

March 3, 1950

Mr. Simon Lebow
608 Capital Building
Tulsa, Oklahoma

Dear Sir:

Enclosed herewith is the report of the analysis made on the 3 inch rotary core taken from the McClimans Lease, Core Test Well No. 1, Bourbon County, Kansas, and submitted to our laboratory on February 25, 1950.

McClimans

Very truly yours,

OIL FIELD RESEARCH LABORATORIES



Carl L. Pate

CLP:dt

SIMON LEBOW

CORE ANALYSIS REPORT

McLIMONS LEASE CORE TEST WELL NO. 1

BOURBON COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

MARCH 3, 1950

Oil Field Research Laboratories

No. 1

GENERAL INFORMATION & SUMMARY

Company Simon Lebow Lease McLimons Core Test Well No. 1

Location 510 ft. east of west line and 215 ft. south of north line, SE₄, SE₄

Section 8 Twp. 24S Rge. 22E County Bourbon State Kansas

Name of Sand	Bartlesville
Top of Core	500.90
Bottom of Core	547.10
Top of Sand	518.00
Pay Bottom of Sand	527.70
Total Feet of Permeable Sand	9.97

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 20	1.60	1.60
20 - 60	2.25	3.85
60 - 100	1.55	5.40
100 - 150	1.32	6.72
150 - 250	0.95	7.67
250 - 350	0.60	8.27
350 & above	1.70	9.97

Average Permeability, Millidarcys	152.10
Average Percent Porosity	26.57
Average Percent Oil Saturation	26.22
Average Percent Water Saturation	67.05
Average Oil Content, Bbls./A. Ft.	554.
Total Oil Content, Bbls./Acre	5,805.
Average Percent Oil Recovery by Laboratory Flooding Tests	7.04
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	146.
Aotal Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,320.
Total Calculated Oil Recovery, Bbls./Acre	2,350. -
Packer Setting, Feet	518.5

Note: The hole should be plugged back to 528.0 feet.

Viscosity, Centipoises @

A. P. I. Gravity, degrees @ 60 °F

Fresh water was used as a circulating fluid in the coring of the sand in this well. The core bled very freely as it was removed from the core barrel.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
500.90 - 515.00	- Shale (discarded at well).
515.00 - 518.00	- Gray shale.
518.00 - 524.22	- Brown coarse grained sandstone.
524.22 - 524.40	- Gray sandy shale.
524.40 - 527.70	- Dark brown coarse grained sandstone.
527.70 - 528.65	- Grayish brown coarse grained shaley sandstone.
528.65 - 528.83	- Hard fine grained carbonaceous sandstone.
528.83 - 530.45	- Gray fairly soft cross-bedded shale.
530.45 - 532.13	- Gray finely laminated sandy shale.
532.13 - 533.75	- Dark shale.
533.75 - 534.77	- Dark broken shale.
534.77 - 536.75	- Dark gray shale.
536.75 - 537.98	- Black shale.
537.98 - 538.75	- Gray shale.
538.75 - 539.00	- Gray cross-bedded shale.
539.00 - 547.10	- Shale (discarded at well).

Coring was started at a depth of 500.⁹⁰ feet in shale and completed at 547.10 feet in shale. This core shows a total of 10.47 feet of sandstone, of which 9.02 feet is pay sand. For the most part, the pay is made up of soft coarse grained sandstone.

PERMEABILITY

The sand in this well is very loose, having an overall weighted average permeability of 152.10 millidarcys. For the sake of distribution the core was divided into two sections. The weighted average permeability of the upper and lower sections are 75.87 and 254.92 millidarcys respectively (See Table II). By observing the data given on the coregraph it is noticeable that the sand has an irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The sand in this core has only a fair weighted average percent oil saturation, namely, 26.22. The weighted average percent oil saturation of the upper and lower sections are 23.95 and 29.53 respectively. The weighted average percent water saturation of the upper and lower sections are 67.80 and 65.95 respectively; the overall average being 67.05 (See Table IV). This gives an overall weighted average total fluid saturation of 93.27 percent.

In an effort to get some idea of the degree of flushing of the sand during coring all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. By observing the data given in these tables and on the coregraph, it is evident that some flushing of the sand did occur during coring.

The weighted average oil content of the upper and lower sections are 481 and 662 barrels per acre foot respectively; the overall average being 554. The total oil content, as shown by this core, is 5,805 barrels per acre (See Table IV). From the data given in Table IV you will note that the sand has a high percent porosity.

Inasmuch as we were unable to obtain an oil sample, one milliliter of oil recovered from the laboratory flooding tests was used to determine the A. P. I. gravity of the oil, and was found to be 31.9° at 60° F.

LABORATORY FLOODING TESTS

This core responded very well to laboratory flooding tests, especially when taking into consideration that the oil saturation in the core was comparatively low. A total recovery of 1,320 barrels of oil per acre was obtained from 9.02 feet of sand. The weighted average percent oil saturation was reduced from 28.08 to 21.04, or represents an average recovery of 7.04 percent. The weighted average effective permeability of the samples is 8.01 millidarcys, while the average initial fluid production pressure is 17.6 pounds per square inch (See Table VI). You will note that from the data given in this table that the sand flooded down to a comparatively low average residual oil saturation.

Of the ten samples tested, nine produced oil and all took water. This would indicate that practically all of the sand represented by these samples is floodable (See Table V). There is a comparatively wide variation in the effective permeability of the sand.

CONCLUSION

From a study of the above data we believe that an efficient water flood within the vicinity of this well will recover approximately 2,350 barrels of oil per acre. In calculating this recovery an allowance was made for oil lost during coring, and it was assumed that the true water saturation of the sand is 40 percent. We are

inclined to believe that the latter figure is rather conservative. Inasmuch as the sand bled very freely as it was removed from the core barrel, and on the basis of the data given above, we believe that considerable flushing of the sand occurred during coring which would account for the comparatively low oil saturation and high water saturation. If the sand were partially or completely watered out from upper water entering the sand through old holes, it is doubtful whether the core would bleed any appreciable amount of oil. In coring your next well a special effort should be made to get a dry core, thereby making it possible to get a true water saturation of the sand.

If this well is used as an injection well, we are inclined to believe that the sand will take sufficient water without shooting. Inasmuch as the sand in the bottom of the sand section does not contain any recoverable oil, we recommend that the hole be plugged back to 528.00 feet, provided it is used as an injection well.

Oil Field Research Laboratories
RESULTS OF PERMEABILITY TESTS
TABLE I

Company Simon Lebow Lease McLimons Core Test Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	518.50	6.0	0.65	0.65	3.90
2	518.81	8.2	0.30	0.95	2.46
3	519.18	79.	0.55	1.50	43.45
4	519.77	25.	0.45	1.95	11.25
5	520.10	30.	0.35	2.30	10.50
6	520.50	Imp.	0.50	2.80	0.00
7	521.20	88.	0.50	3.30	44.00
8	521.41	141.	0.25	3.55	35.20
9	521.69	23.	0.40	3.95	9.20
10	522.21	164.	0.45	4.40	73.80
11	522.70	53.	0.50	4.90	26.50
12	523.14	202.	0.50	5.40	101.00
13	523.67	106.	0.40	5.80	42.40
14	523.97	39.	0.25	6.05	9.75
15	524.15	115.	0.17	6.22	19.55
16	524.90	300.	0.60	6.82	180.00
17	525.15	420.	0.40	7.22	168.00
18	525.75	579.	0.60	7.82	347.50
19	526.22	143.	0.50	8.32	71.50
20	526.73	64.	0.50	8.82	32.00
21	527.30	590.	0.70	9.52	273.00
22	527.76	35.	0.30	9.82	10.50
23	528.13	1.5	0.65	10.47	0.97
24	528.74	Imp.	0.18	10.65	0.00

Oil Field Research Laboratories
SUMMARY OF PERMEABILITY TESTS

TABLE II

Company <u>Simon Lebow</u>	Lease <u>McLimons</u>	Core Test	Well No. <u>1</u>
Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
518.00 - 524.22	5.72	75.87	432.96
524.40 - 528.65	4.25	254.92	1,083.47
518.00 - 528.65	9.97	152.10	1,516.43

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RESULTS OF SATURATION TESTS

TABLE III

Company Simon Lebow Lease McLimons Core Test Well No. 1

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
1	516.30	20.9	20.6	64.2	84.8	334	0.95	0.95	317
2	519.60	26.3	18.3	77.4	95.7	374	1.35	2.30	505
3	521.05	24.7	29.2	68.6	97.8	560	1.20	3.50	672
4	522.05	28.0	23.8	64.6	88.4	517	1.10	4.60	568
5	523.30	27.6	26.8	63.6	90.1	574	1.62	6.22	930
6	524.80	28.2	40.1	59.4	99.5	873	0.70	6.92	611
7	525.35	29.8	48.8	49.4	99.2	1,130	0.90	7.82	1,018
8	526.60	31.6	21.9	72.7	94.6	537	1.00	8.82	537
9	527.46	28.2	33.7	62.8	96.5	737	0.70	9.52	516
10	528.54	21.1	8.4	81.7	90.1	138	0.95	10.47	131
							Total - -		5,805

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SUMMARY OF SATURATION TESTS

TABLE IV

Company	Simon Lebow	Lease	McLimons	Core Test	Well No.	
					1	
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbls./A. Ft.	Total Oil Content Bbls./Acre
516.00-524.22	6.22	25.79	23.95	67.80	481	2,992
524.40-528.65	4.25	27.72	29.53	65.95	662	2,813
516.00-528.65	10.47	26.57	26.22	67.05	554	5,805

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Simon Lebow Lease McLimons Core Test 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.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	518.10	27.6	17.9	384	3.7	79	14.2	82.3	305	47	1.90	20
2	519.40	25.2	18.1	354	3.0	59	15.1	76.8	295	4	0.200	40
3	520.83	26.6	26.7	551	3.3	68	23.4	74.5	483	33	1.28	25
4	521.83	29.4	23.4	517	7.5	166	18.9	77.0	351	170	15.73	10
5	523.50	27.0	27.5	576	4.5	94	23.0	75.2	482	101	2.31	15
6	524.60	22.4	46.2	805	23.6	410	22.6	69.5	395	110	6.49	10
7	525.54	29.7	46.1	1,063	18.9	390	29.2	51.7	673	54	40.55	5
8	526.40	30.7	22.6	539	4.5	107	18.1	76.7	432	226	4.27	10
9	527.62	24.0	38.1	710	2.8	52	35.3	80.9	658	18	0.406	25
10	528.34	21.8	14.4	244	0.0	0	14.4	77.4	244	2	0.101	45

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 VI

Company	Lease	McLimons	Core Test Well No.
Simon Lebow			1
Depth Interval, Feet	518.00 - 524.22	524.40 - 527.70	518.00 - 527.70
Feet of Core Analyzed	5.72	3.30	9.02
Average Percent Porosity	26.87	27.24	27.01
Average Percent Original Oil Saturation	22.76	37.28	28.08
Average Percent Oil Recovery	4.42	11.58	7.04
Average Percent Residual Oil Saturation	18.36	25.70	21.04
Average Percent Residual Water Saturation	76.98	72.00	75.16
Average Percent Total Residual Fluid Saturation	95.34	97.70	96.80
Average Original Oil Content, Bbls./A. Ft.	477.	774.	586.
Average Oil Recovery, Bbls./A. Ft.	94.	237.	146.
Average Residual Oil Content, Bbls./A. Ft.	383.	537.	440.
Total Original Oil Content, Bbls./Acre	2,730.	2,555.	5,265.
Total Oil Recovery, Bbls./Acre	538.	782.	1,320.
Total Residual Oil Content, Bbls./Acre	2,192.	1,773.	3,965.
Average Effective Permeability, Millidarcys	4.67	13.80	8.01
Average Initial Fluid Production Pressure, p.s.i.	22.0	12.5	17.8

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

Oil Field Research Laboratories
RESULTS OF WATER DIFFERENTIATION TESTS
TABLE VII

Company Simon Lebow Lease McLamons Core Test Well No. 1

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Connate Percent Water Saturation Drilling & Foreign	Total
1	518.30	10,640		
2	519.60	8,610		
3	521.05	11,030		
4	522.05	9,960		
5	523.30	9,470		
6	524.80	10,130		
7	525.35	8,540		
8	526.60	9,580		
9	527.46	10,820		
10	528.54	7,810		

Note: ppm - parts per million.

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company	Simon Lebow	Lease	McLimons	Core Test No.	1
Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water		
518.00 - 524.22	9,844				
524.40 - 528.65	9,244				
518.00 - 528.65	9,600				

Note: ppm - parts per million.