OILFIELD RESEARCH LABORATORIES

536 NORTH HIGHLAND - CHANUTE, KANSAS 66720 - PHONE (316) 431-2650

June 12, 1979

Oaks Petroleum, Inc.
Rt. 2
Stoystown, Pennsylvania 15563

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary cores taken from the Armstrong Lease, Well No. LO-4, Franklin County, Kansas, and submitted to our laboratory on June 1, 1979.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

Benjamin R. Pearman

SAM:km
3 c to Stoystown, Pennsylvania
1 c to Ottawa, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Oaks Petroleum, Inc. Lease Armstrong Well No. LO-4

Location 440' SNL & 1,485' WEL

Section 22 Twp. 17S Rge. 21E County Franklin State Kansas

Name of Sand	Peru
Top of Core	331.0
Bottom of Core	351.0
Top of Sand	331.0
Bottom of Sand	350.5
Total Feet of Permeable Sand	18.2
Total Feet of Floodable Sand	15.1

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 100	9.5	9.5
100 - 200	6.2	15.7
200 - 400	2.0	17.7
400 & Above	0.5	18.2

Average Permeability Millidarcys	144.8
Average Percent Porosity	18.8
Average Percent Oil Saturation	34.9
Average Percent Water Saturation	51.2
Average Oil Content, Bbls./A. Ft.	510.
Total Oil Content, Bbls./Acre	9,289.
Average Percent Oil Recovery by Laboratory Flooding Tests	6.1
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	95.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,437.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Waterflooding)	3,835.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

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GENERAL INFORMATION & SUMMARY

Company Oaks Petroleum, Inc. Lease Armstrong Well No. LO-4

Location 440' SNL & 1,485' WEL

Section 22 Twp. 17S Rge. 21E County Franklin State Kansas

Name of Sand	Upper Squirrel
Top of Core	502.0
Bottom of Core	512.5
Top of Sand	502.0
Bottom of Sand	512.5
Total Feet of Permeable Sand	5.0
Total Feet of Floodable Sand	

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 – 5	5.0	5.0

Average Permeability Millidarcys	3.5
Average Percent Porosity	16.2
Average Percent Oil Saturation	24.7
Average Percent Water Saturation	62.8
Average Oil Content, Bbls./A. Ft.	319.
Total Oil Content, Bbls./Acre	1,946.
Average Percent Oil Recovery by Laboratory Flooding Tests	
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	
Total Calculated Oil Recovery, Bbls./Acre	
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

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GENERAL INFORMATION & SUMMARY

Company Oaks Petroleum, Inc. Lease Armstrong Well No. LO-4

Location 440' SNL & 1,485' WEL

Section 22 Twp. 17S Rge. 21E County Franklin State Kansas

Name of Sand	Lower Squirrel
Top of Core	557.0
Bottom of Core	562.0
Top of Sand	557.0
Bottom of Sand	560.7
Total Feet of Permeable Sand	3.2
Total Feet of Floodable Sand	

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	2.3	2.3
5 - 10	0.9	3.2

Average Permeability Millidarcys	2.7
Average Percent Porosity	17.2
Average Percent Oil Saturation	24.8
Average Percent Water Saturation	53.7
Average Oil Content, Bbls./A. Ft.	344.
Total Oil Content, Bbls./Acre	1,100.
Average Percent Oil Recovery by Laboratory Flooding Tests	
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	
Total Calculated Oil Recovery, Bbls./Acre	
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

The cores were sampled by a representative of Oilfield Research Laboratories. The drilling fluid consisted of fresh water mud. These cores were reported to be from a non-virgin area.

At the request of the client, only the Peru Sand was subjected to floodpot testing.

FORMATION CORED

The detailed log of the formation cored is as follows:

PERU SAND

Depth Interval, Feet	Description
331.0 - 331.5	Dark brown sandstone.
331.5 - 331.9	Light brown and gray laminated sandstone and shale.
331.9 - 335.8	Dark brown slightly calcareous sandstone.
335.8 - 336.2	White limestone.
336.2 - 340.2	Dark brown slightly calcareous sandstone.
340.2 - 340.7	Brown very calcareous sandstone.
340.7 - 342.5	Dark brown calcareous sandstone.
342.5 - 343.0	White limestone.
343.0 - 350.5	Dark brown slightly calcareous sandstone.
350.5 - 351.0	White limestone.

UPPER SQUIRREL SAND

Depth Interval, Feet	Description
502.0 - 502.8	Brown very shaly sandstone.
502.8 - 504.2	Gray sandy shale.
504.2 - 504.7	Light brown very shaly sandstone.
504.7 - 506.1	Gray sandy shale.

Depth Interval, Feet	Description
506.1 - 506.8	Gray and brown laminated sandstone and shale.
506.8 - 508.6	Brown slightly shaly sandstone.
508.6 - 510.2	Gray sandy shale.
510.2 - 510.8	Brown very shaly sandstone.
510.8 - 512.5	Brown slightly shaly sandstone.

LOWER SQUIRREL SAND

Depth Interval, Feet	Description
557.0 - 557.9	Dark brown slightly shaly sandstone.
557.9 - 559.9	Light brown and gray laminated sandstone and shale.
559.9 - 560.4	Gray sandy shale.
560.4 - 560.7	Brown slightly shaly sandstone.
560.7 - 562.0	Gray sandy shale.

LABORATORY FLOODING TESTS

PERU SAND

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,437 barrels of oil per acre was obtained from 15.1 feet of sand. The weighted average percent oil saturation was reduced from 36.2 to 30.1, or represents an average recovery of 6.1 percent. The weighted average effective permeability of the samples is 2.28 millidarcys, while the average initial fluid production pressure is 20.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 20 samples tested, 20 produced water and 16 oil. This indicates that approximately 80 percent of the sand represented by these samples is floodable pay sand.

CALCULATED RECOVERY

PERU SAND

It would appear from a study of the data, that efficient primary and waterflood operations in the vicinity of this well should recover approximately 3,835 barrels of oil per acre. This is an average recovery of 254 barrels per acre foot from 15.1 feet of floodable sand analyzed in this core.

These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.03
Reservoir water saturation, percent	35.0
Average porosity, percent	19.8
Oil saturation after flooding, percent	30.1
Performance factor, percent	50.0
Net floodable pay sand, feet	15.1

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Oaks Petroleum, Inc. **Lease** Armstrong **Well No.** LO-4

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	Total			Ft.	Cum. Ft.		
						PERU SAND					
1	331.4	24.9	38	37	75	734	986.	0.5	0.5	367	493.00
2	332.4	12.4	31	39	70	298	47.	1.1	1.6	328	51.70
3	333.4	15.1	25	62	87	293	82.	1.0	2.6	293	82.00
4	334.4	16.8	38	54	92	495	31.	1.0	3.6	495	31.00
5	335.4	19.2	38	49	87	566	79.	0.8	4.4	453	63.20
6	336.4	16.6	45	50	95	580	84.	0.8	5.2	464	67.20
7	337.4	21.9	42	41	83	714	77.	1.0	6.2	714	77.00
8	338.4	16.0	37	43	80	459	97.	1.0	7.2	459	97.00
9	339.4	19.6	36	44	80	547	125.	1.2	8.4	656	150.00
10	340.4	8.6	40	53	93	267	11.	0.5	8.9	134	5.50
11	341.4	16.3	32	62	94	405	58.	1.3	10.2	527	75.40
12	342.3	17.6	28	61	89	382	52.	0.5	10.7	191	26.00
13	343.5	17.4	39	48	87	527	203.	1.0	11.7	527	203.00
14	344.4	20.8	39	50	89	629	198.	1.0	12.7	629	198.00
15	345.3	19.7	31	64	95	474	174.	1.0	13.7	474	174.00
16	346.5	22.9	38	47	85	675	178.	1.0	14.7	675	178.00
17	347.5	23.9	35	49	84	649	247.	1.0	15.7	649	247.00
18	348.5	24.3	36	54	90	679	190.	1.0	16.7	679	190.00
19	349.4	20.2	27	57	84	423	187.	1.0	17.7	423	187.00
20	350.4	19.5	20	64	84	303	78.	0.5	18.2	152	39.00

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Oaks Petroleum, Inc. **Lease** Armstrong **Well No.** LO-4

UPPER SQUIRREL SAND

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	Total			Ft.	Cum. Ft.		
1	502.5	17.6	25	63	88	341	0.37	0.8	0.8	273	0.30
2	504.4	11.7	2	90	92	18	Imp.	0.5	1.3	9	0.00
3	506.2	16.8	34	53	87	443	4.1	0.7	2.0	310	2.87
4	507.5	16.7	23	61	84	298	4.2	1.2	3.2	358	5.04
5	508.5	14.6	19	70	89	215	4.9	0.6	3.8	129	2.94
6	510.4	15.6	18	70	88	218	Imp.	0.6	4.4	131	0.00
7	511.5	16.9	33	55	88	433	3.6	1.7	6.1	736	6.12

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Oaks Petroleum, Inc. **Lease** Armstrong **Well No.** LO-4

LOWER SQUIRREL SAND

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	Total			Ft.	Cum. Ft.		
1	557.6	20.7	33	40	73	530	7.5	0.9	0.9	477	6.75
2	558.6	15.0	16	68	84	186	0.27	1.0	1.9	186	0.27
3	559.5	16.9	32	42	74	420	0.98	1.0	2.9	420	0.98
4	560.5	14.7	5	86	91	57	2.6	0.3	3.2	17	0.78

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Oaks Petroleum, Inc. Lease Armstrong Well No. LO-4

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
	PERU SAND		
331.0 - 342.5	10.7	113.9	1219.00
343.0 - 350.5	7.5	188.8	1416.00
331.0 - 350.5	18.2	144.8	2635.00

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
331.0 - 342.5	10.7	17.1	35.5	49.6	475	5,081
343.0 - 350.5	7.5	21.2	34.0	53.5	561	4,208
331.0 - 350.5	18.2	18.8	34.9	51.2	510	9,289

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Oaks Petroleum, Inc. Lease Armstrong Well No. LO-4

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
	UPPER SQUIRREL SAND		
502.0 - 512.5	5.0	3.5	17.27

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
502.0 - 512.5	6.1	16.2	24.7	62.8	319	1,946

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Oaks Petroleum, Inc. Lease Armstrong Well No. LO-4

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
	LOWER SQUIRREL SAND		
557.0 - 560.7	3.2	2.7	8.78

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
557.0 - 560.7	3.2	17.2	24.8	53.7	344	1,100

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Oaks Petroleum, Inc. Lease Armstrong Well No. LO-4

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.			
						PERU SAND						
1	331.4	25.2	38	743	18	352	20	66	391	211	14.37	10
2	332.4	12.0	32	298	0	0	32	50	298	10	0.30	30
3	333.4	15.3	25	297	0	0	25	65	297	5	0.22	40
4	334.4	16.5	38	486	10	128	28	78	358	45	0.90	20
5	335.4	18.7	38	552	4	58	34	62	494	61	1.30	20
6	336.4	16.6	45	580	6	78	39	57	502	18	0.44	30
7	337.4	21.5	42	701	13	217	29	51	484	138	3.00	20
8	338.4	16.4	37	471	8	102	29	62	369	49	0.89	20
9	339.4	19.2	36	536	4	60	32	58	476	55	1.11	20
10	340.4	9.0	40	279	0	0	40	55	279	12	0.33	30
11	341.4	16.8	32	417	2	26	30	66	391	53	1.11	20
12	342.3	18.1	28	393	2	28	26	71	365	49	1.00	20
13	343.5	17.6	39	532	5	68	34	63	464	161	3.66	20
14	344.4	21.1	39	638	6	99	33	65	539	130	2.80	20
15	345.3	20.2	31	486	2	31	29	67	455	53	1.00	20
16	346.5	22.4	38	660	8	139	30	68	521	127	2.78	20
17	347.5	23.3	35	633	3	54	32	65	579	144	3.44	20
18	348.5	23.8	36	665	7	130	29	69	535	102	2.22	20
19	349.4	20.7	27	434	4	64	23	64	369	166	3.89	20
20	350.4	19.1	21	311	0	0	21	74	311	21	0.44	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.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Oaks Petroleum, Inc. Lease Armstrong Well No. LO-4

PERU SAND

Depth Interval, Feet	331.0 - 342.5	343.0 - 350.5	331.0 - 350.5
Feet of Core Analyzed	8.1	7.0	15.1
Average Percent Porosity	18.4	21.3	19.8
Average Percent Original Oil Saturation	37.2	35.0	36.2
Average Percent Oil Recovery	7.0	5.0	6.1
Average Percent Residual Oil Saturation	30.2	30.0	30.1
Average Percent Residual Water Saturation	63.0	65.9	64.3
Average Percent Total Residual Fluid Saturation	93.2	95.9	94.4
Average Original Oil Content, Bbls./A. Ft.	533.	579.	554.
Average Oil Recovery, Bbls./A. Ft.	105.	84.	95.
Average Residual Oil Content, Bbls./A. Ft.	428.	495.	459.
Total Original Oil Content, Bbls./Acre	4,317.	4,047.	8,364.
Total Oil Recovery, Bbls./Acre	852.	585.	1,437.
Total Residual Oil Content, Bbls./Acre	3,465.	3,462.	6,927.
Average Effective Permeability, Millidarcys	2.05	2.83	2.28
Average Initial Fluid Production Pressure, p.s.i.	20.0	20.0	20.0

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