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DEASPHALTING, DEASHING, AND UPGRADING OF COAL LIQUIDS

Quarterly Technical Progress Report
for
The Period January-March 1979

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ABSTRACT

Feedstock for Demex®deashing of coal liquids was prepared by liquefying a slurry of Illinois No. 6 coal in a coal derived solvent. Of the moisture free slurry fed, 95% was obtained as feed to the Demex unit. The remainder was C_6- light ends. Coal conversion on a MAF basis was 92.5%.

The Demex operation has been completed after overcoming problems with the bottoms product transfer system. The results are currently being evaluated and product analyses are in progress.

The hydrotreating of the Demex product is to be started in early May.

Task 1.1

Work Accomplished

The inspections of the UOP coal liquefaction solvent, Illinois No. 6 coal, and blends for coal liquefaction in UOP Research Pilot Plant 666 R-43 are shown on Tables 1, 2 and 3.

Coal oil slurry was pumped upflow under hydrogen pressure through an empty tube at elevated temperature. Gas was separated for recycle or venting. The product, composed of liquefied coal, unconverted coal, water and ash, was collected and the water removed.

Product distributions were calculated for two periods of operation midway in the run. The operating conditions during these tests and the accompanying distributions are shown on Table 4.

The tests have shown 95% of the liquefaction product is comprised of coal oil plus solids available as a Demex®feed. Losses to CO, CO_2, and H_2S amount to 1-1.5 wt-%. The remaining 3.5-4 wt-% losses are light hydrocarbons recoverable for other uses.

The net hydrogen consumption amounted to 1000-1150 SCF/bbl. This represents formation of water, ammonia, hydrogen sulfide, solubility losses, as well as uptake by coal in the liquefaction. This hydrogen consumption is based on the difference of measured hydrogen input and output to and from the plant. Samples of this solubilized coal oil product were not analyzed for carbon and hydrogen contents.

At the operating conditions employed, a conversion of coal (MAF basis) was 91-94%. Samples to determine these conversions were selected during periods near the beginning and end of the liquefaction run. These stream samples were drawn over one hour periods, and were separated in the laboratory into a liquid product, solids and water. The results are shown on Table 5 along with the calculated conversions.

Task 1.2

Work Accomplished

The Demex operation on the coal liquefaction product from Task 1.1 has been completed in Plant 633.

Analyses of the Demex products are in progress, and will be reported when completed.

Continued problems with the bottom product transfer system and valves have delayed the completion of this phase, pending installation of new

stellite erosion resistant valves to replace the deteriorated stainless steel valves.

As a result the work plan shown on Figure 1 has been rescheduled as shown on Figure 2.

Task 1.3

Work Forecast

Hydrotreating of the demetalized oil (DMO) will begin in early May, and will be completed in the same month.

Task 1.4

Work Forecast

Final coal liquefaction should begin in early June, and be completed near the end of the month.

Task 2.0

Work Forecast

Work on deasphalting and deashing the Solvent Refined Coal (SRC-I) filter feed will also begin in early May, and will be completed in the early part of July.

Table 1

Inspections of Coal Liquefaction Solvent

Sample No.	3776-1
°API @ 60°F	8.5
Sp. Gr. @ 60°F	1.0107
Distillation, ASTM D-1160	
IBP, °F	350
5%	458
10%	491
20%	542
30%	582
40%	625
50%	678
60%	730
70%	807
80%	909
85%	970
% Over	85.0
% Bottoms	15.0
Hydrogen, Wt-%	9.69
Carbon, Wt-%	88.40
Sulfur, Wt-ppm	45
Nitrogen, Wt-ppm	2770
Oxygen, Wt-ppm	22000
Heptane Insoluble, Wt-%	3.00
Toluene Insoluble, Wt-%	0.37
Viscosity at 210°F CST	4.505
Sayboldt Univ. Sec.	41

Table 2

Inspections of Illinois No. 6 Coal

Sample	3776-3
UOP Identification	93-3425

Analyses wt.%

Moisture	15.12
Ash (ASTM D 3174)	7.19
Sulfur	2.65
Nitrogen	0.95
Carbon	63.57
Hydrogen	6.10
Oxygen	8.82

Table 3

Blends and Inspection of
Illinois No. 6 Coal and Coal Liquefaction Solvent

Blend Data

Blend Identification No.	3776-2	3776-4
Blend Composition		
Solvent, gm	69,485	54,871
Coal, gm (moisture free)	40,927	32,320

Inspections

Sample No.	3810-3	3810-15
Coal in Blend, moisture free, wt-%	30.33(a)	31.67(b)
Solvent in Blend, wt-%	60.89	61.25
Water in Blend, wt-%	8.78	7.08

(a) Ash content of coal in blend is 6.46 wt-% on a moisture free basis.

(b) Ash content of coal in blend is 6.87 wt-% on a moisture free basis.

Table 4

Coal Liquefaction
Plant 666 R-43

Product Distributions

Test No.	43-17	43-27
Operating Conditions		
P-P (base) psig	815	830
T-T (base) °F	45	45
LHSV/LHSV (base)	1.2	1.2
Product Distribution, wt-% (MAF Basis)		
Product Gas		
$CO + CO_2$	0.3	0.6
H_2S	0.8	0.8
$C_1 - C_4$	2.3	3.0
$C_5 + C_6$	1.5	0.8
Settler Product	95.1	94.8
Total	100.0	100.0
Net Hydrogen Consumption SCF/bbl	1008	1147

Table 5

Coal Liquefaction
Plant 666 R-43

Operating Conditions, Product Inspections, Coal Conversions

Hours on Stream	42-43	332-333
Operating Conditions		
P-P (base) psig	825	845
T-T (base) °F	47	47
LHSV/LHSV (base)	1.2	1.2
Product Analyses Wt.%		
Sample No.	3810-1	3810-9
Liquid Product	83.80	87.95
Solids	3.74	4.81
Water	12.46	10.24
Total	100.00	100.00
C_7 Insoluble in Coal Oil	8.72	12.0
Coal Conversion (MAF basis) wt-%	93.7	91.1

Figure 1

Work Plan and Progress

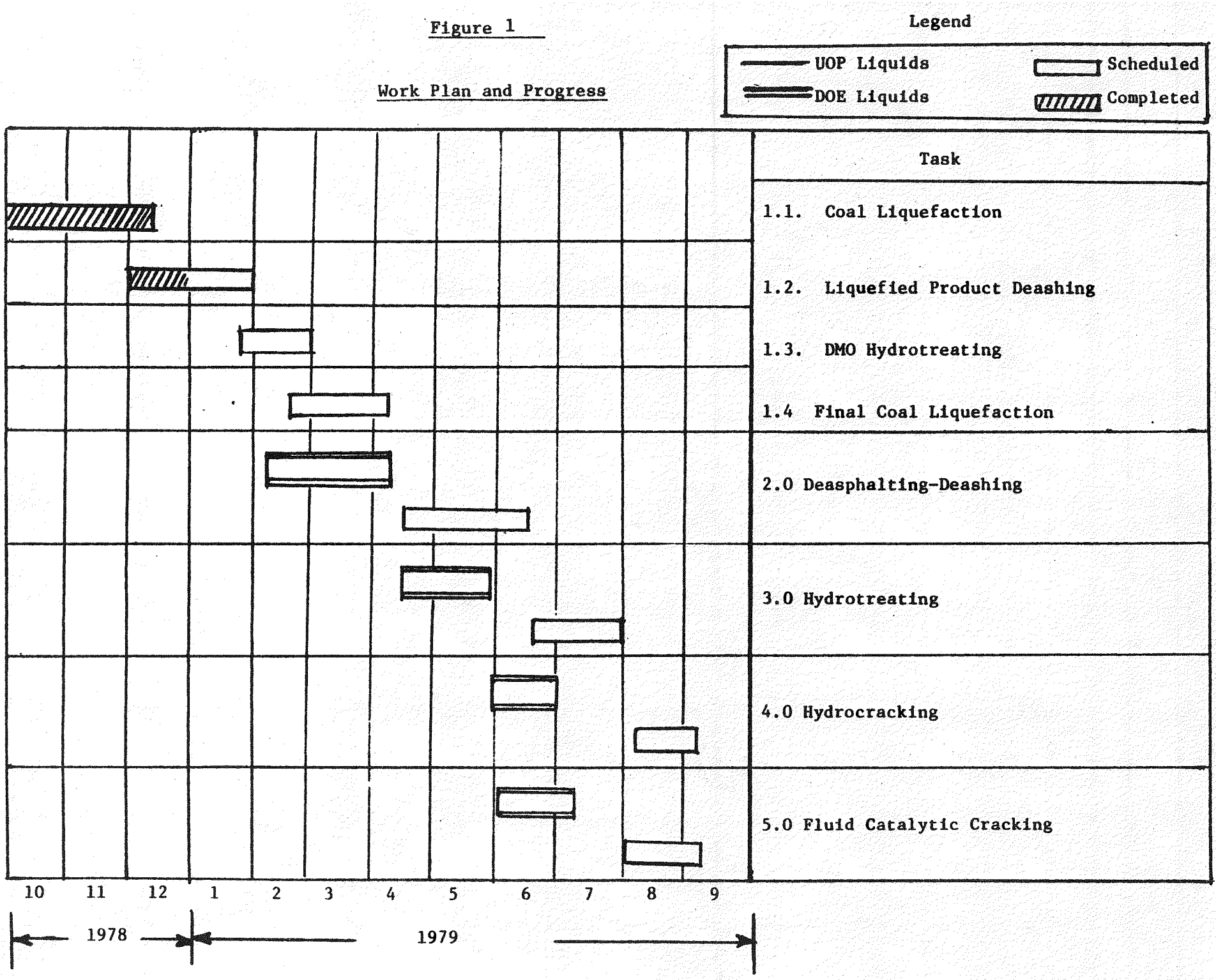

Figure 2

Work Plan and Progress