● CORE ANALYSIS ● WATER REPRESSURING ENGINEERING ● WATER ANALYSIS ● FLOODING WATER TREATMENT ● SURVEYING

OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

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June 26, 1961

Standard Magnesium Corporation
7500 East 41st Street
Tulsa, Oklahoma

Gentlemen:

Enclosed herewith is the report of the analysis of the Winslow Lease, Well No. H-3, Allen County, Kansas, and submitted to our laboratory on June 14, 1961.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

Benjamin R. Pearman

BRP:rf

2 c. - Jim French

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GENERAL INFORMATION & SUMMARY

Company Standard Magnesium Corp. Lease Winslow Well No. H-3

Location 1040' N. of South line and 240' East of W. line SE¼

Section 34 Twp. 24S Rge. 20E County Allen State Kansas

Name of Sand	Bartlesville
Top of Core	819.8
Bottom of Core	840.8
Top of Sand	819.8
Bottom of Sand	838.2
Total Feet of Permeable Sand	16.9
Total Feet of Floodable Sand	13.5

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 100	7.1	7.1
100 - 300	4.1	11.2
300 - 500	2.5	13.7
500 & above	3.2	16.9

Average Permeability Millidarcys	246.0
Average Percent Porosity	21.9
Average Percent Oil Saturation	45.5
Average Percent Water Saturation	23.4
Average Oil Content, Bbls./A. Ft.	780.
Total Oil Content, Bbls./Acre	13,334.
Average Percent Oil Recovery by Laboratory Flooding Tests	9.9
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	178.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,411.
Total Calculated Oil Recovery, Bbls./Acre	3,860.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

This core was taken with a Cable tool core barrel. The core was exposed to air 8 to 10 hours prior to sampling. The core was sampled, the samples sealed in plastic bags and submitted to the laboratory by a representative of the client. The well was drilled in non-virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
819.8 - 824.6	Dark brown sandstone.
824.6 - 825.3	Soft shale.
825.3 - 826.9	Dark brown sandstone.
826.9 - 827.7	Laminated sandstone and shale.
827.7 - 829.5	Dark brown sandstone.
829.5 - 830.1	Soft shale.
830.1 - 838.2	Dark brown sandstone.
838.2 - 838.7	Coal.
838.7 - 840.8	Soft shale.

Coring was started at a depth of 819.8 feet in dark brown sandstone and completed at 840.8 feet in soft shale. This core shows a total of 16.9 feet of sandstone. For the most part, the pay is made up of dark brown sandstone.

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 230.0, 55.1 and 393.9 millidarcys respectively; the overall average being 246.0 (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 11. to a maximum of 800. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 45.5. The weighted average percent oil saturation of the upper, middle and lower sections is 48.6, 42.8 and 45.3 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 12.4, 30.1 and 26.0 respectively; the overall average being 23.4 (See Table III). This gives an overall weighted average total fluid saturation of 68.9 percent. This low total fluid saturation indicates considerable fluid was lost during or after coring part of which was probably oil.

The weighted average oil content of the upper, middle and lower sections is 921, 665 and 770 barrels per acre foot respectively; the overall average being 780. The total oil content, as shown by this core, is 13,334 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded very well to laboratory flooding tests, as a total recovery of 2,411 barrels of oil per acre was obtained from 13.5 feet of sand. The weighted average percent oil saturation was reduced from 47.5 to 37.6, or represents an average recovery of 9.9 percent. The weighted average effective permeability of the samples is 14.91 millidarcys, while the average initial fluid production pressure is 21.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 17 samples tested, all produced water and 15 oil. This indicates that approximately 88 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.

Additional flooding tests were carried out on seven samples. In

these tests water containing 25 ppm. of detergent (Triton X-100) was passed through the core samples. The results of these tests are given on Table V-A, while the results in themselves are inconclusive, the average residual oil saturation has been reduced and the effective permeability increased by the use of 25 ppm. detergent in the flood water.

CONCLUSION

Based on the results of the laboratory tests, it appears that an efficient water-flood in the vicinity of this well should recover approximately 3,860 barrels of oil per acre. This represents an average recovery of 286 barrels per acre foot from the 13.5 feet of floodable pay sand analyzed in this core.

The above recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.05
Present formation volume factor	1.02
Reservoir water saturation, percent	23.0
Primary production, percent, estimated	7.0
Average porosity, percent	22.8
Abandonment oil saturation, percent	37.6
Performance factor, percent	55.0
Net floodable pay sand, feet	13.5

This core indicates a reservoir with a clean sand section having a good oil saturation, a low water saturation and good effective permeability to water.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Standard Magnesium Corp. Lease Winslow Well No. H-3

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.		
1	820.0	21.8	49	12	61	829	115.	0.6	0.6	496	69.00
2	820.8	25.0	48	9	57	931	152.	1.6	2.2	1,491	243.20
3	823.0	25.3	47	12	59	923	453.	1.5	3.7	1,385	679.50
4	824.0	23.7	52	18	70	955	100.	1.1	4.8	1,051	110.00
5	825.5	22.5	49	12	61	856	11.	0.5	5.3	428	5.50
6	826.0	23.5	56	29	85	1,021	94.	0.9	6.2	919	84.60
7-A	826.8	19.0	58	-	-	854	-	0.2	6.4	171	-
7	827.0	11.7	25	46	71	227	25.	0.8	7.2	182	20.00
8	828.0	18.6	42	28	70	606	49.	0.8	8.0	485	39.20
9	829.0	20.7	37	31	68	594	42.	1.0	9.0	594	42.00
10	830.4	19.5	45	28	73	680	84.	1.0	10.0	680	84.00
11	831.7	24.3	41	38	79	774	153.	1.0	11.0	774	153.00
12	832.4	23.7	40	34	74	735	536.	0.6	11.6	441	321.60
13	833.1	21.1	45	25	70	737	426.	1.0	12.6	737	426.00
14	834.2	23.1	46	23	69	824	209.	0.9	13.5	740	188.10
15	834.9	17.0	56	34	90	738	60.	1.0	14.5	738	60.00
16	836.1	22.6	39	18	57	684	800.	1.0	15.5	684	800.00
17	837.3	22.8	45	16	61	796	535.	1.0	16.5	796	535.00
18	838.0	23.3	50	21	71	904	511.	0.6	17.1	542	306.60

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III - B

Company Standard Magnesium Corp. Lease Winslow Well No. H-3

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
819.8 - 824.6	4.8	230.0	1101.70
825.3 - 831.1	5.0	55.1	275.30
831.1 - 838.2	7.1	393.9	2790.30
819.8 - 838.2	16.9	246.0	4167.30

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
819.8 - 824.6	4.8	24.4	48.6	12.4	921	4,423
825.3 - 831.1	5.2	19.4	42.8	30.1	665	3,459
831.1 - 838.2	7.1	22.0	45.3	26.0	770	5,452
819.8 - 838.2	17.1	21.9	45.5	23.4	780	13,334

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Standard Magnesium Corp. Lease Winslow Well No. H-3

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	Bbls./A. Ft.			
1	820.0	21.9	49	832	16	272	33	62	560	360	17.22	20
2	820.8	24.8	48	924	14	270	34	64	654	353	29.20	10
3	823.0	25.0	47	911	19	368	28	69	543	236	34.10	10
4	824.0	23.6	52	951	5	92	47	49	859	39	2.16	25
5	825.5	22.0	49	836	7	120	42	45	716	6	0.332	35
6	826.0	23.1	56	1004	28	502	28	62	502	49	2.32	25
7-A	826.8	19.0	58	855	4	59	54	44	796	39	2.39	25
8					Sample Not Obtainable							
9	829.0	20.6	35	559	0	0	35	51	559	2	0.194	50
10	830.4	20.0	47	729	0	0	47	50	729	71	3.56	30
11	831.7	24.0	41	762	2	37	39	57	725	197	8.96	20
12	832.4	23.4	40	726	3	54	37	59	672	19	1.15	35
13	833.1	21.5	45	750	11	183	34	59	567	313	17.30	20
14	834.2	23.0	46	821	7	125	39	55	696	32	2.34	30
15	834.9	17.5	56	761	5	68	51	47	693	254	7.10	20
16	836.1	22.5	39	681	3	52	36	61	629	219	19.30	10
17	837.3	22.6	43	754	2	35	41	56	719	175	20.20	10
18	838.0	23.4	50	907	11	200	39	55	707	253	21.06	20

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 Standard Magnesium Corp. Lease Winslow Well No. H-3

Depth Interval, Feet	819.8 - 826.9	828.5 - 838.2	819.8 - 826.9
Feet of Core Analyzed	6.4	7.1	13.5
Average Percent Porosity	23.7	22.0	22.8
Average Percent Original Oil Saturation	50.1	44.9	47.5
Average Percent Oil Recovery	14.9	5.3	9.9
Average Percent Residual Oil Saturation	35.2	39.6	37.6
Average Percent Residual Water Saturation	60.0	56.0	58.0
Average Percent Total Residual Fluid Saturation	95.2	95.6	95.6
Average Original Oil Content, Bbls./A. Ft.	918.	764.	835.
Average Oil Recovery, Bbls./A. Ft.	277.	90.	178.
Average Residual Oil Content, Bbls./A. Ft.	641.	674.	657.
Total Original Oil Content, Bbls./Acre	5,872.	5,427.	11,299.
Total Oil Recovery, Bbls./Acre	1,771.	640.	2,411.
Total Residual Oil Content, Bbls./Acre	4,101.	4,787.	8,888.
Average Effective Permeability, Millidarcys	17.71	12.43	14.91
Average Initial Fluid Production Pressure, p.s.i.	21.4	20.6	21.0

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

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Results of Laboratory Flooding Tests

TABLE V-A

Company Standard Magnesium Corp. Lease Winslow Well No. H-3

			Without Detergent			With Detergent		
Sample No.	Depth Feet	Effective Porosity Percent	Residual Oil Sat.	Bbls./ Ac.Ft.	Effective Permeability	Residual Oil Sat.	Bbl./ Ac.Ft.	Effective Permeability
1	820.0	22.1	33	566	17.22	35	600	52.95
2	820.8	24.5	34	646	29.20	39	741	23.04
5	825.5	21.6	42	705	0.332	39	654	3.96
10	830.4	21.3	47	777	3.56	34	562	20.72
13	833.1	21.8	34	575	17.30	32	541	30.00
14	834.2	23.4	39	708	2.34	38	689	9.25
15	834.9	17.0	51	673	7.10	45	593	Imp.
Average		23.4	39.8	665	13.22	37.6	635	23.18