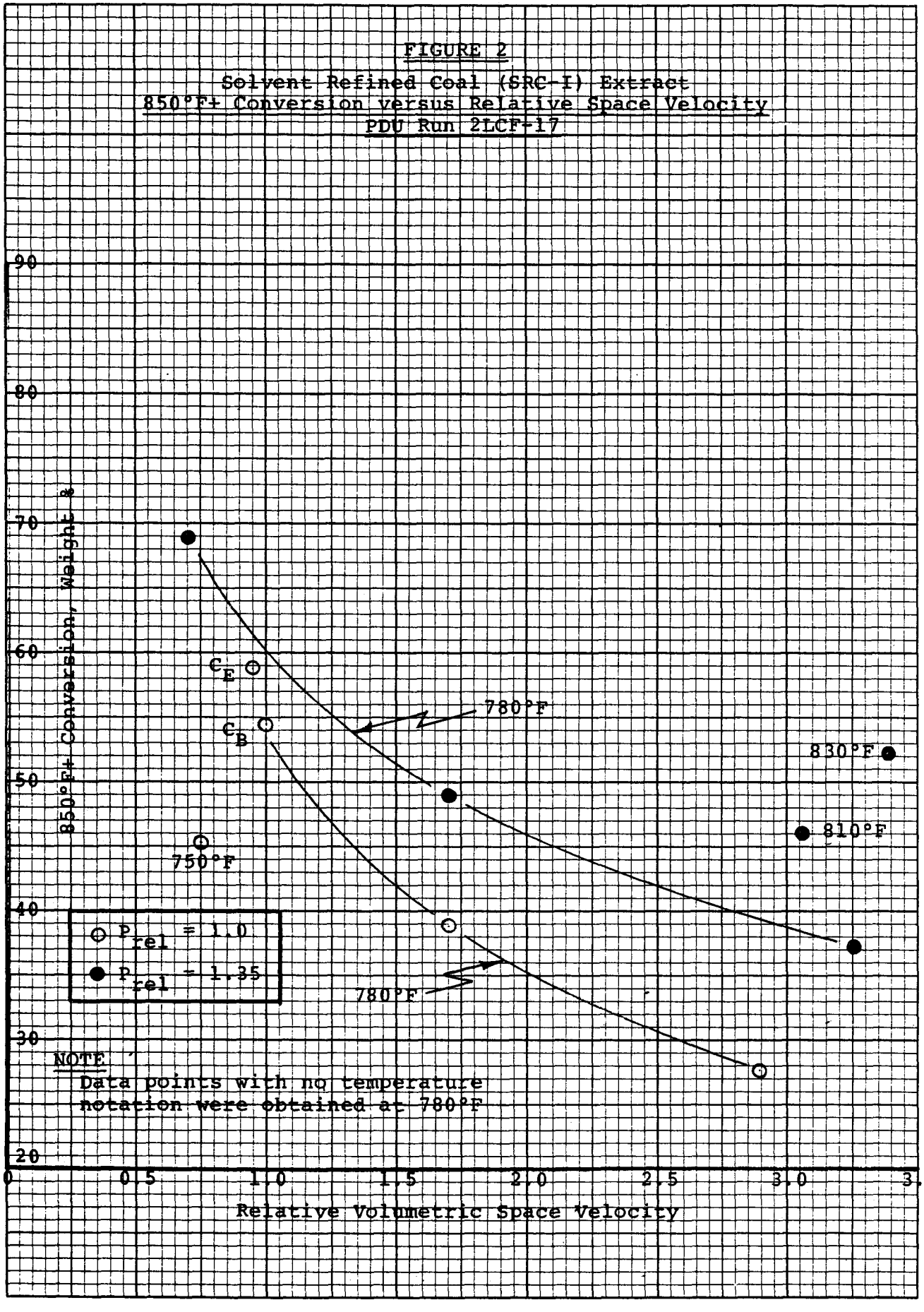
Non-Deashed Short Contact Time Coal Extract
850°F+ Conversion versus Relative Space Velocity
PDU Run 2LCF-16



NOTE
Data points with no temperature notation were obtained at 780°F

FIGURE 2

Solvent Refined Coal (SRC-I) Extract
850°F+ Conversion versus Relative Space Velocity
PDU Run 2LCF-17



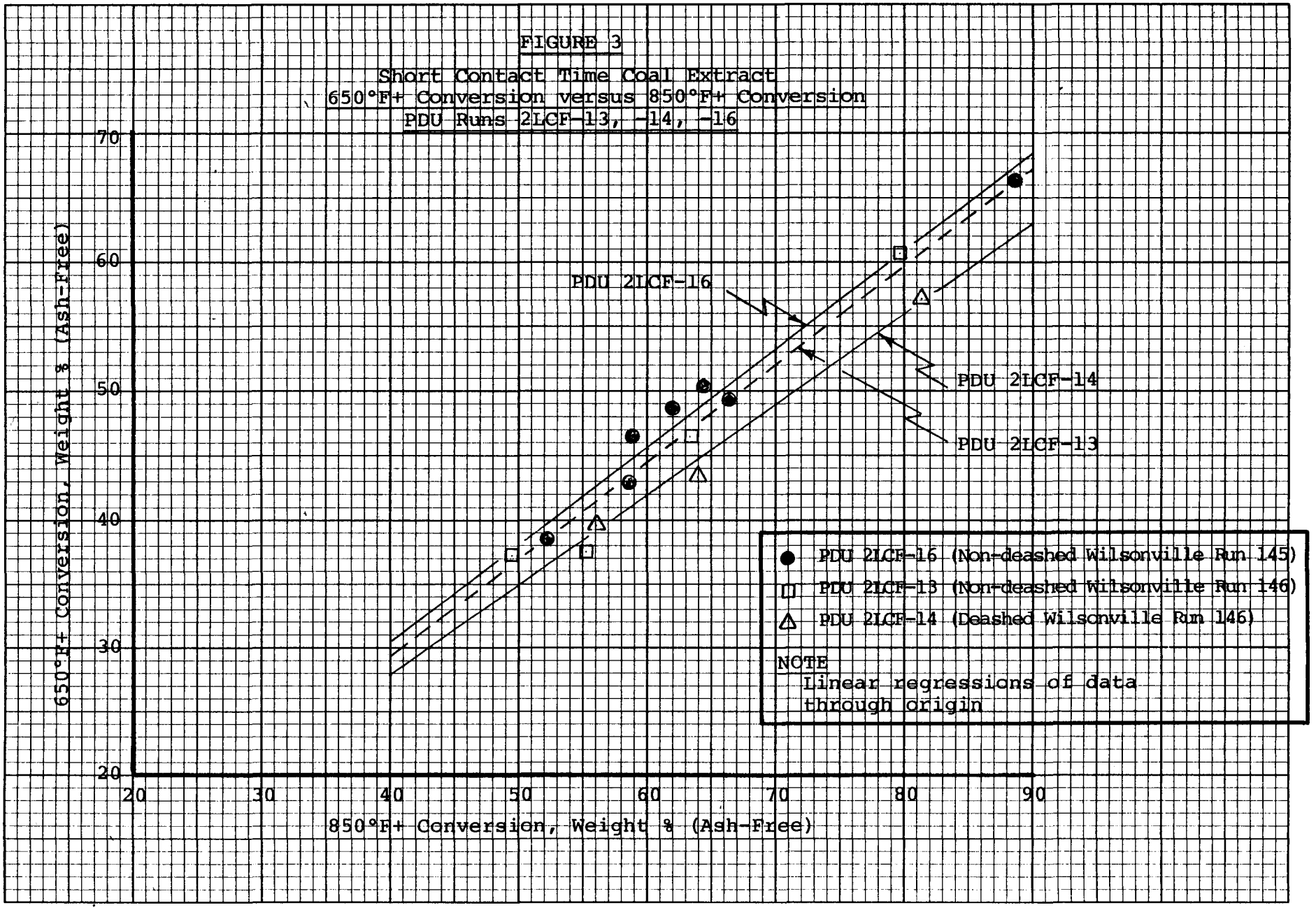


FIGURE 3
Short Contact Time Coal Extract
650°F+ Conversion versus 850°F+ Conversion
PDU Runs 2LCF-13, -14, -16
650°F+ Conversion, Weight % (Ash-Free)
850°F+ Conversion, Weight % (Ash-Free)
70
60
50
40
30
20
20
30
40
50
60
70
80
90
PDU 2LCF-16
PDU 2LCF-14
PDU 2LCF-13
PDU 2LCF-16 (Non-deashed Wilsonville Run 145)
PDU 2LCF-13 (Non-deashed Wilsonville Run 146)
PDU 2LCF-14 (Deashed Wilsonville Run 146)
NOTE
Linear regressions of data through origin

FIGURE 4

Short Contact Time Coal Extract
500°F+ Conversion versus 850°F+ Conversion
PDU Runs 2LCF-13, -14, -16

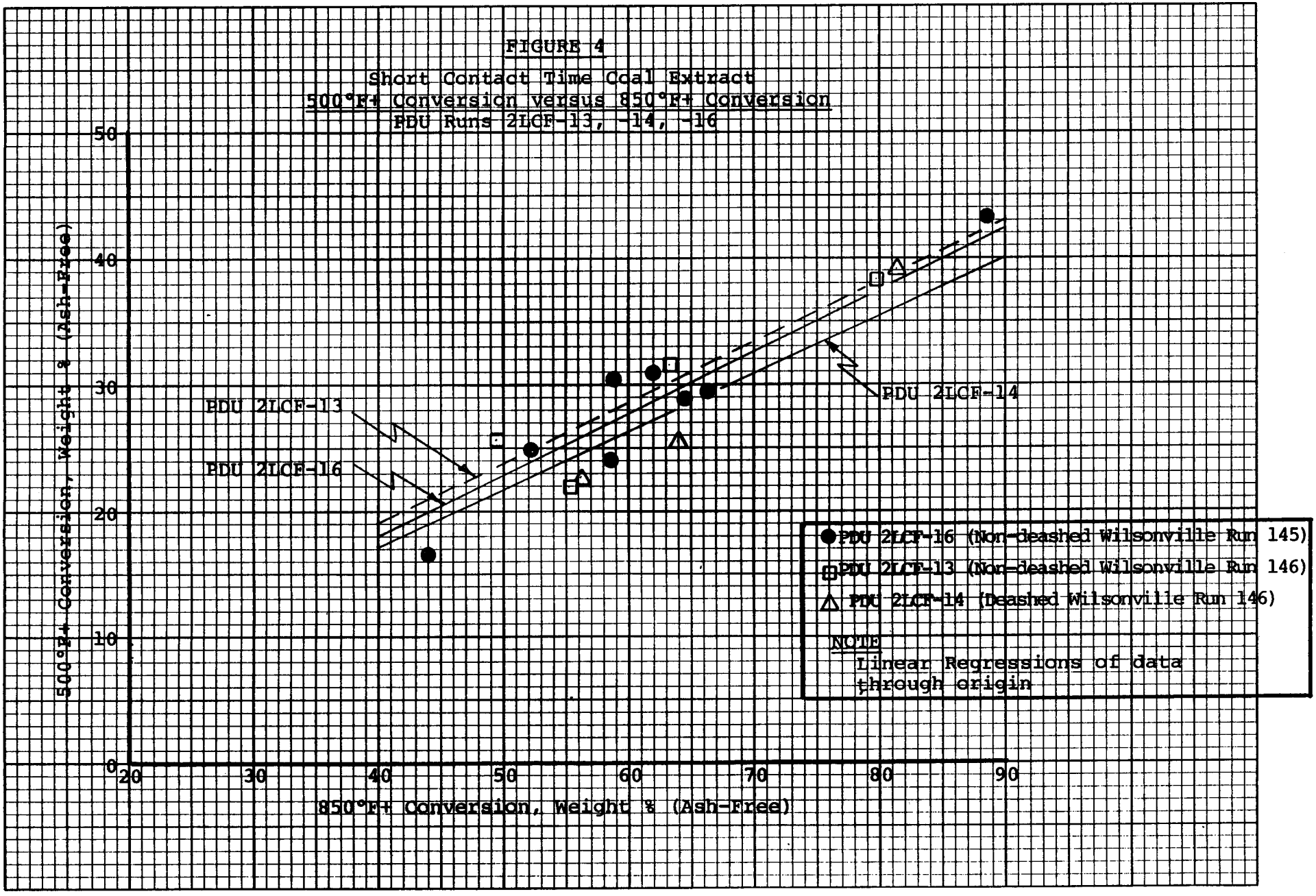
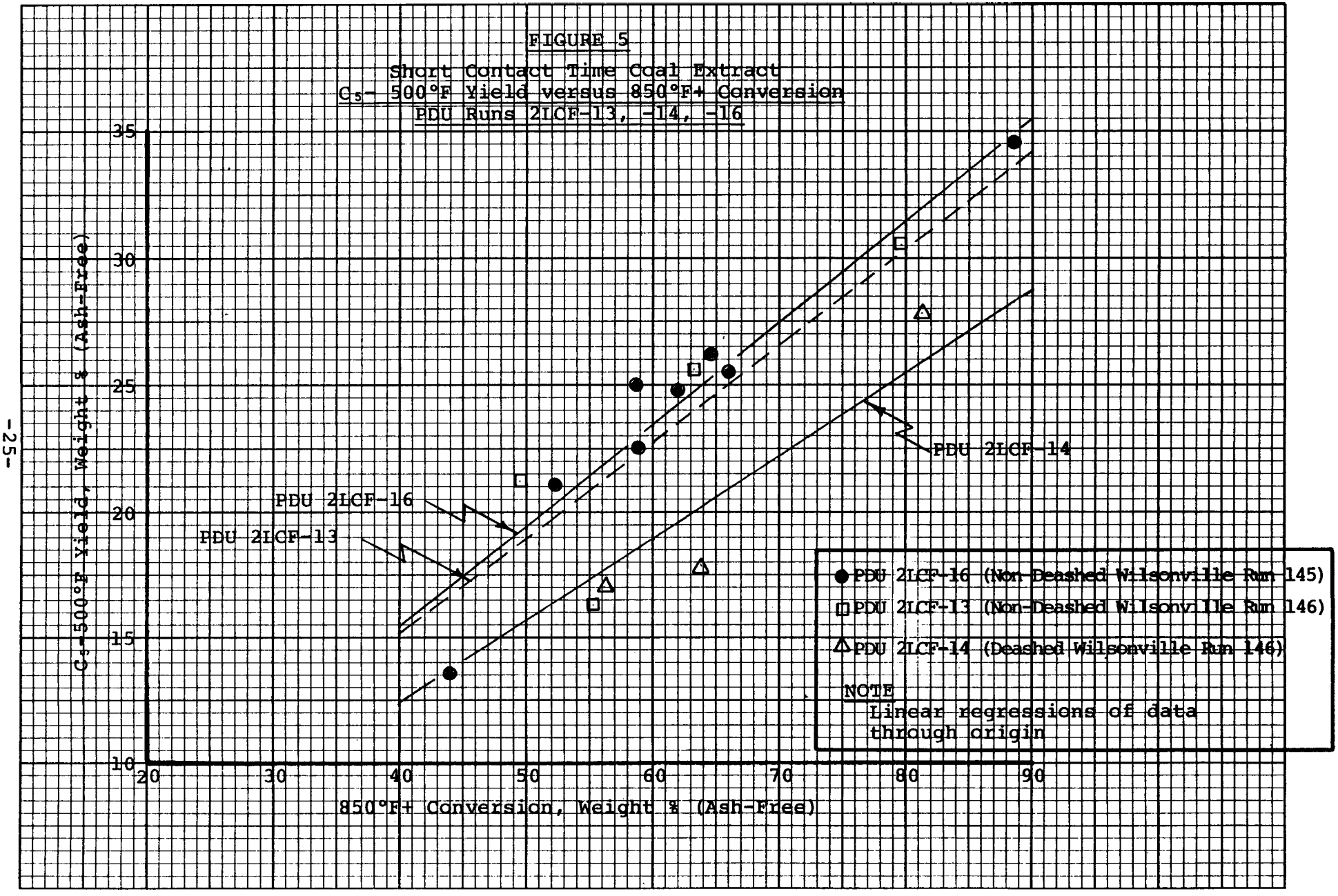


FIGURE 5

Short Contact Time Coal Extract
C_5- 500°F Yield versus 850°F+ Conversion
PDU Runs 2LCF-13, -14, -16



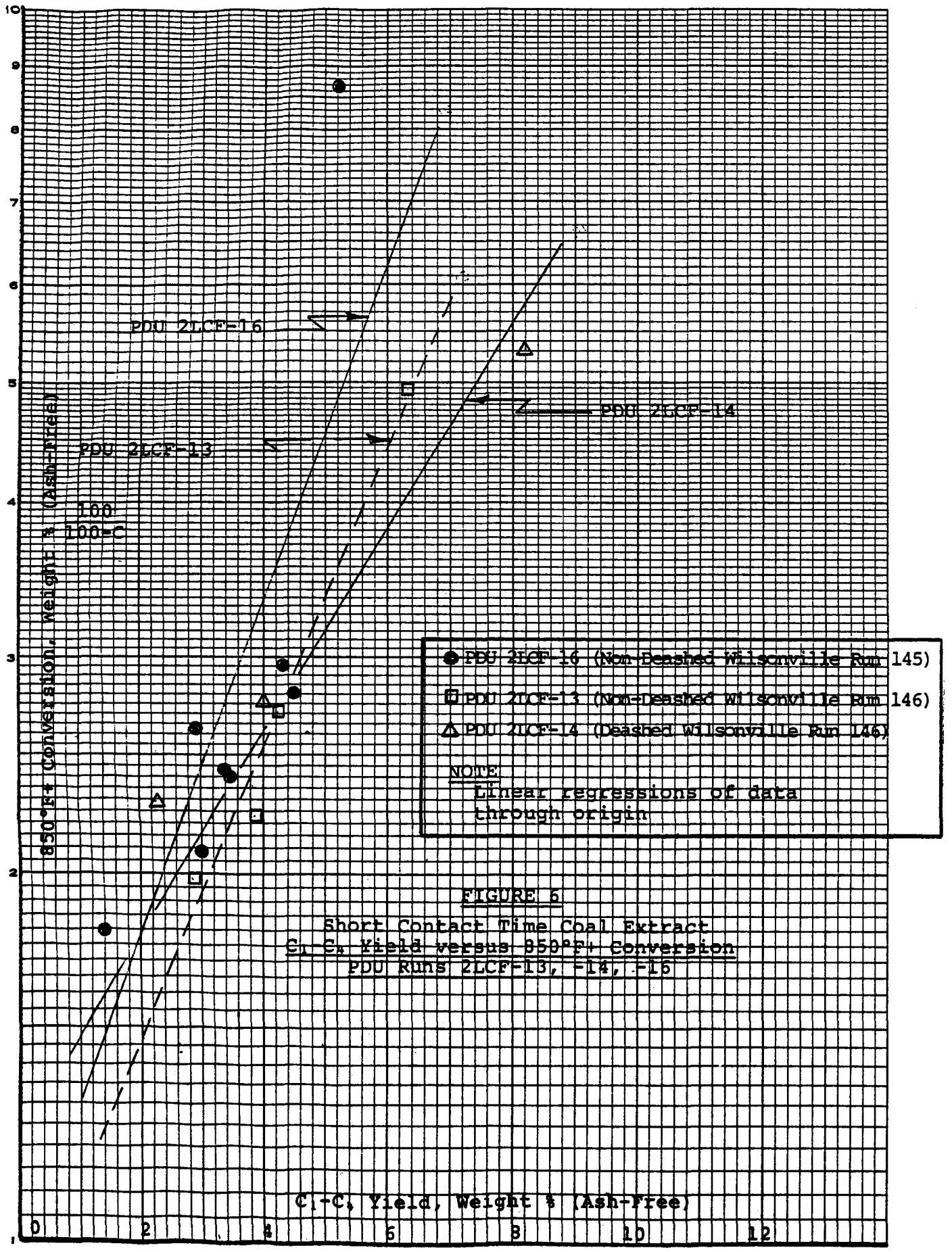


FIGURE 6

Short Contact Time Coal Extract
C_1-C_4 Yield versus 850°F+ Conversion
PDU Runs 2LCF-13, -14, -16

FIGURE 7

SRC-I Coal Extract
650°F+ Conversion versus 850°F+ Conversion
PDU Runs 2LCF-10, -12, -15, -17

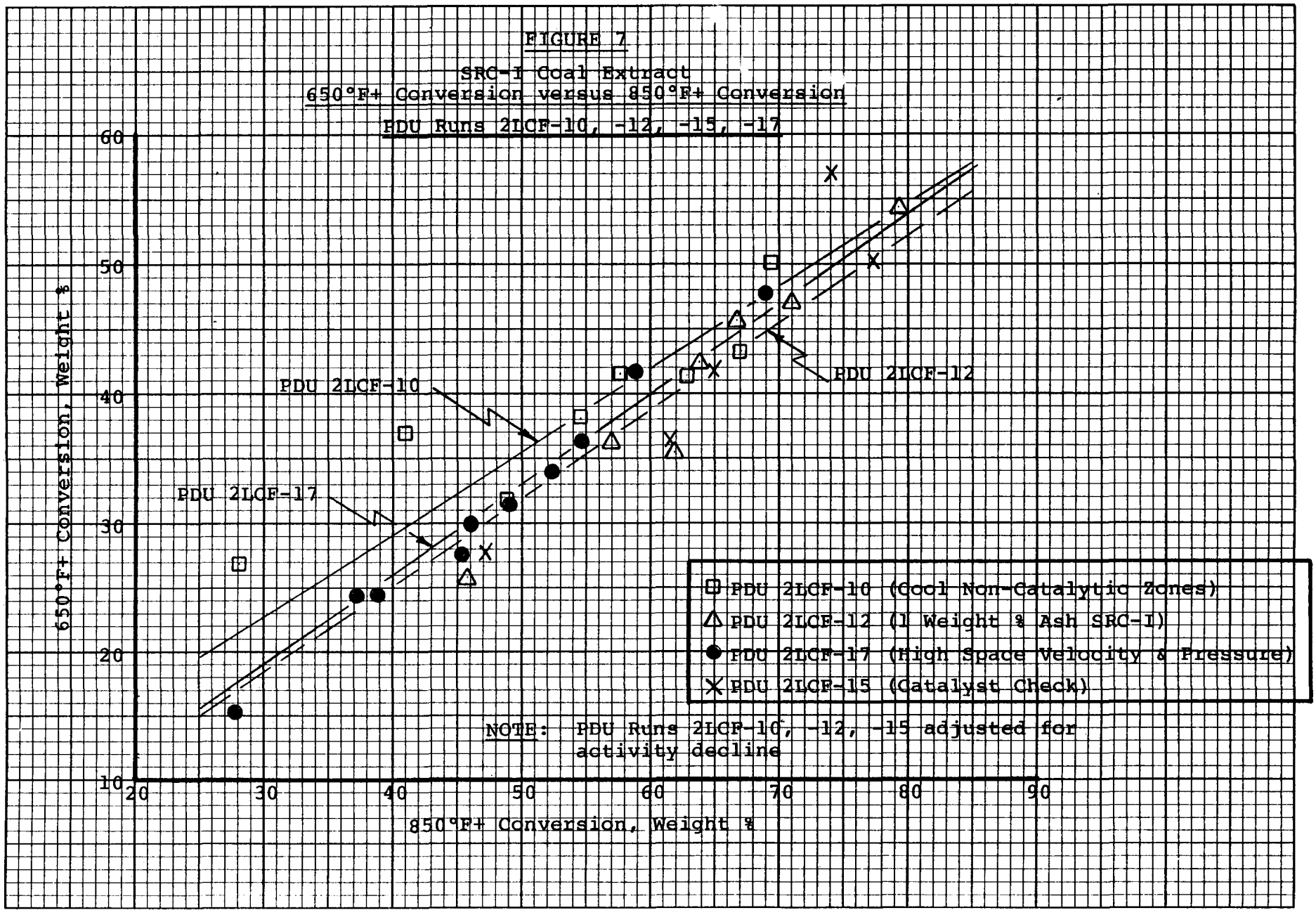
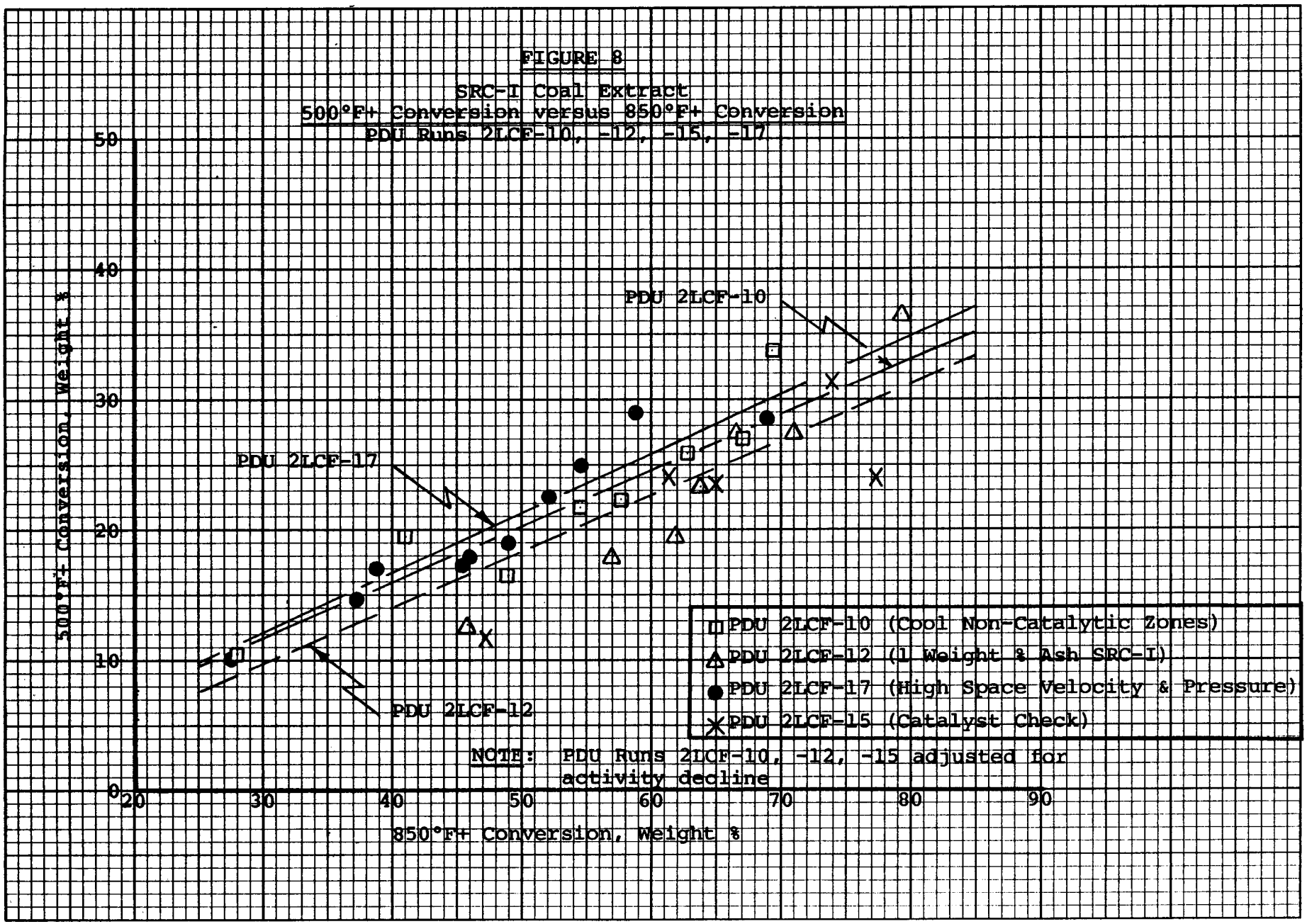


FIGURE 8

SRC-I Coal Extract
500°F+ Conversion versus 850°F+ Conversion
PDU Runs 2LCF-10, -12, -15, -17



NOTE: PDU Runs 2LCF-10, -12, -15 adjusted for activity decline

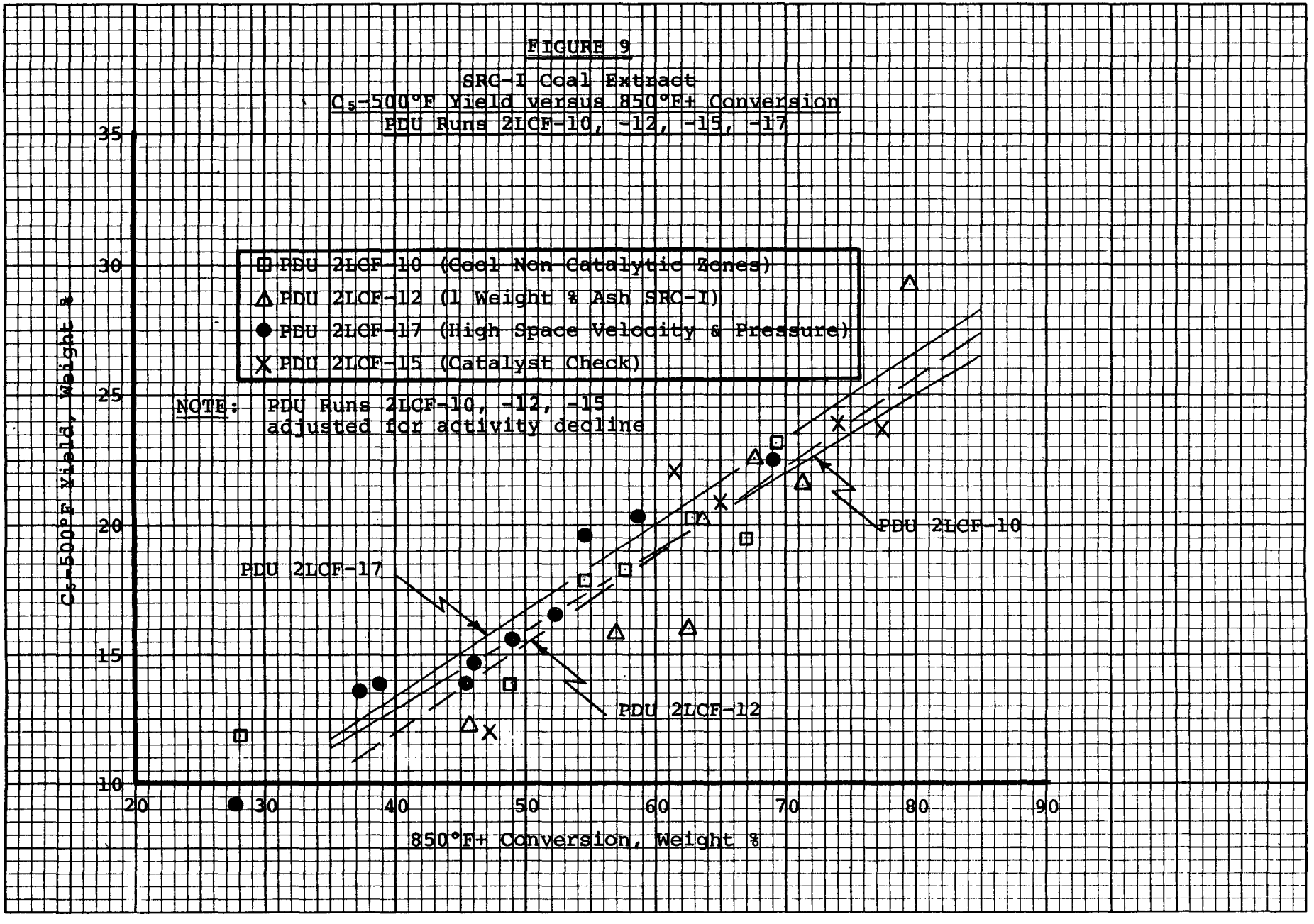


FIGURE 9
SRC-I Coal Extract
C5-500°F Yield versus 850°F+ Conversion
PDU Runs 2LCF-10, -12, -15, -17
PDU 2LCF-10 (Cool Non-Catalytic Zones)
PDU 2LCF-12 (1 Weight % Ash SRC-I)
PDU 2LCF-17 (High Space Velocity & Pressure)
PDU 2LCF-15 (Catalyst Check)
NOTE: PDU Runs 2LCF-10, -12, -15 adjusted for activity decline
PDU 2LCF-10
PDU 2LCF-17
PDU 2LCF-12
C5-500°F Yield, Weight %
850°F+ Conversion, Weight %
10
15
20
25
30
35
20
30
40
50
60
70
80
90

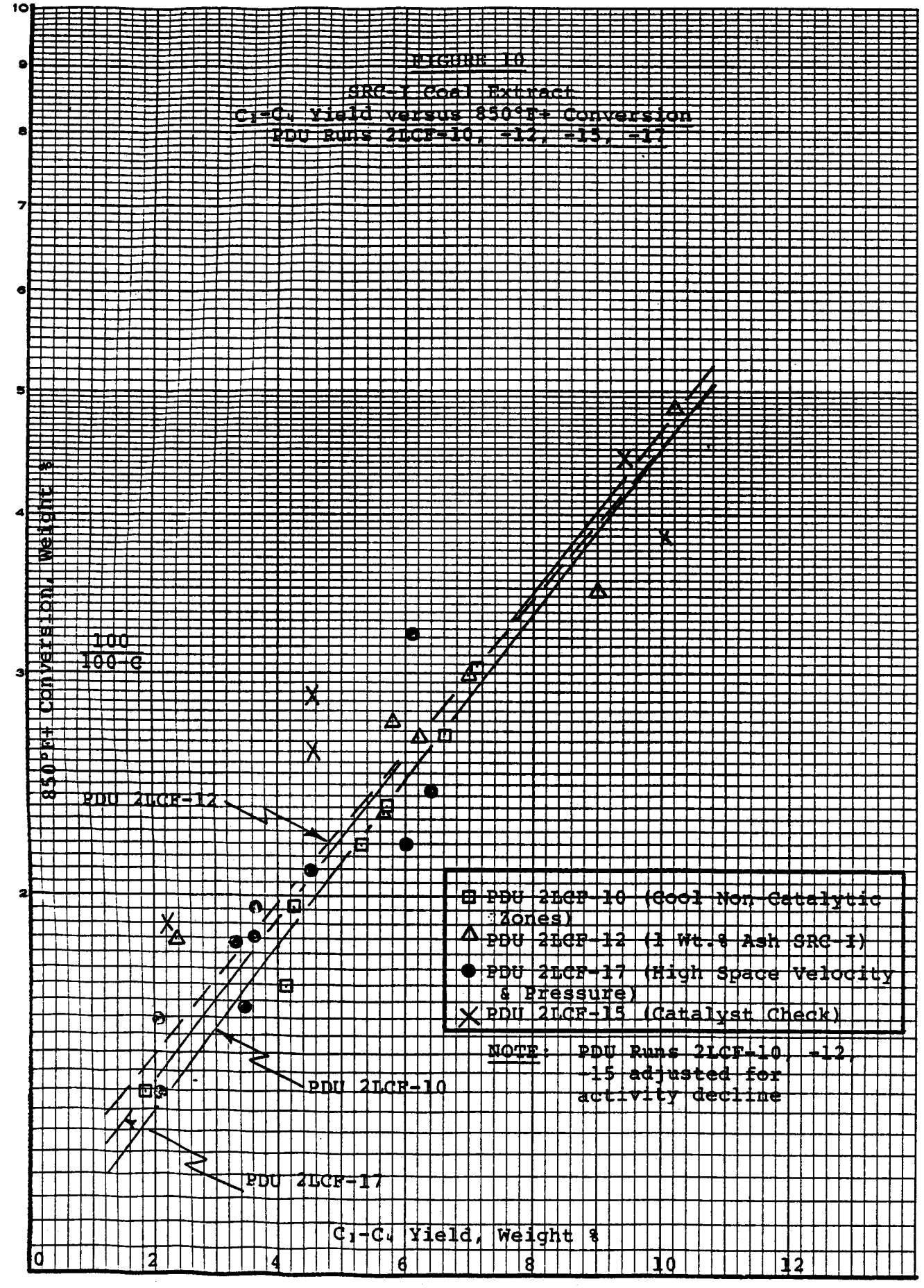


FIGURE 10
SRC-I Coal Extract
C1-C4 Yield versus 850°F+ Conversion
PDU Runs 2LCF-10, -12, -15, -17
850°F+ Conversion, Weight %
100/100-C
C1-C4 Yield, Weight %
PDU 2LCF-12
PDU 2LCF-10
PDU 2LCF-17
PDU 2LCF-10 (Cool Non-Catalytic Zones)
PDU 2LCF-12 (1 Wt.% Ash SRC-I)
PDU 2LCF-17 (High Space Velocity & Pressure)
PDU 2LCF-15 (Catalyst Check)
NOTE: PDU Runs 2LCF-10, -12, -15 adjusted for activity decline

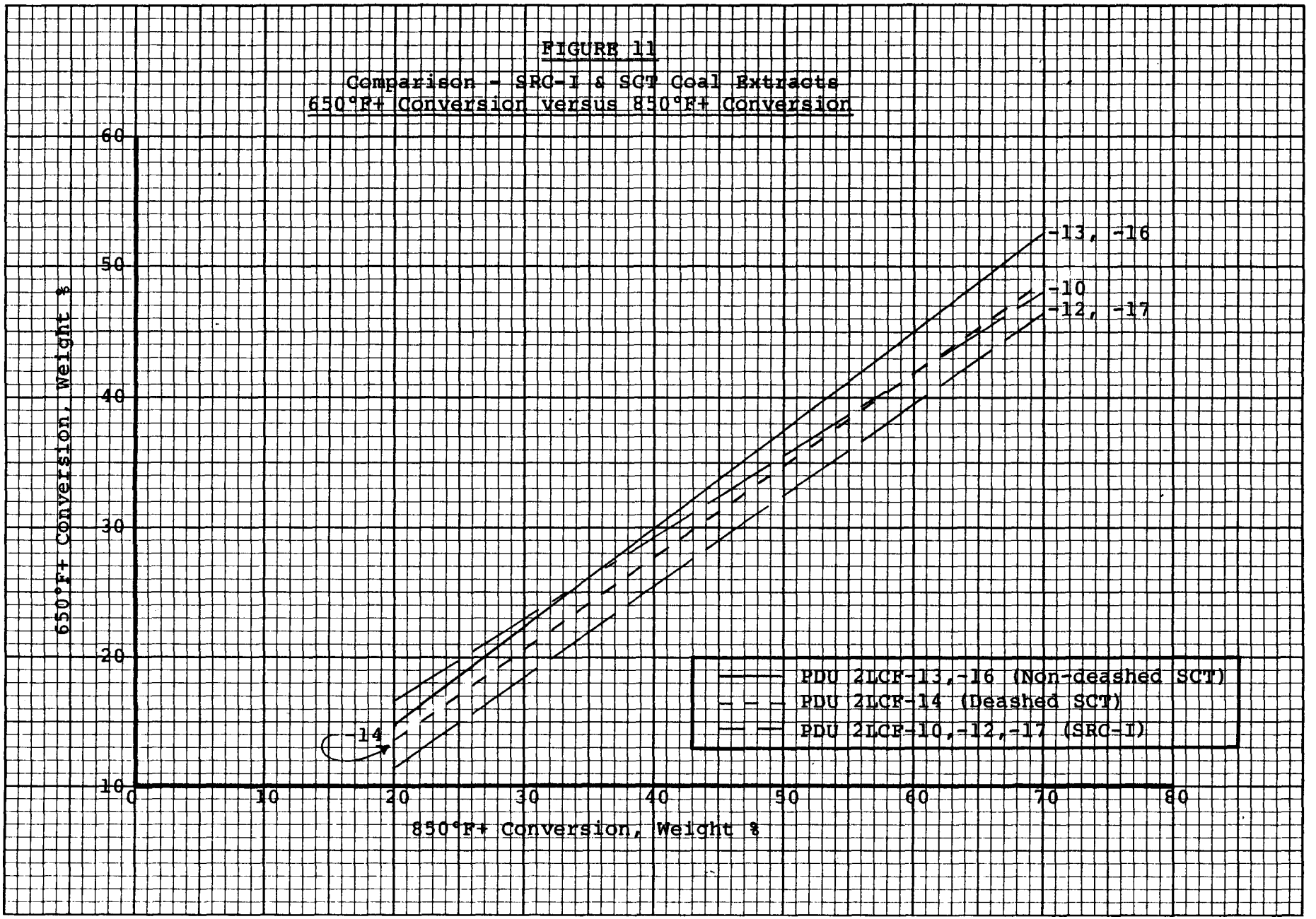
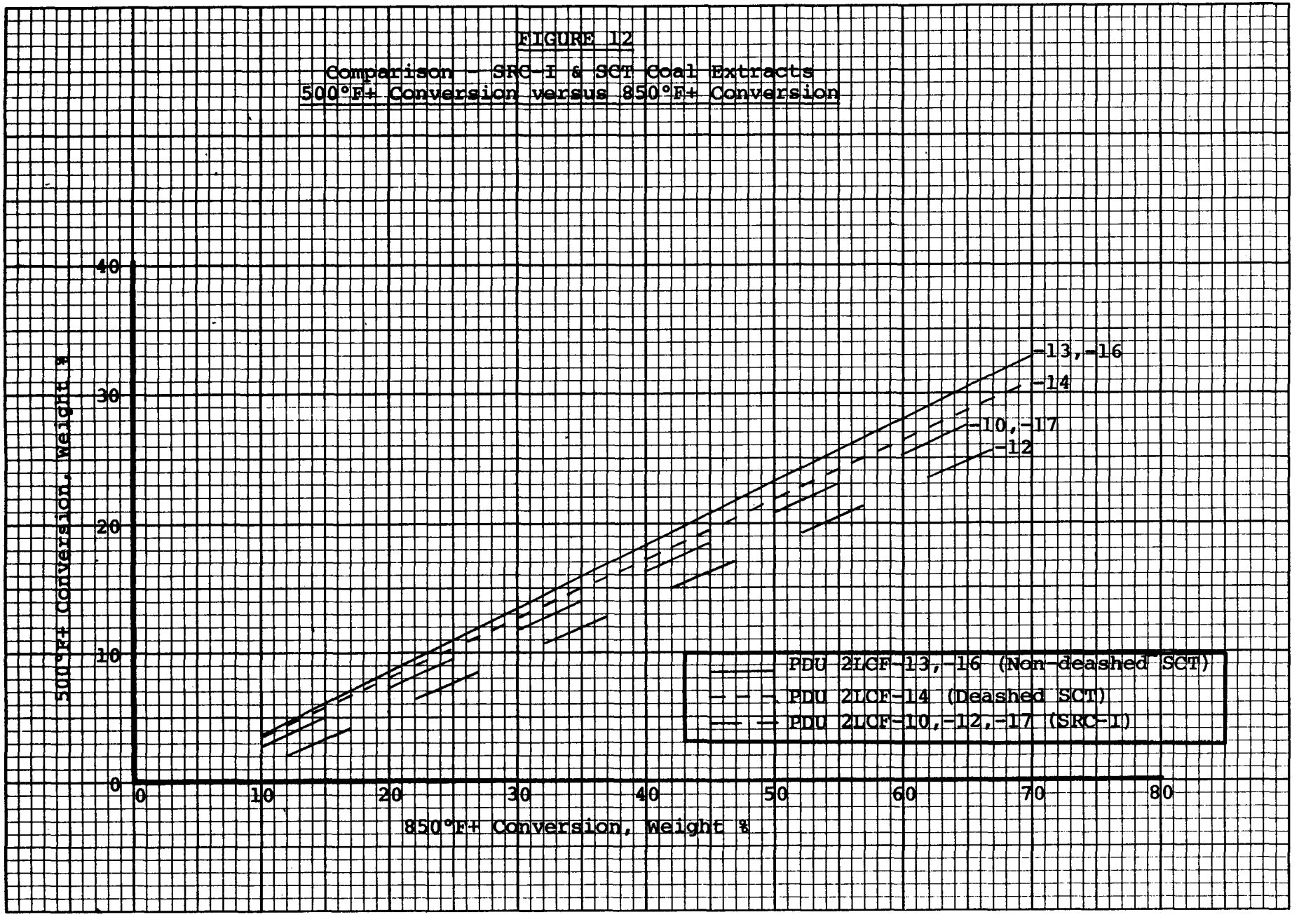


FIGURE 11
Comparison - SRC-I & SCT Coal Extracts
650°F+ Conversion versus 850°F+ Conversion
650°F+ Conversion, Weight %
850°F+ Conversion, Weight %
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
-13, -16
-10
-12, -17
-14
PDU 2LCF-13,-16 (Non-deashed SCT)
PDU 2LCF-14 (Deashed SCT)
PDU 2LCF-10,-12,-17 (SRC-I)

FIGURE 12

Comparison - SRC-I & SCT Coal Extracts
500°F+ Conversion versus 850°F+ Conversion



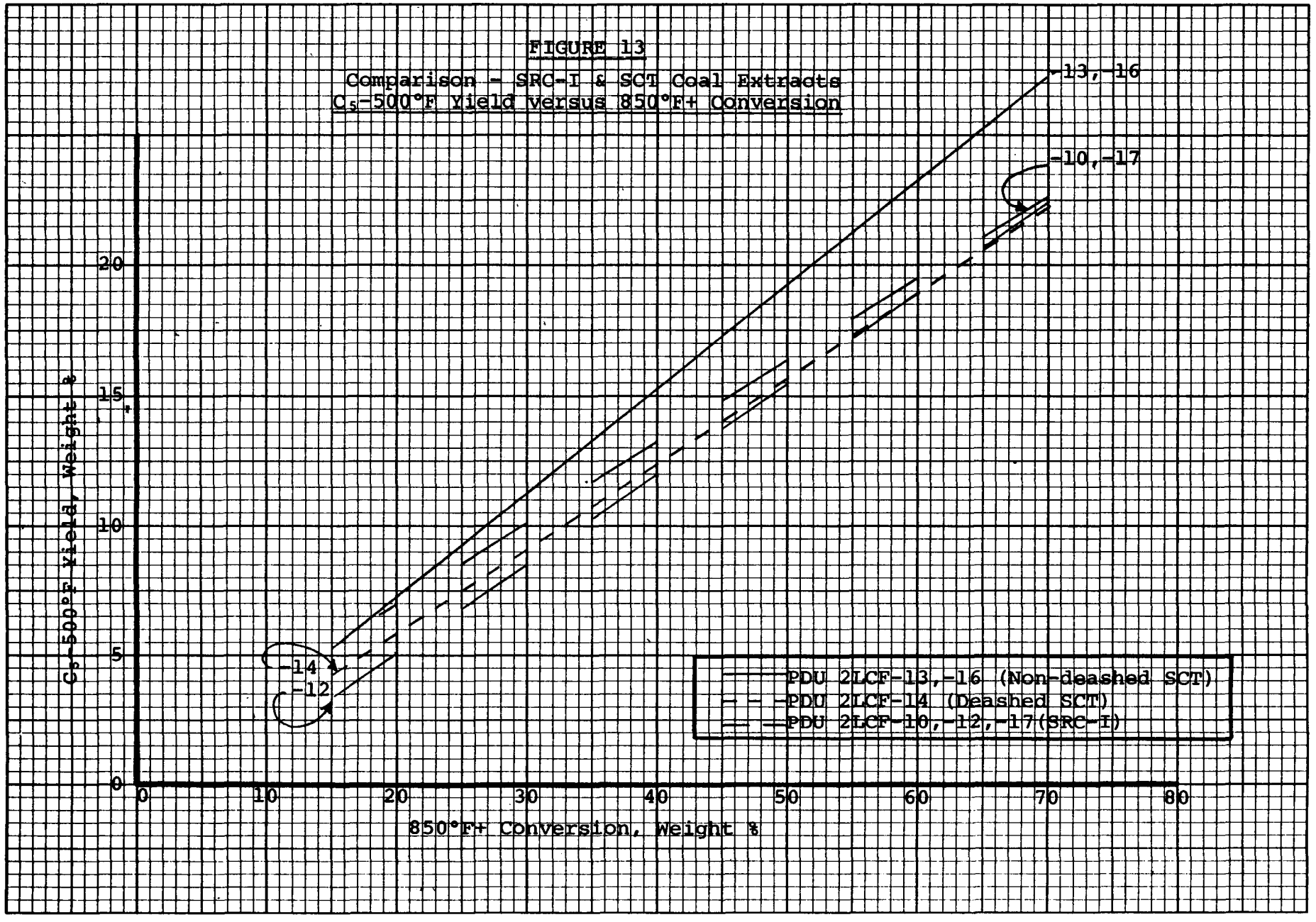
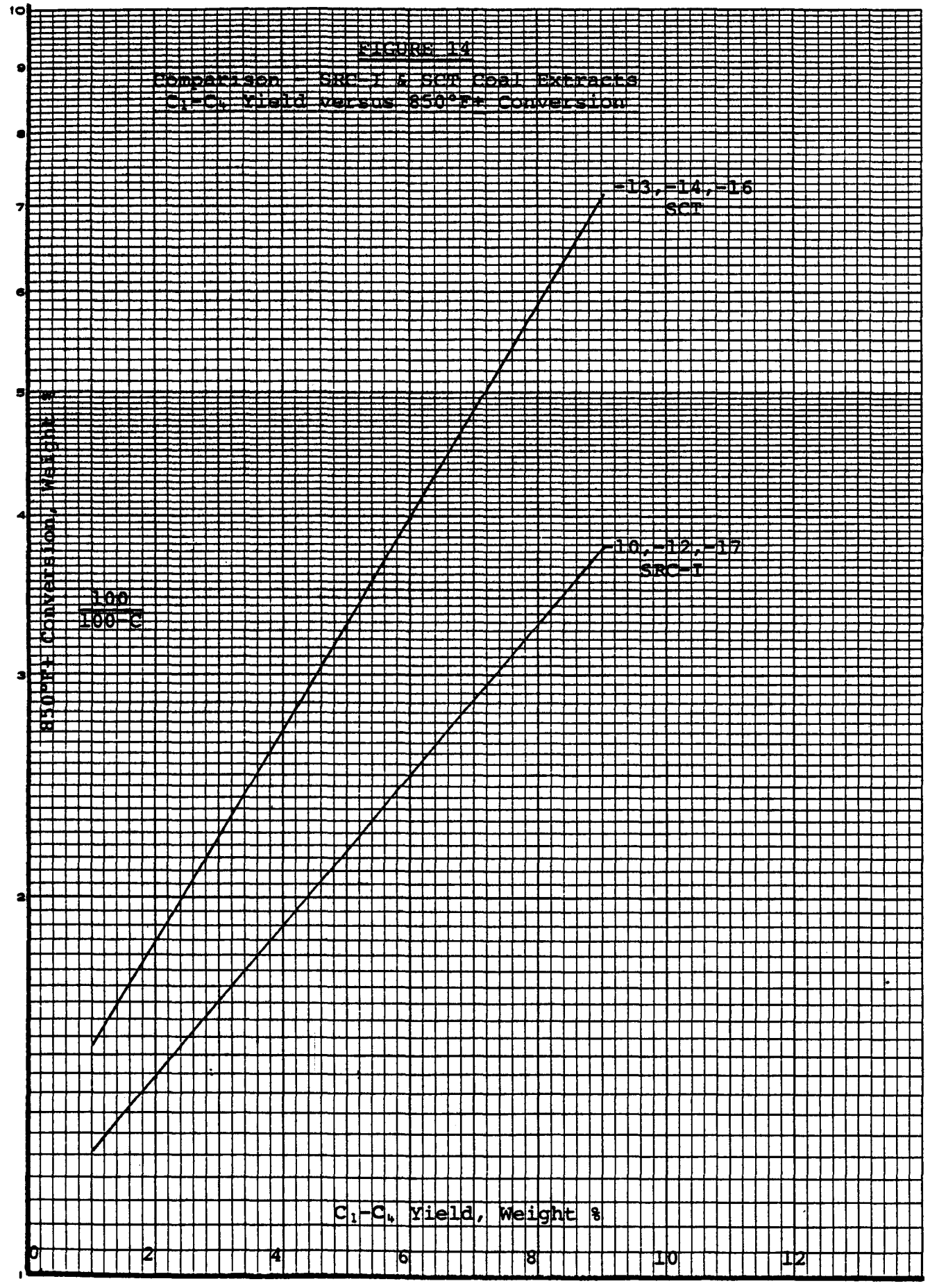


FIGURE 13
Comparison - SRC-I & SCT Coal Extracts
C_5-500°F Yield versus 850°F+ Conversion
-13,-16
-10,-17
-14
-12
PDU 2LCF-13,-16 (Non-deashed SCT)
PDU 2LCF-14 (Deashed SCT)
PDU 2LCF-10,-12,-17(SRC-I)
C_5-500°F Yield, Weight %
850°F+ Conversion, Weight %
0
5
10
15
20
0
10
20
30
40
50
60
70
80

FIGURE 14

Comparison – SRC-I & SCT Coal Extracts
C_1-C_4 Yield versus 850°F+ Conversion



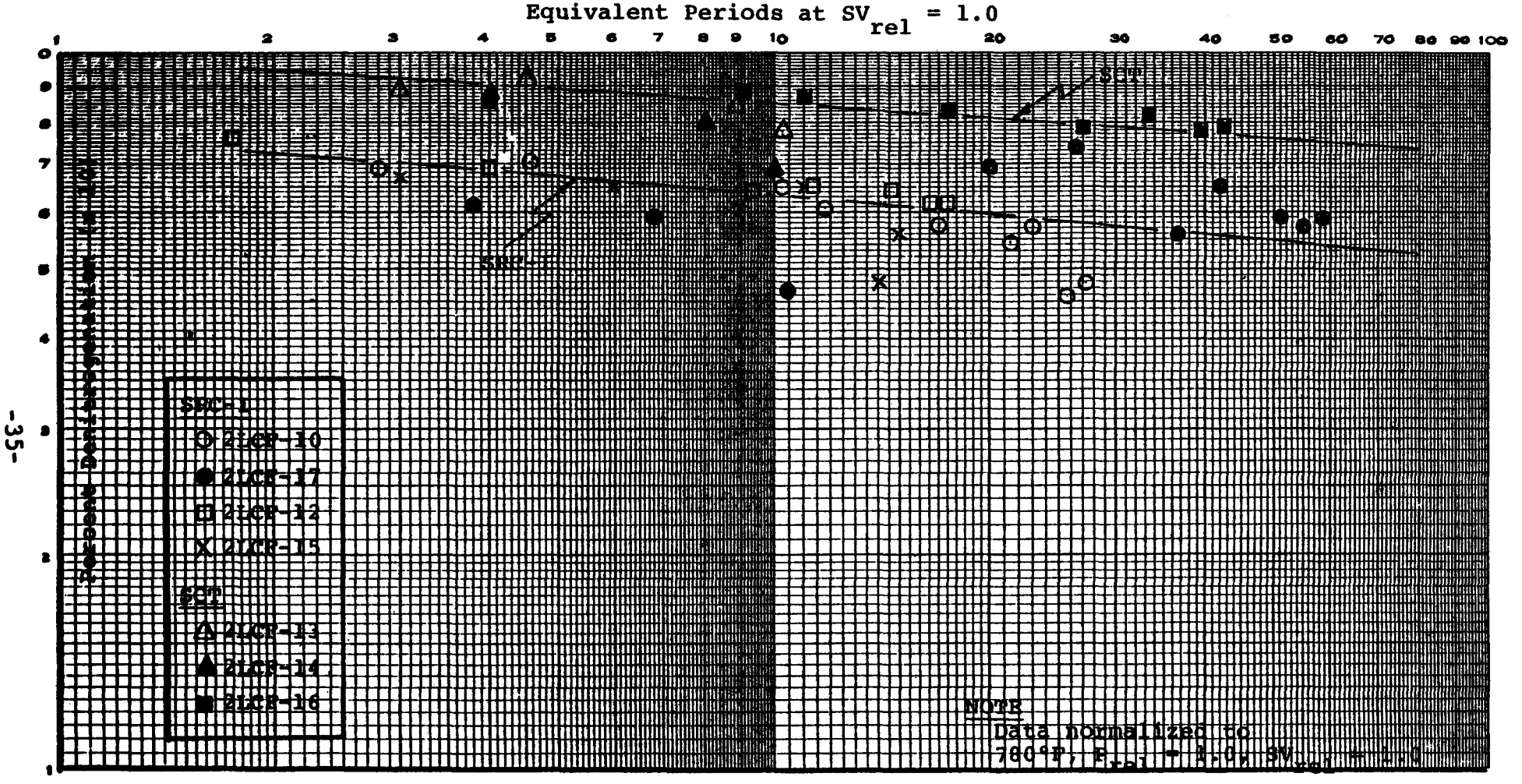


FIGURE 15

Percentage Denitrogenation versus Equivalent Time

TABLE I

LC-FINING PDU OPERATION
FEED PROPERTIES
SRC-I/PREHYDROGENATED KOPPERS HEAVY RESIDUE CREOSOTE OIL
(Cool Non-catalytic Zones)

Run No. (2LCF-)	10	10	10	10
Component	Solvent LCF-41/KC-12	SRC N-024	Blend (1-9)	Blend (10-31)
Composition				
Solvent, Wt% (ex drum)	-	-	45.9	43.4
Description, IBP °F	500	-	-	-
SRC, Wt% (ex drum)	-	-	54.1	56.6
850°F+, Vol% (by distilln)	-	-	51.6	55.1
850°F+, Wt% (by distilln)	-	-	53.5	57.4
Gravity, °API	-1.0	-15.7	-12.7	-12.2
, SP 60/60°F	1.0844	1.2217	1.1913	1.1858
Softening Point, °F	<-10(a)	332	142	133
Viscosity, Kin. CS @ 100°F	12.86	-	-	-
Kin. CS @ 210°F	2.40	-	690	3669
Kin. CS @ 310°F	-	-	30.86	71.71
Elemental Content, Wt%				
Carbon	92.37	86.54	89.17	89.82
Hydrogen	7.41	5.88	6.37	6.45
Oxygen	-	4.65	2.47	2.85
Nitrogen	0.28	2.10	1.13	1.36
Sulfur	<0.06	-	0.44	0.46
Ash, Wt%	-	-	0.10	0.09
Metals, ppm				
Vanadium		<50	8	5
Nickel		<5	<1	2
Iron		<5	151	212
Titanium		526	106	150
Sodium		<5	3	5
Potassium		126	17	1
Calcium		721	33	18
Distillate Fractions				
IBP-500°F, Vol%	10.4			
Gravity, °API	15.0			
, SP 60/60°F	0.9654			
Carbon, Wt%	90.08			
Hydrogen, Wt%	9.31			
Nitrogen, Wt%	<0.20			
Sulfur, Wt%	<0.06			
500-650°F, Vol%	42.7		25.3	21.8
Gravity, °API	3.2		5.3	3.6
, SP 60/60 °F	1.0505		1.0344	1.0474
Carbon, Wt%	91.67		89.46	90.01
Hydrogen, Wt%	7.74		7.74	7.55
Nitrogen, Wt%	<0.20		<0.20	<0.20
Sulfur, Wt%	<0.06		<0.06	0.09
650-850°F, Vol%	43.4	-(b)	25.8	24.5
Gravity, °API	-5.9	-(b)	-5.5	-6.3
, SP 60/60 °F	1.1269	-(b)	1.1231	1.1304
Carbon, Wt%	92.30	87.90	91.86	91.98
Hydrogen, Wt%	6.61	7.10	6.80	6.46
Nitrogen, Wt%	0.38	1.26	0.48	0.55
Sulfur, Wt%	0.14	0.50	0.19	0.23
850°F+, Vol%	3.8	90.4	51.6	55.1
Gravity, °API	-13.4	-17.7	-16.8	-17.2
, SP 60/60 °F	1.198	1.243	1.234	1.238
Carbon, Wt%	92.45	87.90	86.67	90.34
Hydrogen, Wt%	6.07	5.85	5.79	5.50
Nitrogen, Wt%	0.06	2.17	1.98	2.02
Sulfur, Wt%	0.21	0.66	0.66	0.65

(a) Pour Point
(b) Insufficient Sample

TABLE II
LC-FINING PDU OPERATION
FEED PROPERTIES
SRC-I/PREHYDROGENATED KOPPERS HEAVY RESIDUE CREOSOTE OIL
(1 Weight % Ash)

Run No. (2LCF-)	12	12	12	12
Component	Solvent KC-15	SRC N-024	Hi-Ash SRC N-084	Blend
Composition				
Solvent, Wt% (ex drum)	-	-	-	43.7
Description, IBP °F	500	-	-	500
SRC, Wt% (ex drum)	-	-	-	56.3(c)
850°F+, Vol% (by distilln)	-	-	-	53.7
850°F+, Wt% (by distilln)	-	-	-	56.4
Gravity, °API	0.7	-15.7	-40.8	-13.4
, SP 60/60°F	1.0703	1.2217	1.5602	1.198
Softening Point, °F	<-15(p)	332	370	140
Viscosity, Kin. CS @ 100°F	9.79	-	-	-
Kin. CS @ 210°F	2.06	-	-	-
Kin. CS @ 300°F	-	-	-	89.6
Kin. CS @ 350°F	-	-	-	29.4
Kin. CS @ 450°F	-	970.5	-	-
Elemental Content, Wt%				
Carbon	90.85	86.54	55.14	89.15
Hydrogen	7.06	5.88	3.32	6.37
Oxygen	-	4.65	14.99	3.13
Nitrogen	0.23	2.10	1.24	1.30
Sulfur	<0.06	-	3.19	0.49
Ash, Wt%	Tr	-	31.78	0.98
Metals, ppm				
Vanadium		<50	2.4	7.5
Nickel		<5	<5	1.9
Iron		<5	32800	330
Titanium		526	1024	145
Sodium		<5	310	38
Potassium		126	4600	90
Calcium		721	1049	290
Distillate Fractions				
IBP-500°F, Vol%	11.6		(b)	
Gravity, °API	17.8			
, SP 60/60°F	0.9478			
Carbon, Wt%	89.99			
Hydrogen, Wt%	9.33			
Nitrogen, Wt%	<0.20			
Sulfur, Wt%	<0.06			
500-650°F, Vol%	48.1			27.7
Gravity, °API	3.3			5.5
, SP 60/60 °F	1.0495			1.0328
Carbon, Wt%	90.34			91.28
Hydrogen, Wt%	7.53			8.08
Nitrogen, Wt%	<0.20			<0.20
Sulfur, Wt%	<0.06			<0.06
650-850°F, Vol%	33.8	-(a)		20.1
Gravity, °API	-5.8	-(a)		-5.9
, SP 60/60 °F	1.1261	-(a)		1.1213
Carbon, Wt%	92.16	87.90		91.44
Hydrogen, Wt%	6.62	7.10		6.43
Nitrogen, Wt%	0.35	1.26		0.53
Sulfur, Wt%	<0.06	0.50		0.14
850°F+, Vol%	5.8	90.4		53.7
Gravity, °API	-11.3	-17.7		-19.1
, SP 60/60 °F	1.177	1.243		1.259
Carbon, Wt%	93.48	87.90		86.59
Hydrogen, Wt%	5.90	5.85		5.64
Nitrogen, Wt%	0.46	2.17		1.97
Sulfur, Wt%	<0.06	0.66		0.80

(a) Insufficient Sample
(b) Cracked at beginning of distillation
(c) SRC (N-024) and high ash SRC (N-084) were 53.4 Wt.% and 2.9 Wt.%, respectively
(d) IBP-650°F
(p) Pour Point

TABLE III
LC-FINING PDU OPERATION
FEED PROPERTIES
SHORT CONTACT TIME COAL EXTRACT
(Wilsonville Run 146)

Run No. (2LCF-)	13(a)	14(b)	14(b)	14(b)
Period	-	1/2	3/9B	10/11
Composition				
Solvent, Wt% (ex drum)	-	-	-	-
Description,	No. 3199	No. 3199-DA	No. 3199-DA	No. 3199-DA
SRC, Wt% (ex drum)	-	-	-	-
850°F+, Vol% (by distilln)	-	-	-	-
850°F+, Wt% (by distilln)	-	-	-	-
Gravity, °API	-13.4	-11.5	-11.3	-10.2
, SP 60/60°F	1.1979	1.179	1.177	1.1667
Softening Point, °F	222	230	-	-
Viscosity, Kin. CS @ 300°F	755.96	-	-	-
Kin. CS @ 310°F	-	-	-	-
Kin. CS @ 350°F	157.5	516.12	-	-
Kin. CS @ 400°F	-	82.0	-	-
Elemental Content, Wt%				
Carbon	81.36	85.67	86.11	85.75
Hydrogen	6.87	6.94	7.12	7.09
Oxygen	7.00	4.92	4.85	5.05
Nitrogen	1.28	1.53	1.44	1.37
Sulfur	1.56	0.99	0.95	0.96
Ash, Wt%	6.03	0.14	0.14	0.16
Metals, ppm				
Vanadium	28	8.9		
Nickel	52	4.5		
Iron	9500	330		
Titanium	220	380		
Sodium	110	6.8		
Potassium	720	2.7		
Calcium	860	13		
Distillate Fractions				
IBP-500°F, Vol%				
Gravity, °API				
, SP 60/60°F				
Carbon, Wt%				
Hydrogen, Wt%				
Nitrogen, Wt%				
Sulfur, Wt%				
500-650°F, Vol%	25.2(c)(d)	12.0(c)(d)	12.7(c)(d)	19.6(c)(d)
Gravity, °API	9.1	7.3	7.7	8.0
, SP 60/60 °F	1.0064	1.0195	1.0165	1.0143
Carbon, Wt%	86.74	87.19	86.63	87.01
Hydrogen, Wt%	8.95	9.20	8.88	8.90
Nitrogen, Wt%	0.66	0.75	0.65	0.66
Sulfur, Wt%	0.38	0.41	-	-
650-850°F, Vol%	30.4(c)	35.0(c)	32.2(c)	28.7(c)
Gravity, °API	1.0	1.0	2.3	1.7
, SP 60/60 °F	1.0679	1.0679	1.0575	1.0623
Carbon, Wt%	87.68	86.61	87.41	87.12
Hydrogen, Wt%	8.02	8.70	8.39	8.36
Nitrogen, Wt%	1.12	1.08	0.99	1.01
Sulfur, Wt%	0.57	0.58	-	-
850°F+, Vol%	46.2(c)	54.9(c)	57.4(c)	53.9(c)
Gravity, °API	-25.5	-16.9	-16.6	-16.4
, SP 60/60 °F	1.335	1.235	1.231	1.229
Carbon, Wt%	69.70	85.06	84.61	85.24
Hydrogen, Wt%	5.07	6.12	6.05	6.07
Nitrogen, Wt%	1.53	1.88	1.77	1.82
Sulfur, Wt%	2.37	1.44	-	-

(a) Topped filter feed from Wilsonville - Run 146. Non-deashed
(b) Topped filter feed from Wilsonville - Run 146. Deashed
(c) Total volume of fractions is higher than charge due to volume decrease when combined and blended.
(d) IBP-650°F cut

TABLE IV

LC-FINING PDU OPERATION
FEED PROPERTIES
SRC-I/PREHYDROGENATED KOPPERS HEAVY RESIDUE CREOSOTE OIL
(Catalyst Check)

Run No. (2LCF-)	15	15	15	15
Component	Solvent KC-15	SRC N-024	(1-9) Blend	(10-15) Blend
Composition				
Solvent, Wt% (ex drum)	-	-	44.5	44.5
Description, IBP °F	500	-	500	500
SRC, Wt% (ex drum)	-	-	55.5	55.5
850°F+, Vol% (by distilln)	-	-	51.1	55.4
850°F+, Wt% (by distilln)	-	-	53.9	58.0
Gravity, °API	0.7	-15.7	-10.9	-12.2
, SP 60/60°F	1.0703	1.2217	1.1731	1.186
Softening Point, °F	<-15(a)	332	-	-
Viscosity, Kin. CS @ 100°F	9.79	-	-	-
Kin. CS @ 210°F	2.06	-	-	-
Kin. CS @ 300°F	-	-	151.52	-
Kin. CS @ 350°F	-	-	42.11	-
Elemental Content, Wt%				
Carbon	90.85	86.54	89.01	89.12
Hydrogen	7.06	5.88	6.25	6.30
Oxygen	-	4.65	2.66	3.18
Nitrogen	0.23	2.10	1.25	1.39
Sulfur	<0.06	-	0.36	0.41
Ash, Wt%	Tr	-	0.09	
Metals, ppm				
Vanadium		<50	43	
Nickel		<5	<2	
Iron		<5	180	
Titanium		526	150	
Sodium		<5	37	
Potassium		126	<2	
Calcium		721	74	
Distillate Fractions				
IBP-500°F, Vol%	11.6			
Gravity, °API	17.8			
, SP 60/60°F	0.9478			
Carbon, Wt%	89.99			
Hydrogen, Wt%	9.33			
Nitrogen, Wt%	<0.20			
Sulfur, Wt%	<0.06			
500-650°F, Vol%	48.1		27.9(c)	25.5(c)
Gravity, °API	3.3		5.9	5.4
, SP 60/60 °F	1.0495		1.0298	1.0336
Carbon, Wt%	90.34		89.01	-
Hydrogen, Wt%	7.53		7.72	-
Nitrogen, Wt%	<0.20		<0.20	-
Sulfur, Wt%	<0.06		<0.06	<0.06
650-850°F, Vol%	33.8	-(b)	22.4	20.5
Gravity, °API	-5.8	-(b)	-6.6	-5.9
, SP 60/60 °F	1.1261	-(b)	1.1325	1.1267
Carbon, Wt%	92.16	87.90	92.03	-
Hydrogen, Wt%	6.62	7.10	6.61	-
Nitrogen, Wt%	0.35	1.26	0.53	-
Sulfur, Wt%	<0.06	0.50	0.15	0.14
850°F+, Vol%	5.8	90.4	51.1	55.4
Gravity, °API	-11.3	-17.7	-17.1	-17.7
, SP 60/60 °F	1.177	1.243	1.2366	1.243
Carbon, Wt%	93.48	87.90	87.15	-
Hydrogen, Wt%	5.90	5.85	5.79	-
Nitrogen, Wt%	0.46	2.17	2.00	-
Sulfur, Wt%	-	0.66	0.66	0.64

(a) Pour Point
(b) Insufficient Sample
(c) IBP-650°F

TABLE V

LC-FINING PDU OPERATION
FEED PROPERTIES
SHORT CONTACT TIME COAL EXTRACT
(High Space Velocity and Pressure)

Run No. (2LCF-)	16	16	16	16	16
Period	1/3	4/12	13/16	17/19A	19B/25
Composition					
Solvent, Wt% (ex drum)	-	-	-	-	-
Description, IBP °F	No. 3198(a)	No. 3198(a)	No. 3198(a)	No. 3198(a)	No. 3198(a)
SRC, Wt% (ex drum)	-	-	-	-	-
850°F+, Vol% (by distiln)	-	-	-	-	-
850°F+, Wt% (by distiln)	-	-	-	-	-
Gravity, °API	-15.3	-15.5	-14.9	-14.8	-12.3
, SP 60/60°F	1.2175	1.2199	1.2139	1.2129	1.1871
Softening Point, °F	182	187	190	-	179
Viscosity, Kin. CS @ 300°F	170.73	1840.9	637.8	-	298.0
Kin. CS @ 310°F	-	-	-	-	-
Kin. CS @ 350°F	50.15	175.9	112.11	-	57.6
Kin. CS @ 400°F	-	-	-	-	-
Elemental Content, Wt%					
Carbon	80.42	78.99	81.39	81.11	80.12
Hydrogen	6.82	6.52	6.78	6.70	6.66
Oxygen	7.56	7.60	7.34	7.95	7.21
Nitrogen	1.34	1.34	1.43	1.38	1.33
Sulfur	1.55	1.63	1.73	1.71	1.55
Ash, Wt%	6.94	7.36	6.81	6.84	6.19
Metals, ppm					
Vanadium	25	20	21		36
Nickel	23	17	18		52
Iron	12000	12000	11000		8700
Titanium	190	200	190		240
Sodium	200	180	170		170
Potassium	110	800	750		870
Calcium	1300	1500	1300		1200
Distillate Fractions					
IBP-650°F, Vol%	10.5(b)	16.9(b)	14.8(b)	20.0(b)	23.1
Gravity, °API	7.9	6.7	8.0	7.9	8.5
, SP 60/60°F	1.0151	1.0239	1.0143	1.0151	1.0107
Carbon, WtT	86.45	86.60	86.83	85.59	84.55
Hydrogen	8.90	8.62	8.82	8.68	8.85
Nitrogen, Wt%	0.64	0.69	0.79	0.76	0.73
Sulfur, Wt%	0.38	0.39	0.41	0.43	0.39
650-850°F, Vol%	34.1(b)	35.0(b)	31.9(b)	29.5(b)	28.4
Gravity, °API	1.6	-1.1	0.9	-0.6	0.1
, SP 60/60 °F	1.0631	1.0852	1.0687	1.0806	1.0753
Carbon, Wt%	88.16	86.51	86.89	87.52	87.92
Hydrogen, Wt%	8.46	7.94	8.29	8.17	8.28
Nitrogen, Wt%	1.13	1.16	1.13	1.18	1.16
Sulfur, Wt%	0.56	0.66	0.61	0.63	0.63
850°F+, Vol%	55.8(b)	49.4(b)	54.2(b)	51.6(b)	48.5
Gravity, °API	-26.1	-26.6	-25.5	-26.0	-25.5
, SP 60/60°F	1.342	1.349	1.3355	1.3415	1.3354
Carbon, Wt%	73.80	72.93	74.24	73.90	74.27
Hydrogen, Wt%	5.25	5.14	5.16	5.07	5.25
Nitrogen, Wt%	1.64	1.78	1.62	1.70	1.66
Sulfur, Wt%	2.17	2.48	2.49	2.46	2.45

(a) Topped filter feed from Wilsonville - Run 145. Non-deashed.
(b) Total volume of fractions is higher than charge due to volume decrease when combined and blended.

TABLE VI
LC-FINING PDU OPERATION
FEED PROPERTIES
SRC-I/PREHYDROGENATED KOPPERS HEAVY RESIDUE CREOSOTE OIL
(High Space Velocity and Pressure)

Run No. (2LCF-) Component	17 Solvent KC-15	17 SRC N-024	17 (1-9) Blend	17 (10) Blend	17 (11-15) Blend	17 (16-17) Blend	17 (18-22) Blend	17 (d) (23-25) Blend	17 (e) (26-27) Blend	17 (30-32) Blend
Composition	-	-	21.8	23.2	21.3	21.8	21.8	21.8	20.3	21.4
Solvent, Wt% (ex drum)	500	-	500	500	500	500	500	500	500	500
Description, IBP °F	-	-	78.2	76.8	78.7	78.2	78.2	78.2	79.7	78.6
SRC, Wt% (ex drum)	-	-	69.8	68.4	73.0	70.3	71.6	73.1	75.6	72.4
850°F+, Vol% (by distilln)	-	-	72.5	71.2	75.5	71.6	72.6	75.2	79.0	73.7
850°F+, Wt% (by distilln)	0.7	-15.7	-13.0	-13.2	-13.5	-15.0	-15.6	-13.9	-12.5	-15.5
Gravity, °API	1.0703	1.2217	1.1941	1.1960	1.1989	1.2148	1.2205	1.2029	1.189	1.220
, SP 60/60°F	<-15(a)	332								
Softening Point, °F	9.79	-	-							
Viscosity, Kin. CS @ 100°F	2.06	-	-							
Kin. CS @ 210°F	-	-	7711.3							
Kin. CS @ 300°F	-	-	654.8							
Kin. CS @ 350°F										
Elemental Content, Wt%	20.85	86.54	87.79	88.25	87.22	88.13	88.39	88.13	89.26	88.75
Carbon	7.06	5.88	6.07	6.11	6.10	6.08	6.21	6.04	6.00	6.06
Hydrogen	-	4.65	3.54	3.70	4.20	3.74	3.68	3.83	3.86	3.98
Oxygen	0.23	2.10	1.39	1.66	1.54	1.68	1.59	1.65	1.79	1.59
Nitrogen	<0.06	-	0.58		0.58	0.65	0.58	0.77	0.60	0.61
Sulfur	Tr	-	0.22		0.24	0.17	0.19	0.13	0.13	0.23
Ash, Wt%										
Metals, ppm		<50	<5							8
Vanadium		<5	<5							<5
Nickel		<5	380							250
Iron		526	250							230
Titanium		<5	73							62
Sodium		126	14							3
Potassium		721	120							91
Calcium										
Distillate Fractions	11.6									
IBP-500°F, Vol%	17.8									
Gravity, °API	0.9478									
, SP 60/60°F	89.99									
Carbon, Wt%	9.33									
Hydrogen, Wt%	<0.20									
Nitrogen, Wt%	<0.06									
Sulfur, Wt%	48.1		14.9(c)	15.8(c)	14.6(c)	15.4(c)	15.8(c)	11.4(c)	7.8(c)	12.8(c)
500-650°F, Vol%	3.3		4.9	4.3	5.1	5.2	5.1	2.4	2.3	4.6
Gravity, °API	1.0495		1.0374	1.0420	1.0359	1.0351	1.0359	1.0568	1.0575	1.0397
, SP 60/60 °F	90.34		89.06	-	88.02	89.27	88.19	88.98	90.18	88.59
Carbon, Wt%	7.53		7.76	-	7.75	7.80	7.87	7.51	7.68	7.59
Hydrogen, Wt%	<0.20		<0.20	-	<0.20	<0.20	0.22	0.20	0.23	<0.20
Nitrogen, Wt%	<0.06		<0.06	-	0.05	0.08	0.07	0.07	0.06	0.12
Sulfur, Wt%	33.8	-(b)	15.3	15.7	12.7	16.3	14.9	15.7	14.9	16.4
650-850°F, Vol%	-5.8	-(b)	-6.9	-7.4	-5.7	-7.2	-7.1	-6.5	-5.6	-5.9
Gravity, °API	1.1261	-(b)	1.1354	1.1400	1.1250	1.1381	1.1371	1.1322	1.1239	1.1262
, SP 60/60 °F	92.16	87.90	90.84	-	90.83	91.39	91.22	91.62	90.75	91.67
Carbon, Wt%	6.62	7.10	6.72	-	6.55	6.78	6.61	6.64	6.70	6.83
Hydrogen, Wt%	0.35	1.26	0.76	-	0.65	0.82	0.82	0.81	0.70	0.75
Nitrogen, Wt%	<0.06	0.50	0.29	-	0.22	0.33	0.29	0.27	0.24	0.35
Sulfur, Wt%	5.8	90.4	69.8	68.4	73.0	70.3	71.6	73.1	75.6	72.4
850°F+, Vol%	-11.3	-17.7	-17.4	-17.8	-17.3	-17.1	-17.1	-17.1	-17.6	-17.6
Gravity, °API	1.177	1.243	1.2401	1.245	1.2392	1.2373	1.2374	1.2368	1.2420	1.2420
, SP 60/60 °F	93.48	87.90	86.74	-		86.73	87.42	87.39	86.89	83.99
Carbon, Wt%	5.90	5.85	5.84	-	5.80	5.74	5.68	5.73	5.70	5.73
Hydrogen, Wt%	0.46	2.17	2.09	-	2.02	2.12	2.16	2.06	1.99	2.07
Nitrogen, Wt%		0.66	0.74	-	0.71	0.80	0.69	0.71	0.72	0.71
Sulfur, Wt%										

(a) Pour Point
(b) Insufficient Sample
(c) IBP-650°F
(d) The prehydrogenated creosote oil was stripped with nitrogen at 390°F to remove light ends causing "vapor lock" in feed pump.
(e) A different drum of prehydrogenated creosote oil with a smaller amount of IBP-650°F fraction was used. Lummus Sample No. KC-18.

TABLE VII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOL% SRC-I/500°F IBP SOLVENT COOL NON-CATALYTIC ZONES)
Run 2LCF-10 (Period 3)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and Weight Percent on Fresh Feed	3.00(b) 1.74(b)	12.63 10.04	33.00 28.31	20.66 18.55	37.87 37.05	107.16 95.69
Gravity, °API	30.9	18.6	8.2	1.9	-9.0	1.5
SP 60/60°F	0.8713	0.9427	1.0129	1.0607	1.155	1.0639
Pour Point, °F	<-15	<-15	<-15	20	-	25
Softening Point, °F	-	-	-	-	203	-
Viscosity, CST @ 100°F	1.27	2.47	8.82	68.1	-	176.07
CST @ 210°F	-	1.04	2.09	5.10	-	9.19
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.7	2.0				
Naphthenes	-	-				
Aromatics	41.4	77.6				
Saturates	56.9	20.4				
Elemental, Wt%						
Carbon	86.64	88.73	89.57	91.13	90.80	89.01
Hydrogen	12.20	10.59	9.22	8.66	7.27	8.35
Oxygen	0.38	0.10	0.51	0.31	0.94	0.53
Nitrogen	<0.20(a)	0.06	0.15	0.28	1.05	0.50
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.21	0.07

(a) Nitrogen lower limit approximately 0.20 weight percent.
(b) C_5+ in gas are 2.56 liquid volume % and 1.62 weight % on feed.

TABLE VIII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 50/50 VOL% SRC-I/500°F IBP SOLVENT (COOL NON-CATALYTIC ZONES) Run 2LCF-10 (Period 5)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	3.62(b)	17.32	32.70	19.72	31.34	104.70
Weight Percent on Fresh Feed	2.55(b)	13.68	27.65	17.59	30.58	92.05
Gravity, °API	30.7	19.2	9.6	2.3	-9.2	3.6
SP 60/60°F	0.8724	0.9390	1.0028	1.0575	1.157	1.0474
Pour Point, °F	<-15	<-15	<-15	20	-	<-10
Softening Point, °F	-	-	-	-	162	-
Viscosity, CST @ 100°F	1.18	2.37	7.8	43.2	-	44.27
CST @ 210°F	0.63	0.99	1.92	4.26	-	5.34
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.7	1.8				
Naphthenes	-	-				
Aromatics	50.0	78.8				
Saturates	48.3	19.4				
Elemental, Wt%						
Carbon	86.78	89.12	90.99	91.74	91.16	89.50
Hydrogen	11.55	10.69	9.55	8.36	7.02	8.50
Oxygen	0.18	0.11	0.26	0.18	0.73	0.28
Nitrogen	<0.20(a)	0.054	0.10	0.21	0.79	0.32
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.16	0.04

(a) Nitrogen lower limit approximately 0.20 weight percent.
(b) C_5+ in gas are 5.18 liquid volume % and 3.18 weight % on feed.

TABLE IX

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOL% SRC-I/500°F IBP SOLVENT (COOL NON-CATALYTIC ZONES)
Run 2LCF-10 (Period 11)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	3.07(b)	11.08	29.97	28.17	29.41	101.70
Weight Percent on Fresh Feed	2.03(b)	8.88	25.56	25.68	29.37	91.52
Gravity, °API	31.1	18.5	9.7	0.6	-10.9	1.1
SP 60/60°F	0.8702	0.9433	1.0021	1.0709	1.1731	1.0671
Pour Point, °F	<-15	<-15	<-15	25	-	0
Softening Point, °F	-	-	-	-	223	-
Viscosity, CST @ 100°F	1.22	2.22	6.40	65.9	-	96.6
CST @ 210°F	0.60	0.95	1.75	4.73	-	14.04
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.8	2.0				
Naphthenes	-	-				
Aromatics	46.9	82.0				
Saturates	51.3	16.0				
Elemental, Wt%						
Carbon	86.86	89.29	91.04	90.64	90.09	90.25
Hydrogen	11.63	10.18	9.27	8.22	6.93	8.25
Oxygen	0.39	0.11	0.39	0.27	0.81	0.45
Nitrogen	<0.20(a)	<0.20(a)	0.14	0.29	0.98	0.48
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.29	0.01

(a) Nitrogen lower limit approximately 0.20 weight percent.
(b) C_5+ in gas are 4.76 liquid volume and 2.91 weight % on feed.

TABLE X

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOL% SRC-I/500°F IBP SOLVENT COOL NON-CATALYTIC ZONES)
Run 2LCF-10 (Period 13)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	3.18(b)	15.02	32.62	25.00	24.38	100.20
Weight Percent on Fresh Feed	2.12(b)	11.97	27.93	22.69	24.65	89.36
Gravity, °API	31.9	18.7	8.6	0.7	-12.9	2.3
SP 60/60°F	0.8660	0.9421	1.0100	1.0703	1.193	1.0575
Pour Point, °F	<-15	<-15	<-15	20	-	<-5
Softening Point, °F	-	-	-	-	225	-
Viscosity, CST @ 100°F	1.14	2.28	7.55	87.96	-	50.2
CST @ 210°F	0.62	0.97	1.87	5.37	-	5.18
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.7	1.7				
Naphthenes	-	-				
Aromatics	44.4	81.3				
Saturates	53.9	17.0				
Elemental, Wt%						
Carbon	86.89	89.26	90.31	91.78	91.82	89.80
Hydrogen	11.79	10.24	9.05	7.97	6.67	8.19
Oxygen	0.37	0.13	0.31	0.24	0.67	0.33
Nitrogen	<0.20(a)	0.09	0.14	0.32	1.00	0.40
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.28	0.01

(a) Nitrogen lower limit approximately 0.20 weight percent.
(b) C_5+ in gas are 6.19 liquid volume % and 3.78 weight % on feed.

TABLE XI

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOL% SRC-I/500°F IBP SOLVENT (COOL NON-CATALYTIC ZONES)
Run 2LCF-10 (Period 19)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	2.85(b)	13.19	30.62	26.07	27.69	100.42
Weight Percent on Fresh Feed	2.14(b)	10.44	25.92	23.62	27.71	89.83
Gravity, °API	29.8	18.3	9.4	0.2	-12.3	0.9
SP 60/60°F	0.8772	0.9446	1.0043	1.0746	1.1873	1.0688
Pour Point, °F	<-15	<-15	<-15	35	-	-5
Softening Point, °F	-	-	-	-	228	-
Viscosity, CST @ 100°F	1.17	2.32	6.23	73.40	-	80.73
CST @ 210°F	0.60	1.05	1.74	5.20	-	6.15
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.7	1.7				
Naphthenes	-	-				
Aromatics	50.6	82.5				
Saturates	47.7	15.8				
Elemental, Wt%						
Carbon	86.91	89.46	89.73	91.94	90.63	90.07
Hydrogen	11.46	10.18	8.89	8.01	6.70	7.94
Oxygen	0.56	0.14	0.39	0.30	0.84	0.46
Nitrogen	<0.20(a)	0.12	0.16	0.36	1.12	0.51
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.81	0.07

(a) Nitrogen lower limit approximately 0.20 weight percent.
(b) C_5^+ in gas are 6.12 liquid volume % and 3.70 weight % on feed.

TABLE XII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOL% SRC-I/500°F IBP SOLVENT (COOL NON-CATALYTIC ZONES)
Run 2LCF-10 (Period 24B)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	5.69(b)	14.70	29.02	27.95	23.43	100.79
Weight Percent on Fresh Feed	4.05(b)	11.80	24.86	25.60	23.86	90.17
Gravity, °API	34.8	18.0	8.9	-0.1	-13.4	1.9
SP 60/60°F	0.8509	0.9465	1.0078	1.0768	1.198	1.0607
Pour Point, °F	<-15	<-15	<-5	25	-	<-5
Softening Point, °F	-	-	-	-	233	-
Viscosity, CST @ 100°F	0.96	2.15	6.77	80.7	-	42.6
CST @ 210°F	0.52	0.92	1.86	5.11	-	4.69
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.7	1.8				
Naphthenes	-	-				
Aromatics	41.6	85.3				
Saturates	56.7	12.9				
Elemental, Wt%						
Carbon	86.99	88.09	91.29	91.95	90.59	90.23
Hydrogen	11.93	10.03	9.00	7.97	6.44	8.04
Oxygen	0.48	0.16	0.38	0.25	0.64	0.44
Nitrogen	<0.20(a)	0.17	0.17	0.34	1.19	0.48
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.14	Tr

(a) Nitrogen Lower limit approximately 0.20 weight percent.
(b) C_5+ in gas are 3.08 liquid volume % and 1.86 weight % on feed.

TABLE XIII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 50/50 VOL% SRC-I/500°F IBP SOLVENT (COOL NON-CATALYTIC ZONES) Run 2LCF-10 (Period 26)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	3.37(b)	11.83	29.78	28.26	21.79	95.03
Weight Percent on Fresh Feed	2.13(b)	9.51	25.49	25.92	22.33	85.38
Gravity, °API	31.8	17.5	8.9	-0.5	-14.3	1.3
SP 60/60°F	0.8665	0.9497	1.0078	1.0802	1.207	1.0655
Pour Point, °F	<-10	<-5	<-10	25	-	-5
Softening Point, °F	-	-	-	-	224	-
Viscosity, CST @ 100°F	1.02	2.14	6.05	59.79	-	43.46
CST @ 210°F	0.55	0.92	1.68	4.67	-	4.67
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.7	1.8				
Naphthenes	-	-				
Aromatics	50.1	89.3				
Saturates	48.2	8.9				
Elemental, Wt%						
Carbon	87.19	90.28	89.65	90.59	91.92	89.08
Hydrogen	11.31	10.13	8.77	7.72	6.06	8.10
Oxygen	0.51	0.13	0.34	0.20	0.57	0.32
Nitrogen	<0.20(a)	0.14	0.17	0.32	1.04	0.36
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.06	0.02

(a) Nitrogen lower limit approximately 0.20 weight percent.
(b) C_5+ in gas are 8.16 liquid volume % and 4.91 weight % on feed.

TABLE XIV

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOL% SRC-I/500°F IBP SOLVENT (COOL NON-CATALYTIC ZONES)
Run 2LCF-10 (Period 29)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	3.83(b)	14.14	28.45	23.97	20.34	90.73
Weight Percent on Fresh Feed	2.71(b)	11.38	24.54	22.25	21.01	81.89
Gravity, °API	30.1	17.3	7.8	-2.0	-15.3	0.7
SP 60/60°F	0.8756	0.9509	1.0158	1.093	1.2174	1.0703
Pour Point, °F	<-15	<-15	<-15	40	-	-5
Softening Point, °F	-	-	-	-	228	-
Viscosity, CST @ 100°F	1.09	2.21	7.37	64.4	-	33.88
CST @ 210°F	0.59	0.93	1.83	4.5	-	4.02
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.6	1.8				
Naphthenes	-	-				
Aromatics	57.4	91.0				
Saturates	41.0	7.2				
Elemental, Wt%						
Carbon	88.02	90.63	90.14	92.10	90.98	90.04
Hydrogen	11.25	9.98	8.45	7.37	6.00	7.58
Oxygen	0.60	0.15	0.34	0.25	0.63	0.36
Nitrogen	<0.20(a)	0.16	0.19	0.38	1.12	0.43
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.53	0.01

(a) Nitrogen lower limit approximately 0.20 weight percent.
(b) C_5+ in gas are 9.21 liquid volume % and 5.46 weight % on feed.

TABLE XV

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 50/50 VOL% SRC-I/500°F IBP SOLVENT (COOL NON-CATALYTIC ZONES) Run 2LCF-10 (Period 31)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	2.32(a)	7.87	30.59	27.31	32.58	100.67
Weight Percent on Fresh Feed	1.52(a)	6.39	26.66	25.19	33.12	92.88
Gravity, °API	29.1	17.1	7.1	-0.5	-12.7	-2.2
SP 60/60°F	0.8811	0.9522	1.0209	1.0802	1.191	1.0940
Pour Point, °F	<-15	<-15	<-15	40	-	45
Softening Point, °F	-	-	-	-	247	-
Viscosity, CST @ 100°F	1.34	2.43	8.25	91.22	-	502.1
CST @ 210°F	0.64	0.98	1.97	5.50	-	14.1
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.8	2.0				
Naphthenes	-	-				
Aromatics	48.2	89.8				
Saturates	50.0	8.2				
Elemental, Wt%						
Carbon	87.52	89.18	90.55	91.91	91.33	90.90
Hydrogen	11.29	9.97	8.66	7.61	6.53	7.97
Oxygen	1.49	0.36	0.50	0.39	1.12	0.67
Nitrogen	0.27	0.31	0.27	0.46	1.29	0.68
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.21	0.07

(a) C_5+ in gas are 3.14 liquid volume % and 1.93 weight % on feed.

TABLE XVI

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 50/50 VOL% 1% ASH SRC-I/500°F IBP SOLVENT PDU Run 2LCF-12 (Period 2)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	2.35(b)	13.06	33.00	27.38	29.14	104.93
Weight Percent on Fresh Feed	1.80(b)	10.36	27.89	24.29	29.12	93.46
Gravity, °API	31.3	17.5	8.1	1.5	-13.4	1.1
SP 60/60°F	0.8692	0.9497	1.0136	1.0641	1.1985	1.0671
Pour Point, °F	<-15	<-15	<-15	25	-	0
Softening Point, °F	-	-	-	-	230	-
Viscosity, CST @ 100°F	1.20	2.41	8.81	138.9	-	116
CST @ 210°F	0.66	1.61	2.05	6.70	-	8.08
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.5	0.8				
Naphthenes	-	-				
Aromatics	45.4	81.1				
Saturates	53.1	18.1				
Elemental, Wt%						
Carbon	87.95	89.84	89.55	91.11	88.16	90.74
Hydrogen	12.00	10.27	9.25	8.42	6.78	8.30
Oxygen	0.28	0.15	0.38	0.31	1.89(c)	0.77
Nitrogen	0.06	-	0.16	0.36	0.99	0.45
Sulfur	<0.06	<0.06	<0.06	<0.06	0.17	0.10
Ash, Wt%					2.79	0.87

(a) SRC (N-024) and high ash SRC (N-084) were 53.4 Wt.% and 2.9 Wt.%, respectively.
(b) C_5+ in gas are 3.87 liquid volume % and 2.38 weight % on feed.
(c) The value was calculated due to sample contamination.

TABLE XVII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOL% 1% ASH SRC-I/500°F IBP SOLVENT
PDU Run 2LCF-12 (Period 5)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	4.77(c)	12.46	33.62	29.80	20.14	100.79
Weight Percent on Fresh Feed	3.56(c)	9.88	28.26	26.52	20.35	88.57
Gravity, °API	26.6	17.5	9.4	1.7	-15.0	2.9
SP 60/60°F	0.8950	0.9497	1.0043	1.0625	1.215	1.0528
Pour Point, °F	<-15	<-15	<-15	15	-	<-15
Softening Point, °F	-	-	-	-	201	-
Viscosity, CST @ 100°F	1.35	2.50	7.59	76.48	-	29.32
CST @ 210°F	0.67	1.02	1.94	5.39	-	4.01
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.6	1.9				
Naphthenes	-	-				
Aromatics	58.8	81.5				
Saturates	39.6	16.6				
Elemental, Wt%						
Carbon	87.64	89.44	88.73	91.73	92.38	89.7[1]
Hydrogen	11.27	10.44	9.19	8.33	6.79	8.37
Oxygen	0.14	0.10	0.31	0.18	1.27	0.84
Nitrogen	0.05	0.06	0.13	0.32	0.87	0.33
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.27	<0.06
Ash, Wt%					2.43	0.43(b)

(a) SRC (N-024) and high ash SRC (N-084) were 53.4 Wt.% and 2.9 Wt.%, respectively.
(b) Not representative sample.
(c) C_5+ in gas are 6.60 liquid volume % and 3.94 weight % on feed.

TABLE XVIII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 50/50 VOL% 1% ASH SRC-I/500°F IBP SOLVENT PDU Run 2LCF-12 (Period 11)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	2.56(b)	12.87	35.04	26.49	24.52	101.48
Weight Percent on Fresh Feed	2.06(b)	10.25	29.76	23.72	24.95	90.74
Gravity, °API	30.0	17.2	8.0	0.8	-15.1	0.6
SP 60/60°F	0.8762	0.9516	1.0143	1.0695	1.216	1.0712
Pour Point, °F	<-15	<-15	<-15	45	-	<-15
Softening Point, °F	-	-	-	-	222	-
Viscosity, CST @ 100°F	1.15	2.36	7.80	103.3	-	57.71
CST @ 210°F	0.62	0.98	1.94	5.93	-	5.37
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.3	0.9				
Naphthenes	-	-				
Aromatics	48.4	81.0				
Saturates	50.3	18.1				
Elemental, Wt%						
Carbon	87.58	89.47	90.06	91.74	91.74	90.25
Hydrogen	11.63	10.21	9.07	8.20	6.78	8.09
Oxygen	0.55	0.16	0.39	0.27	1.64	1.61
Nitrogen	0.14	0.15	0.19	0.41	1.10	0.46
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					2.45	0.84

(a) SRC (N-024) and high Ash SRC (N-084) were 53.4 Wt.% and 2.9 Wt.% respectively.
(b) C_5+ in gas are 5.56 liquid volume % and 3.37 weight % on feed.

TABLE XIX

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 50/50 VOL% 1% ASH SRC-I/500°F IBP SOLVENT PDU Run 2LCF-12 (Period 13)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	3.87(c)	17.91	32.65	24.65	19.93	99.01
Weight Percent on Fresh Feed	3.17(c)	14.25	27.79	22.21	20.17	87.59
Gravity, °API	30.2	17.5	7.8	0.1	-14.4	2.0
SP 60/60°F	0.8751	0.9497	1.0158	1.0754	1.208	1.0599
Pour Point, °F	<-15	<-15	<-15	45	-	<-15
Softening Point, °F	-	-	-	-	215	-
Viscosity, CST @ 100°F	1.19	2.31	7.56	85.71	-	28.71
CST @ 210°F	0.65	0.97	1.91	5.32	-	3.71
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.7	0.9				
Naphthenes	-	-				
Aromatics	49.3	84.5				
Saturates	49.0	14.6				
Elemental, Wt%						
Carbon	87.41	89.40	89.14	92.05	92.31	89.71
Hydrogen	11.02	9.97	8.92	8.27	6.20	8.21
Oxygen	0.47	0.18	0.31	0.18	0.57	0.35
Nitrogen	0.11	0.13	0.21	0.38	1.04	0.45
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.21(b)	0.99

(a) SRC (N-024) and high ash SRC (N-084) were 53.4 Wt.% and 2.9 Wt.% respectively.
(b) Not representative sample.
(c) C_5+ in gas are 7.36 liquid volume % and 4.42 weight % on feed.

TABLE XX

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOL% 1% ASH SRC-I/500°F IBP SOLVENT
PDU Run 2LCF-12 (Period 16)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	7.54(c)	12.61	34.08	25.81	22.06	102.10
Weight Percent on Fresh Feed	5.72(c)	10.05	28.99	23.28	22.49	90.53
Gravity, °API	24.9	17.0	7.9	-0.04	-15.1	1.7
SP 60/60°F	0.9047	0.9529	1.0151	1.0764	1.216	1.0623
Pour Point, °F	<-15	<-15	<-15	35	-	<-15
Softening Point, °F	-	-	-	-	226	-
Viscosity, CST @ 100°F	1.35	2.49	8.11	89.19	-	34.37
CST @ 210°F	0.72	1.02	1.88	5.29	-	4.28
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0.9	0.9				
Naphthenes	-	-				
Aromatics	64.6	84.4				
Saturates	34.5	14.7				
Elemental, Wt%						
Carbon	89.13	89.40	89.91	91.55	91.65	89.57
Hydrogen	10.47	9.97	8.68	7.76	6.23	7.86
Oxygen	0.43	0.14	0.39	0.27	1.13	0.98
Nitrogen	0.12	0.14	0.23	0.45	1.14	0.50
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.89(b)	0.41(b)

(a) SRC (N-024) and high ash SRC (N-084) were 53.4 Wt.% and 2.9 Wt.% respectively.
(b) Not representative sample.
(c) C_5+ in gas are 4.94 liquid volume % and 2.93 weight % on feed.

TABLE XXI

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOLUME % 1% ASH SRC-I/500°F IBP SOLVENT
Run 2LCF-12 (Period 18)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	3.35(b)	16.13	33.04	26.58	18.25	97.35
Weight Percent on Fresh Feed	2.73(b)	12.69	28.12	24.15	18.77	86.46
Gravity, °API	31.3	17.0	7.8	-1.0	-16.3	1.5
SP 60/60°F	0.8692	0.9402	1.0518	1.0845	1.228	1.0639
Pour Point, °F	<-15	<-15	<-15	20	-	<-15
Softening Point, °F	-	-	-	-	219	-
Viscosity, CST @ 100°F	1.11	2.42	7.09	106.83	-	30.04
CST @ 210°F	0.66	0.99	1.80	17.74	-	3.71
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.9	0.0				
Naphthenes	-	-				
Aromatics	50.1	93.9				
Saturates	48.0	6.1				
Elemental, Wt%						
Carbon	88.14	89.86	90.52	91.11	90.65	89.13
Hydrogen	11.42	10.07	8.72	7.70	6.30	7.86
Oxygen	0.61	0.17	0.35	0.26	1.26	0.70
Nitrogen	0.18	0.14	0.20	0.63	1.24	0.40
Sulfur	<0.06	<0.06	<0.06	<0.06	0.26	<0.06
Ash, Wt%					1.73	0.78

(a) SRC (N-024) and high ash SRC (N-084) were 53.4 Wt.% and 2.9 Wt.%, respectively.
(b) C_5^+ in gas are 6.93 liquid volume % and 4.14 weight % on feed.

TABLE XXII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOLUME % 1% ASH SRC-I/500°F IBP SOLVENT
Run 2LCF-12 (Period 19B)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	4.72(b)	22.66	29.24	25.97	13.76	96.35
Weight Percent on Fresh Feed	3.62(b)	18.07	24.86	23.53	14.46	84.54
Gravity, °API	30.7	16.6	7.7	-0.9	-18.9	3.1
SP 60/60°F	0.8724	0.9554	1.0165	1.0834	1.2571	1.0513
Pour Point, °F	<-15	<-15	<-15	25	-	<-15
Softening Point, °F	-	-	-	-	228	-
Viscosity, CST @ 100°F	1.12	2.23	6.66	69.29	-	14.57
CST @ 210°F	0.64	0.93	1.83	4.97	-	3.55
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0.0	1.8				
Naphthenes	-	-				
Aromatics	52.6	87.7				
Saturates	47.4	10.5				
Elemental, Wt%						
Carbon	87.81	90.38	90.23	91.61	88.77	89.21
Hydrogen	11.43	10.06	9.14	7.88	5.77	7.90
Oxygen	0.58	0.22	0.34	0.21	1.84	0.89
Nitrogen	0.17	0.14	0.21	0.54	1.23	0.42
Sulfur	<0.06	<0.06	<0.06	<0.06	0.35	<0.06
Ash, Wt%					3.03	0.84

(a) SRC (N-024) and high ash SRC (N-084) were 53.4 wt.% and 2.9 wt.%, respectively.
(b) C_5+ in gas are 8.83 liquid volume % and 5.26 weight % on feed.

TABLE XXIII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
TOPPED NON-DEASHED SHORT CONTACT TIME COAL EXTRACT (a)
PDU Run 2LCF-13 (Period 2)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	4.48(b)	12.76	33.45	29.59	24.02	104.30
Weight Percent on Fresh Feed	3.18(b)	9.87	27.19	24.99	26.44	91.67
Gravity, °API	36.7	22.9	15.4	9.9	-23.0	2.9
SP 60/60°F	0.8413	0.9165	0.9632	1.0007	1.3042	1.0528
Pour Point, °F	<-15	<-15	<-15	65	-	0
Softening Point, °F	-	-	-	-	208	-
Viscosity, CST @ 100°F	1.12	2.33	7.96	73.87	-	45.78
CST @ 210°F	0.61	0.98	1.96	5.73	-	4.79
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	23.0	65.5				
Saturates	77.0	34.5				
Elemental, Wt%						
Carbon	86.46	88.22	89.15	90.01	68.10	80.80
Hydrogen	12.85	11.50	10.77	9.94	5.75	9.00
Oxygen	0.31	0.32	0.33	0.34	10.27	3.26
Nitrogen	0.05	0.11	0.19	0.28	0.62	0.29
Sulfur	<0.06	<0.06	0.07	<0.06	2.54	0.78
Ash, Wt%					24.02	6.57

(a) Wilsonville Run 146
(b) C_5+ in gas are 3.61 liquid volume % and 2.16 weight % on feed.

TABLE XXIV

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF TOPPED NON-DEASHED SHORT CONTACT TIME COAL EXTRACT (a) PDU Run 2LCF-13 (Period 4B)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	7.79(b)	13.80	29.24	26.77	26.01	103.61
Weight Percent on Fresh Feed	5.63(b)	10.59	23.66	22.55	28.31	90.74
Gravity, °API	36.3	23.2	15.2	9.5	-22.4	3.4
SP 60/60°F	0.8433	0.9147	0.9646	1.0035	1.2973	1.0489
Pour Point, °F	<-15	<-15	<-15	75	-	-10
Softening Point, °F	-	-	-	-	229	-
Viscosity, CST @ 100°F	1.15	2.23	7.59	78.25	-	50.24
CST @ 210°F	0.63	1.02	1.93	5.76	-	5.38
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	2.0	0				
Naphthenes	-	-				
Aromatics	22.9	58.9				
Saturates	75.1	41.1				
Elemental, Wt%						
Carbon	86.04	86.27	88.66	88.79	71.61	81.10
Hydrogen	13.10	11.29	10.70	9.65	6.11	8.71
Oxygen	0.61	0.42	0.41	0.46	8.75	3.48
Nitrogen	0.12	0.16	0.20	0.37	0.77	0.33
Sulfur	<0.06	<0.06	<0.06	<0.06	2.19	0.75
Ash, Wt%					18.52	5.80

(a) Wilsonville Run 146
(b) C_5+ in gas are 6.02 liquid volume % and 3.66 weight % on feed.

TABLE XXV

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
TOPPED NON-DEASHED SHORT CONTACT TIME COAL EXTRACT (a)
PDU Run 2LCF-13 (Period 7)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	10.30(b)	16.24	30.21	26.17	19.62	102.54
Weight Percent on Fresh Feed	7.08(b)	12.49	24.76	22.17	22.82	89.32
Gravity, °API	37.5	23.3	13.7	9.0	-29.2	4.1
SP 60/60°F	0.8373	0.9141	0.9745	1.0071	1.383	1.0435
Pour Point, °F	<-15	<-15	-10	65	-	<-15
Softening Point, °F	-	-	-	-	240	-
Viscosity, CST @ 100°F	1.10	2.31	6.94	64.89	-	27.77
CST @ 210°F	0.60	1.00	1.83	5.36	-	3.07
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0.3				
Naphthenes	-	-				
Aromatics	22.0	73.0				
Saturates	78.0	26.5				
Elemental, Wt%						
Carbon	87.15	86.81	88.40	89.23	64.89	80.91
Hydrogen	12.55	11.16	10.35	9.72	5.17	8.81
Oxygen	0.46	0.37	0.36	0.37	11.45	3.59
Nitrogen	0.10	0.13	0.21	0.37	0.66	0.36
Sulfur	<0.06	<0.06	<0.06	<0.06	2.93	0.77
Ash, Wt%					26.24	6.74

(a) Wilsonville Run 146
(b) C_5+ in gas are 7.06 liquid volume % and 4.23 weight % on feed.

TABLE XXVI

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF TOPPED NON-DEASHED SHORT CONTACT TIME COAL EXTRACT (a) PDU Run 2LCF-13 (Period 8B)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	11.45(b)	19.10	35.53	22.53	11.50	100.11
Weight Percent on Fresh Feed	8.70(b)	14.37	29.00	19.35	14.45	85.87
Gravity, °API	37.0	22.6	14.3	7.0	-36.9	6.2
SP 60/60°F	0.8698	0.8950	0.9705	1.0217	1.4953	1.0276
Pour Point, °F	<-15	<-15	0	70	-	<-15
Softening Point, °F	-	-	-	-	258	-
Viscosity, CST @ 100°F	1.05	2.06	6.78	59.55	-	9.29
CST @ 210°F	0.71	0.90	1.79	5.07	-	1.87
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	29.2	73.6				
Saturates	70.8	26.4				
Elemental, Wt%						
Carbon	86.74	87.74	89.76	90.68	60.87	79.76
Hydrogen	12.52	11.07	10.21	9.41	4.46	8.45
Oxygen	0.39	0.31	0.32	0.32	13.51	3.27
Nitrogen	0.05	0.11	0.19	0.37	0.56	0.28
Sulfur	<0.06	<0.06	<0.06	<0.06	3.57	0.70
Ash, Wt%					32.49	6.05

(a) Wilsonville Run 146
(b) C_5+ in gas are 8.82 liquid volume % and 5.29 weight % on feed.

TABLE XXVII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF TOPPED DEASHED SHORT CONTACT TIME COAL EXTRACT(a)
PDU Run 2LCF-14 (Period 4)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	7.51(b)	11.96	28.44	31.80	26.71	106.42
Weight Percent on Fresh Feed	5.52(b)	9.29	23.55	27.35	26.36	92.07
Gravity, °API	33.7	23.0	14.2	8.8	-9.21	7.4
SP 60/60°F	0.8565	0.9159	0.9712	1.0086	1.157	1.0187
Pour Point, °F	<-15	<-15	<-15	70	-	<-10
Softening Point, °F	-	-	-	-	350	-
Viscosity, CST @ 100°F	1.15	2.33	9.12	102.8	-	100.6
CST @ 210°F	0.60	0.96	2.2	6.2	-	8.38
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	2.3	2.4				
Naphthenes	-	-				
Aromatics	32.4	59.9				
Saturates	65.3	37.7				
Elemental, Wt%						
Carbon	86.55	88.56	89.16	89.72	89.00	87.87
Hydrogen	12.35	11.45	10.17	9.71	7.46	9.46
Oxygen	1.13	0.70	0.58	0.62	1.51	0.87
Nitrogen	0.18	0.29	0.23	0.44	1.07	0.52
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.38	0.12

(a) Wilsonville Run 146.
(b) C_5+ in gas are 3.61 liquid volume % and 2.23 weight % on feed.

TABLE XXVIII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF TOPPED DEASHED SHORT CONTACT TIME COAL EXTRACT(a) PDU Run 2LCF-14 (Period 8)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	6.68(b)	11.93	28.85	33.20	21.67	102.36
Weight Percent on Fresh Feed	4.90(b)	9.30	23.91	28.69	21.77	88.57
Gravity, °API	34.4	22.8	13.8	7.8	-11.6	7.4
SP 60/60°F	0.8529	0.9170	0.9738	1.0158	1.180	1.0187
Pour Point, °F	<-15	<-15	0	78	-	-5
Softening Point, °F	-	-	-	-	233	-
Viscosity, CST @ 100°F	1.13	2.24	8.67	93.18	-	35.36
CST @ 210°F	0.61	0.94	2.18	4.73	-	4.19
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	3.0	1.9				
Naphthenes	-	-				
Aromatics	30.2	59.6				
Saturates	66.8	38.5				
Elemental, Wt%						
Carbon	86.14	86.31	89.29	89.08	90.21	88.00
Hydrogen	12.42	11.00	10.33	9.48	7.09	9.17
Oxygen	1.00	0.47	0.46	0.46	1.12	0.62
Nitrogen	0.19	0.23	0.21	0.38	0.94	0.45
Sulfur	<0.06	<0.06	<0.06	<0.06	0.10	<0.06
Ash, Wt%					0.25	0.08

(a) Wilsonville Run 146.
(b) C_5+ in gas are 5.97 liquid volume % and 3.64 weight % on feed.

TABLE XXIX

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF TOPPED DEASHED SHORT CONTACT TIME COAL EXTRACT(a)
Run 2LCF-14 (Period 10B)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	11.27(b)	15.03	30.05	28.09	10.36	94.80
Weight Percent on Fresh Feed	8.29(b)	11.86	25.33	24.90	10.70	81.08
Gravity, °API	34.5	22.1	12.9	5.8	-14.2	10.3
SP 60/60°F	0.8524	0.9212	0.9799	1.0306	1.206	0.9979
Pour Point, °F	<-15	<-15	-10	53	-	<-15
Softening Point, °F	-	-	-	-	221	-
Viscosity, CST @ 100°F	1.31	2.12	7.55	59.75	-	12.78
CST @ 210°F	0.58	0.94	1.81	4.55	-	2.39
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	38.75	80.03				
Saturates	61.25	19.97				
Elemental, Wt%						
Carbon	87.21	87.51	90.44	89.25	91.07	89.21
Hydrogen	12.56	10.98	10.09	8.98	6.36	9.33
Oxygen	0.91	0.46	0.50	0.47	1.00	0.61
Nitrogen	0.21	0.33	0.27	0.49	0.99	0.42
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.31	Tr

(a) Wilsonville Run 146.
(b) C_5+ in gas are 12.57 liquid volume % and 7.62 weight % on feed.

TABLE XXX

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOLUME % SRC-I/500°F IBP SOLVENT (CATALYST CHECK)
Run 2LCF-15 (Period 3B)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	3.75(a)	10.60	35.13	25.13	28.53	103.14
Weight Percent on Fresh Feed	2.45(a)	8.64	30.82	23.07	28.55	93.53
Gravity, °API	30.7	17.0	6.8	0.7	-10.3	1.5
SP 60/60°F	0.8724	0.9529	1.0231	1.0706	1.1672	1.0639
Pour Point, °F	<-15	<-15	<-15	35	-	-5
Softening Point, °F	-	-	-	-	234	-
Viscosity, CST @ 100°F	1.44	2.34	9.04	51.64	-	115.45
CST @ 210°F	0.65	0.98	2.24	20.16	-	7.49
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	1.9				
Naphthenes	-	-				
Aromatics	42.4	85.0				
Saturates	57.6	13.1				
Elemental, Wt%						
Carbon	87.78	89.96	90.19	92.11	92.52	90.78
Hydrogen	11.81	10.28	8.81	8.47	7.32	8.47
Oxygen	1.36	0.26	0.44	0.32	0.85	0.50
Nitrogen	0.27	0.16	0.22	0.46	1.09	0.54
Sulfur	<0.60	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.24	0.06

(a) C_5^+ in gas are 4.66 liquid volume % and 2.95 weight % on feed.

TABLE XXXI

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOLUME % SRC-I/500°F IBP SOLVENT (CATALYST CHECK)
Run 2LCF-15 (Period 6)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	10.74(b)	13.78	28.61	27.57	20.62	101.32
Weight Percent on Fresh Feed	8.48(b)	11.24	24.90	25.21	21.11	90.94
Gravity, °API	32.2	16.8	7.7	1.3	-13.2	2.9
SP 60/60°F	0.8644	0.9541	1.0165	1.0655	1.196	1.0528
Pour Point, °F	<-15	<-15	<-15	40	-	-10
Softening Point, °F	-	-	-	-	225	-
Viscosity, CST @ 100°F	1.11	2.44	7.68	95.63	-	(a)
CST @ 210°F	0.61	0.99	1.93	5.47	-	(a)
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	4.8	0				
Naphthenes	-	-				
Aromatics	44.7	96.1				
Saturates	50.5	3.9				
Elemental, Wt%						
Carbon	87.00	89.50	90.70	91.33	91.32	88.44
Hydrogen	11.83	10.21	8.85	8.12	6.64	8.24
Oxygen	0.42	0.31	0.38	0.27	0.92	(a)
Nitrogen	0.16	0.17	0.18	0.37	1.06	0.46
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.36	0.07

(a) Water contamination interfered with analysis.
(b) C_5+ in gas are 6.07 liquid volume % and 3.68 weight % on feed.

TABLE XXXII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
50/50 VOLUME % SRC-I/500°F IBP SOLVENT (CATALYST CHECK)
Run 2LCF-15 (Period 11)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	6.21(a)	16.63	32.79	27.68	19.98	103.29
Weight Percent on Fresh Feed	4.35(a)	13.34	28.17	24.98	20.23	91.07
Gravity, °API	31.9	17.8	8.0	1.3	-13.2	3.8
SP 60/60°F	0.8660	0.9478	1.0143	1.0655	1.196	1.0458
Pour Point, °F	<-15	<-15	<-15	30	-	<-15
Softening Point, °F	-	-	-	-	224	-
Viscosity, CST @ 100°F	1.16	2.27	7.18	98.06	-	23.35
CST @ 210°F	0.58	0.94	1.87	5.51	-	3.87
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	41.5	89.8				
Saturates	58.5	10.2				
Elemental, Wt%						
Carbon	87.29	89.43	90.15	91.39	91.24	89.92
Hydrogen	11.65	10.20	9.15	8.14	6.49	8.21
Oxygen	0.84	0.26	0.44	0.26	0.68	0.39
Nitrogen	0.29	0.23		0.39	1.07	0.44
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.37	0.08

(a) C_5+ in gas are 5.21 liquid volume % and 3.18 weight % on feed.

TABLE XXXIII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 50/50 VOLUME % SRC-I/500°F IBP SOLVENT (CATALYST CHECK) Run 2LCF-15 (Period 14)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	5.57(a)	17.17	36.70	20.28	15.46	95.18
Weight Percent on Fresh Feed	3.95(a)	13.81	31.89	18.71	15.87	84.23
Gravity, °API	31.3	17.0	6.8	-1.2	-14.4	3.3
SP 60/60°F	0.8692	0.9525	1.0231	1.0861	1.208	1.0497
Pour Point, °F	<-15	<-15	<-15	45	-	-15
Softening Point, °F	-	-	-	-	185	-
Viscosity, CST @ 100°F	1.25	2.39	8.10	79.30	-	20.06
CST @ 210°F	0.61	0.97	2.18	5.31	-	4.20
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	48.7	89.9				
Saturates	51.3	10.1				
Elemental, Wt%						
Carbon	87.42	89.89	90.19	92.15	91.62	89.42
Hydrogen	11.69	10.17	8.64	7.48	6.05	7.76
Oxygen	0.88	0.21	0.34	0.22	0.72	0.45
Nitrogen	0.34	0.23	0.23	0.58	1.08	0.56
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.48	0.10

(a) C_5+ in gas are 8.86 liquid volume % and 5.32 weight % on feed.

TABLE XXXIV

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 50/50 VOLUME % SRC-I/500°F IBP SOLVENT (CATALYST CHECK) Run 2LCF-15 (Period 15)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	6.37(a)	15.80	32.24	28.08	13.62	96.11
Weight Percent on Fresh Feed	4.44(a)	12.72	27.74	25.76	14.16	84.82
Gravity, °API	30.7	17.5	7.9	-0.7	-16.0	3.7
SP 60/60°F	0.8724	0.9497	1.0151	1.0817	1.225	1.0466
Pour Point, °F	<-15	<-15	<-15	15	-	<-15
Softening Point, °F	-	-	-	-	220	-
Viscosity, CST @ 100°F	1.11	2.23	6.53	79.27	-	18.58
CST @ 210°F	0.59	1.03	1.84	4.97	-	2.85
Hydrocarbon Type, Vol%						
Paraffins	35.8	-				
Olefins	-	0				
Naphthenes	13.9	-				
Aromatics	50.3	90.5				
Saturates	49.7	9.5				
Elemental, Wt%						
Carbon	86.66	88.70	89.32	91.07	91.06	89.13
Hydrogen	11.75	10.19	8.71	7.83	6.01	8.10
Oxygen	0.81	0.23	0.40	0.23	0.71	0.33
Nitrogen	0.33	0.25	0.23	0.46	1.02	0.43
Sulfur	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Ash, Wt%					0.65	0.08

(a) C_5+ in gas are 9.37 liquid volume % and 5.55 weight % on feed.

TABLE XXXV

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
NOMINAL 600°F IBP NON-DEASHED SCT (a)
Run 2LCF-16 (Period 4)

Fraction	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Product
Volume Percent and	7.21 (b)	14.41	26.63	30.86	26.57	105.68
Weight Percent on Fresh Feed	5.00 (b)	10.82	21.34	25.64	29.43	92.23
Gravity, °API	35.7	23.0	14.8	9.6	-27.2	1.4
SP 60/60°F	0.8463	0.9159	0.9672	1.0028	1.357	1.0647
Pour Point, °F	<-15	<-15	-5	10	-	-5
Softening Point, °F	-	-	-	-	239	-
Viscosity, CST @ 100°F	1.19	2.3	8.53	-	-	65.10
CST @ 210°F	0.62	1.0	2.04	-	-	7.29
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	5.0	4.3				
Naphthenes	-	-				
Aromatics	22.8	59.2				
Saturates	72.2	36.5				
Elemental, Wt%						
Carbon	87.34	87.39	88.32	89.79	67.38	83.09
Hydrogen	12.98	11.22	10.44	10.12	5.78	9.09
Oxygen	0.75	0.49	0.44	0.44	10.31	5.17
Nitrogen	0.12	0.17	0.25	0.37	0.64	0.40
Sulfur	<0.06	<0.06	<0.06	<0.06	2.67	0.85
Ash, Wt%					23.18	7.34

(a) Wilsonville Run 145
(b) C_5+ in gas are 6.35 liquid volume % and 3.72 weight % on feed.

TABLE XXXVI

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF NOMINAL 600°F IBP NON-DEASHED SCT (a) Run 2LCF-16 (Period 9)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	8.66 (b)	17.12	29.29	28.33	22.39	105.79
Weight Percent on Fresh Feed	5.93 (b)	12.76	22.99	22.96	25.25	89.89
Gravity, °API	36.4	24.6	16.8	12.2	-28.2	5.0
SP 60/60°F	0.8428	0.9065	0.9541	0.9847	1.370	1.0366
Pour Point, °F	<-15	<-15	<-15	65	-	<-15
Softening Point, °F	-	-	-	-	257	-
Viscosity, CST @ 100°F	1.14	2.61	7.75	67.18	-	23.2
CST @ 210°F	0.61	1.14	2.04	5.58	-	3.7
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	2.0	0				
Naphthenes	-	-				
Aromatics	18.9	49.9				
Saturates	79.1	50.1				
Elemental, Wt%						
Carbon	87.39	88.17	88.82	89.20	66.47	79.97
Hydrogen	12.95	11.74	11.26	10.48	5.90	9.25
Oxygen	0.56	0.47	0.23	0.25	10.66	2.91
Nitrogen	0.12	0.13	0.08	Trace	0.59	0.21
Sulfur	<0.06	<0.06	<0.06	<0.06	2.63	0.81
Ash, Wt%					23.99	3.30

(a) Wilsonville Run 145
(b) C_5+ in gas are 7.31 liquid volume % and 4.33 weight % on feed.

TABLE XXXVII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF NOMINAL 600°F IBP NON-DEASHED SCT (a) Run 2LCF-16 (Period 11)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	11.59 (b)	20.25	32.40	25.92	10.79	101.95
Weight Percent on Fresh Feed	8.43 (b)	15.03	26.19	20.97	12.72	83.34
Gravity, °API	37.4	24.8	16.6	12.1	-32.9	10.4
SP 60/60°F	0.8378	0.9053	0.9554	0.9854	1.4351	0.9972
Pour Point, °F	<-15	<-15	<-15	70	-	<-15
Softening Point, °F	-	-	-	-	(c)	-
Viscosity, CST @ 100°F	1.1	2.3	7.46	51.63	-	9.1
CST @ 210°F	0.6	1.0	1.94	5.12	-	1.9
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	25.9	54.8				
Saturates	79.1	45.2				
Elemental, Wt%						
Carbon	86.93	88.01	89.07	89.85	59.98	79.96
Hydrogen	12.99	11.66	10.81	10.18	5.07	9.51
Oxygen	0.37	0.21	0.29	0.20	13.72	2.53
Nitrogen	0.07	0.001	0.002	0.05	0.36	0.12
Sulfur	<0.06	<0.06	<0.06	<0.06	3.21	0.53
Ash, Wt%					31.45	3.17

(a) Wilsonville Run 145
(b) C_5+ in gas are 14.47 liquid volume % and 8.57 weight % on feed.
(c) Not enough sample.

TABLE XXXVIII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF NOMINAL 600°F IBP NON-DEASHED SCT (a) Run 2LCF-16 (Period 15)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	8.39 (b)	14.33	27.16	26.05	25.20	101.13
Weight Percent on Fresh Feed	5.86 (b)	10.77	21.69	21.46	28.47	88.25
Gravity, °API	35.3	23.6	15.2	10.8	-27.8	2.1
SP 60/60°F	0.8483	0.9123	0.8646	0.9944	1.3650	1.0591
Pour Point, °F	<-15	<-15	0	70	-	-15
Softening Point, °F	-	-	-	-	259	-
Viscosity, CST @ 100°F	1.16	2.33	8.45	52.13	-	32.1
CST @ 210°F	0.59	0.97	2.00	4.72	-	4.0
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.7	0				
Naphthenes	-	-				
Aromatics	20.5	57.8				
Saturates	77.8	42.2				
Elemental, Wt%						
Carbon	85.36	87.21	90.12	89.83	69.23	80.10
Hydrogen	12.64	11.56	10.72	10.56	5.67	8.71
Oxygen	1.09	0.49	0.36	0.38	9.84	2.05
Nitrogen	0.21	0.05	0.16	0.23	0.88	0.40
Sulfur	<0.06	<0.06	<0.06	0.02	2.70	0.97
Ash, Wt%					20.72	4.20

(a) Wilsonville Run 145
(b) C_5+ in gas are 7.40 liquid volume % and 4.41 weight % on feed.

TABLE XXXIX

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF NOMINAL 600°F IBP NON-DEASHED SCT (a) Run 2LCF-16 (Period 18)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	5.89 (b)	9.51	20.71	37.06	31.07	104.24
Weight Percent on Fresh Feed	4.04 (b)	7.26	16.66	30.85	35.17	93.98
Gravity, °API	33.8	22.6	15.1	10.1	-17.4	-2.1
SP 60/60°F	0.8560	0.9182	0.9652	0.9993	1.359	1.0934
Pour Point, °F	<-15	<-15	<-15	70	-	10
Softening Point, °F	-	-	-	-	312	-
Viscosity, CST @ 100°F	1.3	2.2	8.0	48.9	-	168.0
CST @ 210°F	0.6	1.0	2.0	4.7	-	24.2
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	5.4	5.9				
Naphthenes	-	-				
Aromatics	23.5	57.9				
Saturates	71.1	36.2				
Elemental, Wt%						
Carbon	87.21	86.87	88.66	88.60	70.17	80.80
Hydrogen	12.83	10.91	10.17	9.99	5.62	8.34
Oxygen	1.79	1.02	0.57	0.62	10.07	4.58
Nitrogen	<0.20	0.20	<0.20	0.24	1.08	0.61
Sulfur	<0.06	<0.06	<0.06	<0.06	2.35	0.83
Ash, Wt%					20.23	7.03

(a) Wilsonville Run 145
(b) C_5+ in gas are 2.25 liquid volume % and 1.36 weight % on feed.

TABLE XL

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
NOMINAL 600°F IBP NON-DEASHED SCT (a)
Run 2LCF-16 (Period 20)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	9.64 (b)	17.22	29.32	24.89	18.95	100.02
Weight Percent on Fresh Feed	7.45 (b)	13.54	24.15	21.21	22.41	88.76
Gravity, °API	35.1	21.8	14.3	9.4	-30.0	2.8
SP 60/60°F	0.8493	0.9230	0.9705	1.0043	1.3939	1.0536
Pour Point, °F	<-15	<-15	-5	75	-	<-15
Softening Point, °F	-	-	-	-	293	-
Viscosity, CST @ 100°F	1.1	2.3	8.30	66.14	-	34.0
CST @ 210°F	0.6	0.9	3.09	5.36	-	
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	1.7	0				
Naphthenes	-	-				
Aromatics	25.0	71.6				
Saturates	73.3	28.4				
Elemental, Wt%						
Carbon	86.07	86.83	88.87	89.94		79.18
Hydrogen	12.50	10.81	10.28	9.69		8.59
Oxygen	1.40	0.77	0.50	0.50	12.80	4.55
Nitrogen	0.25	0.26	0.21	0.20	0.91	0.38
Sulfur	<0.06	<0.06	<0.06	<0.06	3.19	0.85
Ash, Wt%					27.86	6.78

(a) Wilsonville Run 145
(b) C_5+ in gas are 7.83 liquid volume % and 4.72 weight % on feed.

TABLE XLI

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
NOMINAL 600°F IBP NON-DEASHED SCT (a)
Run 2LCF-16 (Period 22)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	10.49 (b)	16.34	29.46	25.83	22.49	104.61
Weight Percent on Fresh Feed	7.59 (b)	12.72	24.49	22.27	26.06	93.13
Gravity, °API	33.3	21.6	14.3	9.0	-26.9	2.4
SP 60/60°F	0.8586	0.9242	0.9705	1.0071	1.353	1.0568
Pour Point, °F	<-15	<-15	5	75	-	-10
Softening Point, °F	-	-	-	-	295	-
Viscosity, CST @ 100°F	1.20	2.51	8.52	69.83	-	18.69
CST @ 210°F	0.59	0.98	1.97	4.47	-	3.19
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins						
Naphthenes	-	-				
Aromatics	28.3	66.0				
Saturates	71.7	34.0				
Elemental, Wt%						
Carbon	85.42	86.34	88.44	87.29	67.55	80.17
Hydrogen	12.53	10.75	10.48	9.96	5.25	8.66
Oxygen	1.87	0.88	0.58	0.63	10.74	3.73
Nitrogen	0.24	0.24	0.24	0.25	1.10	0.50
Sulfur	<0.06	<0.06	<0.06	0.05	2.60	0.85
Ash, Wt%					22.70	6.58

(a) Wilsonville Run 145
(b) C_5+ in gas are 5.12 liquid volume % and 3.10 weight % on feed.

TABLE XLII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF NOMINAL 600°F IBP NON-DEASHED SCT (a) Run 2LCF-16 (Period 25)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	10.60 (b)	17.64	31.58	23.45	19.57	102.84
Weight Percent on Fresh Feed	7.49 (b)	13.61	25.68	19.72	23.57	90.07
Gravity, °API	35.7	24.4	16.4	11.4	-31.7	4.6
SP 60/60°F	0.8463	0.9076	0.9567	0.9902	1.4173	1.0397
Pour Point, °F	<-15	<-15	<-10	75	-	<-15
Softening Point, °F	-	-	-	-	284	-
Viscosity, CST @ 100°F	1.09	2.25	11.79	88.54	-	11.31
CST @ 210°F	0.58	0.96	1.93	4.98	-	2.43
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	23.3	54.5				
Saturates	76.7	45.5				
Elemental, Wt%						
Carbon	86.71	87.85	87.45	89.78	64.73	80.04
Hydrogen	12.95	11.65	10.82	10.41	5.05	9.18
Oxygen	0.66	0.34	0.29	0.35	12.28	3.78
Nitrogen	0.14	0.13	0.11	0.21	0.90	0.28
Sulfur	<0.06	<0.06	<0.06	0.04	3.22	0.79
Ash, Wt%					26.65	7.42

(a) Wilsonville Run 145
(b) C_5+ in gas are 5.87 liquid volume % and 3.55 weight % on feed.

TABLE XLIII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
70/30 VOLUME % SRC-I/500°F IBP SOLVENT
Run 2LCF-17 (Period 4)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	2.75 (a)	10.54	21.17	26.34	40.16	100.96
Weight Percent on Fresh Feed	2.19 (a)	8.37	17.85	23.28	39.67	91.36
Gravity, °API	31.8	18.6	9.6	3.2	-11.0	-0.5
SP 60/60°F	0.8665	0.9427	1.0028	1.0505	1.174	1.0804
Pour Point, °F	<-15	<-15	<-15	35	-	35
Softening Point, °F	-	-	-	-	243	-
Viscosity, CST @ 100°F	1.34	2.28	8.74	183.0	-	965.0
CST @ 210°F	0.63	0.94	2.07	7.04	-	20.04
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	34.0	82.9				
Saturates	66.0	17.1				
Elemental, Wt%						
Carbon	86.81	87.97	90.55	90.67	90.22	89.58
Hydrogen	12.02	10.32	9.57	8.72	6.86	8.26
Oxygen	1.06	0.35	0.42	0.36	1.09	0.62
Nitrogen	0.27	0.24	0.27	0.44	1.15	0.66
Sulfur	<0.06	<0.06	<0.06	<0.06	0.13	0.06
Ash, Wt%					0.42	0.20

(a) C_5+ in gas are 5.51 liquid volume % and 3.35 weight % on feed.

TABLE XLIV

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
70/30 VOLUME % SRC-I/500°F IBP SOLVENT
Run 2LCF-17 (Period 7)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	6.54 (a)	12.41	21.18	25.29	32.81	98.23
Weight Percent on Fresh Feed	4.69 (a)	9.86	17.93	22.51	32.92	87.91
Gravity, °API	30.6	18.5	9.6	2.6	-12.5	0.9
SP 60/60°F	0.8729	0.9433	1.0028	1.0544	1.1893	1.0687
Pour Point, °F	<-15	<-15	<-15	25	-	10
Softening Point, °F	-	-	-	-	232	-
Viscosity, CST @ 100°F	1.26	2.47	8.54	104.76	-	178.9
CST @ 210°F	0.65	1.02	1.99	7.54	-	9.55
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	42.7	82.2				
Saturates	57.3	17.8				
Elemental, Wt%						
Carbon	86.89	87.15	90.42	90.90	89.77	89.62
Hydrogen	11.77	10.15	9.35	8.52	6.64	8.18
Oxygen	0.69	0.31	0.36	0.32	0.81	0.49
Nitrogen	0.25	0.24	0.29	0.49	1.11	0.63
Sulfur	<0.06	<0.06	<0.06	<0.06	0.09	<<0.06
Ash, Wt%					0.38	0.16

(a) C_5+ in gas are 8.43 liquid volume % and 5.08 weight % on feed.

TABLE XLV

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
70/30 VOLUME % SRC-I/500°F IBP SOLVENT
Run 2LCF-17 (Period 9)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	4.16 (a)	10.32	18.12	23.38	43.83	99.81
Weight Percent on Fresh Feed	2.80 (a)	8.32	15.62	21.12	44.48	92.34
Gravity, °API	29.6	17.1	7.4	1.1	-13.5	-3.4
SP 60/60°F	0.8783	0.9522	1.0187	1.0671	1.199	1.1046
Pour Point, °F	<-15	<-15	<-15	50	-	65
Softening Point, °F	-	-	-	-	266	-
Viscosity, CST @ 100°F	1.27	2.38	9.17	118.03	-	6547
CST @ 210°F	0.65	0.94	2.07	7.65	-	42.37
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	40.6	85.7				
Saturates	59.4	14.3				
Elemental, Wt%						
Carbon	85.84	89.11	89.30	90.81	90.32	89.86
Hydrogen	11.54	10.44	8.94	8.20	6.55	7.79
Oxygen	1.88	0.71	0.61	0.54	2.21	0.92
Nitrogen	<0.20	<0.20	0.34	0.65	1.51	0.99
Sulfur	<0.06	<0.06	<0.06	<0.06	0.18	0.10
Ash, Wt%					0.76	0.19

(a) C_5+ in gas are 4.49 liquid volume % and 2.67 weight % on feed.

TABLE XLVI

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 70/30 VOLUME % SRC-I/500°F IBP SOLVENT Run 2LCF-17 (Period 14)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	5.04 (a)	10.66	23.12	24.32	38.87	102.01
Weight Percent on Fresh Feed	3.79 (a)	8.37	19.31	21.35	38.62	91.44
Gravity, °API	31.0	19.3	10.2	3.3	-12.4	0.2
SP 60/60°F	0.8708	0.9383	0.9986	1.0497	1.188	1.0747
Pour Point, °F	<-15	<-15	<-15	45	-	40
Softening Point, °F	-	-	-	-	240	-
Viscosity, CST @ 100°F	1.28	2.33	7.49	143.02	-	655.03
CST @ 210°F	0.65	0.96	2.32	6.64	-	20.93
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	37.3	81.0				
Saturates	62.7	19.0				
Elemental, Wt%						
Carbon	87.10	89.11	89.97	91.20	90.94	89.81
Hydrogen	11.52	11.56	9.60	8.91	6.96	8.38
Oxygen	1.31	0.39	0.44	0.40	1.12	0.73
Nitrogen	0.003	0.22	0.24	0.45	1.23	0.66
Sulfur	<0.06	<0.06	<0.06	<0.06	0.13	0.07
Ash, Wt%					1.52	0.17

(a) C_5+ in gas are 5.77 liquid volume % and 3.49 weight % on feed.

TABLE XLVII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 70/30 VOLUME % SRC-I/500°F IBP SOLVENT Run 2LCF-17 (Period 17)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	4.09 (a)	11.17	21.12	23.35	46.23	105.96
Weight Percent on Fresh Feed	2.98 (a)	8.71	17.98	20.87	45.50	96.04
Gravity, °API	28.7	17.9	8.2	1.6	-14.0	-3.0
SP 60/60°F	0.8833	0.9471	1.0129	1.0631	1.204	1.1009
Pour Point, °F	<-15	<-15	<-15	30	-	85
Softening Point, °F	-	-	-	-	300	-
Viscosity, CST @ 100°F	1.49	2.49	10.51	284.40	-	-
CST @ 210°F	0.69	1.01	2.00	7.13	-	102.53
CST @ 300°F	-	-	-	-	-	14.53
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	39.2	84.2				
Saturates	60.8	15.8				
Elemental, Wt%						
Carbon	86.21	88.74	89.61	91.11	89.69	89.89
Hydrogen	11.52	10.27	9.25	8.18	6.48	7.79
Oxygen	2.11	0.77	0.64	0.61	1.82	1.19
Nitrogen	0.14	0.13	0.34	0.26	1.50	0.89
Sulfur	<0.06	<0.06	<0.06	<0.06	0.22	0.11
Ash, Wt%					0.36	0.14

(a) C_5+ in gas are 3.48 liquid volume % and 2.09 weight % on feed.

TABLE XLVIII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
70/30 VOLUME % SRC-I/500°F IBP SOLVENT
Run 2LCF-17 (Period 20)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	2.41 (a)	7.32	16.30	22.64	53.27	101.94
Weight Percent on Fresh Feed	1.77 (a)	5.75	14.29	20.93	52.47	95.21
Gravity, °API	25.8	16.2	6.5	-0.7	14.9	-7.4
SP 60/60°F	0.8996	0.9580	1.0254	1.0814	1.214	1.1400
Pour Point, °F	<-15	<-15	<-15	40	-	-
Softening Point, °F	-	-	-	-	313	75(b)
Viscosity, CST @ 100°F	1.52	2.54	8.93	168.83	-	-
CST @ 210°F	0.71	0.99	2.09	6.50	-	312.75
CST @ 300°F	-	-	-	-	-	29.82
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	5.7	0				
Naphthenes	-	-				
Aromatics	49.5	89.7				
Saturates	44.8	10.3				
Elemental, Wt%						
Carbon	86.22	88.75	88.82	91.11	89.95	89.77
Hydrogen	10.98	9.65	8.56	7.70	6.29	7.27
Oxygen	2.96	1.20	0.79	0.70	1.86	1.41
Nitrogen	0.45	0.54	0.33	0.66	1.65	1.17
Sulfur	<0.06	<0.06	<0.06	<0.06	0.46	0.16
Ash, Wt%					0.24	0.15

(a) C_{5+} in gas are 2.85 liquid volume % and 1.77 weight % on feed.
(b) Sample was too heavy for a Pour Point determination.

TABLE XLIX

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 70/30 VOLUME % SRC-I/500°F IBP SOLVENT Run 2LCF-17 (Period 23)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	4.55 (a)	9.88	21.39	24.96	40.53	101.31
Weight Percent on Fresh Feed	3.29 (a)	7.72	18.25	22.51	40.52	92.29
Gravity, °API	31.2	19.1	9.3	1.8	-14.5	-2.4
SP 60/60°F	0.8697	0.9396	1.0050	1.0615	1.209	1.0958
Pour Point, °F	<-15	<-15	<-15	50	-	50
Softening Point, °F	-	-	-	-	287	-
Viscosity, CST @ 100°F	1.24	2.05	8.48	115.25	-	-
CST @ 210°F	0.62	0.88	1.98	6.18	-	34.15
CST @ 300°F	-	-	-	-	-	6.42
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	38.9	82.4				
Saturates	61.1	17.6				
Elemental, Wt%						
Carbon	85.24	88.73	90.06	91.60	90.55	90.31
Hydrogen	11.67	10.46	9.17	8.44	6.33	7.92
Oxygen	1.58	0.62	0.13	0.12	2.43	
Nitrogen	0.44	0.24	0.22	0.43	1.39	0.80
Sulfur	<0.06	<0.06	<0.06	<0.06	0.22	0.09
Ash, Wt%					0.32	0.32

(a) C_5^+ in gas are 6.15 liquid volume % and 3.68 weight % on feed.

TABLE L

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 70/30 VOLUME % SRC-I/500°F IBP SOLVENT
Run 2LCF-17 (Period 25)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	5.57 (a)	11.16	21.23	26.15	35.28	99.39
Weight Percent on Fresh Feed	4.03 (a)	8.71	11.93	23.50	35.92	90.11
Gravity, °API	31.0	19.1	9.4	1.1	-16.4	-1.8
SP 60/60°F	0.8708	0.9396	1.0043	1.0671	1.229	1.0908
Pour Point, °F	<-15	<-15	<-15	25	-	35
Softening Point, °F	-	-	-	-	281	-
Viscosity, CST @ 100°F	1.20	2.22	7.53	91.26	-	-
CST @ 210°F	0.61	0.93	1.91	5.61	-	18.16
CST @ 300°F	-	-	-	-	-	4.53
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	42.5	84.2				
Saturates	57.5	15.8				
Elemental, Wt%						
Carbon	86.02	89.00	90.86	90.67	90.84	90.08
Hydrogen	11.68	10.02	9.31	8.08	6.07	7.80
Oxygen	1.57	0.62	0.46	0.41	1.21	
Nitrogen	0.31	0.31	0.23	0.46	1.43	0.78
Sulfur	<0.06	<0.06	<0.06	<0.06	0.16	0.03
Ash, Wt%					0.27	0.15

(a) C_5+ in gas are 6.57 liquid volume % and 3.90 weight % on feed.

TABLE LI

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF 70/30 VOLUME % SRC-I/500°F IBP SOLVENT Run 2LCF-17 (Period 27)

Fraction	Distillation Fractions IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	Total Liquid Product
Volume Percent and	4.32 (a)	18.01	26.56	26.42	24.36	99.67
Weight Percent on Fresh Feed	3.16 (a)	14.43	22.90	23.94	24.60	89.08
Gravity, °API	30.8	16.9	7.9	1.1	-13.8	1.7
SP 60/60°F	0.8718	0.9535	1.0151	1.0671	1.202	1.0623
Pour Point, °F	<-15	<-15	<-15	32	-	5
Softening Point, °F	-	-	-	-	278	-
Viscosity, CST @ 100°F	1.15	2.08	8.51	94.28	-	98.0
CST @ 210°F	0.81	0.89	2.01	5.50	-	9.39
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	4.3	0				
Naphthenes	-	-				
Aromatics	53.4	91.2				
Saturates	42.3	8.8				
Elemental, Wt%						
Carbon	87.41	89.82	89.35	91.11	89.69	89.74
Hydrogen	11.22	10.10	9.15	8.18	6.48	8.30
Oxygen	0.95	0.19	0.50	0.44	1.60	0.73
Nitrogen	0.001	0.22	0.17	0.26	1.35	0.47
Sulfur	<0.06	<0.06	<0.06	<0.06	0.20	0.09
Ash, Wt%					0.62	0.10

(a) C_5 in gas are 8.36 liquid volume % and 5.05 weight % in feed.

TABLE LII

LIQUID PRODUCT YIELDS FROM THE PROCESSING OF
70/30 VOLUME % SRC-I/500°F IBP SOLVENT
Run 2LCF-17 (Period 31)

Fraction	Distillation Fractions					Total Liquid Product
	IBP-390°F	390-500°F	500-650°F	650-850°F	850°F+	
Volume Percent and	4.49 (a)	12.56	22.81	24.13	30.54	94.53
Weight Percent on Fresh Feed	3.22 (a)	9.74	19.18	21.52	30.44	84.10
Gravity, °API	30.0	18.1	8.5	0.5	-15.0	-1.1
SP 60/60°F	0.8762	0.9459	1.0107	1.0720	1.215	1.0854
Pour Point, °F	<-15	<-15	<-15	25	-	15
Softening Point, °F	-	-	-	-	263	-
Viscosity, CST @ 100°F	1.18	1.36	7.49	111.88	-	241.16
CST @ 210°F	0.60	0.88	1.94	16.76	-	11.66
Hydrocarbon Type, Vol%						
Paraffins	-	-				
Olefins	0	0				
Naphthenes	-	-				
Aromatics	46.2	88.5				
Saturates	53.8	11.5				
Elemental, Wt%						
Carbon	86.88	89.45	89.23	91.13	90.74	90.22
Hydrogen	11.20	10.04	8.92	7.97	6.29	7.75
Oxygen	1.65	0.46	0.51	0.38	1.01	0.69
Nitrogen	0.42	0.35	0.29	0.44	1.35	0.70
Sulfur	<0.06	<0.06	<0.06	0.02	0.15	0.06
Ash, Wt%					0.25	0.08

(a) C_5+ in gas are 12.71 liquid volume % and 7.44 weight % on feed.

TABLE LIII

LC-FINING PDU OPERATION
YIELD DATA AS A PERCENTAGE OF FEED
PDU 2LCF-10
(50/50 Vol.% SRC-I/500°F IBP Solvent with Cool Non-Catalytic Zones)

Blend Period PDU 2LCF-10	3	5	11	13	19	24b	26	29	31
Average Reactor Temp, °F	750	780	780	790	790	800	810	830	~780
Space Velocity (SV_{rel})	0.93	0.88	0.93	0.76	0.88	0.88	0.81	0.93	0.81
Conversion, Vol% 850°F+	26.4	39.3	46.6	55.6	49.8	57.5	60.5	63.1	40.9
Yield - Weight % of Feed									
H_2O	1.89	2.41	2.76	2.50	2.65(a)	3.07(a)	2.61(a)	2.79(a)	2.39(a)
H_2S	0.47	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.48
NH_3	0.79	1.01	1.10	1.19	1.07	1.10	1.25	1.20	0.87
CH_4	0.49	0.99	1.01	1.36	1.28	1.55	2.14	2.83	1.01
C_2H_6	0.52	0.96	1.04	1.32	1.26	1.57	2.14	2.84	1.03
C_3H_8	0.48	1.04	1.03	1.40	1.27	1.58	2.26	2.99	0.96
C_3H_6	0.01	0.02	0.03	0.04	0.05	0.08	0.08	0.17	0.04
$i\text{-}C_4H_{10}$	0.03	0.07	0.07	0.12	0.12	0.13	0.20	0.25	0.06
$n\text{-}C_4H_{10}$	0.44	1.13	1.08	1.44	1.22	1.50	0.03	2.77	0.88
C_4H_8	-	-	-	-	-	-	0.03	0.03	-
C_5-390°F	3.38	5.73	4.94	5.92	5.84	5.91	7.05	8.17	3.46
390-500°F	10.06	13.68	8.88	12.01	10.44	11.80	9.51	11.38	6.39
500-650°F	28.38	27.65	25.56	28.01	25.92	24.86	25.49	24.54	26.66
650-850°F	18.60	17.59	25.68	22.76	23.62	25.60	25.92	22.25	25.19
850°F+	37.14	30.58	29.37	24.73	27.71	23.86	22.33	21.01	33.12
Total	102.68	103.33	103.03	103.28	102.93	103.09	101.52	103.70	102.54
Yield - Volume % of Feed									
C_5-390°F	5.59	8.79	7.89	9.37	8.97	8.77	11.53	13.03	5.46
390-500°F	12.66	17.32	11.08	15.02	13.19	14.70	11.83	14.14	7.87
500-650°F	33.08	32.70	29.97	32.62	30.62	29.02	29.78	28.45	30.59
650-850°F	20.71	19.72	28.17	25.00	26.07	27.95	28.26	23.97	27.31
850°F+	37.96	31.34	29.41	24.38	27.69	23.43	21.79	20.34	32.58
Total	110.00	109.87	106.52	106.39	106.54	103.87	103.19	99.93	103.81
H_2 Consumption (SCF/BBL)	2173	2620	2366	2557	2298	2412	2974	2892	1985

(a) Yield of water calculated based on oxygen balance.
High pressure, low temperature separator insufficiently cooled.

TABLE LIV

LC-FINING PDU OPERATION
YIELD DATA AS A PERCENTAGE OF FEED
PDU Run 2LCF-12
(50/50 Vol% 1% Ash SRC-I/500°FIBP Solvent)(a)

Blend Period PDU 2LCF-12	2	5	11	13	16	18	19
Average Reactor Temp, °F	750	780	780	790	790	800	810
Space Velocity (SV_{rel})	0.88	0.76	0.88	1.0	1.12	0.93	1.0
Conversion, Vol% 850°F+	45.74	62.50	54.34	62.88	58.92	66.0	74.4
Yield - Weight % of Feed							
H_2O (b)	2.60	2.67	1.81	3.12	2.52	2.73	2.64
H_2S	0.42	0.39	0.43	0.51	0.51	0.51	0.51
NH_3	1.05	1.20	1.06	1.08	1.00	1.13	1.12
CH_4	0.70	1.15	1.27	1.50	1.27	1.98	2.19
C_2H_6	0.74	1.62	1.37	1.58	1.29	2.02	2.28
C_3H_8	0.74	1.79	1.41	1.71	1.35	2.17	2.49
C_3H_6	0.01	0.07	0.06	0.08	0.05	0.08	0.13
$i\text{-}C_4H_{10}$	0.05	0.17	0.12	0.16	0.12	0.18	0.21
$n\text{-}C_4H_{10}$	0.66	1.69	1.35	1.69	1.31	2.01	2.27
C_4H_8	-	0.02	0.02	0.03	0.02	0.04	0.04
C_5-390°F	4.18	7.50	5.43	7.59	8.65	6.87	8.88
390-500°F	10.36	9.88	10.25	14.25	10.05	12.69	18.07
500-650°F	27.89	28.26	29.76	27.79	28.99	28.12	24.86
650-850°F	24.29	26.52	23.72	22.21	23.28	24.15	23.53
850°F+	29.12	20.35	24.95	20.17	22.49	18.77	14.46
Total	102.81	103.28	103.01	103.47	102.90	103.45	103.68
Yield - Volume % of Feed							
C_5-390°F	2.35	4.77	2.56	3.87	7.54	10.28	13.55
390-500°F	13.06	12.46	12.87	17.91	12.61	16.13	22.66
500-650°F	33.00	33.62	35.04	32.65	34.08	33.04	29.24
650-850°F	27.38	29.80	26.49	24.65	25.81	26.58	25.97
850°F+	29.14	20.14	24.52	19.93	22.06	18.25	13.76
Total	104.93	100.79	101.48	99.01	102.10	104.28	105.18
H_2 Consumption (SCF/BBL)	2230	2882	2372	2782	2292	2731	2919

(a) SRC (N-024) and high ash SRC (N-084) were 53.4 wt% and 2.9 wt%, respectively.
(b) Water yield calculated by oxygen balance.

TABLE LV

LC-FINING PDU OPERATION
YIELD DATA AS A PERCENTAGE OF FEED
PDU Runs 2LCF-13 and 2LCF-14
(SCT from Wilsonville Run 146)

Blend Period PDU 2LCF-	14/4	14/8B	14/10B	13/2	13/4B	13/7	13/8
Feed Blend	Deashed SCT			Non-deashed SCT			
Average Reactor Temp., °F	750	780	810	750	750	780	810
Space Velocity (SV_{rel})	1.31	1.31	1.31	1.0	1.26	1.45	1.44
Conversion, Vol% 850°F+	53.5	62.2	80.8	48.0	43.7	57.5	75.3
Gravity Rise, °API	19.1	18.8	20.5	16.4	15.9		16.7
Yield - Weight % of Feed							
H_2O	4.70	4.93	5.11	3.92(a)	3.98(a)	3.85(a)	4.24
H_2S	0.93	1.00	1.01	0.84	0.87	0.87	0.95
NH_3	1.15	1.24	1.23	1.17	1.13	1.11	1.20
CH_4	0.59	1.05	2.13	0.93	0.70	0.99	1.58
C_2H_6	0.59	0.99	1.89	0.90	0.69	0.96	1.54
C_3H_8	0.56	1.04	2.08	0.95	0.69	1.05	1.69
C_3H_6	0.01	0.03	0.08	0.01	0.01	0.02	0.02
$i\text{-}C_4H_{10}$	0.05	0.12	0.23	0.09	0.06	0.12	0.18
$n\text{-}C_4H_{10}$	0.42	0.78	1.73	0.68	0.52	0.79	1.39
C_4H_8	0.01	-	0.04	0.01	-	-	0.01
C_5-390°F	7.75	8.54	15.90	5.34	9.28	11.31	14.33
390-500°F	9.29	9.30	11.86	9.87	10.59	12.49	14.24
500-650°F	23.55	23.91	25.33	27.19	23.66	24.76	28.73
650-850°F	27.35	28.69	24.90	24.99	22.55	22.17	19.18
850°F+	26.36	21.77	10.70	26.44	28.31	22.82	14.32
Total	103.31	103.39	104.22	103.33	103.04	103.31	103.60
Yield - Volume % of Feed							
C_5-390°F	11.13	12.65	23.84	8.09	13.81	17.36	20.88
390-500°F	11.96	11.93	15.03	12.76	13.80	16.24	18.92
500-650°F	28.44	28.85	30.05	33.45	29.24	30.21	35.21
650-850°F	31.80	33.20	28.09	29.59	26.77	26.17	22.32
850°F+	26.71	21.67	10.36	24.02	26.01	19.62	11.39
Total	110.04	108.30	107.37	107.91	109.63	109.60	108.72
H_2 Consumption (SCF/BBL)	2562	2623	3260	2637	2434	2598	2846

(a) Water yield calculated by oxygen balance.

TABLE LVI

LC-FINING PDU OPERATION
YIELD DATA AS A PERCENTAGE OF FEED
PDU Run 2LCF-15
(Catalyst Check)

Blend Period PDU 2LCF-15	15/3B	15/6	15/11	15/14	15/15
Average Reactor Temp., °F	750	780	780	810	810
Space Velocity (SV_{rel})	0.81	1.0	0.81	0.88	0.88
Conversion, Vol% 850°F+	44.2	59.6	63.9	72.1	75.4
Gravity Rise, °API		14.4		15.7	
Yield - Weight % of Feed					
H_2O (a)	2.58	2.66	2.75	2.70	2.75
H_2S	0.38	0.29	0.44	0.44	0.44
NH_3	0.91	1.00	1.20	1.10	1.24
CH_4	0.64	1.20	1.23	2.33	2.10
C_2H_6	0.73	1.21	1.21	2.37	2.10
C_3H_8	0.68	1.18	1.23	2.49	2.34
C_3H_6	0.02	0.02	0.07	0.12	0.13
$i\text{-}C_4H_{10}$	0.05	0.10	0.11	0.21	0.20
$n\text{-}C_4H_{10}$	0.60	1.13	0.71	2.30	2.25
C_4H_8	-	0.01	0.01	0.04	0.03
C_5-390°F	5.40	12.17	7.53	9.27	9.99
390-500°F	8.64	11.24	13.34	13.81	12.72
500-650°F	30.82	24.90	28.17	31.89	27.74
650-850°F	23.07	25.21	24.98	18.71	25.76
850°F+	28.55	21.11	20.23	15.87	14.16
Total	103.07	103.43	103.21	103.65	103.95
Yield - Volume % of Feed					
C_5-390°F	8.40	16.81	11.41	14.43	15.73
390-500°F	10.60	13.78	16.63	17.17	15.80
500-650°F	35.13	28.61	32.79	36.70	32.24
650-850°F	25.13	27.57	27.68	20.28	28.08
850°F+	28.53	20.62	19.98	15.46	13.62
Total	107.79	107.39	108.49	104.04	105.47
H_2 Consumption (SCF/BBL)	2381	2648	2506	2866	3083

(a) Water yield calculated by oxygen balance.

TABLE LVII
LC-FINING PDU OPERATION
YIELD DATA AS A PERCENTAGE OF FEED
Run PDU 2LCF-16
(600°F IBP Non-Deashed SCT from Wilsonville Run 145)

Blend Period PDU 2LCF-16		4	9	11	15	18	20	22	25
Reactor Pressure (P_{rel})	1.0	1.35	1.35	1.35	1.35	1.35	1.35	1.35	
Average Reactor Temp, °F		750	750	780	780	780	810	800	780
Space Velocity (SV_{rel})		1.06	1.00	0.94	1.94	2.88	3	3	1.31
Conversion, Vol% 850°F+		46.2	54.7	78.2	53.5	39.8	60.9	53.6	59.6
Gravity Rise, °API		16.3		25.2		14.4	13.8	14.5	
Yield - Weight % of Feed									
H_2O		2.71	5.01	5.72	5.61	3.87	3.45	2.07	4.02
H_2S		0.90	0.96	1.26	0.93	0.99	0.85	0.81	0.89
NH_3		1.18	1.40	1.43	1.31	0.98	1.21	1.05	1.31
CH_4		0.66	0.61	0.94	0.76	0.34	1.08	0.81	0.93
C_2H_6		0.70	0.68	1.17	0.77	0.35	1.16	0.84	1.05
C_3H_8		0.73	0.72	1.30	0.82	0.33	1.19	0.81	1.13
C_3H_6		0.02	0.01	0.02	0.02	0.01	0.04	0.04	0.03
$i\text{-}C_4H_{10}$		0.11	0.07	0.16	0.08	0.03	0.13	0.08	0.13
$n\text{-}C_4H_{10}$		0.56	0.58	1.21	0.65	0.25	1.02	0.64	0.90
C_4H_8		-	0.01	0.01	0.01	-	0.03	0.03	0.01
C_5-390°F		8.72	10.26	17.00	10.27	5.40	12.17	10.69	11.04
390-500°F		10.82	12.76	15.03	10.77	7.26	13.54	12.72	13.61
500-650°F		21.34	22.99	26.19	21.69	16.66	24.15	24.49	25.68
650-850°F		25.64	22.96	20.97	21.46	30.85	21.21	22.27	19.72
850°F+		29.43	25.25	12.72	28.47	35.17	22.41	26.06	23.57
Total		103.52	104.27	105.13	103.62	102.49	103.64	103.41	104.02
Yield - Volume % of Feed									
C_5-390°F		13.56	15.97	26.06	15.80	8.14	17.46	15.61	16.47
390-500°F		14.41	17.12	20.25	14.33	9.51	17.22	16.34	17.64
500-650°F		26.63	29.29	33.40	27.16	20.71	29.32	29.46	31.58
650-850°F		30.86	28.33	25.92	26.05	37.06	24.89	25.83	23.45
850°F+		26.57	22.39	10.79	25.20	31.07	18.95	22.49	19.57
Total		112.03	113.10	116.42	108.54	106.49	107.84	109.73	108.71
H_2 Consumption (SCF/BBL)		2860	3444	4133	2893	1994	2837	2664	3146

TABLE LVIII
LC-FINING PDU OPERATION
YIELD DATA AS A PERCENTAGE OF FEED
Run PDU 2LCF-17
70/30 Vol.% SRC-I/500°F IBP KC-Oil

Blend Period PDU 2LCF-	4	7	9	14	17	20	23	25	27	31
Reactor Pressure (P_{rel})	1.0	1.0	1.0	1.35	1.35	1.0	1.35	1.35	1.35	1.0
Average Reactor Temp, °F	750	780	780	780	780	780	810	830	780	780
Space Velocity (SV_{rel})	0.75	1.00	1.69	1.69	3.25	2.88	3.06	3.38	0.69	0.94
Conversion, Vol% 850°F+	42.5	53.0	37.2	46.8	35.0	25.6	44.6	51.7	67.8	57.8
Gravity Rise, °API	12.5			13.8		8.9				
Yield - Weight % of Feed										
H_2O	3.45	2.84	2.88	3.15	1.83	1.77	1.59	2.69	1.63	3.96
H_2S	0.56	0.58	0.52	0.56	0.58	0.45	0.73	0.78	0.54	0.59
NH_3	1.28	1.34	0.91	1.14	1.00	0.56	1.10	1.14	1.63	1.19
CH_4	0.82	1.49	0.98	0.93	0.60	0.61	1.00	1.27	1.60	1.60
C_2H_6	0.83	1.44	0.85	0.94	0.54	0.56	0.87	1.02	1.39	1.48
C_3H_8	0.81	1.47	0.79	0.90	0.48	0.47	0.85	1.07	1.52	1.51
C_3H_6	0.02	0.06	0.04	0.02	0.02	0.03	0.03	0.05	0.04	0.06
$i\text{-}C_4H_{10}$	0.06	0.15	0.07	0.08	0.04	0.04	0.08	0.10	0.15	0.16
$n\text{-}C_4H_{10}$	0.76	1.37	0.70	0.76	0.38	0.36	0.75	0.95	1.40	1.54
C_4H_8	0.01	0.02	0.02	0.01	0.01	0.02	0.03	0.03	0.01	0.04
C_5-390°F	5.55	9.77	5.47	7.28	5.01	3.45	6.97	7.93	8.21	10.66
390-500°F	8.37	9.86	8.32	8.37	8.61	5.75	7.72	8.71	14.43	9.74
500-650°F	17.85	17.93	15.62	19.31	17.71	14.29	18.25	17.95	22.90	19.18
650-850°F	23.28	22.51	21.12	21.35	20.63	20.93	22.51	23.50	23.94	21.52
850°F+	39.67	32.92	44.48	38.62	44.98	52.47	40.52	35.92	24.60	30.44
Total	103.32	103.75	102.77	103.42	102.42	101.76	103.00	103.11	103.99	103.67
Yield - Volume % of Feed										
C_5-390°F	8.26	14.97	8.65	10.80	7.48	5.26	10.70	12.13	12.68	17.20
390-500°F	10.54	12.41	10.32	10.66	11.04	7.32	9.88	11.16	18.01	12.56
500-650°F	21.17	21.18	18.12	23.12	20.88	16.30	21.39	21.23	26.56	22.81
650-850°F	26.34	25.29	23.38	24.32	23.09	22.64	24.96	26.15	26.42	24.13
850°F+	40.16	32.81	43.83	38.87	45.71	53.27	40.53	35.28	24.36	30.54
Total	106.47	106.66	104.30	107.77	108.20	104.79	107.46	105.95	108.03	107.24
H_2 Consumption (SCF/BBL)	2625	2946	2163	2702	1968	1417	2365	2461	3168	2955

TABLE LVIX

Summary Table
Nominal Process Parameter Characteristics

PDU Run No.	Periods	P_{rel}	SV_{rel}	Temp (°F)
2LCF-10 (Cool Zone Operation)				
	1-3	1.0	1.0	750
	4-11	1.0	1.0	780
	12-19	1.0	1.0	790
	20-24	1.0	1.0	800
	25-26	1.0	1.0	810
	27-29	1.0	1.0	830
	30-31	1.0	1.0	780
2LCF-12 (SRC-I Contained 1 wt.% Ash)				
	1-3	1.0	1.0	750
	4-11	1.0	1.0	780
	12-16	1.0	1.0	790
	17-18	1.0	1.0	800
	19	1.0	1.0	780
2LCF-13 (Non-deashed SCT, Wilsonville Run 146)				
	1-4	1.0	1.0	750
	5-7	1.0	1.0	780
	8	1.0	1.0	810
2LCF-14 (Deashed SCT, Wilsonville Run 146)				
	2-4	1.0	1.0	750
	7-8	1.0	1.0	780
	9-11	1.0	1.0	810
2LCF-15 (Verification Run, New Lot Shell 324 Ni/Mo Catalyst)				
	1-3	1.0	1.0	750
	4-11	1.0	1.0	780
	12-15	1.0	1.0	810
2LCF-16 (Non-deashed SCT, Wilsonville Run 145)				
	2-4	1.0	1.0	750
	6-9	1.35	1.0	750
	10-12	1.35	1.0	780
	13-15	1.35	1.9	780
	16-18	1.35	3.0	780
	19-20	1.35	3.0	810
	21-22	1.35	3.0	800
	23-25	1.35	1.0	780
2LCF-17 (70/30 SRC-I/KC-Oil)				
	1-4	1.0	1.0	750
	5-7	1.0	1.0	780
	8-10	1.0	1.9	780
	11-14	1.35	1.9	780
	15-17	1.35	3.0	780
	18-20	1.0	3.0	780
	22-23	1.35	3.0	810
	24-25	1.35	3.0	830
	27	1.35	1.0	780
	30-32	1.0	1.0	780

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