

# OILFIELD RESEARCH LABORATORIES

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

November 23, 1981

Ram Gas & Oil Company  
306 N. Walnut St.  
Paola, Kansas 66701

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Ball Lease, Well No. 5, located in Linn County, Kansas and submitted to our laboratory on November 11, 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

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

Company Ram Gas & Oil Company Lease Ball Well No. 5  
 Location \_\_\_\_\_  
 Section 7 Twp. 21S Rge. 22E County Linn State Kansas

Elevation, Feet .....  
 Name of Sand.....  
 Top of Core ..... 500.0  
 Bottom of Core ..... 510.7  
 Top of Sand ..... 500.0  
 Bottom of Sand ..... (Tested) 509.8  
 Total Feet of Permeable Sand ..... 9.8  
 Total Feet of Floodable Sand ..... 9.8

**Distribution of Permeable Sand:**  
**Permeability Range**  
**Millidarcys**

**Feet**

**Cum. Ft.**

Permeability Range (Millidarcys)	Feet	Cum. Ft.
4 - 10	2.5	2.5
15 - 25	3.0	5.5
25 - 35	4.3	9.8

Average Permeability Millidarcys ..... 20.9  
 Average Percent Porosity ..... 18.7  
 Average Percent Oil Saturation ..... 35.9  
 Average Percent Water Saturation ..... 38.8  
 Average Oil Content, Bbls./A. Ft. .... 520.  
 Total Oil Content, Bbls./Acre ..... 5,099.  
 Average Percent Oil Recovery by Laboratory Flooding Tests ..... 5.4  
 Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. .... 78.  
 Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre ..... 766.  
 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,</u> <u>Feet</u>	<u>Description</u>
500.0 - 501.2	Brown sandstone.
501.2 - 502.2	Grayish brown shaly sandstone.
502.2 - 508.3	Brown sandstone containing a vertical fracture.
508.3 - 509.8	Gray and brown laminated sandstone and shale.
509.8 - 510.1	Brown sandstone.
510.1 - 510.7	Gray shale.

#### LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 766 barrels of oil per acre was obtained from 9.8 feet of sand. The weighted average percent oil saturation was reduced from 35.9 to 30.5, or represents an average recovery of 5.4 percent. The weighted average effective permeability of the samples is 1.87 millidarcys, while the average initial fluid production pressure is 32.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 10 samples tested, 10 produced water and oil. This indicates that 100 percent of the sand represented by these samples is floodable pay sand.

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 2970 barrels of oil per acre. This is an average recovery of 304 barrels per acre foot from 9.8 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	18.8
Oil saturation after flooding, percent	30.5
Performance factor, percent, estimated	50.0
Net floodable sand, feet	9.8

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

**TABLE 1-B**

Company Ram Gas & Oil Company Lease Ball Well No. 5

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			Ft.	Cum. Ft.		
1	500.5	20.5	37	28	588	34.	1.2	1.2	706	40.80
2	501.7	18.9	33	39	484	8.7	1.0	2.2	484	8.70
3	502.6	20.5	36	36	573	26.	1.0	3.2	573	26.00
4	503.7	19.6	39	34	593	17.	1.0	4.2	593	17.00
5	504.8	18.6	46	29	664	21.	1.0	5.2	664	21.00
6	505.6	20.1	33	40	515	22.	1.0	6.2	515	22.00
7	506.6	18.8	36	33	525	28.	0.8	7.0	420	22.40
8	507.4	21.1	28	42	458	32.	0.7	7.7	321	22.40
9	508.1	20.0	32	51	497	30.	0.6	8.3	298	18.00
10	509.5	12.9	35	55	350	4.2	1.5	9.8	525	6.30

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## SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Lease	Well No.					
Ram Gas & Oil Company	Ball	5					
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.	Average Percent Porosity	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
500.0 - 509.8	9.8	20.9	204.60	18.7	35.9	520	5,099
500.0 - 509.8	9.8	38.8		18.7	35.9	520	5,099

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## RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Ram Gas & Oil Company Lease Ball Well No. 5

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	500.5	20.6	37	591	7	112	30	64	186	4.12	30
2	501.7	19.0	33	486	3	44	30	53	30	0.52	40
3	502.6	20.7	36	578	7	112	29	59	92	2.02	20
4	503.7	19.7	39	596	6	92	33	51	28	0.52	40
5	504.8	18.7	46	667	11	160	35	50	352	6.75	25
6	505.6	20.3	33	520	4	63	29	54	30	0.94	40
7	506.6	18.8	36	525	3	44	33	48	42	0.75	30
8	507.4	21.2	28	461	2	33	26	58	44	0.90	35
9	508.1	19.8	32	492	3	46	29	60	34	0.67	30
10	509.5	13.0	35	353	5	50	30	63	36	0.67	30

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.

## SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

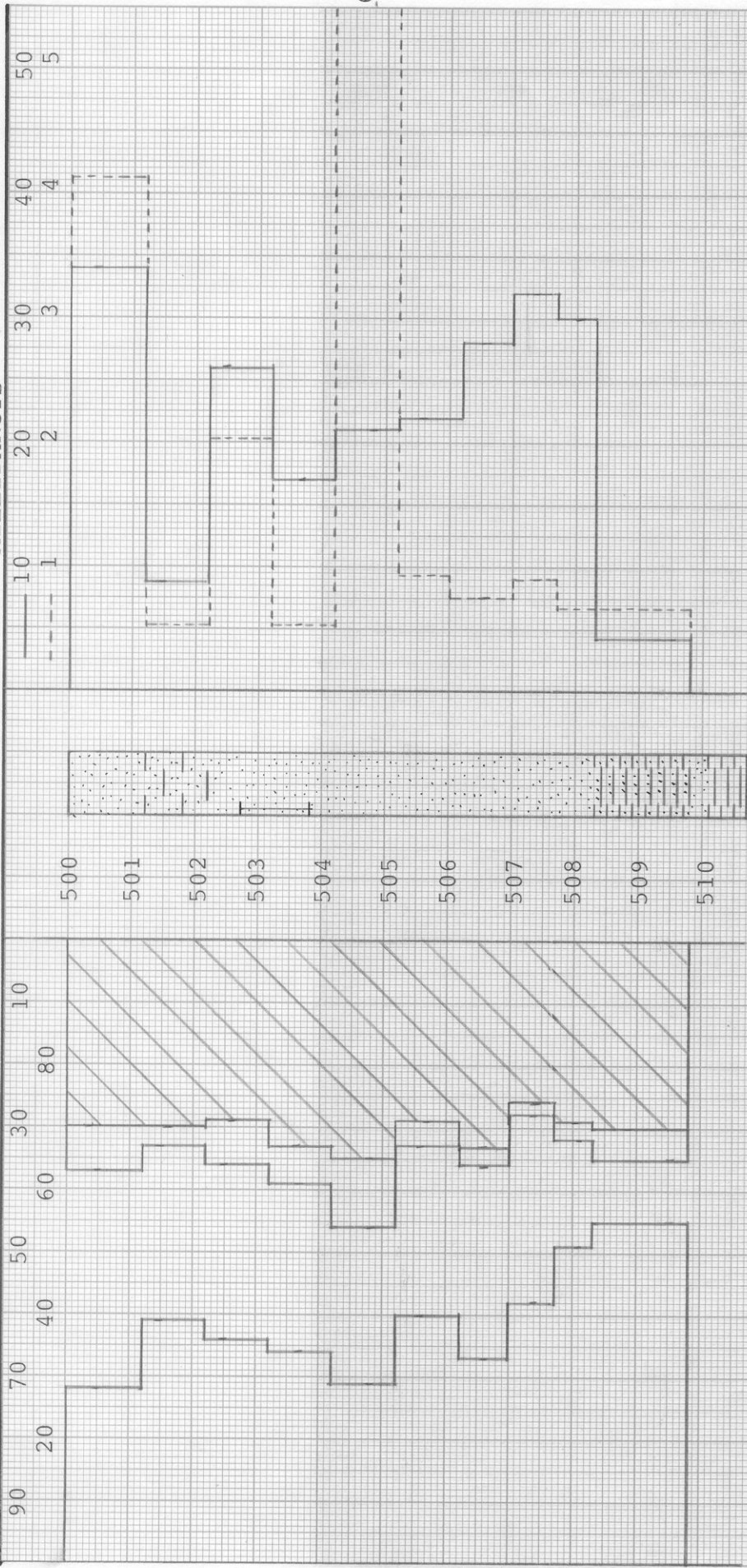
Company	Ram Gas & Oil Company	Lease	Ball	Well No.	5
Depth Interval, Feet	500.0 - 509.8				
Feet of Core Analyzed	9.8				
Average Percent Porosity	18.8				
Average Percent Original Oil Saturation	35.9				
Average Percent Oil Recovery	5.4				
Average Percent Residual Oil Saturation	30.5				
Average Percent Residual Water Saturation	56.5				
Average Percent Total Residual Fluid Saturation	87.0				
Average Original Oil Content, Bbls./A. Ft.	523.				
Average Oil Recovery, Bbls./A. Ft.	78.				
Average Residual Oil Content, Bbls./A. Ft.	445.				
Total Original Oil Content, Bbls./Acre	5,125.				
Total Oil Recovery, Bbls./Acre	766.				
Total Residual Oil Content, Bbls./Acre	4,359.				
Average Effective Permeability, Millidarcys	1.87				
Average Initial Fluid Production Pressure, p.s.i.	32.0				

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:

SANDSTONE

SHALY SANDSTONE

SHALE

LAMINATED SANDSTONE AND SHALE

FORMATION CONTAINING A VERTICAL FRACTURE

FLOODPOT RESIDUAL OIL SATURATION

# RAM GAS & OIL

BALL LEASE  
LINN COUNTY, KANSAS  
WELL NO. 5

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
500.0 - 509.8	9.8	18.7	35.9	38.8	20.9	2970 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES  
CHANUTE, KANSAS  
NOVEMBER, 1981 PDC