

OILFIELD RESEARCH LABORATORIES

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- REGISTERED ENGINEERS -

Chanute, Kansas

April 29, 1961

536 N. HIGHLAND
CHANUTE, KANSAS
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Union Texas Natural Gas Corporation
& Layton Oil Company
P.O. Box 263
Independence, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Mealy Lease, Well No. 5-C, Allen County, Kansas, and submitted to our laboratory by Mr. Bob Cozad on April 21, 1961.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman
Benjamin R. Pearman

BRP:db

5 c.

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Union Texas Natural Gas Corp.
& Layton Oil Company Lease Mealy Well No. 5-C

Location SE NW NW

Section 11 Twp 24S Rge. 18E County Allen State Kansas

Name of Sand - - - - - Bartlesville

Top of Core - - - - - 864.0

Bottom of Core - - - - - 914.0

Top of Sand - - - - - 864.2

Bottom of Sand - - - - - 914.0

Total Feet of Permeable Sand - - - - - 48.8

Total Feet of Floodable Sand - - - - - 36.4

Distribution of Permeable Sand:
 Permeability Range
 Millidarcys

Feet

Cum. Ft.

0 - 1000	5.1	5.1
1000 - 2000	16.9	22.0
2000 - 3000	15.7	37.7
3000 - 4000	11.1	48.8

Average Permeability Millidarcys - - - - - 2180.

Average Percent Porosity - - - - - 25.4

Average Percent Oil Saturation - - - - - 40.1

Average Percent Water Saturation - - - - - 23.4

Average Oil Content, Bbls./A. Ft. - - - - - 795.

Total Oil Content, Bbls./Acre - - - - - 38,808.

Average Percent Oil Recovery by Laboratory Flooding Tests - - - - - 13.0

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - - 259.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - - 9,431.

Total Calculated Oil Recovery, Bbls./Acre - - - - - 13,550.

Packer Setting, Feet - - - - -

Viscosity, Centipoises @ - - - - -

A. P. I. Gravity, degrees @ 60 °F - - - - -

Elevation, Feet - - - - -

This core was taken with a rotary core barrel. The core was sampled and the samples sealed in plastic bags by a representative of the client. The well was drilled in non-virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
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864.0 - 864.2	- Sandy shale.
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864.2 - 866.9	- Soft dark brown slightly laminated shaley sandstone.
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866.9 - 870.0	- Soft dark brown sandstone.
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870.0 - 870.3	- Shaley limestone.
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870.3 - 886.0	- Soft brown sandstone.
---------------	-------------------------

886.0 - 886.7	- Shaley limestone.
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886.7 - 913.0	- Soft dark brown sandstone.
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913.0 - 914.0	- Dark carbonaceous sandstone.
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Coring was started at a depth of 864.0 feet in sandy shale and completed at 914.0 feet in carbonaceous sandstone. This core shows a total of 48.8 feet of sandstone. For the most part, the pay is made up of soft brown to dark brown sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into four sections. The weighted average permeability of the sections is 733, 2,713, 2,195 and 1,380 millidarcys; the overall average being 2,180 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a rather irregular permeability profile. The permeability of the sand varies from 33 to a maximum of 3,920 millidarcys. Vertical permeability was determined on three samples. The results of these tests are shown on Table 1-B.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly good weighted average percent oil saturation, namely, 40.1. The weighted average percent oil saturation of the sections is 27.6, 51.4, 40.3 and 19.7. The weighted average percent water saturation of the sections is 17.6, 8.6, 20.4 and 59.4; while that of the pay sand is 12.7, the overall average being 23.4 (See Table III). This gives an overall weighted average total fluid saturation of 63.5 percent. This low total fluid saturation indicates considerable fluid was lost during coring most of which was probably oil.

The weighted average oil content of the sections is 462, 1,026, 824 and 370 barrels per acre foot; the overall average being 795. The total oil content, as shown by this core, is 38,808 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded rather well to laboratory flooding tests, as a total recovery of 9,431 barrels of oil per acre was obtained from 36.4 feet of sand. The weighted average percent oil saturation was reduced from 47.2 to 34.2, or represents an average recovery of 13.0 percent. The weighted average effective permeability of the samples is 47.90 millidarcys, while the average initial fluid production pressure is 7.4 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 49 samples tested, all produced water and 37 oil. This indicates that approximately 75 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a very good and more or less uniform effective permeability to water.

CONCLUSION

Based on the results of the laboratory tests, it appears that approximately 13,550 barrels of oil per acre could be recovered from the area in

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the vicinity of this well by efficient water flooding methods. This represents an average recovery of 372 barrels per acre foot from the 36.4 feet of floodable sand analyzed in this core.

The above recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.04
Present formation volume factor	1.01
Average reservoir water saturation, percent	12.0
Primary recovery, estimated, percent	4.0
Average porosity, percent	25.6
Abandonment oil saturation, percent	34.2
Performance factor, percent	40.0
Net floodable pay sand, feet	36.4

This core indicates a reservoir having a high oil saturation, a low water saturation and good effective permeability to water.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Union Texas Natural Gas Corp.
& Layton Oil Company

Lease

Mealy

Well No.

5-C

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation		Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water			Ft.	Cum. Ft.		
1	864.6	20.5	38	18	604	33.	0.9	0.9	544	29.70
2	865.6	24.8	13	16	250	1860.	1.0	1.9	250	1860.00
3	866.6	21.6	34	19	569	111.	0.8	2.7	455	88.80
4	867.3	24.2	47	18	887	1775.	0.9	3.6	800	1597.50
5	868.3	25.0	48	13	930	2280.	1.0	4.6	930	2280.00
6	869.4	26.2	52	7	1,059	3340.	1.2	5.8	1,270	4008.00
7	870.7	28.6	49	14	1,089	1600.	0.9	6.7	980	1440.00
8	871.7	24.1	56	7	1,049	2220.	0.8	7.5	839	1776.00
9	872.2	26.9	51	4	1,062	1390.	0.7	8.2	745	973.00
10	873.1	24.9	54	8	1,043	3200.	0.9	9.1	940	2880.00
11	874.2	25.5	55	8	1,088	2710.	1.0	10.1	1,088	2710.00
12	875.1	24.8	58	7	1,116	2960.	1.0	11.1	1,116	2960.00
13	876.1	27.2	54	12	1,139	3820.	1.0	12.1	1,139	3820.00
14	877.1	26.0	53	13	1,069	2960.	1.0	13.1	1,069	2960.00
15	878.1	25.9	45	11	904	1495.	1.0	14.1	904	1495.00
16	879.1	27.8	54	6	1,165	1480.	1.0	15.1	1,165	1480.00
17	880.1	25.6	50	7	992	2760.	1.0	16.1	992	2760.00
18	881.1	25.4	52	8	1,023	3560.	1.0	17.1	1,023	3560.00
19	882.1	24.0	45	10	837	3900.	1.0	18.1	837	3900.00
20	883.1	26.2	54	6	1,099	3140.	1.0	19.1	1,099	3140.00
21	884.1	26.6	52	6	1,072	2590.	1.0	20.1	1,072	2590.00
22	885.1	26.8	50	8	1,039	2840.	0.9	21.0	935	2556.00
23	885.8	27.0	50	7	1,048	1980.	0.5	21.5	524	990.00
24	887.1	24.9	54	9	1,042	1220.	0.9	22.4	940	1098.00
25	888.1	25.6	48	8	952	3560.	1.0	23.4	952	3560.00
26	889.1	25.8	50	8	1,000	3520.	1.0	24.4	1,000	3520.00
27	890.1	22.7	51	4	897	2270.	1.0	25.4	897	2270.00
28	891.1	26.6	50	5	1,030	3920.	1.0	26.4	1,030	3920.00
29	892.6	26.4	44	14	901	1390.	2.0	28.4	1,802	2780.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Union Texas Natural Gas Corp.

& Layton Oil Company

Lease

Mealy

Well No.

5-C

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation		Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water			Ft.	Cum. Ft.		
30	894.1	26.2	37	17	751	2720.	1.0	29.4	751	2720.00
31	895.1	25.3	39	14	765	2770.	1.0	30.4	765	2770.00
32	896.1	27.6	44	18	941	2980.	1.0	31.4	941	2980.00
33	897.1	26.8	40	18	831	3200.	1.0	32.4	831	3200.00
34	898.1	27.2	43	17	907	1770.	1.0	33.4	907	1770.00
35	899.1	26.6	41	22	845	2570.	1.0	34.4	845	2570.00
36	900.1	26.3	35	26	714	1670.	1.0	35.4	714	1670.00
37	901.1	24.9	38	31	733	1530.	1.0	36.4	733	1530.00
38	902.1	25.9	38	34	763	2160.	1.0	37.4	763	2160.00
39	903.1	25.5	21	55	415	1390.	1.0	38.4	415	1390.00
40	904.1	26.9	18	55	376	2010.	1.0	39.4	376	2010.00
41	905.1	26.0	17	63	342	3130.	1.0	40.4	342	3130.00
42	906.1	26.1	17	63	344	2900.	1.0	41.4	344	2900.00
43	907.1	24.2	20	65	375	1030.	1.0	42.4	375	1030.00
44	908.1	24.5	17	72	323	1490.	1.0	43.4	323	1490.00
45	909.1	24.8	16	66	308	1140.	1.0	44.4	308	1140.00
46	910.1	23.8	12	75	221	1390.	1.0	45.4	221	1390.00
47	911.1	21.2	11	77	181	750.	1.0	46.4	181	750.00
48	912.1	23.8	20	41	369	245.	1.4	47.8	516	343.00
49	913.1	22.5	47	19	820	135.	1.0	48.8	820	135.00
VERTICAL PERMEABILITY										
	865.8					14.				
	867.1					190.				
	870.1					Imp.				

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Union Texas Natural Gas Corp.
& Layton Oil Company

Lease

Mealy

Well No. 5-C

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
864.2 - 866.9	2.7	733.	1,978.50
866.9 - 891.6	23.7	2713.	64,243.50
891.6 - 902.6	11.0	2195.	24,150.00
902.6 - 914.0	11.4	1380.	15,708.00
864.2 - 914.0	48.8	2180.	106,080.00

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
864.2 - 866.9	2.7	22.4	27.6	17.6	462	1,249
866.9 - 891.6	23.7	25.8	51.4	8.6	1,026	24,286
891.6 - 902.6	11.0	26.3	40.3	20.4	824	9,052
902.6 - 914.0	11.4	24.4	19.7	59.4	370	4,221
864.2 - 914.0	48.8	25.4	40.1	23.4	795	38,808

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Union Texas Natural Gas Corp.
& Layton Oil Company

Lease

Mealy

Well No.

5-C

Sample No.	Depth, Feet	Original Oil Saturation		Oil Recovery		Residual Saturation		Volume of Water Recovered cc*	Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
		%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water			
1	864.6	38	616	2	32	36	37	111	6.14	10
2	865.6	15	285	0	0	15	62	62	4.57	15
3	866.6	34	561	4	66	30	54	403	44.25	15
4	867.3	47	875	16	298	31	61	465	55.70	10
5	868.3	48	938	12	234	36	43	286	33.70	5
6	869.4	52	1,049	13	262	39	44	263	34.95	5
7	870.7	49	1,071	15	328	34	48	183	32.40	5
8	871.7	56	1,064	20	380	36	51	523	86.20	5
9	872.2	51	1,043	16	327	35	44	169	38.25	5
10	873.1	54	1,050	18	350	36	48	257	39.95	5
11	874.2	55	1,067	13	252	42	50	216	32.50	5
12	875.1	58	1,142	20	394	38	44	206	53.30	5
13	876.1	54	1,122	21	436	33	55	669	110.00	5
14	877.1	53	1,090	13	267	40	45	171	43.30	5
15	878.1	45	904	13	261	32	49	408	62.40	5
16	879.1	54	1,148	24	510	30	54	439	67.50	5
17	880.1	50	1,003	17	341	33	45	154	34.65	5
18	881.1	52	1,017	18	352	34	51	247	51.20	5
19	882.1	45	824	14	256	31	52	250	35.00	5
20	883.1	54	1,097	20	406	34	53	253	51.20	5
21	884.1	52	1,069	18	370	34	53	493	80.00	5
22	885.1	50	1,042	15	313	35	59	408	36.20	5
23	885.8	50	1,031	19	392	31	49	179	34.30	5
24	887.1	54	1,021	21	397	33	49	172	20.00	5
25	888.1	48	938	19	371	29	52	411	44.30	10
26	889.1	50	988	17	336	33	55	296	61.40	10

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

**—Determined by passing water through sample which still contains residual oil.

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Union Texas Natural Gas Corp.
& Layton Oil Company

Lease Mealy

Well No. 5-C

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation		Volume of Water Recovered cc*	Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbbls./A. Ft.	%	Bbbls./A. Ft.	% Oil	% Water			
27	890.1	22.9	51	905	15	266	36	44	387	67.50	2
28	891.1	26.3	50	1,020	17	347	33	54	303	61.00	10
29	892.6	26.1	44	890	9	182	35	49	171	18.30	15
30	894.1	25.7	37	737	7	140	30	51	125	41.60	10
31	895.1	25.0	39	756	5	97	34	52	370	53.90	10
32	896.1	27.2	44	928	12	253	32	63	296	28.30	10
33	897.1	26.2	40	812	5	102	35	53	120	39.95	10
34	898.1	27.0	43	900	9	189	34	53	245	50.00	10
35	899.1	26.3	41	836	6	122	35	53	135	22.00	15
36	900.1	26.3	35	713	2	41	33	57	648	117.50	10
37	901.1	24.9	38	734	2	39	36	59	169	18.55	10
38	902.1	26.0	38	766	2	40	36	53	244	81.20	5
39	903.1	25.4	22	433	0	0	22	68	160	65.00	5
40	904.1	26.4	20	409	0	0	20	70	398	80.00	5
41	905.1	26.3	18	367	0	0	18	62	120	125.00	2
42	906.1	26.0	16	322	0	0	16	74	359	62.40	2
43	907.1	24.0	20	372	0	0	20	67	246	33.00	2
44	908.1	24.2	16	300	0	0	16	76	200	49.90	2
45	909.1	24.5	18	342	0	0	18	68	140	33.30	2
46	910.1	23.6	14	256	0	0	14	73	207	37.90	2
47	911.1	21.5	13	217	0	0	13	77	295	147.40	2
48	912.1	23.4	23	418	0	0	23	65	122	14.30	15
49	913.1	22.4	50	869	0	0	50	31	6	0.600	50

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

**—Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Union Texas Natural Gas Corp. & Layton Oil Company		Lease	Mealy	Well No.
				5-C
Depth Interval, Feet	864.2 - 891.6	891.6 - 902.6	864.2 - 902.6	
Feet of Core Analyzed	25.4	11.0	36.4	
Average Percent Porosity	25.3	26.1	25.6	
Average Percent Original Oil Saturation	50.3	40.3	47.2	
Average Percent Oil Recovery	15.9	6.2	13.0	
Average Percent Residual Oil Saturation	34.4	34.1	34.2	
Average Percent Residual Water Saturation	49.8	53.9	51.0	
Average Percent Total Residual Fluid Saturation	84.2	88.0	85.2	
Average Original Oil Content, Bbls./A. Ft.	991.	815.	939.	
Average Oil Recovery, Bbls./A. Ft.	316.	126.	259.	
Average Residual Oil Content, Bbls./A. Ft.	675.	689.	680.	
Total Original Oil Content, Bbls./Acre	25,184.	8,962.	34,146.	
Total Oil Recovery, Bbls./Acre	8,044.	1,387.	9,431.	
Total Residual Oil Content, Bbls./Acre	17,140.	7,575.	24,715.	
Average Effective Permeability, Millidarcys	49.40	44.50	47.90	
Average Initial Fluid Production Pressure, p.s.i.	6.2	10.5	7.4	

NOTE: Only those samples which recovered oil were used in calculating the above averages.