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

August 23, 1966

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

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Lormor Lease, Well No. 1, Bourbon County, Kansas, and submitted to our laboratory on August 18, 1966.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

BRP:rf

3 c. - Wellington, Kansas
1 c. - Muskogee, Oklahoma
1 c. - Roy Wood

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company CRA, Incorporated Lease Lormor Well No. 1

Location 150' EWL & 400' NSL, SE¼

Section 1 Twp. 25S Rge. 21E County Bourbon State Kansas

Name of Sand	Bartlesville
Top of Core	658.0
Bottom of Core	700.6
Top of Sand	658.8
Bottom of Sand	699.5
Total Feet of Permeable Sand	35.2
Total Feet of Floodable Sand	13.4

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	13.3	13.3
5 - 10	5.0	18.3
10 - 50	11.3	29.6
50 - 100	3.6	33.2
100 & above	2.0	35.2

Average Permeability Millidarcys	26.6
Average Percent Porosity	18.5
Average Percent Oil Saturation	38.0
Average Percent Water Saturation	42.1
Average Oil Content, Bbls./A. Ft.	549.
Total Oil Content, Bbls./Acre	19,884.
Average Percent Oil Recovery by Laboratory Flooding Tests	11.3
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	180.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,410.
Total Calculated Oil Recovery, Bbls./Acre - (Primary & Secondary)	4,380.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Fresh water mud was used as the circulating fluid while taking this core. The core was sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories. The well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
658.0 - 658.8	Sandy shale.
658.8 - 661.0	Light brown, slightly shaly sandstone.
661.0 - 661.3	Sandy shale.
661.3 - 665.6	Light brown, shaly sandstone.
665.6 - 669.6	Brown, laminated, slightly shaly sandstone.
669.6 - 671.0	Sandy shale.
671.0 - 673.6	Brown, slightly shaly sandstone with a vertical fracture from 673.0 to 673.6.
673.6 - 677.0	Brown, laminated, shaly sandstone with a vertical fracture.
677.0 - 679.8	Laminated sandstone and shale with a vertical fracture from 677.0 to 677.8.
679.8 - 682.0	Brown, slightly shaly sandstone.
682.0 - 684.6	Brown to dark, carbonaceous sandstone.
684.6 - 692.6	Dark carbonaceous sandstone.
692.6 - 696.6	Dark carbonaceous, slightly calcareous sandstone.
696.6 - 699.5	Dark carbonaceous, conglomeratic sandstone.
699.5 - 700.6	Shale.

Coring was started at a depth of 658.0 feet in sandy shale and completed at 700.6 feet in shale. For the most part, the pay is made

up of brown, laminated, 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 40.8 and 5.0 millidarcys respectively; the overall average being 26.6 (See Table III). By observing the data given on the core-graph, it is noticeable that the sand has an irregular permeability profile. The permeability of the sand varies from impermeable to a maximum of 107. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 38.0. The weighted average percent oil saturation of the upper and lower sections is 36.3 and 40.4 respectively. The weighted average percent water saturation of the upper and lower sections is 42.1 and 42.1 respectively; the overall average being 42.1 (See Table III). This gives an overall weighted average total fluid saturation of 80.1 percent.

The weighted average oil content of the upper and lower sections is 545 and 555 barrels per acre foot respectively; the overall average being 549. The total oil content, as shown by this core, is 19,884 barrels per acre of which 8,615 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 2,410 barrels of oil per acre was obtained from 13.4 feet of sand. The weighted average percent oil saturation was

reduced from 41.3 to 30.0, or represents an average recovery of 11.3 percent. The weighted average effective permeability of the samples is 6.40 millidarcys, while the average initial fluid production pressure is 29.3 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 36 samples tested, 19 produced water and 14 oil. This indicates that approximately 39 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

Based on the results of the laboratory tests it appears that efficient primary and secondary operations in the vicinity of this well should recover approximately 4,380 barrels of oil per acre or an average of 327 barrels per acre foot from the 13.4 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	25.0
Average porosity, percent	19.9
Oil saturation after flooding, percent	30.0
Performance factor, percent	50.0
Net floodable pay sand, feet	13.4

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, Incorporated Lease Lormor Well No. 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	659.1	20.7	13	49	62	208	49.	0.8	0.8	166	39.20
2	660.1	19.5	21	46	67	318	48.	1.4	2.2	446	67.20
3	662.1	14.9	25	73	98	289	44.	1.3	3.5	376	57.20
4	663.1	18.4	24	46	70	342	20.	1.0	4.5	342	20.00
5	664.1	19.3	50	42	92	748	80.	1.0	5.5	748	80.00
6	665.1	20.1	40	38	78	623	23.	1.0	6.5	623	23.00
7	666.1	20.0	41	38	79	636	17.	1.0	7.5	636	17.00
8	667.1	20.0	32	40	72	496	44.	1.0	8.5	496	44.00
9	668.1	19.5	41	38	79	620	74.	1.0	9.5	620	74.00
10	669.1	24.0	35	30	65	651	102.	1.0	10.5	651	102.00
11	671.1	21.8	54	30	84	914	72.	0.6	11.1	548	43.20
12	672.1	21.9	52	25	77	883	107.	1.0	12.1	883	107.00
13	673.1	18.3	41	43	84	581	8.0	1.0	13.1	581	8.00
14	674.1	15.6	32	52	84	387	2.2	1.0	14.1	387	2.20
15	675.1	17.0	33	47	80	435	6.3	1.0	15.1	435	6.30
16	676.1	15.4	31	55	86	370	5.0	1.4	16.5	518	7.00
17	680.1	20.9	45	28	73	729	21.	0.8	17.3	583	16.80
18	681.1	17.1	36	44	80	477	26.	1.4	18.7	669	36.40
19	682.1	21.5	48	28	76	800	44.	0.6	19.3	480	26.40
20	683.1	19.9	48	38	86	740	8.7	1.0	20.3	740	8.70
21	684.1	21.1	42	28	70	687	84.	1.0	21.3	687	84.00
22	685.1	18.3	47	32	79	666	2.4	1.0	22.3	666	2.40
23	686.1	17.7	57	37	94	782	2.2	1.0	23.3	782	2.20
24	687.1	20.2	53	21	74	829	5.1	1.0	24.3	829	5.10

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company CRA, Incorporated Lease Lormor Well No. 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.		
25	688.1	18.6	51	28	79	735	3.9	1.0	25.3	735	3.90
26	689.1	16.6	35	51	86	451	1.8	1.0	26.3	451	1.80
27	690.1	20.0	48	29	77	744	4.2	1.0	27.3	744	4.20
28	691.1	15.5	27	60	87	324	1.7	1.0	28.3	324	1.70
29	692.1	18.3	46	37	83	653	1.3	1.0	29.3	653	1.30
30	693.1	19.2	39	29	68	580	1.0	1.0	30.3	580	1.00
31	694.1	16.1	37	41	78	461	3.2	1.0	31.3	461	3.20
32	695.1	18.6	12	54	66	173	Imp.	1.0	32.3	173	0.00
33	696.1	15.3	45	31	76	534	6.1	1.0	33.3	534	6.10
34	697.1	14.1	34	64	98	372	2.6	1.0	34.3	372	2.60
35	698.1	16.6	35	63	98	451	33.	1.0	35.3	451	33.00
36	699.1	18.4	40	56	96	571	0.60	0.9	36.2	514	0.54
								Total		19,884	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company CRA. Incorporated Lease Lormor Well No. 1

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
658.8 - 684.6	21.3	40.8	869.60
684.6 - 699.5	13.9	5.0	69.04
658.8 - 699.5	35.2	26.6	938.64

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
658.8 - 684.6	21.3	19.1	36.3	42.1	545	11,615
684.6 - 699.5	14.9	17.5	40.4	42.1	555	8,269
658.8 - 699.5	36.2	18.5	38.0	42.1	549	19,884

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company CRA, Incorporated Lease Lormor Well No. 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	659.1	20.5	14	222	0	0	14	80	222	121	3.90	20
2	660.1	19.5	21	318	0	0	21	76	318	132	6.90	20
3	662.1	15.0	26	302	0	0	26	70	302	194	11.70	20
4	663.1	18.9	25	366	0	0	25	69	366	119	3.30	20
5	664.1	19.5	50	756	22	333	28	71	423	185	4.90	20
6	665.1	19.7	40	611	10	153	30	67	458	25	0.600	40
7	666.1	19.5	41	620	14	212	27	67	408	54	1.50	40
8	667.1	20.4	32	506	7	111	25	73	395	398	9.80	20
9	668.1	20.0	41	636	10	155	31	67	481	216	5.50	20
10	669.1	23.6	35	640	13	238	22	74	402	420	40.00	20
11	671.1	21.4	54	896	27	448	27	69	448	201	13.30	20
12	672.1	21.6	52	872	26	436	26	70	436	221	12.80	10
13	673.1	18.8	41	597	2	29	39	60	568	7	0.300	40
14	674.1	15.4	33	394	0	0	33	55	394	0	Imp.	-
15	675.1	17.5	33	448	3	41	30	68	407	3	0.200	50
16	676.1	15.4	31	370	0	0	31	58	370	0	Imp.	-
17	680.1	20.4	45	711	19	300	26	70	411	14	0.300	30
18	681.1	17.5	36	489	5	68	31	66	421	30	0.700	20
19	682.1	20.9	48	777	2	32	46	44	745	26	0.700	40
20	683.1	20.0	48	745	0	0	48	47	745	3	0.200	50
21	684.1	20.7	42	673	5	80	37	56	593	17	0.500	40
22	685.1	18.5	47	674	0	0	47	34	674	0	Imp.	-
23	686.1	17.6	58	791	0	0	58	39	791	0	Imp.	-
24	687.1	20.0	53	823	0	0	53	22	823	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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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company CRA, Incorporated Lease Lormor Well No. 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.			
25	688.1	18.8	53	773	0	0	53	29	773	0	Imp.	-
26	689.1	16.6	35	451	0	0	35	50	451	0	Imp.	-
27	690.1	20.3	46	724	0	0	46	33	724	0	Imp.	-
28	691.1	15.4	27	322	0	0	27	63	322	0	Imp.	-
29	692.1	18.4	47	671	0	0	47	39	671	0	Imp.	-
30	693.1	19.0	40	589	0	0	40	32	589	0	Imp.	-
31	694.1	16.0	40	496	0	0	40	43	496	0	Imp.	-
32	695.1	18.8	13	190	0	0	13	56	190	0	Imp.	-
33	696.1	15.4	43	513	0	0	43	33	513	0	Imp.	-
34	697.1	14.0	37	401	0	0	37	60	401	0	Imp.	-
35	698.1	16.8	36	469	0	0	36	62	469	0	Imp.	-
36	699.1	18.6	41	591	0	0	41	54	591	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.

Oilfield Research Laboratories

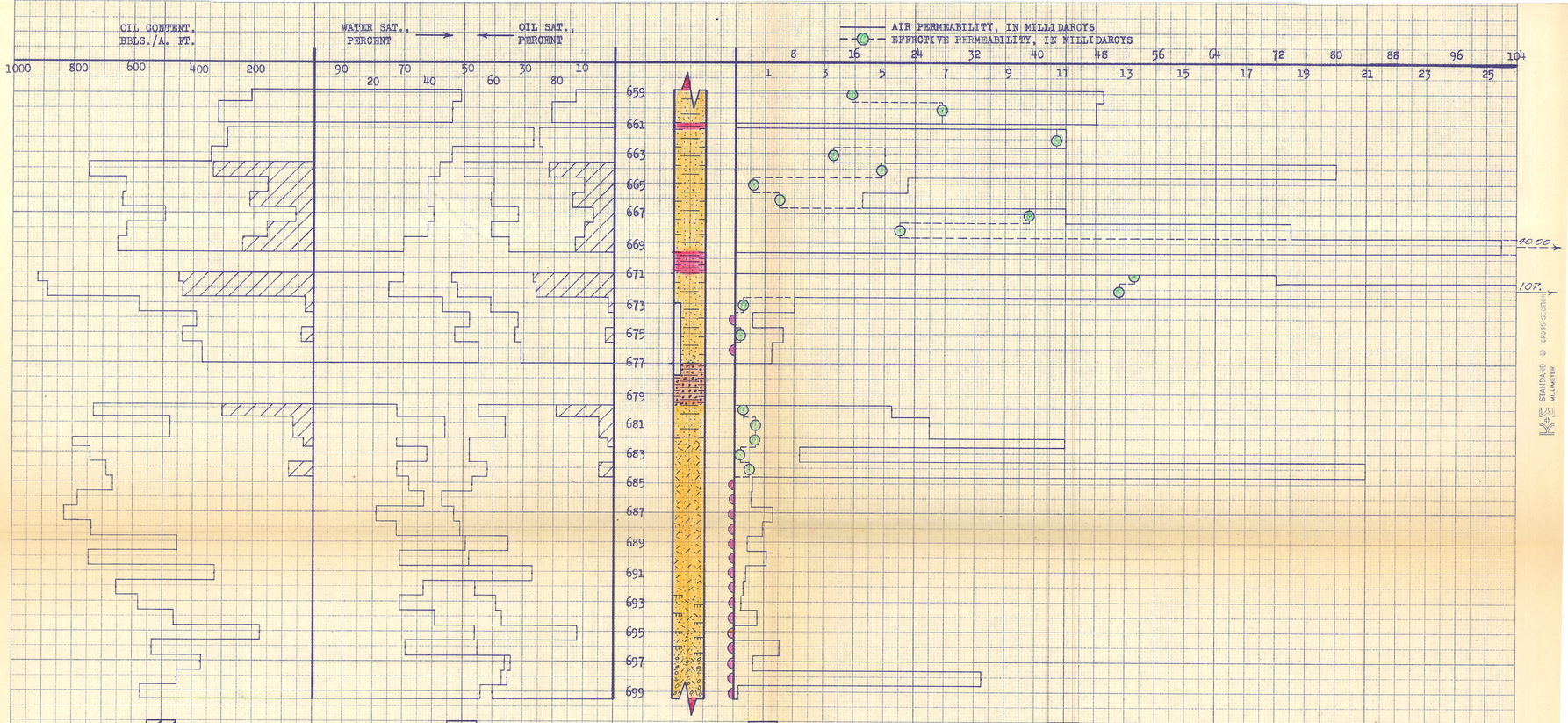
SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company CRA, Incorporated Lease Lormor Well No. 1

Depth Interval, Feet	658.8 - 684.6
Feet of Core Analyzed	13.4
Average Percent Porosity	19.9
Average Percent Original Oil Saturation	41.3
Average Percent Oil Recovery	11.3
Average Percent Residual Oil Saturation	30.0
Average Percent Residual Water Saturation	66.3
Average Percent Total Residual Fluid Saturation	96.3
Average Original Oil Content, Bbls./A. Ft.	635.
Average Oil Recovery, Bbls./A. Ft.	180.
Average Residual Oil Content, Bbls./A. Ft.	455.
Total Original Oil Content, Bbls./Acre	8,615.
Total Oil Recovery, Bbls./Acre	2,410.
Total Residual Oil Content, Bbls./Acre	6,205.
Average Effective Permeability, Millidarcys	6.40
Average Initial Fluid Production Pressure, p.s.i.	29.3

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



C. R. A., INC.

LORMOR LEASE WELL NO. 1

BOURBON COUNTY, KANSAS

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE POROSITY, PERCENT	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVG. OIL CONTENT BBLS./A.FT.	TOTAL OIL CONTENT BBLS./ACRE	AVG. AIR PERMEABILITY, MILLIDARCYS	CALCULATED OIL RECOVERY BBLS./ACRE
658.8 - 684.6	21.3	19.1	36.3	42.1	545	11,615	40.8	
684.6 - 699.5	14.9	17.5	40.4	42.1	555	8,269	5.0	
658.8 - 699.5	36.2	18.5	38.0	42.1	549	19,884	26.6	4,380(Primary & Secondary)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
AUGUST, 1966