OILFIELD RESEARCH LABORATORIES

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

December 11, 1981

Jayhawk Production Company
c/o Don Bloomer
Box 105
Rantoul, Kansas 66079

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Cooper Lease, Well No. 13, located in Franklin County, Kansas and submitted to our laboratory on December 4, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/tem

5 c to Rantoul, Kansas

T18S, R20E, Sec. 34

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jayhawk Production Company Lease Cooper Well No. 13

Location -

Section - Twp. - Rge. - County Franklin State Kansas

Elevation, Feet	
Name of Sand	
Top of Core	814.0
Bottom of Core	834.0
Top of Sand	814.0
Bottom of Sand	821.0
Total Feet of Permeable Sand	7.0
Total Feet of Floodable Sand	1.0

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
3 - 5	2.3	2.3
20 - 25	1.7	4.0
120 - 340	3.0	7.0

Average Permeability Millidarcys	108.8
Average Percent Porosity	21.3
Average Percent Oil Saturation	67.0
Average Percent Water Saturation	18.7
Average Oil Content, Bbls./A. Ft.	1,112.
Total Oil Content, Bbls./Acre	7,781.
Average Percent Oil Recovery by Laboratory Flooding Tests	6.0
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	108.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	108.
Total Calculated Oil Recovery, Bbls./Acre	See "Calculated Recovery" Section.

The core was sampled by a representative of Oilfield Research Laboratories. The core was reported to be from a non-virgin area.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
814.0 - 817.0	Black slightly carbonaceous sandstone.
817.0 - 818.2	Brown sandstone with micaceous partings.
818.2 - 819.5	Grayish brown shaly sandstone with micaceous partings.
819.5 - 820.0	Dark brown sandstone.
820.0 - 823.0	Grayish brown shaly sandstone with micaceous partings.
823.0 - 834.0	Gray shale.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 108 barrels of oil per acre was obtained from 1.0 foot of sand. The weighted average percent oil saturation was reduced from 62.0 to 56.0, or represents an average recovery of 6.0 percent. The weighted average effective permeability of the samples is 7.57 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 7 samples tested, 1 produced water and oil, and 1 produced water only. This indicates that approximately 14.0 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 286 barrels of oil per acre. This is an average recovery of 286 barrels per acre foot from 1.0 foot of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.06
Reservoir water saturation, percent, estimated	10.0
Average porosity, percent	23.2
Oil saturation after flooding, percent	56.0
Performance factor, percent, estimated	55.0
Net floodable sand, feet	1.0

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jayhawk Production Company Lease Cooper Well No. 13

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	814.4	23.1	62	13	75	1111	259.	1.0	1.0	1111.	259.00
2	815.5	21.8	73	18	91	1235	122.	1.0	2.0	1235.	122.00
3	816.7	24.4	77	16	93	1458	335.	1.0	3.0	1458.	335.00
4	817.5	19.3	70	21	91	1048	21.	1.2	4.2	1258.	25.20
5	818.4	21.3	73	14	87	1206	3.8	1.3	5.5	1568.	4.94
6	819.6	19.4	40	41	81	602	22.	0.5	6.0	301.	11.00
7	820.6	18.9	58	20	78	850	4.4	1.0	7.0	850.	4.40

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jayhawk Production Company Lease Cooper Well No. 13

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
814.0 - 817.0	3.0	238.7	716.00
817.0 - 821.0	4.0	11.4	45.54
814.0 - 821.0	7.0	108.8	761.54

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
814.0 - 817.0	3.0	23.1	70.7	15.7	1,268.	3,804.
817.0 - 821.0	4.0	19.9	64.2	21.0	994.	3,977.
814.0 - 821.0	7.0	21.3	67.0	18.7	1,112.	7,781.

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jayhawk Production Company Lease Cooper Well No. 13

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	814.4	23.2	62	1116	6	108	56	30	1008	312	7.57	25
2	815.5	21.9	73	1240	0	0	73	19	1240	36	0.94	40
3	816.7	24.8	76	1462	0	0	76	18	1462	0	Imp.	-
4	817.5	19.2	70	1043	0	0	70	22	1043	0	Imp.	-
5	818.4	21.4	73	1212	0	0	73	15	1212	0	Imp.	-
6	819.6	19.3	40	599	0	0	40	42	599	0	Imp.	-
7	820.6	18.5	59	847	0	0	59	20	847	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 Jayhawk Production Company Lease Cooper Well No. 13

Depth Interval, Feet	814.0 - 817.0
Feet of Core Analyzed	1.0
Average Percent Porosity	23.2
Average Percent Original Oil Saturation	62.0
Average Percent Oil Recovery	6.0
Average Percent Residual Oil Saturation	56.0
Average Percent Residual Water Saturation	30.0
Average Percent Total Residual Fluid Saturation	86.0
Average Original Oil Content, Bbls./A. Ft.	1116.
Average Oil Recovery, Bbls./A. Ft.	108.
Average Residual Oil Content, Bbls./A. Ft.	1008.
Total Original Oil Content, Bbls./Acre	1116.
Total Oil Recovery, Bbls./Acre	108.
Total Residual Oil Content, Bbls./Acre	1008.
Average Effective Permeability, Millidarcys	7.57
Average Initial Fluid Production Pressure, p.s.i.	25.0

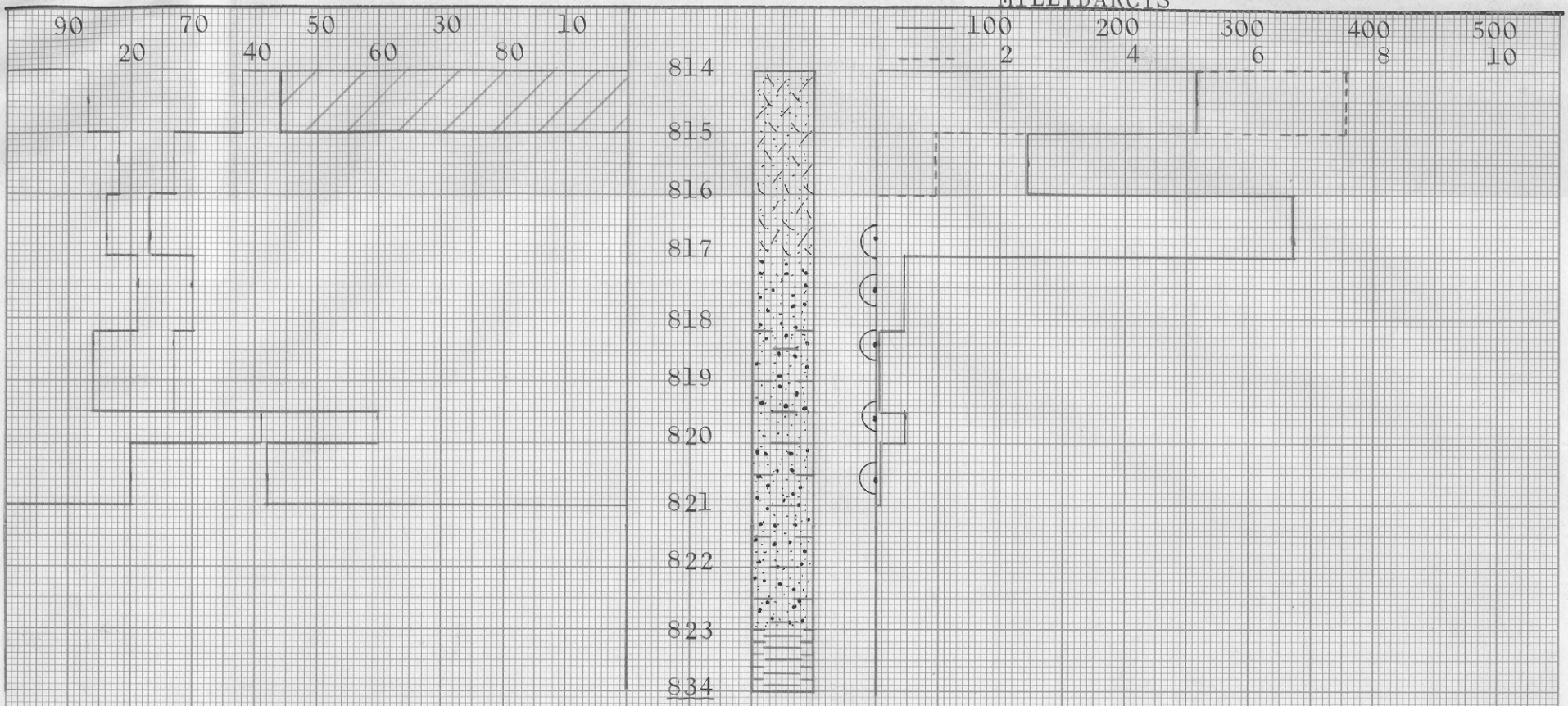
NOTE: Only those samples which recovered oil were used in calculating the above averages.

WATER SAT., PERCENT ⟶ 90 70 50 30 10

⟵ OIL SAT., PERCENT 20 40 60 80

——— 100 200 300 400 500 PERMEABILITY, IN MILLIDARCYS

- - - - - 2 4 6 8 10 EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS



KEY:

- SANDSTONE
- SHALY MICACEOUS SANDSTONE
- IMPERMEABLE TO WATER
- CARBONACEOUS SANDSTONE
- MICACEOUS SANDSTONE
- SHALE
- FLOODPOT RESIDUAL OIL SATURATION

JAYHAWK PRODUCTION COMPANY

COOPER LEASE WELL NO. 13

FRANKLIN COUNTY, KANSAS

DEPTH INTERVAL — FEET OF CORE — AVERAGE — AVG. OIL — AVG. WATER — AVERAGE — CALCULATED

○ IMPERMEABLE TO WATER

▨ FLOODPOT RESIDUAL OIL SATURATION

JAYHAWK PRODUCTION COMPANY

COOPER LEASE WELL NO. 13

FRANKLIN 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
814.0 - 817.0	3.0	23.1	70.7	15.7	238.7	
817.0 - 821.0	4.0	19.9	64.2	21.0	11.4	
814.0 - 821.0	7.0	21.3	67.0	18.7	108.8	286 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
DECEMBER, 1981

PDC