

MISSOURI LEAD & ZINC COMPANY

CORE ANALYSIS DATA

GRAY LEASE

WELL NO. 5

NEOSHO COUNTY, KANSAS

# SAMPLE LOG

DRILL HOLE: MLZ #5 Gray  
 PROP. OWNER: D.D. & B.E. Gray  
 DRILL CONTRACTOR: L-K Drilling Co.  
 DRILL OPERATOR: H. Laverty  
 DATE STARTED: 9/8/78  
 CASING LEFT IN HOLE: 21' of 7" O.D.

LOC: ~ 330' west of Gray #4  
 LOGGED BY: M.L. Ebers  
 ELEV.: 839.97' surveyed  
 DATE COMPLETED: 9/12/78  
 TOTAL DEPTH: 275'

- surface casing; 257' of 4 1/2" O.D.  
 casing, cemented in
- 0- 1 - Soil
  - 1- 10 - Clay
  - 10- 20 - Limestone, light gray, mostly coral; 10% brown jasper
  - 20- 30 - Shale, silty, dark gray (70%); limestone, brown, micrite, few small fossils (25%); shale, black, trace pyrite (5%)
  - 30- 40 - Limestone, medium light to medium dark brown, micrite, few fossils (coral, etc.)
  - 40- 50 - Limestone, brown, micrite, few fossils (40%); shale, medium dark gray, silty (30%); shale, black, fissile (30%)
  - 50 -60 - Limestone, brown to medium dark gray; micrite, 70%; shale, medium dark gray, silty, 20%; shale, black, fissile, trace pyrite, 10%
  - 60- 70 - Shale, dark gray, platy, 5%; some biotite specks
  - 70- 80 - Shale, medium dark gray, platy, few biotite specks
  - 80- 90 - Shale, medium dark gray, platy, 5%; small biotite specks
  - 90-120 - Shale, same as above
  - 120-130 - Shale, medium dark gray, platy, 90%; shale, brownish gray, platy, 10%
  - 130-140 - Shale, grayish black, locally limy with fossils (tubular), 65%; traces pyrite; coal, vitreous, blocky, 25%; shale, olive gray, 10%
  - 140-150 - Shale, dark gray, platy, 70%; limestone, brown, micrite, 25%; shale, brownish gray (fallin?), 5%
  - 150-155 - Shale, grayish black, large chips, platy to fissile, trace pyrite, 90%; shale, medium gray, platy, 10%
  - 155-160 - Shale, medium gray, platy to fissile, trace pyrite, 90%; shale, black, 8%; coal, 2%; limestone, brown, traces
  - 160-165 - Limestone, light olive gray, micrite, speckled, 5% pyrite, 80%; shale, medium gray, platy, large chips (fallin?), 20%; shale, black, large chips (fallin?), trace
  - 165-170 - Shale, light gray, soft-clay, 10% well rounded and sorted fine brown quartz(?) sand, locally thin limestone lens; few carbonaceous plant fossils, 50%; shale dark gray, platy, scattered carbonaceous plant fossils, 50%
  - at 170 - Core #1 (170-190) Core #2 (190-210)
  - 170-178 - Shale, gray
  - 178-192 - Laminate sand and shale, upper, portion contains less shale, oil and gas
  - 192-199 - Sandy shale, saturated with oil, bleeding oil
  - 199-210 - Sandstone with shale laminate and few tan coal seams, oil and water permeated
  - 210-220 - Sandstone, brownish gray, fine grained, well sorted and subrounded, 5% bitumen, oil, 95%; siltstone, light gray to medium dark gray, 5%
  - 220-230 - Sandstone as above, 5% bitumen, oil, 95%; siltstone, light gray-medium dark gray, 5%
  - 230-240 - Sandstone as above, 15% bitumen, oil, 90%; siltstone, light olive gray and medium dark gray, 10%
  - 240-250 - Shale, medium dark gray, platy, 50%; sandstone as above, 20% bitumen, oil, 35%; siltstone, limy, light olive gray and light gray, 10%; coal, vitreous, blocky, 5%
  - 250-260 - Shale, medium gray, local olive gray, platy, 75%; shale, black, 25%

260-270 - Shale, light gray to medium dark gray, platy, local sand grains,  
85%; shale, black, fissile, trace pyrite, 15%  
270-275 - Shale, medium dark gray, platy, 70%; shale, black, fissile, trace  
pyrite, 30%  
TD at 275

Comments - Water-oil interface at about 205'

- 1) Standard rotary hole with water, no additives
- 2) The interval from 170 to 210 was cored and sent on 9/11/78  
to Oil Field Research, Chanute
- 3) The oil-bearing sand including a 7' sandy shale (192-199)  
was approximately 67' thick (178-245)
- 4) Oil appeared in the pit at 180'
- 5) Hole was running some oil (several gallons per hr.) and  
gas upon completion



# OILFIELD RESEARCH LABORATORIES

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

September 20, 1978

Missouri Lead & Zinc Company  
1705 North Walnut  
Pittsburg, Kansas 66762

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Gray Lease, Well No. 5, Neosho County, Kansas, and submitted to our laboratory on September 11, 1978.

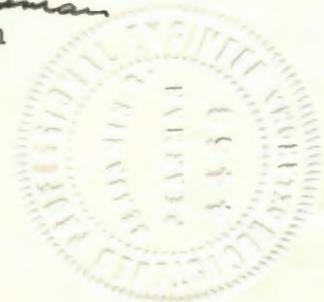
Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

*Benjamin R. Pearman*  
Benjamin R. Pearman

BRP:km  
4 c to Pittsburg, Kansas  
1 c to Chanute, Kansas



- REGISTERED ENGINEERS -

CORE ANALYSIS - WATER ANALYSIS - REPRESSURING ENGINEERING - SURVEYING & MAPPING - PROPERTY EVALUATION & OPERATION

# Oilfield Research Laboratories

## GENERAL INFORMATION & SUMMARY

Company Missouri Lead & Zinc Co. Lease Gray Well No. 5

Location \_\_\_\_\_

Section 34 Twp. 30 Rge. 21E County Neosho State Kansas

Name of Sand	- - - - -	Bartlesville
Top of Core	- - - - -	170.0
Bottom of Core	- - - - -	210.0
Top of Sand	- - - - -	177.9
Bottom of Sand	- - - - -	210.0
Total Feet of Permeable Sand	- - - - -	25.4
Total Feet of Floodable Sand	- - - - - (Analyzed) - - - - -	7.1

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

Permeability Range Millidarcys	Feet	Cum. Ft.
5 - 50	9.3	9.3
50 - 100	3.6	12.9
100 - 200	5.4	18.3
200 & Above	7.1	25.4

Average Permeability Millidarcys	- - - - -	134.4
Average Percent Porosity	- - - - -	21.0
Average Percent Oil Saturation	- - - - -	43.5
Average Percent Water Saturation	- - - - -	40.0
Average Oil Content, Bbls./A. Ft.	- - - - -	715.
Total Oil Content, Bbls./Acre	- - - - -	18,122.
Average Percent Oil Recovery by Laboratory Flooding Tests	- - - - -	19.6
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	- - - - -	360.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	- - - - -	2,558.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Waterflooding)	- - - - -	3,290.
Packer Setting, Feet	- - - - -	
Viscosity, Centipoises @	- - - - -	
A. P. I. Gravity, degrees @ 60 °F	- - - - -	
Elevation, Feet	- - - - -	

The core was sampled and the samples sealed in plastic bags by a representative of the client. The well was reported to have been drilled in virgin territory. Fresh water mud was used as the circulating fluid while taking this core.

#### FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
170.0 - 177.9	Gray sandy shale.
177.9 - 181.6	Brown sandstone.
181.6 - 182.0	Brown laminated carbonaceous sandstone.
182.0 - 185.0	Brown sandstone.
185.0 - 187.6	Brown shaly sandstone.
187.6 - 190.0	Dark brown carbonaceous slightly shaly sandstone.
190.0 - 190.3	Gray sandy shale.
190.3 - 191.2	Brown shaly sandstone.
191.2 - 197.6	Gray sandy shale.
197.6 - 198.8	Brown shaly sandstone.
198.8 - 203.6	Brown slightly shaly sandstone.
203.6 - 210.0	Brown slightly carbonaceous sandstone.

#### CONCLUSION

A study of the laboratory data would indicate that efficient primary and waterflooding operations in the vicinity of this well should recover approximately 3,290 barrels of oil per acre. This is an average recovery of 464 barrels per acre foot from the 7.1 feet of floodable pay sand analyzed in this core.

# GRAY 5

OILFIELD RESEARCH LABORATORIES

- 3 -

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

Original formation volume factor	1.01	<del>1.03</del>
Reservoir water saturation, percent	15.0	21.0
Average porosity, percent	23.8	23.7
Oil saturation after flooding, percent	37.4	37.0
Performance factor, percent	55.0	
Net floodable pay sand, feet	7.1	7.0

**Oilfield Research Laboratories**

**RESULTS OF SATURATION & PERMEABILITY TESTS**

**TABLE 1-B**

Company Missouri Lead & Zinc Company Lease Gray 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	Total			Ft.	Cum. Ft.		
1	178.5	23.7	62	11	73	1,140	371.	1.1	1.1	1,254	408.10
2	179.5	23.0	66	19	85	1,178	241.	1.0	2.1	1,178	241.00
3	180.5	23.5	62	14	76	1,130	173.	1.0	3.1	1,130	173.00
4	181.5	21.9	60	25	85	1,019	301.	0.6	3.7	611	180.60
5	182.5	24.8	57	21	78	1,097	208.	1.4	5.1	1,536	291.20
6	183.5	23.5	48	26	74	875	250.	1.0	6.1	875	250.00
7	184.5	23.2	45	31	76	810	358.	1.0	7.1	810	358.00
8	185.5	14.7	28	63	91	320	12.	1.0	8.1	320	12.00
9	186.5	15.2	41	55	96	485	17.	1.0	9.1	485	17.00
10	187.5	13.9	52	42	94	561	18.	0.6	9.7	337	10.80
11	188.5	19.3	48	34	82	719	50.	1.4	11.1	1,009	70.00
12	189.5	22.1	46	37	83	789	77.	1.0	12.1	789	77.00
13	190.6	19.5	42	39	81	635	5.4	0.9	13.0	571	4.86
14	197.7	14.8	27	66	93	310	46.	0.2	13.2	62	9.20
15	198.5	18.8	39	37	76	569	53.	1.0	14.2	569	53.00
16	199.5	19.0	43	54	97	634	9.0	1.2	15.4	760	10.80
17	200.5	17.9	30	55	85	417	15.	1.0	16.4	417	15.00
18	201.5	14.4	32	60	92	358	71.	1.0	17.4	358	71.00
19	202.5	19.9	43	40	83	664	18.	1.0	18.4	664	18.00
20	203.5	22.1	43	40	83	737	99.	0.6	19.0	442	59.40
21	204.5	24.5	36	49	85	684	195.	1.4	20.4	957	273.00
22	205.5	19.6	53	43	96	808	169.	1.0	21.4	808	169.00
23	206.5	26.8	32	39	71	665	188.	1.0	22.4	665	188.00
24	207.5	25.9	23	49	72	462	131.	1.0	23.4	462	131.00
25	208.5	24.3	32	52	84	603	277.	1.0	24.4	603	277.00
26	209.5	18.7	31	57	88	450	42.	1.0	25.4	450	42.00
	<u>5044.3</u>	<u>535</u>		<u>1058</u>			<u>3394.4</u>				

**Oilfield Research Laboratories**

**SUMMARY OF PERMEABILITY & SATURATION TESTS**

**TABLE III**

Company Missouri Lead & Zinc Company Lease Gray Well No. 5

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
177.9 - 185.0	7.1	267.9	1901.90
185.0 - 203.6	11.9	35.9	428.06
203.6 - 210.0	6.4	168.9	1080.00
177.9 - 210.0	25.4	134.4	3409.96

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
177.9 - 185.0	7.1	23.6	57.1	20.6	1041	7394
185.0 - 203.6	11.9	18.1	40.1	46.8	569	6783
203.6 - 210.0	6.4	23.4	34.6	48.2	616	3945
177.9 - 210.0	25.4	21.0	43.5	40.0	715	18122

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Missouri Lead & Zinc Company Lease Gray Well No. 5

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		18 Residual Saturation			Volume of Water Recovered cc*	18 Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil X	% Water	Bbls./A. Ft.			
1	178.5	24.0	62	1153	21 <sup>33.8</sup>	390 1.1	(41)	49	763	258	28.55	5
2	179.5	23.5	66	1202	32 <sup>48.5</sup>	583 1.0	(34)	61	619	276	29.58	5
3	180.5	23.2	62	1115	27 <sup>43.6</sup>	486 1.0	(35)	63	629	537	34.25	10
4	181.5	22.4	60	1042	25 <sup>41.7</sup>	435 .6	(35)	59	607	455	72.45	5
5	182.5	25.3	57	1119	15 <sup>26.3</sup>	294 1.4	(42)	53	825	452	73.90	10
6	183.5	23.9	48	889	14 <sup>29.2</sup>	260 1.0	(34)	61	629	347	31.30	10
7	184.5	23.5	45	819	7 <sup>15.5</sup>	127 1.0	(38)	59	692	243	18.62	10
8	185.5	14.8	30	344	0	0 1.0	30	65	344	0	Imp.	-
							5.02	289			288.65	
							11.37					
							13.70					

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	Missouri Lead & Zinc Company	Lease	Gray	Well No.	5
Depth Interval, Feet	177.9 - 185.0				
Feet of Core Analyzed	7.1				
Average Percent Porosity	23.8				
Average Percent Original Oil Saturation	57.0				
Average Percent Oil Recovery	19.6				
Average Percent Residual Oil Saturation	37.4				
Average Percent Residual Water Saturation	57.4				
Average Percent Total Residual Fluid Saturation	94.8				
Average Original Oil Content, Bbls./A. Ft.	1,054.				
Average Oil Recovery, Bbls./A. Ft.	360.				
Average Residual Oil Content, Bbls./A. Ft.	694.				
Total Original Oil Content, Bbls./Acre	7,485.				
Total Oil Recovery, Bbls./Acre	2,558.				
Total Residual Oil Content, Bbls./Acre	4,927.				
Average Effective Permeability, Millidarcys	41.10				
Average Initial Fluid Production Pressure, p.s.i.	7.9				

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