OILFIELD RESEARCH LABORATORIES
536 NORTH HIGHLAND - CHANUTE, KANSAS - PHONE HE1-2650

January 18, 1967

CRA, Incorporated
P.O. Box 98
Wellington, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core samples taken from the Humphrey Lease, Well No. CT-1, Bourbon County, Kansas, and submitted to our laboratory on January 12, 1967.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

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BRP:rf

3 c. - Wellington, Kansas
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Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company CRA, Inc. Lease Humphrey Well No. CT-1

Location 330' NSL & 330' WEL, SW¼

Section 36 Twp. 24S Rge. 21E County Bourbon State Kansas

Name of Sand	Bartlesville
Top of Core (Received)	625.5
Bottom of Core (Received)	671.0
Top of Sand (Received)	625.5
Bottom of Sand (Received)	671.0
Total Feet of Permeable Sand	16.0
Total Feet of Floodable Sand	11.0

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	6.0	6.0
10 - 20	4.0	10.0
20 - 50	4.0	14.0
50 & above	2.0	16.0

Average Permeability Millidarcys	26.2
Average Percent Porosity	18.4
Average Percent Oil Saturation	38.6
Average Percent Water Saturation	37.6
Average Oil Content, Bbls./A. Ft.	545.
Total Oil Content, Bbls./Acre	8,725.
Average Percent Oil Recovery by Laboratory Flooding Tests	6.5
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	97.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,057.
Total Calculated Oil Recovery, Bbls./Acre - (Primary & Secondary)	3,180.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	1030.

Fresh water mud was used as the circulating fluid while taking this core. The core was sampled and the samples, sealed in plastic bags, were submitted to the laboratory by a representative of the client. The well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
625.5 - 629.5	Light brown, slightly shaly sandstone.
629.5 - 630.5	Core not received.
630.5 - 635.5	Light brown, slightly shaly sandstone.
635.5 - 664.0	Core not received.
664.0 - 666.0	Light brown, slightly shaly sandstone.
666.0 - 668.0	Brown, slightly shaly, slightly carbonaceous sandstone.
668.0 - 671.0	Gray and light brown, laminated, shaly sandstone.

The pay is made up of light brown, slighlty shaly sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections is 37.7 and 11.6 millidarcys respectively; the overall average being 26.2 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a fairly uniform permeability profile. The permeability of the sand varies from 0.26 to a maximum of 89. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil

saturation, namely, 38.6. The weighted average percent oil saturation of the upper and lower sections is 34.4 and 44.0 respectively. The weighted average percent water saturation of the upper and lower sections is 38.0 and 37.2 respectively; the overall average being 37.6 (See Table III). This gives an overall weighted average total fluid saturation of 76.2 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 upper and lower sections is 520 and 576 barrels per acre foot respectively; the overall average being 545. The total oil content, as shown by this core, is 8,725 barrels per acre of which 5,749 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,057 barrels of oil per acre was obtained from 11.0 feet of sand. The weighted average percent oil saturation was reduced from 35.3 to 28.8, or represents an average recovery of 6.5 percent. The weighted average effective permeability of the samples is 2.60 millidarcys, while the average initial fluid production pressure is 28.2 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 16 samples tested, 11 produced water and oil. This indicates that approximately 69 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in effective permeability to water.

CONCLUSION

The results of the laboratory tests indicate that efficient primary and secondary operations in the vicinity of this well should recover approximately 3,180 barrels of oil per acre or an average of 289 barrels per acre foot from the 11.0 feet of floodable pay sand analyzed in this core. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.06
Reservoir water saturation, percent	30.0
Average porosity, percent	19.2
Oil saturation after flooding, percent	28.8
Performance factor, percent	50.0
Net floodable pay sand, feet	11.0

This core shows a pay sand section having a good oil saturation, a moderate water saturation and a wide variation in effective permeability to water.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company CRA, Inc. Lease Humphrey Well No. CT-1

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	Total			Ft.	Cum. Ft.		
1	626.0	18.6	35	32	67	504	10.	1.0	1.0	504	10.00
2	627.0	18.6	31	31	62	446	15.	1.0	2.0	446	15.00
3	628.0	18.0	42	42	84	586	14.	1.0	3.0	586	14.00
4	629.0	19.1	32	40	72	474	11.	1.0	4.0	474	11.00
5	631.0	19.2	37	37	74	550	38.	1.0	5.0	550	38.00
6	632.0	21.1	34	34	68	556	89.	1.0	6.0	556	89.00
7	633.0	20.5	31	41	72	492	39.	1.0	7.0	492	39.00
8	634.0	20.4	34	43	77	537	78.	1.0	8.0	537	78.00
9	635.0	21.1	33	42	75	540	45.	1.0	9.0	540	45.00
10	664.5	17.1	37	38	75	491	10.	1.0	10.0	491	10.00
11	665.5	16.2	42	42	84	528	43.	1.0	11.0	528	43.00
12	666.5	17.2	62	24	86	826	4.2	1.0	12.0	826	4.20
13	667.5	18.4	39	33	72	556	19.	1.0	13.0	556	19.00
14	668.5	17.2	46	39	85	614	2.3	1.0	14.0	614	2.30
15	669.5	17.3	50	36	86	670	2.4	1.0	15.0	670	2.40
16	670.5	14.3	32	48	80	355	0.26	1.0	16.0	355	0.26
								Total	------	8,725	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company CRA, Inc. Lease Humphrey Well No. CT-1

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
625.5 - 635.5	9.0	37.7	339.00
664.0 - 671.0	7.0	11.6	81.16
625.5 - 671.0	16.0	26.2	420.16

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
625.5 - 635.5	9.0	19.6	34.4	38.0	520	4,685
664.0 - 671.0	7.0	16.8	44.0	37.2	576	4,040
625.5 - 671.0	16.0	18.4	38.6	37.6	545	8,725

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company CRA, Inc. Lease Humphrey Well No. CT-1

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.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	626.0	18.2	35	494	6	85	29	53	409	23	0.400	40
2	627.0	18.2	31	437	3	42	28	56	395	18	0.500	40
3	628.0	18.5	42	602	12	172	30	64	430	54	1.10	30
4	629.0	19.5	32	484	6	91	26	60	393	83	1.80	20
5	631.0	19.6	37	561	6	91	31	67	470	230	6.00	20
6	632.0	20.8	34	549	10	161	24	65	388	116	2.40	20
7	633.0	20.9	31	501	4	65	27	67	436	250	6.00	20
8	634.0	20.7	34	546	6	96	28	69	450	360	8.50	20
9	635.0	20.8	33	532	6	97	27	65	435	43	1.00	30
10	664.5	17.4	37	499	3	40	34	57	459	13	0.300	40
11	665.5	16.7	42	544	9	117	33	59	427	30	0.600	30
12	666.5	17.0	63	831	0	0	63	26	831	0	Imp.	-
13	667.5	18.0	39	544	0	0	39	35	544	0	Imp.	-
14	668.5	17.2	46	613	0	0	46	40	613	0	Imp.	-
15	669.5	17.2	52	693	0	0	52	37	693	0	Imp.	-
16	670.5	14.4	32	357	0	0	32	51	357	0	Imp.	-

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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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company CRA, Inc. Lease Humphrey Well No. CT-1

Depth Interval, Feet	625.5 - 635.5	664.0 - 671.0	625.5 - 671.0
Feet of Core Analyzed	9.0	2.0	11.0
Average Percent Porosity	19.7	17.1	19.2
Average Percent Original Oil Saturation	34.4	39.5	35.3
Average Percent Oil Recovery	6.6	6.0	6.5
Average Percent Residual Oil Saturation	27.8	33.5	28.8
Average Percent Residual Water Saturation	63.0	58.0	62.0
Average Percent Total Residual Fluid Saturation	90.8	91.5	90.8
Average Original Oil Content, Bbls./A. Ft.	524.	522.	523.
Average Oil Recovery, Bbls./A. Ft.	100.	79.	97.
Average Residual Oil Content, Bbls./A. Ft.	424.	443.	426.
Total Original Oil Content, Bbls./Acre	4,706.	1,043.	5,749.
Total Oil Recovery, Bbls./Acre	900.	157.	1,057.
Total Residual Oil Content, Bbls./Acre	3,806.	886.	4,692.
Average Effective Permeability, Millidarcys	3.08	0.450	2.60
Average Initial Fluid Production Pressure, p.s.i.	26.7	35.0	28.2

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