

Table A21  
RESULT OF SYNGAS OPERATION

RUN NO. 11885-02  
 CATALYST Co/Th/X4/X8-U103+U101 1186420 250 CC 107.0G(156.3 @END +49.3)  
 FEED H2:CO:ARGON OF 50:50:0 @ 1260 CC/MN OR 302 GHSV

RUN & SAMPLE NO.	11885-02-21	885-02-23	885-02-25	885-02-27	885-02-29
FEED H2:CO:AR	50:49: 0	50:49: 0	50:49: 0	49:50: 0	49:50: 0
HRS ON STREAM	325.5	350.5	374.5	398.5	422.5
PRESSURE,PSIG	300	300	300	302	301
TEMP. C	260	260	260	259	259
FEED CC/MIN	1260	1260	1260	1260	1260
HOURS FEEDING	24.00	25.00	24.00	24.00	24.00
EFFLNT GAS LITER	882.55	920.75	880.85	791.15	895.15
GM AQUEOUS LAYER	146.98	153.68	145.89	145.35	143.18
GM OIL	53.40	54.24	51.52	51.10	50.32
MATERIAL BALANCE					
GM ATOM CARBON %	81.76	81.07	80.74	71.18	78.83
GM ATOM HYDROGEN %	81.33	80.84	80.44	77.51	83.55
GM ATOM OXYGEN %	84.89	84.94	84.40	76.47	82.06
RATIO CHX/(H2O+CO2)	0.8792	0.8507	0.8573	0.7900	0.8685
RATIO X IN CHX	2.3982	2.3996	2.4040	2.3929	2.4135
USAGE H2/CO PRODT	2.0923	2.1298	2.1253	2.1041	2.1102
FEED H2/CO FRM EFFLNT	1.0270	1.0296	1.0287	1.0551	1.0268
RESIDUAL H2/CO RATIO	0.5698	0.5733	0.5735	0.5793	0.5812
RATIO CO2/(H2O+CO2)	0.0694	0.0667	0.0667	0.0912	0.0693
K SHIFT IN EFFLNT	0.0425	0.0410	0.0410	0.0581	0.0432
SPECIFIC ACTIVITY SA	1.0428	1.0025	1.0030	1.1081	1.0252
CONVERSION					
ON CO %	30.03	29.31	29.33	31.20	29.14
ON H2 %	61.19	60.64	60.60	62.23	59.89
ON CO+H2 %	45.82	45.21	45.18	47.13	44.72
PRDT SELECTIVITY,WT %					
CH4	14.12	14.19	14.45	13.85	14.92
C2 HC'S	2.83	2.77	2.98	2.87	2.94
C3H8	3.80	3.77	3.78	3.69	3.97
C3H6=	2.46	2.40	2.53	2.35	2.94
C4H10	2.98	3.00	2.89	2.81	2.95
C4H8=	3.96	3.99	3.93	3.69	4.00
C5H12	3.01	3.11	2.83	2.67	2.89
C5H10=	4.70	4.56	4.33	4.02	4.56
C6H14	3.08	3.04	2.92	2.85	3.10
C6H12= & CYCLO'S	3.75	3.19	3.66	3.18	3.34
C7+ IN GAS	11.03	11.38	11.48	11.10	11.21
LIQ HC'S	44.27	44.58	44.22	46.92	43.18
TOTAL	100.00	100.00	100.00	100.00	100.00

Table A21 (continued)

SUB-GROUPING						
C1 -C4	30.15	30.13	30.56	29.27	31.72	
C5 -420 F	45.06	44.68	44.23	44.46	44.10	
420-700 F	20.36	20.60	20.79	21.72	20.11	
700-END PT	4.43	4.59	4.42	4.56	4.07	
C5+-END PT	69.85	69.87	69.44	70.73	68.28	
ISO/NORMAL MOLE RATIO						
C4	0.0574	0.0603	0.0586	0.0540	0.0624	
C5	0.0732	0.0681	0.0561	0.0567	0.0600	
C6	0.1484	0.1518	0.1414	0.1182	0.1352	
C4=	0.0778	0.0792	0.0771	0.0793	0.0816	
PARAFFIN/OLEFIN RATIO						
C3	1.4742	1.4957	1.4256	1.4969	1.2907	
C4	0.7265	0.7248	0.7100	0.7340	0.7134	
C5	0.6220	0.6632	0.6349	0.6453	0.6159	
SCHULZ-FLORY DISTRIB						
ALPHA (EXP(SLOPE))	0.8118	0.8123	0.8089	0.8149	0.8095	
RATIO CH4/(1-A)**2	3.9867	4.0281	3.9574	4.0414	4.1108	
ALPHA FRM CORRELATION						
ALPHA (EXPTL/CORR)	0.8382	0.8379	0.8379	0.8374	0.8373	
ALPHA (EXPTL/CORR)						
ALPHA (EXPTL/CORR)	0.9685	0.9694	0.9654	0.9730	0.9668	
W%CH4 FRM CORRELATION						
W%CH4 (EXPTL/CORR)	18.0084	18.1009	18.1075	18.0309	18.0806	
W%CH4 (EXPTL/CORR)	0.7840	0.7842	0.7982	0.7683	0.8253	
LIQ HC COLLECTION						
PHYS. APPEARANCE	CLDY &SLD	CLDY &SLD	CLDY &SLD	CLDY &SLD	CLDY &SLD	
DENSITY	0.756	0.757	0.756	0.757	0.757	
N, REFRACTIVE INDEX	1.4263	1.4264	1.4261	1.4260	1.4261	
SIMULT'D DISTILATN						
10 WT % @ DEG F	294	296	273	295	295	
16	306	307	300	306	306	
50	451	451	439	450	447	
84	643	644	640	642	634	
90	699	705	706	696	692	
RANGE(16-84 %)	337	337	340	336	328	
WT % @ 420 F	44.00	43.50	43.00	44.00	44.00	
WT % @ 700 F	90.00	89.70	90.00	90.29	90.57	

NEW FORMAT JAN 25,85

Table A22

## RESULT OF SYNGAS OPERATION

RUN NO. 11885-02  
 CATALYST Co/Th/X4/X8-U103+U101 1186420 250 CC 107.0G(156.3 @END +49.3)  
 FEED H2:CO:ARGON OF 50:50:0 @ 1260 CC/MN OR 302 GHSV

RUN & SAMPLE NO.	11885-02-31	885-02-33	885-02-35	885-02-37	885-02-39
FEED H2:CO:AR	50:49: 0	50:49: 0	50:49: 0	50:49: 0	50:49: 0
HRS ON STREAM	447.5	471.3	495.0	517.5	541.5
PRESSURE,PSIG	300	300	300	300	300
TEMP. C	261	262	261	261	261
FEED CC/MIN	1260	1260	1260	1260	1260
HOURS FEEDING	73.00	23.83	23.70	22.50	24.00
EFFLNT GAS LITER	2596.45	875.60	871.85	834.25	893.95
GM AQUEOUS LAYER	439.94	146.54	140.73	133.44	139.18
GM OIL	154.08	46.99	48.56	46.40	48.13
MATERIAL BALANCE					
GM ATOM CARBON %	78.94	80.25	81.22	80.72	81.08
GM ATOM HYDROGEN %	79.07	80.99	80.34	80.98	81.14
GM ATOM OXYGEN %	82.40	83.92	84.08	83.85	83.34
RATIO CHX/(H2O+CO2)	0.8640	0.8562	0.8867	0.8756	0.9083
RATIO X IN CHX	2.4076	2.4252	2.4126	2.4174	2.4170
USAGE H2/CO PRODT	2.1112	2.1826	2.0855	2.1045	2.0762
FEED H2/CO FRM EFFLNT	1.0342	1.0421	1.0213	1.0358	1.0333
RESIDUAL H2/CO RATIO	0.5709	0.5775	0.5707	0.5898	0.5930
RATIO CO2/(H2O+CO2)	0.0694	0.0533	0.0714	0.0695	0.0689
K SHIFT IN EFFLNT	0.0426	0.0325	0.0439	0.0440	0.0439
SPECIFIC ACTIVITY SA	0.9859	0.8751	0.9759	0.9173	0.9207
CONVERSION					
ON CO %	30.08	28.94	29.75	29.45	29.68
ON H2 %	61.41	60.62	60.74	59.83	59.64
ON CO+H2 %	46.01	45.11	45.41	44.90	44.91
PRDT SELECTIVITY,WT %					
CH4	14.56	15.52	14.71	15.02	14.80
C2 HC'S	3.19	3.19	3.41	3.44	4.07
C3H8	4.06	4.15	4.25	4.00	4.45
C3H6=	2.51	2.78	3.00	2.52	2.99
C4H10	2.89	3.05	3.23	3.08	3.76
C4H8=	3.88	4.02	4.34	3.95	4.70
C5H12	3.08	3.21	3.27	3.34	3.51
C5H10=	4.37	4.56	4.34	4.65	2.86
C6H14	3.05	3.21	3.12	3.15	3.21
C6H12= & CYCLO'S	3.36	3.34	3.18	3.37	3.28
C7+ IN GAS	11.60	12.21	11.69	11.12	11.84
LIQ HC'S	43.46	40.76	41.46	42.35	40.54
TOTAL	100.00	100.00	100.00	100.00	100.00

Table A22 (continued)

SUB-GROUPING					
C1 -C4	31.09	32.71	32.94	32.01	34.77
C5 -420 F	44.58	44.26	43.43	44.70	42.94
420-700 F	19.99	18.87	19.40	19.40	18.53
700-END PT	4.35	4.16	4.23	3.90	3.77
C5+-END PT	68.91	67.29	67.06	67.99	65.23
ISO/NORMAL MOLE RATIO					
C4	0.0567	0.0558	0.0732	0.0469	0.1085
C5	0.0794	0.0769	0.0850	0.0725	0.1039
C6	0.1370	0.1216	0.1360	0.1383	0.1543
C4=	0.0756	0.0784	0.0854	0.0783	0.1013
PARAFFIN/OLEFIN RATIO					
C3	1.5475	1.4224	1.3498	1.5135	1.4177
C4	0.7181	0.7324	0.7195	0.7527	0.7730
C5	0.6862	0.6845	0.7318	0.6989	1.1908
SCHULZ-FLORY DISTRBTN					
ALPHA (EXP(SLOPE))	0.8108	0.8073	0.8076	0.8057	0.8025
RATIO CH4/(1-A)**2	4.0674	4.1776	3.9721	3.9774	3.7953
ALPHA FRM CORRELATION					
ALPHA (EXPTL/CORR)	0.8380	0.8374	0.8381	0.8365	0.8362
	0.9675	0.9640	0.9636	0.9632	0.9597
W%CH4 FRM CORRELATION					
W%CH4 (EXPTL/CORR)	18.2652	18.6648	18.2600	18.7585	18.8391
	0.7971	0.8314	0.8057	0.8007	0.7855
LIQ HC COLLECTION					
PHYS. APPEARANCE	CLDY &SLD	CLDY &SLD	CLDY &SLD	CLDY &SLD	CLDY &SLD
DENSITY	0.756	0.756	0.756	0.759	0.757
N, REFRACTIVE INDEX	1.4261	1.4261	1.4260	1.4261	1.4262
SIMULT'D DISTILAIN					
10 WT % @ DEG F	297	297	297	298	298
16	307	309	310	309	309
50	451	451	452	448	445
84	642	644	643	635	635
90	700	704	702	688	693
RANGE(16-84 %)	335	335	333	326	326
WT % @ 420 F	44.00	43.50	43.00	45.00	45.00
WT % @ 700 F	90.00	89.80	89.80	90.80	90.70

NEW FORMAT JAN 25,85

Table A23

## RESULT OF SYNGAS OPERATION

RUN NO. 11885-02  
 CATALYST Co/Th/X4/X8-U103+U101 1186420 250 CC 107.0G(156.3 @END +49.3)  
 FEED H2:CO:ARGON OF 50:50:0 @ 1260 CC/MN OR 302 GHSV

RUN & SAMPLE NO.	11885-02-41	885-02-43	885-02-45	885-02-47	885-02-49
FEED H2:CO:AR	50:49: 0	50:49: 0	50:49: 0	50:49: 0	50:49: 0
HRS ON STREAM	565.5	589.5	613.5	638.7	661.0
PRESSURE,PSIG	300	300	300	300	300
TEMP. C	261	261	261	261	261
FEED CC/MIN	1260	1260	1260	1260	1260
HOURS FEEDING	24.00	24.00	24.00	25.17	22.30
EFFLNT GAS LITER	897.25	901.80	906.48	973.61	828.07
GM AQUEOUS LAYER	141.99	138.63	137.62	147.71	123.72
GM OIL	47.10	45.94	46.08	48.25	39.74
MATERIAL BALANCE					
GM ATOM CARBON %	81.21	81.41	80.33	81.73	78.54
GM ATOM HYDROGEN %	80.87	80.64	78.93	80.42	77.97
GM ATOM OXYGEN %	84.53	84.10	84.64	86.58	82.19
RATIO CHX/(H2O+CO2)	0.8679	0.8906	0.8235	0.8057	0.8454
RATIO X IN CHX	2.4297	2.4180	2.4396	2.4434	2.4339
USAGE H2/CO PRODT	2.1091	2.0920	2.1680	2.1920	2.1440
FEED H2/CO FRM EFFLNT	1.0283	1.0228	1.0145	1.0159	1.0250
RESIDUAL H2/CO RATIO	0.5837	0.5869	0.5851	0.5875	0.6001
RATIO CO2/(H2O+CO2)	0.0720	0.0691	0.0692	0.0684	0.0688
K SHIFT IN EFFLNT	0.0453	0.0436	0.0435	0.0431	0.0443
SPECIFIC ACTIVITY SA	0.9201	0.9082	0.8421	0.8211	0.8264
CONVERSION					
ON CO %	29.14	28.96	27.13	26.70	27.52
ON H2 %	59.78	59.23	57.98	57.61	57.57
ON CO+H2 %	44.67	44.27	42.66	42.28	42.73
PRDT SELECTIVITY,WT %					
CH4	15.69	15.03	16.34	16.34	15.88
C2 HC'S	3.66	3.83	3.17	3.31	3.71
C3H8	4.22	4.32	3.79	3.95	4.13
C3H6=	2.46	2.38	2.09	2.15	2.35
C4H10	3.09	3.59	2.86	2.95	3.45
C4H8=	3.79	4.36	3.55	3.65	4.03
C5H12	2.98	3.17	2.79	2.92	3.04
C5H10=	4.60	4.88	4.12	4.21	4.16
C6H14	3.49	3.26	3.01	3.10	3.12
C6H12= & CYCLO'S	3.46	3.64	3.26	3.40	3.41
C7+ IN GAS	11.98	11.97	11.92	11.00	12.45
LIQ HC'S	40.58	39.57	43.12	43.02	40.27
TOTAL	100.00	100.00	100.00	100.00	100.00

Table A23 (continued)

SUB-GROUPING					
C1 -C4	32.90	33.52	31.78	32.35	33.55
C5 -420 F	44.38	44.52	44.07	43.78	44.10
420-700 F	19.07	18.40	20.27	20.22	19.05
700-END PT	3.65	3.56	3.88	3.66	3.30
C5+-END PT	67.10	66.48	68.22	67.65	66.45
ISO/NORMAL MOLE RATIO					
C4	0.0507	0.0967	0.0548	0.0471	0.1004
C5	0.0525	0.0721	0.0538	0.0520	0.0533
C6	0.1529	0.1559	0.1103	0.1036	0.1183
C4*	0.0833	0.1010	0.0807	0.0812	0.1017
PARAFFIN/OLEFIN RATIO					
C3	1.6381	1.7297	1.7316	1.7543	1.6760
C4	0.7878	0.7953	0.7759	0.7811	0.8257
C5	0.6300	0.6321	0.6586	0.6747	0.7096
SCHULZ-FLORY DISTRTBN					
ALPHA (EXP(SLOPE))	0.8030	0.8008	0.8074	0.8054	0.7995
RATIO CH4/(1-A)**2	4.0427	3.7863	4.4023	4.3139	3.9500
ALPHA FRM CORRELATION					
ALPHA (EXPTL/CORR)	0.8370	0.8367	0.8369	0.8366	0.8356
ALPHA (EXPTL/CORR)	0.9594	0.9571	0.9648	0.9627	0.9568
W%CH4 FRM CORRELATION					
W%CH4 (EXPTL/CORR)	18.6015	18.6837	18.6355	18.6994	19.0189
W%CH4 (EXPTL/CORR)	0.8435	0.8043	0.8766	0.8736	0.8349
LIQ HC COLLECTION					
PHYS. APPEARANCE	CLDY &SLD	CLDY &SLD	CLDY &SLD	CLDY &SLD	CLDY WH
DENSITY	0.754	0.755	0.755	0.755	0.755
N, REFRACTIVE INDEX	1.4264	1.4263	1.4265	1.4265	1.4266
SIMULT'D DISTILATN					
10 WT % @ DEG F	299	299	299	299	299
16	311	310	313	313	311
50	449	448	450	449	446
84	634	633	634	629	621
90	687	686	686	683	681
RANGE(16-84 %)	323	323	321	316	310
WT % @ 420 F	44.00	44.50	44.00	44.50	44.50
WT % @ 700 F	91.00	91.00	91.00	91.50	91.80

NEW FORMAT JAN 25,85

Table A24

## RESULT OF SYNGAS OPERATION

RUN NO. 11885-02  
 CATALYST Co/Th/X4/X8-U103+U101 1186420 250 CC 107.0G(156.3 @END +49.3)  
 FEED H2:CO:ARGON OF 50:50:0 @ 1260 CC/MN OR 302 GHSV

RUN & SAMPLE NO.	11885-02-51	885-02-53	885-02-55
FEED H2:CO:AR	50:49: 0	50:49: 0	50:49: 0
HRS ON STREAM	685.0	709.0	733.0
PRESSURE, PSIG	300	300	300
TEMP. C	261	261	261
FEED CC/MIN	1260	1260	1260
HOURS FEEDING	24.00	24.00	24.00
EFFLNT GAS LITER	932.00	1162.95	1237.60
GM AQUEOUS LAYER	130.43	138.02	141.24
GM OIL	41.82	42.46	43.14
MATERIAL BALANCE			
GM ATOM CARBON %	79.90	93.88	100.17
GM ATOM HYDROGEN %	79.63	93.74	99.47
GM ATOM OXYGEN %	83.83	98.38	103.63
RATIO CHX/(H2O+CO2)	0.8320	0.8182	0.8644
RATIO X IN CHX	2.4362	2.4453	2.4425
USAGE H2/CO PRODT	2.1495	2.2178	2.1576
FEED H2/CO FRM EFFLNT	1.0290	1.0310	1.0253
RESIDUAL H2/CO RATIO	0.6267	0.6744	0.6764
RATIO CO2/(H2O+CO2)	0.0715	0.0577	0.0604
K SHIFT IN EFFLNT	0.0482	0.0413	0.0435
SPECIFIC ACTIVITY SA	0.7396	0.5703	0.5824
CONVERSION			
ON CO %	26.42	23.10	23.56
ON H2 %	55.18	49.70	49.57
ON CO+H2 %	41.01	36.60	36.73
PRDT SELECTIVITY, WT %			
CH4	16.10	16.63	16.45
C2 HC'S	3.66	3.27	3.53
C3H8	4.20	4.16	4.52
C3H6=	2.46	2.44	2.78
C4H10	3.10	3.06	3.20
C4H8=	3.74	3.85	4.14
C5H12	3.14	3.17	3.46
C5H10=	4.87	4.32	4.72
C6H14	3.33	3.20	3.32
C6H12= & CYCLO'S	3.16	3.33	3.26
C7+ IN GAS	11.76	13.15	13.83
LIQ HC'S	40.49	39.41	36.79
TOTAL	100.00	100.00	100.00

Table A24 (continued)

SUB-GROUPING			
C1 -C4	33.25	33.41	34.62
C5 -420 F	43.67	43.93	44.22
420-700 F	19.43	18.72	17.44
700-END PT	3.64	3.94	3.72
C5+-END PT	66.75	66.59	65.38
ISO/NORMAL MOLE RATIO			
C4	0.0495	0.0485	0.0809
C5	0.0528	0.0532	0.0532
C6	0.1543	0.1253	0.1048
C4=	0.0860	0.0839	0.0864
PARAFFIN/OLEFIN RATIO			
C3	1.6273	1.6273	1.5488
C4	0.7991	0.7684	0.7465
C5	0.6274	0.7138	0.7132
SCHULZ-FLORY DISTRBTN			
ALPHA (EXP(SLOPE))	0.8035	0.8080	0.8016
RATIO CH4/(1-A)**2	4.1668	4.5102	4.1797
ALPHA FRM CORRELATION			
ALPHA (EXPTL/CORR)	0.8335	0.8299	0.8298
	0.9639	0.9736	0.9661
W%CH4 FRM CORRELATION			
W%CH4 (EXPTL/CORR)	19.6745	20.7841	20.8282
	0.8181	0.8001	0.7897
LIQ HC COLLECTION			
PHYS. APPEARANCE	CLDY WH	CLDY WAXY	CLDY WAXY
DENSITY	0.757	0.758	0.755
N, REFRACTIVE INDEX	1.4268	1.4274	1.4274
SIMULT'D DISTILATN			
10 WT % @ DEG F	300	302	302
16	321	334	334
50	451	453	453
84	634	640	642
90	687	700	702
RANGE(16-84 %)	313	306	308
WT % @ 420 F	43.00	42.50	42.50
WT % @ 700 F	91.00	90.00	89.90

NEW FORMAT JAN 25,85



IX. Run 8 (11885-04) with Catalyst 8 (Co/X<sub>4</sub>/X<sub>8</sub>/UCC-103+UCC-101)

This catalyst was identical to Catalyst 7 except for the omission of thorium.

Conversion, product selectivity, isomerization of the pentane, and percent olefins of the C<sub>4</sub>'s are plotted against time on stream in Figs. A184-187. Simulated distillations of the C<sub>5</sub><sup>+</sup> product are plotted in Figs. A188-190. Carbon number product distributions are plotted in Figs. A191-203. Chromatograms from simulated distillations are reproduced in Figs. A204-206. Detailed material balances appear in Tables A25-27.

The initial specific activity was a very low 0.65, only about one third as high as the 1.89 of Catalyst 7, which itself was below standard for catalysts with this level of cobalt. The stability was poor as well, with a loss of conversion of one percentage point every 57 hours. Thorium evidently contributes substantially both to the activity and the stability of the cobalt/X<sub>4</sub>/X<sub>8</sub> class of catalyst.

Thorium does not, however, appear to lower the selectivity for methane. Methane production was 17 to 19 percent, varying with changes in the H<sub>2</sub>:CO ratios due to deactivation. This was 87 to 90 percent as much methane as predicted by a model based on catalysts containing cobalt and thorium.

The production of C<sub>5</sub><sup>+</sup> was less than 71 percent initially and

down to 67 percent at the end of the run, a loss of one percentage point every 60 hours. As usual the gasoline fraction of the motor fuels increased with time, due to loss of diesel fuel at a rate of one percentage point every 80 hours. There was some isomerization activity initially, but it decreased rapidly. The hydrocarbon distribution plots show some departures from the Schulz-Flory model, but without any consistent pattern.

Thorium clearly contributes in an important way to the selectivity and stability of cobalt/ $X_4$  catalysts. The same effect was seen in Run 10225-09 (Tenth Quarter Catalyst 10), when a cobalt/ $X_4$  catalyst was less stable than a formulation with thorium, Run 10225-08 (Tenth Quarter Catalyst 9).

RUN 11885-04

11.2, 100  
300 PSIG  
800°C

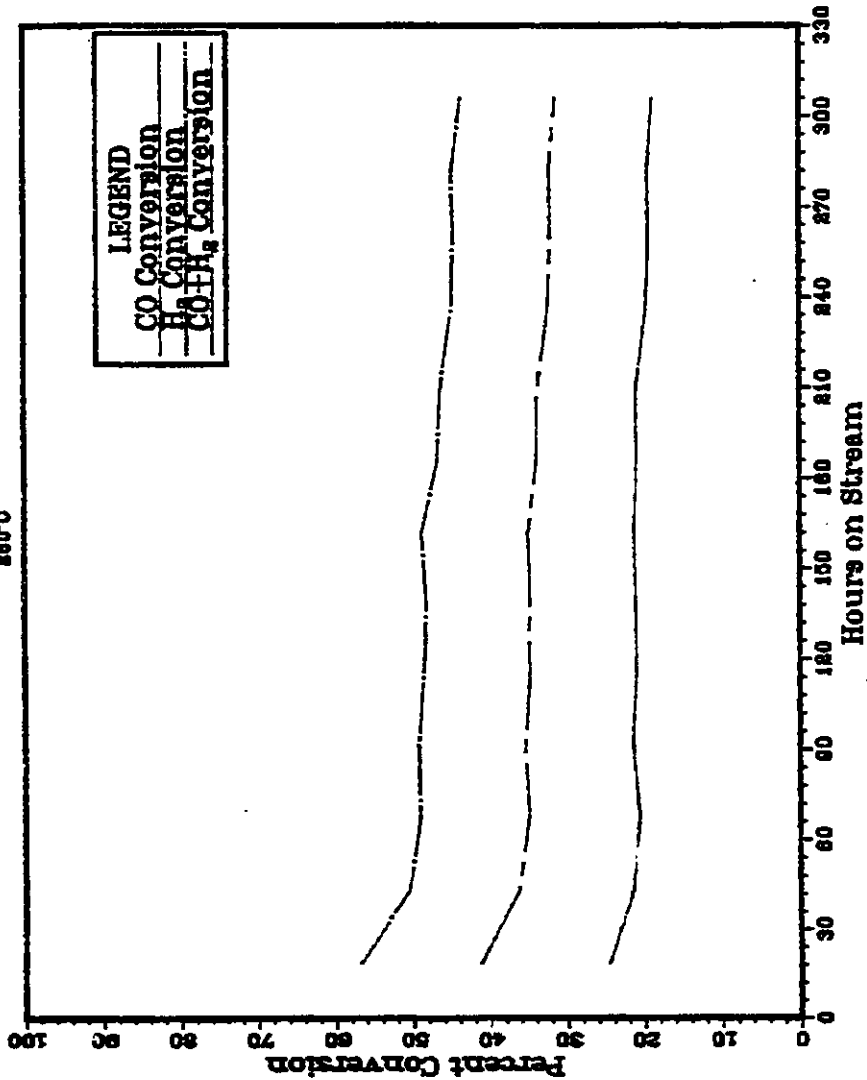


Fig. A184

RUN 11885-04

515,100  
300 PSIG  
280°O

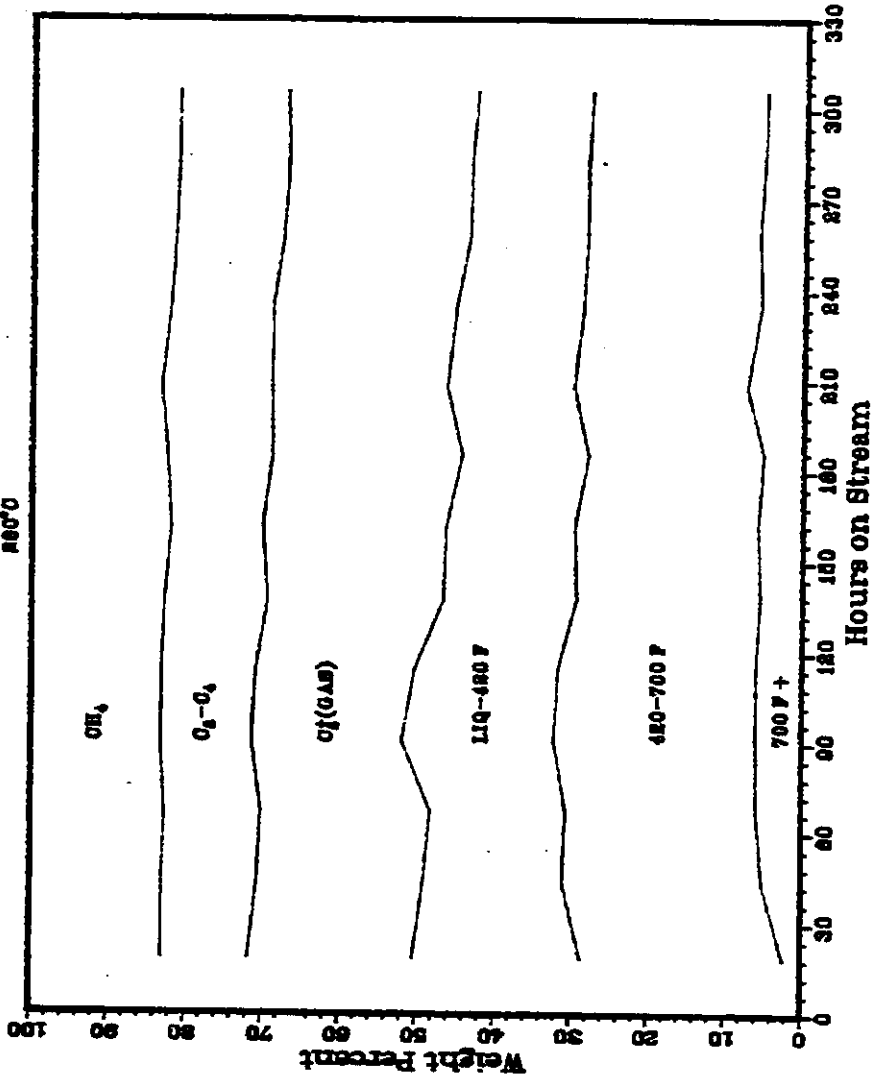


Fig. A185

RUN 11885-04

1113.100  
300.000  
160°

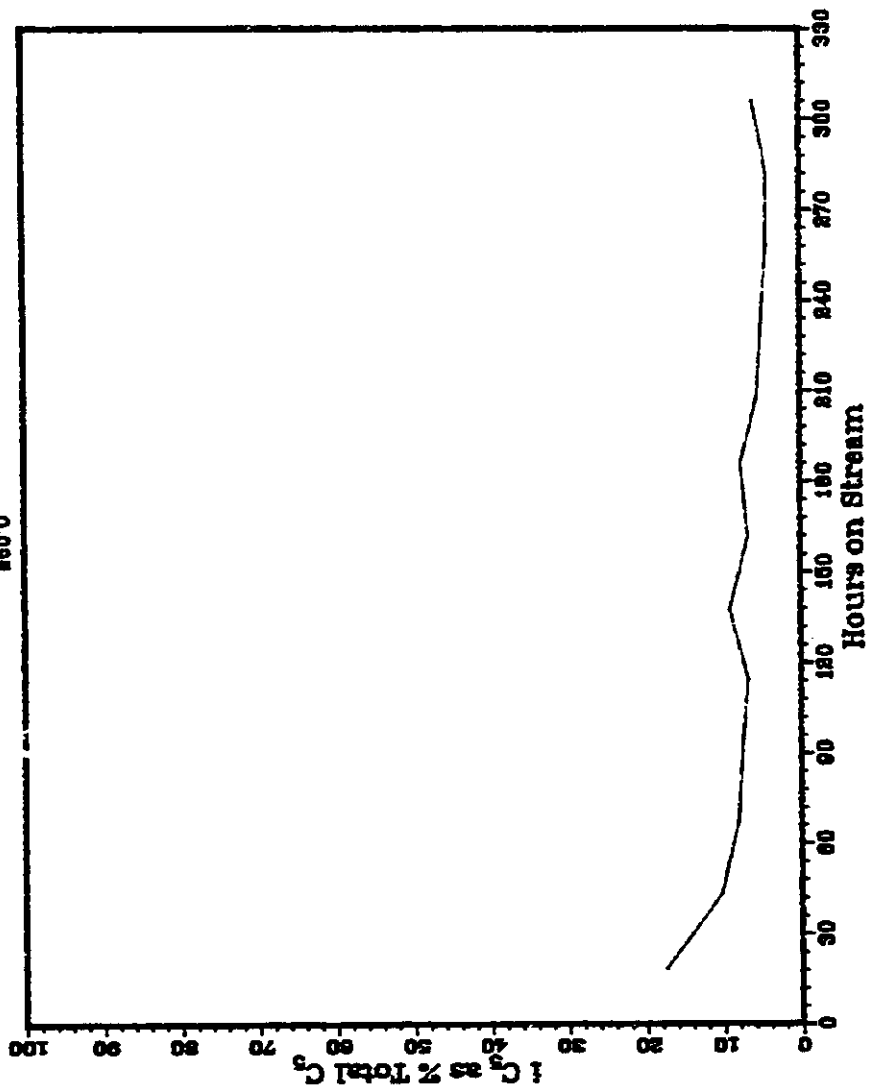


Fig. A186

RUN 11885-04

111 H<sub>2</sub>O  
300 PSIG  
800°C

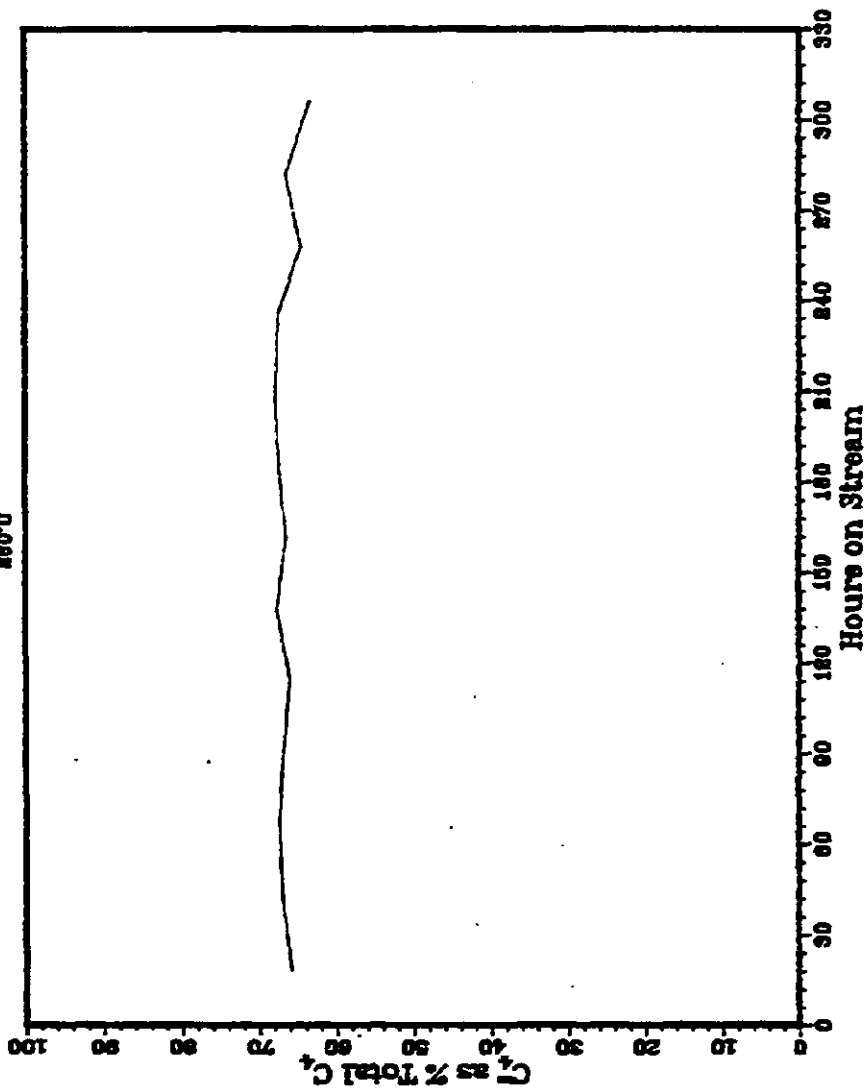
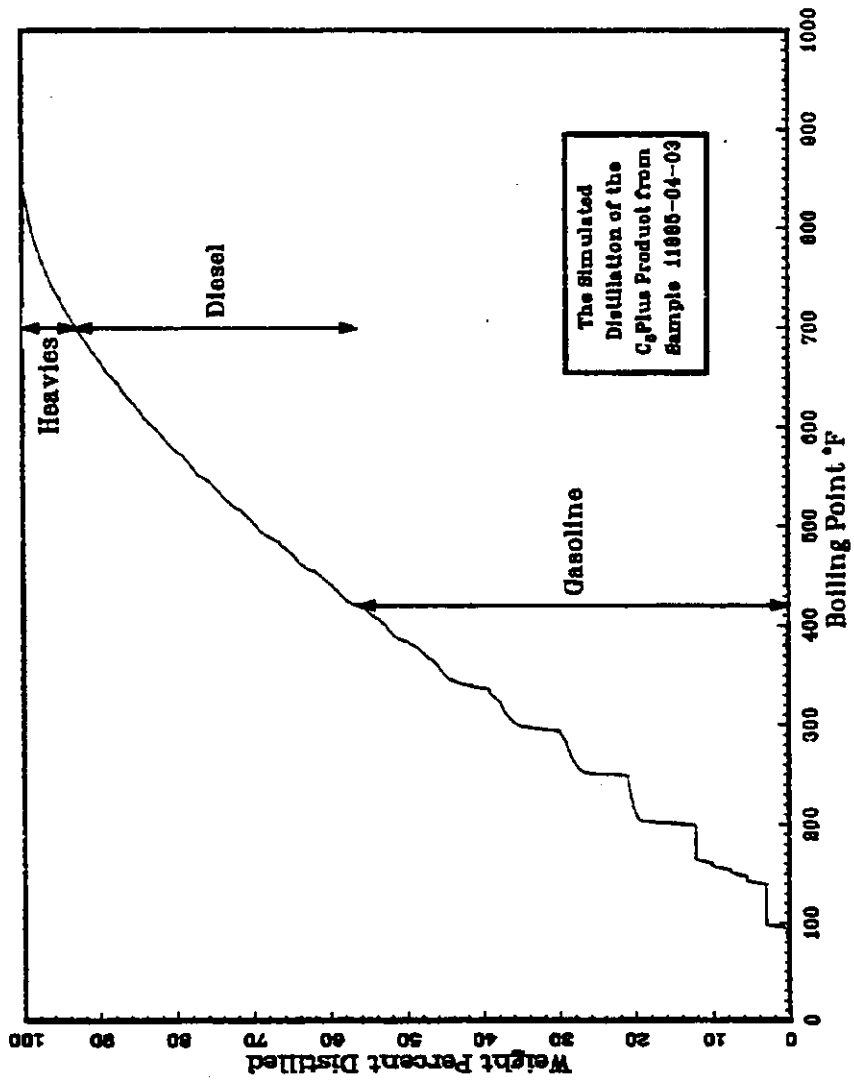
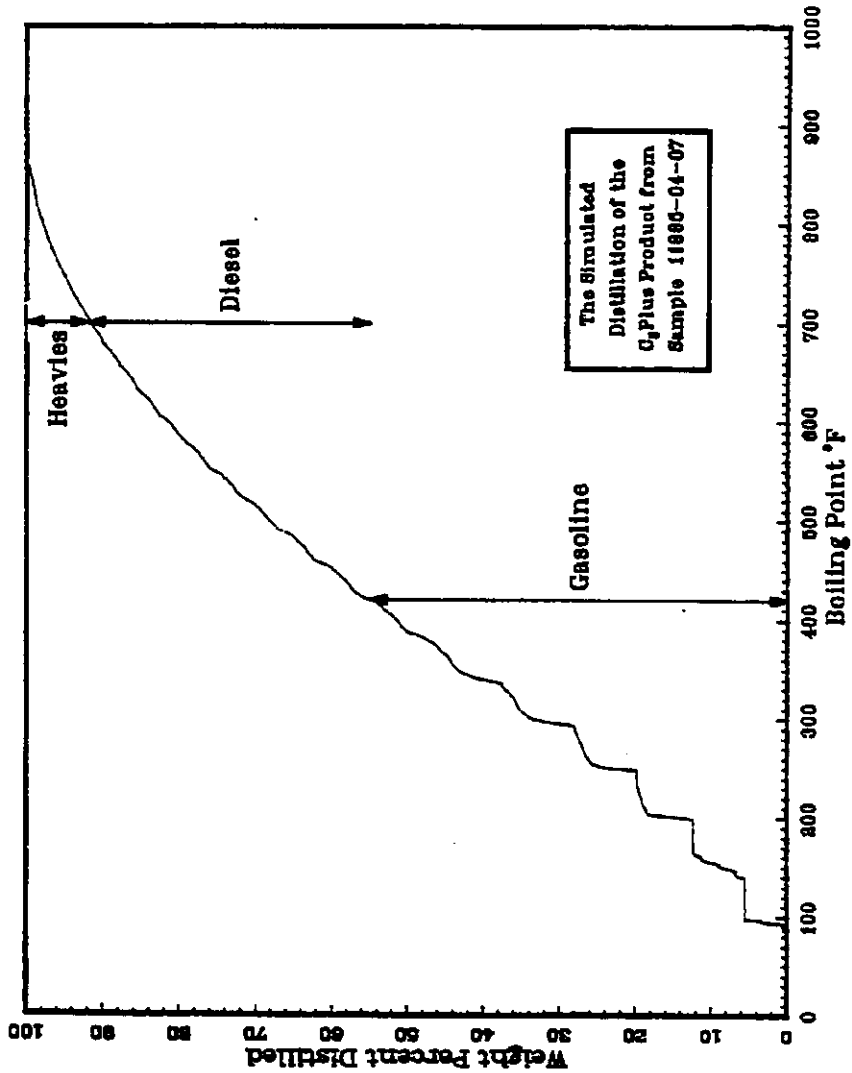


Fig. A187



The Simulated  
Distillation of the  
C<sub>8</sub>Plus Product from  
Sample 11885-04-03

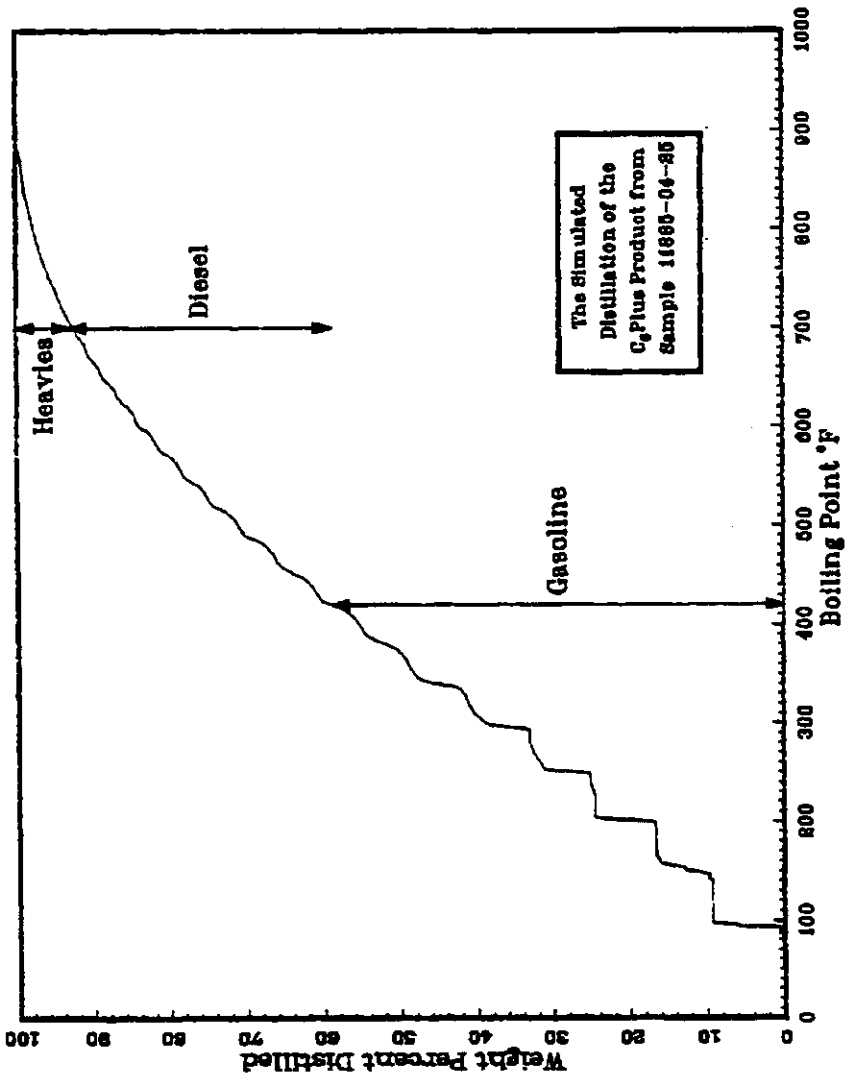
Fig. A188



The Simulated  
Distillation of the  
C<sub>1</sub> Plus Product from  
Sample 11886-04-07

Fig. A189





The Simulated  
Distillation of the  
C<sub>6</sub>+ Plus Product from  
Sample 11885-04-85

Fig. A190

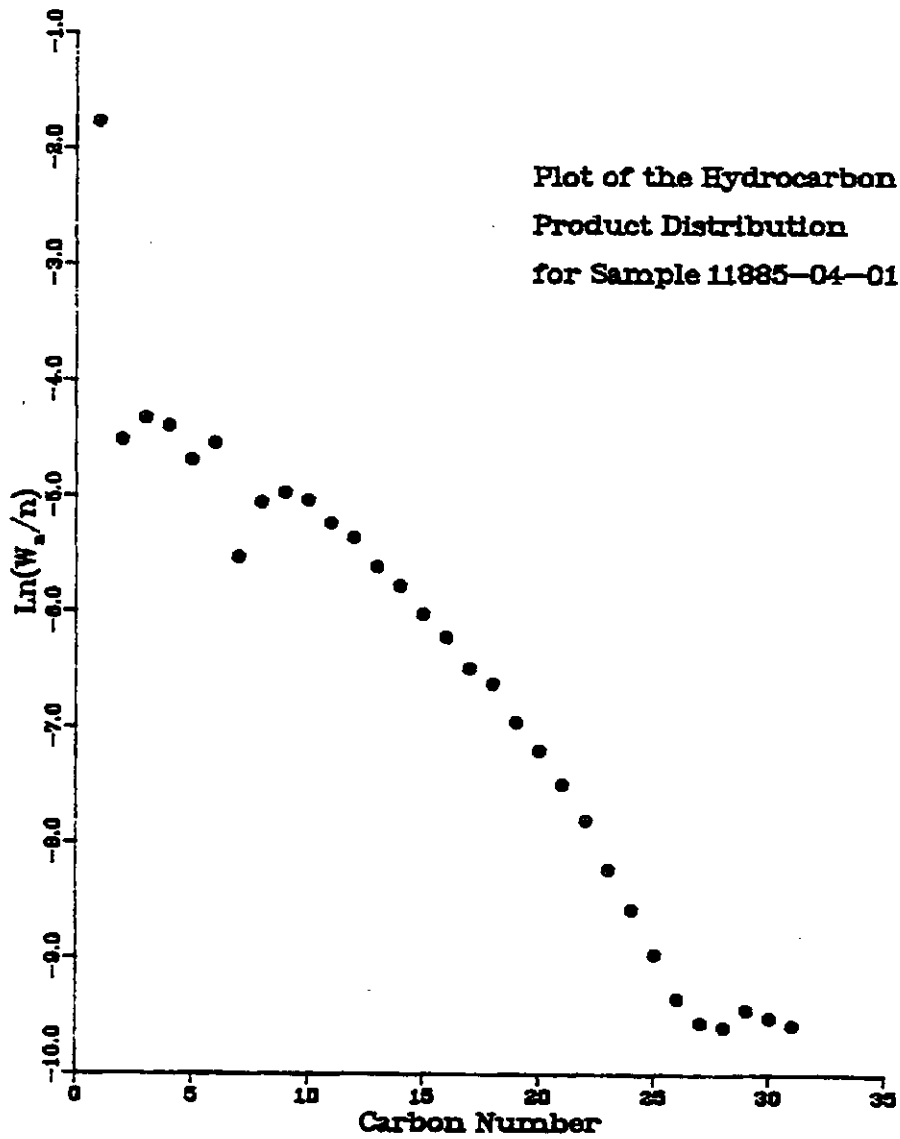


Fig. A191

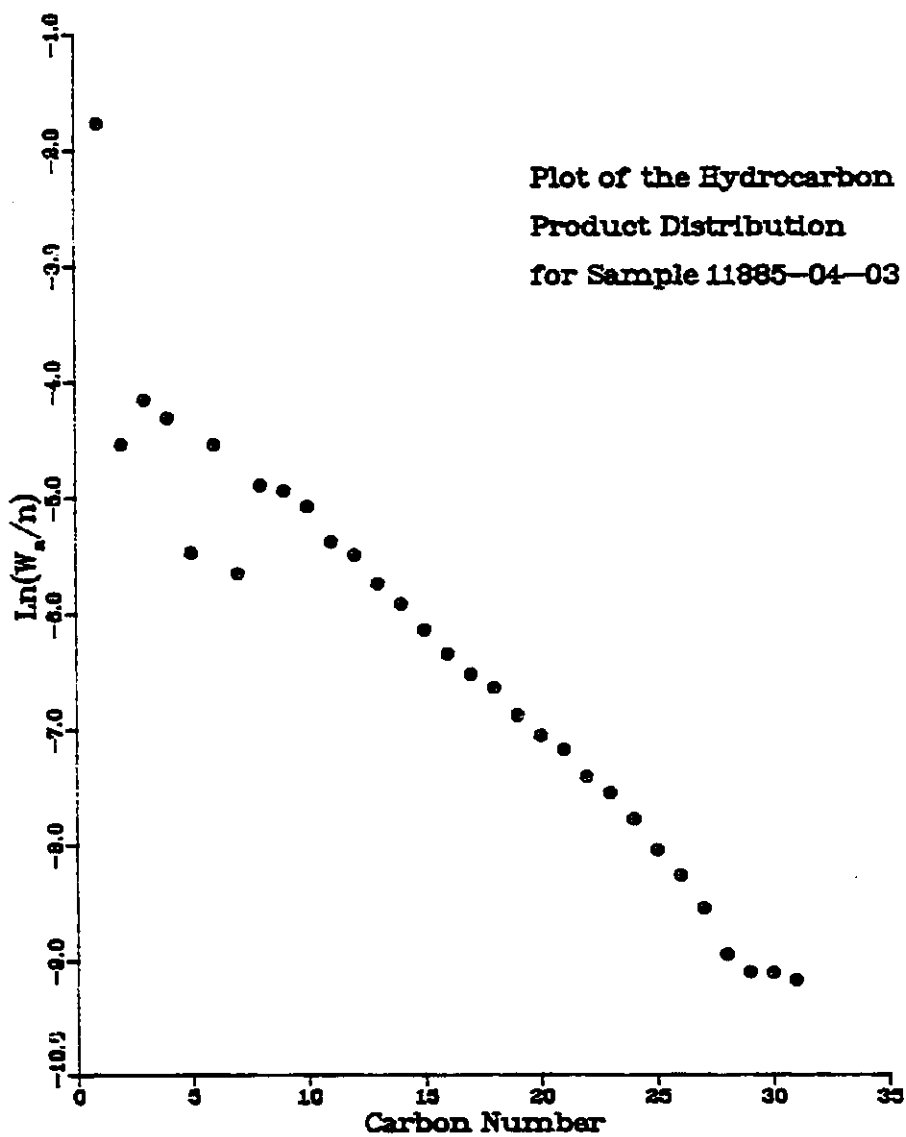


Fig. A192

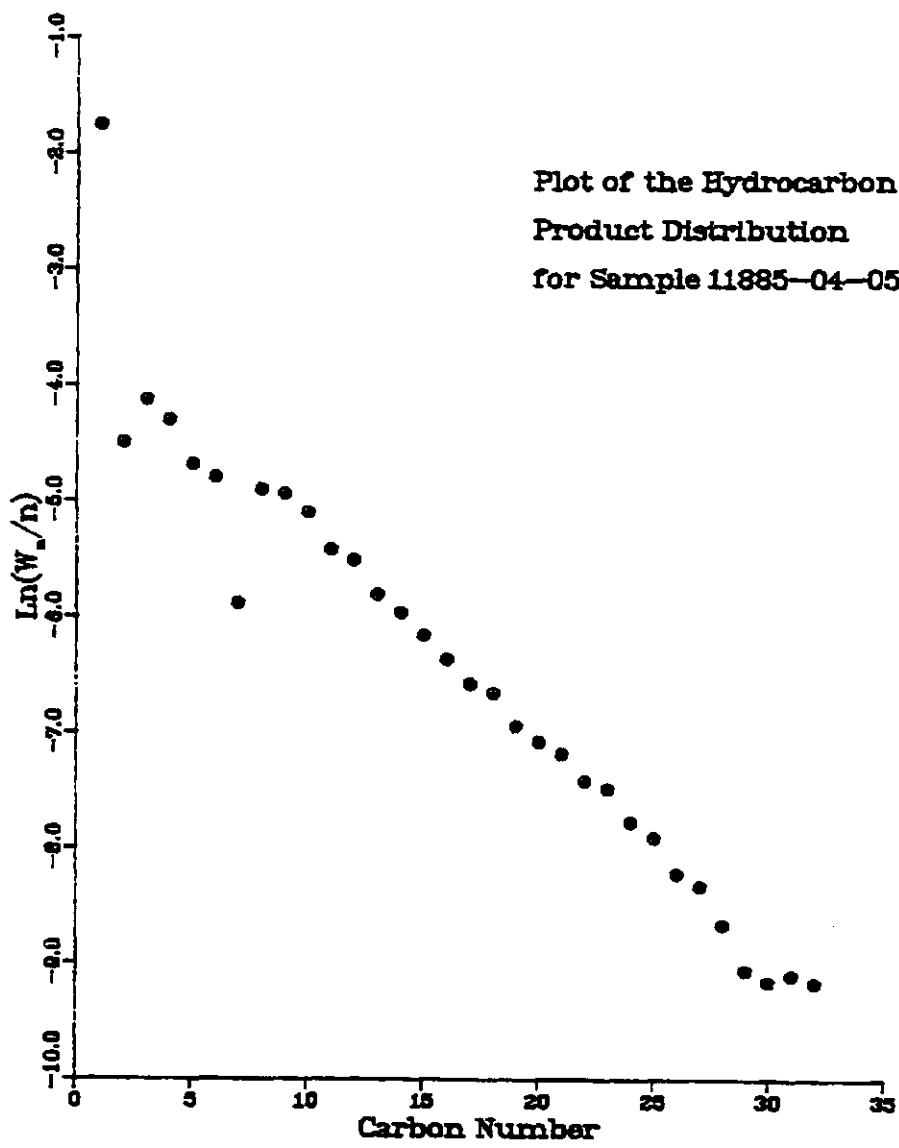


Fig. A193

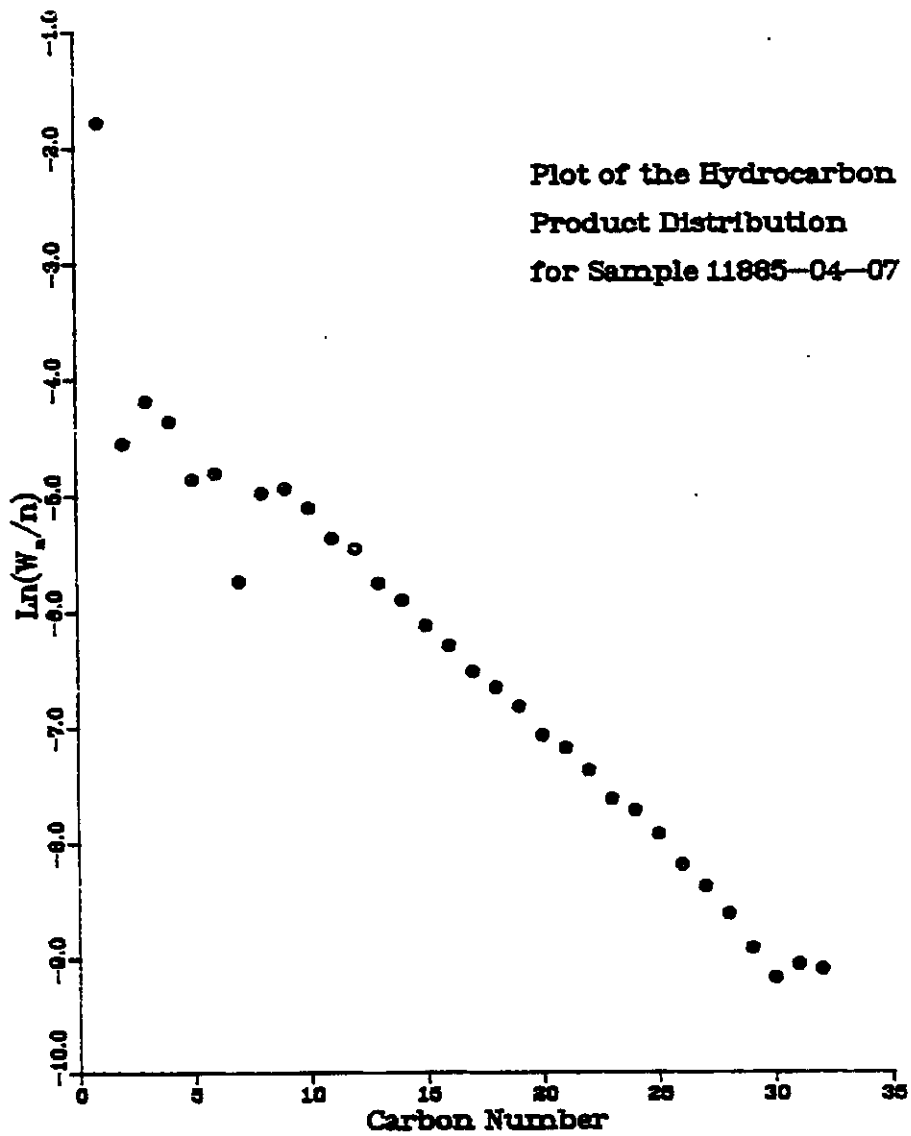


Fig. A194

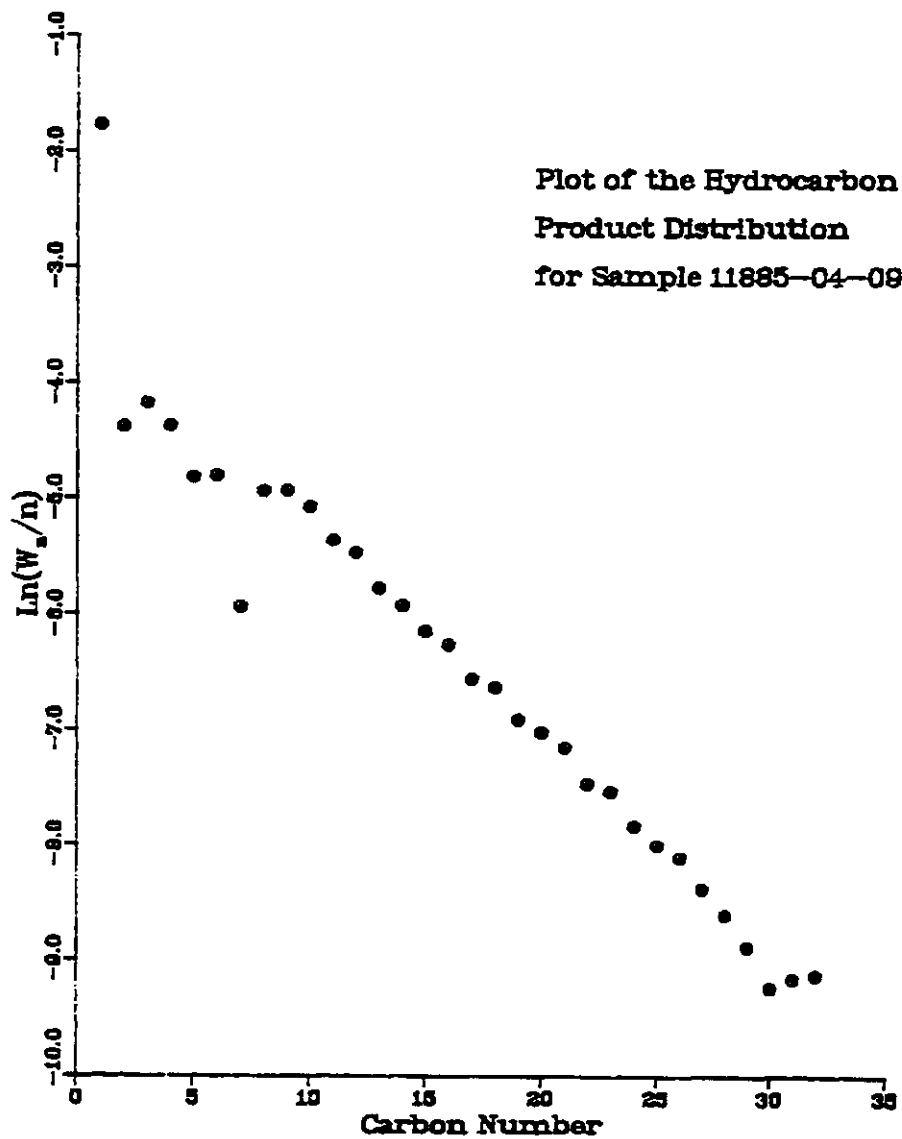


Fig. A195

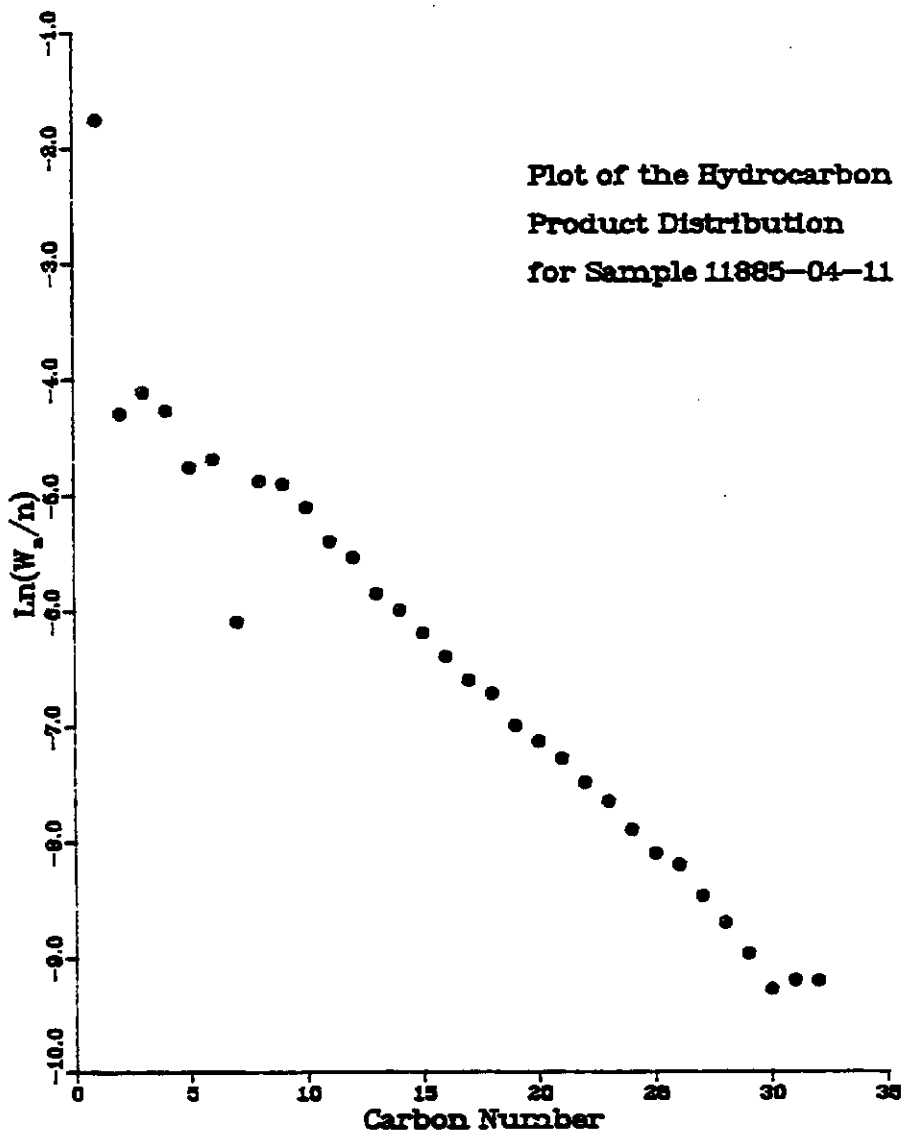


Fig. A196

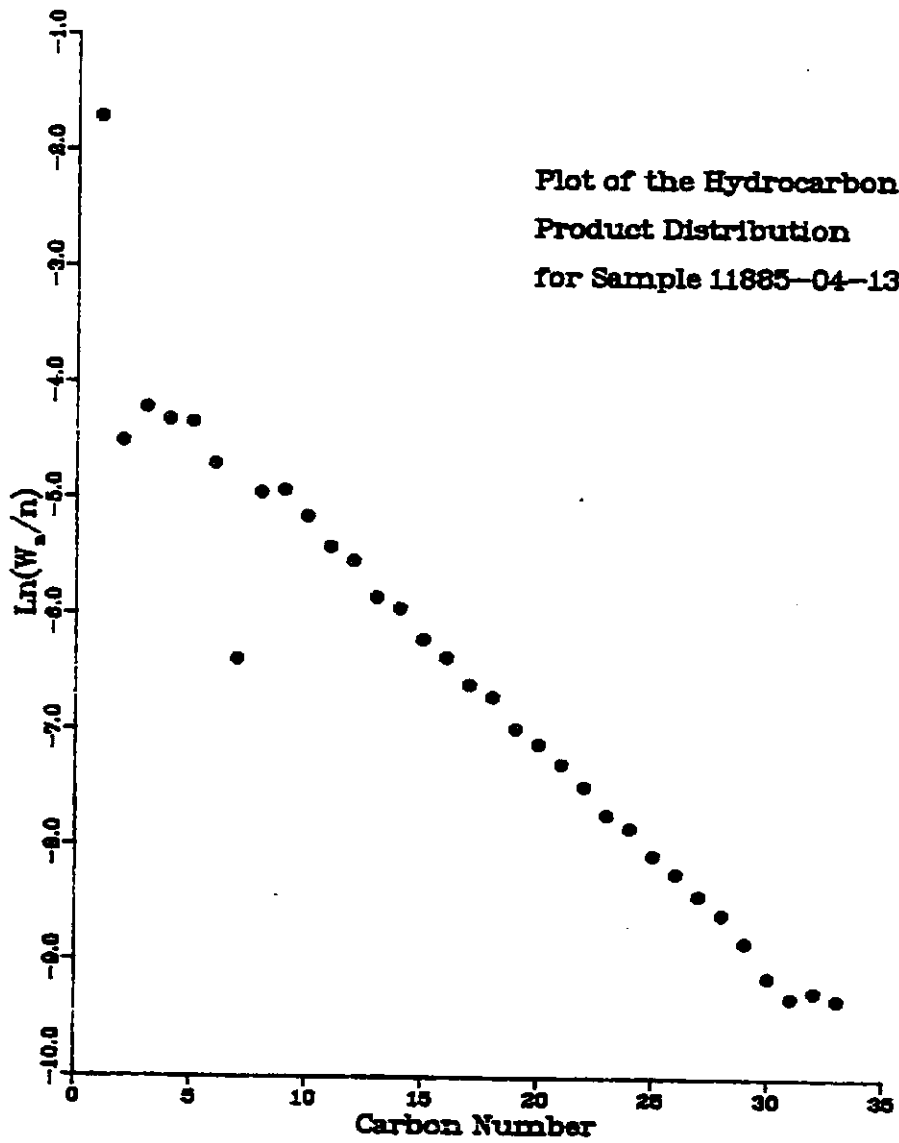


Fig. A197



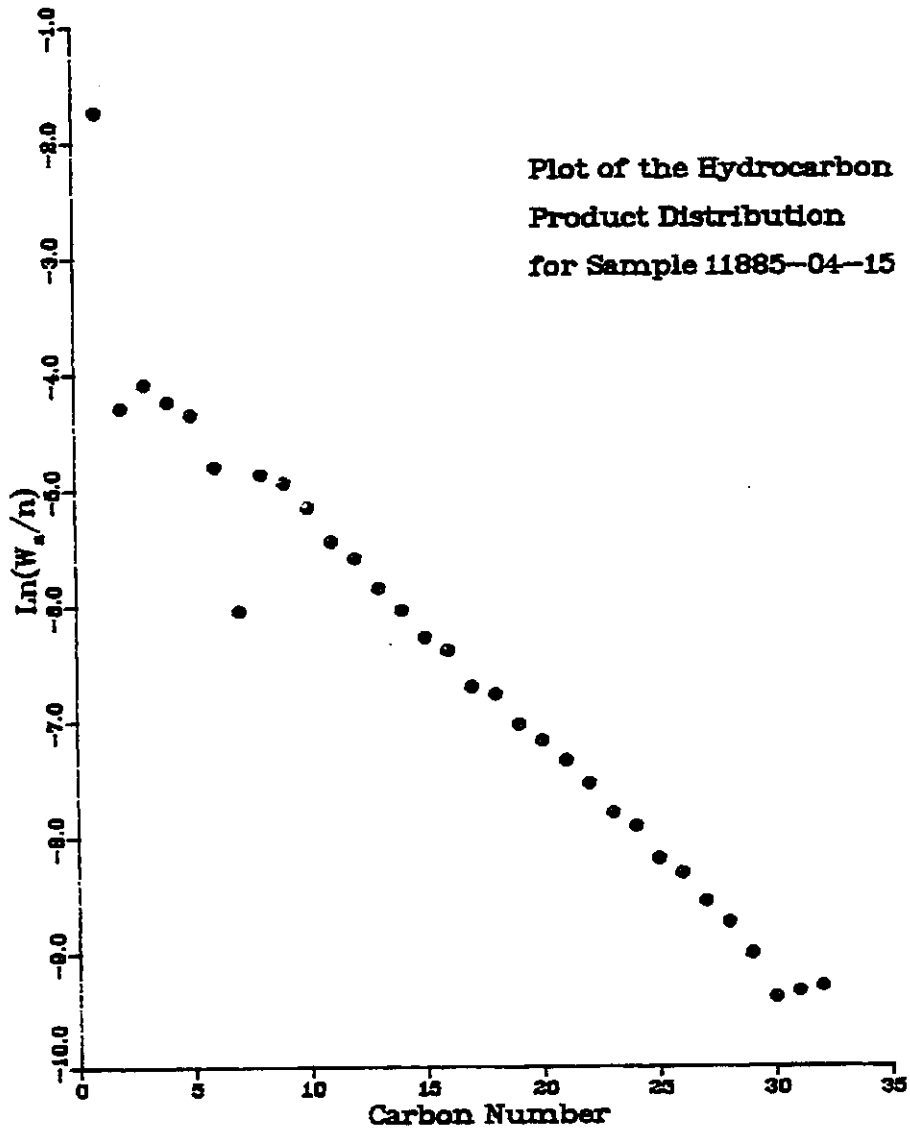


Fig. A198