

OILFIELD RESEARCH LABORATORIES

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

November 17, 1981

Ram Gas & Oil
306 N. Walnut Street
Paola, Kansas 66071

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Carrol Ball Lease, Well No. 4, located in Linn County, Kansas and submitted to our laboratory on November 9, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/mkf

5 c to Paola, Ks.

- REGISTERED ENGINEERS -

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

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GENERAL INFORMATION & SUMMARY

Company Ram Gas & Oil Lease Carrol Ball Well No. 4
 Location 125' FWL & 850' FNL S½, SE½
 Section 7 Twp. 21S Rge. 22E County Linn State Kansas

Elevation, Feet

Name of Sand..... SQUIRREL

Top of Core 496.0

Bottom of Core 509.5

Top of Sand 496.0

Bottom of Sand 509.5

Total Feet of Permeable Sand 7.2

Total Feet of Floodable Sand 1.0

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 1	2.8	2.8
1 - 5	3.0	5.8
5 -10	1.4	7.2

Average Permeability Millidarcys 3.4

Average Percent Porosity 13.7

Average Percent Oil Saturation 13.1

Average Percent Water Saturation..... 75.6

Average Oil Content, Bbls./A. Ft. 159.

Total Oil Content, Bbls./Acre..... 2,146.

Average Percent Oil Recovery by Laboratory Flooding Tests..... 4.0

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 51.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 51.

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. The core was reported to be from a non-virgin area.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> Feet	<u>Description</u>
496.0 - 497.0	Light gray very shaly sandstone.
497.0 - 497.5	Light grayish brown very shaly sandstone.
497.5 - 498.9	Light gray very shaly sandstone.
498.9 - 500.7	Light grayish brown very shaly sandstone.
500.7 - 501.7	Light grayish brown shaly sandstone with intermittent micaceous partings.
501.7 - 503.2	Light grayish brown very shaly sandstone with intermittent micaceous partings.
503.2 - 505.1	Light brown slightly calcareous sandstone.
505.1 - 506.0	Light gray very shaly sandstone.
506.0 - 508.0	Gray and light brown laminated shale and sandstone.
508.0 - 508.5	Light brown slightly shaly sandstone with intermittent micaceous partings.
508.5 - 509.5	Gray and light brown laminated shale and sandstone.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 51 barrels of oil per acre was obtained from 1.0 feet of sand. The weighted average percent oil saturation was reduced from 31.0 to 27.0, or represents an average recovery of 4.0 percent. The weighted average effective permeability of the

samples is 0.22 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 14 samples tested, 1 produced water and oil. This indicates that approximately 7 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 operation in the vicinity of this well should recover approximately 212 barrels of oil per acre. This is an average recovery of 212 barrels per acre foot from 1.0 feet of floodable sand analyzed in this core.

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

Original formation volume factor, estimated	1.05
Reservoir water saturation, percent, estimated	40.0
Average porosity, percent	16.5
Oil saturation after flooding, percent	27.0
Performance factor, percent, estimated	55.0
Net floodable sand, feet	1.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbbs. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	496.5	11.9	1	94	95	9	Imp.	1.0	1.0	9	0.00
2	497.4	7.9	23	70	93	141	Imp.	0.5	1.5	141	0.00
3	498.4	14.4	1	89	90	11	Imp.	1.4	2.9	15	0.00
4	499.6	16.1	6	80	86	75	1.2	1.0	3.9	75	1.20
5	500.6	14.2	21	72	93	231	0.33	0.8	4.7	185	0.26
6	501.5	18.1	18	58	76	253	4.6	1.0	5.7	253	4.60
7	502.4	14.8	7	83	90	80	Imp.	1.5	7.2	120	0.00
8	503.5	17.4	24	58	82	324	9.9	0.9	8.1	292	8.91
9	504.5	16.4	31	45	76	394	4.5	1.0	9.1	394	4.50
10	505.7	5.3	9	87	96	37	Imp.	0.9	10.0	33	0.00
11	506.7	14.4	2	87	89	22	0.25	1.0	11.0	22	0.25
12	507.7	13.4	6	89	95	62	0.33	1.0	12.0	62	0.33
13	908.4	18.8	46	40	86	671	8.3	0.5	12.5	356	4.15
14	509.4	12.2	20	76	96	189	Imp.	1.0	13.5	189	0.00

Company Ram Gas & Oil

Lease Carrol Ball

Well No. 4

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Lease	Well No.	Well No.		
Ram Gas & Oil	Carrol Ball			4	
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.		
496.0 - 509.5	7.2	3.4	24.20		
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Water Saturation	Average Oil Content Ebl./A. Ft.	Total Oil Content Ebls./Acre
496.0 - 509.5	13.5	13.7	13.1	75.6	159
					2,146

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Ram Gas & Oil Lease Carrol Ball Well No. 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			
1	496.5	12.0	1	9	0	0	1	94	0	Imp.	-
2	497.4	8.0	23	143	0	0	23	71	0	Imp.	-
3	498.4	14.5	1	11	0	0	1	90	0	Imp.	-
4	499.6	16.2	6	75	0	0	6	81	0	Imp.	-
5	500.6	14.7	20	228	0	0	20	73	0	Imp.	-
6	501.5	18.0	18	251	0	0	18	59	0	Imp.	-
7	502.4	14.9	7	81	0	0	7	84	0	Imp.	-
8	503.5	17.9	23	319	0	0	23	60	0	Imp.	-
9	504.5	16.5	31	397	4	51	27	50	6	Imp.	45
10	505.7	5.4	9	38	0	0	9	88	0	Imp.	-
11	506.7	14.3	2	22	0	0	2	88	0	Imp.	-
12	507.7	13.5	6	63	0	0	6	90	0	Imp.	-
13	508.4	18.7	46	667	0	0	46	41	0	Imp.	-
14	509.4	12.7	19	187	0	0	19	78	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

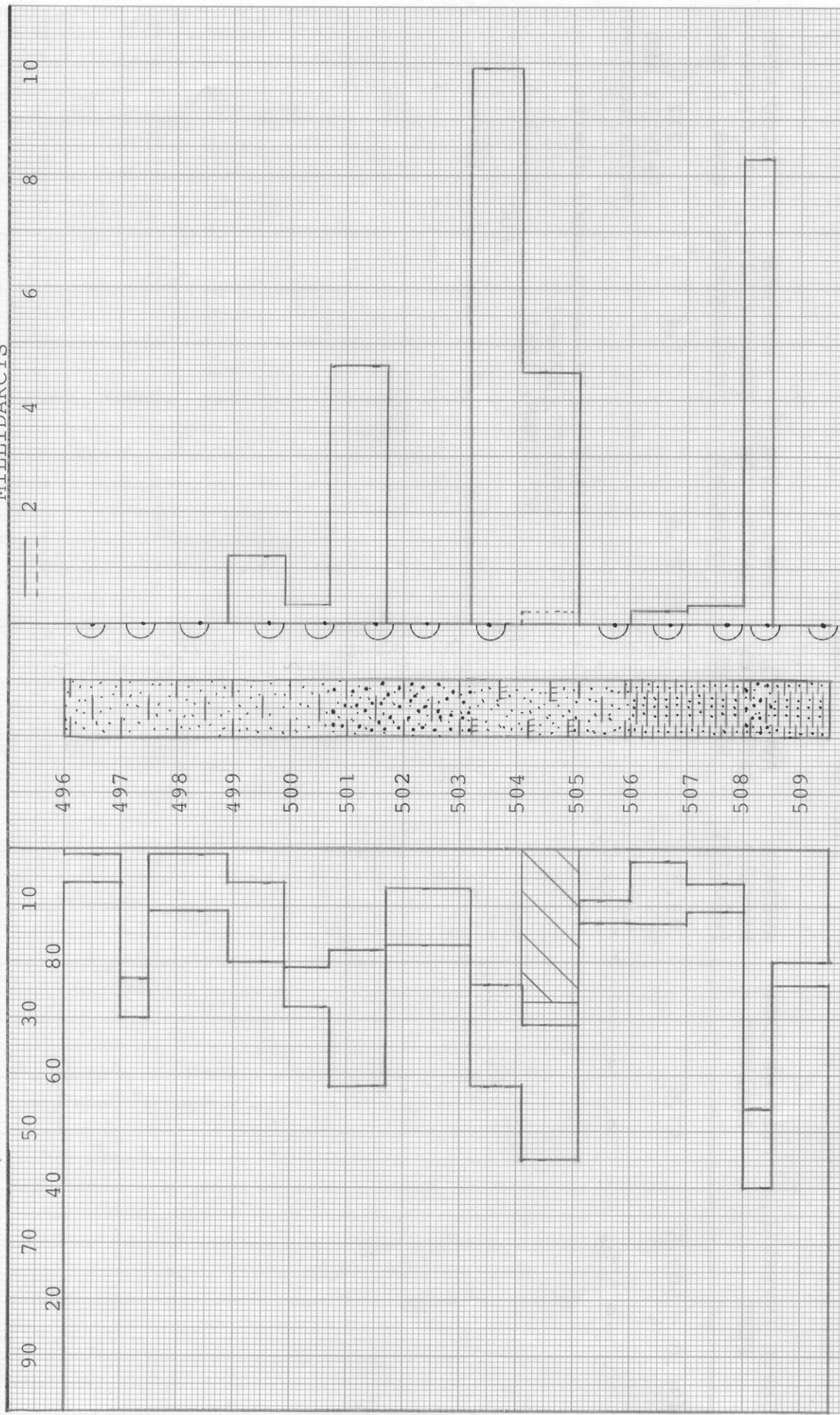
Company	Ram Gas & Oil	Lease	Carrol Ball	Well No.	4
Depth Interval, Feet	496.0 - 509.5				
Feet of Core Analyzed	1.0				
Average Percent Porosity	16.5				
Average Percent Original Oil Saturation	31.0				
Average Percent Oil Recovery	4.0				
Average Percent Residual Oil Saturation	27.0				
Average Percent Residual Water Saturation	50.0				
Average Percent Total Residual Fluid Saturation	77.0				
Average Original Oil Content, Bbls./A. Ft.	397.				
Average Oil Recovery, Bbls./A. Ft.	51.				
Average Residual Oil Content, Bbls./A. Ft.	346.				
Total Original Oil Content, Bbls./Acre	397.				
Total Oil Recovery, Bbls./Acre	51.				
Total Residual Oil Content, Bbls./Acre	346.				
Average Effective Permeability, Millidarcys	0.22				
Average Initial Fluid Production Pressure, p.s.i.	45.0				

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



KEY:

SHALY SANDSTONE

CALCAREOUS SANDSTONE

MICACEOUS SHALY SANDSTONE

LAMINATED SANDSTONE AND SHALE

FLOODPOT RESIDUAL OIL SATURATION

EFFECTIVE PERMEABILITY TO WATER

RAM OIL & GAS

CARROL BALL LEASE

WELL NO. 4

LINN 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
496.0 - 509.5	13.5	13.7	13.1	75.6	3.4	212 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
NOVEMBER, 1981

PDC