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

August 19, 1966

CRA, Incorporated
Box 98
Wellington, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Holeman Lease, Well No. 1, Bourbon County, Kansas, and submitted to our laboratory on August 15, 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 Holeman Well No. 1

Location 400' NSL & 150' WEL, SW

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

Name of Sand	Bartlesville
Top of Core	658.0
Bottom of Core	695.0
Top of Sand (Analyzed)	668.8
Bottom of Sand (Analyzed)	691.6
Total Feet of Permeable Sand	22.8
Total Feet of Floodable Sand	9.8

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	10.0	10.0
10 - 20	4.0	14.0
20 - 50	5.0	19.0
50 - 100	2.8	21.8
100 & above	1.0	22.8

Average Permeability Millidarcys	24.4
Average Percent Porosity	19.0
Average Percent Oil Saturation	41.6
Average Percent Water Saturation	36.6
Average Oil Content, Bbls./A. Ft.	621.
Total Oil Content, Bbls./Acre	14,193.
Average Percent Oil Recovery by Laboratory Flooding Tests	18.6
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	290.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,840.
Total Calculated Oil Recovery, Bbls./Acre - (Primary & Secondary)	3,760.
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 - 668.8	Alternate layers sandstone and shale.
668.8 - 678.6	Brown, slightly laminated, slightly shaly sandstone.
678.6 - 687.6	Dark carbonaceous sandstone.
687.6 - 689.6	Dark, carbonaceous, shaly sandstone.
689.6 - 692.0	Dark carbonaceous sandstone.
692.0 - 695.0	Gray sandy shale.

Coring was started at a depth of 658.0 feet in layered sandstone and shale and completed at 695.0 feet in sandy shale. For the most part, the pay is made up of brown, slightly laminated, slightly 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 48.1 and 6.5 millidarcys respectively; the overall average being 24.4 (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 0.54 to a maximum of 119. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 41.6. The weighted average percent oil saturation of the upper and lower sections is 45.9 and 38.4 respectively. The weighted average percent water saturation of the upper and lower sections is 30.9 and 41.0 respectively; the overall average being 36.6 (See Table III). This gives an overall weighted average total fluid saturation of 78.2 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 710 and 556 barrels per acre foot respectively; the overall average being 621. The total oil content, as shown by this core, is 14193 barrels per acre of which 6948 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 2840 barrels of oil per acre was obtained from 9.8 feet of sand. The weighted average percent oil saturation was reduced from 45.8 to 27.2, or represents an average recovery of 18.6 percent. The weighted average effective permeability of the samples is 2.99 millidarcys, while the average initial fluid production pressure is 16.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 23 samples tested, 10 produced water and oil. This indicates that approximately 43 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 3760 barrels per acre or an average of 384 barrels per acre foot from the 9.8 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	20.0
Average porosity, percent	19.9
Oil saturation after flooding, percent	27.2
Performance factor, percent	50.0
Net floodable pay sand, feet	9.8

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 Holeman 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	669.1	20.9	55	24	79	891	78.	0.8	0.8	712	62.40
2	670.1	20.1	49	26	75	763	68.	1.0	1.8	763	68.00
3	671.1	20.4	46	25	71	726	119.	1.0	2.8	726	119.00
4	672.1	19.2	47	32	79	699	22.	1.0	3.8	699	22.00
5	673.1	20.6	42	29	71	671	19.	1.0	4.8	671	19.00
6	674.1	19.7	49	30	79	748	53.	1.0	5.8	748	53.00
7	675.1	19.4	41	36	77	616	33.	1.0	6.8	616	33.00
8	676.1	19.3	40	39	79	599	24.	1.0	7.8	599	24.00
9	677.1	17.9	40	37	77	555	43.	1.0	8.8	555	43.00
10	678.1	21.8	51	29	80	862	28.	1.0	9.8	862	28.00
11	679.1	16.9	30	42	72	392	12.	1.0	10.8	392	12.00
12	680.1	20.4	37	30	67	585	5.8	1.0	11.8	585	5.80
13	681.1	19.7	42	32	74	641	12.	1.0	12.8	641	12.00
14	682.1	17.4	42	35	77	566	10.	1.0	13.8	566	10.00
15	683.1	18.5	46	40	86	660	4.7	1.0	14.8	660	4.70
16	684.1	19.0	45	32	77	663	3.8	1.0	15.8	663	3.80
17	685.1	19.5	44	33	77	664	12.	1.0	16.8	664	12.00
18	686.1	19.9	52	34	86	803	8.2	1.0	17.8	803	8.20
19	687.1	19.2	43	38	81	641	5.2	1.0	18.8	641	5.20
20	688.1	16.2	39	52	91	489	5.0	1.0	19.8	489	5.00
21	689.1	14.6	20	64	84	226	1.8	1.0	20.8	226	1.80
22	690.1	17.7	22	45	67	302	0.54	1.0	21.8	302	0.54
23	691.1	20.7	38	56	94	610	3.2	1.0	22.8	610	3.20

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company CRA, Inc. Lease Holeman Well No. 1

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
668.8 - 678.6	9.8	48.1	471.40
678.6 - 691.6	13.0	6.5	84.24
668.8 - 691.6	22.8	24.4	555.64

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
668.8 - 678.6	9.8	19.9	45.9	30.9	710	6951
678.6 - 691.6	13.0	18.4	38.4	41.0	556	7242
668.8 - 691.6	22.8	19.0	41.6	36.6	621	14193

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company CRA, Inc. Lease Holeman 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	669.1	20.9	55	890	30	486	25	66	404	128	2.70	10
2	670.1	20.4	49	775	26	411	23	70	364	121	3.30	10
3	671.1	20.1	46	716	22	343	24	71	373	244	6.70	10
4	672.1	19.7	47	718	16	244	31	62	474	168	3.60	20
5	673.1	20.2	42	659	14	220	28	69	439	46	1.30	20
6	674.1	19.5	49	740	20	302	29	69	438	100	3.20	10
7	675.1	19.0	41	604	12	177	29	69	427	9	0.200	30
8	676.1	19.8	40	614	14	215	26	66	399	62	1.20	10
9	677.1	18.2	40	564	10	141	30	66	423	102	3.50	20
10	678.1	21.4	51	846	24	398	27	65	448	158	4.10	20
11	679.1	16.7	31	401	0	0	31	43	401	0	Imp.	-
12	680.1	20.4	37	585	0	0	37	32	585	0	Imp.	-
13	681.1	20.0	42	651	0	0	42	34	651	0	Imp.	-
14	682.1	17.3	41	549	0	0	41	35	549	0	Imp.	-
15	683.1	18.7	46	667	0	0	46	42	667	0	Imp.	-
16	684.1	19.3	47	704	0	0	47	31	704	0	Imp.	-
17	685.1	19.3	44	659	0	0	44	34	659	0	Imp.	-
18	686.1	19.8	50	769	0	0	50	37	769	0	Imp.	-
19	687.1	19.2	43	640	0	0	43	39	640	0	Imp.	-
20	688.1	16.2	39	489	0	0	39	54	489	0	Imp.	-
21	689.1	14.7	20	228	0	0	20	66	228	0	Imp.	-
22	690.1	17.5	22	298	0	0	22	47	298	0	Imp.	-
23	691.1	20.3	39	614	0	0	39	55	614	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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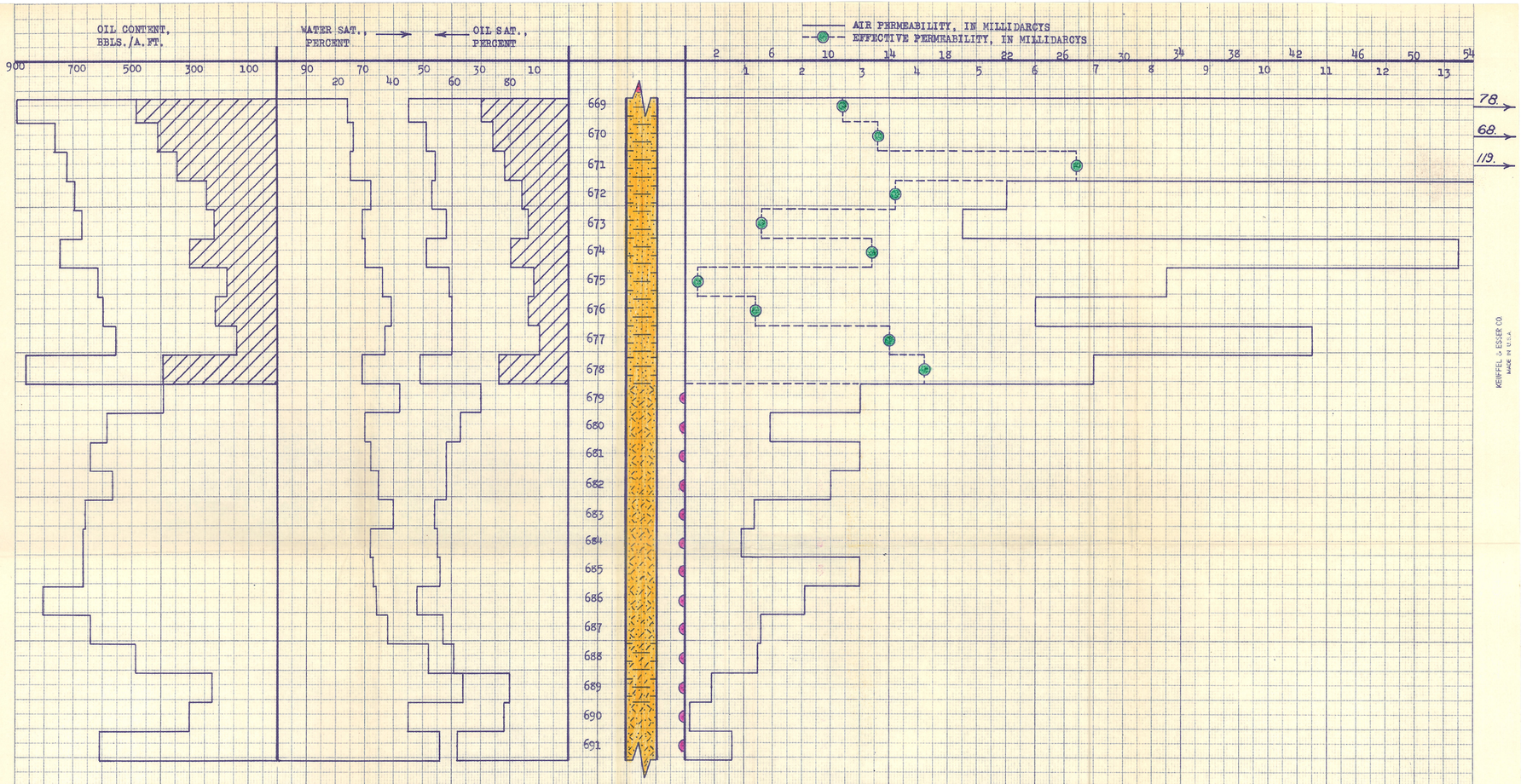
SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company CRA, Inc. Lease Holeman Well No. 1

Depth Interval, Feet	668.8 - 678.6
Feet of Core Analyzed	9.8
Average Percent Porosity	19.9
Average Percent Original Oil Saturation	45.8
Average Percent Oil Recovery	18.6
Average Percent Residual Oil Saturation	27.2
Average Percent Residual Water Saturation	67.3
Average Percent Total Residual Fluid Saturation	94.5
Average Original Oil Content, Bbls./A. Ft.	709.
Average Oil Recovery, Bbls./A. Ft.	290.
Average Residual Oil Content, Bbls./A. Ft.	419.
Total Original Oil Content, Bbls./Acre	6948.
Total Oil Recovery, Bbls./Acre	2840.
Total Residual Oil Content, Bbls./Acre	4108.
Average Effective Permeability, Millidarcys	2.99
Average Initial Fluid Production Pressure, p.s.i.	16.0

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



KEUFFEL & ESSER CO.
MADE IN U.S.A.

C. R. A., INC.

HOLEMAN 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
668.8 - 678.6	9.8	19.9	45.9	30.9	710	6,951	48.1	
678.6 - 691.6	13.0	18.4	38.4	41.0	556	7,242	6.5	
668.8 - 691.6	22.8	19.0	41.6	36.6	621	14,193	24.4	3,760 (Primary & Secondary)

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CHANUTE, KANSAS
AUGUST, 1966

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