

OILFIELD RESEARCH LABORATORIES

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July 11, 1983

Petroleum Production Corporation
Box 202
Paola, Kansas 66071

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary cores taken from the Lowe Lease, Well No. 1, located in Miami County, Kansas and submitted to our laboratory on June 29, 1983.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


Sanford A. Michel

SAM/rmc

5 c to Paola, Kansas

Oilfield Research Laboratories
GENERAL INFORMATION & SUMMARY

Company Petroleum Production Corporation Lease Lowe Well No. 1
Location _____
Section 30 Twp. 17S Rge. 22E County Miami State Kansas

Elevation, Feet

Name of Sand	Peru	Squirrel
Top of Core	333.0	498.0
Bottom of Core	354.9	503.7
Top of Sand	333.0	498.0
Bottom of Sand	354.7	503.0
Total Feet of Permeable Sand	16.4	4.4
Total Feet of Floodable Sand	9.0	1.0

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

PERU SANDSTONE

0 - 12	7.6	7.6
12 - 32	1.5	9.1
33 - 83	2.2	11.3
156 - 224	1.7	13.0
346 - 372	2.0	15.0
955 - 1093	1.4	16.4

SQUIRREL SANDSTONE

4 - 13	3.2	3.2
30 - 33	1.2	4.4

Average Permeability Millidarcys	160.0	15.1
Average Percent Porosity	16.3	19.3
Average Percent Oil Saturation	41.8	56.2
Average Percent Water Saturation	34.3	30.1
Average Oil Content, Bbls./A. Ft.	531.	843.
Total Oil Content, Bbls./Acre	8,707.	3,710.
Average Percent Oil Recovery by Laboratory Flooding Tests	9.6	15.0
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	158.	202.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,426.	202.
Total Calculated Oil Recovery, Bbls./Acre	See "Calculated Recovery" Section	

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The core was sampled and the samples sealed in plastic by a representative of the client. Fresh water mud was used as a drilling fluid.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
	<u>PERU SANDSTONE</u>
333.0 - 334.0	Brown slightly shaly sandstone with scattered gray shale partings.
334.0 - 334.4	Brown shaly sandstone with gray shale inclusions and partings.
334.4 - 335.9	Gray slightly sandy slightly calcareous shale.
335.9 - 336.5	Alternate layers gray shale and slightly calcareous brown sandstone.
336.5 - 337.0	Brown slightly calcareous shaly sandstone.
337.0 - 337.6	Brown slightly calcareous slightly shaly sandstone.
337.6 - 338.3	Brown slightly calcareous shaly sandstone with scattered limestone partings.
338.3 - 340.0	Gray calcareous shale with scattered limestone nodules and inclusions.
340.0 - 340.5	Brown calcareous sandstone.
340.5 - 340.9	Alternate layers limestone, shale, and brown sandstone.
340.9 - 341.7	Brown calcareous shaly sandstone with gray shale partings.
341.7 - 342.3	Grayish light brown limestone.
342.3 - 343.3	Brown calcareous sandstone with scattered gray shale partings.
343.3 - 344.7	Brown very slightly carbonaceous very slightly calcareous sandstone.

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<u>Depth Interval, Feet</u>	<u>Description</u>
344.7 - 347.1	Brown very slightly calcareous sandstone with scattered gray shale partings.
347.1 - 348.7	Grayish brown calcareous very shaly sandstone.
348.7 - 349.0	Brown slightly calcareous sandstone.
349.0 - 350.0	Brown sandy limestone.
350.0 - 351.0	Brown calcareous sandstone.
351.0 - 351.5	Gray and brown laminated shale and sandstone.
351.5 - 353.7	Brown calcareous sandstone with scattered gray shale partings and inclusions.
353.7 - 354.7	Gray and brown laminated shale and sandstone.
354.7 - 354.9	Gray shale.
354.9 - 498.0	No core.
<u>SQUIRREL SANDSTONE</u>	
498.0 - 499.2	Dark brown very slightly carbonaceous sandstone.
499.2 - 499.8	Gray shale.
499.8 - 501.0	Dark brown very slightly carbonaceous sandstone.
501.0 - 502.0	Gray and dark brown laminated shale and sandstone.
502.0 - 503.0	Black slightly carbonaceous sandstone with scattered gray shale partings.
503.0 - 503.7	Gray slightly sandy shale.

LABORATORY FLOODING TESTS

PERU SANDSTONE

The Peru Sandstone in this core responded to laboratory flooding tests, as a total recovery of 1,426 barrels of oil per acre was obtained from 9.0 feet of sand. The weighted average percent oil saturation was reduced from 45.4 to 35.8, or represents an average recovery of 9.6 percent. The weighted average effective permeability

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of the samples is 15.46 millidarcys, while the average initial fluid production pressure is 16.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 20 samples tested, 10 produced water and oil, and 4 produced water only. This indicates that approximately 50 percent of the sand represented by these samples is floodable pay sand.

LABORATORY FLOODING TESTS

SQUIRREL SANDSTONE

The Squirrel Sandstone in this core responded to laboratory flooding tests, as a total recovery of 202 barrels of oil per acre was obtained from 1.0 foot of sand. The weighted average percent oil saturation was reduced from 54.0 to 39.0, or represents an average recovery of 15.0 percent. The weighted average effective permeability of the samples is 2.40 millidarcys, while the average initial fluid production pressure is 25.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 4 samples tested, 1 produced water and oil. This indicates that approximately 25 percent of the sand represented by these samples is floodable pay sand.

CALCULATED RECOVERY

It would appear from a study of the core data, that efficient primary and waterflood operations in the vicinity of this well should recover approximately 3,480 barrels of oil per acre from the Peru Sandstone, and approximately 307 barrels of oil per acre from the Squirrel Sandstone. This is an average recovery of 387 barrels per acre foot from 9.0 feet of floodable sand from the Peru Sandstone, and an average recovery of 307 barrels per acre foot from 1.0 foot of floodable sand from the Squirrel Sandstone.

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

	<u>Peru Sandstone</u>	<u>Squirrel Sandstone</u>
Original formation volume factor, (estimated)	1.03	1.04
Reservoir water saturation, percent, (estimated)	15.0	20.0
Average porosity, percent	19.4	17.4
Oil saturation after flooding, percent	35.8	39.0
Performance factor, percent, (estimated)	55.0	60.0
Net floodable sand, feet	9.0	1.0

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Petroleum Production Corporation Lease Low Well No. 1

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 SANDSTONE											
1	333.1	20.7	31	40	71	498	7.1	1.0	1.0	498	7.10
2	334.1	20.9	19	48	67	308	4.8	0.4	1.4	123	1.92
3	336.7	12.8	43	25	68	427	5.4	0.5	1.9	214	2.70
4	337.5	10.2	38	15	53	301	6.0	0.6	2.5	181	3.60
5	338.1	14.9	53	38	91	613	5.8	0.7	3.2	429	4.06
6	340.4	15.2	37	54	91	436	21.	0.5	3.7	218	10.50
7	341.6	17.1	24	61	85	318	2.6	0.8	4.5	254	2.08
8	342.7	24.9	35	23	58	676	371.	1.0	5.5	676	371.00
9	343.7	24.5	64	20	84	1216	1092.	0.7	6.2	851	764.40
10	344.3	26.1	50	15	65	1012	955.	0.7	6.9	708	668.50
11	345.8	23.5	50	17	67	912	156.	1.4	8.3	1277	218.40
12	346.8	16.9	35	23	58	459	346.	1.0	9.3	459	346.00
13	347.5	5.1	40	49	89	158	0.17	1.6	10.9	253	0.27
14	348.9	20.5	26	28	54	414	223.	0.3	11.2	124	66.90
15	349.5	4.1	48	50	98	153	0.34	1.0	12.2	153	0.34
16	350.6	13.0	39	44	83	393	13.	1.0	13.2	393	13.00
17	351.7	14.6	52	18	70	589	82.	0.7	13.9	412	57.40
18	352.3	17.9	48	20	68	667	65.	0.8	14.7	534	52.00
19	353.3	18.5	50	32	82	718	33.	0.7	15.4	503	23.10
20	354.2	14.4	40	53	93	447	3.1	1.0	16.4	447	3.10
SQUIRREL SANDSTONE											
21	498.2	20.2	49	34	83	768	12.	1.2	1.2	922	14.40
22	500.3	20.2	52	23	75	815	31.	1.2	2.4	978	37.20
23	501.5	17.2	54	41	95	721	4.9	1.0	3.4	721	4.90
24	502.5	19.5	72	23	95	1089	10.	1.0	4.4	1089	10.00

Oilfield Research Laboratories
SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Petroleum Production Corporation Lease Lowe Well No. 1

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
<u>PERU SANDSTONE</u>			
333.0 - 341.7	4.5	7.1	31.96
342.3 - 354.7	11.9	217.2	2584.41
333.0 - 354.7	16.4	160.0	2616.37
<u>SQUIRREL SANDSTONE</u>			
498.0 - 503.0	4.4	15.1	66.50

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
<u>PERU SANDSTONE</u>						
333.0 - 341.7	4.5	16.3	35.0	40.7	426	1,917
342.3 - 354.7	11.9	16.3	44.4	31.9	571	6,790
333.0 - 354.7	16.4	16.3	41.8	34.3	531	8,707
<u>SQUIRREL SANDSTONE</u>						
498.0 - 503.0	4.4	19.3	56.2	30.1	843	3,710

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company		Petroleum Production Corporation				Lease		Lowe		Well No. 1		
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 SANDSTONE												
1	333.1	20.2	31	486	0	0	31	42	486	10	0.22	50
2	334.1	20.4	20	317	0	0	20	47	317	0	Imp.	-
3	336.7	13.0	43	434	0	0	43	25	434	0	Imp.	-
4	337.5	10.7	37	307	0	0	37	16	307	0	Imp.	-
5	338.1	15.3	52	617	0	0	52	41	617	6	0.08	50
6	340.4	15.7	36	438	0	0	36	58	438	12	0.22	45
7	341.6	17.6	23	314	0	0	23	62	314	0	Imp.	-
8	342.7	24.6	35	668	6	115	29	54	553	284	14.14	10
9	343.7	24.7	64	1226	28	537	36	51	689	334	65.97	10
10	344.3	26.1	50	1012	12	243	38	47	769	162	30.49	10
11	345.8	23.3	50	904	14	253	36	54	651	366	24.98	10
12	346.8	16.5	35	448	3	38	32	63	410	280	4.42	20
13	347.5	5.6	40	174	0	0	40	49	174	0	Imp.	-
14	348.9	20.1	26	405	0	0	26	70	405	168	3.07	25
15	349.5	4.6	47	168	0	0	47	51	168	0	Imp.	-
16	350.6	13.2	39	399	4	41	35	63	358	206	3.67	20
17	351.7	14.6	52	589	13	147	39	56	442	250	8.83	15
18	352.3	17.7	48	659	6	82	42	55	577	292	5.10	20
19	353.3	18.2	50	706	13	184	37	56	522	260	4.20	20
20	354.2	14.8	40	459	3	34	37	59	425	126	1.20	25
SQUIRREL SANDSTONE												
21	498.2	20.6	48	767	0	0	48	35	767	0	Imp.	-
22	500.3	19.9	52	803	0	0	52	24	803	0	Imp.	-
23	501.5	17.4	54	729	15	202	39	57	527	132	2.40	25
24	502.5	19.8	71	1091	0	0	71	24	1091	0	Imp.	-

Notes: cc—cubic centimeter.

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

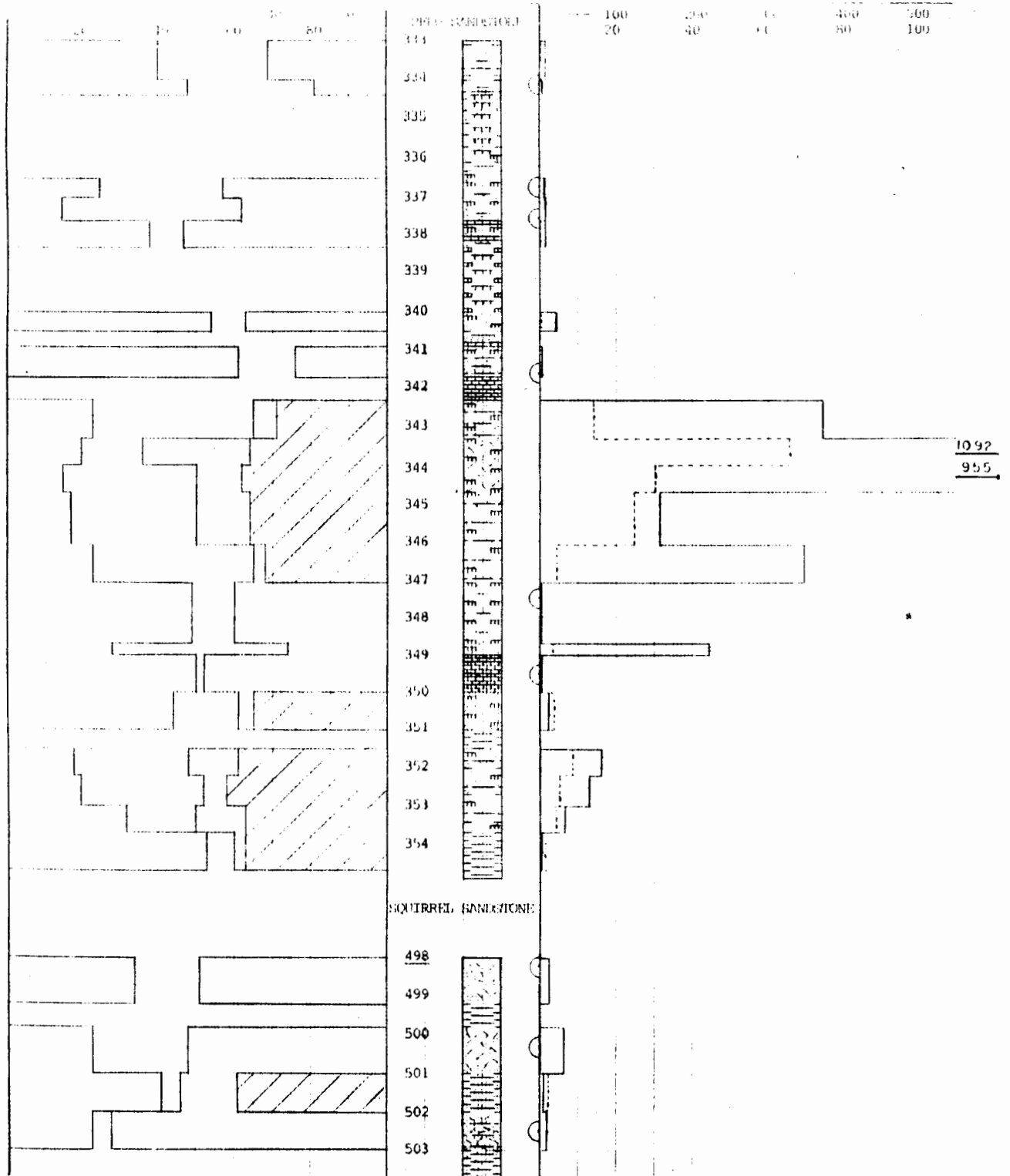
**—Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories
SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Petroleum Production Corporation	Lease	Lowe	Well No.	1
		<u>PERU SANDSTONE</u>		<u>SQUIRREL SANDSTONE</u>	
Depth Interval, Feet		342.3 - 354.7		498.0 - 503.0	
Feet of Core Analyzed		9.0		1.0	
Average Percent Porosity		19.4		17.4	
Average Percent Original Oil Saturation		45.4		54.0	
Average Percent Oil Recovery		9.6		15.0	
Average Percent Residual Oil Saturation		35.8		39.0	
Average Percent Residual Water Saturation		56.2		57.0	
Average Percent Total Residual Fluid Saturation		92.0		96.0	
Average Original Oil Content, Bbls./A. Ft.		693.		729.	
Average Oil Recovery, Bbls./A. Ft.		158.		202.	
Average Residual Oil Content, Bbls./A. Ft.		535.		527.	
Total Original Oil Content, Bbls./Acre		6,239.		729.	
Total Oil Recovery, Bbls./Acre		1,426.		202.	
Total Residual Oil Content, Bbls./Acre		4,813.		527.	
Average Effective Permeability, Millidarcys		15.46		2.40	
Average Initial Fluid Production Pressure, p.s.i.		16.0		25.0	

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



KEY:

- SHALE
- CARBONACEOUS SANDSTONE
- SANDY SHALE
- LIMESTONE
- SANDY LIMESTONE
- CALCAREOUS SANDSTONE
- SHALY CALCAREOUS SANDSTONE
- SANDY CALCAREOUS SHALE
- CARBONACEOUS CALCAREOUS SANDSTONE
- CARBONACEOUS SANDSTONE WITH SHALE PARTINGS
- IMPERMEABLE TO WATER

- SHALY SANDSTONE WITH SHALE INCLUSIONS AND PARTINGS
- ALTERNATE LAYERS OF SHALE AND CALCAREOUS SANDSTONE
- ALTERNATE LAYERS OF LIMESTONE AND CALCAREOUS SANDSTONE
- CALCAREOUS SHALE WITH LIMESTONE NODULES AND INTERFACES
- ALTERNATE LAYERS OF LIMESTONE, SHALE AND SANDSTONE
- CALCAREOUS SANDSTONE WITH SHALE PARTINGS AND INCLUSIONS
- SHALY SANDSTONE WITH SHALE PARTINGS
- SHALY CALCAREOUS SANDSTONE WITH SHALE PARTINGS
- CALCAREOUS SANDSTONE WITH SHALE PARTINGS
- LAMINATED SANDSTONE AND SHALE
- FLOODPOT RESIDUAL OIL SATURATION

PETROLEUM PRODUCTION CORPORATION

LOWE LEASE

MIAMI COUNTY, KANSAS

WELL NO. 1

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE PERCENT POROSITY	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVERAGE PERMEABILITY, MILLIDARCYS	CALCULATED OIL RECOVERY BBLs. / ACRE
PERU SANDSTONE						
333.0 - 341.7	4.5	16.3	35.0	40.7	7.1	
342.3 - 354.7	11.9	16.3	44.4	31.9	217.2	
333.0 - 354.7	16.4	16.3	41.8	34.3	160.0	3480