OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

16-31-20E

Hunley O-31

February 15, 1952

Oko Oil & Gas Company
Atlas Life Building
Tulsa, Oklahoma

Gentlemen:

Enclosed herewith is the report of the analysis of the 3" Rotary core taken from the Hunley Lease, Well No. O-31, Anderson County, Kansas, and submitted to our laboratory on January 29, 1952.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Fred O. Stenger

FOS:pc
c.c. to - D. K. Auld
Garnett, Kansas

Salmon Oil Corporation
Wright Building Annex
Tulsa, Oklahoma

Salmon Oil Corporation
11 West 42nd Street
New York 18, New York

OKO OIL & GAS COMPANY

CORE ANALYSIS REPORT

HUNLEY LEASE WELL NO. O-31

ANDERSON COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

FEBRUARY 15, 1952

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Oko Oil & Gas Company Lease Hunley Well No. 0-31

Location

Section 16 Twp. 21S Rge. 20E County Anderson State Kansas

Name of Sand		Squirrel
Top of Core		790.00
Bottom of Core		833.00
Top of Sand (Pay)		799.10
Bottom of Sand (Pay)		822.24
Total Feet of Permeable Sand	(Analyzed)	24.67
Total Feet of Floodable Sand	(Analyzed)	16.56

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 2	3.79	3.79
2 - 4	3.18	6.97
4 - 8	5.48	12.45
8 - 12	2.45	14.90
12 - 16	4.73	19.63
16 - 20	2.86	22.49
20 & above	2.18	24.67

Average Permeability Millidarcys	9.69
Average Percent Porosity	17.76
Average Percent Oil Saturation	42.31
Average Percent Water Saturation	34.98
Average Oil Content, Bbls./A. Ft.	591.
Total Oil Content, Bbls./Acre	13,216.
Average Percent Oil Recovery by Laboratory Flooding Tests	12.00
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	171.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	3,251.
Total Calculated Oil Recovery, Bbls./Acre	4,100.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	1137.

Water was used as the circulating fluid used in the coring of the sand in this well. A small amount of bleeding was observed in several of the sand samples.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
790.00 - 790.30	Gray sandy shale.
790.30 - 790.75	Gray shale.
790.75 - 790.90	Shaley sandstone.
790.90 - 791.40	Gray shale.
791.40 - 791.72	Laminated sandstone and shale.
791.72 - 792.50	Gray shale.
792.50 - 792.90	Brown fine grained finely laminated micaceous shaley sandstone.
792.90 - 794.47	Gray shale.
794.47 - 795.30	Laminated sandy shale.
795.30 - 795.75	Gray shale.
795.75 - 796.17	Laminated shaley sandstone.
796.17 - 796.45	Brown fine grained laminated micaceous shaley sandstone.
796.45 - 797.20	Laminated sandstone and shale.
797.20 - 797.50	Brown fine grained finely laminated micaceous shaley sandstone.
797.50 - 799.10	Brown fine grained laminated micaceous shaley sandstone containing a shale break.
799.10 - 799.80	Brown fine grained micaceous slightly shaley sandstone.
799.80 - 800.70	Brown fine grained micaceous slightly shaley sandstone containing a shale break.

800.70 - 800.85 - Laminated sandstone and shale.

800.85 - 801.55 - Brown fine grained laminated micaceous shaley sandstone.

801.55 - 802.00 - Brown fine grained slightly laminated micaceous shaley sandstone.

802.00 - 803.00 - Brown fine grained micaceous sandstone.

803.00 - 803.30 - Brown fine grained laminated micaceous shaley sandstone.

803.30 - 803.43 - Laminated sandstone and shale.

803.43 - 806.90 - Brown fine grained micaceous sandstone.

806.90 - 808.03 - Brown fine grained slightly laminated micaceous shaley sandstone.

808.03 - 808.55 - Brown fine grained laminated micaceous shaley sandstone.

808.55 - 808.90 - Laminated sandstone and shale.

808.90 - 809.58 - Brown fine grained laminated micaceous shaley sandstone.

809.58 - 810.60 - Brown fine grained micaceous sandstone.

810.60 - 811.40 - Brown fine grained laminated micaceous shaley sandstone.

811.40 - 812.20 - Brown fine grained slightly laminated micaceous shaley sandstone.

812.20 - 814.95 - Brown fine grained micaceous sandstone.

814.95 - 815.10 - Gray shale.

815.10 - 815.80 - Brown fine grained micaceous slightly shaley sandstone.

815.80 - 816.70 - Brown fine grained micaceous sandstone.

816.70 - 817.27 - Laminated sandstone and shale.

817.27 - 817.65 - Brown fine grained micaceous sandstone.

817.65 - 817.80 - Gray shale.

817.80 - 822.26 - Brown fine grained micaceous sandstone.

822.26 - 823.40 - Gray shale.

823.40 - 823.60 - Brown fine grained micaceous calcareous sandstone.

823.60 - 833.00 - According to log, dark shale and lime. (Core not received).

Coring was started at a depth of 799.00 feet in gray sandy shale and completed at a depth of 833.00 feet in dark shale and lime, according to the log. The top section is made up of alternate layers of gray shale, laminated sandy shale and brown fine grained micaceous shaley sandstone. The middle and lower sections contain more of the brown fine grained micaceous shaley sandstone and only a few thin layers of shale and laminated sandstone and shale. This core shows a total of 24.76 feet of sand. A total of 24.67 feet was analyzed and found to be permeable and 16.56 feet floodable.

PERMEABILITY

The sand in this well is comparatively tight having an overall weighted average permeability of only 9.69 millidarcys. For the sake of distribution, the core was divided into three sections. The weighted average permeability of the upper, middle and lower sections is 7.72, 7.46 and 18.64 millidarcys respectively (See Table II).

PERCENT SATURATION & OIL CONTENT

This core shows a weighted average percent oil saturation of 42.31 percent. The weighted average oil saturation for the upper, middle and lower sections is 43.94, 42.81 and 37.62 percent respectively. The weighted average percent water saturation for the upper, middle and lower sections is 33.20, 34.93 and 39.24 respectively. The overall average being 34.98 (See Table IV). This gives a weighted average total fluid saturation of 77.29 percent. This fairly low total fluid saturation indicates that an appreciable amount of fluid was lost during coring. In order 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. The results of this core analysis would indicate that the water used as the circulating fluid in the coring of the sand in this well was slightly salty.

The weighted average oil content of the upper, middle and lower sections is 593, 578 and 586 barrels per acre foot respectively; the overall average being 591. The total oil content, as shown by this core, is 13,216 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

The sand in this core responded fairly well to laboratory flooding, as a total recovery of 3,251 barrels per acre was obtained from 19.05 feet of sand by laboratory flooding tests. The weighted average percent oil saturation was reduced from 43.41 to 31.41, which represents an average recovery of 12.00 percent. The weighted average effective permeability of the samples is 0.723 millidarcys, while the average initial fluid production pressure is 26.6 pounds per square inch (See Table VI). From Table V, it is observed that of the 25 samples tested, all except 3 produced some oil, while all except 8 produced water.

CONCLUSION

On the basis of the above data and assumed the sand will take the required amount of water, it is believed that an efficient water flood within the vicinity of this well will recover approximately 4,100 barrels of oil per acre, or an average of 248 barrels per acre

foot from the 16.56 feet of floodable sand analyzed. In calculating this recovery, an allowance was made for oil lost during coring, and it was assumed that the primary production and the true water saturation of the sand are 10 and 34 percent respectively.

From a study of this report and the enclosed coregraph, it is believed that in the later stages of flooding, selective plugging of the more permeable layers in this well would result in additional oil recovery.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Oko Oil & Gas Company Lease Hunley Well No C-31

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	792.75	0.48	0.40	0.40	0.19
2	794.60	Imp.	0.43	0.83	0.00
3	795.25	Imp.	0.40	1.23	0.00
4	795.95	0.83	0.42	1.65	0.35
5	796.35	1.1	0.28	1.93	0.31
6	796.80	Imp.	0.55	2.48	0.00
7	797.13	0.44	0.20	2.68	0.09
8	797.64	0.80	0.32	3.00	0.26
9	798.15	1.5	0.55	3.55	0.83
10	798.72	2.8	0.65	4.20	1.82
11	799.27	5.1	0.40	4.60	2.04
12	799.75	7.1	0.30	4.90	2.13
13	800.30	13.	0.79	5.69	10.27
14	800.75	0.60	0.15	5.84	0.09
15	801.45	2.5	0.70	6.54	1.75
16	802.10	12.	0.70	7.24	8.40
17	802.48	16.	0.50	7.74	8.00
18	803.08	7.4	0.55	8.29	4.07
19	803.55	12.	0.37	8.66	4.44
20	804.08	12.	0.45	9.11	5.40
21	804.42	21.	0.35	9.46	7.35
22	804.75	14.	0.50	9.96	7.00
23	805.37	14.	0.50	10.46	7.00
24	805.75	9.9	0.50	10.96	4.95
25	806.37	9.2	0.80	11.76	7.36
26	807.00	6.4	0.40	12.16	2.56
27	807.58	3.3	0.45	12.61	1.49
28	807.96	2.5	0.28	12.89	0.70
29	808.60	0.58	0.10	12.99	0.06
30	809.10	4.2	0.68	13.67	2.86
31	809.85	14.	0.42	14.09	5.88
32	810.15	2.9	0.60	14.69	1.74
33	810.65	2.5	0.30	14.99	0.75
34	811.13	4.7	0.50	15.49	2.35
35	811.75	1.9	0.80	16.29	1.52
36	812.35	4.5	0.55	16.84	2.48
37	813.15	7.3	0.65	17.49	4.75
38	813.65	16.	0.45	17.94	7.20
39	814.05	7.4	0.45	18.39	3.33
40	814.52	9.3	0.65	19.04	6.05

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Oko Oil & Gas Company Lease Hunley Well No. 0-31

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
41	815.22	4.7	0.30	19.34	1.41
42	815.60	19.	0.40	19.74	7.60
43	816.29	7.1	0.70	20.44	4.97
44	816.65	2.4	0.20	20.64	0.48
46	817.16	0.86	0.57	21.21	0.49
46	817.55	29.	0.38	21.59	11.02
47	818.27	18.	0.70	22.29	12.60
48	818.65	15.	0.40	22.69	6.00
49	819.08	32.	0.40	23.09	12.80
50	819.42	17.	0.45	23.54	7.65
51	819.96	21.	0.45	23.99	9.45
52	820.42	11.	0.50	24.49	5.50
53	821.02	13.	0.60	25.09	7.80
54	821.57	26.	0.60	25.69	15.60
55	822.20	16.	0.36	26.05	5.76

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Oko Oil & Gas Company Lease Hunley Well No. 6-31

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
792.50 - 808.03	11.51	7.72	88.85
808.55 - 817.65	8.70	7.46	64.94
817.80 - 822.26	4.46	18.64	83.16
792.50 - 822.26	24.67	9.69	236.95

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RESULTS OF SATURATION TESTS

TABLE III

Company Oko Oil & Gas Company Lease Hunley Well No. O-31

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- A	792.60	14.1	12.8	-	-	140	0.40	0.40	56
2	796.12	15.1	40.5	47.3	87.8	475	0.42	0.82	200
F- 2	796.23	14.7	41.2	-	-	470	0.28	1.10	132
3	797.35	13.2	37.8	57.2	95.0	389	0.30	1.40	117
4	798.45	15.1	34.0	42.0	76.0	404	1.52	2.92	615
5	799.55	17.4	49.3	36.4	85.7	665	0.70	3.62	465
6	800.52	17.2	39.0	38.6	77.6	521	0.78	4.40	406
7	801.85	18.8	47.2	28.8	76.0	689	0.80	5.20	550
8	802.80	18.7	53.0	32.9	85.9	770	0.65	5.85	500
9	803.85	18.9	49.2	36.5	85.7	722	0.97	6.82	700
10	804.96	18.7	48.5	23.9	72.4	704	1.15	7.97	810
11	806.12	18.4	48.7	30.5	79.2	695	1.35	9.32	940
12	807.35	16.0	50.0	37.1	87.1	621	1.13	10.45	701
13	808.40	13.9	39.6	50.0	89.6	427	0.52	10.97	222
F-14	809.48	16.3	43.7	-	-	553	0.68	11.65	376
14	809.65	17.4	39.1	39.4	78.5	528	0.47	12.12	248

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Oko Oil & Gas Company Lease Gumley Well No. C-31

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.	
15	810.40	18.6	36.9	33.2	70.1	533	0.55	12.67	293
16	811.55	16.8	39.0	36.6	75.6	509	1.60	14.27	814
17	812.65	16.3	40.4	40.7	81.1	512	1.10	15.37	563
18	813.85	18.1	41.4	42.4	83.8	582	1.00	16.37	582
19	814.88	18.4	50.7	33.9	84.5	740	0.65	17.02	481
20	815.98	19.4	54.7	33.8	88.5	824	0.90	17.92	740
22	817.95	19.6	42.6	41.7	84.3	689	0.60	18.52	388
23	818.85	18.9	31.5	41.9	73.4	463	0.90	19.42	417
24	819.75	19.8	39.3	38.4	77.7	604	0.95	20.37	574
25	820.75	20.2	34.8	39.2	74.0	545	1.05	21.42	572
26	821.85	21.5	41.4	36.2	77.6	691	0.96	22.38	664
							Total		13,126

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Oko Oil & Gas Company Lease Hunley Well No. 0-31

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
792.50 - 808.03	10.45	17.11	43.94	33.20	593	6,192
808.03 - 817.27	7.47	17.31	42.81	34.93	578	4,319
817.80 - 822.26	4.46	20.04	37.62	39.24	586	2,615
792.50 - 822.26	22.38	17.76	42.31	34.98	591	13,216

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Oko Oil & Gas Company Lease Hunley Well No. 9-31

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.			
A	792.60	14.1	12.8	140	0.0	0	12.8	65.0	140	0	Imp.	50#
2	796.25	14.7	41.2	471	5.7	66	35.5	62.5	405	0	0.009	50
3	797.35	13.4	37.3	388	4.8	50	32.5	67.0	338	0	0.001	50
4	798.45	15.6	31.9	366	0.0	0	31.9	65.1	386	0	0.001	50
5	799.55	17.2	49.4	659	11.8	157	37.6	57.0	508	0	0.015	30
6	800.52	17.2	37.9	507	10.8	145	27.1	68.2	362	0	0.005	50
7	801.65	16.8	47.1	708	13.5	197	34.6	61.6	505	20	0.465	25
8	802.80	18.4	52.7	758	19.2	274	33.5	64.6	478	7	0.200	20
9	803.85	18.9	47.9	702	14.8	217	33.1	61.7	485	30	0.805	20
10	804.96	18.9	47.8	697	14.6	204	32.9	65.9	483	34	0.818	20
11	806.12	18.0	47.1	658	16.2	226	30.9	64.9	452	17	0.457	15
12	807.35	16.2	51.1	644	13.4	169	37.7	62.2	478	0	0.002	30
13	808.40	14.1	39.8	435	0.0	0	39.8	70.0	435	0	Imp.	50#
14	809.48	16.3	43.7	553	13.8	175	29.9	66.4	378	3	0.100	25
15	810.40	19.1	38.9	578	10.5	156	28.4	65.1	422	41	0.813	20
16	811.55	16.8	38.6	503	7.0	91	31.6	65.3	412	11	0.190	30
17	812.65	16.3	42.3	536	7.8	99	34.5	61.5	437	5	0.804	30
18	813.85	17.8	40.1	548	8.7	119	31.4	68.0	489	24	0.634	25
19A	814.73	18.9	47.8	698	13.0	190	34.8	64.5	508	103	2.92	20
20	815.96	19.9	57.6	869	21.8	336	35.8	56.7	583	10	0.294	20
22	817.95	20.1	43.9	670	16.7	261	26.2	69.3	409	153	3.60	15
23	818.85	19.8	31.1	483	10.1	151	21.0	67.8	312	58	1.45	20
24	819.75	19.7	37.7	577	11.8	181	25.9	71.5	396	60	1.64	20
25	820.75	20.6	35.7	536	6.4	101	27.5	67.1	435	27	0.653	30
26	821.85	21.2	39.2	645	9.0	148	30.2	62.3	497	62	1.67	20

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" Sample was taken after the core was received in the laboratory.

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Oko Oil & Gas Company Lease Hunley Well No. O-31

	796.17 - 808.03	808.90 - 816.70	817.80 - 822.26	796.17 - 822.26
Depth Interval Feet				
Feet of Core Analyzed	8.11	6.48	4.46	19.05
Average Percent Porosity	17.67	17.61	20.20	18.24
Average Percent Original Oil Saturation	47.10	43.58	36.46	43.41
Average Percent Oil Recovery	13.70	11.08	10.25	12.00
Average Percent Residual Oil Saturation	33.40	32.50	26.21	31.41
Average Percent Residual Water Saturation	63.30	63.23	67.47	64.25
Average Percent Total Residual Fluid Saturation	96.70	95.73	93.68	95.66
Average Original Oil Content, Bbls./A. Ft.	646.	600.	572.	614.
Average Oil Recovery, Bbls./A. Ft.	189.	155.	160.	171.
Average Residual Oil Content, Bbls./A. Ft.	457.	445.	412.	443.
Total Original Oil Content, Bbls./Acre	5,240.	3,891.	2,550.	11,681.
Total Oil Recovery, Bbls./Acre	1,533.	1,005.	713.	3,251.
Total Residual Oil Content, Bbls./Acre	3,707.	2,886.	1,837.	8,430.
Average Effective Permeability, Millidarcys	0.324	0.593	1.64	0.723
Average Initial Fluid Production Pressure, p.s.i.	31.0	24.3	21.0	26.6

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 Oko Oil & Gas Company Lease Hunley Well No. O-31

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation Connate	Drilling & Foreign	Total
2	796.12	20,400			
3	797.35	25,600			
4	798.45	22,500			
5	799.55	20,300			
6	800.52	17,900			
7	801.85	22,700			
8	802.80	18,800			
9	803.85	14,600			
10	804.96	22,500			
11	806.12	19,300			
12	807.35	23,200			
13	808.40	22,700			
14	809.65	21,700			
15	810.40	17,600			
16	811.55	23,100			
17	812.65	18,000			
18	813.85	15,200			
19	814.88	21,800			
20	815.98	16,300			
22	817.95	6,500			
23	818.85	12,700			
24	819.75	7,000			
25	820.75	7,600			
26	821.85	8,400			

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTATION TESTS

TABLE VIII

Company Oke Oil & Gas Company Lease Hunley Well No. 0-31

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
795.75 - 808.03	20,610		
808.03 - 816.70	19,527		
817.80 - 822.26	8,522		
795.75 - 822.26	17,696		

Note: ppm - parts per million.