

# OILFIELD RESEARCH LABORATORIES

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

September 28, 1981

Pathfinder Petroleum Corporation  
10603 North Penn  
Suite 300  
Oklahoma City, Oklahoma 73120

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Smith Lease, Well No. L-24, located in Neosho County, Kansas and submitted to our laboratory on September 14, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas

5 c to Oklahoma City, Oklahoma

**Oilfield Research Laboratories**  
**GENERAL INFORMATION & SUMMARY**

Company Pathfinder Petroleum Corporation Lease Smith Well No. L-24

Location \_\_\_\_\_

Section 34 Twp. 28S Rge. 19E County Neosho State Kansas

Elevation, Feet .....  
Name of Sand..... Upper Bartlesville  
Top of Core ..... 666.0  
Bottom of Core ..... 677.0  
Top of Sand ..... 666.4  
Bottom of Sand ..... 674.5  
Total Feet of Permeable Sand ..... 8.1  
Total Feet of Floodable Sand.....

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 12	4.1	4.1
60 - 65	1.0	5.1
70 - 80	3.0	8.1

Average Permeability Millidarcys ..... 31.4  
Average Percent Porosity ..... 18.3  
Average Percent Oil Saturation ..... 39.4  
Average Percent Water Saturation..... 28.2  
Average Oil Content, Bbls./A. Ft. .... 535.  
Total Oil Content, Bbls./Acre..... 4,336.  
Average Percent Oil Recovery by Laboratory Flooding Tests..... 4.4  
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. .... 71.  
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre ..... 163.  
Total Calculated Oil Recovery, Bbls./Acre..... See "Calculated Recovery"  
Section

The core was sampled and the samples sealed in plastic bags 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>
666.0 - 666.4	Gray shale.
666.4 - 667.0	Grayish brown shaly sandstone.
667.0 - 671.7	Brown sandstone.
671.7 - 674.5	Grayish brown shaly sandstone with shale partings.
674.5 - 677.0	Gray shale.

#### LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 163 barrels of oil per acre was obtained from 2.3 feet of sand. The weighted average percent oil saturation was reduced from 39.6 to 35.2, or represents an average recovery of 4.4 percent. The weighted average effective permeability of the samples is 8.7 millidarcys, while the average initial fluid production pressure is 35.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 9 samples tested, 3 produced water and oil, and 3 produced water only. This indicates that approximately 33 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 640 barrels of oil per acre. This is an average recovery of 276 barrels per acre foot from 2.3 feet of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.04
Reservoir water saturation, percent, estimated	25.0
Average porosity, percent	19.3
Oil saturation after flooding, percent	35.2
Performance factor, percent, estimated	50.0
Net floodable sand, feet	2.3

**Oilfield Research Laboratories**  
**RESULTS OF SATURATION & PERMEABILITY TESTS**

TABLE 1-B

Company Pathfinder Petroleum Corporation Lease Smith Well No. L-24

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	666.5	18.0	59	17	76	824	4.0	0.6	0.6	494	2.40
2	667.5	20.1	23	36	59	359	63.	1.0	1.6	359	63.00
3	668.5	21.4	32	27	59	531	76.	1.0	2.6	531	76.00
4	669.5	21.1	29	32	61	475	72.	1.0	3.6	475	72.00
5	670.6	17.6	34	31	65	464	11.	0.7	4.3	325	7.70
6	671.5	19.6	24	31	55	365	73.	1.0	5.3	365	73.00
7	672.6	14.7	51	28	79	582	0.28	1.0	6.3	582	0.28
8	673.6	14.3	66	26	92	732	4.6	1.0	7.3	732	4.60
9	674.4	17.3	44	21	65	591	0.74	0.8	8.1	473	0.69

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## SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Lease	Smith	Well No.	L-24	
Pathfinder Petroleum Corporation					
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbks./Acre
666.4 - 671.7	5.3	47.0	249.10	481	2,549
671.7 - 674.5	2.8	2.0	5.47	638	1,787
666.4 - 674.5	8.1	31.4	254.57	535	4,336
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Total Oil Content Bbks./Acre
666.4 - 671.7	5.3	19.9	31.6	29.8	2,549
671.7 - 674.5	2.8	15.3	54.4	25.3	1,787
666.4 - 674.5	8.1	18.3	39.4	28.2	4,336

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## RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

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.	
			%	Bbbs./A. Ft.	%	Bbbs./A. Ft.	% Oil	% Water				
1	666.5	18.1	59	828	9	126	50	32	702	16	0.30	45
2	667.5	20.1	23	359	0	0	23	61	359	406	6.07	15
3	668.5	21.3	32	529	2	33	30	46	496	236	19.49	10
4	669.5	21.1	29	475	0	0	29	50	475	320	9.00	10
5	670.6	17.4	34	459	4	54	30	42	405	10	0.37	50
6	671.5	19.7	24	367	0	0	24	72	367	112	2.10	30
7	672.6	15.2	50	590	0	0	50	30	590	0	Imp.	-
8	673.6	14.4	66	737	0	0	66	28	737	0	Imp.	-
9	674.4	16.8	45	587	0	0	45	22	587	0	Imp.	-

Company Pathfinder Petroleum Corporation Lease Smith Well No. L-24

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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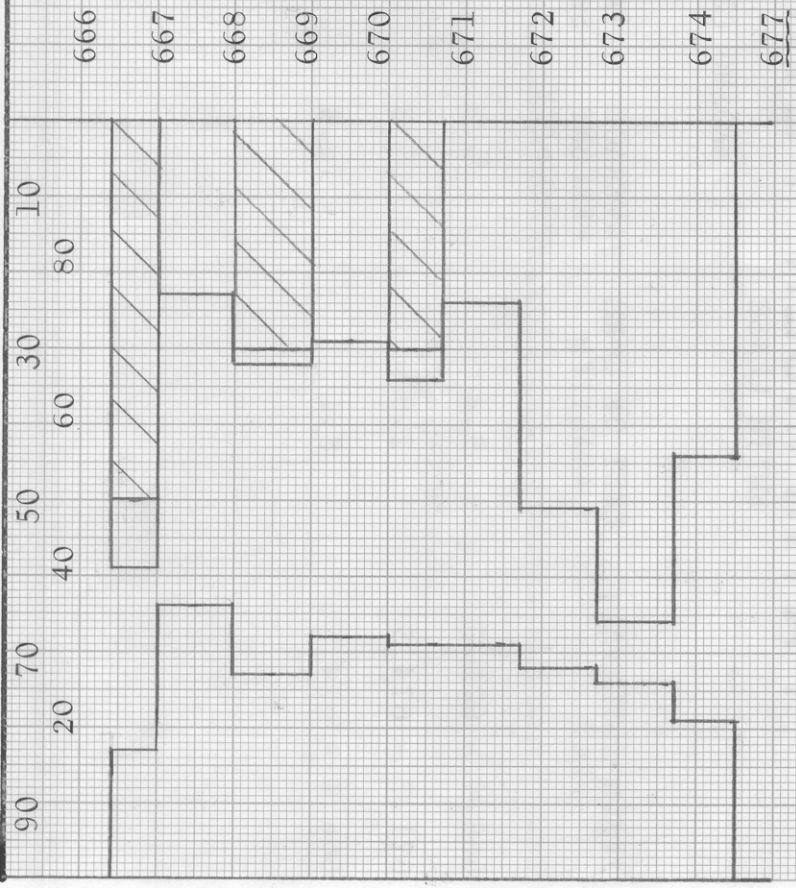
## SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

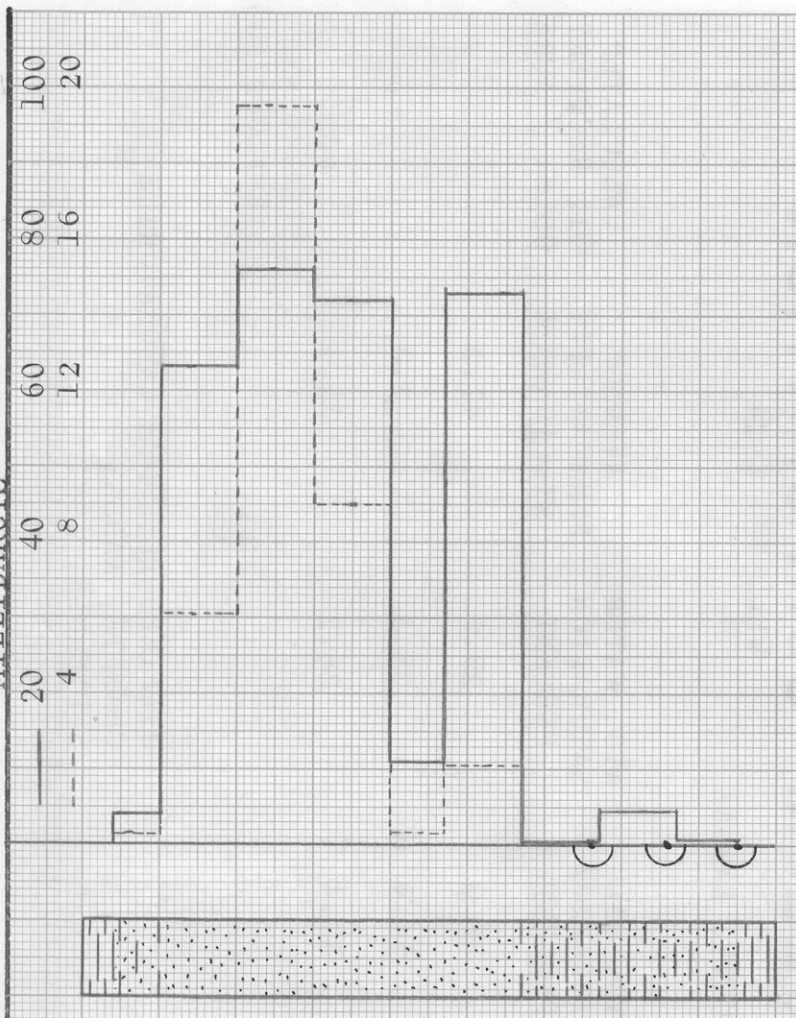
Company	Pathfinder Petroleum Corporation	Lease	Smith	Well No.	L-24
Depth Interval, Feet	666.4 - 671.7				
Feet of Core Analyzed	2.3				
Average Percent Porosity	19.3				
Average Percent Original Oil Saturation	39.6				
Average Percent Oil Recovery	4.4				
Average Percent Residual Oil Saturation	35.2				
Average Percent Residual Water Saturation	41.1				
Average Percent Total Residual Fluid Saturation	76.3				
Average Original Oil Content, Bbls./A. Ft.	593.				
Average Oil Recovery, Bbls./A. Ft.	71.				
Average Residual Oil Content, Bbls./A. Ft.	522.				
Total Original Oil Content, Bbls./Acre	1,364.				
Total Oil Recovery, Bbls./Acre	163.				
Total Residual Oil Content, Bbls./Acre	1,201.				
Average Effective Permeability, Millidarcys	8.7				
Average Initial Fluid Production Pressure, p.s.i.	35.0				

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

WATER SAT., PERCENT  $\rightarrow$  OIL SAT., PERCENT  $\leftarrow$



PERMEABILITY, IN MILLIDARCYS  
EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS



KEY:

SANDSTONE  
SHALE

SHALY SANDSTONE  
SHALY SANDSTONE WITH SHALE PARTINGS  
FLOODPOT RESIDUAL OIL SATURATION

666  
667  
668  
669  
670  
671  
672  
673  
674  
677

○ IMPERMEABLE TO WATER

# PATHFINDER PETROLEUM CORPORATION

SMITH LEASE

WELL NO. L-24

NEOSHO COUNTY, KANSAS

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
666.4 - 671.7	5.3	19.9	31.6	29.8	47.0	
671.7 - 674.5	2.8	15.3	54.4	25.3	2.0	
666.4 - 674.5	8.1	18.3	39.4	28.2	31.4	640 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES  
CHANUTE, KANSAS  
SEPTEMBER, 1981