



OILFIELD RESEARCH LABORATORIES

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March 8, 1978

Shalae Oil Production
P.O. Box 18056
Wichita, Kansas 67218

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Lowry Lease, Well No. 1-SOP, Chautauqua County, Kansas, and submitted to our laboratory on February 28, 1978.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:cb
7 c to Wichita, Kansas

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GENERAL INFORMATION & SUMMARY

Company Shalae Oil Production Lease Lowry Well No 1-SOP

Location _____

Section 21 Twp. 34S Rge. 11E County Chautauqua State Kansas

Name of Sand - - - - - Peru

Top of Core - - - - - (Recovered) - - - - - 1298.0

Bottom of Core - - - - - 1328.5

Oil
Top of Sand - - - - - 1299.0

Pay
Bottom of Sand - - - - - 1317.0

Total Feet of Permeable Sand - - - - - 25.6

Total Feet of Floodable Sand - - - - - 15.9

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 10	3.0	3.0
10 - 15	2.8	5.8
15 - 20	6.2	12.0
20 - 30	10.9	22.9
30 & Above	2.7	25.6

Average Permeability Millidarcys - - - - - 19.8

Average Percent Porosity - - - - - 16.6

Average Percent Oil Saturation - - - - - 28.9

Average Percent Water Saturation - - - - - 54.5

Average Oil Content, Bbls./A. Ft. - - - - - 374.

Total Oil Content, Bbls./Acre - - - - - 9,578.

Average Percent Oil Recovery by Laboratory Flooding Tests - - - - - 7.2

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - - 95.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - - 1,513.

Total Calculated Oil Recovery, Bbls./Acre (Primary & Waterflooding) 3,736.

Packer Setting, Feet - - - - -

Viscosity, Centipoises @ - - - - -

A. P. I. Gravity, degrees @ 60 °F - - - - -

Elevation, Feet - - - - -

A fresh water mud was used as a circulating fluid in the coring of the sand in this well. The core was sampled by a representative of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
1276.0 - 1298.0	Sandy shale (examination of cuttings).
1298.0 - 1304.7	Brownish gray fine grained silty sandstone.
1304.7 - 1313.2	Grayish brown fine grained sandstone.
1313.2 - 1313.6	Gray sandy conglomerate.
1313.6 - 1318.4	Light brown fine grained sandstone.
1318.4 - 1322.2	Brown fine grained silty sandstone.
1322.2 - 1324.6	Gray carbonaceous sandstone.
1324.6 - 1325.4	Hard gray limestone.
1325.4 - 1328.5	Hard gray limestone (discarded at well).

Coring of the Peru Sand was started at a depth of 1298.0 feet in brownish gray fine grained silty sandstone and completed at 1328.5 feet in hard gray limestone. This core shows a total of 26.2 feet of sandstone. For the most part, the pay is made up of grayish to light brown fine grained 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 23.2 and 10.8 millidarcys respectively; the overall average being 19.8 (See Table III). By observing

the data given on the coregraph, it is noticeable that the sand has a comparatively uniform permeability profile. The permeability of the sand varies from 7.7 to a maximum of 34 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly low weighted average percent oil saturation, namely, 28.9. The weighted average percent oil saturation of the upper and lower sections is 26.9 and 34.1 respectively. The weighted average percent water saturation of the upper and lower sections is 56.6 and 48.9 respectively; the overall average being 54.5 (See Table III). This gives an overall weighted average total fluid saturation of 83.4 percent.

The weighted average oil content of the upper and lower sections is 343 and 458 barrels per acre foot respectively; the overall average being 374. The total oil content, as shown by this core, is 9,578 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration that the sand in the core had a fairly low oil saturation, one would expect very little oil to be recovered by laboratory flooding tests, however, a total recovery of 1,513 barrels of oil per acre was obtained from 15.9 feet of sand. The weighted average percent oil saturation was reduced from 28.5 to 21.3, or represents an average recovery of 7.2 percent. The weighted average effective permeability of the samples is 1.80 millidarcys, while the average initial fluid production pressure is 16.6 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 25 samples tested, 19 produced water and 15 oil. This indicates that approximately 60 percent of the sand represented by these samples is floodable pay sand.

CONCLUSION

On the basis of the above data, we estimate 3,736 barrels of oil per acre can be recovered from the sand reservoir, represented by this core, by efficient primary and waterflood operations. The produced oil, in barrels per acre, would have to be subtracted from the above value in order to get the volume of remaining recoverable oil in place. The following data and assumptions were used in calculating the above oil recovery value:

Original formation volume factor	1.08
Irreducible water saturation, percent	42.0
Primary recovery	None
Average porosity, percent	17.0
Oil saturation after flooding, percent	21.3
Performance factor	0.55
Net floodable pay sand, feet	15.9

The core shows a rather clean sand section having a fairly low oil saturation, a rather high water saturation and a fair permeability and porosity.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Shalae Oil Production Lease Lowry Well No. 1-SOP

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			Ft.	Cum. Ft.		
1	1298.5	16.8	14	79	183	33.	1.0	1.0	183	33.00
2	1299.5	15.8	26	57	319	23.	1.0	2.0	319	23.00
3	1300.5	15.7	24	67	293	28.	1.0	3.0	293	28.00
4	1301.5	15.3	21	61	250	31.	1.0	4.0	250	31.00
5	1302.5	15.6	27	55	328	17.	1.0	5.0	328	17.00
6	1303.5	16.2	29	55	365	16.	1.0	6.0	365	16.00
7	1304.5	16.1	19	60	238	34.	0.7	6.7	167	23.80
8	1305.5	16.1	36	43	451	23.	1.3	8.0	586	29.90
9	1306.5	17.0	33	53	436	24.	1.0	9.0	436	24.00
10	1307.5	16.7	34	56	442	21.	1.0	10.0	442	21.00
11	1308.5	17.2	26	54	348	31.	1.0	11.0	348	31.00
12	1309.5	16.9	23	52	302	28.	1.0	12.0	302	28.00
13	1310.5	16.7	32	54	416	18.	1.0	13.0	416	18.00
14	1311.5	16.6	20	59	258	22.	1.0	14.0	258	22.00
15	1312.5	16.9	24	54	315	20.	1.2	15.2	378	24.00
16	1314.4	17.7	29	53	399	21.	1.4	16.6	559	29.40
17	1315.4	15.6	32	55	388	13.	1.0	17.6	388	13.00
18	1316.5	15.3	30	58	356	19.	1.0	18.6	356	19.00
19	1317.5	19.0	34	45	501	7.7	1.4	20.0	701	10.78
20	1318.5	15.2	27	55	318	8.9	0.6	20.6	191	5.34
21	1319.5	17.4	29	48	392	12.	1.0	21.6	392	12.00
22	1320.5	16.9	33	49	433	11.	1.0	22.6	433	11.00
23	1321.5	17.5	36	44	489	15.	1.2	23.8	587	18.00
24	1322.5	16.8	43	47	561	11.	0.8	24.6	449	8.80
25	1323.5	16.6	35	59	451	9.4	1.0	25.6	451	9.40

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Shalae Oil Production	Lease	Lowry	Well No.	1-SOP
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.		
1298.0 - 1317.0	18.6	23.2	431.10		
1317.0 - 1324.0	7.0	10.8	75.32		
1298.0 - 1324.0	25.6	19.8	506.42		
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Total Oil Content Bbls./Acre
1298.0 - 1317.0	18.6	16.4	26.9	56.6	6,374
1317.0 - 1324.0	7.0	17.3	34.1	48.9	3,204
1298.0 - 1324.0	25.6	16.6	28.9	54.5	9,578

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company			Shalae Oil Production			Lease			Lowry			Well No.			1-SOP		
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	1298.5	16.9	14	184	0	0	14	80	86	1.30	10						
2	1299.5	17.0	26	343	79	79	20	76	75	1.70	10						
3	1300.5	16.8	24	313	78	78	18	78	123	4.70	10						
4	1301.5	15.9	21	259	37	37	18	74	81	2.30	15						
5	1302.5	16.4	27	341	99	99	19	76	57	1.60	15						
6	1303.5	17.2	29	387	107	107	21	75	44	1.20	15						
7	1304.5	16.7	20	259	0	0	20	65	77	1.50	10						
8	1305.5	17.1	36	478	173	173	23	68	49	1.20	15						
9	1306.5	17.4	33	446	189	189	19	70	69	1.70	15						
10	1307.5	17.2	34	454	200	200	19	77	55	1.40	15						
11	1308.5	17.5	26	353	68	68	21	72	75	1.90	15						
12	1309.5	17.5	23	313	14	14	22	76	38	2.70	15						
13	1310.5	17.2	32	427	147	147	21	70	57	1.40	15						
14	1311.5	17.1	21	279	0	0	21	78	114	4.00	15						
15	1312.5	17.4	24	325	41	41	21	74	66	1.60	15						
16	1314.4	17.4	29	392	122	122	20	77	75	2.70	15						
17	1315.4	16.2	32	403	38	38	29	65	17	0.50	25						
18	1316.5	15.9	30	370	12	12	29	61	3	0.20	40						
19	1317.5	18.7	33	479	0	0	33	58	14	0.50	30						
20	1318.5	15.2	27	318	0	0	27	55	0	Imp.	-						
21	1319.5	17.4	29	392	0	0	29	48	0	Imp.	-						
22	1320.5	16.9	33	433	0	0	33	49	0	Imp.	-						
23	1321.5	17.5	36	489	0	0	36	44	0	Imp.	-						
24	1322.5	16.9	42	551	0	0	42	54	0	Imp.	-						
25	1323.5	16.6	35	451	0	0	35	59	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	Shalae Oil Production	Lease	Lowry	Well No.	1-SOP
Depth Interval, Feet	1298.0 - 1324.0				
Feet of Core Analyzed	15.9				
Average Percent Porosity	17.0				
Average Percent Original Oil Saturation	28.5				
Average Percent Oil Recovery	7.2				
Average Percent Residual Oil Saturation	21.3				
Average Percent Residual Water Saturation	72.6				
Average Percent Total Residual Fluid Saturation	93.9				
Average Original Oil Content, Bbls./A. Ft.	375.				
Average Oil Recovery, Bbls./A. Ft.	95.				
Average Residual Oil Content, Bbls./A. Ft.	280.				
Total Original Oil Content, Bbls./Acre	5,968.				
Total Oil Recovery, Bbls./Acre	1,513.				
Total Residual Oil Content, Bbls./Acre	4,455.				
Average Effective Permeability, Millidarcys	1.80				
Average Initial Fluid Production Pressure, p.s.i.	16.6				

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