

OILFIELD RESEARCH LABORATORIES

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

January 10, 1981

Jennings Drilling
646 Louisiana
Lawrence, Kansas 66044

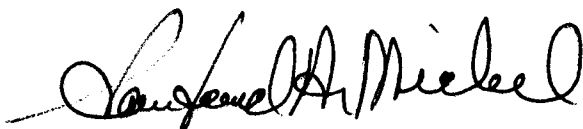
Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Harring Lease, Well No. 1, located in Leavenworth County, Kansas and submitted to our laboratory on November 18, 1980.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

A handwritten signature in dark ink, appearing to read "Sanford A. Michel". The signature is fluid and cursive, with the first name "Sanford" and last name "Michel" being the most prominent parts.

Sanford A. Michel

SAM/kas

5 c to Lawrence, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jennings Drilling Lease Harring Well No. 1

Location _____

Section 19 Twp. 11S Rge. 22E County Leavenworth State Kansas

Elevation, Feet - - - - -

Name of Sand - - - - -

Top of Core - - - - - 647.0

Bottom of Core - - - - - 695.0

Top of Sand - - - - - 647.0

Bottom of Sand - - - - - 695.0

Total Feet of Permeable Sand - - - - - 17.0

Total Feet of Floodable Sand - - - - - 5.0

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 10

4.0

4.0

10 - 20

4.0

8.0

20 - 40

3.0

11.0

40 - 60

4.0

15.0

60 & Above

2.0

17.0

Average Permeability Millidarcys - - - - - 27.1

Average Percent Porosity - - - - - 20.5

Average Percent Oil Saturation - - - - - 25.5

Average Percent Water Saturation - - - - - 54.6

Average Oil Content, Bbls./A. Ft. - - - - - 411.

Total Oil Content, Bbls./Acre - - - - - 6,989.

Average Percent Oil Recovery by Laboratory Flooding Tests - - - - - 4.2

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - - 71.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - - 356.

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. A representative of Oilfield Research Laboratories was present at the rig when the core was taken.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
647.0 - 648.0	Brown slightly calcareous sandstone.
651.0 - 652.0	Brown slightly calcareous sandstone.
653.0 - 654.0	Light brown slightly calcareous sandstone.
655.0 - 656.0	Light brown slightly calcareous sandstone.
657.0 - 658.0	Light brown slightly calcareous sandstone.
661.0 - 662.0	Grayish light brown shaly sandstone.
664.0 - 665.0	Grayish light brown slightly calcareous sandstone.
668.0 - 669.0	Grayish light brown slightly calcareous sandstone.
671.0 - 672.0	Grayish light brown slightly calcareous sandstone.
673.0 - 674.0	Grayish light brown slightly calcareous sandstone.
678.0 - 679.0	Grayish light brown slightly calcareous slightly shaly sandstone.
680.0 - 681.0	Grayish light brown slightly calcareous sandstone.
686.0 - 687.0	Grayish light brown slightly calcareous sandstone.
689.0 - 690.0	Grayish light brown shaly sandstone.
692.0 - 693.0	Grayish light brown slightly calcareous sandstone.
693.0 - 694.0	Gray laminated slightly calcareous sandstone and shale.
694.0 - 695.0	Gray laminated sandstone and shale.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 356 barrels of oil per acre was obtained from 5.0 feet of sand. The weighted average percent oil saturation was reduced from 35.6 to 31.4, or represents an average recovery of 4.2 percent. The weighted average effective permeability of the samples is 0.52 millidarcys, while the average initial fluid production pressure is 40.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 17 samples tested, 5 produced water and oil, and 10 samples produced water only. This indicates that approximately 29 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 operations in the vicinity of this well should recover approximately 1,680 barrels of oil per acre. This is an average recovery of 335 barrels per acre foot from 5.0 feet of floodable sand analyzed in this core.

OILFIELD RESEARCH LABORATORIES

-4-

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

Original formation volume factor, estimated	1.05
Reservoir water saturation, percent, estimated	25.0
Average porosity, percent	21.6
Oil saturation after flooding, percent	31.4
Performance factor, percent, estimated	50.0
Net floodable sand, feet	5.0

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jennings Drilling Lease Harring Well No. 1

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	647.1	22.4	41	30	71	713	62.	1.0	1.0	713	62.00
2	651.1	21.4	40	33	73	664	43.	1.0	2.0	664	43.00
3	653.1	21.1	34	36	70	557	14.	1.0	3.0	557	14.00
4	655.1	22.0	31	38	69	529	47.	1.0	4.0	529	47.00
5	657.1	21.7	32	36	68	539	44.	1.0	5.0	539	44.00
6	661.1	19.2	27	62	89	402	5.8	1.0	6.0	402	5.80
7	664.1	19.7	17	69	86	260	10.	1.0	7.0	260	10.00
8	668.1	20.4	19	61	80	301	15.	1.0	8.0	301	15.00
9	671.1	20.2	23	58	81	360	23.	1.0	9.0	360	23.00
10	673.1	22.9	24	55	79	426	24.	1.0	10.0	426	24.00
11	678.1	18.1	21	70	91	295	9.4	1.0	11.0	295	9.40
12	680.5	23.1	21	57	78	376	46.	1.0	12.0	376	46.00
13	686.1	22.6	22	50	72	386	34.	1.0	13.0	386	34.00
14	689.1	16.4	15	72	87	191	1.3	1.0	14.0	191	1.30
15	692.1	21.2	26	59	85	428	14.	1.0	15.0	428	14.00
16	693.5	16.5	19	74	93	243	62.	1.0	16.0	243	62.00
17	694.5	19.6	21	69	90	319	6.6	1.0	17.0	319	6.60

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Jennings Drilling	Lease	Harring	Well No.	1
	Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.	
	647.0 - 658.0	5.0	42.0	210.00	
	661.0 - 695.0	12.0	20.9	251.10	
	647.0 - 695.0	17.0	27.1	461.10	
	Depth Interval, Feet	Feet of Core Analyzed	Average Percent Oil Saturation	Average Percent Water Saturation	Total Oil Content Bbl./Acre
	647.0 - 658.0	5.0	21.7	35.6	3,002
	661.0 - 695.0	12.0	20.0	21.3	3,987
	647.0 - 695.0	17.0	20.5	25.5	6,989

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jennings Drilling Lease Harring Well No. 1

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	647.1	22.2	41	706	11	189	30	58	69	1.20	25
2	651.1	21.3	40	661	3	50	37	48	9	0.33	45
3	653.1	21.1	34	557	3	49	31	54	6	0.08	50
4	655.1	21.9	31	527	2	34	29	55	26	0.60	35
5	657.1	21.6	32	536	2	34	30	66	8	0.40	45
6	661.1	19.4	27	406	0	0	27	66	22	0.86	35
7	664.1	20.2	16	251	0	0	16	80	41	1.00	30
8	668.1	20.6	19	304	0	0	19	67	55	1.40	20
9	671.1	20.3	23	362	0	0	23	62	39	1.00	30
10	673.1	22.9	24	426	0	0	24	70	82	1.80	20
11	678.1	18.0	21	293	0	0	21	70	6	0.40	40
12	680.5	23.2	21	378	0	0	21	70	207	4.80	15
13	686.1	22.7	22	387	0	0	22	73	96	1.80	20
14	689.1	16.9	14	184	0	0	14	76	0	Imp.	-
15	692.1	21.3	26	430	0	0	26	70	96	1.80	20
16	693.5	16.1	20	250	0	0	20	73	0	Imp.	-
17	694.5	19.5	21	318	0	0	21	75	238	10.00	15

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.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Jennings Drilling	Lease	Harring	Well No.
				1
Depth Interval, Feet	647.0 - 658.0			
Feet of Core Analyzed	5.0			
Average Percent Porosity	21.6			
Average Percent Original Oil Saturation	35.6			
Average Percent Oil Recovery	4.2			
Average Percent Residual Oil Saturation	31.4			
Average Percent Residual Water Saturation	56.2			
Average Percent Total Residual Fluid Saturation	87.6			
Average Original Oil Content, Bbls./A. Ft.	597.			
Average Oil Recovery, Bbls./A. Ft.	71.			
Average Residual Oil Content, Bbls./A. Ft.	526.			
Total Original Oil Content, Bbls./Acre	2,987.			
Total Oil Recovery, Bbls./Acre	356.			
Total Residual Oil Content, Bbls./Acre	2,631.			
Average Effective Permeability, Millidarcys	0.52			
Average Initial Fluid Production Pressure, p.s.i.	40.0			

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