

OILFIELD RESEARCH LABORATORIES

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

October 23, 1981

Jayhawk Production Company
113 South Kansas
Olathe, Kansas 66061
c/o Gerald Williams

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Spencer "A" Lease, Well No. 9, located in Franklin County, Kansas and submitted to our laboratory on October 7, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas

5 c to Olathe, Kansas

- REGISTERED ENGINEERS -

CORE ANALYSIS - WATER ANALYSIS - REPRESSURING ENGINEERING - SURVEYING & MAPPING - PROPERTY EVALUATION & OPERATION

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GENERAL INFORMATION & SUMMARY

Company Jayhawk Production Company Lease Spencer "A" Well No. 9
 Location SW ¼
 Section 13 Twp. 18S Rge. 20E County Franklin State Kansas

Elevation, Feet
 Name of Sand..... Squirrel
 Top of Core 667.0
 Bottom of Core 743.0
 Top of Sand 667.0
 Bottom of Sand 738.6
 Total Feet of Permeable Sand 9.7
 Total Feet of Floodable Sand 1.9

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 4	6.1	6.1
4 - 8	1.3	7.4
8 - 16	2.3	9.7

Average Permeability Millidarcys 4.7
 Average Percent Porosity 14.6
 Average Percent Oil Saturation 38.4
 Average Percent Water Saturation 49.9
 Average Oil Content, Bbls./A. Ft. 444.
 Total Oil Content, Bbls./Acre 8,222.
 Average Percent Oil Recovery by Laboratory Flooding Tests 9.2
 Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 113.
 Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 214.
 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 Oilfield Research Laboratories. Air was used as a drilling fluid. The core was reported to be from a virgin area.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
667.0 - 668.8	Grayish brown slightly calcareous shaly sandstone.
668.8 - 669.4	Grayish brown calcareous very shaly sandstone.
669.4 - 669.9	Grayish brown very shaly sandstone.
669.9 - 670.8	Brown sandstone with intermittent shale partings containing a vertical fracture.
670.8 - 671.7	Dark brown slightly calcareous slightly carbonaceous shaly sandstone.
671.7 - 672.9	Grayish brown shaly sandstone with shale partings.
672.9 - 678.0	Gray and brown laminated shale and sandstone.
678.0 - 678.6	Brown and gray laminated sandstone and shale.
678.6 - 679.0	Dark brown shaly sandstone.
679.0 - 679.4	Gray and brown laminated shale and sandstone.
679.4 - 679.9	Dark brown shaly sandstone.
679.9 - 685.7	Gray sandy shale with intermittent brown sandstone partings.
685.7 - 687.6	Gray very shaly sandstone.
687.6 - 723.0	No core.
723.0 - 726.5	Brown and gray laminated sandstone and shale.
726.5 - 733.4	Dark gray slightly sandy shale.
733.4 - 733.9	Grayish brown calcareous shaly sandstone.
733.9 - 735.2	Brown and gray laminated sandstone and shale.
735.2 - 735.7	Brown slightly calcareous sandstone.
735.7 - 737.6	Grayish light brown slightly sandy limestone.
737.6 - 738.1	Grayish brown calcareous shaly sandstone.

738.1 - 738.6 Brown slightly calcareous sandstone.

738.6 - 743.0 Gray slightly sandy shale containing a vertical fracture.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 214 barrels of oil per acre was obtained from 1.9 feet of sand. The weighted average percent oil saturation was reduced from 64.1 to 54.9, or represents an average recovery of 9.2 percent. The weighted average effective permeability of the samples is 0.25 millidarcys, while the average initial fluid production pressure is 45.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 21 samples tested, 3 produced water and oil. This indicates that approximately 14 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 272 barrels of oil per acre. This is an average recovery of 143 barrels per acre foot from 1.9 feet of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.05
Reservoir water saturation, percent, estimated	20.0
Average porosity, percent	15.7
Oil saturation after flooding, percent	54.9
Performance factor, percent, estimated	55.0
Net floodable sand, feet	1.9

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jayhawk Production Company Lease Spencer "A" Well No. 9

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			Ft.	Cum. Ft.		
1	667.6	12.6	46	44	450	1.7	1.0	1.0	450	1.70
2	668.7	14.4	35	50	391	5.2	0.8	1.8	313	4.16
3	669.7	13.2	45	46	461	0.53	0.5	2.3	231	0.27
4	670.7	16.4	69	27	878	15.	0.9	3.2	790	13.50
5	671.6	15.2	61	24	719	3.1	0.9	4.1	647	2.79
6	672.6	15.3	62	31	736	1.8	1.2	5.3	883	2.16
7	674.4	14.3	25	59	277	Imp.	1.6	6.9	443	0.00
8	675.8	13.1	28	61	285	Imp.	1.5	8.4	428	0.00
9	676.7	15.0	30	54	349	Imp.	1.0	9.4	349	0.00
10	677.4	15.5	24	67	289	0.78	1.0	10.4	289	0.78
11	678.8	20.7	66	21	1060	8.5	0.4	10.8	424	3.40
12	679.6	20.7	52	30	835	7.8	0.5	11.3	418	3.90
13	685.8	13.3	11	66	113	Imp.	0.9	12.2	102	0.00
14	686.7	14.0	22	61	239	Imp.	1.0	13.2	239	0.00
15	723.4	13.1	34	60	346	Imp.	1.0	14.2	346	0.00
16	724.3	14.8	28	65	322	0.22	1.0	15.2	322	0.22
17	733.5	11.2	39	57	339	Imp.	0.5	15.7	170	0.00
18	734.6	14.3	31	60	344	Imp.	1.3	17.0	447	0.00
19	735.5	16.1	55	23	687	9.2	0.5	17.5	344	4.60
20	737.7	13.3	67	30	691	3.8	0.5	18.0	346	1.90
21	737.4	16.8	37	51	482	13.	0.5	18.5	241	6.50

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Lease	Well No.				
Jayhawk Production Company	Spencer "A"	9				
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.	Average Percent Oil Saturation	Average Percent Water Saturation	Total Oil Content Bbls./Acre
667.0 - 687.6	7.2	4.5	32.66	38.5	48.5	455
723.0 - 738.6	2.5	5.3	13.22	38.0	53.5	418
667.0 - 738.6	9.7	4.7	45.88	38.4	49.9	444
667.0 - 687.6	13.2			14.8		6,006
723.0 - 738.6	5.3			14.2		2,216
667.0 - 738.6	18.5			14.6		8,222

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company **Jayhawk Production Company**

Lease

Spencer "A"

Well No.

9

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			
1	667.6	12.7	46	453	0	0	46	453	0	Imp.	-
2	668.7	14.5	35	394	0	0	35	394	0	Imp.	-
3	669.7	13.3	45	464	0	0	45	464	0	Imp.	-
4	670.7	16.7	68	881	11	143	57	738	12	0.37	40
5	671.6	15.3	61	724	0	0	61	724	0	Imp.	-
6	672.6	15.4	62	741	0	0	62	741	0	Imp.	-
7	674.4	14.4	25	279	0	0	25	279	0	Imp.	-
8	675.8	13.3	28	289	0	0	28	289	0	Imp.	-
9	676.7	14.9	30	347	0	0	30	347	0	Imp.	-
10	677.4	15.4	24	287	0	0	24	287	0	Imp.	-
11	678.8	20.6	66	1055	0	0	66	1055	0	Imp.	-
12	679.6	20.8	52	839	0	0	52	839	0	Imp.	-
13	685.8	13.4	11	114	0	0	11	114	0	Imp.	-
14	686.7	14.1	22	241	0	0	22	241	0	Imp.	-
15	723.4	13.6	33	348	0	0	33	348	0	Imp.	-
16	724.3	14.9	28	324	0	0	28	324	0	Imp.	-
17	733.5	11.3	39	342	0	0	39	342	0	Imp.	-
18	734.6	14.4	31	346	0	0	31	346	0	Imp.	-
19	735.5	16.2	55	691	5	63	50	628	7	0.13	50
20	737.7	13.5	66	691	10	105	56	586	8	0.15	45
21	738.4	16.9	37	485	0	0	37	485	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.

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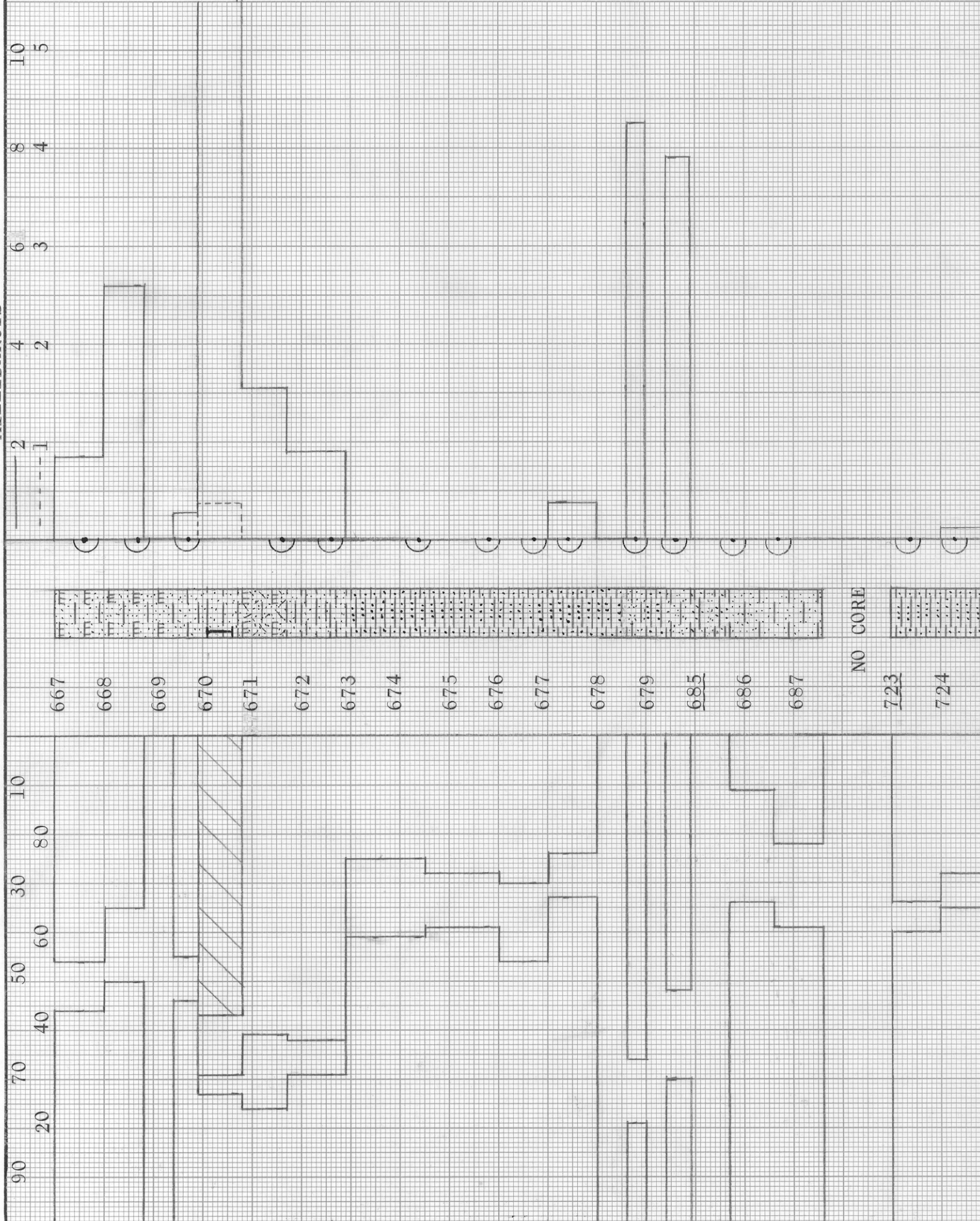
SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

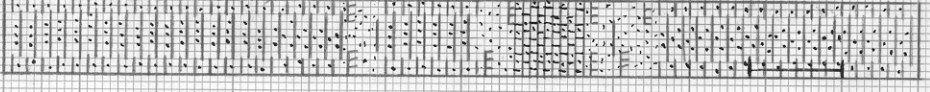
Company	Lease	Spencer "A"	Well No.
Jayhawk Production Company	667.0 - 687.6	723.0 - 738.6	667.0 - 738.6
Depth Interval, Feet	0.9	1.0	1.9
Feet of Core Analyzed	16.7	14.9	15.7
Average Percent Porosity	68.0	60.5	64.1
Average Percent Original Oil Saturation	11.0	7.5	9.2
Average Percent Oil Recovery	57.0	53.0	54.9
Average Percent Residual Oil Saturation	40.0	35.5	37.6
Average Percent Residual Water Saturation	97.0	88.5	92.5
Average Percent Total Residual Fluid Saturation	88.1	692.	782.
Average Original Oil Content, Bbls./A. Ft.	143.	85.	113.
Average Oil Recovery, Bbls./A. Ft.	738.	607.	669.
Average Residual Oil Content, Bbls./A. Ft.	793.	692.	1,485.
Total Original Oil Content, Bbls./Acre	129.	85.	214.
Total Oil Recovery, Bbls./Acre	664.	607.	1,271.
Total Residual Oil Content, Bbls./Acre	0.37	0.15	0.25
Average Effective Permeability, Millidarcys	40.0	47.5	45.0
Average Initial Fluid Production Pressure, p.s.i.			

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














WATER SAT., PERCENT →
 OIL SAT., PERCENT ←
 PERMEABILITY, IN MILLIDARCYS
 EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS



723
724
725
726
733
734
735
737
738
740
741
742
743



KEY:

-  CALCAREOUS SANDSTONE
-  SHALY SANDSTONE
-  CALCAREOUS SHALY SANDSTONE
-  SANDY LIMESTONE
-  SANDY SHALE
-  SHALY SANDSTONE WITH SHALE PARTINGS
-  SANDSTONE WITH SHALE PARTINGS
-  LAMINATED SANDSTONE AND SHALE
-  CARBONACEOUS CALCAREOUS SHALY SANDSTONE
-  SANDY SHALE WITH SANDSTONE PARTINGS
-  FORMATION CONTAINING A VERTICAL FRACTURE
-  FLOODPOT RESIDUAL OIL SATURATION
-  IMPERMEABLE TO WATER

SANDY SHALE

FLOODPOT RESIDUAL OIL SATURATION

SHALY SANDSTONE WITH SHALE
PARTINGS

IMPERMEABLE TO WATER

JAYHAWK PRODUCTION COMPANY

SPENCER "A" LEASE

WELL NO. 9

FRANKLIN COUNTY, KANSAS

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE		AVG. OIL		AVG. WATER		AVERAGE		CALCULATED OIL RECOVERY BBLs. / ACRE
		POROSITY PERCENT	SATURATION PERCENT	SATURATION PERCENT	SATURATION PERCENT	PERMEABILITY, MILLIDARCYs	PERMEABILITY, MILLIDARCYs	PERMEABILITY, MILLIDARCYs	PERMEABILITY, MILLIDARCYs	
667.0 - 687.6	13.2	14.8	38.5	48.5	4.5					
723.0 - 738.6	5.3	14.2	38.0	53.5	5.3					
667.0 - 738.6	18.5	14.6	38.4	49.9	4.7					272 (PRIMARY AND WATERFLOODING)

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CHANUTE, KANSAS
OCTOBER, 1981

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