



OILFIELD RESEARCH LABORATORIES

536 NORTH HIGHLAND - CHANUTE, KANSAS - PHONE HE1-2650

March 7, 1967

Virgyl D. Johnson
Suite 1119 Mid-City Building
1331 Union Avenue
Memphis, Tennessee

Dear Sir:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Westhoff Lease, Well No. 14, Crawford County, Kansas, and submitted to our laboratory on March 4, 1967.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


Benjamin R. Pearman

BRP:rf

4 c. - Memphis, Tennessee
2 c. - Jim Guinotte

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company	Virgyl D. Johnson	Lease	Westhoff	Well No.	14	
Location	SW NE NW					
Section	5	Twp.	29S	Rge.	22E	
		County	Crawford		State	Kansas
Name of Sand	-				Bartlesville	
Top of Core	-				399.0	
Bottom of Core	-				415.0	
Top of Sand	-				399.0	
Bottom of Sand	-				412.0	
Total Feet of Permeable Sand	-				12.1	
Total Feet of Floodable Sand	-				8.0	
Distribution of Permeable Sand:						
	Permeability Range Millidarcys		Feet		Cum. Ft.	
	0 - 5		3.6		3.6	
	5 - 10		2.2		5.8	
	10 - 45		6.3		12.1	
Average Permeability Millidarcys	-				18.4	
Average Percent Porosity	-				18.1	
Average Percent Oil Saturation	-				48.6	
Average Percent Water Saturation	-				35.2	
Average Oil Content, Bbls./A. Ft.	-				688.	
Total Oil Content, Bbls./Acre	-				8,321.	
Average Percent Oil Recovery by Laboratory Flooding Tests	-				13.0	
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	-				191.	
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	-				1,525.	
Total Calculated Oil Recovery, Bbls./Acre	- (Primary & Secondary)				2,060.	
Packer Setting, Feet	-					
Viscosity, Centipoises @	-					
A. P. I. Gravity, degrees @ 60 °F	-					
Elevation, Feet	-					

Fresh water mud was used as the circulating fluid while taking this core. The core was sampled and the samples sealed in plastic bags by a representative of Oilfield Research Laboratories. The well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
399.0 - 399.8	Light brown, laminated, shaly sandstone.
399.8 - 400.4	Gray, laminated, sandy shale.
400.4 - 402.4	Brown, slightly shaly sandstone.
402.4 - 402.7	Gray sandy shale.
402.7 - 404.9	Brown, slightly shaly sandstone.
404.9 - 405.9	Gray and brown, laminated, shaly sandstone.
405.9 - 407.6	Brown, slightly shaly sandstone.
407.6 - 408.9	Brown, laminated, micaceous, shaly sandstone.
408.9 - 411.0	Dark, slightly carbonaceous sandstone.
411.0 - 412.0	Brown, slightly carbonaceous, slightly shaly sandstone.
412.0 - 415.0	Shale.

Coring was started at a depth of 399.0 feet in shaly sandstone and completed at 415.0 feet in shale. This core shows a total of 12.1 feet of sandstone. For the most part, the pay is made up of brown, slightly shaly sandstone.

PERMEABILITY

The weighted average permeability of the core is 18.4 millidarcys (See Table III). By observing the data given on the coregraph, it is

noticeable that the sand has a rather irregular permeability profile. The permeability of the sand varies from 0.40 to a maximum of 45. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 48.6. The weighted average percent water saturation is 35.2 (See Table III). This gives an overall weighted average total fluid saturation of 83.8 percent.

The weighted average oil content of the core is 688 barrels per acre foot. The total oil content, as shown by this core, is 8,321 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,525 barrels of oil per acre was obtained from 8.0 feet of sand. The weighted average percent oil saturation was reduced from 51.6 to 38.6, or represents an average recovery of 13.0 percent. The weighted average effective permeability of the samples is 0.670 millidarcys, while the average initial fluid production pressure is 36.7 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 13 samples tested, 9 produced water and oil. This indicates that approximately 69 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in effective permeability to water.

CONCLUSION

The results of the laboratory tests indicate that efficient primary and secondary operations in the vicinity of this well should recover approximately 2,060 barrels of oil per acre or an average of 258 barrels per acre foot from the 8.0 feet of floodable pay sand analyzed in this core. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.03
Reservoir water saturation, percent	25.0
Average porosity, percent	18.9
Oil saturation after flooding, percent	38.6
Performance factor, percent	50.0
Net floodable pay sand, feet	8.0

This core shows a pay sand section having a good oil saturation, a moderate water saturation and a wide variation in effective permeability to water. The above recovery values were calculated assuming that satisfactory injection rates will be maintained throughout the flood life of the property.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Virgyl D. Johnson

Lease Westhoff

Well No. 14

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	399.1	16.9	46	38	603	2.3	0.8	0.8	482	1.84
2	400.5	18.0	54	33	754	10.	0.5	1.3	377	5.00
3	401.1	18.8	49	21	714	3.4	0.5	1.8	357	1.70
4	402.1	20.6	50	29	799	31.	1.0	2.8	799	31.00
5	403.1	20.1	53	28	826	13.	1.0	3.8	826	13.00
6	404.1	20.3	52	29	819	32.	1.2	5.0	982	38.40
7	405.1	15.6	33	64	399	6.0	1.0	6.0	399	6.00
8	406.1	16.3	45	46	568	8.2	0.7	6.7	398	5.74
9	407.1	19.2	45	37	670	37.	1.0	7.7	670	37.00
10	408.1	15.5	48	49	576	0.40	1.3	9.0	749	0.52
11	409.1	17.6	56	25	763	21.	0.7	9.7	534	14.70
12	410.1	17.7	57	22	781	45.	1.4	11.1	1,093	63.00
13	411.1	18.8	45	32	655	4.9	1.0	12.1	655	4.90
Total							Total		8,321	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Virgyl D. Johnson	Lease	Westhoff	Well No.	14
	Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.	
	399.0 - 412.0	12.1	18.4	222.80	
	Depth Interval, Feet	Feet of Core Analyzed	Average Percent Water Saturation	Average Oil Content Ebl./A. Ft.	Total Oil Content Ebls./Acre
	399.0 - 412.0	12.1	18.1	48.6	35.2
			Average Percent Porosity	688	8,321

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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.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water			
1	399.1	16.4	47	597	0	0	47	42	0	Imp.	-
2	400.5	18.5	54	774	17	244	37	54	3	0.083	50
3	401.1	18.8	49	714	12	175	37	55	11	0.250	40
4	402.1	20.2	50	783	14	219	36	54	30	0.500	30
5	403.1	19.6	53	805	14	212	39	56	29	0.583	30
6	404.1	20.0	52	806	14	217	38	54	53	1.00	30
7	405.1	15.4	34	406	0	0	34	64	0	Imp.	-
8	406.1	16.8	45	586	9	117	36	56	9	0.250	40
9	407.1	18.7	45	652	11	159	34	60	5	0.167	50
10	408.1	15.7	48	584	0	0	48	50	0	Imp.	-
11	409.1	18.1	56	786	17	238	39	57	18	0.333	40
12	410.1	18.1	57	799	11	154	46	49	83	1.67	20
13	411.1	18.4	45	641	0	0	45	34	0	Imp.	-

Company **Virgyl D. Johnson**
Lease **Westhoff**
Well No. **14**

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	Virgyl D. Johnson	Lease	Westhoff	Well No.	14
Depth Interval, Feet	400.4 - 411.0				
Feet of Core Analyzed	8.0				
Average Percent Porosity	18.9				
Average Percent Original Oil Saturation	51.6				
Average Percent Oil Recovery	13.0				
Average Percent Residual Oil Saturation	38.6				
Average Percent Residual Water Saturation	54.6				
Average Percent Total Residual Fluid Saturation	93.2				
Average Original Oil Content, Bbls./A. Ft.	755.				
Average Oil Recovery, Bbls./A. Ft.	191.				
Average Residual Oil Content, Bbls./A. Ft.	564.				
Total Original Oil Content, Bbls./Acre	6,031.				
Total Oil Recovery, Bbls./Acre	1,525.				
Total Residual Oil Content, Bbls./Acre	4,506.				
Average Effective Permeability, Millidarcys	0.670				
Average Initial Fluid Production Pressure, p.s.i.	36.7				

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