OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

August 29, 1951

35-19-23E

Deep Rock Oil Corporation
Atlas Life Building
Tulsa, Oklahoma

Attention: Mr. T. F. Lavry

Gentlemen:

Enclosed herewith is the report of the analysis of the 3" Rotary core taken from the Long Lease, Well No. A-3, Linn County, Kansas, and submitted to our laboratory on August 23, 1951.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:mm

c.c. to Mr. D. K. Auld

A-3

Long

DEEP ROCK OIL CORPORATION

CORE ANALYSIS REPORT

LONG LEASE WELL NO. A-3

LINN COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

AUGUST 29, 1951

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Deep Rock Oil Corporation Lease Long Well No. A-3

Location SW¼

Section 36 Twp. 19S Rge. 23E County Linn State Kansas

Name of Sand	Peru
Top of Core	251.00
Bottom of Core	276.40
Top of Sand (Pay)	252.00
Bottom of Sand (Pay)	263.50
Total Feet of Permeable Sand (Analyzed)	8.63
Total Feet of Floodable Sand	7.48

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	2.83	2.83
5 - 10	0.77	3.60
10 - 30	2.71	6.31
30 - 60	2.20	8.51
60 - 90	1.55	10.06
90 & above	1.10	11.16

Average Permeability Millidarcys	36.25
Average Percent Porosity	21.12
Average Percent Oil Saturation	44.14
Average Percent Water Saturation	38.38
Average Oil Content, Bbls./A. Ft.	737.
Total Oil Content, Bbls./Acre	7,041.
Average Percent Oil Recovery by Laboratory Flooding Tests	25.07
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	437.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	3,868.
Total Calculated Oil Recovery, Bbls./Acre	2,600.
Packer Setting, Feet	252.00
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

The above averages are for that part of the sand section extending from the packer setting (bottom of cement) to the top of the cement plug.

Fresh water was used as a circulating fluid in the coring of the sand in this well.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
251.00 - 251.70	Gray sandy calcareous shale with limestone inclusions.
251.70 - 252.00	Brown fine grained micaceous slightly shaley sandstone.
252.00 - 253.50	Brown fine grained micaceous sandstone.
253.50 - 253.80	Brown fine grained slightly laminated micaceous shaley sandstone.
253.80 - 254.10	Brown fine grained micaceous sandstone.
254.10 - 254.60	Light brown fine grained micaceous calcareous shaley sandstone.
254.60 - 255.70	Brown fine grained micaceous sandstone.
255.70 - 255.90	Brown fine grained laminated micaceous shaley sandstone.
255.90 - 256.15	Brown fine grained micaceous sandstone.
256.15 - 256.50	Brown fine grained slightly laminated micaceous shaley sandstone.
256.50 - 256.65	Laminated sandy shale.
256.65 - 257.05	Brown fine grained slightly laminated micaceous shaley sandstone.
257.05 - 257.30	Brown fine grained laminated micaceous shaley sandstone.
257.30 - 258.55	Dark brown fine grained micaceous sandstone.
258.55 - 259.28	Dark brown fine grained slightly laminated micaceous shaley sandstone.
259.28 - 259.50	Brown fine grained laminated micaceous shaley sandstone.

259.50 - 259.85 - Dark brown fine grained micaceous sandstone.

259.85 - 259.95 - Brown fine grained laminated micaceous shaley sandstone.

259.95 - 260.20 - Laminated shale and limestone.

260.20 - 260.68 - Brown fine grained micaceous sandstone.

260.68 - 261.00 - Limestone.

261.00 - 261.18 - Dark brown fine grained micaceous sandstone.

261.18 - 261.43 - Dark brown fine grained slightly laminated micaceous shaley sandstone.

261.43 - 261.75 - Limestone.

261.75 - 263.00 - Dark brown fine grained micaceous sandstone containing a shale break.

263.00 - 263.18 - Dark brown fine grained laminated micaceous shaley sandstone.

263.18 - 263.50 - Dark brown fine grained micaceous sandstone containing a shale break.

263.50 - 264.10 - Brown fine grained slightly laminated micaceous shaley sandstone.

264.10 - 264.35 - Brown fine grained micaceous slightly shaley sandstone.

264.35 - 264.52 - Limestone.

264.52 - 265.45 - Brown fine grained slightly laminated micaceous shaley sandstone.

265.45 - 266.00 - Brown fine grained laminated micaceous shaley sandstone.

266.00 - 266.85 - Gray sandy shale.

266.85 - 267.30 - Finely laminated shaley sandstone.

267.30 - 267.80 - Laminated sandy shale.

267.80 - 268.15 - Finely laminated shaley sandstone.

268.15 - 269.05 - Laminated sandy shale.

269.05 - 269.55 - Finely laminated shaley sandstone.

269.55 - 270.75 - Finely laminated sandy shale.

270.75 - 271.30 - Brown fine grained finely laminated micaceous shaley sandstone.

271.30 - 272.15 - Brown fine grained laminated micaceous shaley sandstone.

272.15 - 272.45 - Laminated shale and sandstone.

272.45 - 273.35 - Finely laminated sandy shale.

273.35 - 273.75 - Finely laminated shale and sandstone.

273.75 - 273.88 - Finely laminated sandy shale.

273.88 - 274.10 - Brown fine grained laminated micaceous shaley sandstone.

274.10 - 274.45 - Laminated shale and sandstone.

274.45 - 275.54 - Finely laminated sandy shale.

275.54 - 276.40 - Blue shale with some sand laminations. (Discarded at well

Coring was started at a depth of 251.00 feet in gray sandy calcareous shale and completed at 276.40 feet in laminated sandy shale. This core shows a total of 13.79 feet of sandstone. For the most part, the pay is made up of fine grained micaceous 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 44.70 and 6.29 millidarcys respectively; while that of the pay sand, or that part of the cored section extending from the packer setting (bottom of cement) to the top of the cement plug is 36.25 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The pay sand in this core shows a good weighted average percent oil saturation, namely, 44.14. The weighted average percent oil saturation of the upper and lower sections is 46.58 and 35.14 respectively. The

weighted average percent water saturation of the upper and lower sections is 36.12 and 50.76 respectively; while that of the pay sand is 38.38. (See Table IV). This gives an overall weighted average total fluid saturation of 82.52 percent.

In an effort to determine whether or not any flushing of the sand occurred during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. From the data given in these tables and on the coregraph, it is evident that very little flushing of the sand occurred during coring as the sand section has a fairly uniform chloride content.

The weighted average oil content of the upper and lower sections is 805 and 474 barrels per acre foot respectively; while that of the pay sand is 737. The total oil content, as shown by this core, is 7,659 barrels per acre, of which 7,041 barrels are in the pay sand section (See Table IV).

LABORATORY FLOODING TESTS

The pay sand in this core responded very well to laboratory flooding tests, as a total recovery of 3,268 barrels of oil per acre was obtained from the 7.48 feet of sand. The weighted average percent oil saturation was reduced from 49.50 to 24.43, or represents an average recovery of 25.07 percent. The weighted average effective permeability of the samples is 4.0 millidarcys, while the average initial fluid production is 10 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 15 samples tested, 11 produced water and oil. This indicates that most of the sand represented by these samples is floodable. The tests also show

that the sand has a fairly wide variation in effective permeability.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 2,600 barrels of oil per acre, or an average of 347 barrels per acre foot from the 7.48 feet of floodable sand analyzed. In calculating this recovery, no allowance was made for oil lost during coring, and it is assumed that the sand is not pressured up.

The principle drawback of this core is that it shows a fairly thin sand section and that the sand has a wide variation in permeability.

Oil Field Research Laboratories

SHOT RECOMMENDATION

Company Deep Rock Oil Corporation Lease Long Well No. A-3

Depth Interval, Feet	Feet of Sand	Size of Shell Inches	Qts./Ft.	Total Quarts
256.0 - 263.0	7.0	4½	3.1	21.7

Recommended Packer Setting 252.0 feet (Bottom of Cement)

Note: Plug hole back to 266.0 feet

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Deep Rock Oil Corporation Lease Long Well No. A-3

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	251.90	Imp.	0.30	0.30	0.00
2	252.26	103.	0.60	0.90	61.80
3	252.90	78.	0.50	1.40	39.00
4	253.30	66.	0.40	1.80	26.40
5	253.90	4.7	0.30	2.10	1.41
6	254.50	Imp.	0.50	2.60	0.00
7	254.84	2.9	0.45	3.05	1.31
8	255.23	68.	0.65	3.70	44.20
9	255.75	7.1	0.20	3.90	1.42
10	256.30	9.5	0.35	4.25	3.33
11	256.77	37.	0.40	4.65	14.80
12	257.25	2.1	0.25	4.90	0.53
13	257.65	52.	0.50	5.40	26.00
14	258.07	40.	0.45	5.85	18.00
15	258.45	51.	0.30	6.15	15.30
16	258.97	18.	0.73	6.88	13.14
17	259.35	6.9	0.22	7.10	1.52
18	259.90	0.85	0.10	7.20	0.09
19	260.66	15.	0.48	7.68	7.20
20	261.08	27.	0.50	8.18	13.50
21	262.03	140.	0.50	8.68	70.00
22	262.46	22.	0.40	9.08	8.80
23	262.85	54.	0.45	9.53	24.30
24	263.46	33.	0.10	9.63	3.30
25	263.75	11.	0.60	10.23	6.60
26	264.16	3.4	0.25	10.48	0.85
27	264.55	3.8	0.33	10.81	1.25
28	265.10	1.0	0.60	11.41	0.10
29	265.71	0.65	0.55	11.96	0.36
30	270.90	0.93	0.55	12.51	0.51
31	271.35	Imp.	0.35	12.86	0.00
32	271.90	1.4	0.50	13.36	0.70
33	272.35	1.3	0.30	13.66	0.39
34	273.95	7.0	0.22	13.88	1.54

Oil Field Research Laboratories

SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Deep Rock Oil Corporation Lease Long Well No. A-3

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
251.70 - 263.00	8.53	44.70	381.25
263.00 - 274.10	4.20	6.29	26.40
252.00 - 266.00	11.16	36.25	404.51

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Deep Rock Oil Corporation Lease Long Well No. A-3

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.	
F-1A	251.74	21.2	31.3	-	-	515	0.30	0.30	155
1	252.60	23.5	49.7	38.5	88.2	906	1.80	2.10	1,630
F-1B	254.05	23.3	35.1	-	-	634	0.30	2.40	190
F-1C	254.63	18.7	23.8	-	-	345	0.45	2.85	155
2	255.50	23.6	48.5	34.0	82.5	808	0.65	3.50	576
F-2A	256.46	18.0	24.9	-	-	348	0.35	3.85	122
3	257.46	23.2	43.9	37.8	81.7	790	1.25	5.10	986
4	258.73	19.0	57.0	33.3	90.3	841	0.73	5.83	615
F-4A	259.75	23.3	46.7	-	-	845	0.35	6.18	296
5	260.40	18.7	52.7	45.7	98.4	764	0.48	6.66	367
6	262.24	23.5	56.9	29.6	86.5	1,038	1.15	7.81	1,193
F-6A	263.24	21.6	34.2	-	-	573	0.27	8.08	155
7	263.96	17.3	36.7	54.5	91.2	493	0.85	8.93	419
F-7A	265.25	16.0	29.2	-	-	362	0.93	9.86	337
8	271.63	17.4	40.3	47.1	87.4	545	0.85	10.71	463
							Total - - - -		7,659

Note: "A", "B" and "C" samples were taken from the core after it was received in the laboratory.

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Deep Rock Oil Corporation Lease Long Well No. A-3

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
251.70-263.00	7.81	22.13	46.58	36.12	805	6,285
263.18-272.15	2.90	17.34	35.14	50.76	474	1,374
252.00-266.00	9.56	21.12	44.14	38.38	737	7,041

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Deep Rock Oil Corporation Lease Long Well No. A-3

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.			
1A	251.74	21.8	51.3	516	8.9	64	87.4	64.7	461	6	0.095	55
1	255.60	23.0	50.7	904	25.9	468	84.8	69.8	448	107	2.68	5
1B	254.05	25.3	36.1	554	6.7	121	93.4	60.8	513	73	1.16	20
1C	254.85	19.7	33.6	345	0.0	0	93.6	61.0	345	0	Imp.	50+
2	255.50	23.0	49.6	869	25.8	461	24.6	73.7	408	75	1.01	10
2A	256.46	18.0	34.9	346	0.0	0	24.9	65.1	348	0	Imp.	50+
3	257.46	23.0	44.6	798	22.0	392	22.6	72.0	403	128	4.27	10
4	258.73	19.8	56.9	869	30.3	461	26.6	69.3	404	19	0.415	5
4A	259.75	25.3	46.7	845	24.7	447	22.0	73.6	398	212	6.45	10
5	260.40	18.6	51.6	744	25.0	376	25.5	71.3	368	46	1.25	5
6	262.24	23.8	56.7	1,047	31.9	589	24.8	73.0	456	168	6.30	5
6A	263.24	21.6	34.8	573	8.7	146	25.5	66.5	427	38	1.21	20
7	263.98	16.6	35.9	467	0.0	0	35.9	55.9	467	0	Imp.	50+
7A	269.35	16.0	39.2	502	0.0	0	39.2	63.6	362	0	Imp.	50+
8	271.35	17.6	40.9	559	15.3	188	27.6	70.9	377	6	0.305	25

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.
"A", "B" and "C" = Sample was taken from core after it was received in the laboratory.

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Deep Rock Oil Corporation Lease Long Well No. A-3

Depth Interval, Feet	251.70 - 263.00	263.18 - 272.15	252.00 - 266.00
Feet of Core Analyzed	7.51	1.12	7.48
Average Percent Porosity	22.50	18.57	22.63
Average Percent Original Oil Saturation	49.31	38.39	49.50
Average Percent Oil Recovery	24.81	11.34	25.07
Average Percent Residual Oil Saturation	24.50	27.05	24.43
Average Percent Residual Water Saturation	71.46	69.64	71.55
Average Percent Total Residual Fluid Saturation	95.96	96.69	95.98
Average Original Oil Content, Bbls./A. Ft.	858.	561.	862.
Average Oil Recovery, Bbls./A. Ft.	432.	173.	437.
Average Residual Oil Content, Bbls./A. Ft.	426.	388.	425.
Total Original Oil Content, Bbls./Acre	6,450.	629.	6,451.
Total Oil Recovery, Bbls./Acre	3,248.	194.	3,268.
Total Residual Oil Content, Bbls./Acre	3,202.	435.	3,183.
Average Effective Permeability, Millidarcys	3.94	0.522	4.00
Average Initial Fluid Production Pressure, p.s.i.	11.7	22.5	10.0

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 Deep Rock Oil Corporation Lease Long Well No. A-3

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	252.60	10,800			
2	255.50	10,000			
3	257.46	10,800			
4	258.73	10,700			
5	260.40	11,100			
6	262.24	10,400			
7	263.96	11,700			
8	271.63	14,400			

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Deep Rock Oil Corporation Lease Long Well No. A-3

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
252.00 - 263.00	10,649		
263.50 - 272.15	13,050		
252.00 - 266.00	10,771		

Note: ppm - parts per million.