

OILFIELD RESEARCH LABORATORIES

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October 30, 1957

Home-Stake Production Company
Philtower Building
Tulsa 3, Oklahoma

Gentlemen:

Enclosed herewith is the report of the analysis of the 2 11/16" Rotary core taken from the Poss Lease, Well No. I-11, Anderson County, Kansas, and submitted to our laboratory on October 18, 1957.

This core was sampled and the samples sealed in cans by a representative of our laboratory.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate
Carl L. Pate

OLP:cb

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Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company	<u>Home-Stake Production Co.</u>	Lease	Poss	Well No. <u>I-11</u>
Location	<u>580' West & 500' South, NW$\frac{1}{4}$</u>			
Section	<u>11</u>	Twp. <u>20S</u>	Rge. <u>20E</u>	County <u>Anderson</u> State <u>Kansas</u>
Name of Sand				Squirrel
Top of Core				658.0
Bottom of Core				724.0
Pay				
Top of Sand				672.5
Pay				
Bottom of Sand				707.6
Total Feet of Permeable Sand	(Analyzed)			41.1
Total Feet of Floodable Sand				30.9
Distribution of Permeable Sand:				
Permeability Range Millidarcys	Feet	Cum. Ft.		
0 - 10	7.3	7.3		
10 - 30	5.9	13.2		
30 - 40	6.0	19.2		
40 - 50	6.0	25.2		
50 - 70	6.0	31.2		
70 - 100	5.5	36.7		
100 & above	4.4	41.1		
Average Permeability Millidarcys				49.1
Average Percent Porosity				20.9
Average Percent Oil Saturation				35.0
Average Percent Water Saturation				50.7
Average Oil Content, Bbls./A. Ft.				578.
Total Oil Content, Bbls./Acre				29,481.
Average Percent Oil Recovery by Laboratory Flooding Tests				10.7
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.				185.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre				6,195.
Total Calculated Oil Recovery, Bbls./Acre				5,600.
Fracture Setting, Feet				
Viscosity, Centipoises @				
A. P. I. Gravity, degrees @ 60 °F				
Elevation, Feet				910.

A fresh water mud 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
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658.0 - 662.0	- Gray sandy shale.
662.0 - 672.5	- Alternate thin layers of brown sandstone and shale containing a vertical fracture.
672.5 - 680.5	- Brown fine grained micaceous sandstone.
680.5 - 682.5	- Laminated sandstone and shale.
682.5 - 704.0	- Brown fine grained micaceous sandstone containing 3 vertical fractures and 3 angular fractures.
704.0 - 704.2	- Gray and brown fine grained laminated micaceous shaley sandstone.
704.2 - 709.0	- Brown to dark fine grained micaceous carbonaceous sandstone.
709.0 - 710.5	- Dark carbonaceous sandstone.
710.5 - 719.0	- Gray sandy shale.
719.0 - 723.0	- Laminated sandstone and shale.
723.0 - 724.0	- Loss.

Coring was started at a depth of 658.0 feet in gray sandy shale and completed at 724.0 feet; probably in laminated sandstone and shale. There was one foot core loss extending from a depth of 723.0 to 724.0 feet. This core shows a total of 36.0 feet of sandstone. For the most part, the pay is made up of brown fine grained micaceous sandstone. The core shows several vertical and angular fractures.

PERMEABILITY

For the sake of distribution, the core was divided into four sections. The weighted average permeability of the four sections, in order of increasing depth, is 2.0, 55.6, 53.1 and 17.3 millidarcys respectively; the overall average being 49.1 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile. The permeability of the sand varies from impermeable to a maximum of 202 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fair weighted average percent oil saturation, namely, 35.0. The weighted average percent oil saturation of the four sections, in order of increasing depth, is 28.5, 36.1, 36.4 and 6.5 respectively. The weighted average percent water saturation of the corresponding sections is 60.4, 50.3, 48.4 and 44.2 respectively; the overall average being 50.7 (See Table III). This gives an overall weighted average total fluid saturation of 85.7 percent.

The weighted average oil content of the four sections, in order of increasing depth, is 416, 615, 621 and 551 barrels per acre foot respectively; the overall average being 578. The total oil content, as shown by this core, is 29,481 barrels per acre of which 21,627 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded very well to laboratory flooding tests, as a total recovery of 6,195 barrels of oil per acre was obtained from 33.4 feet of sand. The weighted average percent oil saturation was

reduced from 37.2 to 26.5, or represents an average recovery of 10.7 percent. The weighted average effective permeability of the samples is 6.36 millidarcys, while the average initial fluid production pressure is 15.6 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 48 samples tested, 33 produced water and oil. This indicates that approximately 69 percent of the formation represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in effective permeability.

CONCLUSION

On the basis of the above data, it is evident that an efficient water-flood, within the vicinity of this well, will recover approximately 5,600 barrels of oil per acre or an average of 181 barrels per acre foot from the 30.9 feet of floodable pay sand analyzed. In calculating the above oil recovery value, the following facts and assumptions were employed:

1. Estimated primary recovery, percent - 10
2. Estimated true water saturation, percent - 45
3. Shrinkage factor, percent - 5
4. An allowance was made for oil lost during coring and for permeability distribution.
5. No allowance was made for sweep efficiency.
6. Residual oil saturation was taken from flood pot data.

This core shows a rather clean pay sand section having a fair oil saturation, a high water saturation and a wide variation in permeability. The core also shows several vertical and angular fractures which are

Company Home-Stake Production Company Lease Poss Well No. T-11

Set 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	662.6	16.5	19	69	88	244	1.4	1.4	342
2	664.1	16.1	16	75	91	200	1.4	2.8	280
3	665.5	19.8	44	47	91	675	1.1	3.9	743
4	666.5	17.8	19	71	90	262	1.1	5.0	288
5	668.1	18.6	29	53	82	418	1.1	6.1	460
6	669.1	19.5	40	53	93	605	1.0	7.1	605
7	670.1	21.1	40	47	87	655	1.0	8.1	655
8	671.1	22.8	53	31	84	937	1.0	9.1	937
9	672.1	16.9	25	66	91	328	0.9	10.0	295
10	673.1	21.4	38	49	87	630	1.1	11.1	693
11	674.1	21.3	45	46	91	743	1.0	12.1	743
12	675.1	21.8	38	48	86	642	1.0	13.1	642
13	676.1	21.3	33	58	91	545	1.0	14.1	545
14	677.1	20.9	34	51	85	551	1.0	15.1	551
15	678.1	19.4	36	53	89	542	1.0	16.1	542
16	679.1	21.5	33	49	82	550	1.0	17.1	550
17	680.1	22.6	37	44	81	648	0.9	18.0	584
18	681.1	18.5	19	70	89	273	1.1	19.1	300
19	682.1	19.8	35	56	91	538	0.9	20.0	484
20	683.1	22.6	36	52	88	631	1.1	21.1	694
21	684.1	24.1	35	47	82	655	1.0	22.1	655
22	685.1	20.9	38	54	92	616	1.0	23.1	616
23	686.1	22.7	30	54	84	528	1.0	24.1	528
24	687.1	23.5	41	47	88	748	1.0	25.1	748
25	688.1	22.5	33	47	80	576	1.0	26.1	576
26	689.1	23.0	36	46	82	642	1.0	27.1	642
27	690.1	23.8	39	47	86	720	1.0	28.1	720
28	691.1	23.6	35	50	85	640	1.0	29.1	640
29	692.1	23.3	41	48	89	741	1.0	30.1	741
30	693.1	22.4	36	51	87	625	1.0	31.1	625

—Determined by passing water through sample which still contains residual oil.

Company Home-Stake Production Company Lease POSS Well No. T-17

Sd. 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.	
31	694.1	22.0	42	44	86	717	1.0	32.1	717
32	695.1	21.8	36	50	86	509	1.0	33.1	609
33	696.1	23.7	40	48	88	736	1.0	34.1	736
34	697.1	22.9	32	53	85	569	1.0	35.1	769
35	698.1	20.0	30	59	89	466	1.0	36.1	466
36	699.1	20.8	40	52	92	646	1.0	37.1	646
37	700.1	21.0	37	51	88	603	1.0	38.1	603
38	701.1	21.4	35	45	80	580	1.0	39.1	580
39	702.1	22.9	40	42	82	817	1.0	40.1	817
40	703.1	22.4	32	43	75	556	0.9	41.0	500
41	703.9	21.5	42	46	88	700	0.3	41.5	350
F-41	704.1	16.4	17	43	60	216	0.2	41.7	43
42	705.1	23.3	39	49	88	705	1.4	43.1	987
43	706.1	23.6	31	48	79	617	1.0	44.1	617
44	707.1	22.6	31	48	68	568	1.0	45.1	568
45	708.1	21.6	42	41	73	912	0.4	46.5	1,277
46	709.1	18.3	24	45	69	704	0.2	47.1	422
47	710.1	16.9	44	47	91	341	0.9	48.0	307
48	719.5	16.3	31	45	66	376	1.1	49.1	634
49	720.5	17.3	18	70	88	392	1.0	50.1	392
50	721.5					241	0.9	51.0	217
			Total						29,481

*—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

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Home-Stake Production Company Lease Pass Well No. I-11

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	662.6	16.5	19	243	0	0	19	72	243	0	Imp.	50+
2	664.1	16.3	18	228	0	0	18	77	228	0	Imp.	50+
4	666.5	17.4	17	229	0	0	17	75	229	0	Imp.	50+
5	668.1	18.3	26	369	0	0	26	60	369	0	Imp.	50+
6	669.7	19.4	36	542	0	0	36	60	542	0	Imp.	50+
7	670.1	20.7	38	610	0	0	38	58	610	0	Imp.	50+
8	671.1	22.6	53	930	22	386	31	62	544	21	0.700	20
9	672.1	16.5	27	346	0	0	27	68	346	0	Imp.	50+
10	673.1	21.6	38	637	11	184	27	67	453	92	3.18	15
11	674.1	21.3	45	743	16	264	29	70	479	84	3.20	15
12	675.1	21.4	38	631	10	166	28	70	465	117	3.32	10
13	676.1	21.6	33	553	7	117	26	72	436	188	6.00	10
14	677.1	21.1	34	557	10	164	24	74	393	87	3.36	15
15	678.1	19.2	36	536	8	119	28	70	417	36	2.00	25
16	679.1	21.1	33	539	12	196	21	74	343	80	2.80	15
17	680.1	22.5	37	646	14	244	23	68	402	112	15.86	5
18	681.1	18.2	21	296	0	0	21	72	296	0	Imp.	50+
19	682.1	19.4	33	497	0	0	33	60	497	0	Imp.	50+
20	683.1	22.9	36	640	10	178	26	67	462	140	10.50	15
21	684.1	24.0	35	652	9	168	26	70	484	122	17.65	15
22	685.1	20.5	38	604	8	127	30	68	477	38	0.950	25
23	686.1	22.4	30	521	8	139	22	70	382	149	6.04	10
24	687.1	23.1	41	735	17	305	24	70	430	141	6.46	15
25	688.1	22.8	33	583	11	194	22	74	389	176	6.56	15
26	689.1	23.3	36	651	14	253	22	74	396	128	8.13	15
27	690.1	24.0	39	726	14	261	25	74	465	169	8.99	10
28	691.1	24.0	35	652	14	261	21	76	391	169	9.50	10
29	692.1	23.0	41	732	15	268	26	68	464	91	4.03	15

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

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company <u>Home-Stake Production Company</u> Lease <u>Pass</u> Well No. <u>1-11</u>												
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.			
30	693.1	22.7	36	634	11	194	25	69	440	151	9.66	10
31	694.1	22.2	42	723	15	258	27	68	465	132	5.40	15
32	695.1	21.9	36	612	11	187	25	68	425	63	2.78	20
33	696.1	23.3	40	723	14	253	26	71	470	121	6.39	15
34	697.1	23.2	32	576	7	126	25	70	450	160	8.26	10
35	698.1	20.3	30	472	6	94	24	73	378	40	1.24	15
36	699.1	20.4	40	634	3	48	37	62	586	8	0.380	35
37	700.1	20.7	37	594	4	64	33	71	530	12	0.390	35
38	701.1	21.1	35	573	6	98	29	71	475	42	1.77	20
39	702.1	23.2	46	828	18	324	28	66	504	174	6.51	15
40	703.1	22.2	32	552	7	121	25	66	431	164	5.85	15
41	704.1	16.4	17	216	0	0	17	76	216	0	Imp.	50+
42	705.1	23.6	39	714	10	183	29	66	531	157	10.83	15
43	706.1	20.2	39	611	9	141	30	68	470	129	11.18	10
44	707.1	23.4	31	562	2	36	29	67	526	172	19.07	10
45	708.1	22.2	55	947	0	0	55	19	947	0	Imp.	50+
46	709.1	21.3	45	743	0	0	45	34	743	0	Imp.	50+
47	710.1	18.5	22	316	0	0	22	52	316	0	Imp.	50+
48	719.5	16.5	40	512	0	0	40	55	512	0	Imp.	50+
49	720.5	16.5	29	371	0	0	29	69	371	0	Imp.	50+

*—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

**—measured by passing water through sample within still containing residual oil