FE-2566-27
Distribution Category UC-90d

UPGRADING OF COAL LIQUIDS

INTERIM REPORT

HYDROTREATING AND REFORMING SRC II PROCESS DERIVED NAPHTHA

FREDERICK J. RIEDL AND ARMAND J. deROSSET
UOP INC.
CORPORATE RESEARCH CENTER
TEN UOP PLAZA
DES PLAINES, IL 60016

DATE PUBLISHED - JUNE, 1979
PREPARED FOR THE UNITED STATES
DEPARTMENT OF ENERGY
UNDER CONTRACT No. EF-77-C-01-2566

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Solvent Refined Coal II (SRC II) process naphtha has been refined in UOP research pilot plants to 100 octane fuel by conventional refinery processing using commercial UOP catalysts.

The naphtha is principally comprised of cyclic hydrocarbons. In addition, it contains over 9% phenols and heterocyclic structures, such as pyridines and thiophenes. Hydrotreatment was effective in reducing the sulfur and nitrogen to levels acceptable for reforming. Conditions used were substantially more severe than required to clean up a Middle East naphtha. However, they were well within commercial practice for hydrotreating heavier petroleum distillates.

Reforming the hydrotreated SRC II naphtha produced 88 vol-% of 99.9 octane (RON) gasoline. Conditions were relatively mild due to the predominance of cyclic structures in the feed. Dehydrogenation of naphthenes to aromatics was the principal reaction. The reforming operation yielded 1550 SCF/bbl hydrogen, about three times the amount needed for naphtha hydrotreatment.

1. INTRODUCTION

The object of the work reported is to produce high octane motor fuel by refining Solvent Refined Coal II (SRC II) process naphtha. The work entails hydrotreatment of the naphtha to a quality suitable for a reformer feedstock, and development of a yield octane relationship by Platforming.® All processing is done in research pilot plants. Detailed analyses of feed and product streams are provided.

This is the third primary coal derived naphtha examined under Task 3 of Contract EF-77-C-01-2566. DOE Report FE-2566-12 covers parallel work on H-Coal process derived naphthas, and DOE Report FE-2566-25 covers work on Exxon Donor Solvent process derived naphthas.

For reporting purposes, the experimental conditions employed in this work were expressed in terms of base conditions:

Temperature	T-T (base), °C
Pressure	P-P (base), psi
Space Velocity	LHSV/LHSV (base)

The base conditions for hydrotreating represent conditions employed commercially for hydrotreating a typical straight run naphtha from Light Arabian crude to make Platformer feed quality. Similarly, the base conditions for Platforming refer to those conditions used commercially for typical modern Platformers processing hydrotreated Light Arabian straight run naphtha.

2. EQUIPMENT

Naphtha hydrotreating was carried out in a bench scale continuous unit (UOP Research Plant 505). A simplified flow diagram of this plant is shown in Figure 1. Hydrogen and primary naphtha were passed concurrently downflow over a fixed bed (100 ml) of commercial hydrotreating catalyst. The catalyst was a composite of Group VI and Group VIII metals on a high surface area refractory support.

Reforming of the upgraded naphtha was conducted in UOP Research Plant 636. Figure 2 is a simplified flow diagram of a bench scale reforming plant. The reforming reactor was loaded with 50 ml of a commercial Platforming catalyst.

3. CHARGE STOCKS

3.1. Naphtha Hydrotreating

Three 5-gallon containers of SRC II naphtha were received on November 3, 1978 from the Pittsburgh and Midway Coal Mining Co. in DuPont, Washington. The contents of the containers were blended together into a 15 gallon stainless steel drum and thoroughly mixed.

Analysis of the SRC II naphtha showed that the sample contained 4400 wt-ppm sulfur, 5140 wt-ppm nitrogen, and 7814 wt-ppm oxygen. These are relatively high compared to petroleum-derived naphthas. Tables 1 and 2 show the inspection and mass spectroscopy (MS) analysis of this liquid (3777-1). Paraffin content (P) was 31.5 vol-%, considerably higher than other primary coal naphthas examined.

In accordance with current UOP procedures for evaluating Platformer charge stocks, it was necessary to hydrotreat the naphtha to bring the heteroatoms content within acceptable limits.

3.2. Naphtha Reforming

The Platforming run was carried out on the upgraded SRC II naphtha. Inspection of this Platformer feed 3777-2 is given in Table 1.

4. RESULTS AND DISCUSSION

4.1. Naphtha Hydrotreating

The primary objective in hydrotreating the SRC II primary naphtha was the reduction of nitrogen, sulfur and oxygen contents to levels acceptable for a Platformer feedstock. The hydrotreating was successfully carried out over a commercial hydrotreating catalyst in UOP Research Plant 505, Run 874. Conditions used, shown in Table 3, were similar to those employed in hydrotreating the EDS naphtha (FE-2566-25). No attempt was made to optimize hydrotreating conditions. Operating temperature was adjusted to maintain the nitrogen content of the product at less than 1 ppm. The run was on stream for 16.5 days. A comparison of feed and product inspections is given in Table 1.

Table 4 is a summary of the overall material balance for the hydrotreating operation. The total over 100% represents hydrogen added to the feedstock. Since hydrocracking to C_2-C_4 light gases was fairly low, a high C_5+ liquid yield of 95.9 wt-% was obtained.

Hydrogen consumption was 560 SCF/bbl. Of this hydrogen 78.5 wt-% remained in the hydrocarbon products, while the remaining 21.5% was lost as NH_3, H_2O, and H_2S (Table 5). A comparison of MS analyses of raw naphtha and upgraded product (Tables 1, 2 and 6) indicates a large increase in naphthene content from saturation of cyclo-olefins and some aromatics. Of the non-hydrocarbon compounds, phenol would yield aromatics, while pyridines and thiophenes would yield paraffins. The reason for the considerable drop in paraffin content is not clear.

4.2. Naphtha Reforming

The upgraded SRC II naphtha from Plant 505, Run 874 was blended to provide the feedstock for the reforming run. Inspections are given in Table 1, Table 6 shows the distribution of C_5 and C_6+ fractions. The table also gives MS analysis of the C_6+ fractions.

The hydrotreated material was reformed over a commercial Platforming catalyst in a continuous UOP Research unit, Plant 636. The run was carried out at base pressure and 1.5x base space velocity, the same conditions as were used for reforming the EDS naphtha. A range of temperatures was studied to obtain yield-octane curves. Since this feed is highly naphthenic, the required reforming temperature was relatively low. As naphthene dehydrogenation is a fast reaction, a high space velocity was adequate. At these low severity conditions the yield of gasoline of a given octane number is generally very high.

The effect of temperature on C_5+ gasoline yield and unleaded gasoline Research octane number (RON) was as follows:

T-T Base, °C	RON Clear	C_5+ Yield, Vol-%
-68	88.5	91.7
-58	92.1	90.8
-48	93.8	91.1
-48	94.5	90.2
-33	97.6	88.4
-16	99.9	88.0

These data are summarized in Table 7 which also shows reforming conditions, product yields, octane number and inspection of C_5+ products (stabilized). Figure 3 is the yield-octane curve. The 88 vol-% yield at 99.9 RON is slightly less than obtained with H-Coal and EDS naphtha (90 vol-% and correlates with the slightly higher paraffin content of the SRC II upgraded naphtha.

Mass spectroscopy analyses were made on each of the C_6+ reformates. These results, as well as the corresponding product distribution data, are shown in Tables 8-13. These tables are arranged in the order of increasing temperature. Since increasing temperature favors aromatics formation, these tables also appear in the order of increasing RON of C_5+ reformate. Dehydrogenation of naphthenes was the primary reaction. Naphthene content of the product dropped by some 47.5 vol-% over the temperature range. The aromatic content increased from 22 vol-% in the Platformer feed to 78.5 vol-% in the reformate with a 99.9 RON.

4.3 Hydrogen Production

Naphtha reforming is an important source of hydrogen for upstream processing. The yield of hydrogen in reforming to 99.9 RON amounted to 3.1 wt-%. This corresponds to 1550 SCF/bbl, which is well within excess of the 560 SCF/bbl required for the naphtha hydrotreatment. A plot of hydrogen yield (SCF/bbl) vs. RON is shown in Figure 4.

Table 1

Inspection Data of SRC II Process Naphtha

	As Received	Upgraded
Sample No.	3777-1	3777-2
API @ 60°F	49.7	52.0
Sp. Gr. @ 60°F	0.7809	0.7711
Distillation ASTM D-86		
IBP, °F	107	136
5%	134	168
10%	157	180
20%	188	196
30%	209	209
40%	226	220
50%	243	233
60%	261	249
70%	279	270
80%	292	289
90%	316	311
95%	346	330
EP°F	367	388
% Over	97.5	98.5
Hydrogen, Wt-%	12.91	13.66
Carbon, Wt-%	85.87	86.00
Sulfur, Wt-ppm	4400	0.22
Nitrogen, Wt-ppm	5140	0.8
Oxygen, Wt. ppm	7814	359
Chloride, Wt-ppm	195	3.8
FIA, Vol-%		
A	-	18.8
P&N	-	81.2
M S Hydrocarbon Types, Vol-%		
A	23.0[(a)]	22.0
N	37.1	52.8
P	31.5	25.2
O	8.4	-
Bromine Index	30.0[(b)]	101.0
RON, Clear	80.8	70.9
N Jet Gum, mg/100 ml	12.0	-

(a) Includes 6.8% Polars.

(b) Bromine number.

Table 2

MS Analysis of SRC II Naphtha 3777-1

Series	Hydrocarbon Types	Wt-%	Vol-%
C_nH_{2n+2}	Paraffins	27.8	31.5
	Naphthenes		
C_nH_{2n}	Monocycloparaffins	28.4	28.9
	Cyclopentanes	-	-
	Cyclohexanes	-	-
C_nH_{2n-2}	Bi, Dicycloparaffins	7.1	7.2
C_nH_{2n-4}	Tricycloparaffins	1.0	1.0
	Aromatics		
C_nH_{2n-6}	Alkylbenzenes	17.4	15.6
C_nH_{2n-8}	Indanes/Tetralins	0.7	0.6
C_nH_{2n-10}	Dinaphthenebenzenes	<0.1	Trace
C_nH_{2n-12}	Napthalenes	<0.05	Trace
	Polars		
$C_nH_{2n-5}N$	Pyridines	3.0	2.3
$C_nH_{2n-4}O$	Furans	-	-
$C_nH_{2n-6}O$	Phenols	4.5	3.2
$C_nH_{2n-7}N$	Naphthenopyridines	Trace	Trace
$C_nH_{2n-4}S$	Thiophenes	1.6	1.3
	Olefins*		
C_nH_{2n}	Monoolefins	1.9	2.1
C_nH_{2n-2}	Diolefins and/or Monocycloolefins	5.1	5.0
C_nH_{2n-4}	Triolefins and/or Dicycloolefins	1.4	1.3
	Total	100.0	100.0

Carbon Number Distribution, Vol-%

Carbon	Aromatics				Polars
No.	J = 6	J = 8	J = 10	J = 12	J = 6^O
5					1.4
6	1.0				4.6
7	4.2				0.8
8	8.1				0.4
9	3.7	0.5	Trace		0.2
10	0.4	0.2	Trace		<0.05
11	Trace	Trace			<0.05
Total	17.4	0.7	Trace		7.4

*The total olefin number was obtained by SiO_2 separation, but the mono-, di-, tri-olefin split is estimated since no calibration coefficients are available.

Table 3

Upgrading SRC II Naphtha

Plant 505, Run 874

LHSV/LHSV (base) = 0.125; P-P(base) psi = 450; T-T (base)°C = 24 to 37

Period No.	Hours on Stream	N, ppm	S, ppm
Feed		5140	4400
1	16	-	0.27
2	26	-	0.29
4	46	0.44	0.13
7	76	-	0.28
9	96	0.50	0.40
11	116	0.43	0.10
13	136	0.60	0.10
15	156	0.75	0.10
17	176	0.92	0.10
19	196	1.31	0.10
20	208	2.08	0.10
24	246	0.62	0.10
26	266	0.78	0.10
32	326	-	0.10
39	396	-	0.10

Table 4

Upgrading of SRC II Naphtha 3777-1
Product Distribution and Hydrogen Consumption

Plant 505, Run 874

Product Distribution, Wt-% of Feed

C_1	Trace
C_2-C_4	3.20
C_5 and C_6 (in Plant Gas)	3.50
Liquid Product[(a)]	92.43
H_2O	0.86
H_2S	0.48
NH_3	0.63
Total	101.10
Hydrogen Consumption, Wt-% of Feed	1.10
Hydrogen Consumption SCF/bbl	560

(a) Designated as Upgraded SRC II Naphtha 3777-2

Table 5

Upgrading of SRC II Naphtha 3777-1

Distribution of Hydrogen Consumption

Plant 505, Run 874

	Wt-%
C_2-C_4	15.38
C_5 and C_6 (in Plant Gas)	10.82
Liquid Product[(a)]	52.27
H_2O	8.72
H_2S	2.54
NH_3	10.27
Total	100.00
Total Hydrogen Consumption, SCF/bbl	560

(a) Designated as Upgraded SRC II Naphtha 3777-2

Table 6

Distribution of Upgraded SRC II Naphtha 3777-2

Product Distribution	Wt-%	Vol-%
C_3	0.1	0.1
C_4	1.2	1.6
n-Pentane	2.4	2.9
Isopentane	0.9	1.1
C_6 Plus	95.4	94.3
Total	100.0	100.0

MS Analysis of C_6 Plus Fraction

I. Hydrocarbon Types	Vol-%
Paraffins	25.20
Naphthenes	
Monocycloparaffins	47.28
Bi, Dicycloparaffins	5.57
Tricycloparaffins	0.0
Aromatics	
Alkylbenzenes	21.53
Indans, Tetralins	0.42
Naphthalenes	0.0
Total	100.00

II. Carbon Number Distribution, Vol-%

Carbon No.	Paraffins	Monocyclo-Paraffins	J = 6	J = 8	J = 12
6	7.09	17.45	1.32		
7	6.28	12.34	6.24		
8	4.98	8.76	10.10	0.0	
9	3.81	5.89	3.80	0.42	
10	3.03	2.57	0.07	0.0	0.0
11	0.01	0.27	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0
Total	25.20	47.28	21.53	0.42	0.0

Table 7

Platforming® Upgraded SRC II Naphtha

Plant 636, Run 335

Period No.	Feed		1		2		3		4		5	
Reforming Conditions												
P-P (base), psi			0		0		0		0		0	
T-T (base), °C			-121		-87		-60		-105		-29	
LHSV/LHSV (base)			1.52		1.48		1.50		1.50		1.54	
Product Yields	Wt-%	Vol-%	Wt-%	Vol-%	Wt-%	Vol-%	Wt-%	Vol-%	Wt-%	Vol-%	Wt-%	Vol-%
H_2	-	-	2.4	-	2.6	-	2.9	-	2.5	-	3.1	
C_1-C_3	-	-	0.7	-	0.9	-	1.4	-	0.7	-	1.9	-
nC_4	-	-	0.4	0.6	1.1	1.4	1.2	1.6	0.9	1.2	0.8	1.1
iC_4	-	-	0.7	0.9	0.6	0.8	0.6	0.8	0.5	0.7	0.4	0.6
C_5 Plus	-	-	95.8	91.7	94.8	90.2	93.9	88.4	95.4	90.8	93.8	88.0
Total			100.0	93.2	100.0	92.4	100.0	90.8	100.0	92.7	100.0	89.7
Product (C_5+) Inspection												
°API @ 60°F	52.0		43.4		42.1		-		43.0		39.0	
Sp. Gr. @ 60°F	0.7711		0.8090		0.8151		-		0.8109		0.8299	
Distillation, ASTM D-86												
IBP, °F	136		152		158		-		154		150	
5%	168		172		173		-		172		171	
10%	180		182		183		-		182		181	
30%	209		212		209		-		212		212	
50%	233		244		247		-		246		246	
70%	270		280		282		-		285		284	
90%	311		322		330		-		327		329	
95%	330		343		359		-		351		348	
EP	388		396		411		-		380		398	
RON, Clear	70.9		88.5		94.5		97.6		92.6		99.9	
Elemental Analysis												
Hydrogen, Wt-%	13.66		11.36		10.91		10.55		11.35		10.42	
Carbon, Wt-%	86.00		87.73		87.61		87.31		87.89		88.33	
Sulfur, Wt-ppm	0.22		0.1		0.1		0.1		0.1		0.1	
Nitrogen, Wt-ppm	-		0.1		0.1		0.1		0.1		0.1	
Oxygen, Wt-ppm	359		160		183		299		336		311	

Table 7, Cont'd.

Period No.	6	
Reforming Conditions		
P-P (base), psi	0	
T-T (base), °C	-87	
LHSV/LHSV (base)	1.46	
Product Yields	Wt-%	Vol-%
H_2	2.6	-
C_1-C_3	1.0	-
nC_4	0.3	0.4
iC_4	0.2	0.2
C_5 Plus	95.9	91.1
Total	100.0	91.7
Product (C_5+) Inspection		
°API @ 60°F	42.7	
Sp. Gr. @ 60°F	0.8123	
Distillation, ASTM D-86		
IBP, °F	151	
5%	171	
10%	181	
30%	211	
50%	245	
70%	283	
90%	326	
95%	351	
EP	383	
RON, Clear	93.8	
Elemental Analysis		
Hydrogen, Wt-%	10.75	
Carbon, Wt-%	87.26	
Sulfur, Wt-ppm	0.1	
Nitrogen, Wt-ppm	0.1	
Oxygen, Wt-ppm	251	

Table 8

Platforming Upgraded SRC II Naphtha
Product Distribution and MS Analysis

Plant 636, Run 335, Period 1

Product Distribution	Wt-%	Vol-%
H_2	2.4	
C_1-C_3	0.7	
nC_4	0.4	0.6
iC_4	0.7	0.9
nC_5	4.1	5.1
iC_5	1.2	1.4
C_6 Plus	90.5	85.2
Total	100.0	93.2

Reformate (C_5 Plus)	
Yield, Vol-%	91.7
RON Clear	88.5

MS Analysis of C_6 Plus Fraction, Vol-%

I. Hydrocarbon Types

Paraffins	26.39
Naphthenes	
Monocycloparaffins	13.60
Bi, Dicycloparaffins	1.63
Tricycloparaffins	0.0
Aromatics	
Alkylbenzenes	56.37
Indans, Tetralins	2.01
Naphthalenes	0.0
Total	100.00

II. Carbon Number Distribution, Vol-%

Carbon No.	Paraffins	Monocyclo-paraffins	Aromatics J = 6	Aromatics J = 8	Aromatics J = 12
6	1.66	4.80	16.83		
7	5.78	2.84	16.00		
8	6.64	3.12	14.97		
9	6.25	1.99	7.28	1.54	
10	4.90	0.85	1.26	0.47	
11	1.16	0.0	0.03	0.0	
12	0.0	0.0	0.0	0.0	
13	0.0	0.0	0.0	0.0	
Total	26.39	13.60	56.37	2.01	0.0

Table 9

Platforming Upgraded SRC II Naphtha
Product Distribution and MS Analysis

Plant 636, Run 335, Period 4

Product Distribution	Wt-%	Vol-%
H_2	2.5	-
C_1-C_3	0.7	-
nC_4	0.9	1.2
iC_4	0.5	0.7
nC_5	4.0	4.8
iC_5	1.1	1.4
C_6 Plus	90.3	84.6
Total	100.0	90.8

Reformate (C_5 Plus)

Yield, Vol-%	90.8
RON Clear	92.1

MS Analysis of C_6 Plus Fraction, Vol-%

I. Hydrocarbon Types

Paraffins	25.19
Naphthenes	
Monocycloparaffins	10.77
Bi, Dicycloparaffins	1.39
Tricycloparaffins	0.0
Aromatics	
Alkylbenzenes	60.52
Indans, Tetralins	1.97
Naphthalenes	0.16
Total	100.00

II. Carbon Number Distribution, Vol-%

Carbon No.	Paraffins	Monocyclo-paraffins	Aromatics J = 6	Aromatics J = 8	Aromatics J = 12
6	7.53	4.00	19.93	-	-
7	7.24	4.15	16.06		
8	4.92	2.20	14.77	0.0	-
9	3.66	0.42	7.48	1.20	-
10	1.84	0.0	1.95	0.64	0.12
11	0.0	0.0	0.33	0.13	0.04
12	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0
Total	25.19	10.77	60.52	1.97	0.16

Table 10

Platforming Upgraded SRC II Naphtha
Product Distribution and MS Analysis

Plant 636, Run 335, Period 6

Product Distribution	Wt-%	Vol-%
H_2	2.6	-
C_1-C_3	1.0	-
nC_4	0.3	0.4
iC_4	0.2	0.2
nC_5	4.1	5.0
iC_5	1.2	1.6
C_6 Plus	90.6	84.5
Total	100.0	91.1

Reformate (C_5 Plus)

Yield, Vol-%	91.1
RON Clear	93.8

MS Analysis of C_6 Plus Fraction, Vol-%

I. Hydrocarbon Types

Paraffins	20.64
Naphthenes	
Monocycloparaffins	6.80
Bi, Dicycloparaffins	1.20
Tricycloparaffins	0.0
Aromatics	
Alkylbenzenes	68.13
Indans, Tetralins	2.96
Naphthalenes	0.27
Total	100.00

II. Carbon Number Distribution, Vol-%

Carbon No.	Paraffins	Monocyclo-paraffins	Aromatics J = 6	Aromatics J = 8	Aromatics J = 12
6	5.96	3.80	23.25		
7	5.03	1.50	18.18		
8	3.90	0.90	16.36	0.0	
9	3.00	0.43	7.98	1.87	
10	2.24	0.17	2.03	0.97	0.16
11	0.51	0.0	0.33	0.12	0.07
12	0.0	0.0	0.0	0.0	0.03
13	0.0	0.0	0.0	0.0	0.01
Total	20.64	6.80	68.13	2.96	0.27

Table 11

Platforming Upgraded SRC II Naphtha
Product Distribution and MS Analysis

Plant 636, Run 335, Period 2

Product Distribution	Wt-%	Vol-%
H_2	2.6	-
C_1-C_3	0.9	-
nC_4	1.1	1.4
iC_4	0.6	0.8
nC_5	4.3	5.2
iC_5	1.0	1.3
C_6 Plus	89.5	83.7
Total	100.0	90.2

Reformate (C_5 Plus)	
Yield, Vol-%	90.2
RON Clear	94.5

MS Analysis of C_6 Plus Fraction, Vol-%

I. Hydrocarbon Types

Paraffins	23.89
Naphthenes	
Monocycloparaffins	8.34
Bi, Dicycloparaffins	0.74
Tricycloparaffins	0.0
Aromatics	
Alkylbenzenes	64.93
Indans, Tetralins	2.10
Naphthalenes	0.0
Total	100.00

II. Carbon Number Distribution, Vol-%

Carbon No.	Paraffins	Monocyclo-paraffins	Aromatics J = 6	Aromatics J = 8	Aromatics J = 12
6	7.18	4.00	17.98		
7	6.31	2.31	19.00		
8	4.70	1.24	18.25	0.0	
9	3.36	0.53	8.37	1.56	
10	2.34	0.26	1.30	0.54	
11	0.0	0.0	0.03	0.0	
12	0.0	0.0	0.0	0.0	
13	0.0	0.0	0.0	0.0	
Total	23.89	8.34	64.75	2.10	0.0

Table 12

Platforming Upgraded SRC II Naphtha
Product Distribution and MS Analysis

Plant 636, Run 335, Period 3

Product Distribution	Wt-%	Vol-%
H_2	2.9	-
C_1-C_3	1.4	-
nC_4	1.2	1.6
iC_4	0.6	0.8
nC_5	4.0	4.9
iC_5	1.3	1.6
C_6 Plus	88.6	81.9
Total	100.0	88.4

Reformate (C_5 Plus)

Yield, Vol-%	88.4
RON Clear	97.6

MS Analysis of C_6 Plus Fraction, Vol-%

I. Hydrocarbon Types

Paraffins	20.60
Naphthenes	
Monocycloparaffins	7.40
Bi, Dicycloparaffins	0.28
Tricycloparaffins	0.0
Aromatics	
Alkylbenzenes	69.36
Indans, Tetralins	2.11
Naphthalenes	0.25
Total	100.00

II. Carbon Number Distribution, Vol-%

Carbon No.	Paraffins	Monocyclo-paraffins	Aromatics J = 6	Aromatics J = 8	Aromatics J = 12
6	2.91	2.20	17.14	-	-
7	6.74	3.58	19.34		
8	5.96	1.53	19.41	0.0	
9	3.64	0.09	10.19	1.28	
10	1.35	0.0	2.83	0.75	0.16
11	0.0	0.0	0.45	0.08	0.07
12	0.0	0.0	0.0	0.0	0.02
13	0.0	0.0	0.0	0.0	0.0
Total	20.60	7.40	69.36	2.11	0.25

Table 13

Platforming Upgraded SRC II Naphtha
Product Distribution and MS Analysis

Plant 636, Run 335, Period 5

Product Distribution	Wt-%	Vol-%
H_2	3.1	-
C_1-C_3	1.9	-
nC_4	0.8	1.1
iC_4	0.4	0.6
nC_5	3.7	4.5
iC_5	1.3	1.7
C_6 Plus	88.8	81.8
Total	100.0	88.0

Reformate (C_5 Plus)	
Yield, Vol-%	88.0
RON Clear	99.9

MS Analysis of C_6 Plus Fraction, Vol-%

I. Hydrocarbon Types

Paraffins	16.21
Naphthenes	
Monocycloparaffins	5.03
Bi, Dicycloparaffins	0.36
Tricycloparaffins	0.0
Aromatics	
Alkylbenzenes	75.80
Indans, Tetralins	2.17
Naphthalenes	0.43
Total	100.00

II. Carbon Number Distribution, Vol-%

Carbon No.	Paraffins	Monocyclo-paraffins	Aromatics J = 6	Aromatics J = 8	Aromatics J = 12
6	7.47	2.20	24.73		
7	5.29	2.15	20.75		
8	2.64	0.68	18.20	0.0	-
9	0.81	0.0	9.28	1.44	-
10	0.0	0.0	2.48	0.65	0.29
11	0.0	0.0	0.34	0.08	0.12
12	0.0	0.0	0.02	0.0	0.02
13	0.0	0.0	0.0	0.0	0.0
Total	16.21	5.03	75.80	2.17	0.43

FIGURE 1

NAPHTHA HYDROTREATING PLANT

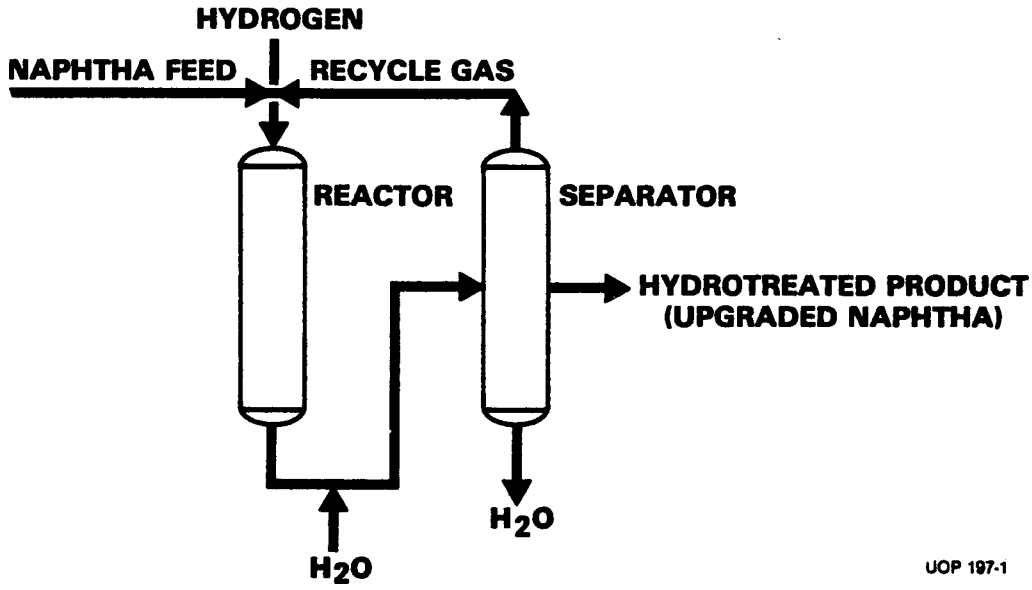


FIGURE 2

NAPHTHA REFORMING PLANT

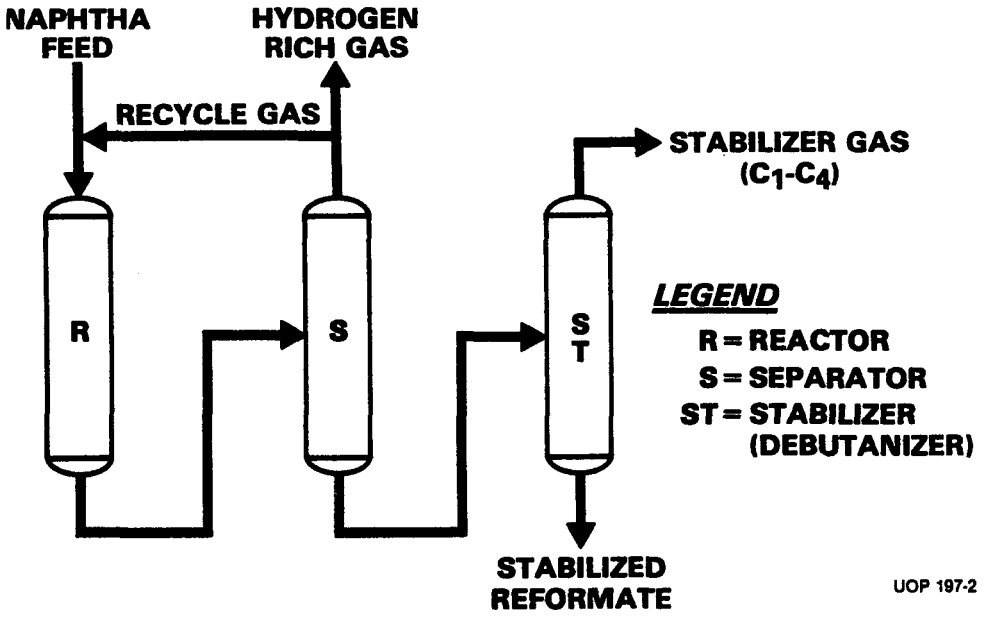


FIGURE 3

YIELD OCTANE CURVE FOR UPGRADED SRC II NAPHTHA

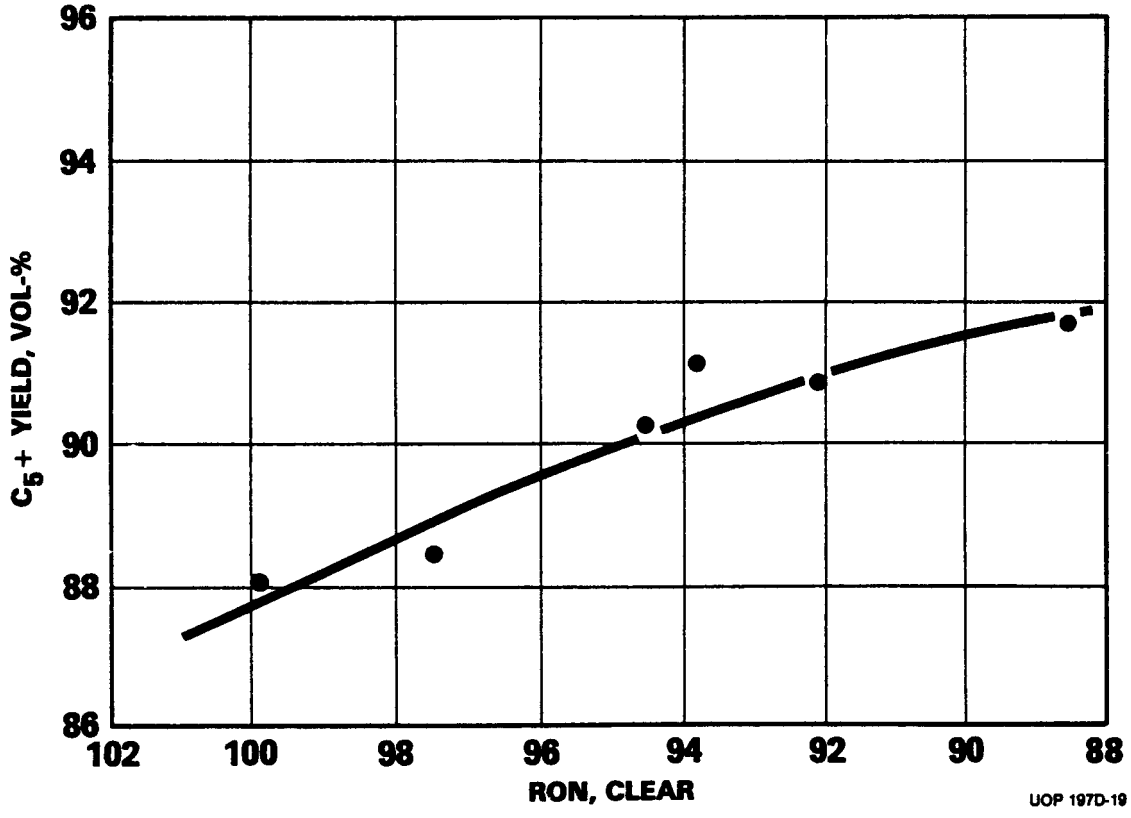
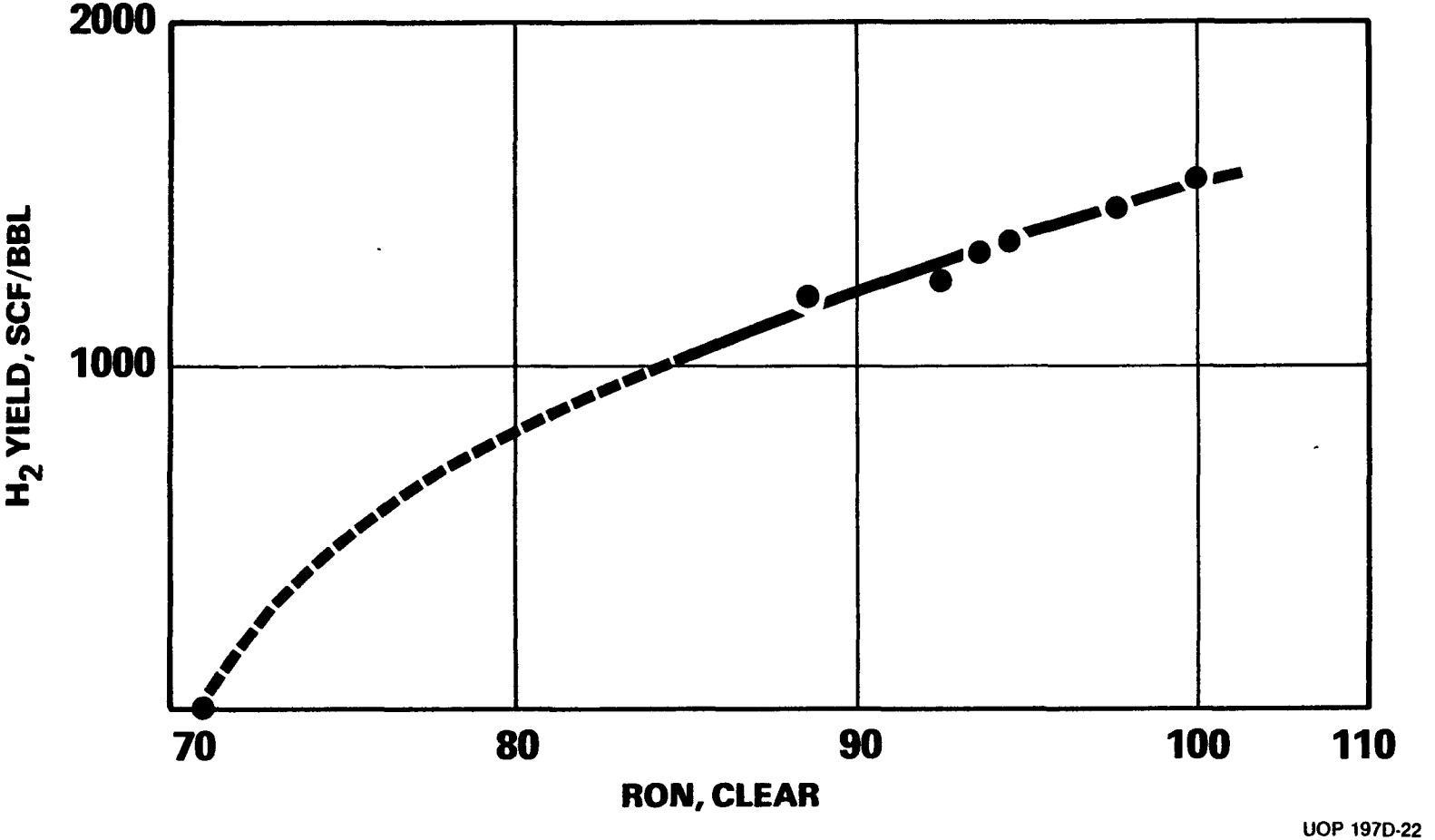


FIGURE 4

HYDROGEN YIELD IN REFORMING UPGRADED SRC II NAPHTHA



UOP 197D-22