

OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

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February 2, 1962

C. H. Schwader, et al
c/o Comet Moving & Storage Inc.
Topeka, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Cable Tool core taken from the W.H.D. Wood Lease, Well No. 1-A, Franklin County, Kansas, and submitted to our laboratory on January 27, 1962.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman
Benjamin R. Pearman

BRP:rf

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Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company C.H. Schwader, et al Lease W.H.D. Wood Well No. 1-A

Location N $\frac{1}{2}$ SW

Section 29 Twp. 15S Rge. 20E County Franklin State Kansas

Name of Sand	Squirrel
Top of Core	731.8
Bottom of Core	777.9
Top of Sand	731.8
Bottom of Sand	775.0
Total Feet of Permeable Sand	36.6
Total Feet of Floodable Sand	16.2

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 100	4.0	4.0
100 - 200	15.7	19.7
200 - 300	11.1	30.8
300 - 400	4.8	35.6
400 & above	1.0	36.6

Average Permeability Millidarcys	205.9
Average Percent Porosity	22.9
Average Percent Oil Saturation	37.3
Average Percent Water Saturation	50.1
Average Oil Content, Bbls./A. Ft.	666.
Total Oil Content, Bbls./Acre	27,021.
Average Percent Oil Recovery by Laboratory Flooding Tests	4.0
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	71.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,153.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	6,030.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Fresh water was used as the coring fluid in taking this core. The core was sampled and the samples sealed in cans by a representative of the laboratory. The well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u>	<u>Description</u>
<u>Feet</u>	

731.8 - 735.0	- Light brown and gray laminated shaley sandstone.
735.0 - 736.8	- Gray and light brown shaley sandstone.
736.8 - 739.4	- Brown laminated shaley sandstone.
739.4 - 742.0	- Brown sandstone.
742.0 - 742.4	- Gray and light brown shaley sandstone.
742.4 - 752.3	- Brown sandstone.
752.3 - 754.0	- Brown, finely laminated shaley sandstone.
754.0 - 761.6	- Brown sandstone.
761.6 - 765.4	- Brown, laminated, shaley sandstone.
765.4 - 765.8	- Sandy shale.
765.8 - 775.0	- Brown, laminated, shaley sandstone.
775.0 - 777.9	- Shale.

Coring was started at a depth of 731.8 feet in laminated shaley sandstone and completed at 777.9 feet in shale. For the most part, the pay is made up of brown sandstone. Some of the sand is laminated to such an extent that it was impossible to obtain sufficient permeability and flood pot samples to completely analyze the upper portion of this core.

PERMEABILITY

For the sake of distribution, the core was divided into three sections. The weighted average permeability of the upper, middle and lower sections is unknown, 198.0 and 251.6 millidarcys respectively;

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the overall average being 205.9 (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 45. to a maximum of 501. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly good weighted average percent oil saturation, namely, 37.3. The weighted average percent oil saturation of the upper, middle and lower sections is 24.6, 39.0 and 34.8 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 67.5, 48.6 and 49.4 respectively; the overall average being 50.1 (See Table III). This gives an overall weighted average total fluid saturation of 87.4 percent.

The weighted average oil content of the upper, middle and lower sections is 359, 702 and 625 barrels per acre foot respectively; the overall average being 666. The total oil content, as shown by this core, is 27,021 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The majority of the sand in this core responded to laboratory flooding tests, as a total recovery of 1,153 barrels of oil per acre was obtained from 16.2 feet of sand. The weighted average percent oil saturation was reduced from 41.8 to 37.8, or represents an average recovery of 4.0 percent. The weighted average effective permeability of the samples is 7.32 millidarcys, while the average initial fluid production pressure is 22.5 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 26 samples tested, all produced water and 16 oil. This indicates that approximately 62 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a good

effective permeability to water.

CONCLUSION

A study of the laboratory data indicates that efficient primary and secondary operations in the vicinity of this well should recover approximately 2,870 and 3,160 barrels of oil per acre respectively. The following data and assumptions were used in calculating the above recovery values:

Original formation volume factor	1.05
Reservoir water saturation, percent	37.0
Primary recovery, estimated, percent	7.0
Present oil saturation, percent	63.0
Average porosity, percent	23.0
Oil saturation after flooding, percent	37.8
Performance factor, percent	55.0
Net floodable pay sand, feet	20.0

This core shows a sand section having a fairly good oil saturation, a moderate water saturation and good effective permeability to water. No difficulty should be encountered in obtaining satisfactory injection rates.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company C.H. Schwader, et al

Lease W.H.D. Wood

Well No. 1-A

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	732.1	17.6	25	71	341	-	0.8	0.8	272	-
2	733.1	19.6	28	57	426	-	1.0	1.8	426	-
3	734.1	18.9	22	73	322	-	1.4	3.2	451	-
4	737.1	23.4	47	48	853	201.	0.8	4.0	681	160.80
5	738.1	25.9	46	39	924	501.	1.0	5.0	924	501.00
6	739.1	20.1	42	51	654	-	0.8	5.8	523	-
7	740.1	23.5	46	45	838	165.	1.2	7.0	1,007	198.00
8	741.1	24.6	38	42	724	335.	1.4	8.4	1,013	469.00
9	742.5	24.9	48	41	926	201.	0.6	9.0	556	120.60
10	743.5	23.0	41	46	731	226.	1.0	10.0	731	226.00
11	744.5	21.0	47	45	765	276.	1.0	11.0	765	276.00
12	745.5	23.2	47	42	845	175.	1.0	12.0	845	175.00
13	746.5	22.6	38	44	666	175.	1.0	13.0	666	175.00
14	747.5	20.4	43	51	679	276.	1.0	14.0	679	276.00
15	748.5	23.0	46	49	821	235.	1.0	15.0	821	235.00
16	749.5	27.1	30	37	630	230.	1.0	16.0	630	230.00
17	750.5	22.7	43	44	756	133.	1.0	17.0	756	133.00
18	751.5	24.5	34	49	645	151.	1.3	18.3	839	196.30
19	752.5	23.3	26	70	470	235.	0.7	19.0	329	164.50
20	753.5	22.9	29	68	515	145.	1.0	20.0	515	145.00
21	754.5	22.9	46	43	816	155.	1.0	21.0	816	155.00
22	755.5	23.2	49	42	882	72.	1.0	22.0	882	72.00
23	756.5	22.6	41	48	719	63.	1.0	23.0	719	63.00
24	757.5	22.4	41	44	712	54.	1.0	24.0	712	54.00
25	758.5	23.7	31	52	569	234.	1.0	25.0	569	234.00
26	759.5	22.1	36	52	616	45.	1.0	26.0	616	45.00
27	760.5	22.5	46	40	803	179.	1.0	27.0	803	179.00
28	761.5	22.8	40	45	707	171.	0.6	27.6	424	102.60

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

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.		
29	762.5	24.0	33	52	85	614	395.	1.4	29.0	859	553.00
30	763.5	23.0	38	58	96	677	104.	1.0	30.0	677	104.00
31	764.5	22.5	28	52	80	489	121.	1.4	31.4	685	169.40
33	766.5	24.4	37	48	85	700	177.	1.2	32.6	840	212.40
34	767.5	24.8	34	59	93	654	233.	1.0	33.6	654	233.00
35	768.5	22.2	25	63	88	430	132.	1.0	34.6	430	132.00
36	769.5	23.9	42	49	91	779	263.	1.0	35.6	779	263.00
37	770.5	23.5	35	47	82	637	129.	1.0	36.6	637	129.00
38	771.5	23.3	36	56	92	650	376.	1.0	37.6	650	376.00
39	772.5	24.2	26	59	85	488	220.	1.0	38.6	488	220.00
40	773.5	23.6	31	49	80	567	358.	1.0	39.6	567	358.00
41	774.5	22.0	46	36	82	785	175.	1.0	40.6	785	175.00
								Total	-----	27,021	

Company C.H. Schwader, et al

Lease W.H.D. Wood

Well No. 1-A

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company C.H. Schwader, et al		Lease W.H.D. Wood		Well No. 1-A	
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.		
731.8 - 735.0	0.0	-	-		
736.8 - 770.0	31.6	198.0	6252.60		
770.0 - 775.0	5.0	251.6	1258.00		
736.8 - 775.0	36.6	205.9	7510.60		

Depth Interval, Feet	Feet of Core Analyzed	Average Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
731.8 - 735.0	3.2	18.8	24.6	67.5	359	1,149
736.8 - 770.0	32.4	23.2	39.0	48.6	702	22,745
770.0 - 775.0	5.0	23.3	34.8	49.4	625	3,127
731.8 - 775.0	40.6	22.9	37.3	50.1	666	27,021

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RESULTS OF LABORATORY FLOODEING TESTS

TABLE IV

Company		C.H. Schwader, et al		Lease		W.H.D. Wood		Well No.		1-A	
Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation		Volume of Water Recovered cc ^a	Effective Permeability Millidarcys	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water			
4	737.1	23.7	47	863	8	147	39	57	17	1.05	40
7	740.1	23.8	46	849	3	55	43	49	281	14.20	10
11	744.5	21.4	47	780	8	133	39	58	81	3.22	20
12	745.5	23.6	47	860	7	128	40	50	86	5.50	30
13	746.5	22.4	38	660	2	35	36	54	131	4.15	20
14	747.5	20.7	43	690	3	48	40	55	178	10.70	20
16	749.5	26.8	32	665	0	0	32	61	148	13.20	20
17	750.5	23.0	43	767	4	71	39	57	117	6.59	20
18	751.5	24.1	37	598	0	0	32	60	60	4.26	20
21	754.5	23.3	46	830	5	90	41	54	112	5.40	20
23	756.5	22.9	41	727	2	36	39	58	25	1.91	20
24	757.5	22.1	41	702	3	51	38	52	13	1.13	30
25	758.5	24.0	33	614	0	0	33	63	130	17.30	20
26	759.5	22.0	36	614	2	34	34	60	30	2.12	30
27	760.5	22.9	46	816	6	106	40	58	22	1.47	30
28	761.5	23.0	40	714	6	107	34	60	78	3.18	20
29	762.5	24.1	33	616	2	37	31	66	178	25.80	10
30	763.5	23.6	36	659	0	0	36	90	110	16.50	10
31	764.5	22.8	30	531	0	0	30	58	141	8.10	10
33	766.5	24.7	37	709	2	39	35	58	185	12.62	20
36	769.5	24.0	42	781	4	74	38	58	86	5.36	20
37	770.5	23.9	36	666	0	0	36	59	137	10.80	20
38	771.5	23.6	33	604	0	0	33	60	219	12.20	20
39	772.5	24.6	27	515	0	0	27	70	247	32.42	10
40	773.5	23.8	30	553	0	0	30	66	128	10.40	20
41	774.5	22.4	43	748	0	0	43	49	23	2.28	20

Notes: cc—cubic centimeter.

^a—Volume of water recovered at the time of maximum oil recovery.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	C.H. Schwader, et al	Lease	W.H.D. Wood	Well No.	1-A
Depth Interval, Feet	736.8 - 758.0	758.0 - 775.0	736.8 - 775.0		
Feet of Core Analyzed	10.0	6.2	16.2		
Average Percent Porosity	22.7	23.6	23.0		
Average Percent Original Oil Saturation	43.9	38.5	41.8		
Average Percent Oil Recovery	4.4	3.4	4.0		
Average Percent Residual Oil Saturation	39.5	35.1	37.8		
Average Percent Residual Water Saturation	54.2	60.4	56.5		
Average Percent Total Residual Fluid Saturation	93.7	95.5	94.3		
Average Original Oil Content, Bbls./A. Ft.	772.	701.	746.		
Average Oil Recovery, Bbls./A. Ft.	78.	61.	71.		
Average Residual Oil Content, Bbls./A. Ft.	694.	640	675.		
Total Original Oil Content, Bbls./Acre	7,717.	4,352.	12,069.		
Total Oil Recovery, Bbls./Acre	776.	377.	1,153.		
Total Residual Oil Content, Bbls./Acre	6,941.	3,975.	10,916.		
Average Effective Permeability, Millidarcys	5.65	10.03	7.32		
Average Initial Fluid Production Pressure, p.s.i.	23.0	21.7	22.5		

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