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Development of a Catalyst for Conversion
of Syngas-derived Materials to Isobutylene
DE-AC22-91PC90042

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QUARTERLY TECHNICAL REPORT

The main goal of this contract is to develop a catalyst and technology that will produce iC_4 directly from coal-derived syngas and that is capable of utilizing a lower (0.5 to 1.0) $H_2:CO$ ratio. The research will identify and optimize the key catalyst and process characteristics that give improved performance for CO conversion by a non-Fischer-Tropsch process.

This report, which is the seventh quarterly report for contract DE-AC22-91PC90042, covers the testing of various ZrO_2 -based catalyst systems designed to examine the effects of catalyst preparation and process variables, especially low calcination temperature and mild reaction conditions (low temperature, low pressure and low space velocity). Testing of solvent-extracted sol-gel ZrO_2 catalysts indicates a decrease in isobutene yield. Lowering the reaction temperature, pressure and space velocity resulted in a small improvement in isobutene yield. Three extended runs demonstrated reasonable catalyst stability.

In view of the generally poor isobutene yields, the emphasis in this project will shift to isoalcohol production.

RESEARCH RESULTS

Catalyst Preparation

The preparation of catalysts IS-1 through IS-28 was discussed previously.^{1,2,3,4,5,6} Four sol-gel catalysts and three solvent extracted catalysts were prepared during the period, as indicated in Table 1.

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Table 1

Preparation of Catalysts

Catalyst	Catalyst Description	Surface Area, m ² /g	Calcination Temp, °C
IS-13	ZrO ₂	60	550
IS-29	1% Y-ZrO ₂ /n-C ₇ ^a	-	450
IS-30	1% Cs-ZrO ₂ /EtOH ^a	-	450
IS-31	1% Cs-ZrO ₂ /Me ₂ CO ^a	-	450
IS-32	ZrO ₂	95	475
IS-33	ZrO ₂	107	450
IS-34	ZrO ₂	122	425

^a Solvent Extracted

Catalyst Testing

The catalysts were tested in the laboratory catalyst test plant, described in Quarterly Report No 1.² The catalyst was activated to 400°C in flowing nitrogen in the laboratory test plant. The catalyst was then reduced at 600 psig and 400°C in flowing H₂:CO for 4 hr. The ratio of H₂ to CO varied in some tests. Conversion and selectivity were measured at three combinations of temperature, pressure, and space velocity. These operating conditions were selected to give intermediate conversions (10-30%). A detailed summary of each successful run is given in the appendix.

Runs 2-47 were discussed previously.^{1,2,3,4,5,6} Runs 48 through 59 were completed this quarter and are summarized in Table 2. Previous work indicated that lower catalyst calcination temperatures yield higher surface area catalysts and better isobutene yields.^{1,2} Runs 48 through 50 used catalysts that had been solvent extracted to remove sol-gel residue and permit lower calcination temperatures. However, the isobutene yields are below those from the reference catalyst in run 34.

Run 51 tested the effects of methanol addition to the feed. The products were dimethyl ether and methane. This completes the evaluation of potential recycle intermediates. None of the

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materials tested (ethylene, propylene, ethanol or methanol) yields isobutene when added to the feed to simulate recycle.

Runs 52 through 56 tested the effects of lower temperature and lower pressure on isobutene yield. Work by Maruya, et al., indicated high isobutene selectivities under mild conditions.⁷ By extending the calcination time, usable catalysts were obtained at calcination temperatures as low as 425°C. Comparison of run 34 with runs 52 through 56 indicates small improvements in the maximum isobutene yield. Lowering the H₂:CO from 2:1 to 1:1 reduced the isobutene yield due to more rapid deactivation.

Runs 57 through 59 were extended tests of catalyst performance to evaluate short-term stability. Run 57 shows high isobutane and low isobutene yields due to hydrogenation activity from the reactor internals. Runs 58 and 59 used a modified reactor to avoid the hydrogenation problem. Runs 58 and 59 indicate reasonable stability over the tested conditions. The isobutene yield as a function of time is given in Figures 1 and 2. The vertical lines represent condition changes. Plots of isobutene yield as a function of CO conversion are given in Figures 3 and 4. As can be seen from Figures 3 and 4, isobutene yield appears to reach a limit of about 4% as CO conversion increases. Thus any gains in selectivity at mild conditions are compensated by lower conversions and hence lower yields. As conversion increases with decreasing space velocity, the isobutene yield appears to converge to the same limit.

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Table 2
Conversion of CO at Maximum Isobutene Yield

Run	Cat.	Description	Feed H ₂ :CO Ratio	CO Conv., %	iC4 = Yld, %
34	IS-21	ZrO ₂ , sol-gel	2:1	21.3	2.33
48	IS-29	1% Y-ZrO ₂ , extracted	2:1	27.0	1.86
49	IS-30	1% Cs-ZrO ₂ , extracted	2:1	29.7	1.76
50	IS-31	1% Cs-ZrO ₂ , extracted	2:1	28.3	1.53
51	IS-13	ZrO ₂ , sol-gel	2:1	19.6	1.70
52	IS-13	ZrO ₂ , sol-gel	2:1	20.5	2.00
53	IS-32	ZrO ₂ , sol-gel	2:1	16.4	2.41
54	IS-33	ZrO ₂ , sol-gel	2:1	28.9	3.70
55	IS-34	ZrO ₂ , sol-gel	2:1	31.7	3.75
56	IS-33	ZrO ₂ , sol-gel	1:1	23.0	2.32
57	IS-21	ZrO ₂ , sol-gel	2:1	33.8	1.24
58	IS-32	ZrO ₂ , sol-gel	2:1	27.8	3.57
59	IS-33	ZrO ₂ , sol-gel	2:1	25.5	3.17

CONCLUSIONS

Reducing the catalyst calcination temperature increases the surface area and improves the isobutene yield. A limit is reached at 425°C calcination temperature. Using mild reaction conditions, isobutene selectivity can be slightly improved, but the overall yield tends to a limit of about 4% as CO conversion increases.

Addition of methanol to the feed results in the formation of methane and dimethyl ether. Thus intermediate recycle is not a viable option for Isosynthesis catalysts.

FUTURE WORK

In view of the low isobutene yield by direct synthesis and the failure of potential recycle intermediates to produce isobutene, no further work in Isosynthesis will be conducted. The research effort will shift to developing higher alcohol (IsoAlcohol) synthesis catalysts.

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APPENDIX

Figure 1

Isobutene Yield vs. Hours on Stream (Run 58)

Figure 2
Isobutene Yield vs. Hours on Stream (Run 59)

Figure 3

Isobutene Yield vs. CO Conversion (Run 58)

x 400C, 200psig, 200GHSV + 375C, 200psig, 200GHSV

* 375C, 200psig, 100GHSV * 375C, 100psig, 100GHSV

x 375C, 100psig, 50GHSV

Figure 4

Isobutene Yield vs. CO Conversion (Run 59)

× 400C, 200psig, 200GHSV + 385C, 200psig, 200GHSV

* 385C, 200psig, 100GHSV * 385C, 100psig, 100GHSV

⊗ 385C, 100psig, 50GHSV 385C, 100psig, 25GHSV

RUN SUMMARY

Run: 48.00

Catalyst: IS-29

HOURS ON STREAM	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
Temperature, C	416.00	416.00	433.00	430.00	424.00	417.00	416.00	427.00
Pressure, psig	620.00	610.00	610.00	610.00	615.00	615.00	620.00	620.00
GHSV, hr-1	960.00	960.00	960.00	960.00	960.00	960.00	960.00	960.00
Mass Balance, %	0.0	207.9	0.0	62.5	75.8	75.2	70.1	72.8
Conversions, %								
CO	7.28	27.30	25.34	25.92	26.99	25.44	23.04	22.58
H2	55.88	7.06	7.56	6.41	8.85	7.63	7.41	6.50
Selectivities, C mole %								
CO2	37.06	56.24	54.77	49.28	50.28	51.32	50.68	47.80
Hydrocarbon	62.94	43.76	45.23	50.72	49.72	48.68	49.32	52.20
HC Selectivities, C mole %								
Methane	36.69	18.17	21.28	22.82	25.42	24.55	25.34	24.39
Ethane	17.75	9.20	9.14	4.28	10.15	9.81	8.75	7.72
Ethylene	10.06	9.31	7.73	6.08	6.21	5.90	5.11	4.10
Propane	6.21	3.13	3.13	3.14	3.56	3.52	3.20	2.88
Propylene	4.79	5.25	4.66	3.65	3.70	3.52	3.20	2.72
I-Butane	0.98	5.95	6.81	6.61	7.95	7.82	7.57	6.95
I-butene	1.39	13.92	15.09	12.95	13.87	14.30	15.10	14.03
N-Butenes+n-Butane	6.15	7.56	7.90	6.91	7.21	7.62	7.74	7.14
C5+	15.98	27.51	24.27	33.57	21.94	22.96	23.99	30.09
Oxygen Balance, %	58.88	128.50	121.11	97.18	101.14	105.43	102.75	91.56
I-Butene Yield, C mole %	0.06	1.66	1.73	1.70	1.86	1.77	1.72	1.65
i-C4H8/CH4, C-molar	0.04	0.77	0.71	0.57	0.55	0.58	0.60	0.58
i-C4H8/C4s, C-molar	0.16	0.51	0.51	0.49	0.48	0.48	0.50	0.50
i-C4s/C4s, C-molar	0.28	0.72	0.73	0.74	0.75	0.74	0.75	0.75
Isosynthesis Profile	0.22	1.02	1.21	1.54	1.23	1.31	1.50	1.61

RUN SUMMARY

Run: 49.00
Catalyst: IS-30

HOURS ON STREAM	0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00
Temperature, C	435.00	433.00	425.00	420.00	432.00	435.00	430.00	421.00
Pressure, psig	600.00	625.00	620.00	620.00	625.00	625.00	625.00	625.00
GHSV, hr-1	960.00	960.00	960.00	960.00	960.00	960.00	960.00	960.00
Mass Balance, %	0.0	72.6	75.8	82.4	84.0	87.0	84.5	87.3
Conversions, %								
CO	20.54	26.56	29.67	22.86	20.79	23.41	22.82	21.86
H2	98.09	7.61	8.42	8.64	6.84	8.14	9.21	8.27
Selectivities, C mole %								
CO2	62.90	54.63	53.63	51.43	48.94	45.16	46.97	44.55
Hydrocarbon	37.10	45.37	46.37	48.57	51.06	54.84	53.03	55.45
HC Selectivities, C mole %								
Methane	19.67	21.39	23.54	22.98	24.15	26.57	28.06	24.65
Ethane	12.17	9.67	9.50	8.22	7.54	8.57	9.23	7.40
Ethylene	13.07	8.13	7.07	5.54	4.42	4.14	4.33	3.42
Propane	4.60	3.62	3.56	3.08	2.92	3.14	3.36	2.80
Propylene	7.17	5.35	4.59	3.77	3.27	2.86	2.91	2.49
I-Butane	8.35	7.01	6.86	6.13	5.89	4.32	7.32	6.16
I-butene	10.93	12.65	12.78	12.83	13.08	7.78	12.56	11.57
N-Butenes+n-Butane	8.42	7.47	7.28	7.19	7.07	6.09	6.63	6.25
C5+	15.62	24.71	24.81	30.26	31.66	36.54	25.61	35.26
Oxygen Balance, %	169.57	120.40	115.68	105.88	95.85	82.36	88.58	80.36
I-Butene Yield, C mole %	0.83	1.52	1.76	1.42	1.39	1.00	1.52	1.40
i-C4H8/CH4, C-molar	0.56	0.59	0.54	0.56	0.54	0.29	0.45	0.47
i-C4H8/C4s, C-molar	0.39	0.47	0.47	0.49	0.50	0.43	0.47	0.48
i-C4s/C4s, C-molar	0.70	0.72	0.73	0.72	0.73	0.66	0.75	0.74
Isosynthesis Profile	0.75	1.01	1.09	1.27	1.44	0.97	1.34	1.49

RUN SUMMARY

Run: 50.00

Catalyst: IS-31

HOURS ON STREAM	0.00	1.00	2.00	3.00	4.00	5.00	6.00
Temperature, C	428.00	423.00	418.00	424.00	429.00	431.00	428.00
Pressure, psig	600.00	600.00	600.00	605.00	610.00	615.00	610.00
GHSV, hr-1	960.00	960.00	960.00	960.00	960.00	960.00	960.00
Mass Balance, %	0.0	68.8	72.1	80.7	73.9	85.1	78.3
Conversions, %							
CO	26.37	28.30	23.34	21.39	21.08	23.71	23.24
H2	98.83	6.64	7.56	5.71	6.43	8.79	8.37
Selectivities, C mole %							
CO2	59.05	51.63	54.27	51.96	49.99	46.71	47.50
Hydrocarbon	40.95	48.37	45.73	48.04	50.01	53.29	52.50
HC Selectivities, C mole %							
Methane	18.18	17.25	23.06	22.96	27.96	27.98	27.31
Ethane	11.80	8.05	8.74	7.83	8.85	9.46	9.09
Ethylene	12.41	0.00	6.87	5.28	4.66	4.49	4.32
Propane	4.36	2.96	3.35	3.08	3.19	3.51	3.43
Propylene	6.59	4.70	4.70	3.92	3.36	3.07	3.05
I-Butane	7.54	5.40	6.32	5.97	6.26	4.43	4.65
I-butene	9.58	11.18	13.10	13.67	13.09	7.67	8.05
N-Butenes+n-Butane	7.03	6.36	7.48	7.46	6.96	6.34	6.71
CS+	22.51	44.10	26.38	29.83	25.66	33.05	33.40
Oxygen Balance, %	144.20	106.72	118.66	108.14	99.97	87.66	90.47
I-Butene Yield, C mole %	1.03	1.53	1.40	1.40	1.38	0.97	0.98
i-C4H8/CH4, C-molar	0.53	0.65	0.57	0.60	0.47	0.27	0.29
i-C4H8/C4s, C-molar	0.40	0.49	0.49	0.50	0.50	0.42	0.41
i-C4s/C4s, C-molar	0.71	0.72	0.72	0.72	0.74	0.66	0.65
Isosynthesis Profile	0.69	1.46	1.14	1.35	1.31	0.90	0.98

RUN SUMMARY

Run: 51.00
Catalyst: IS-13

HOURS ON STREAM	0.00	1.00	2.00	3.00	4.00	6.00	7.00	8.00	9.00
Temperature, C	425.00	421.00	422.00	430.00	434.00	422.00	418.00	405.00	404.00
Pressure, psig	615.00	620.00	625.00	605.00	605.00	600.00	605.00	600.00	620.00
GHSV, hr-1	960.00	960.00	960.00	960.00	960.00	960.00	960.00	960.00	960.00
Mass Balance, %	0.0	77.1	81.5	81.4	85.6	186.9	133.6	0.0	126.8
Conversions, %									
CO	22.39	21.04	19.61	17.50	18.92	59.31	65.75	14.46	62.67
H2	12.56	5.73	5.77	3.73	4.66	-40.77	-38.37	6.73	-24.02
Selectivities, C mole %									
CO2	50.25	52.48	52.26	52.09	47.60	14.66	11.31	33.41	8.65
Hydrocarbon	49.75	47.52	47.74	47.91	52.40	85.34	88.69	66.59	91.35
HC Selectivities, C mole %									
Methane	12.23	16.72	18.77	18.26	24.86	13.03	9.04	12.42	4.68
Ethane	7.63	7.40	7.12	6.83	7.70	0.67	0.40	1.56	0.17
Ethylene	7.63	6.62	5.63	5.01	4.70	0.26	0.18	1.19	0.14
Propane	2.76	2.70	2.74	2.62	2.82	0.34	0.18	0.75	0.08
Propylene	4.22	3.86	3.35	3.08	2.82	0.16	0.11	0.94	0.09
I-Butane	6.19	6.87	6.81	6.58	6.95	0.00	0.00	3.01	0.00
I-butene	11.60	16.93	18.13	19.23	16.72	0.00	0.00	5.25	0.40
N-Butenes+n-Butane	7.69	9.00	8.81	8.96	7.76	0.39	0.24	2.63	0.21
C5+	40.04	29.90	28.63	29.42	25.67	85.15	89.84	72.26	94.23
Oxygen Balance, %	101.00	110.42	109.45	108.73	90.83	17.17	12.76	50.17	9.47
I-Butene Yield, C mole %	1.29	1.69	1.70	1.61	1.66	0.00	0.00	0.51	0.23
i-C4H8/CH4, C-molar	0.95	1.01	0.97	1.05	0.67	0.00	0.00	0.42	0.09
i-C4H8/C4s, C-molar	0.46	0.52	0.54	0.55	0.53	0.00	0.00	0.48	0.65
i-C4s/C4s, C-molar	0.70	0.73	0.74	0.74	0.75	0.00	0.00	0.76	0.65
Isosynthesis Profile	1.15	1.59	1.79	1.98	1.74	0.27	0.27	2.45	1.26

10.00	11.00	12.00	13.00	14.00
402.00	401.00	424.00	424.00	424.00
610.00	620.00	630.00	650.00	635.00
960.00	960.00	960.00	960.00	960.00
141.6	134.4	134.8	135.0	136.9

63.58	62.04	53.55	38.56	42.33
-23.42	-23.78	-39.98	-49.27	-32.47

8.65	8.75	15.45	28.99	22.14
91.35	91.25	84.55	71.01	77.86

4.73	4.83	15.45	47.66	36.63
0.13	0.16	0.71	2.50	2.85
0.13	0.11	0.31	1.85	1.27
0.06	0.05	0.25	21.88	14.79
0.08	0.08	0.18	0.84	0.52
0.00	0.00	0.00	0.00	0.00

0.30	0.09	0.34	2.68	1.09
0.05	0.19	0.43	1.49	0.98
94.53	94.49	82.34	21.09	41.87

9.47	9.59	18.28	40.83	28.43
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0.17	0.05	0.16	0.74	0.36
0.06	0.02	0.02	0.06	0.03

0.85	0.32	0.44	0.64	0.53
0.85	0.32	0.44	0.64	0.53
0.89	0.70	0.54	0.15	0.11

RUN SUMMARY

Run: 52.00
Catalyst: IS-13

HOURS ON STREAM	0.00	1.00	2.00	3.00	4.00	5.00	6.00
Temperature, C	405.00	402.00	398.00	403.00	398.00	393.00	399.00
Pressure, psig	300.00	290.00	300.00	300.00	300.00	200.00	200.00
GHSV, hr-1	240.00	240.00	240.00	240.00	240.00	240.00	240.00
Mass Balance, %	0.0	82.5	74.4	76.2	79.7	90.3	106.1
Conversions, %							
CO	15.75	19.85	17.49	20.52	18.11	12.21	13.77
H2	55.04	4.25	3.57	4.74	4.65	-3.58	-0.18
Selectivities, C mole %							
CO2	58.56	54.67	56.96	53.68	60.27	53.16	48.24
Hydrocarbon	41.44	45.33	43.04	46.32	39.73	46.84	51.76
HC Selectivities, C mole %							
Methane	12.36	10.68	10.23	15.46	16.57	24.23	20.95
Ethane	6.10	4.55	3.81	5.86	6.17	4.01	5.35
Ethylene	16.86	13.07	9.53	10.76	11.32	7.80	8.76
Propane	2.41	1.65	1.43	2.15	2.35	1.34	1.84
Propylene	7.59	5.51	4.55	4.90	5.25	3.18	3.55
i-Butane	4.96	3.07	2.56	3.62	3.61	1.49	2.13
i-butene	17.68	17.04	19.62	21.03	24.73	19.24	21.01
N-Butenes+n-Butane	11.56	8.81	8.84	9.67	10.68	4.46	7.71
C5+	20.47	35.61	39.43	26.56	19.33	34.26	28.70
Oxygen Balance, %	141.31	120.59	132.37	115.90	151.73	113.48	93.21
i-Butene Yield, C mole %	1.15	1.53	1.48	2.00	1.78	1.10	1.50
i-C4H8/CH4, C-molar	1.43	1.60	1.92	1.36	1.49	0.79	1.00
i-C4H8/C4s, C-molar	0.52	0.59	0.63	0.61	0.63	0.76	0.68
i-C4s/C4s, C-molar	0.66	0.70	0.72	0.72	0.73	0.82	0.75
Isosynthesis Profile	1.04	1.17	1.61	1.45	1.56	1.54	1.58

RUN SUMMARY

Run: 53
Catalyst: IS-32

HOURS ON STREAM	0	1	2	3	4	5	6	7	8
Temperature, C	405	397	395	396	397	397	405	399	399
Pressure, psig	305	300	300	300	300	300	300	200	200
GHSV, hr-1	240	480	480	480	480	480	480	240	240
Mass Balance, %	0.0	64.6	62.5	60.9	61.9	61.8	63.8	42.6	42.5
Conversions, %									
CO	15.75	13.29	14.72	15.09	16.87	16.36	20.31	19.98	5.08
H2	55.04	-2.61	-1.59	-2.21	-0.74	-0.76	1.69	2.38	15.38
Selectivities, C mole %									
CO2	58.56	56.58	52.95	50.28	45.01	45.88	47.63	49.37	6.60
Hydrocarbon	41.44	43.42	47.05	49.72	54.99	54.12	52.37	50.63	93.40
HC Selectivities, C mole %									
Methane	12.36	0.00	8.79	11.62	14.05	15.87	18.49	16.18	0.14
Ethane	6.10	4.99	3.89	4.44	5.37	5.82	8.37	7.29	1.85
Ethylene	16.86	9.98	7.48	7.31	7.85	8.01	10.21	10.22	4.42
Propane	2.41	1.87	1.31	1.70	1.96	2.18	2.84	2.44	0.43
Propylene	7.59	3.74	2.77	2.87	3.00	3.06	3.30	3.22	1.93
I-Butane	4.96	0.00	2.90	3.37	3.80	3.91	5.10	4.94	0.00
I-butene	17.68	0.00	22.17	24.83	25.68	27.24	21.80	22.28	0.00
N-Butenes+n-Butane	11.56	6.48	5.25	5.57	5.92	6.26	5.75	5.73	3.14
C5+	20.47	72.94	45.43	38.29	32.37	27.66	24.14	27.68	88.09
Oxygen Balance, %	141.31	130.30	112.54	101.13	81.85	84.79	90.95	97.49	7.06
I-Butene Yield, C mole %	1.15	0.00	1.54	1.86	2.38	2.41	2.32	2.25	0.00
i-C4H8/CH4, C-molar	1.43	ERR	2.52	2.14	1.83	1.72	1.18	1.38	0.00
i-C4H8/C4s, C-molar	0.52	0.00	0.73	0.74	0.73	0.73	0.67	0.68	0.00
i-C4s/C4s, C-molar	0.66	0.00	0.83	0.84	0.83	0.83	0.82	0.83	0.00
Isosynthesis Profile	1.04	0.32	1.96	2.07	1.95	1.96	1.32	1.42	0.36

9	10	11	12	13	14	15	16	17	18	19
391	391	390	210	205	205	102	100	100	102	102
200	200	200	210	205	205	102	100	100	102	102
240	240	240	240	240	240	120	120	120	60	60
51.0	51.3	47.3	31.1	29.7	29.5	41.8	47.9	44.6	43.5	61.4
16.25	15.66	18.63	19.22	19.42	18.38	8.33	16.20	15.87	12.52	18.84
-3.62	-3.92	-3.01	4.18	1.66	0.17	21.38	1.58	-3.38	-3.00	3.20
45.41	47.57	46.23	50.74	54.53	50.99	9.34	32.04	40.31	49.90	48.94
54.59	52.43	53.77	49.26	45.47	49.01	90.66	67.96	59.69	50.10	51.06
17.88	17.85	17.25	18.33	17.61	16.96	0.00	16.14	15.58	23.49	20.56
6.02	5.69	5.12	6.53	6.12	5.91	3.39	6.06	5.27	7.46	0.66
8.52	8.37	7.46	8.40	9.70	8.39	0.00	6.18	0.00	10.65	7.32
2.31	2.13	1.97	2.29	2.13	2.08	1.27	2.32	1.86	2.66	2.41
2.97	2.84	2.63	2.71	2.69	2.63	4.37	2.78	2.33	3.37	2.20
4.54	4.18	3.65	5.29	5.10	4.92	0.96	0.00	0.00	5.36	6.94
22.05	23.62	22.66	21.23	22.21	22.51	7.31	0.00	0.00	24.23	18.38
5.58	5.69	5.26	5.55	5.52	5.40	2.07	4.82	4.03	5.92	4.39
30.11	29.62	33.99	29.68	28.92	31.19	80.63	61.69	70.93	16.86	37.14
83.18	90.72	85.96	102.99	119.93	104.05	10.30	47.16	67.52	99.59	95.87
1.96	1.94	2.27	2.01	1.96	2.03	0.55	0.00	0.00	1.52	1.77
1.23	1.32	1.31	1.16	1.26	1.33	ERR	0.00	0.00	1.03	0.89
0.69	0.71	0.72	0.66	0.68	0.69	0.71	0.00	0.00	0.68	0.62
0.83	0.83	0.83	0.83	0.83	0.84	0.80	0.00	0.00	0.83	0.85
1.62	1.76	1.84	1.61	1.59	1.73	1.15	0.28	0.43	1.47	2.36

20
405
310
480
63.8

11.50
-5.07

50.27
49.73

12.58
2.30
1.15
1.21
1.72
1.69

20.36
4.14
54.85

101.09

1.16
1.62

0.78
0.84
4.11

RUN SUMMAR

Run: 54
Catalyst: IS-33

HOURS ON STREAM	0	1	2	3	4	5	6	7	8
Temperature, C	388	394	405	398	392	388	400	406	394
Pressure, psig	205	205	202	203	203	205	205	205	203
GHSV, hr ⁻¹	240	480	480	480	480	240	240	240	240
Mass Balance, %	0.0	83.0	60.2	68.6	72.8	52.9	62.1	57.8	64.7
Conversions, %									
CO	3.41	13.05	17.20	13.45	14.22	20.62	23.17	12.10	18.90
H2	26.47	6.54	8.29	4.93	4.56	12.14	12.81	-2.05	10.10
Selectivities, C mole %									
CO2	74.00	58.64	59.05	63.90	60.89	68.39	63.45	74.80	66.56
Hydrocarbon	26.00	41.36	40.95	36.10	39.11	31.61	36.55	25.20	33.44
HC Selectivities, C mole %									
Methane	0.00	0.00	8.30	16.80	18.64	17.37	16.97	11.13	21.31
Ethane	47.51	3.96	5.96	7.62	7.91	9.83	9.85	8.30	9.45
Ethylene	34.48	11.88	15.30	18.11	15.93	19.47	17.55	18.02	17.32
Propane	0.00	0.00	0.00	0.00	0.00	2.29	2.59	0.00	2.51
Propylene	16.09	4.41	5.06	6.18	6.34	5.44	5.29	5.77	5.61
I-Butane	0.00	2.65	2.94	5.20	5.30	4.53	6.41	8.38	3.63
I-butene	0.00	17.71	22.47	38.27	35.89	31.56	27.39	37.78	32.78
N-Butenes+n-Butane	0.00	0.00	0.00	0.00	2.38	2.10	2.45	0.00	0.00
C5+	1.92	59.39	39.97	7.81	7.59	7.40	11.51	10.63	7.38
Oxygen Balance, %	284.67	141.80	144.21	177.01	155.72	216.32	173.61	296.86	199.02
I-Butene Yield, C mole %	0.00	0.96	1.58	1.86	2.00	2.06	2.32	1.15	2.07
i-C4H8/CH4, C-molar	ERR	ERR	2.71	2.28	1.92	1.82	1.61	3.39	1.54
i-C4H8/C4s, C-molar	ERR	0.87	0.88	0.88	0.82	0.83	0.76	0.82	0.90
i-C4s/C4s, C-molar	ERR	1.00	1.00	1.00	0.95	0.95	0.93	1.00	1.00
Isosynthesis Profile	0.00	1.01	0.97	1.36	1.44	1.03	1.03	1.44	1.04

9	10	11	12	13	14	15	16	17	18	19
401	397	403	404	390	396	398	402	398	402	405
205	205	205	205	150	150	155	150	150	150	150
240	120	120	120	120	120	120	120	60	60	60
65.5	67.9	71.2	68.5	69.3	72.2	56.2	62.2	65.0	72.1	69.0
21.52	28.91	27.90	22.77	21.64	7.26	21.15	21.69	20.95	27.62	19.14
11.25	12.43	10.71	7.51	10.36	2.98	18.26	10.91	11.81	15.72	6.65
59.42	57.82	61.90	65.67	61.76	77.49	51.96	58.23	61.38	58.65	66.91
40.58	42.18	38.10	34.33	38.24	22.51	48.04	41.77	38.62	41.35	33.09
20.92	21.55	20.84	16.47	18.19	0.00	36.54	27.95	37.83	28.15	23.15
9.51	10.98	10.24	7.73	8.93	7.13	15.51	10.72	15.50	12.11	10.23
15.20	13.75	15.30	14.18	16.01	19.25	13.83	13.13	15.57	12.41	12.77
2.81	3.06	3.17	2.03	2.99	0.00	4.88	3.22	4.41	3.45	2.63
4.58	4.81	4.17	4.05	4.43	0.00	3.75	3.51	3.86	2.99	3.07
5.54	4.60	4.54	7.51	6.64	9.22	0.97	6.32	1.98	5.62	8.93
26.94	26.01	28.18	30.15	28.92	42.12	7.39	22.67	8.45	25.44	23.63
2.36	2.24	2.56	1.95	2.66	0.00	2.32	2.08	2.50	2.04	0.00
12.14	13.00	10.99	15.94	11.25	22.28	14.81	10.40	9.92	7.79	15.59
146.43	137.07	162.49	191.26	161.49	344.21	108.16	139.42	158.91	141.81	202.24
2.35	3.17	2.99	2.36	2.39	0.69	0.75	2.05	0.68	2.91	1.50
1.29	1.21	1.35	1.83	1.59	ERR	0.20	0.81	0.22	0.90	1.02
0.77	0.79	0.80	0.76	0.76	0.82	0.69	0.73	0.65	0.77	0.73
0.93	0.93	0.93	0.95	0.93	1.00	0.78	0.93	0.81	0.94	1.00
1.09	1.01	1.07	1.42	1.18	1.95	0.28	1.02	0.33	1.07	1.13

Run 54

20
404
210
480
94.0

6.32
-1.57

63.93
36.07

0.00
5.35
8.84
0.00
0.00
2.84

34.11
0.00
48.86

177.24

0.78
ERR

0.92
1.00
2.60

RUN SUMMARY

Run: 55
Catalyst: IS-34

HOURS ON STREAM	0	1	2	3	4	5	6	7	8
Temperature, C	392	389	390	391	391	392	393	390	391
Pressure, psig	210	205	205	204	204	205	205	205	205
GHSV, hr-1	240	480	480	480	480	240	240	240	240
Mass Balance, %	0.0	93.7	91.5	93.6	91.7	70.8	103.1	102.3	71.7
Conversions, %									
CO	11.97	10.54	10.38	11.87	11.57	21.77	14.31	2.74	18.45
H2	-19.41	-13.78	-12.99	-12.39	-11.97	-9.55	-10.67	-19.25	-12.56
Selectivities, C mole %									
CO2	34.58	50.51	54.75	48.40	50.00	47.61	63.16	88.12	56.09
Hydrocarbon	65.42	49.49	45.25	51.60	50.00	52.39	36.84	11.88	43.91
HC Selectivities, C mole %									
Methane	0.00	0.00	0.00	3.45	3.49	7.00	12.29	0.00	13.09
Ethane	0.00	3.25	3.77	3.29	3.49	3.83	6.50	0.00	5.62
Ethylene	2.38	7.15	8.40	6.46	6.98	6.40	10.53	0.00	9.15
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	3.12	3.69	2.79	3.49	2.49	4.68	0.00	2.27
i-Butane	1.15	2.34	2.78	2.38	2.40	2.11	5.67	18.15	2.60
i-butene	4.11	15.60	21.26	17.55	16.21	14.70	24.24	81.85	23.42
N-Butenes+n-Butane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	92.36	68.55	60.10	64.07	63.95	63.46	36.09	0.00	43.85
Oxygen Balance, %	52.87	102.08	121.00	93.81	100.00	90.88	171.46	742.00	127.74
i-Butene Yield, C mole %	0.32	0.81	1.00	1.08	0.94	1.68	1.28	0.27	1.90
i-C4H8/CH4, C-molar	ERR	ERR	ERR	5.09	4.65	2.10	1.97	ERR	1.79
i-C4H8/C4s, C-molar	0.78	0.87	0.88	0.88	0.87	0.87	0.81	0.82	0.90
i-C4s/C4s, C-molar	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Isosynthesis Profile	2.21	1.33	1.52	1.59	1.33	1.32	1.38	ERR	1.53

9	10	11	12	13	14	15	16	17	18	19
392	392	390	391	391	390	391	392	392	289	389
205	205	204	203	203	205	205	205	205	200	200
240	240	120	120	120	120	120	120	120	60	60
73.0	91.2	64.3	84.2	79.0	84.8	74.1	83.3	88.9	52.8	69.2
15.01	13.52	28.83	22.04	21.90	5.14	26.65	19.56	20.03	26.85	30.58
-9.68	-9.80	-4.75	-5.37	-5.29	-21.69	-11.10	-10.46	-9.85	-6.41	-2.20
67.64	66.53	46.89	65.70	64.41	56.69	44.58	65.55	64.48	52.88	58.51
32.36	33.47	53.11	34.30	35.59	43.31	55.42	34.45	35.52	47.12	41.49
20.13	20.05	12.05	18.87	19.18	0.00	11.48	21.61	22.28	19.29	24.38
8.42	8.20	6.30	9.62	9.35	6.67	5.06	9.17	9.18	9.73	13.45
13.99	12.91	7.22	13.61	13.02	5.51	6.16	12.71	12.21	8.66	10.66
0.00	0.00	1.75	2.99	2.75	0.00	1.52	2.66	2.78	2.71	3.78
5.14	4.78	3.32	4.36	4.06	0.00	1.98	4.22	4.10	2.63	3.05
7.41	6.76	2.66	7.49	7.18	3.02	2.05	8.45	7.46	4.48	8.73
35.99	38.19	16.54	30.07	31.27	13.79	15.54	30.30	31.82	20.28	23.11
0.00	0.00	1.50	2.54	2.27	0.00	1.23	2.29	2.34	1.91	2.79
8.92	9.11	48.64	10.44	10.92	71.01	54.98	8.59	7.82	30.29	10.05
208.99	198.79	88.29	191.52	181.00	130.87	80.43	190.26	181.53	112.22	141.05
1.75	1.73	2.53	2.27	2.44	0.31	2.30	2.04	2.26	2.57	2.93
1.79	1.91	1.37	1.59	1.63	ERR	1.35	1.40	1.43	1.05	0.95
0.83	0.85	0.80	0.75	0.77	0.82	0.83	0.74	0.76	0.76	0.67
1.00	1.00	0.93	0.94	0.94	1.00	0.93	0.94	0.94	0.93	0.92
1.58	1.74	1.11	1.31	1.40	1.38	1.28	1.43	1.47	1.12	1.12

20
392
200
60
69.1

31.66
-3.25

61.32
38.68

22.73
12.95
11.38
3.62
3.20
2.55

30.63
2.58
10.37

158.52

3.75
1.35

0.86
0.93
1.15

RUN SUMMARY

Run: 56
Catalyst: IS-33

HOURS ON STREAM	0	1	2	3	4	5	6	7	8
Temperature, C	398	392	387	389	389	392	392	395	387
Pressure, psig	205	210	210	210	210	200	200	200	210
GHSV, hr-1	240	480	480	480	480	240	240	240	240
Mass Balance, %	0.0	104.9	96.7	96.4	95.2	74.4	84.2	84.2	76.5
Conversions, %									
CO	6.63	10.50	9.71	7.84	7.65	15.53	15.08	15.47	13.96
H2	-18.43	-5.62	-4.40	-2.89	-1.98	4.78	4.28	4.05	4.65
Selectivities, C mole %									
CO2	81.99	61.62	64.93	78.76	79.82	72.08	73.37	71.15	74.24
Hydrocarbon	18.01	38.38	35.07	21.24	20.18	27.92	26.63	28.85	25.76
HC Selectivities, C mole %									
Methane	0.00	0.00	0.00	0.00	0.00	17.63	16.40	17.31	19.54
Ethane	11.59	3.80	3.98	7.71	9.44	8.81	8.77	8.54	7.96
Ethylene	35.14	9.76	9.11	16.76	17.45	14.32	14.50	13.29	13.27
Propane	0.00	0.00	0.00	0.00	0.00	3.15	3.08	3.20	0.00
Propylene	10.65	3.90	3.66	5.59	5.58	5.26	5.36	4.95	4.89
I-Butane	9.33	3.19	3.47	7.25	8.69	4.95	8.25	7.68	4.31
I-butene	33.29	21.32	26.55	53.39	58.83	34.51	35.26	34.61	38.88
N-Butenes+n-Butane	0.00	0.00	0.00	0.00	0.00	2.60	0.00	1.94	2.41
C5+	0.00	58.03	53.24	9.31	0.00	8.76	8.39	8.49	8.75
Oxygen Balance, %	455.33	160.52	185.18	370.74	395.42	258.14	275.54	246.65	288.24
I-Butene Yield, C mole %	0.40	0.86	0.90	0.89	0.91	1.50	1.42	1.54	1.40
i-C4H8/CH4, C-molar	ERR	ERR	ERR	ERR	ERR	1.96	2.15	2.00	1.99
i-C4H8/C4s, C-molar	0.78	0.87	0.88	0.88	0.87	0.82	0.81	0.78	0.85
i-C4s/C4s, C-molar	1.00	1.00	1.00	1.00	1.00	0.94	1.00	0.96	0.95
Isosynthesis Profile	0.74	1.40	1.79	2.02	2.08	1.33	1.37	1.48	1.75

9	10	11	12	13	14	15	16	17	18	19
389	393	393	388	392	392	394	397	392	397	388
210	205	205	205	205	205	210	210	105	110	210
240	120	120	120	120	120	120	120	120	120	480
86.5	50.3	83.7	81.1	75.8	74.6	82.0	70.4	67.6	68.7	94.6
13.42	25.85	19.71	20.64	23.04	4.20	21.26	10.22	14.49	5.11	6.28
4.67	15.55	8.63	9.96	10.90	-10.50	10.83	-2.91	-0.36	-1.82	-3.54
72.13	69.00	71.86	69.55	67.53	80.02	67.77	75.61	66.50	78.90	73.00
27.87	31.00	28.14	30.45	32.47	19.98	32.23	24.39	33.50	21.10	27.00
19.99	22.40	17.56	18.54	20.23	0.00	27.83	18.99	23.37	0.00	25.91
8.06	11.20	7.86	8.02	9.48	10.97	10.36	11.50	9.67	11.57	8.29
12.21	12.56	12.40	11.73	11.50	14.62	11.46	14.46	12.18	18.18	10.36
0.00	4.08	3.12	3.34	3.70	0.00	3.86	0.00	3.49	0.00	0.00
4.67	3.85	4.51	4.25	4.04	0.00	3.86	0.00	4.30	0.00	0.00
7.59	4.91	5.66	8.04	7.12	9.37	3.61	8.97	7.28	12.72	15.20
36.88	27.74	35.15	32.27	31.04	42.85	27.40	32.15	31.04	57.53	40.24
2.53	2.93	2.77	2.70	2.92	0.00	2.57	0.00	3.76	0.00	0.00
8.06	10.33	10.97	11.12	9.96	22.19	9.04	13.94	4.92	0.00	0.00
258.81	222.58	255.41	228.45	207.97	400.52	210.30	309.93	198.52	373.97	270.34
1.38	2.22	1.95	2.03	2.32	0.36	1.88	0.80	1.51	0.62	0.68
1.85	1.24	2.00	1.74	1.53	ERR	0.98	1.69	1.33	ERR	1.55
0.78	0.78	0.81	0.75	0.76	0.82	0.82	0.78	0.74	0.82	0.73
0.95	0.92	0.94	0.94	0.93	1.00	0.92	1.00	0.91	1.00	1.00
1.88	1.12	1.56	1.57	1.43	2.04	1.14	1.58	1.42	2.36	2.97

20
390
210
480
93.6

3.40
-14.59

68.36
31.64

0.00
18.71
6.65
0.00
20.58
2.88

34.55
0.00
16.63

216.01

0.37
ERR

0.92
1.00
0.81

4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	7	7	7
41	43	45	47	52	54	56	58	60	62	64	66	68	70	76	78	80	82	84	86	88
0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.082	0.082
0.181	0.186	0.194	0.191	0.187	0.167	0.176	0.175	0.183	0.187	0.195	0.21	0.185	0.198	0.194	0.197	0.184	0.176	0.188	0.074	0.081
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
451.7	451.9	451.9	451.9	452.2	452.2	451.9	452.1	452	427.3	427	426.8	426.6	426.5	426.8	426.7	426.8	426.8	427.3	427	427.2
0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.005380	0.002520	0.002520
0.006356	0.006501	0.006642	0.006589	0.006614	0.005908	0.006004	0.005325	0.006080	0.006133	0.006373	0.006942	0.006133	0.006586	0.007012	0.006641	0.006496	0.006143	0.006577	0.002712	0.002926
1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.5	0.5
118.15	120.84	123.46	122.48	122.95	109.81	111.61	110.14	113.02	115.04	110.47	123.04	114.01	122.43	130.34	123.44	120.75	114.18	124.12	107.59	116.07
41	43	45	47	52	54	56	58	60	62	64	66	68	70	76	78	80	82	84	86	88
5.43	5.46	5.39	5.43	5.42	5.52	5.53	5.56	5.53	5.24	5.18	5.10	5.21	5.16	5.15	5.17	5.18	5.22	5.24	5.80	5.63
0.16	0.17	0.15	0.18	0.14	0.15	0.16	0.13	0.16	0.16	0.15	0.13	0.15	0.13	0.13	0.13	0.13	0.14	0.15	0.29	0.22
62.61	62.82	63.54	63.28	63.77	63.09	62.67	62.10	63.08	63.36	64.04	64.46	64.46	64.88	64.35	64.25	64.13	63.66	63.67	61.64	62.30
3.33	3.25	3.17	3.16	3.33	3.55	3.57	3.55	3.60	2.42	2.37	2.17	2.42	2.31	2.32	2.36	2.41	2.53	2.42	4.58	3.88
21.48	21.44	21.39	21.42	21.00	20.93	21.20	21.36	21.73	24.18	24.18	24.24	22.97	23.05	23.54	23.53	23.49	23.58	23.80	19.34	20.39
5.94	5.86	5.43	5.59	5.42	5.76	5.86	5.81	5.87	4.36	4.22	3.33	4.19	3.95	4.01	4.06	4.09	4.31	4.21	7.17	6.57
0.33	0.31	0.30	0.29	0.30	0.33	0.33	0.32	0.32	0.15	0.15	0.13	0.16	0.14	0.15	0.15	0.16	0.17	0.16	0.37	0.31
0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.00
0.10	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.05	0.04	0.11	0.09
0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
0.39	0.37	0.34	0.34	0.35	0.38	0.38	0.38	0.38	0.18	0.18	0.15	0.17	0.17	0.17	0.18	0.18	0.19	0.18	0.50	0.41
0.06	0.06	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.09	0.09	0.09	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.09	0.08
0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.04	0.05
0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.04	0.05
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99.999	100.000	99.999	100.001	100.000	99.994	99.999	100.000	100.001	99.999	100.000	100.002	100.000	100.001	99.995	100.000	100.000	99.998	99.999	99.998	99.999
13.11094	13.04938	12.7822	12.88048	12.70712	12.9321	13.06052	13.20612	13.20738	12.73702	12.64116	12.4054	12.35628	12.20302	12.34276	12.37838	12.4197	12.5708	12.55526	13.4952	13.2589
29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48
39.87	40.27	39.59	39.97	41.03	42.29	41.65	40.14	40.24	29.76	29.05	27.66	32.94	32.07	30.46	30.79	30.96	31.25	30.87	49.25	44.92
20.23	20.36	18.34	19.28	18.50	20.83	21.51	22.62	22.30	16.62	15.38	13.01	14.37	12.39	13.51	13.99	14.24	15.53	15.86	26.39	23.41
12.58	12.27	11.57	11.72	11.72	12.47	12.64	12.54	12.67	8.57	8.35	7.61	8.52	7.94	7.93	8.06	8.34	8.70	8.30	15.59	13.73
36.94	36.40	35.10	35.37	35.82	37.34	37.35	36.46	36.82	26.17	25.69	23.89	27.06	25.62	25.18	25.52	26.20	26.94	25.85	44.63	40.25
0.547638	0.559239	0.522323	0.545214	0.516531	0.557737	0.575953	0.620361	0.605555	0.635151	0.598797	0.544700	0.531071	0.506868	0.536281	0.548460	0.543502	0.576335	0.613708	0.591299	0.581712
26.504	26.442	27.355	26.999	28.406	28.464	28.254	28.273	28.412	28.240	28.320	28.521	28.421	29.106	29.274	29.318	28.912	29.036	29.155	29.359	28.260
47.253	47.735	46.897	47.726	46.244	46.183	46.372	46.284	46.349	50.831	50.467	50.375	49.202	49.786	50.599	50.323	49.059	49.575	50.717	45.976	47.863
5.279	5.117	5.134	5.017	5.104	5.228	5.190	5.103	5.116	3.523	3.589	3.524	3.708	3.627	3.710	3.747	3.717	3.841	3.953	4.797	4.529
0.715	0.766	0.761	0.751	0.615	0.593	0.585	0.606	0.600	0.887	0.861	0.920	0.751	0.806	0.800	0.800	0.696	0.800	0.800	0.000	0.000
2.385	2.298	2.282	2.253	2.305	2.357	2.374	2.344	2.368	1.505	1.508	1.460	1.584	1.549	1.552	1.563	1.583	1.587	1.591	2.155	1.922
0.692	0.758	0.700	0.768	0.666	0.625	0.641	0.646	0.639	0.735	0.754	0.789	0.704	0.718	0.681	0.707	0.684	0.690	0.651	0.346	0.502
12.338	11.930	11.893	11.639	11.915	12.091	12.058	11.992	11.968	8.432	8.519	8.047	9.012	8.715	8.631	8.685	8.682	8.740	8.485	12.878	11.942
1.781	1.793	1.763	1.707	1.844	1.860	1.899	1.945	1.895	0.000	0.000	0.000	1.126	0.000	0.000	0.000	1.151	1.288	0.000	2.206	2.185
1.526	1.581	1.608	1.570	1.451	1.299	1.313	1.403	1.326	2.869	2.991	3.182	2.746	2.846	2.776	2.829	2.758	2.622	2.724	1.142	1.398
1.526	1.581	1.608	1.570	1.451	1.299	1.313	1.403	1.326	2.869	2.991	3.182	2.746	2.846	2.776	2.829	2.758	2.622	2.724	1.142	1.398
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
89.586	91.331	88.314	91.299	86.027	85.816	86.471	86.166	86.389	103.536	101.384	101.510	96.858	99.147	102.427	101.299	96.304	98.312	102.910	85.102	91.802
1.310	1.064	1.352	1.020	1.637	1.769	1.710	1.735	1.724	-0.307	-0.157	-0.115	0.268	0.068	-0.192	-0.105	0.308	0.147	-0.241	2.323	1.126
0.564	0.575	0.564	0.555	0.520	0.485	0.491	0.512	0.488	0.751	0.768	0.760	0.743	0.729	0.699	0.722	0.723	0.706	0.704	0.510	0.563
5.121	4.918	4.739	4.672	4.787	5.000	4.994	4.884	4.895	2.974	2.957	2.632	3.182	2.962	2.873	2.938	2.997	3.061	2.897	6.257	5.369
5.121	4.918	4.739	4.672	4.787	5.000	4.994	4.884	4.895	2.974	2.957	2.632	3.182	2.962	2.873	2.938	2.997	3.061	2.897	6.257	5.369
0.089	0.094	0.095	0.095	0.087	0.078	0.079	0.084	0.080	0.202	0.206	0.221	0.176	0.198	0.196	0.197	0.180	0.172	0.196	0.066	0.083
0.807	0.800	0.800	0.801	0.802	0.809	0.806	0.800	0.805	0.798	0.794	0.779	0.752	0.802	0.804	0.803	0.745	0.744	0.804	0.807	0.788
1.893	1.889	1.901	1.876	1.917	1.880	1.887	1.925	1.893	2.140	2.160	2.153	2.317	2.150	2.386	2.334	2.298	2.496	2.249	2.380	2.434

7	7	7	8	8	8	8	8	8	9	9	9	9	9	9	10	10	10	10
90	92	94	99	101	103	105	107	109	111	113	115	117	119	124	126	128	130	132
0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082
0.085	0.082	0.086	0.089	0.072	0.065	0.062	0.07	0.233	0.068	0.1	0.104	0.083	0.08	0.08	0.081	0.081	0.081	0.083
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
427.2	427.1	427.1	427.1	427.4	427.6	427.5	427.4	407	407	401.5	401.6	401.6	401.7	401.8	401.7	401.7	401.6	401.4
0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520	0.002520
0.003197	0.002972	0.003200	0.002824	0.002449	0.002116	0.002049	0.002257	0.007393	0.002312	0.003255	0.003438	0.002676	0.002649	0.002573	0.002621	0.003403	0.003038	0.002759
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
126.84	117.93	126.94	112.03	97.15	83.95	81.30	89.55	293.28	91.75	129.15	136.38	106.18	105.10	102.03	103.38	135.02	122.39	109.45
90	92	94	99	101	103	105	107	109	111	113	115	117	119	124	126	128	130	132
5.58	5.50	5.62	5.73	5.60	5.88	5.74	5.78	4.84	5.10	4.87	4.33	4.87	5.01	4.95	4.98	4.93	5.00	4.97
0.19	0.21	0.19	0.30	0.30	0.29	0.25	0.29	0.24	0.38	0.18	0.21	0.17	0.24	0.19	0.19	0.14	0.25	0.25
62.52	62.86	62.27	61.08	61.74	60.17	61.54	60.60	64.80	62.77	64.17	63.68	64.70	63.75	64.93	64.64	64.40	63.72	63.34
3.85	3.58	3.90	3.71	4.09	4.21	4.20	3.98	0.44	1.47	1.23	1.16	1.29	1.33	1.37	1.36	1.16	1.38	1.40
20.42	20.92	20.43	21.16	20.20	20.39	20.11	20.61	28.62	26.77	27.06	27.26	26.32	26.59	25.73	26.03	22.07	26.88	27.19
6.47	6.06	6.55	7.07	7.01	7.93	7.08	7.63	0.93	3.28	2.24	2.51	2.39	2.81	2.57	2.53	2.19	2.59	2.67
0.29	0.26	0.29	0.29	0.32	0.33	0.32	0.31	0.05	0.08	0.06	0.06	0.07	0.07	0.07	0.07	0.06	0.07	0.07
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.00	0.04	0.04
0.09	0.08	0.09	0.08	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.02	0.02	0.02	0.03	0.02	0.03	0.02	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.41	0.36	0.42	0.39	0.45	0.46	0.48	0.45	0.03	0.08	0.05	0.05	0.06	0.06	0.07	0.06	0.06	0.07	0.07
0.07	0.06	0.07	0.07	0.08	0.08	0.09	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.05	0.05	0.05	0.05	0.04	0.05	0.04	0.05	0.00	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.04	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.000	100.001	100.000	100.000	100.071	100.000	99.999	99.999	99.999	100.000	100.000	100.000	100.001	100.000	99.999	99.999	95.000	99.999	100.001
13.18136	13.03124	13.26066	13.68376	13.48628	14.04486	13.53538	13.8923	11.84672	12.69872	12.15528	12.34192	12.0336	12.36454	12.0099	12.08204	10.67834	12.3042	12.41104
29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48
44.28	42.08	44.58	43.83	45.90	47.27	46.68	45.74	9.95	20.16	15.38	15.89	17.71	19.26	20.93	20.45	31.96	18.15	16.84
22.36	20.80	23.35	26.22	24.75	29.20	25.76	27.41	7.21	14.80	8.69	10.57	7.95	11.90	9.19	10.10	9.64	11.72	11.84
13.56	12.55	13.67	13.94	14.54	15.80	14.88	15.20	1.63	5.31	4.28	4.49	4.54	5.02	4.83	4.77	3.69	4.46	4.57
39.90	37.51	40.02	39.71	41.86	43.65	42.52	42.44	5.39	17.83	13.65	14.14	14.72	15.88	15.80	15.50	14.34	14.24	14.38
0.560381	0.554547	0.583340	0.660139	0.591367	0.668880	0.605927	0.645786	1.339352	0.830285	0.636350	0.747192	0.539856	0.749256	0.581508	0.651725	0.672178	0.822708	0.823058
28.432	28.525	28.525	26.604	28.117	26.662	28.242	26.168	26.982	25.374	28.755	25.930	28.411	26.509	28.273	28.473	31.357	30.847	30.611
47.702	48.240	47.937	50.710	48.188	50.222	47.576	50.191	61.094	56.447	52.371	55.937	52.663	55.895	53.128	52.923	59.166	58.087	58.485
4.323	4.174	4.301	4.133	4.387	4.190	4.316	4.132	5.532	2.617	2.710	2.450	2.861	2.748	2.941	2.975	3.087	3.226	3.197
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.430	1.682	1.782	1.629	1.633	1.491	1.467	0.000	1.658	1.664
1.948	1.898	1.909	1.808	1.980	1.899	1.997	1.915	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.421	0.478	0.417	0.646	0.413	0.646	0.363	0.671	0.000	1.136	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12.158	11.598	12.171	11.135	12.322	11.748	12.934	11.896	6.392	5.302	4.853	4.634	5.194	4.939	5.468	5.364	6.390	6.183	6.043
2.095	1.975	2.077	1.980	2.145	2.127	2.313	2.158	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.461	1.561	1.331	1.492	1.224	1.253	1.129	1.211	0.000	3.822	4.812	4.634	4.621	4.143	4.350	4.400	0.000	0.000	0.000
1.461	1.561	1.331	1.492	1.224	1.253	1.129	1.211	0.000	3.822	4.812	4.634	4.621	4.143	4.350	4.400	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
91.212	93.198	92.076	102.882	93.006	100.890	90.754	100.766	157.030	129.605	109.956	126.946	111.251	126.682	113.345	112.417	144.894	138.589	140.876
1.191	0.854	1.083	-0.402	1.017	-0.141	1.375	-0.116	-0.920	-1.720	-0.426	-1.210	-0.511	-1.340	-0.644	-0.593	-1.658	-1.723	-1.867
0.583	0.586	0.533	0.593	0.512	0.547	0.480	0.514	0.000	0.631	0.657	0.655	0.680	0.658	0.687	0.682	0.000	0.000	0.000
5.434	4.935	5.404	5.015	5.670	5.675	5.980	5.563	0.344	1.627	1.321	1.310	1.445	1.443	1.551	1.513	0.916	0.880	0.869
5.434	4.935	5.404	5.015	5.670	5.675	5.980	5.563	0.344	1.627	1.321	1.310	1.445	1.443	1.551	1.513	0.916	0.880	0.869
0.085	0.094	0.079	0.093	0.072	0.077	0.065	0.073	0.000	0.295	0.332	0.333	0.320	0.313	0.307	0.311	0.000	0.000	0.000
0.793	0.788	0.798	0.784	0.801	0.794	0.803	0.796	1.000	0.705	0.668	0.667	0.680	0.687	0.693	0.689	1.000	1.000	1.000
2.567	2.553	2.552	2.444	2.495	2.432	2.622	2.299	1.156	2.474	3.298	3.284	3.216	3.018	3.196	3.189	2.070	1.266	1.243

PERIOD	1	1	1	1	2	2	2	2	3	3	3	3	3	3	4	4	4	4
HOURS ON STREAM	1	1	1	1	2	2	2	2	3	3	3	3	3	3	4	4	4	4
SCFH Feed	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
SCFH Gas Out	0.697	0.705	0.709	0.71	0.708	0.713	0.705	0.7	0.287	0.283	0.287	0.283	0.278	0.29	0.282	0.285	0.283	0.187
Grams Liquid Product	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sample Length (hr)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PRESSURE (PSIO)	200	200	200	200	200	200	195	200	200	200	200	196	195	194	201	200	195	100
TEMP (C)	402.2	402.3	402.1	401	376.8	376.6	374.8	376.7	376.2	376.5	376.5	374.7	376.4	376.3	376.5	376.5	376.9	376.5
Grams Feed In	0.012297	0.012297	0.012297	0.012297	0.012297	0.012297	0.012297	0.012297	0.006148	0.006148	0.006148	0.006148	0.006148	0.006148	0.006148	0.006148	0.006148	0.006148
Grams Product Out	0.023535	0.023880	0.024040	0.023984	0.023710	0.023929	0.023537	0.024025	0.009760	0.009732	0.009967	0.009761	0.009638	0.010840	0.009724	0.009823	0.009733	0.006400
Feed GHSV (hr ⁻¹)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Mass Balance (%)	191.39	194.19	195.49	195.03	192.81	194.59	191.40	195.37	158.73	158.29	162.10	158.76	156.75	176.31	158.15	159.76	158.30	104.09
HOURS ON STREAM	2	4	9	11	18	20	22	24	26	28	30	32	34	36	40	42	44	48
GC (Mole %)																		
Ar	5.49	5.52	5.49	5.52	5.43	5.35	5.33	5.91	5.45	5.52	5.50	5.46	5.44	6.94	5.45	5.47	5.44	5.37
N2	0.18	0.11	0.10	0.10	0.11	0.11	0.11	1.67	1.17	1.15	1.17	1.15	1.14	4.48	1.20	1.25	1.77	2.00
H2	63.18	63.09	62.90	62.94	62.80	62.71	62.97	61.89	62.62	62.27	61.80	62.10	61.82	58.48	62.11	62.11	62.17	62.32
CH4	0.28	0.37	0.48	0.51	0.31	0.32	0.32	0.32	0.63	0.62	0.63	0.62	0.63	0.60	0.65	0.66	0.65	0.50
C0	28.35	28.26	28.49	28.63	30.04	30.16	29.90	28.84	27.71	27.76	28.17	27.98	28.29	26.96	27.86	27.85	27.35	27.37
C02	2.20	2.32	2.21	1.99	1.16	1.24	1.27	1.27	2.10	2.36	2.42	2.38	2.35	2.21	2.41	2.34	2.31	2.14
C2H6	0.03	0.04	0.05	0.05	0.02	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.05
C2H4	0.08	0.07	0.06	0.05	0.02	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
C3H8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
C3H6	0.03	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
IC4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
nC4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IC4=	0.18	0.20	0.19	0.19	0.11	0.11	0.11	0.11	0.21	0.21	0.21	0.21	0.21	0.21	0.19	0.21	0.21	0.18
nC4=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavies/CS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	99.999	99.999	100.000	100.001	100.000	100.000	100.001	100.000	100.003	100.001	99.999	100.000	99.999	99.965	99.999	100.001	100.001	100.000
Aug. MW	12.60638	12.6459	12.6587	12.61134	12.50286	12.52954	12.46426	12.81384	12.69596	12.83954	12.96574	12.87786	12.94354	13.95616	12.87352	12.86766	12.84038	12.77818
Feed Composition, mole%																		
C0	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
H2	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
Ar	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Aug. MW	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48
Conversions																		
C0	21.48	22.09	21.01	21.04	15.86	14.29	14.63	25.69	22.69	23.47	22.04	21.98	20.94	40.91	22.17	22.55	23.51	22.45
H2	20.37	20.85	20.63	20.99	19.94	18.89	18.20	27.44	20.51	21.89	22.16	21.20	21.38	41.66	21.03	21.42	20.87	19.64
C mole% prdn	3.51	3.79	3.76	3.53	1.99	2.01	2.04	2.04	3.80	4.06	4.13	4.09	4.08	3.82	4.14	4.09	4.02	3.62
C0 (prdn)	11.03	11.82	11.65	10.97	6.23	6.25	6.37	6.59	12.07	12.77	12.79	12.74	12.60	12.41	12.95	12.80	12.80	11.69
H2/C0	1.847134	1.764204	1.771263	1.913042	3.202606	3.023955	2.855629	4.161193	1.699325	1.714223	1.733298	1.664154	1.696009	3.355856	1.624838	1.673212	1.630441	1.680351
Selectivities, C mole%																		
CH4	8.082	9.746	12.833	14.395	15.547	15.679	15.774	15.668	16.671	15.256	15.157	15.251	15.490	15.681	15.737	16.116	16.235	13.753
C02	62.692	61.226	58.946	56.418	58.175	61.822	62.211	62.328	55.220	58.095	58.499	58.164	57.647	57.723	58.170	57.202	57.445	59.155
C2H6	1.935	2.219	2.716	2.777	2.207	0.000	0.000	0.000	2.577	2.608	2.615	2.644	2.598	2.618	2.655	2.690	2.739	2.927
C2H4	4.439	3.856	3.248	3.060	1.805	0.000	0.000	0.000	1.893	1.919	1.937	1.812	1.814	1.885	1.786	1.761	1.843	2.596
C3H8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.942	0.000	0.000	0.000	0.000
C3H6	2.476	2.139	1.917	2.040	0.000	0.000	0.000	0.000	1.657	1.550	1.453	1.469	1.471	1.571	1.376	1.394	1.419	1.574
IC4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
nC4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IC4=	20.376	20.814	20.341	21.309	22.267	22.499	22.015	22.004	21.983	20.571	20.339	20.661	20.980	19.581	20.275	20.836	20.319	19.994
nC4=	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavies/CS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oxygen Balance	168.040	157.902	143.580	129.454	139.089	161.930	164.629	165.450	123.312	138.638	140.957	139.029	136.111	136.533	139.065	133.657	134.991	144.828
H2O (calc, mole%)	-2.391	-2.192	-1.637	-1.039	-0.779	-1.244	-1.315	-1.333	-0.887	-1.570	-1.692	-1.594	-1.473	-1.396	-1.618	-1.376	-1.405	-1.623
IC4= Yield	2.247	2.459	2.369	2.339	1.386	1.405	1.403	1.451	2.653	2.627	2.601	2.632	2.644	2.431	2.625	2.667	2.601	2.336
IC4s Yield	2.247	2.459	2.369	2.339	1.386	1.405	1.403	1.451	2.653	2.627	2.601	2.632	2.644	2.431	2.625	2.667	2.601	2.336
IC4s+IC5s Yield	2.247	2.459	2.369	2.339	1.386	1.405	1.403	1.451	2.653	2.627	2.601	2.632	2.644	2.431	2.625	2.667	2.601	2.336
IC4H8/C4s	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
IC4s/C4s	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
C4s/(C2s+C3s)	2.302	2.534	2.581	2.705	5.550	ERR	ERR	ERR	3.588	3.385	3.387	3.488	3.567	2.791	3.485	3.565	3.386	2.817
CH4 Yield	0.891	1.152	1.495	1.580	0.968	0.979	1.005	1.033	2.012	1.948	1.938	1.943	1.952	1.946	2.037	2.063	2.079	1.607

5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	7	7	7	7	7	8
50	52	54	56	58	60	64	65	66	67	68	69	70	71	72	73	74	75	81	83	93
0.182	0.174	0.151	0.167	0.182	0.188	0.028	0.031	0.06	0.062	0.093	0.08	0.11	0.134	0.134	0.119	0.105	0.119	0.122	0.109	0.089
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	105	100	100	100	100
0.006148	0.006148	0.006148	0.006148	0.006148	0.006148	0.002459	0.002459	0.002459	0.002459	0.002459	0.002459	0.002459	0.002459	0.002459	0.002459	0.002459	0.002459	0.002459	0.002459	0.003074
0.006201	0.006010	0.005247	0.005779	0.006386	0.006866	0.000948	0.001077	0.001973	0.002081	0.003079	0.003847	0.004586	0.004592	0.004033	0.003645	0.004175	0.004285	0.003990	0.004074	0.003203
0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
100.85	97.74	85.34	93.99	103.87	111.67	38.56	43.83	80.22	84.62	125.21	156.45	186.48	186.74	163.98	148.22	169.78	174.23	162.27	165.65	104.21
50	52	54	56	58	60	64	65	66	67	68	69	70	71	72	73	74	75	81	83	93
5.33	5.40	5.32	5.23	5.28	4.98	5.81	5.79	5.35	5.56	5.37	5.43	5.37	5.49	5.43	5.65	5.50	5.48	5.46	5.48	5.76
1.84	2.09	2.07	2.15	1.87	5.41	0.72	1.46	5.82	0.50	2.98	0.21	2.36	0.18	2.77	0.47	0.18	0.18	0.17	0.16	0.25
62.37	61.72	61.45	61.55	61.86	60.42	62.37	62.40	60.14	63.89	62.05	64.51	63.25	64.02	61.35	62.54	62.48	62.40	62.73	62.98	62.33
0.51	0.60	0.59	0.58	0.53	0.52	1.35	1.83	0.97	0.96	0.63	0.71	0.61	0.68	0.70	0.73	0.71	0.77	0.79	0.76	1.02
27.76	27.95	28.22	28.26	28.45	26.67	25.08	23.18	23.09	24.74	25.61	26.18	25.92	26.98	27.04	27.86	28.26	28.30	27.88	27.77	26.94
1.91	1.95	2.06	1.96	1.76	1.72	4.03	4.48	4.09	3.80	2.99	2.55	2.16	2.31	2.38	2.42	2.54	2.49	2.57	2.49	3.20
0.05	0.06	0.06	0.06	0.05	0.05	0.17	0.24	0.12	0.11	0.07	0.07	0.06	0.06	0.07	0.07	0.06	0.07	0.08	0.07	0.11
0.04	0.04	0.04	0.04	0.04	0.04	0.11	0.13	0.09	0.09	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.07
0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.05	0.03	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02
0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.11	0.05	0.04	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.03
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.18	0.18	0.17	0.17	0.16	0.17	0.24	0.29	0.23	0.26	0.21	0.23	0.20	0.21	0.21	0.20	0.19	0.21	0.21	0.20	0.24
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.001	100.000	99.999	100.000	100.000	100.001	100.000	100.000	100.003	99.999	100.000	100.000	100.000	100.000	100.000	100.000	100.000	99.997	99.996	100.000	99.999
12.72042	12.89504	12.97296	12.92022	12.8161	13.15166	13.06094	13.1005	13.63554	12.64602	12.98144	12.27646	12.53234	12.36204	13.05942	12.77802	12.79614	12.80468	12.7307	12.65314	12.96144
29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48
20.76	21.24	19.29	17.73	18.08	18.59	34.31	39.15	34.30	32.30	27.47	26.58	26.61	25.22	24.20	24.91	21.81	21.41	22.33	22.95	28.79
18.98	20.86	20.03	18.46	18.94	16.06	25.65	25.43	22.13	20.45	20.05	17.67	18.51	19.26	21.74	23.31	21.35	21.15	20.47	20.48	25.04
3.35	3.51	3.59	3.46	3.13	3.15	7.34	8.91	6.78	6.54	4.81	4.60	3.84	4.10	4.19	4.31	4.46	4.64	4.40	4.40	5.82
10.76	11.17	11.29	10.91	9.91	10.55	22.65	27.77	22.69	20.91	15.82	14.94	12.90	13.18	13.42	13.24	13.23	13.62	14.26	13.67	17.77
1.764389	1.867689	1.773639	1.692695	1.911372	1.521954	1.132624	0.915824	0.975480	0.978138	1.267244	1.182305	1.435238	1.461835	1.620502	1.761326	1.614457	1.553048	1.435585	1.498147	1.409015
15.208	16.994	16.309	16.652	17.008	16.587	18.401	20.492	14.330	14.620	13.048	15.395	15.942	16.630	16.734	17.172	16.411	17.216	17.044	17.266	17.514
57.036	55.508	57.417	56.693	56.362	54.655	54.822	50.320	60.360	58.036	62.165	55.534	56.239	56.288	56.768	56.881	59.030	55.884	55.512	56.711	54.876
3.048	3.188	3.173	3.180	3.063	3.241	4.685	5.476	3.483	3.273	2.701	2.914	2.917	3.077	3.151	3.199	2.971	3.228	3.236	3.230	3.606
2.450	2.505	2.449	2.428	2.302	2.415	3.078	2.940	2.656	2.875	2.493	2.566	2.449	2.393	2.399	2.352	2.275	2.421	2.330	2.411	2.541
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.344	1.537	1.503	1.388	1.439	1.621	1.348	1.818	1.195	1.101	0.000	0.848	0.000	0.000	0.000	0.000	0.000	0.000	1.009	1.036	1.236
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.412	1.424	1.433
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.381	0.000	1.219
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20.914	20.268	19.148	19.659	19.821	21.481	12.966	12.838	13.813	16.088	17.370	19.917	21.047	20.220	19.575	18.913	17.920	18.830	18.037	17.925	16.758
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
132.754	124.760	134.837	130.908	129.158	120.533	121.345	101.288	152.271	138.302	164.305	124.890	128.512	128.771	131.309	131.915	144.079	126.677	124.782	131.004	121.613
-1.096	-0.870	-1.252	-1.069	-0.912	-0.646	-1.567	-0.115	-3.542	-2.505	-3.095	-1.145	-1.095	-1.178	-1.312	-1.357	-1.899	-1.190	-1.149	-1.363	-1.259
2.250	2.263	2.162	2.144	1.964	2.267	2.937	3.565	3.134	3.363	2.748	2.976	2.715	2.664	2.626	2.504	2.370	2.564	2.571	2.450	2.979
2.250	2.263	2.162	2.144	1.964	2.267	3.640	4.899	3.777	3.913	2.892	3.184	2.715	2.664	2.626	2.504	2.370	2.564	2.768	2.450	3.357
2.250	2.263	2.162	2.144	1.964	2.267	3.640	4.899	3.777	3.913	2.892	3.184	2.715	2.664	2.626	2.504	2.370	2.564	2.768	2.450	3.357
1.000	1.000	1.000	1.000	1.000	1.000	0.807	0.728	0.830	0.859	0.950	0.935	1.000	1.000	1.000	1.000	1.000	1.000	0.929	1.000	0.887
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
3.057	2.803	2.688	2.810	2.911	2.952	1.501	1.528	1.922	2.170	2.812	2.745	3.108	2.947	2.828	2.689	2.699	2.333	2.419	2.213	2.165
1.636	1.898	1.842	1.816	1.685	1.751	4.168	5.691	3.251	3.056	2.064	2.300	2.056	2.191	2.245	2.273	2.171	2.344	2.430	2.360	3.113

8	9	9	9	9	9	9	10	10	10	11	11	11	11
95	98	100	102	104	106	108	116	118	120	122	124	126	132
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7	0.7	0.7	0.7	0.7	0.7	0.7
0.06	0.056	0.06	0.056	0.06	0.058	0.059	0.438	0.396	0.439	0.657	0.665	0.708	0.695
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
100	100	100	102	100	100	100	200	200	200	200	200	200	200
375.9	375.8	376	375.9	376	376	375.8	401	404	402.8	401.5	403.2	403	402.9
0.003074	0.003074	0.003074	0.003074	0.003074	0.003074	0.003074	0.021520	0.021520	0.021520	0.021520	0.021520	0.021520	0.021520
0.002195	0.001965	0.002067	0.001926	0.002068	0.002000	0.002054	0.014940	0.013625	0.015131	0.022660	0.023159	0.024150	0.023678
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8	0.8	0.8	0.8	0.8	0.8	0.8
71.42	63.92	67.26	62.67	67.27	65.07	66.83	69.42	63.31	70.31	105.30	107.61	112.22	110.03
95	98	100	102	104	106	108	116	118	120	122	124	126	132
5.90	6.02	5.81	5.83	5.94	5.89	6.12	6.02	6.02	5.93	5.98	5.98	5.87	5.87
0.27	0.21	3.88	3.64	2.44	3.81	0.27	0.12	0.10	0.47	0.10	0.27	0.10	0.10
62.16	62.23	59.96	60.26	60.87	59.94	62.25	62.47	62.66	62.46	62.43	62.05	62.52	62.55
1.17	1.17	1.08	1.05	1.09	1.09	1.12	0.97	0.99	0.95	0.96	0.94	0.73	0.77
26.20	25.96	25.00	25.05	25.45	25.15	26.02	27.34	26.94	27.04	27.39	27.49	28.46	28.42
3.72	3.81	3.71	3.62	3.65	3.58	3.65	2.64	2.85	2.72	2.71	2.85	2.03	2.01
0.13	0.13	0.12	0.11	0.12	0.11	0.12	0.09	0.10	0.09	0.09	0.09	0.07	0.07
0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.05	0.06	0.05	0.06	0.05	0.04	0.04
0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.00	0.00
0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
0.05	0.05	0.05	0.04	0.05	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.26	0.27	0.26	0.26	0.27	0.26	0.27	0.22	0.22	0.21	0.21	0.20	0.16	0.16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99.999	99.996	99.998	99.997	100.000	99.999	100.000	100.001	99.996	99.999	99.999	100.001	99.999	100.000
13.10038	13.113	13.6692	13.5808	13.43962	13.66306	13.10176	12.86592	12.8455	12.86836	12.87658	13.00156	12.73462	12.7194
29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48
32.46	34.43	34.49	34.69	34.80	34.99	35.35	30.92	31.93	30.57	30.25	30.10	26.28	26.32
27.08	28.48	28.51	28.49	29.04	29.49	29.61	28.18	27.96	27.01	27.66	28.21	26.31	26.21
6.73	6.85	6.58	6.43	6.55	6.45	6.61	5.03	5.25	5.07	5.03	5.12	3.67	3.68
20.44	20.89	20.85	20.42	20.46	20.41	20.26	15.54	16.32	15.78	15.51	15.69	11.41	11.46
1.325185	1.363389	1.367427	1.395114	1.419599	1.444711	1.461683	1.812794	1.713564	1.711854	1.783597	1.797708	2.305171	2.287912
17.385	17.056	16.403	16.324	16.593	16.855	16.884	19.177	18.843	18.831	19.077	18.296	20.016	20.881
55.275	55.573	56.349	56.303	56.829	55.543	55.280	52.484	54.168	53.731	53.909	55.786	55.331	54.676
3.804	3.677	3.615	3.486	3.514	3.535	3.510	3.657	3.616	3.672	3.740	3.557	3.654	3.752
2.585	2.393	2.521	2.490	2.445	2.450	2.421	2.146	2.094	2.132	2.188	2.072	2.127	2.121
1.293	1.313	1.185	1.167	1.238	1.209	1.225	1.252	1.199	1.184	1.194	1.056	0.000	0.000
1.293	1.313	1.276	1.307	1.375	1.303	1.316	1.490	1.199	1.421	1.432	1.407	1.309	1.387
2.734	2.976	2.795	2.739	2.811	2.977	2.965	2.146	2.284	2.211	2.069	1.955	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15.632	15.699	15.857	16.184	16.196	16.127	16.399	17.647	16.597	16.818	16.391	15.872	17.562	17.133
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
123.588	125.090	129.088	128.846	126.392	124.939	123.613	110.456	118.189	116.126	116.962	126.172	123.871	120.636
-1.587	-1.720	-1.915	-1.854	-1.727	-1.608	-1.561	-0.526	-0.956	-0.817	-0.853	-1.339	-0.875	-0.759
3.195	3.279	3.305	3.305	3.313	3.292	3.322	2.743	2.708	2.654	2.542	2.490	2.004	1.969
3.754	3.901	3.888	3.864	3.888	3.899	3.923	3.076	3.081	3.003	2.862	2.797	2.004	1.969
3.754	3.901	3.888	3.864	3.888	3.899	3.923	3.076	3.081	3.003	2.862	2.797	2.004	1.969
0.851	0.841	0.850	0.855	0.852	0.844	0.847	0.892	0.879	0.884	0.888	0.890	1.000	1.000
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.046	2.148	2.170	2.239	2.217	2.248	2.286	2.316	2.329	2.263	2.158	2.203	2.477	2.367
3.553	3.562	3.419	3.333	3.394	3.440	3.420	2.981	3.075	2.972	2.958	2.871	2.285	2.392

PERIOD	1	1	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4
HOURS ON STREAM	2	4	6	8	10	12	18	20	22	24	26	28	30	32	34	40	42	44
SCFH Feed	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
SCFH Gas Out	0.424	0.44	0.443	0.441	0.444	0.446	0.452	0.453	0.456	0.46	0.232	0.212	0.222	0.216	0.221	0.223	0.232	0.233
Grains Liquid Product	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sample Length (hr)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PRESSURE (PSIO)	215	215	215	215	215	215	215	215	215	215	215	215	215	215	215	215	115	115
TEMP (C)	402.7	402.7	402.4	402.5	402.4	400.4	386.4	386.5	386.6	386.5	386	386.2	386	386	386	386.5	385.8	385.9
Grains Feed In	0.012297	0.012297	0.012297	0.012297	0.012297	0.012297	0.012297	0.012297	0.012297	0.012297	0.006148	0.006148	0.006148	0.006148	0.006148	0.006148	0.006148	0.006148
Grains Product Out	0.014351	0.014912	0.015065	0.015066	0.015186	0.014672	0.015179	0.015285	0.015364	0.015777	0.007759	0.007086	0.007717	0.007511	0.007655	0.007661	0.007605	0.007749
Feed GHSV (hr ⁻¹)	226.4	226.4	226.4	226.4	226.4	226.4	226.4	226.4	226.4	226.4	113.2	113.2	113.2	113.2	113.2	113.2	113.2	113.2
Mass Balance (2)	116.71	121.26	122.51	122.52	123.50	119.31	123.44	124.30	124.94	128.30	126.19	115.26	125.51	122.17	124.51	124.61	123.69	126.03
HOURS ON STREAM	2	4	6	8	10	12	18	20	22	24	26	28	30	32	34	40	42	44
GC (Mole %)																		
H ₂	5.20	5.23	5.22	5.22	5.20	4.86	5.08	5.08	5.07	5.20	4.23	4.20	5.20	5.20	5.22	5.21	4.95	5.03
H ₂	0.14	0.14	0.12	0.13	0.12	0.55	0.13	0.12	0.11	0.75	0.45	0.44	0.63	0.66	0.47	0.16	0.10	0.09
H ₂	63.96	63.91	63.65	63.37	63.26	65.00	63.43	63.19	63.23	62.70	63.08	63.04	62.67	62.65	62.84	63.12	64.29	63.58
CH ₄	0.41	0.50	0.57	0.63	0.66	0.66	0.56	0.57	0.58	0.61	0.93	0.92	0.94	0.96	0.96	0.96	0.59	0.59
C ₂	25.91	25.84	26.13	26.41	26.57	24.30	27.78	28.03	28.04	27.42	25.63	25.71	25.86	25.81	25.79	26.04	27.42	28.11
C ₂	3.99	3.98	3.88	3.82	3.75	3.46	2.74	2.72	2.69	2.87	4.23	4.20	4.21	4.21	4.21	4.02	2.38	2.32
C ₂ H ₆	0.06	0.07	0.07	0.08	0.08	0.08	0.06	0.06	0.06	0.07	0.11	0.11	0.11	0.11	0.11	0.10	0.07	0.07
C ₂ H ₄	0.12	0.11	0.10	0.09	0.09	0.08	0.04	0.04	0.04	0.05	0.07	0.07	0.07	0.07	0.07	0.06	0.05	0.04
C ₃ H ₈	0.00	0.00	0.00	0.02	0.02	0.03	0.00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.00
C ₃ H ₆	0.04	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02
IC ₄	0.01	0.01	0.02	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.00
nC ₄	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IC ₄ =	0.15	0.20	0.21	0.21	0.21	0.23	0.17	0.16	0.16	0.21	0.23	0.24	0.24	0.24	0.24	0.24	0.16	0.15
nC ₄ =	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavies/CS	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	100.000	100.000	100.000	100.001	100.000	100.000	100.001	99.999	100.001	100.000	99.036	98.997	100.000	99.999	99.998	99.999	100.001	100.000
Avg. MW	12.6368	12.65302	12.6967	12.75474	12.7697	12.28174	12.5376	12.59772	12.579	12.8052	12.486	12.48008	12.97766	12.98306	12.93264	12.8267	12.2382	12.41688
Feed Composition, mole%																		
C ₂	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
H ₂	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
Ar	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Avg. MW	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48
Conversions																		
C ₂	24.22	24.78	23.84	23.01	22.20	22.11	16.74	16.11	15.88	19.85	7.86	6.80	24.36	24.49	24.88	23.90	15.80	14.94
H ₂	14.85	15.34	15.57	15.95	15.71	7.46	13.48	13.95	13.67	16.58	-3.19	-3.98	16.58	16.59	16.71	16.07	10.16	12.43
C mole% prod	5.55	5.77	5.79	5.77	5.80	6.12	4.22	4.20	4.17	5.05	6.71	6.70	6.75	6.81	6.77	6.55	3.87	3.78
C ₂ (prod)	17.65	18.26	18.14	17.93	17.92	19.72	13.18	13.03	12.95	15.55	20.74	20.67	20.69	20.88	20.79	20.09	12.37	11.86
H ₂ /C ₂	0.841433	0.839810	0.858424	0.889879	0.876731	0.378509	1.022641	1.070790	1.055295	1.066105	-0.15405	-0.19271	0.801179	0.794456	0.804052	0.799897	0.821396	1.047859
Selectivities, C mole%																		
CH ₄	7.436	8.678	9.877	10.832	11.397	10.791	13.300	13.643	13.878	12.042	13.855	13.774	13.907	14.070	14.155	14.650	15.146	15.706
C ₂	71.858	68.855	66.931	66.222	64.724	56.540	64.865	64.833	64.573	56.883	63.117	62.632	62.387	61.889	62.160	61.473	61.411	61.343
C ₂ H ₆	2.089	2.321	2.487	2.738	2.862	2.747	2.832	2.857	2.924	2.694	3.162	3.134	3.113	3.143	3.103	3.178	3.515	3.490
C ₂ H ₄	4.429	3.742	3.557	3.224	3.000	2.583	1.944	1.857	1.870	1.901	2.118	2.089	2.105	2.115	2.039	1.925	2.378	2.327
C ₃ H ₈	0.000	0.000	0.000	0.780	0.828	1.226	0.000	0.000	0.000	1.426	1.119	1.119	1.112	1.101	1.108	1.146	0.000	0.000
C ₃ H ₆	2.161	1.923	1.813	1.716	1.603	1.668	1.351	1.286	1.222	1.604	1.298	1.254	1.245	1.234	1.241	1.192	1.318	1.269
IC ₄	1.008	0.970	1.105	0.000	1.241	1.308	0.000	0.000	0.000	0.000	1.730	1.671	1.720	1.762	1.773	1.772	0.000	0.000
nC ₄	0.000	0.000	0.000	0.000	0.000	1.504	0.000	0.000	0.000	1.981	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IC ₄ =	11.019	13.511	14.229	14.489	14.345	15.173	15.647	15.524	15.532	16.716	13.602	14.326	14.411	14.686	14.421	14.665	16.232	15.865
nC ₄ =	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavies/CS	0.000	0.000	0.000	0.000	0.000	6.458	0.000	0.000	0.000	4.753	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oxygen Balance	255.342	221.079	202.402	196.049	183.480	130.098	184.615	184.360	182.273	131.925	171.128	167.612	165.865	162.389	164.272	159.556	159.143	158.687
H ₂ O (calc, mole%)	-8.628	-6.990	-5.930	-5.542	-4.842	-1.841	-3.569	-3.543	-3.432	-1.612	-4.769	-4.531	-4.443	-4.248	-4.350	-3.899	-2.288	-2.220
IC ₄ = Yield	1.945	2.468	2.581	2.598	2.570	2.992	2.063	2.023	2.012	2.600	2.821	2.962	2.982	3.066	2.997	2.946	2.007	1.882
IC ₄ s Yield	2.123	2.645	2.782	2.598	2.793	3.250	2.063	2.023	2.012	2.600	3.179	3.307	3.337	3.434	3.366	3.302	2.007	1.882
IC ₄ s+IC ₅ s Yield	2.123	2.645	2.782	2.598	2.793	4.524	2.063	2.023	2.012	3.339	3.179	3.307	3.337	3.434	3.366	3.302	2.007	1.882
IC ₄ H ₈ /C ₄ s	0.916	0.933	0.928	1.000	0.920	0.844	1.000	1.000	1.000	0.894	0.887	0.896	0.893	0.893	0.891	0.892	1.000	1.000
IC ₄ s/C ₄ s	1.000	1.000	1.000	1.000	1.000	0.916	1.000	1.000	1.000	0.894	0.887	0.896	0.893	0.893	0.891	0.892	1.000	1.000
C ₄ s/(C ₂ s+C ₃ s)	1.386	1.813	1.952	1.713	1.879	2.187	2.529	2.587	2.582	2.452	1.992	2.106	2.129	2.166	2.162	2.209	2.251	2.239
CH ₄ Yield	1.313	1.585	1.792	1.942	2.042	2.128	1.753	1.778	1.798	1.873	2.873	2.848	2.877	2.937	2.942	2.943	1.873	1.863

4	4	5	5	5	5	5	5	5	6	6	6	7	7	7	7	8	8	8	8	8	9
46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88
0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.4
0.232	0.234	0.098	0.1	0.103	0.109	0.103	0.105	0.1	0.102	0.1	0.052	0.045	0.052	0.056	0.034	0.056	0.053	0.053	0.052	0.448	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
115	115	115	115	115	115	115	115	115	115	115	110	110	110	110	110	115	115	115	115	115	215
385.5	386.4	386	385.8	385.6	385.4	385.4	384.7	385.6	386.1	385.6	385.4	384.8	384.6	384.6	384.6	385.4	385.3	385.3	385.4	385.4	400.6
0.006148	0.006148	0.003074	0.003074	0.003074	0.003074	0.003074	0.003074	0.003074	0.003074	0.003074	0.003074	0.001537	0.001537	0.001537	0.001537	0.001537	0.001537	0.001537	0.001537	0.001537	0.012297
0.007762	0.008463	0.003381	0.003433	0.003531	0.003703	0.003510	0.003570	0.003406	0.003652	0.003424	0.001926	0.001609	0.001954	0.002100	0.001241	0.001972	0.001852	0.001853	0.001816	0.015162	0
113.2	113.2	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	226.4
126.24	137.64	109.97	111.69	114.88	120.45	114.20	116.15	110.81	118.80	111.40	125.33	104.68	127.17	136.66	80.78	128.32	120.52	120.55	118.17	123.30	0
46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88
5.01	5.86	5.19	5.15	5.15	5.11	5.14	5.13	5.14	5.00	5.14	5.18	5.40	5.10	5.03	5.13	5.27	5.29	5.25	5.29	5.15	5.15
0.10	3.24	0.21	0.15	0.18	0.14	0.18	0.14	0.19	3.14	0.13	5.83	0.30	4.90	5.42	3.71	0.62	0.20	0.65	0.20	0.10	0.10
63.28	59.79	62.61	62.95	62.98	63.32	63.20	63.26	63.12	60.70	62.92	58.99	61.98	59.09	59.43	60.36	62.38	62.76	62.70	62.07	63.13	0
0.61	0.63	1.10	1.02	1.00	0.93	0.98	0.97	1.00	0.98	1.02	1.18	1.76	1.34	1.30	1.30	1.37	1.40	1.39	1.41	0.86	0
28.42	27.77	26.58	26.40	26.43	26.49	26.41	26.48	26.59	26.02	26.73	24.50	24.08	23.65	23.29	24.07	24.74	24.71	24.45	24.47	27.44	0
2.32	2.37	3.82	3.86	3.76	3.57	3.63	3.56	3.49	3.71	3.60	3.79	5.71	5.27	4.89	4.79	4.95	4.96	4.89	5.08	2.93	0
0.07	0.07	0.13	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.14	0.23	0.17	0.16	0.15	0.16	0.17	0.16	0.17	0.09	0
0.04	0.05	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.08	0.09	0.12	0.11	0.11	0.10	0.11	0.11	0.11	0.11	0.05	0
0.00	0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0
0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0
0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.10	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.02	0
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
0.14	0.15	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.20	0.21	0.24	0.24	0.21	0.25	0.26	0.26	0.26	0.26	0.19	0
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
99.999	99.969	99.967	99.999	99.999	99.999	100.001	100.001	99.999	100.000	100.000	99.998	99.999	100.001	100.205	100.000	100.000	99.992	99.999	99.999	100.000	0
12.49068	13.50244	12.88004	12.81954	12.80118	12.6832	12.7252	12.69662	12.71866	13.36852	12.78582	13.83222	13.34966	14.0349	14.00468	13.63524	13.15038	13.0495	13.05358	13.04198	12.63532	0
29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	0
65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	0
4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0
11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	11.48	0
13.76	27.92	22.14	22.02	21.94	21.14	21.82	21.39	21.24	20.80	20.94	28.01	32.11	29.37	29.50	28.66	28.56	28.92	29.17	29.68	18.86	0
12.61	29.38	16.53	15.37	15.36	14.21	14.86	14.55	14.93	15.94	15.29	21.13	20.50	19.71	18.12	18.58	18.02	17.85	17.33	17.78	15.06	0
3.77	3.95	6.28	6.34	6.26	5.30	6.07	5.98	5.93	6.09	6.06	6.60	9.77	8.61	9.03	8.07	8.40	8.46	8.37	8.59	5.02	0
11.71	12.44	19.12	19.37	19.14	18.22	18.68	18.42	18.24	18.96	18.49	21.22	28.86	26.70	27.95	25.11	25.36	25.50	25.50	25.93	15.47	0
1.076589	2.361096	0.864722	0.793416	0.802862	0.779901	0.795414	0.789649	0.818519	0.840585	0.826970	0.995972	0.710257	0.738285	0.648346	0.739903	0.710584	0.699737	0.679761	0.684102	0.973938	0
16.158	15.860	17.513	16.007	16.049	15.690	16.104	16.274	16.841	16.012	16.741	17.945	18.057	15.498	14.336	16.047	16.280	16.552	16.611	16.420	17.188	0
61.502	60.071	60.850	60.826	60.150	60.488	59.848	59.592	58.901	60.962	59.327	57.502	58.481	61.179	54.157	59.318	58.931	58.595	58.437	59.083	58.355	0
3.555	3.547	4.203	3.816	3.740	3.626	3.725	3.713	3.709	3.580	3.695	4.122	4.688	3.877	3.476	3.817	3.832	3.902	3.896	3.887	3.505	0
2.335	2.280	2.643	2.586	2.558	2.575	2.604	2.576	2.562	2.398	2.507	2.577	2.436	2.508	2.347	2.577	2.594	2.577	2.533	2.490	1.992	0
0.000	1.292	1.433	1.277	1.295	1.220	1.286	1.254	1.264	1.232	1.188	1.410	1.566	1.358	1.196	1.338	1.321	1.348	1.326	1.327	0.956	0
1.274	1.444	1.194	1.230	1.247	1.220	1.137	1.204	1.214	1.232	1.237	1.228	1.013	1.184	1.063	1.190	1.142	1.135	1.183	1.152	1.195	0
0.000	0.000	0.000	1.956	1.918	1.898	2.044	2.007	1.955	1.905	2.111	2.486	4.013	3.343	3.188	3.271	3.475	3.547	3.585	3.584	1.673	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11.159	0.000	0.000	0.000	0.000	0.000	0.000	0
15.176	15.505	12.164	12.301	13.043	13.284	13.252	13.380	13.554	12.679	13.195	12.731	9.745	11.052	9.078	12.441	12.424	12.343	12.428	12.056	15.136	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
159.752	150.444	155.429	155.274	150.943	153.087	149.056	147.475	143.314	156.163	145.864	135.307	140.853	157.596	118.136	145.812	143.495	141.519	140.598	144.397	140.124	0
-2.252	-1.991	-3.481	-3.505	-3.187	-3.133	-2.976	-2.839	-2.569	-3.420	-2.781	-2.330	-3.991	-4.961	-1.638	-3.697	-3.655	-3.512	-3.397	-3.815	-2.015	0
1.777	1.929	2.325	2.383	2.496	2.421	2.476	2.465	2.472	2.404	2.440	2.701	2.812	2.950	2.537	3.124	3.150	3.148	3.169	3.134	2.341	0
1.777	1.929	2.325	2.761	2.863	2.767	2.858	2.834	2.829	2.765	2.830	3.229	3.970	3.843	3.428	3.946	4.032	4.052	4.084	4.065	2.600	0
1.777	1.929	2.325	2.761	2.863	2.767	2.858	2.834	2.829	2.765	2.830	3.229	3.970	3.843	3.428	3.946	4.032	4.052	4.084	4.065	2.600	0
1.000	1.000	1.000	0.863	0.872	0.875	0.866	0.870	0.874	0.869	0.862	0.837	0.708	0.768	0.388	0.792	0.781	0.777	0.776	0.771	0.900	0
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.524	1.000	1.000	1.000	1.000	1.000	1.000	0
2.119	1.811	1.284	1.600	1.693	1.757	1															

Non-Linear

9	9	9	9	9
100	102	104	106	108
0.4	0.4	0.4	0.4	0.4
0.445	0.444	0.545	0.44	0.433
0	0	0	0	0
1.00	1.00	1.00	1.00	1.00
215	215	215	215	215
400.1	400.2	400.3	400.7	400.7
0.012297	0.012297	0.012297	0.012297	0.012297
0.015098	0.015114	0.018516	0.014979	0.014804
226.4	226.4	226.4	226.4	226.4
122.78	122.91	150.57	121.81	120.39
100	102	104	106	108
5.09	5.08	5.07	5.09	5.13
0.09	0.09	0.09	0.08	0.09
63.00	62.84	62.92	62.83	62.64
0.93	0.94	0.95	0.96	0.99
27.49	27.64	27.55	27.63	27.70
3.01	3.01	3.02	3.02	3.06
0.09	0.09	0.09	0.10	0.09
0.05	0.05	0.05	0.05	0.05
0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.02	0.02	0.02
0.02	0.02	0.02	0.03	0.03
0.00	0.00	0.00	0.00	0.00
0.18	0.19	0.18	0.18	0.18
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
99.999	100.001	99.999	100.000	99.994
12.66712	12.7093	12.68404	12.71018	12.76474
29.8	29.8	29.8	29.8	29.8
65.5	65.5	65.5	65.5	65.5
4.5	4.5	4.5	4.5	4.5
11.48	11.48	11.48	11.48	11.48
17.89	17.14	17.37	17.39	17.88
14.36	14.29	14.13	14.53	15.47
5.18	5.22	5.21	5.23	5.28
15.86	15.87	15.90	15.92	16.02
0.905112	0.900551	0.888591	0.912573	0.965799
17.927	17.948	18.260	18.390	18.660
58.066	57.795	58.007	57.714	57.930
3.589	3.605	3.610	3.632	3.482
2.084	2.071	2.035	2.026	1.968
1.158	1.208	1.210	1.204	1.136
1.274	1.266	1.210	1.204	1.306
1.775	1.841	1.843	1.912	1.969
0.000	0.000	0.000	0.000	0.000
14.126	14.267	13.825	13.917	13.550
0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000
138.472	136.938	138.134	136.483	137.697
-1.994	-1.926	-1.986	-1.908	-1.992
2.241	2.264	2.198	2.215	2.171
2.522	2.556	2.491	2.520	2.486
2.522	2.556	2.491	2.520	2.486
0.888	0.886	0.882	0.879	0.873
1.000	1.000	1.000	1.000	1.000
1.962	1.976	1.943	1.962	1.966
2.844	2.849	2.903	2.927	2.990