GEOCHEMICAL ANALYSIS OF CANNED CUTTINGS
SAMPLES FROM THE ESSO 16/1-1 WELL, NORWAY

SUMMARY

Canned cuttings samples from 1300-10,400 ft. were analyzed for their yields of hydrocarbon gases. Chips of uniform lithology were picked from ten of these cuttings samples and analyzed for total organic matter, light gasoline (C_4-C_7) hydrocarbon yields and visual kerogen characteristics.

There were no zones of notably high cuttings gas yields and none of the samples gave up more than small amounts of C_4-C_7 hydrocarbons, even though the sediments analyzed were fairly rich in total organic matter. The relatively low gasoline and gas yields suggest a rather mediocre hydrocarbon source potential for the section in the 16/1-1 well, but the low yields might conceivably have been caused by imperfect sealing of many of the sample cans.

The samples from 7200 to 9200 feet produced higher gas yields on the average than the samples from the rest of the section, and an appreciable fraction of the gas from this interval was "wet" gas (C_2-C_4). This suggests that this interval may have generated liquid hydrocarbons, but the relatively low total gas content and C_4-C_7 yields suggest that only minor amounts of hydrocarbon liquids might be expected in adjacent reservoir beds in this area. The visual kerogen was only slightly altered, suggesting that thermal conditions have not been severe enough to have destroyed any accumulations of liquid hydrocarbons, if present.

Only minor generation of dry gas might be expected from some of the shallower intervals cut by this well. The high methane compositions would be expected on the basis of the relative immaturity of the organic material, and the relatively minor amounts would be expected on the basis of rather low total gas yields from the cuttings samples.

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INTRODUCTION

Canned cuttings samples from the intervals 1300-10400 feet in the Esso 16/1-1 well were analyzed for their yields of hydrocarbon gases. Chips of uniform lithologies were hand picked from selected samples and analyzed further for characteristics of visual kerogen, total organic matter concentrations and light gasoline (C_4-C_7) yields.

The purpose of these analyses was to provide means for estimating the source character and the degree of diagenetic maturity of the organic matter in the sections penetrated by the well.

Results of cuttings gas analyses were plotted on 1:2000 vertical scale strip logs and transmitted to the North Sea Study Group with our letter of March 28, 1968. Samples that were selected for further analyses were chosen on the basis of results of the cuttings gas data.

This report includes complete tabulations of results of the cuttings gas, visual kerogen, total organic matter and gasoline analyses that were run, plus graphic plots of the various types of data. Explanations of our criteria for interpreting these types of data plus brief discussions of the results of the analyses are included.

Charges for this service work have been billed to the North Sea Study Group through our Job No. 9209.

PROCEDURE

Compositions and concentrations of hydrocarbon gases in the air spaces above the cuttings in the sample cans were determined by gas chromatography. Similar data were obtained on the gases released from a standard mixture of cuttings plus tap water after agitation for 2 minutes in a Waring blender. Combined results on air space gas plus cuttings gas were calculated for each sample. The data from the combined results were plotted graphically to show the vertical variations in total gas (C_1-C_4) and wet gas (C_2-C_4) and graphical plots were also made of the percent wet gas in total gas (Fig. 1).

Cuttings gas yields showed several vertical zonations which roughly correspond to different organic facies in the stratigraphic sections represented by the samples. Representative cuttings samples from the different distinctive zones defined by the cuttings gas were selected for further analyses. The selected samples were then picked by hand to provide materials of uniform lithologies for the additional work.

Some of the sample intervals that were chosen contained soft argillaceous cuttings dispersed in drilling mud, and they completely disaggregated when we attempted to wash the mud away. As a result, we were not able to obtain cuttings chips from all of the intervals of interest.

The "picked" cuttings were analyzed for light gasoline (C_4-C_7) compounds, total organic matter and visual kerogen characteristics.

Results of the cuttings gas analyses are given in Table I. Results of the additional chemical and visual kerogen analyses are given in Tables II and III.

BASES FOR INTERPRETING DATA

Cuttings Gas

Cuttings gas data give indications of the vertical variability in the source character of a section of interest. The ratio of wet gas (C_2-C_4) to total gas (C_1-C_4) may distinguish methane-prone from oil-and "wet" gas-prone sections. The critical value of this ratio varies from basin to basin. In Western Canada wet gas concentrations of about 45% or greater are considered to be indicative of sections that are likely to produce oil or gas with significant amounts of hydrocarbon liquids. In the Permian section of West Texas the significant ratio appears to be closer to 20% or greater of wet gas in total gas.

The significant values for total amounts of hydrocarbon gas yielded by the cuttings also appear to vary from basin to basin, and possibly must be established separately for each area of interest. Zones with the greatest yields of gas are considered to be of most interest as sources.

Oil in the drilling mud makes it nearly impossible to establish practical quantitative criteria that can be used in comparing different wells. The oil will tend to reduce the amount of cuttings gas released during agitation in the blender, and it will affect the composition of the hydrocarbon gas that is obtained for analysis. However, even with oil in the mud, significant vertical patterns in hydrocarbon gas concentrations and compositions can be established in each well. The patterns from different wells can be compared to establish regional trends or areal configurations of different organic facies within a section of interest.

Visual Kerogen

Kerogen data give two types of information. The color alteration (carbonization) provides a gross indication of the amount of thermal diagenesis that the organic matter has undergone. The types of materials comprising the kerogen help define different organic facies that are present in the sampled sections and they may indicate the source character of some of these facies.

Kerogen color alterations are rated on a 1 to 5 scale, from unaltered to almost completely carbonized, respectively. Ratings of 4 or 5 suggest that subsurface temperatures have been high enough to destroy most of the producible liquid hydrocarbons. Sections in which kerogen alteration is rated 4 and 5 are more likely to be characterized by dry gas production, if producible hydrocarbons are found in the associated reservoirs. Immobile pyrobitumens may also be found in these reservoir beds. Alteration ratings of 1 to 2 suggest that thermal diagenesis of the kerogen has barely begun, and reservoired hydrocarbons, if present, are likely to be gases, possibly associated with heavy, asphaltic oils. Ratings of 2+ to 3 suggest that maturation of the material has progressed to the point that gas, liquid hydrocarbons, or mixed oil and gas may be produced, depending on the nature of the original source materials. A rating of 2 may be associated with either immature or moderately mature sediments, based on other chemical evidence, and hence is not diagnostic. The interpretation of the significance of alteration ratings of 4 or 5 is the most reliable of the above tentative rules of thumb.

Types of kerogen materials that are commonly recognized include amorphous, finely disseminated, algal, herbaceous, woody and coaly. The source significance of these types is not established, but there have been suggestions in some areas, such as the offshore of southern Australia, that gas production is possibly associated with woody and coaly kerogen, whereas beds rated as oil sources may include rocks containing amorphous, finely disseminated and algal materials. These observations are speculative.

Total Organic Matter

The total organic matter concentration gives a rough indication of the richness of a rock in materials that can produce hydrocarbons. However, this measure alone does not indicate whether the organic material is oil-prone, gas-prone or mixed oil and gas prone. Rocks containing less than about 0.5% total organic matter are generally rated as poor sources, but this is modified by lithology. Carbonate sequences possibly include source rocks with still lower concentrations of total organic matter than 0.5%.

Sections that are notable for their production of dry gas (mainly methane) have commonly been found to be characterized by source rocks containing greater than about 1.1% total organic matter. However, a measure of the liquid hydrocarbons in these richer rocks is also necessary to determine whether they should be rated as oil prone or gas prone.

Light Gasoline (C_4-C_7) Hydrocarbons

Light gasolines apparently do not appear in source beds in concentrations above one or two parts per million until a fair degree of maturation occurs. Therefore, gasoline concentrations give one criterion of the degree of thermal maturation that the organic matter has attained

In addition, ratios of specific gasoline compounds may indicate the possible source character of the rocks. In particular, the ratio of cyclohexane to methyl-cyclopentane (CH/MCP) has been found to be useful in the U. S. Gulf Coast and the Alaskan areas for distinguishing "non oily" from "oily" facies. To date commerical oil has not been found associated with strata having a CH/MCP ratio of less than 0.25. However, dry gas has been found in strata characterized by lower ratio values as well as in sections with ratios greater than 0.25.

The CH/MCP ratio is also useful in helping distinguish different organic facies that may be present within an oil-like section. Ratios all above 0.25 in value may show groupings in vertical patterns that correlate with stratigraphic zones that have distinctive source characteristics. Definition of such zones may be quite useful for correlating reservoired oils with specific source intervals.

DISCUSSION AND INTERPRETATION OF RESULTS

The analytical results are summarized graphically in Figure 1 and are tabulated in Tables I, II and III. Cuttings gas analyses summarized in Table I were previously transmitted to the North Sea Group. Tables II and III give results of chemical and visual kerogen analyses of ten samples that were picked to give uniform lithologies as described in Table II.

Cuttings Gas

Samples from the interval 7200-9200 feet generally gave the highest yields of gases, and fairly high proportions of these gases consisted of C_2-C_4 hydrocarbons (ethane, propane and butane). On the basis of gas composition this section would be rated a potential source of both liquid and gaseous hydrocarbons, though not necessarily in commercial quantities. The relatively mediocre total yields of gases suggest that this section is not a very rich source interval in the vicinity of the 16/1-1 well.

The generally low yields of total gas in cuttings from this well may be indicative of mediocre source sections, but it is also possible that the low yields were caused by imperfect sealing of the sample cans. There was apparently a problem with the cans or the canning equipment during the drilling of some of the North Sea wells, and many of the cans from the 16/1-1 well were not well sealed. Therefore, while it is considered to be significant that the 7200-9200 ft. interval yielded more gas than the rest of the section and that this gas contained high proportions of "wet" gas (C_2-C_4), the fact that total amounts of gas in this interval are rather low in comparison to yields from richer sections in other offshore Norwegian wells may or may not be significant.

Some of the samples from shallower depths, for example the 2000, 2600, 3200 and 3900 ft. samples, gave up slightly above average yields of methane. These yields are rather low, and do not suggest a rich section, but the high methane content of the gas suggests that the organic matter in this general interval is either diagenetically immature, or else it is gas prone in nature. Conceivably leaky cans caused the relatively low gas yields in this upper section, so that again it is possible that the section is richer than the analysis indicates.

Total Organic Matter

The ten samples analyzed had total organic contents ranging from 0.61 to 2.43 percent, averaging 1.24 percent (Table III). These values are typical of strata that have been considered to be oil and gas sources in other areas.

Light Gasoline (C_4-C_7) Hydrocarbons

None of the ten "picked" cuttings samples gave up notable amounts of light gasolines, suggesting that either the section is a mediocre source of hydrocarbon liquids, or the organic matter in this section is still diagenetically immature (Table II).

The ratios of cyclohexane to methylcyclopentane were only available for 5 samples. Gasoline yields were too low to give an accurate measurement of this ratio in the other samples. The available ratios do not indicate that any production would be limited to dry gas, but are in the range of values that could be associated with either oil or gas generation.

Kerogen

Kerogen alteration ranges from 1+ to 2+, suggesting only moderately matured organic matter (Table II). Presumably the subsurface thermal conditions here have not been severe enough to have destroyed any existing accumulations of liquid hydrocarbons.

Several kerogen types were recognized (Table II, Fig. 1). A possible vertical zonation of the section based mainly on types of kerogen is suggested by the dashed lines on the strip log at the right side of Fig. 1. There is not enough control to define these suggested boundaries accurately, but they would probably correlate with major vertical variations present in the cuttings gas as shown by the strip logs at the left side of Fig. 1. The kerogen assemblages do not suggest either an exclusively oil-prone or gas-prone section but rather a mixed oil and gas source material.

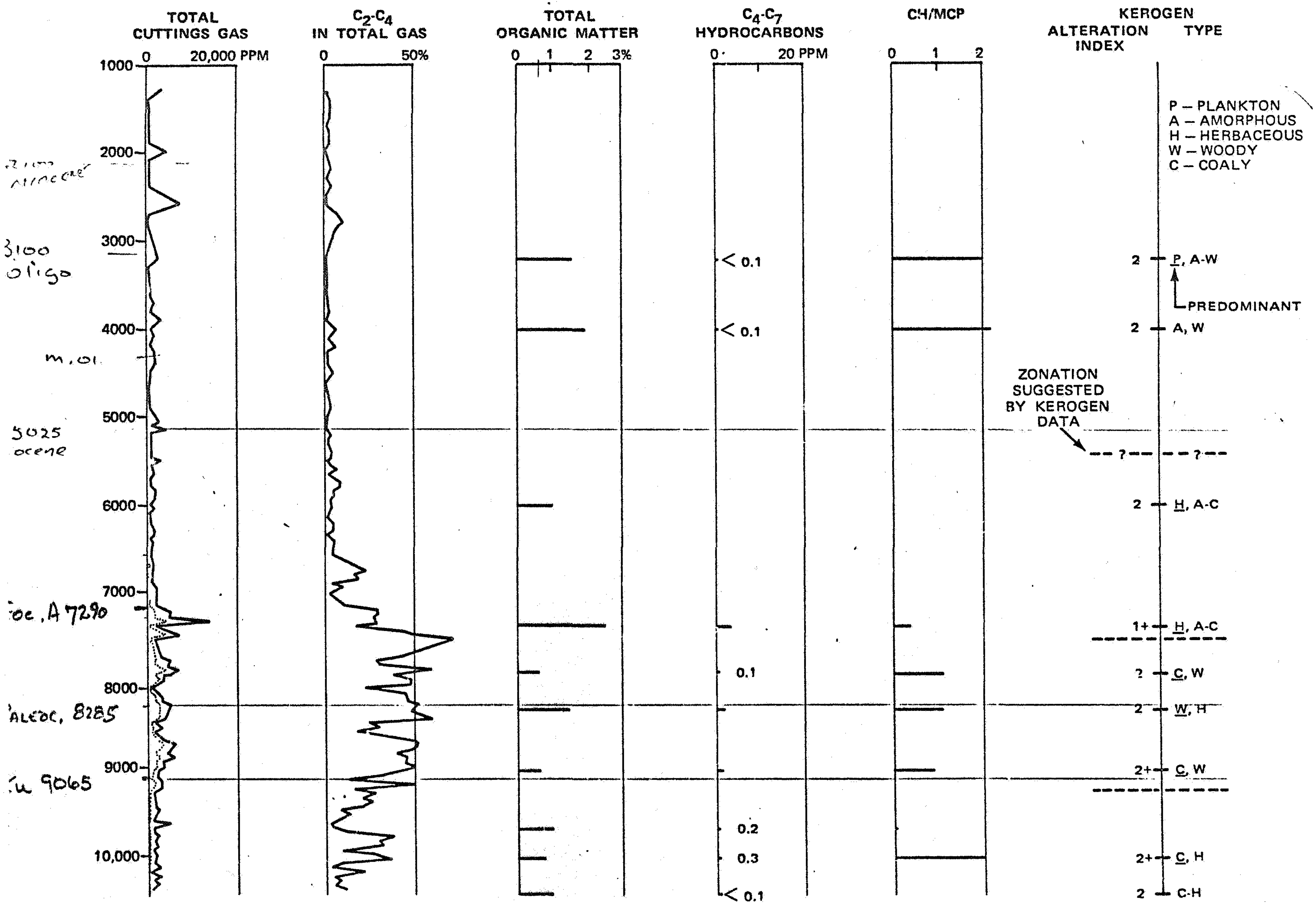

FIGURE 1. GEOCHEMICAL PATTERNS – ESSO 16/1-1 WELL, NORWAY.

TABLE I-4

C_1-C_4 HYDROCARBON ANALYSES - AIR SPACE AT TOP OF CANS

SAMPLE NUMBER	#	DEPTH	GAS CONCENTRATION (VOLUME PER MILLION VOLUMES CUTTINGS) METHANE (C_1)	ETHANE (C_2)	PROPANE (C_3)	ISO BUTANE (iC_4)	N-BUTANE (nC_4)	WET (C_2-C_4)	TOTAL (C_1-C_4)	GAS COMPOSITION (PERCENT) TOTAL GAS C_2-C_4	TOTAL GAS C_1 C_2 C_3 iC_4 nC_4	WET GAS C_2 C_3 iC_4 nC_4	NOTES
54273B	4	1300	2571.05	1.91	2.42	1.90	5.03	11.26	2582.31	0.4360	100.0.00.00.00.0	17.21.17.45.	
54273D	4	1400	5.56	0.09	0.04	0.04	0.09	0.26	5.82	4.4673	94. 2. 1. 1. 2.	35.15.15.35.	
54273F	4	1500	41.15	0.17	0.30	0.23	0.61	1.31	42.46	3.0852	97.0.0 1. 1. 1.	13.23.18.46.	
54273H	4	1600	10.58	0.07	0.05	0.03	0.09	0.24	10.82	2.2181	98. 1.0.00.0 1.	29.21.13.37.	
54273J	4	1700	3.46	0.04	0.02	0.01	0.02	0.09	3.55	2.5352	97. 1. 1.0.0 1.	45.22.11.22.	
54273L	4	1800	82.21	0.19	0.20	0.13	0.42	0.94	83.15	1.1305	99.0.00.00.0 1.	20.21.14.45.	
54273N	4	1900	6.78	0.03	0.04	0.01	0.04	0.12	6.90	1.7391	98.0.0 1.0.0 1.	25.33. 8.34.	
54273P	4	2000	2961.31	3.37	0.92	1.10	2.61	8.00	2969.31	0.2694	100.0.00.00.00.0	41.12.14.33.	
54273R	4	2100	29.27	0.23	0.11	0.04	0.10	0.48	29.75	1.6133	99. 1.0.00.00.0	46.23. 8.21.	
54274B	4	2200	25.26	0.24	0.14	0.03	0.20	0.61	25.87	2.3579	97. 1. 1.0.0 1.	39.23. 5.33.	
54274D	4	2300	4.53	0.09	0.05	0.04	0.04	0.22	4.75	4.6315	95. 2. 1. 1. 1.	41.23.18.18.	
54274F	4	2400	5.89	0.36	0.01	0.02	0.03	0.42	6.31	6.6561	94. 6.0.00.00.0	86. 2. 5. 7.	
54274H	4	2500	3113.41	2.22	3.41	2.25	6.58	14.46	3127.87	0.4623	100.0.00.00.00.0	15.24.16.45.	
54274J	4	2600	5349.60	6.37	5.60	4.58	13.74	30.28	5379.88	0.5629	100.0.00.00.00.0	21.18.15.46.	
54274L	4	2700	50.79	0.86	0.41	0.17	0.49	1.93	52.72	3.6608	96. 2. 1.0.0 1.	45.21. 9.25.	
54274N	4	2800	3.74	0.11	0.05	0.02	0.03	0.21	3.95	5.3164	94. 3. 1. 1. 1.	52.24.10.14.	
54274P	4	2900	6.14	0.07	0.03	0.01	0.01	0.12	6.26	1.9169	99. 1.0.00.00.0	59.25. 8. 8.	
54274R	4	3000	8.88	0.05	0.02	0.03	0.05	0.15	9.03	1.6611	98. 1.0.00.0 1.	33.13.20.34.	
54275B	4	3100	748.80	3.21	1.01	0.32	0.87	5.41	754.21	0.7172	100.0.00.00.00.0	59.19. 6.16.	
54275D	4	3200	1689.68	14.62	2.83	0.18	0.62	18.25	1707.93	1.0685	99. 1.0.00.00.0	80.16. 1. 3.	
54275F	4	3300	28.37	0.24	0.09	0.02	0.03	0.38	28.75	1.3217	99. 1.0.00.00.0	63.24. 5. 8.	
54275H	4	3400	20.90	0.28	0.15	0.08	0.10	0.61	21.51	2.8358	98. 1. 1.0.00.0	46.25.13.16.	
54275J	4	3500	31.65	0.40	0.17	0.10	0.17	0.84	32.49	2.5854	97. 1. 1.0.0 1.	48.20.12.20.	
54275L	4	3600	17.14	0.20	0.07	0.04	0.07	0.33	17.47	1.8888	99. 1.0.00.00.0	61. 6.12.21.	
54275N	4	3700	328.08	1.98	0.99	0.48	1.72	5.17	333.25	1.5514	98. 1.0.00.0 1.	39.19. 9.33.	
54275P	4	3800	293.65	2.28	1.06	0.43	1.36	5.13	298.78	1.7168	99. 1.0.00.00.0	44.21. 8.27.	
54275R	4	3900	2042.55	3.62	1.89	1.27	3.73	10.51	2053.06	0.5119	100.0.00.00.00.0	34.18.12.36.	
54276B	4	4000	152.44	1.80	0.30	0.14	0.96	3.20	155.64	2.0560	98. 1.0.00.0 1.	57. 9. 4.30.	
54276D	4	4100	15.50	0.37	0.14	0.05	0.18	0.74	16.24	4.5565	96. 2. 1.0.0 1.	50.19. 7.24.	
54276F	4	4200	45.45	0.54	0.19	0.08	0.39	1.20	46.65	2.5723	98. 1.0.00.0 1.	44.16. 7.33.	
54276G	4	4250	15.45	0.31	0.11	0.02	0.07	0.51	15.96	3.1955	97. 2. 1.0.00.0	60.22. 4.14.	
54276I	4	4400	29.10	0.59	0.27	0.13	0.57	1.56	30.66	5.0880	95. 2. 1.0.0 2.	38.17. 8.37.	
54276K	4	4500	38.68	0.31	0.10	0.05	0.20	0.66	39.34	1.6776	98. 1.0.00.0 1.	47.15. 8.30.	
54276M	4	4600	4.81	0.15	0.14	0.02	0.05	0.36	5.17	6.9632	93. 3. 3.0.0 1.	41.39. 6.14.	
54276O	4	4700	14.94	0.16	0.07	0.03	0.04	0.30	15.24	1.9685	99. 1.0.00.00.0	54.23.10.13.	
54276Q	4	4800	11.41	0.12	0.05	0.01	0.06	0.24	11.65	2.0601	98. 1.0.00.0 1.	50.21. 4.25.	
54294A	4	4900	30.59	0.29	0.09	0.05	0.17	0.60	31.19	1.9236	98. 1.0.00.0 1.	49.15. 8.28.	
54294C	4	5000	839.67	5.23	1.55	0.64	1.73	9.15	848.82	1.0779	99. 1.0.00.00.0	57.17. 7.19.	
54294D	4	5050	2050.38	13.55	3.71	1.75	3.40	22.41	2072.79	1.0811	99. 1.0.00.00.0	60.17. 8.15.	
54294E	4	5100	129.00	0.98	0.31	0.07	0.41	1.77	130.77	1.3535	99. 1.0.00.00.0	55.18. 4.23.	
54294F	4	5150	2677.51	13.28	1.46	0.57	1.39	16.70	2694.21	0.6198	100.0.00.00.00.0	80. 9. 3. 8.	
54294G	4	5200	7.77	0.10	0.04	0.02	0.05	0.21	7.98	2.6316	97. 1. 1.0.0 1.	47.19.10.24.	
54294H	4	5250	75.47	1.54	0.49	0.08	0.52	2.63	78.10	3.3674	96. 2. 1.0.0 1.	58.19. 3.20.	
54294I	4	5300	4.55	0.11	0.03	0.01	0.02	0.17	4.72	3.6017	97. 2. 1.0.00.0	64.18. 6.12.	
54294J	4	5350	11.74	0.11	0.06	0.02	0.04	0.23	11.97	1.9215	98. 1. 1.0.00.0	48.26. 9.17.	
54294K	4	5400	8.26	0.12	0.04	0.02	0.06	0.24	8.50	2.8235	98. 1.0.00.0 1.	50.17. 8.25.	
54294L	4	5450	3.52	0.06	0.03	0.01	0.01	0.11	3.63	3.0303	97. 2. 1.0.00.0	55.27. 9. 9.	
54294M	4	5500	1787.52	8.19	2.31	1.63	4.29	16.42	1803.94	0.9102	100.0.00.00.00.0	50.14.10.26.	
54294N	4	5550	27.63	0.22	0.05	0.01	0.15	0.43	28.06	1.5323	98. 1.0.00.0 1.	51.12. 2.35.	
54294O	4	5600	12.51	0.24	0.13	0.02	0.22	0.61	13.12	4.6494	95. 2. 1.0.0 2.	40.21. 3.36.	
54294P	4	5650	6.75	0.04	0.18	0.02	0.04	0.28	7.03	3.9829	95. 1. 3.0.0 1.	14.65. 7.14.	
54294Q	4	5700	8.15	0.12	0.04	0.03	0.11	0.30	8.45	3.5503	98. 1.0.00.0 1.	40.13.10.37.	
54294R	4	5750	3.15	0.04	0.02	0.01	0.02	0.09	3.24	2.7777	97. 1. 1.0.0 1.	45.22.11.22.	
54295A	4	5800	56.03	0.83	0.47	0.26	1.12	2.68	58.71	4.5647	96. 1. 1.0.0 2.	31.18.10.41.	
54295B	4	5850	293.42	2.43	0.94	0.80	2.28	6.45	299.87	2.1508	98. 1.0.00.0 1.	38.15.12.35.	
54295C	4	5900	227.52	1.42	0.51	0.39	1.25	3.57	231.09	1.5448	98. 1.0.00.0 1.	40.14.11.35.	
54295D	4	5950	298.64	1.46	0.59	0.59	1.55	4.19	302.83	1.3834	99.0.00.00.0 1.	35.14.14.37.	
54295E	4	6000	5.89	0.07	0.01	0.01	0.02	0.11	6.00	1.8333	99. 1.0.00.00.0	64. 9. 9.18.	
54295F	4	6050	205.08	1.03	0.17	0.09	0.43	1.72	206.80	0.8317	100.0.00.00.00.0	60.10. 5.25.	
54295G	4	6100	7.02	0.03	0.03	0.01	0.03	0.10	7.12	1.4045	100.0.00.00.00.0	30.30.10.30.	
54295H	4	6150	7.72	0.06	0.03	0.04	0.02	0.15	7.87	1.9060	98. 1.0.0 1.0.0	40.20.27.13.	
54295I	4	6200	43.56	0.98	0.57	0.23	1.07	2.85	46.41	6.1409	95. 2. 1.0.0 2.	34.20. 8.38.	
54295J	4	6250	54.42	0.96	0.45	0.10	0.51	2.02	56.44	3.5790	96. 2. 1.0.0 1.	48.22. 5.25.	
54295K	4	6300	432.13	6.08	2.11	0.69	2.13	11.01	443.14	2.4844	99. 1.0.00.00.0	56.19. 6.19.	
54295L	4	6350	8.84	0.16	0.05	0.05	0.05	0.31	9.15	3.3880	95. 2. 1. 1. 1.	52.16.16.16.	
54295M	4	6400	5.51	0.11	0.06	0.03	0.04	0.24	5.75	4.1739	95. 2. 1. 1. 1.	45.25.13.17.	
54295N	4	6450	147.50	4.03	1.67	0.49	1.33	7.52	155.02	4.8510	95. 3. 1.0.0 1.	53.22. 7.18.	
54295O	4	6500	7.02	0.19	0.05	0.02	0.05	0.31	7.33	4.2292	95. 3. 1.0.0 1.	62.16. 6.16.	
54295P	4	6550	31.77	1.17	0.78	0.20	0.64	2.79	34.56	8.0729	92. 3. 2. 1. 2.	42.28. 7.23.	
54295Q	4	6600	14.74	0.41	0.20	0.02	0.13	0.76	15.50	4.9032	95. 3. 1.0.0 1.	54.26. 3.17.	
54295R	4	6650	10.07	1.04	0.95	0.16	0.37	2.52	12.59	20.0159	80. 8. 8. 1. 3.	41.38. 6.15.	
54296A	4	6700	242.37	10.20	4.26	0.57	0.70	15.73	258.10	6.0944	94. 4. 2.0.00.0	65.27. 4. 4.	
54296B	4	6750	44.02	4.03	3.66	0.86	0.82	9.37	53.39	17.5500	81. 8. 7. 2. 2.	43.39. 9. 9.	
54296C	4	6800	112.67	7.83	4.86	0.73	0.83	14.25	126.92	11.2275	88. 6. 4. 1. 1.	55.34. 5. 6.	
54296D	4	6850	29.16	2.48	1.69	0.27	0.34	4.78	33.94	14.0836	86. 7. 5. 1. 1.	52.35. 6. 7.	
54296E	4	6900	4.45	0.10	0.05	0.01	0.01	0.17	4.62	3.6796	97. 2. 1.0.00.0	59.29. 6. 6.	
54296F	4	6950	498.88	22.33	13.80	2.47	2.83	41.43	540.31	7.6677	92. 4. 3.0.0 1.	54.33. 6. 7.	
54296G	4	7000	5.25	0.10	0.06	0.01	0.02	0.19	5.44	3.4926	97. 2. 1.0.00.0	52.32. 5.11.	
54296H	4	7100	886.67	31.69	14.12	2.71	3.98	52.50	939.17	5.5900	95. 3. 2.0.00.0	60.27. 5. 8.	
54296I	4	7150	1043.07	69.70	52.98	10.84	13.61	147.13	1190.20	12.3618	88. 6. 4. 1. 1.	48.36. 7. 9.	
54296J	4	7200	1634.75	241.91	148.91	25.59	23.64	440.05	2074.80	21.2092	79.12. 7. 1. 1.	55.34. 6. 5.	
54296K	4	7250	2674.05	460.04	344.35	66.99	67.28	938.66	3612.71	25.9821	73.13.10. 2. 2.	49.37. 7. 7.	
54296L	4	7300	2301.00	332.77	219.23	38.38	38.38	628.76	2929.76	21.4611	80.11. 7. 1. 1.	53.35. 6. 6.	
54296M	4	7350	7956.65	1331.24	868.49	150.36	145.63	2495.71	10452.36	23.8770	77.13. 8. 1. 1.	53.35. 6. 6.	
54296N	4	7400	102.08	21.49	30.90	7.98	9.15	69.52	171.60	40.5128	59.13.18. 5. 5.	31.45.11.13.	
54296O	4	7450	1668.89	486.68	478.88	88.88	87.44	1141.88	2810.77	40.6252	60.17.17. 3. 3.	42.42. 8. 8.	
54296P	4	7500	2363.52	819.80	826.62	162.44	159.11	1967.97	4331.49	45.4340	54.19.19. 4. 4.	42.42. 8. 8.	
54296Q	4	7550	41.63	20.54	35.21	14.17	18.90	88.82	130.45	68.0874	32.16.27.11.14.	23.40.16.21.	
54296R	4	7750	860.02	257.15	249.62	32.98	43.01	582.76	1442.78	40.3914	60.18.17. 2. 3.	44.43. 6. 7.	
54297A	4	7800	2736.58	486.39	368.69	40.57	56.39	952.04	3688.62	25.8102	74.13.10. 1. 2.	51.39. 4. 6.	
54297B	4	7850	1363.64	427.21	529.32	79.32	103.24	1139.09	2502.73	45.5139	55.17.21. 3. 4.	38.46. 7. 9.	
54297C	4	7900	1681.98	724.46	734.90	111.66	142.13	1713.15	3395.13	50.4590	50.21.22. 3. 4.	42.43. 7. 8.	
54297D	4	7950	705.28	337.12	534.65	90.79	130.52	1093.08	1798.36	60.7820	39.19.30. 5. 7.	31.49. 8.12.	
54297E	4	8000	872.27	330.08	332.11	39.83	60.63	762.65	1634.92	46.6475	54.20.20. 2. 4.	43.44. 5. 8.	
54297F	4	8050	779.58	282.34	306.47	36.71	58.54	683.96	1463.54	46.7332	53.19.21. 3. 4.	41.45. 5. 9.	
54297G	4	8100	3.42	0.30	1.08	0.16	0.38	1.92	5.34	35.9550	64. 6.20. 3. 7.	16.56. 8.20.	
54297H	4	8150	428.11	235.50	264.79	30.45	43.07	573.81	1001.92	57.2710	43.24.26. 3. 4.	41.46. 5. 8.	
54297I	4	8200	902.34	250.81	274.31	28.79	47.83	601.74	1504.08	40.0071	60.17.18. 2. 3.	42.45. 5. 8.	
54297J	4	8250	1021.38	351.73	448.03	50.69	85.16	941.61	1962.99	47.9681	52.18.23. 3. 4.	38.48. 5. 9.	
54297K	4	8300	1292.08	396.48	356.44	37.96	60.55	851.43	2143.51	39.7213	60.18.17. 2. 3.	47.42. 4. 7.	
54346A	4	8350	1353.45	361.63	362.15	44.61	65.85	834.24	2187.69	38.1333	61.17.17. 2. 3.	43.44. 5. 8.	
54346B	4	8400	1115.62	417.74	758.60	151.45	245.04	1567.83	2683.45	58.4259	42.15.28. 6. 9.	26.48.10.16.	
54346C	4	8450	838.54	338.43	483.79	69.98	109.88	1002.08	1840.62	54.4425	46.18.26. 4. 6.	34.48. 7.11.	
54346D	4	8500	290.16	62.04	94.97	15.44	23.50	195.95	486.11	40.3098	59.13.20. 3. 5.	32.48. 8.12.	
54346E	4	8550	861.11	196.12	211.10	28.70	39.57	475.39	1336.50	35.5697	64.15.16. 2. 3.	41.45. 6. 8.	
54346F	4	8600	211.37	47.99	75.46	12.53	19.06	155.04	366.41	42.3132	58.13.21. 3. 5.	31.49. 8.12.	
54346G	4	8700	1146.33	469.11	613.37	100.20	139.51	1322.19	2468.52	53.5620	46.19.25. 4. 6.	35.46. 8.11.	
54346H	4	8750	1912.76	683.93	730.30	113.85	150.57	1678.65	3591.41	46.7407	54.19.20. 3. 4.	41.43. 7. 9.	
54346I	4	8800	1746.19	631.17	728.61	106.27	134.82	1600.87	3347.06	47.8291	52.19.22. 3. 4.	39.46. 7. 8.	
54346J	4	8850	1660.71	493.07	565.93	101.58	124.83	1285.41	2946.12	43.6306	57.17.19. 3. 4.	38.44. 8.10.	
54346K	4	8900	2093.08	697.96	650.04	88.14	106.96	1543.10	3636.18	42.4374	58.19.18. 2. 3.	45.42. 6. 7.	
54346K	4	0	1295.24	432.67	358.83	37.79	50.91	880.20	2175.44	40.4608	60.20.16. 2. 2.	49.41. 4. 6.	
54346L	4	8950	871.17	328.71	298.38	32.47	44.51	704.07	1575.24	44.6960	55.21.19. 2. 3.	47.42. 5. 6.	
54346M	4	9000	1021.00	518.74	627.58	87.48	121.27	1355.07	2376.07	57.0299	43.22.26. 4. 5.	38.47. 6. 9.	
54346N	4	9050	436.93	226.31	330.78	45.60	66.89	669.58	1106.51	60.5128	40.20.30. 4. 6.	34.49. 7.10.	
54346O	4	9100	628.12	195.97	221.89	30.88	40.45	489.19	1117.31	43.7828	55.18.20. 3. 4.	40.46. 6. 8.	
54346P	4	9150	258.00	93.64	134.25	20.26	27.81	275.96	533.96	51.6817	48.18.25. 4. 5.	34.49. 7.10.	
54346Q	4	9200	793.60	441.27	617.53	82.47	126.50	1267.77	2061.37	61.5013	39.21.30. 4. 6.	35.48. 7.10.	
54346R	4	9250	281.95	88.97	179.85	33.59	52.05	354.46	636.41	55.6967	45.14.28. 5. 8.	25.51. 9.15.	
54347A	4	9300	45.64	21.24	50.24	8.56	14.13	94.17	139.81	67.3557	33.15.36. 6.10.	23.53. 9.15.	
54347B	4	9350	122.89	36.68	45.45	5.60	8.21	95.94	218.83	43.8422	55.17.21. 3. 4.	38.47. 6. 9.	
54347C	4	9400	200.35	74.76	115.48	16.13	24.65	231.02	431.37	53.5549	46.17.27. 4. 6.	32.50. 7.11.	
54347D	4	9450	257.79	62.99	83.33	13.88	18.51	178.71	436.50	40.9415	60.14.19. 3. 4.	35.47. 8.10.	
54347E	4	9500	200.73	43.94	55.25	13.27	18.13	130.59	331.32	39.4150	61.13.17. 4. 5.	34.42.10.14.	
54347F	4	9550	326.02	57.81	63.98	11.66	15.36	148.81	474.83	31.3396	70.12.13. 2. 3.	39.43. 8.10.	
54347G	4	9600	159.35	18.66	23.56	5.90	6.68	54.80	214.15	25.5895	74. 9.11. 3. 3.	34.43.11.12.	
54347H	4	9650	214.50	26.69	31.81	12.76	21.36	92.62	307.12	30.1574	70. 9.10. 4. 7.	29.34.14.23.	
54347I	4	9700	29.44	2.95	2.41	0.62	0.67	6.65	36.09	18.4261	81. 8. 7. 2. 2.	45.36. 9.10.	
54347J	4	9750	120.16	30.77	24.59	3.08	3.67	62.11	182.27	34.0758	66.17.13. 2. 2.	49.40. 5. 6.	
54347K	4	9800	311.18	194.87	237.13	26.19	38.34	496.53	807.71	61.4738	39.24.29. 3. 5.	39.48. 5. 8.	
54347L	4	9850	220.76	103.98	127.18	15.36	21.80	268.32	489.08	54.8621	46.21.26. 3. 4.	39.47. 6. 8.	
54347M	4	9900	454.70	172.12	163.23	17.76	25.87	378.98	833.68	45.4586	54.21.20. 2. 3.	45.43. 5. 7.	
54347N	4	9950	106.98	13.39	14.51	2.55	3.14	33.59	140.57	23.8956	76.10.10. 2. 2.	40.43. 8. 9.	
54347O	4	10000	159.18	85.08	103.86	12.75	17.91	219.60	378.78	57.9756	42.22.27. 3. 5.	39.47. 6. 8.	
54347P	4	10050	349.13	162.08	198.05	23.64	36.31	420.08	769.21	54.6118	45.21.26. 3. 5.	39.46. 6. 9.	
54347Q	4	10100	138.98	21.73	27.73	4.19	6.13	59.78	198.76	30.0765	70.11.14. 2. 3.	36.47. 7.10.	
54347R	4	10150	102.49	8.48	17.16	5.00	8.57	39.21	141.70	27.6711	72. 6.12. 4. 6.	22.43.13.22.	
54348A	4	10200	130.88	52.93	69.30	9.75	13.31	145.29	276.17	52.6088	47.19.25. 4. 5.	36.48. 7. 9.	
54348B	4	10250	113.29	15.63	27.48	5.94	7.97	57.02	170.31	33.4801	67. 9.16. 3. 5.	27.49.10.14.	
54348C	4	10300	96.77	10.32	10.92	2.11	2.36	25.71	121.98	21.0772	79. 8. 9. 2. 2.	40.43. 8. 9.	
54348D	4	10350	105.45	23.10	32.83	5.71	7.25	68.89	174.34	39.5147	61.13.19. 3. 4.	34.47. 8.11.	
348E	4	10400	134.68	20.86	21.50	3.70	5.19	51.25	185.93	27.5641	72.11.12. 2. 3.	41.42. 7.10.	

Analyses by S.R. Tillotson

TABLE I-B

C_1-C_4 HYDROCARBON ANALYSES - CUTTINGS ONLY

SAMPLE NUMBER	R	DEPTH	GAS CONCENTRATION (VOLUME GAS PER MILLION VOLUMES CUTTINGS) METHANE (C_1)	ETHANE (C_2)	PROPANE (C_3)	ISO-BUTANE (iC_4)	NORMAL BUTANE (nC_4)	WET (C_2-C_4)	TOTAL (C_1-C_4)	GAS COMPOSITION (PERCENT) TOTAL GAS C_2-C_4	TOTAL GAS C_1 C_2 C_3 iC_4 nC_4	WET GAS C_2 C_3 iC_4 nC_4	NOTES
54273B	4	1300	624.00	1.42	2.00	1.27	7.20	11.89	635.89	1.8698	99.0.00.00.0 1.	12.17.11.60.	
54273D	4	1400	522.00	1.33	1.98	2.94	9.40	15.65	537.65	2.9108	97.0.00.0 1. 2.	8.13.19.60.	
54273F	4	1500	519.00	1.55	2.07	3.53	12.56	20.11	539.11	3.7301	97.0.00.0 1. 2.	10.10.18.62.	
54273H	4	1600	609.60	5.13	1.91	4.36	15.90	27.30	636.90	4.2863	96. 1.0.0 1. 2.	19. 7.16.58.	
54273J	4	1700	556.20	1.86	1.57	2.73	8.51	14.67	570.87	2.5697	99.0.00.00.0 1.	13.11.19.57.	
54273L	4	1800	781.20	1.24	2.77	4.63	15.04	23.68	804.88	2.9420	97.0.00.0 1. 2.	5.12.20.63.	
54273N	4	1900	829.20	2.57	6.45	5.58	13.17	27.77	856.97	3.2404	96.0.0 1. 1. 2.	9.23.20.48.	
54273P	4	2000	1024.80	3.45	2.53	4.02	12.50	22.50	1047.30	2.1483	99.0.00.00.0 1.	15.11.18.56.	
54273R	4	2100	514.80	1.68	1.25	2.39	9.08	14.40	529.20	2.7210	98.0.00.00.0 2.	12. 9.17.62.	
54274B	4	2200	531.60	1.86	1.92	3.12	10.97	17.87	549.47	3.2522	97.0.00.0 1. 2.	10.11.17.62.	
54274D	4	2300	655.20	1.50	1.16	1.37	6.20	10.23	665.43	1.5373	99.0.00.00.0 1.	15.11.13.61.	
54274F	4	2400	756.00	1.86	2.54	4.61	17.46	26.47	782.47	3.3828	97.0.00.0 1. 2.	7.10.17.66.	
54274H	4	2500	756.00	1.33	5.76	5.90	21.31	34.30	790.30	4.3400	95.0.0 1. 1. 3.	4.17.17.62.	
54274J	4	2600	1356.00	3.01	3.66	5.88	22.07	34.62	1390.62	2.4895	98.0.00.00.0 2.	9.11.17.63.	
54274L	4	2700	578.40	4.69	7.19	7.14	22.90	41.92	620.32	6.7578	93. 1. 1. 1. 4.	11.17.17.55.	
54274N	4	2800	55.27	0.88	1.71	0.90	3.09	6.58	61.85	10.6386	90. 1. 3. 1. 5.	13.26.14.47.	
54274P	4	2900	564.60	3.45	7.80	4.93	16.73	32.91	597.51	5.5078	94. 1. 1. 1. 3.	10.24.15.51.	
54274R	4	3000	1155.47	9.20	14.21	6.73	21.31	51.45	1206.92	4.2629	95. 1. 1. 1. 2.	18.28.13.41.	
54275B	4	3100	1191.60	10.09	8.98	5.91	19.62	44.60	1236.20	3.6078	96. 1. 1.0.0 2.	23.20.13.44.	
54275D	4	3200	798.00	4.87	3.15	0.32	1.42	9.76	807.76	1.2082	99. 1.0.00.00.0	50.32. 3.15.	
54275F	4	3300	490.80	1.86	1.28	0.14	0.51	3.89	494.69	0.7862	100.0.00.00.00.0	47.33. 4.16.	
54275H	4	3400	522.60	3.27	3.30	0.62	1.24	8.43	531.03	1.5874	98. 1. 1.0.00.0	39.39. 7.15.	
54275J	4	3500	584.40	4.07	2.94	0.40	1.48	8.89	593.29	1.4984	99. 1.0.00.00.0	46.33. 4.17.	
54275L	4	3600	483.00	1.86	1.35	0.71	2.16	6.08	489.08	1.2431	100.0.00.00.00.0	31.22.12.35.	
54275N	4	3700	993.60	1.33	2.34	3.01	11.45	18.13	1011.73	1.7919	99.0.00.00.0 1.	7.13.17.63.	
54275P	4	3800	481.80	2.57	2.56	2.75	10.67	18.55	500.35	3.7073	95. 1. 1. 1. 2.	14.14.15.57.	
54275R	4	3900	817.20	9.20	3.76	5.43	18.60	36.99	854.19	4.3304	96. 1.0.0 1. 2.	25.10.15.50.	
54276B	4	4000	371.40	4.51	2.91	4.65	16.38	28.45	399.85	7.1150	93. 1. 1. 1. 4.	16.10.16.58.	
54276D	4	4100	1272.00	3.01	3.35	4.46	17.68	28.50	1300.50	2.1914	99.0.00.00.0 1.	11.12.16.61.	
54276F	4	4200	548.40	3.98	3.69	5.21	18.16	31.04	579.44	5.3569	94. 1. 1. 1. 3.	13.12.17.58.	
54276G	4	4250	1128.00	2.30	2.27	2.31	10.30	17.18	1145.18	1.5001	99.0.00.00.0 1.	13.13.13.61.	
54276I	4	4400	1677.60	2.65	3.30	4.39	17.43	27.77	1705.37	1.6284	99.0.00.00.0 1.	10.12.16.62.	
54276K	4	4500	734.40	6.02	4.69	5.62	18.92	35.25	769.65	4.5799	95. 1. 1. 1. 2.	17.13.16.54.	
54276M	4	4600	427.80	1.50	0.82	0.09	0.42	2.83	430.63	0.6571	100.0.00.00.00.0	53.29. 3.15.	
54276O	4	4700	444.60	1.42	1.20	0.09	0.76	3.47	448.07	0.7743	100.0.00.00.00.0	40.35. 3.22.	
54276Q	4	4800	468.60	1.68	2.09	2.61	9.48	15.86	484.46	3.2737	97.0.00.0 1. 2.	11.13.16.60.	
54294A	4	4900	601.20	3.63	4.38	4.39	15.30	27.70	628.90	4.4044	95. 1. 1. 1. 2.	13.16.16.55.	
54294C	4	5000	855.60	4.87	4.34	2.88	10.73	22.82	878.42	2.5978	98. 1.0.00.0 1.	21.19.13.47.	
54294D	4	5050	552.00	2.39	1.33	2.47	6.07	12.26	564.26	2.1727	99.0.00.00.0 1.	19.11.20.50.	
54294E	4	5100	603.00	2.79	2.06	1.54	5.08	11.41	614.41	1.8570	99.0.00.00.0 1.	24.18.13.45.	
54294F	4	5150	1319.53	7.26	2.48	1.77	6.07	17.58	1337.11	1.3147	99. 1.0.00.00.0	41.14.10.35.	
54294G	4	5200	368.40	4.04	1.83	1.02	3.28	10.17	378.57	2.6862	98. 1.0.00.0 1.	40.18.10.32.	
54294H	4	5250	433.80	1.68	1.16	0.88	4.45	8.17	441.97	1.8485	99.0.00.00.0 1.	21.14.11.54.	
54294I	4	5300	465.60	1.86	1.07	1.02	4.67	8.62	474.22	1.8176	99.0.00.00.0 1.	22.12.12.54.	
54294J	4	5350	480.00	2.04	1.43	1.59	6.74	11.80	491.80	2.3997	99.0.00.00.0 1.	17.12.13.5[illegible]	
54294K	4	5400	396.00	1.33	1.47	2.10	8.81	13.71	409.71	3.3461	97.0.00.0 1. 2.	10.11.15.64.	
54294L	4	5450	483.60	2.65	2.41	3.04	11.24	19.34	502.94	3.8453	96. 1.0.0 1. 2.	14.12.16.[illegible]	
54294M	4	5500	781.20	5.40	4.04	5.89	20.67	36.00	817.20	4.4052	95. 1.0.0 1. 3.	15.11.16.58.	
54294N	4	5550	751.20	4.87	2.34	2.86	10.91	20.98	772.18	2.7169	98. 1.0.00.0 [illegible]	23.11.14.[illegible]	
54294O	4	5600	420.60	3.45	2.78	4.45	15.87	26.55	447.15	5.9375	93. 1. 1. 1. 4.	13.10.17.60.	
54294P	4	5650	1243.20	2.65	1.64	3.16	9.70	17.15	1260.35	1.3607	99.0.00.00.0 1.	15.10.18.57.	
54294Q	4	5700	469.20	2.83	3.16	5.86	19.68	31.53	500.73	6.2967	93. 1. 1. 1. 4.	9.10.19.62.	
54294R	4	5750	453.60	3.10	3.72	6.58	22.64	36.04	489.04	7.3695	92. 1. 1. 1. 5.	9.10.18.63.	
54295A	4	5800	512.40	2.57	3.76	7.01	22.90	36.24	548.64	6.6053	94.0.0 1. 1. 4.	7.10.19.64.	
54295B	4	5850	685.20	5.58	4.79	7.44	24.93	42.74	727.94	5.8713	94. 1. 1. 1. 3.	13.11.17.59.	
54295C	4	5900	830.40	3.81	4.17	6.42	21.91	36.31	866.71	4.1894	96.0.00.0 1. 3.	10.11.18.61.	
54295D	4	5950	715.20	2.74	3.14	5.37	19.11	30.36	745.56	4.0721	96.0.00.0 1. 3.	9.10.18.63.	
54295E	4	6000	763.20	2.39	2.14	3.71	13.61	21.85	785.05	2.7832	98.0.00.00.0 2.	11.10.17.62.	
54295F	4	6050	864.00	5.49	2.62	3.81	13.69	25.61	889.61	2.8787	97. 1.0.00.0 2.	21.10.15.54.	
54295G	4	6100	577.80	0.49	1.45	1.97	8.49	12.40	590.20	2.1010	99.0.00.00.0 1.	4.12.16.68.	
54295H	4	6150	591.60	0.44	1.08	1.18	5.01	7.71	599.31	1.2864	99.0.00.00.0 1.	6.14.15.65.	
54295I	4	6200	579.60	0.97	1.86	2.74	10.30	15.87	595.47	2.6651	98.0.00.00.0 2.	6.12.17.65.	
54295J	4	6250	697.20	3.81	3.42	3.01	12.00	22.24	719.44	3.0912	97. 1.0.00.0 2.	17.15.14.54.	
54295K	4	6300	770.40	5.58	6.19	4.98	17.68	34.43	804.83	4.2779	95. 1. 1. 1. 2.	16.18.14.52.	
54295L	4	6350	1334.40	1.06	1.69	1.56	6.58	10.89	1345.29	0.8094	100.0.00.00.00.0	10.16.14.60.	
54295M	4	6400	552.00	3.27	4.28	3.04	9.11	19.70	571.70	3.4457	95. 1. 1. 1. 2.	17.22.15.46.	
54295N	4	6450	862.80	11.15	8.14	4.78	12.89	36.96	899.76	4.1077	96. 1. 1. 1. 1.	30.22.13.35.	
54295O	4	6500	820.80	11.15	10.00	5.51	13.74	40.40	861.20	4.6911	95. 1. 1. 1. 2.	28.25.14.33.	
54295P	4	6550	672.00	5.40	6.81	4.20	10.94	27.35	699.35	3.9107	95. 1. 1. 1. 2.	20.25.15.40.	
54295Q	4	6600	891.60	14.69	17.95	7.72	13.58	53.94	945.54	5.7046	94. 2. 2. 1. 1.	27.34.14.25.	
54295R	4	6650	624.00	12.28	34.75	14.99	17.36	79.38	703.38	11.2855	89. 2. 5. 2. 2.	15.44.19.22.	
54296A	4	6700	1038.00	58.91	91.93	32.74	31.42	215.00	1253.00	17.1588	82. 5. 7. 3. 3.	27.43.15.15.	
54296B	4	6750	760.80	48.85	163.15	37.57	33.90	223.47	984.27	22.7041	78. 5.10. 4. 3.	22.46.17.15.	
54296C	4	6800	786.00	39.65	74.15	25.00	25.92	164.72	950.72	17.3258	82. 4. 8. 3. 3.	24.45.15.16.	
54296D	4	6850	727.20	36.25	76.06	25.59	29.89	167.79	894.99	18.7477	82. 4. 8. 3. 3.	22.45.15.18.	
54296E	4	6900	598.80	3.89	10.12	4.85	9.06	27.92	626.72	4.4549	95. 1. 2. 1. 1.	14.37.17.32.	
54296F	4	6950	752.40	17.68	38.03	15.18	20.89	91.98	844.38	10.8931	89. 2. 5. 2. 2.	19.41.17.23.	
54296G	4	7000	1665.60	5.84	14.12	6.99	12.82	39.77	1705.37	2.3320	98.0.0 1.0.0 1.	15.35.18.32.	
54296H	4	7100	723.60	15.84	25.82	9.78	17.97	69.41	793.01	8.7527	92. 2. 3. 1. 2.	23.37.14.26.	
54296I	4	7150	433.20	6.64	12.07	5.49	9.02	33.22	466.42	7.1222	93. 1. 3. 1. 2.	20.36.17.27.	
54296J	4	7200	947.20	132.54	246.43	88.54	118.55	588.06	1495.26	39.3282	60. 9.17. 6. 8.	23.42.15.20.	
54296K	4	7250	861.60	83.12	177.57	69.04	104.69	434.42	1296.02	33.5195	67. 6.14. 5. 8.	19.41.16.24.	
54296L	4	7300	1046.40	128.86	247.33	88.83	133.31	598.33	1644.73	36.3786	64. 8.15. 5. 8.	22.41.15.22.	
54296M	4	7350	1364.26	251.76	487.01	161.00	241.17	1140.94	2505.00	45.5465	55.10.19. 6.10.	22.43.14.21.	
54296N	4	7400	1252.80	29.03	80.71	38.59	69.96	218.09	1470.89	14.8271	85. 2. 5. 3. 5.	13.37.18.32.	
54296O	4	7450	792.60	145.85	201.10	155.94	223.58	726.47	1516.47	47.7394	52.10.13.10.15.	20.28.22.30.	
54296P	4	7500	804.00	191.16	594.22	249.39	335.81	1370.58	2174.58	63.0273	38. 9.27.11.15.	14.43.18.25.	
54296Q	4	7550	210.00	72.64	221.62	80.35	119.57	494.18	704.18	70.1781	30.10.32.11.17.	15.45.16.24.	
54296R	4	7750	730.80	82.13	283.45	90.32	153.91	609.81	1340.61	45.4875	55. 6.21. 7.11.	13.47.15.25.	
54297A	4	7800	746.40	73.77	207.94	53.57	100.49	435.77	1182.17	36.8618	62. 6.18. 5. 9.	17.48.12.23.	
54297B	4	7850	1452.00	27.97	58.96	18.58	36.00	141.51	1593.51	8.8804	91. 2. 4. 1. 2.	20.42.13.25.	
54297C	4	7900	855.20	259.69	855.00	254.15	444.69	1813.53	2678.73	67.7011	32.10.32. 9.17.	14.47.14.25.	
54297D	4	7950	1459.40	34.98	121.62	37.50	82.81	276.91	1731.31	15.9942	84. 2. 7. 2. 5.	13.43.14.30.	
54297E	4	8000	740.40	115.26	412.04	104.16	189.53	820.99	1561.39	52.5807	48. 7.26. 7.12.	14.50.13.23.	
54297F	4	8050	537.00	55.65	235.30	73.73	141.45	506.13	1043.13	48.5203	51. 5.23. 7.14.	11.46.15.28.	
54297G	4	8100	620.40	10.80	67.99	26.78	55.65	161.22	781.62	20.6263	80. 1. 9. 3. 7.	7.41.17.35.	
54297H	4	8150	603.60	30.34	108.07	31.36	61.69	231.46	835.06	27.7177	72. 4.13. 4. 7.	13.46.14.27.	
54297I	4	8200	708.__	89.63	358.42	95.53	199.19	742.77	1450.77	51.1983	48. 6.25. 7.14.	12.48.13.27.	
54297J	4	8250	651.60	51.57	239.67	65.84	138.65	496.13	1147.73	43.2271	56. 5.21. 6.12.	10.49.13.28.	
54297K	4	8300	1038.00	267.34	785.53	179.45	362.77	1595.09	2633.09	60.5786	39.10.30. 7.14.	17.49.11.23.	
54346A	4	8350	908.40	192.56	636.97	180.94	358.70	1369.19	2277.59	60.1157	40. 8.28. 8.16.	14.47.13.26.	
54346B	4	8400	738.00	42.48	215.05	104.31	223.11	584.95	1322.95	44.2155	56. 3.16. 8.17.	7.37.18.38.	
54346C	4	8450	690.00	94.16	456.36	154.75	306.81	1012.08	1702.08	59.4613	41. 6.27. 9.18.	9.46.15.30.	
54346D	4	8500	589.20	9.20	27.98	9.73	21.46	68.37	657.57	10.3974	91. 1. 4. 1. 3.	13.42.14.31.	
54346E	4	8550	625.20	23.36	61.56	17.41	34.85	137.18	762.38	17.9936	82. 3. 8. 2. 5.	17.45.13.25.	
54346F	4	8600	652.80	4.60	11.08	3.53	8.35	27.56	680.36	4.0507	95. 1. 2. 1. 1.	17.40.13.30.	
54346G	4	8700	625.20	50.06	171.82	51.63	111.17	384.68	1009.88	38.0916	62. 5.17. 5.11.	13.45.13.29.	
54346H	4	8750	816.00	171.62	570.71	169.63	306.81	1218.77	2034.77	59.8972	41. 8.28. 8.15.	14.47.14.25.	
54346I	4	8800	748.80	131.69	427.91	121.12	217.51	898.23	1647.03	54.5363	46. 8.26. 7.13.	15.48.13.24.	
54346J	4	8850	648.20	38.37	104.65	30.32	56.92	230.26	878.26	26.2177	75. 4.12. 3. 6.	17.45.13.25.	
54346K	4	8900	912.00	195.41	472.59	106.24	194.87	967.11	1879.11	51.4664	49.10.25. 6.10.	20.49.11.20.	
54346K	4	C	841.20	226.56	591.02	122.61	230.49	1170.68	2011.88	58.1883	43.11.29. 6.11.	19.51.10.20.	
54346L	4	8950	739.20	161.95	298.22	77.38	138.39	615.94	1355.14	45.4521	54. 8.22. 6.10.	17.48.13.22.	
54346M	4	9000	612.00	35.36	86.32	19.34	41.53	182.55	794.55	22.9752	78. 4.11. 2. 5.	19.47.11.23.	
54346N	4	9050	612.00	15.22	34.95	8.80	19.40	78.37	690.37	11.3518	89. 2. 5. 1. 3.	19.45.11.25.	
54346O	4	9100	493.80	16.99	33.31	8.83	18.63	77.76	571.56	13.6048	86. 3. 6. 2. 3.	22.43.11.24.	
54346P	4	9150	1843.30	9.73	14.95	4.11	9.41	38.20	1898.20	2.0124	98. 1. 1.0.00.0	25.39.11.25.	
54346Q	4	9200	624.00	19.12	46.10	11.12	27.51	103.85	727.85	14.2680	85. 3. 6. 2. 4.	18.45.11.26.	
54346R	4	9250	1824.00	6.02	14.43	4.69	12.46	37.54	1861.54	2.0166	98.0.0 1.0.0 1.	16.39.12.33.	
54347A	4	9300	585.60	14.51	67.44	21.24	42.04	145.23	730.23	19.8882	80. 2. 9. 3. 6.	10.46.15.29.	
54347B	4	9350	595.80	13.45	40.08	10.34	24.01	87.88	683.68	12.8539	86. 2. 6. 2. 4.	15.46.12.27.	
54347C	4	9400	525.60	4.78	8.41	2.10	5.45	20.74	546.34	3.7961	96. 1. 2.0.0 1.	23.41.10.26.	
54347D	4	9450	618.60	7.96	15.22	5.99	11.50	40.67	658.67	6.1746	94. 1. 2. 1. 2.	20.37.15.28.	
54347E	4	9500	1632.00	6.90	5.41	3.12	5.41	21.24	1653.24	1.2847	100.0.00.00.00.0	33.27.15.25.	
54347F	4	9550	690.20	3.63	5.90	2.19	3.90	15.62	705.62	2.2136	97. 1. 1.0.0 1.	23.38.14.25.	
54347G	4	9600	672.00	5.40	6.46	3.41	5.02	20.23	692.23	2.9224	97. 1. 1.0.0 1.	27.31.17.25.	
54347H	4	9650	3715.20	4.96	3.04	1.38	2.23	11.61	3726.81	0.3115	100.0.00.00.00.0	43.26.12.19.	
54347I	4	9700	688.80	5.13	9.15	5.58	7.63	27.49	716.29	3.8378	96. 1. 1. 1. 1.	19.33.20.28.	
54347J	4	9750	679.20	14.16	33.91	9.21	16.73	73.41	752.61	9.7540	91. 2. 4. 1. 2.	19.45.13.23.	
54347K	4	9800	752.40	26.09	78.11	17.74	39.30	161.24	913.64	17.6480	82. 3. 9. 2. 4.	16.48.11.24.	
54347L	4	9850	698.40	17.35	51.71	15.12	31.04	115.22	813.62	14.1613	86. 2. 6. 2. 4.	15.45.13.27.	
54347M	4	9900	702.00	27.26	82.49	20.57	40.70	171.02	873.02	19.5896	81. 3. 9. 2. 5.	16.48.12.24.	
54347N	4	9950	642.00	6.90	15.30	5.54	9.27	37.01	679.01	5.4505	95. 1. 2. 1. 1.	19.41.15.25.	
54347O	4	10000	678.00	18.41	33.31	9.78	18.76	80.26	758.26	10.5847	91. 2. 4. 1. 2.	23.42.12.23.	
54347P	4	10050	476.40	14.16	32.32	10.12	20.48	77.08	553.48	13.9264	85. 3. 6. 2. 4.	18.42.13.27.	
54347Q	4	10100	756.00	5.49	11.78	3.68	8.17	29.12	785.12	3.7089	96. 1. 2.0.0 1.	19.40.13.28.	
54347R	4	10150	1788.00	3.19	2.87	1.55	2.76	10.37	1798.37	0.5766	100.0.00.00.00.0	30.28.15.27.	
54348A	4	10200	636.00	8.14	20.62	5.78	12.27	46.81	682.81	6.8554	93. 1. 3. 1. 2.	17.45.13.26.	
54348B	4	10250	1934.40	5.31	3.37	1.88	2.23	12.79	1947.19	0.6568	100.0.00.00.00.0	42.26.15.17.	
54348C	4	10300	684.00	5.49	13.71	6.29	8.52	34.01	718.01	4.7366	95. 1. 2. 1. 1.	16.41.18.25.	
54348D	4	10350	1480.80	5.49	7.28	3.05	4.58	20.40	1501.20	1.3589	100.0.00.00.00.0	27.36.15.22.	
54348E	4	10400	524.40	6.90	10.26	4.84	6.87	28.87	553.27	5.2180	95. 1. 2. 1. 1.	24.35.17.24.	

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TABLE I-C

C_1-C_4 HYDROCARBON ANALYSES - CUTTINGS AND AIR SPACE

SAMPLE NUMBER	R	DEPTH	GAS CONCENTRATION (VOLUME GAS PER MILLION VOLUMES CUTTINGS) METHANE (C_1)	ETHANE (C_2)	PROPANE (C_3)	ISO-BUTANE (iC_4)	NORMAL BUTANE (nC_4)	WET (C_2-C_4)	TOTAL (C_1-C_4)	GAS COMPOSITION (PERCENT) TOTAL GAS C_2-C_4	TOTAL GAS C_1 C_2 C_3 iC_4 nC_4	WET GAS C_2 C_3 iC_4 nC_4	NOTES
54273B	4	1300	3195.05	3.33	4.42	3.17	12.23	23.15	3218.20	0.7193	100.0.00.00.00.0	14.19.14.53.	
54273D	4	1400	527.56	1.42	2.02	2.98	9.49	15.91	543.47	2.9274	97.0.00.0 1. 2.	9.13.19.59.	
54273F	4	1500	560.15	2.12	2.37	3.76	13.17	21.42	581.57	3.6830	97.0.00.0 1. 2.	10.11.18.61.	
54273H	4	1600	620.18	5.20	1.96	4.39	15.99	27.54	647.72	4.2518	96. 1.0.0 1. 2.	19. 7.16.58.	
54273J	4	1700	559.66	1.90	1.59	2.74	8.53	14.76	574.42	2.5695	99.0.00.00.0 1.	13.11.19.57.	
54273L	4	1800	863.41	1.43	2.97	4.76	15.46	24.62	888.03	2.7724	97.0.00.0 1. 2.	6.12.19.63.	
54273N	4	1900	835.98	2.60	6.49	5.59	13.21	27.89	863.87	3.2284	96.0.0 1. 1. 2.	9.23.20.48.	
54273P	4	2300	3986.11	6.82	3.45	5.12	15.11	30.59	4016.61	0.7593	100.0.00.00.00.0	22.11.17.59.	
54273R	4	2100	544.07	1.91	1.36	2.43	9.18	14.88	558.95	2.6621	98.0.00.00.0 2.	13. 9.16.62.	
54274B	4	2200	556.86	2.10	2.06	3.15	11.17	18.48	575.34	3.2119	97.0.00.0 1. 2.	11.11.17.61.	
54274D	4	2300	659.73	1.59	1.21	1.41	6.24	10.45	670.18	1.5592	99.0.00.00.0 1.	15.12.13.60.	
54274F	4	2400	761.89	2.22	2.55	4.63	17.49	26.89	788.78	3.4090	97.0.00.0 1. 2.	8. 9.17.66.	
54274H	4	2500	3869.41	3.55	9.17	8.15	27.89	48.76	3918.17	1.2444	99.0.00.00.0 1.	7.19.17.57.	
54274J	4	2600	6705.60	9.38	9.26	10.46	35.81	64.90	6770.50	0.9586	99.0.00.00.0 1.	14.14.16.56.	
54274L	4	2700	629.19	5.55	7.60	7.31	23.39	43.85	673.04	6.5152	94. 1. 1. 1. 3.	13.17.17.53.	
54274N	4	2800	59.01	0.99	1.76	0.92	3.12	6.79	65.80	10.3191	89. 2. 3. 1. 5.	15.26.14.45.	
54274P	4	2900	570.74	3.52	7.83	4.94	16.74	33.03	603.77	5.4706	94. 1. 1. 1. 3.	11.24.15.50.	
54274R	4	3000	1164.35	9.25	14.23	6.76	21.96	51.60	1215.95	4.2436	95. 1. 1. 1. 2.	18.28.13.41.	
54275B	4	3100	1940.40	13.30	9.99	6.23	20.49	50.01	1990.41	2.5125	97. 1. 1.0.0 1.	27.20.12.41.	
54275D	4	3200	2487.68	19.49	5.98	0.50	2.04	28.01	2515.69	1.1134	99. 1.0.00.00.0	70.21. 2. 7.	
54275F	4	3300	519.17	2.10	1.37	0.16	0.64	4.27	523.44	0.8156	100.0.00.00.00.0	49.32. 4.15.	
54275H	4	3400	543.50	3.55	3.45	0.70	1.34	9.04	552.54	1.6360	98. 1. 1.0.00.0	39.38. 8.15.	
54275J	4	3500	616.05	4.47	3.11	0.50	1.65	9.73	625.78	1.5548	99. 1.0.00.00.0	46.32. 5.17.	
54275L	4	3600	500.14	2.06	1.37	0.75	2.23	6.41	506.55	1.2653	100.0.00.00.00.0	32.21.12.35.	
54275N	4	3700	1321.68	3.31	3.33	3.49	13.17	23.30	1344.98	1.7323	99.0.00.00.0 1.	14.14.15.57.	
54275P	4	3800	775.45	4.85	3.62	3.18	12.03	23.68	799.13	2.9631	97. 1.0.00.0 2.	20.15.13.52.	
54275R	4	3900	2859.75	12.82	5.65	6.70	22.33	47.50	2907.25	1.6338	99.0.00.00.0 1.	27.12.14.47.	
54276B	4	4000	523.84	6.31	3.21	4.79	17.34	31.65	555.49	5.6976	94. 1. 1. 1. 3.	20.10.15.55.	
54276D	4	4100	1287.50	3.38	3.49	4.51	17.86	29.24	1316.74	2.2206	99.0.00.00.0 1.	12.12.15.61.	
54276F	4	4200	593.85	4.52	3.88	5.29	18.55	32.24	626.09	5.1494	94. 1. 1. 1. 3.	14.12.16.58.	
54276G	4	4250	1143.45	2.61	2.38	2.33	10.37	17.69	1161.14	1.5234	99.0.00.00.0 1.	15.13.13.59.	
54276I	4	4400	1706.70	3.24	3.57	4.52	18.00	29.33	1736.03	1.6895	99.0.00.00.0 1.	11.12.15.62.	
54276K	4	4500	773.08	6.33	4.79	5.67	19.12	35.91	808.99	4.4388	95. 1. 1. 1. 2.	18.13.16.53.	
54276M	4	4600	432.61	1.65	0.96	0.11	0.47	3.19	435.80	0.7319	100.0.00.00.00.0	52.30. 3.15.	
54276O	4	4700	459.54	1.58	1.27	0.12	0.80	3.77	463.31	0.8136	100.0.00.00.00.0	42.34. 3.21.	
54276Q	4	4800	480.01	1.80	2.14	2.62	9.54	16.10	496.11	3.2452	97.0.00.0 1. 2.	11.13.16.60.	
54294A	4	4900	631.79	3.92	4.47	4.44	15.47	28.30	660.09	4.2872	95. 1. 1. 1. 2.	14.16.16.54.	
54294C	4	5000	1695.27	10.10	5.89	3.52	12.46	31.97	1727.24	1.8509	98. 1.0.00.0 1.	32.18.11.39.	
54294D	4	5050	2602.38	15.94	5.04	4.22	9.47	34.67	2637.05	1.3147	99. 1.0.00.00.0	46.15.12.27.	
54294E	4	5100	732.00	3.77	2.31	1.61	5.49	13.18	745.18	1.7686	98. 1.0.00.0 1.	29.18.12.41.	
54294F	4	5150	3997.04	20.54	3.94	2.34	7.46	34.28	4031.32	0.8503	99. 1.0.00.00.0	60.11. 7.22.	
54294G	4	5200	376.17	4.14	1.87	1.04	3.33	10.38	386.55	2.6851	98. 1.0.00.0 1.	40.18.10.32.	
54294H	4	5250	509.27	3.22	1.65	0.96	4.97	10.80	520.07	2.0766	98. 1.0.00.0 1.	30.15. 9.46.	
54294I	4	5300	470.15	1.97	1.10	1.03	4.69	8.79	478.94	1.8352	99.0.00.00.0 1.	22.13.12.53.	
54294J	4	5350	491.74	2.15	1.49	1.61	6.78	12.03	503.77	2.3879	9[illegible].0.00.00.0 1.	18.12.13.57.	
54294K	4	5400	404.26	1.45	1.51	2.12	8.87	13.95	418.21	3.3355	97.0.00.0 1. 2.	10.11.15.64.	
54294L	4	5450	487.12	2.71	2.44	3.05	11.25	19.45	506.57	3.8395	96. 1.0.0 1. 2.	14.13.16.57.	
54294M	4	5500	2568.72	13.59	6.35	7.52	24.96	52.42	2621.14	1.9999	98. 1.0.00.0 1.	26.12.14.48.	
54294N	4	5550	778.83	5.09	2.39	2.87	11.06	21.41	800.24	2.6754	98. 1.0.00.0 1.	24.11.13.52.	
54294O	4	5600	433.11	3.69	2.91	4.47	16.09	27.16	460.27	5.9008	94. 1. 1. 1. 3.	14.11.16.59.	
54294P	4	5650	1249.95	2.69	1.82	3.18	9.74	17.43	1267.38	1.3753	99.0.00.00.0 1.	15.10.18.57.	
54294Q	4	5700	477.35	2.95	3.20	5.89	19.79	31.83	509.18	6.2511	93. 1. 1. 1. 4.	9.10.19.62.	
54294R	4	5750	456.15	3.14	3.74	6.59	22.66	36.13	492.28	7.3392	92. 1. 1. 1. 5.	9.10.18.63.	
54295A	4	5800	568.43	3.40	4.23	7.27	24.02	38.92	607.35	6.4030	93. 1. 1. 1. 4.	9.11.19.61.	
54295B	4	5850	978.62	8.01	5.73	8.24	27.21	49.19	1027.81	4.7858	94. 1. 1. 1. 3.	16.12.17.55.	
54295C	4	5900	1057.92	5.23	4.68	6.81	23.16	39.88	1097.80	3.6327	97.0.00.0 1. 2.	13.12.17.58.	
54295D	4	5950	1013.84	4.20	3.73	5.96	20.66	34.55	1048.39	3.2954	97.0.00.0 1. 2.	12.11.17.60.	
54295E	4	6000	769.09	2.46	2.15	3.72	13.63	21.96	791.05	2.7760	98.0.00.00.0 2.	11.10.17.62.	
54295F	4	6050	1069.08	6.52	2.79	3.90	14.12	27.33	1096.41	2.4926	98. 1.0.00.0 1.	24.10.14.52.	
54295G	4	6100	584.82	0.52	1.48	1.98	8.52	12.50	597.32	2.0927	99.0.00.00.0 1.	4.12.16.68.	
54295H	4	6150	599.32	0.50	1.11	1.22	5.03	7.86	607.18	1.2944	99.0.00.00.0 1.	6.14.16.64.	
54295I	4	6200	623.16	1.95	2.43	2.97	11.37	18.72	641.88	2.9164	98.0.00.00.0 2.	10.13.16.61.	
54295J	4	6250	751.62	4.77	3.87	3.11	12.51	24.26	775.88	3.1267	97. 1.0.00.0 2.	20.16.13.51.	
54295K	4	6300	1202.53	11.66	8.30	5.67	19.81	45.44	1247.97	3.6411	96. 1. 1.0.0 2.	26.18.12.44.	
54295L	4	6350	1343.24	1.22	1.74	1.61	6.63	11.20	1354.44	0.8269	100.0.00.00.00.0	11.16.14.59.	
54295M	4	6400	557.51	3.38	4.34	3.07	9.15	19.94	577.45	3.4530	95. 1. 1. 1. 2.	17.22.15.46.	
54295N	4	6450	1010.30	15.18	9.81	5.27	14.22	44.48	1054.78	4.2169	97. 1. 1.0.0 1.	34.22.12.32.	
54295O	4	6500	827.82	11.34	10.05	5.53	13.79	40.71	868.53	4.6872	95. 1. 1. 1. 2.	28.25.14.33.	
54295P	4	6550	703.77	6.57	7.59	4.40	11.58	30.14	733.91	4.1067	95. 1. 1. 1. 2.	22.25.15.38.	
54295Q	4	6600	906.34	15.10	18.15	7.74	13.71	54.70	961.04	5.6917	94. 2. 2. 1. 1.	28.33.14.25.	
54295R	4	6650	634.07	13.32	35.70	15.15	17.73	81.90	715.97	11.4390	89. 2. 5. 2. 2.	16.44.18.22.	
54296A	4	6700	1280.37	69.11	96.19	33.31	32.12	230.73	1511.10	15.2690	85. 5. 6. 2. 2.	30.42.14.14.	
54296B	4	6750	804.82	52.88	106.81	38.43	34.72	232.84	1037.66	22.4389	78. 5.10. 4. 3.	23.45.17.15.	
54296C	4	6800	898.67	47.48	79.01	25.73	26.75	178.97	1077.64	16.6075	85. 4. 7. 2. 2.	27.44.14.15.	
54296D	4	6850	756.36	38.73	77.75	25.86	30.23	172.57	928.93	18.5772	82. 4. 8. 3. 3.	22.45.15.18.	
54296E	4	6900	603.25	3.99	10.17	4.86	9.07	28.09	631.34	4.4492	95. 1. 2. 1. 1.	14.37.17.32.	
54296F	4	6950	1251.28	40.21	51.83	17.65	23.72	133.41	1384.69	9.6346	90. 3. 4. 1. 2.	30.39.13.18.	
54296G	4	7000	1670.85	5.94	14.18	7.00	12.84	39.96	1710.81	2.3357	98.0.0 1.0.0 1.	15.35.18.32.	
54296H	4	7100	1610.27	47.53	39.94	12.49	21.95	121.91	1732.18	7.0379	93. 3. 2. 1. 1.	39.33.10.18.	
54296I	4	7150	1476.27	76.34	65.05	16.33	22.63	180.35	1656.62	10.8866	89. 5. 4. 1. 1.	42.36. 9.13.	
54296J	4	7200	2541.95	374.45	397.34	114.13	142.19	1028.11	3570.06	28.7981	72.10.11. 3. 4.	36.39.11.14.	
54296K	4	7250	3535.65	543.16	521.92	136.03	171.97	1373.08	4908.73	27.9722	71.11.11. 3. 4.	39.38.10.13.	
54296L	4	7300	3347.40	461.63	466.56	127.21	171.69	1227.09	4574.49	26.8246	73.10.10. 3. 4.	38.38.10.14.	
54296M	4	7350	9320.71	1583.09	1355.50	311.36	386.80	3636.65	12957.36	28.0663	73.12.10. 2. 3.	43.37. 9.11.	
54296N	4	7400	1354.88	50.52	111.61	46.37	79.11	287.61	1642.49	17.5106	82. 3. 7. 3. 5.	18.38.16.28.	
54296O	4	7450	2460.89	632.53	679.98	244.82	309.02	1866.35	4327.24	43.1302	56.15.16. 6. 7.	34.36.13.17.	
54296P	4	7500	3166.52	1010.96	1420.84	411.83	494.92	3338.55	6506.07	51.3144	49.16.22. 6. 8.	30.43.12.15.	
54296Q	4	7550	251.63	93.18	256.83	94.52	138.47	583.00	834.63	69.8513	30.11.31.11.17.	16.44.16.24.	
54296R	4	7750	1590.82	339.28	533.07	123.30	196.92	1192.57	2783.39	42.8459	58.12.19. 4. 7.	28.45.10.17.	
54297A	4	7800	3482.98	560.16	576.63	94.14	156.88	1387.81	4870.79	28.4925	71.12.12. 2. 3.	40.42. 7.11.	
54297B	4	7850	2815.64	655.18	588.28	97.90	139.24	1280.60	4096.24	31.2628	70.11.14. 2. 3.	36.45. 8.11.	
54297C	4	7900	2547.18	984.15	1589.90	365.81	586.82	3526.68	6073.86	58.0632	42.16.26. 6.10.	28.45.10.17.	
54297D	4	7950	2159.68	372.10	656.27	128.29	213.33	1369.99	3529.67	38.8135	60.11.19. 4. 6.	27.48. 9.16.	
54297E	4	8000	1612.67	445.34	744.15	143.99	250.16	1583.64	3196.31	49.5459	50.14.23. 5. 8.	28.47. 9.16.	
54297F	4	8050	1316.58	337.89	541.77	110.44	199.99	1190.09	2506.67	47.4769	53.13.22. 4. 8.	28.46. 9.17.	
54297G	4	8100	623.82	11.10	69.07	26.94	56.03	163.14	786.96	20.7303	80. 1. 9. 3. 7.	7.42.17.34.	
54297H	4	8150	1031.71	265.84	372.86	61.81	104.76	805.27	1836.98	43.8366	57.14.20. 3. 6.	33.46. 8.13.	
54297I	4	8200	1610.34	340.44	632.73	124.32	247.02	1344.51	2954.85	45.5018	55.12.21. 4. 8.	25.48. 9.18.	
54297J	4	8250	1672.98	409.70	687.70	116.53	223.81	1437.74	3110.72	46.2189	54.13.22. 4. 7.	28.48. 8.16.	
54297K	4	8300	2329.08	663.82	1141.97	217.41	423.32	2446.52	4776.60	51.2189	49.14.24. 5. 9.	27.47. 9.17.	
54346A	4	8350	2261.85	554.21	999.12	225.55	424.55	2203.43	4465.28	49.3458	51.12.22. 5.10.	25.46.10.19.	
54346B	4	8400	1854.62	455.22	973.65	255.76	468.15	2152.78	4006.40	53.7335	46.11.24. 6.12.	21.45.12.22.	
54346C	4	8450	1528.54	432.59	940.15	224.73	416.69	2014.16	3542.70	56.8538	43.12.27. 6.12.	21.47.11.21.	
54346D	4	8500	879.36	71.24	122.95	25.17	44.96	264.32	1143.68	23.1113	77. 6.11. 2. 4.	27.46.10.17.	
54346E	4	8550	1486.31	219.38	272.66	46.11	74.42	612.57	2098.88	29.1855	71.10.13. 2. 4.	36.44. 8.12.	
54346F	4	8600	864.17	52.59	86.54	16.06	27.41	182.60	1046.77	17.4440	82. 5. 8. 2. 3.	29.47. 9.15.	
54346G	4	8700	1771.53	519.17	785.19	151.83	250.68	1706.87	3478.40	49.0705	51.15.23. 4. 7.	30.46. 9.15.	
54346H	4	8750	2728.76	855.55	1301.01	283.48	457.38	2897.42	5626.18	51.4989	49.15.23. 5. 8.	30.44.10.16.	
54346I	4	8800	2494.99	762.86	1156.52	227.39	352.33	2499.10	4994.09	50.0412	50.15.23. 5. 7.	31.46. 9.14.	
54346J	4	8850	2308.71	531.44	670.58	131.90	181.75	1515.67	3824.38	39.6318	60.14.18. 3. 5.	35.44. 9.12.	
54346K	4	8900	3005.08	893.37	1120.63	194.38	301.83	2510.21	5515.29	45.5136	55.16.20. 4. 5.	36.44. 8.12.	
54346K	4	0	2136.44	659.23	949.85	160.40	281.40	2050.88	4187.32	48.9783	50.16.23. 4. 7.	32.46. 8.14.	
54346L	4	8950	1610.37	430.66	596.60	109.85	182.90	1320.01	2930.38	45.0457	55.15.20. 4. 6.	33.45. 8.14.	
54346M	4	9000	1633.00	554.10	713.90	106.82	162.80	1537.62	3170.62	48.4958	52.17.23. 3. 5.	36.46. 7.11.	
54346N	4	9050	1048.93	241.53	365.73	54.40	86.29	747.95	1796.88	41.6249	59.13.20. 3. 5.	32.49. 7.12.	
54346O	4	9100	1121.92	212.96	255.20	39.71	59.08	566.95	1688.87	33.5697	67.13.15. 2. 3.	38.45. 7.10.	
54346P	4	9150	2118.00	103.37	149.20	24.37	37.22	314.16	2432.16	12.9169	87. 4. 6. 1. 2.	33.47. 8.12.	
54346Q	4	9200	1417.60	460.39	663.63	93.59	154.01	1371.62	2789.22	49.1757	50.17.24. 3. 6.	34.48. 7.11.	
54346R	4	9250	2105.95	94.99	194.28	38.28	64.45	392.00	2497.95	15.6928	83. 4. 8. 2. 3.	24.50.10.16.	
54347A	4	9300	630.64	35.75	117.68	29.80	56.17	239.40	870.04	27.5159	73. 4.14. 3. 6.	15.50.12.23.	
54347B	4	9350	718.69	50.13	85.53	15.94	32.22	183.82	902.51	20.3676	79. 6. 9. 2. 4.	27.46. 9.18.	
54347C	4	9400	725.95	79.54	123.89	18.23	30.10	251.76	977.71	25.7499	74. 8.13. 2. 3.	32.49. 7.12.	
54347D	4	9450	875.79	70.95	98.55	19.87	30.01	219.38	1095.17	20.0315	80. 6. 9. 2. 3.	32.45. 9.14.	
54347E	4	9500	1832.73	50.84	61.06	16.39	23.54	151.83	1984.56	7.6505	92. 3. 3. 1. 1.	33.40.11.16.	
54347F	4	9550	1016.02	61.44	69.88	13.85	19.26	164.43	1180.45	13.9294	86. 5. 6. 1. 2.	37.43. 8.12.	
54347G	4	9600	831.35	24.06	29.96	9.31	11.70	75.03	906.38	8.2779	92. 3. 3. 1. 1.	32.40.12.16.	
54347H	4	9650	3929.70	31.65	34.85	14.14	23.59	104.23	4033.93	2.5838	97. 1. 1.0.0 1.	30.33.14.23.	
54347I	4	9700	718.24	8.08	11.56	6.20	8.30	34.14	752.38	4.5375	95. 1. 2. 1. 1.	24.34.18.24.	
54347J	4	9750	799.36	44.93	57.90	12.29	20.40	135.52	934.88	14.4959	86. 5. 6. 1. 2.	33.43. 9.15.	
54347K	4	9800	1063.58	220.96	315.24	43.93	77.64	657.77	1721.35	38.2124	61.13.18. 3. 5.	34.47. 7.12.	
54347L	4	9850	919.16	121.33	178.89	30.48	52.84	383.54	1302.70	29.4419	71. 9.14. 2. 4.	32.46. 8.14.	
54347M	4	9900	1156.70	199.38	245.72	38.33	66.57	550.00	1706.70	32.2259	68.12.14. 2. 4.	36.45. 7.12.	
54347N	4	9950	748.98	20.29	29.81	8.09	12.41	70.60	819.58	8.6141	91. 2. 4. 1. 2.	29.42.11.18.	
54347O	4	10000	837.18	103.49	137.17	22.53	36.67	299.86	1137.04	26.3719	74. 9.12. 2. 3.	35.45. 8.12.	
54347P	4	10050	825.53	176.24	230.37	33.76	56.79	497.16	1322.69	37.5870	63.13.17. 3. 4.	35.47. 7.11.	
54347Q	4	10100	894.98	27.22	39.51	7.87	14.30	88.90	983.88	9.0356	91. 3. 4. 1. 1.	31.44. 9.16.	
54347R	4	10150	1890.49	11.67	20.03	6.55	11.33	49.58	1940.07	2.5555	97. 1. 1.0.0 1.	24.40.13.23.	
54348A	4	10200	766.88	61.07	89.92	15.53	25.58	192.10	958.98	20.0316	80. 6. 9. 2. 3.	32.47. 8.13.	
54348B	4	10250	2047.69	20.94	30.85	7.82	10.20	69.81	2117.50	3.2968	98. 1. 1.0.00.0	30.44.11.15.	
54348C	4	10300	780.27	15.81	24.63	8.40	10.88	59.72	839.99	7.1095	93. 2. 3. 1. 1.	26.42.14.18.	
54348D	4	10350	1586.25	28.59	40.11	8.76	11.83	89.29	1675.54	5.3290	94. 2. 2. 1. 1.	32.45.10.13.	
54348E	4	10400	659.08	27.76	31.76	8.54	12.06	80.12	739.20	10.8387	89. 4. 4. 1. 2.	35.39.11.15.	

TABLE II

Sample Descriptions and Results of Total Organic and Visual Kerogen Analyses - Esso 16/1-1 Well Norway
(Lithologic descriptions by R. E. Hukill; kerogen by J. L. Morgan)

Sample Depth (Feet)	EPR No.	Gross Lithology of Analyzed Cuttings Chips	GSA Color Code	Total Organic Matter-%	Kerogen Alteration Index	Types of Kerogen Materials*		
						Predominant	Secondary	Other
3200-3250	54275-D	Claystone; mod.silty;tr. pyrite; tr.glauconite; tr. mica	5Y3/1	1.53	2	P	A, W	C
4000-4050	54276-B	Claystone; silty; tr. glauconite; tr. mica	5Y4/1	1.89	2		A, W	P
6000-6050	54295-E	Shale; tr.silt; tr.pyrite; tr.microfossils;sl.calcareous	5Y4/1	0.98	2	H	A, C	W, P
7350-7400	54296-M	Shale; mod.silty;tr.pyrite; tr.mica	5Y3/1	2.43	1+	H	C	W
7900-7950	54297-C	Shale; tr.pyrite; tr.microfossils;tr.silt;sl.calcareous	5GY6/1	0.61	2	C	W	H
8300-8350	-K	Shale; tr.pyrite; tr.silt;	5Y2/1	1.51	2	W	H	C
9000-9050	54346-M	Shale; tr.silt; tr. pyrite; tr. glauconite; tr. mica	5Y2/1	0.69	2+	C	W	A, H
9650-9700	54347-H	Limestone; sl. sandy	5Y7/1	1.00				
10000-10050	O	Shale; tr. silt; tr. pyrite; tr. sand;	5Y2/1	0.78	2+	C	H	W
10300-10350	54348-C	Shale; tr. pyrite; sl. calcareous	5Y3/1	0.98	2		H, C	W

*A - Amorphous
Al- Algal debris
H - Herbaceous
W - Woody
C - Coaly
F - Finely disseminated material
P - Plankton

TABLE III

Results of Chemical Analyses of Selected Cuttings Chips - Esso 16/1-1 Well Norway

(Hydrocarbon analyses by H. M. Fry)

Sample Depth (Feet)	EPR No.	Lithology (See Table II)	Total Organic Matter-%	Total C_4-C_7 Hydrocarbons ppm	Cyclohexane Methylcyclopentane
3200-3250	54275-D	Claystone	1.53	Trace	-
4000-4050	54276-B	Claystone	1.89	Trace	-
6000-6050	54295-D	Shale	.98	-	-
7350-7400	54296-M	Shale	2.43	3.3	0.4
7900-7950	54297-C	Shale	.61	.1	1.0
8300-8350	-K	Shale	1.51	1.4	1.1
9000-9050	54346-M	Shale	.69	1.3	0.9
9650-9700	54347-H	Limestone	1.00	.2	-
10000-10050	-O	Shale	.78	.3	2.0
10300-10350	54348-C	Shale	0.98	Trace	-