

CORE LABORATORIES, INC.  
*Petroleum Reservoir Engineering*  
DALLAS 1, TEXAS  
October 20, 1960

REPLY TO  
4010 N. YOUNGS BLVD.  
P. O. BOX 7128  
OKLAHOMA CITY, OKLA.

Northern Natural Gas Producing Company  
610 Union Center Building  
Wichita, Kansas

Attention: Mr. Leroy B. Fugitt

Subject: Core Analysis  
No. 2 Fralick "A" Well  
Fralick Field  
Kiowa County, Kansas

Gentlemen:

Formation analyzed from 4805.0 to 4812.5 feet is interpreted to be water productive where permeable.


From 4818 to 4830 feet, formation exhibited residual fluid saturations indicative of oil production with water cuts. Further testing of this zone is recommended. Average core analysis values for the interval are given on page one.

The interval, 4830.0 to 4874.4 feet is interpreted to be water productive. The one sample from 4874.4 to 4876.0 feet exhibited residual fluid saturations indicative of oil and water production. This possibly is a local accumulation; however, further testing is recommended.

We sincerely appreciate this opportunity to be of service to you.

Very truly yours,

Core Laboratories, Inc.

  
J. G. Evertson, Jr.,  
District Manager

JGE:PE:sp  
7 cc. - Addressee

**CORE LABORATORIES, INC.**

Petroleum Reservoir Engineering

DALLAS, TEXAS

CP-10-606 TMI

Page 1 of 1 File CP-1-3986 WC

Well No. 2 Fralick "A"

**CORE SUMMARY AND CALCULATED RECOVERABLE OIL****FORMATION NAME AND DEPTH INTERVAL:** Mississippian 4818.0-4830.0

<b>FEET OF CORE RECOVERED FROM ABOVE INTERVAL</b>	12.0	<b>AVERAGE TOTAL WATER SATURATION: PER CENT OF PORE SPACE</b>	71.7
<b>FEET OF CORE INCLUDED IN AVERAGES</b>	10.0	<b>AVERAGE CONNATE WATER SATURATION: PER CENT OF PORE SPACE</b>	(c) 71.7
<b>AVERAGE PERMEABILITY: MILLIDARCYS</b>	Max. 3.8 90 <sup>0</sup> 2.3	<b>OIL GRAVITY: °API</b>	
<b>PRODUCTIVE CAPACITY: MILLIDARCY-FEET</b>	Max. 38 90 <sup>0</sup> 23	<b>ORIGINAL SOLUTION GAS-OIL RATIO: CUBIC FEET PER BARREL</b>	(e) 520
<b>AVERAGE POROSITY: PER CENT</b>	14.7	<b>ORIGINAL FORMATION VOLUME FACTOR: BARRELS SATURATED OIL PER BARREL STOCK-TANK OIL</b>	(e) 1.31
<b>AVERAGE RESIDUAL OIL SATURATION: PER CENT OF PORE SPACE</b>	6.0	<b>CALCULATED ORIGINAL STOCK-TANK OIL IN PLACE: BARRELS PER ACRE-FOOT</b>	246

Calculated maximum solution gas drive recovery is \_\_\_\_\_ barrels per acre-foot, assuming production could be continued until reservoir pressure declined to zero psig. Calculated maximum water drive recovery is \_\_\_\_\_ barrels per acre-foot, assuming full maintenance of original reservoir pressure, 100% areal and vertical coverage, and continuation of production to 100% water cut. (Please refer to footnotes for further discussion of recovery estimates.)

**FORMATION NAME AND DEPTH INTERVAL:**

<b>FEET OF CORE RECOVERED FROM ABOVE INTERVAL</b>		<b>AVERAGE TOTAL WATER SATURATION: PER CENT OF PORE SPACE</b>	
<b>FEET OF CORE INCLUDED IN AVERAGES</b>		<b>AVERAGE CONNATE WATER SATURATION: PER CENT OF PORE SPACE</b>	
<b>AVERAGE PERMEABILITY: MILLIDARCYS</b>		<b>OIL GRAVITY: °API</b>	
<b>PRODUCTIVE CAPACITY: MILLIDARCY-FEET</b>		<b>ORIGINAL SOLUTION GAS-OIL RATIO: CUBIC FEET PER BARREL</b>	
<b>AVERAGE POROSITY: PER CENT</b>		<b>ORIGINAL FORMATION VOLUME FACTOR: BARRELS SATURATED OIL PER BARREL STOCK-TANK OIL</b>	
<b>AVERAGE RESIDUAL OIL SATURATION: PER CENT OF PORE SPACE</b>		<b>CALCULATED ORIGINAL STOCK-TANK OIL IN PLACE: BARRELS PER ACRE-FOOT</b>	

Calculated maximum solution gas drive recovery is \_\_\_\_\_ barrels per acre-foot, assuming production could be continued until reservoir pressure declined to zero psig. Calculated maximum water drive recovery is \_\_\_\_\_ barrels per acre-foot, assuming full maintenance of original reservoir pressure, 100% areal and vertical coverage, and continuation of production to 100% water cut. (Please refer to footnotes for further discussion of recovery estimates.)

(c) Calculated (e) Estimated (m) Measured (\*) Refer to attached letter.

*These recovery estimates represent theoretical maximum values for solution gas and water drive. They assume that production is started at original reservoir pressure; i.e., no account is taken of production to date or of prior drainage to other areas. The effects of factors tending to reduce actual ultimate recovery, such as economic limits on oil production rates, gas-oil ratios, or water-oil ratios, have not been taken into account. Neither have factors been considered which may result in actual recovery intermediate between solution gas and complete water drive recoveries, such as gas cap expansion, gravity drainage, or partial water drive. Detailed predictions of ultimate oil recovery to specific abandonment conditions may be made in an engineering study in which consideration is given to overall reservoir characteristics and economic factors.*

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**DST #1 2440-2570**

Open 1 hour  
 Rec. 60' Mud  
 IBHP 9354/30"  
 FBHP 2704/30"  
 FP's 45 - 604

**DST #2 4792-4846**

Open 30"  
 Good ble throughout  
 Rec. 365' very slt OCM  
 IBHP 14704/30"  
 FBHP 12154/30"  
 FP's 1304 - 1954

**DST #3 4822 - 30 with straddle packers**

(TD 4878)  
 Open 2 hours  
 Very weak ble throughout  
 Rec. 20' watery mud + 20' very slt OCM  
 + 40' watery and VSOCH  
 IBHP 15364/30"  
 FBHP 13634/45"  
 FP's 15 - 424

**DST #4 4875-78**

Open 2 hours  
 Weak ble immediately and increased to fair ble  
 in 45", remained fair to good ble throughout.  
 Rec. 45' watery mud + 480' very slt gas cut and  
 slt muddy salt water.  
 IBHP 15764/30"  
 FBHP 14954/60"  
 FP's 28 - 2474

**CORE #1 4798-4829 Rec. 31'**

- 800-802 2' sh - maroon - black, waxy (bot 1' carb.)
- 802-807 2' ls - dark gr - brn, dns., sub-litho, shly ✓
- 807-808 5' sh - greenish - gr, waxy, lmy
- 808-809 1' ss - lt. gr., med - c. grains, ang - sub - ang.  
 dolomitic, friable, fair porosity (n.s.)  
 good cut and fluorescent.
- 809-811 1' dt - tan to green, very fine suc., dns. sdy,  
 sl. shly.
- 811-813 2' cz. - gr. dolomitic ss. matrix with large  
 pebbles, and pieces of gr. fresh chert.
- 813-823 4' sh - dark green, waxy, greasy lustre faint odor.  
 8' sh - green, with few pieces wea. chert (tan,  
 stained - good ether cut and flu) good odor,  
 sl. sour, numerous large chunks chert - gr -  
 brn - fresh - few thin stringers dt., green  
 dns. shly
- 823-829 6' sh - tr. dt. with large goodes lined with dt.  
 xls., possible good porosity, no vis. stain,  
 tr tan wea. chert (strained) and some fresh brn  
 and gr. chert.

CORE #2 4829-4846, Rec. 17'

- 829-35-2 6 1/2' sh - green with bands of chert, weathered (15-20%), good stain, sl. bleeding of oil and gas, some gr & brn. fresh chert nodls.
- 35-2-36 4' sh - green, rotten, with pieces weathered chert.
- 3-1-46 10' sh - green, firm with bands of chert, white - lt. gr., weathered, bleeding oil and gas, good odor and porosity, some gr - brn fresh chert.

~~4813~~  
Osgood / Mem

CORE #3 4846-4876, Rec. 30'

- 46-47-2 35' dt - lt. gr. in sec. with bands of wh - lt. gr., sl. weathered - fresh chert, no vis. stain
- 2 1/2' dt - lt. gr with numerous bands of chert - wh - lt. gr - weathered large vugs, bleeding oil, fair odor
- 2 1/2' dt - lt. gr. in. sec. many bands of weathered wh - lt. gr. chert with numerous large vugs within the chert; bleeding oil and gas and popping water after 10 min. fair odor
- 8' dt - lt. gr - tan, fn. sucrosic, fn. xln., with bands of pred. fresh lt. gr. chert.
- 4' dt - lt. gr., fn. sucrosic, with few bands of chert, wh - lt. gr. weathered, bleeding oil.
- 3 1/2' dt - lt. gr with few bands of predon. fresh gr. chert, few pieces of weathered chert, scat. bleeding of oil.
- 1 1/2' dt - chert - gr., fresh
- 5' dt - lt. gr - tan, fn. to med. sucrosic, few chert nodls., gr. sl weathered, fair porosity, good stain, good odor. (core appears to be holding moisture from 4865 - 4876)

DRILLING TOOLS FROM TO REMARKS

ROTARY TOOLS

0

4878

PERCUSSION TOOLS

OTHER

DRILLING DIFFICULTIES: LOST CIRCULATION, CROOKED HOSES, ETC.

COMPLETION PROCEDURE:

10/15/60 Set 4 1/2" csg. @ 4878/150 ax.

10/26/60 WOC

11/1/60 MI Completion Unit

11/7/60 Run correlation log

Perf 4 @ 4832

A/100 15% flush 20 MI

Sqs. with 175 ax. @ 4500#

Perf 4 @ 4817

A/150 15% CUA

Sqs. with 185 ax. (4000#)

Drilled out cement

Perf 8 @ 4823

Perf 8 @ 4825

A/500 15%

Rec. load and subd.

IBPPH 1/3 oil and 2/3 water.

Proc. w/5000 gals. jelled keroseens and  
5000# ad.

(Sanded out w/2900 gals. keroseens and  
1500# ad in formation)

Hole clean

Sub. 27 bbls. load

Sub 30 BF (85% water and 15% oil)

Prep. to Acidize

Sub 13 BPPH (10% oil)

Prep to take 4 hour sub test and release rig.

On 11/14 sub 30 BF and 1 BF in 4 hours

Released rig on 11-16-60

WOC

On 11/25/60 - D & A - (Will use as a salt water disposal well)

SURFACE ELEVATIONS

2296

DERRICK FLOOR

2293

GROUND

2287

NEW WELL

RECOMPLETION

REPAIR

FORMATION	DEPTH	ELEVATION	THICK	OPERATOR
HARTFORD	2452	-156		WELL CO.
UPPER KRIDER	2471	-175		FARM
LOWER KRIDER	2492	-196		WELL NO. 2
WINTFIELD	2548	-252		LOCATION: 14-27-206
GAGE	2594	-298		C 14 20
UPPER FORT RILEY	2619	-323		
PENNSYLVANIAN	3122	-1126		
HEMLOCK	4084	-1768		
TONGHO	4080	-1784		
WICHITA LIMESTONE	4300	-1904		CO. 17
LANING - KANSAS CITY	4318	-1914		STATE. 17
L - SOAR	4379	-2083		AREA
HARTFORD	4625	-2329		FIELD
CHICKER	4742	-2445		DATE COMMENCED: 9-26-60
MISSISSIPPI - WAREHAM	4806	-2510		DATE COMPLETED: 11-20-60
MISSISSIPPI CHAT	4820	-2524		INITIAL PRODUCTION: 2-4-61
TD	4878			

CASING:

ACIDIZING AND FRACTURING:

See Completion Procedure

DIAMETER	LENGTH	WEIGHT	GRADE
3 7/8"	558'	375 lb.	
4 1/2"	4078'	150 lb.	

TUBING: See Completion Procedure

DIAMETER	LENGTH	WEIGHT	GRADE

PERFORATIONS: See Completion Procedure

Northern Natural Gas Producing Co.: No. 2 Fralick; C NE SW,  
14-27-20W, Kiowa Co.

<u>4823'</u> (1) <u>Gnathodus?</u>	(4874' cont.) (1) <u>Spathognathodus</u> (8) <u>Taphrognathus</u>
<u>4825'</u> (1) <u>Lonchodina?</u>	<u>4875'</u> (1) <u>Gnathodus texanus</u>
<u>4848'</u> <u>Gnathodus texanus</u>	<u>4876'</u> (1) <u>Gnathodus texanus</u> (1) <u>Ligonodina</u> (1) <u>Taphrognathus</u>
<u>4861'</u> (1) <u>Gnathodus texanus</u>	
<u>4864'</u> (1) <u>Gnathodus texanus</u>	
<u>4865'</u> (1) <u>Gnathodus texanus</u>	
<u>4866'</u> (3) <u>Gnathodus texanus</u>	
<u>4867'</u> (18) <u>Gnathodus texanus</u> (5) <u>Hindeodella</u> (4) <u>Lonchodina?</u>	
<u>4868'</u> (6) <u>Gnathodus delicatus</u> (1) <u>G. texanus</u> (1) <u>Lonchodina?</u>	
<u>4869'</u> (1) <u>Gnathodus antetexanus</u> (10) <u>G. texanus</u> (1) <u>Ozarkodina</u>	
<u>4871'</u> (1) <u>Gnathodus texanus</u> (1) <u>Lonchodina</u>	
<u>4872'</u> (1) <u>Gnathodus</u> (1) <u>Lonchodina</u>	
<u>4873'</u> (1) <u>Gnathodus texanus</u>	
<u>4874'</u> (22) <u>Gnathodus texanus</u> (15) <u>Lonchodina</u> (4) <u>Neoprioniodus</u>	

Northern Natural Gas Producing Co.: No. 2 Fralick; e NE SW, 14-27-20 W,  
 Kiowa County

	Gnathodus	Gnathodus antetexanus	G. delicatus	G. texanus	Hindebella	Ligonodina	Lonchodina	Neoprioniodus	Ozarkodina	Spathognathodus	Taphrognathus
4823-25	✓						✓				
4848											
4861-65				✓							
4866-70		✓	✓	✓	✓		✓		✓		
4871-75	✓			✓			✓	✓	✓		
4876				✓		✓				✓	

12 7 + 3 1924/28 NC



CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

CP-10-606-TMI

COMPANY NORTHERN NATURAL GAS PRODUCING CO. DATE ON 10-10-60 FILE NO. CP-1-3986-WC  
 WELL NO. 2 FRALICK "A" DATE OFF 10-18-60 ENGRS. NEEB  
 FIELD FRALICK FORMATION MISSISSIPPIAN ELEV. 2296' KB  
 COUNTY KIOWA STATE KANSAS DRLG. FLD. WBM W/OIL ADDED CORES DIAMOND  
 LOCATION C NE SW SEC 14-22S-20W REMARKS SAMPLED BY CLI ENGINEER AS DIRECTED.

Special Analysis  
**CORE REPORT**



These analyses, opinions or interpretations are based on observations and material supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representations as to the productivity, proper operation, or profitability of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

PERMEABILITY, Maximum 0-0  
 MILLIDARCYS  
 40 30 20 10 0

TOTAL WATER 0-0  
 PERCENT PORE SPACE  
 80 60 40 20 0

POROSITY X----X  
 PERCENT  
 40 30 20 10 0

OIL SATURATION X----X  
 PERCENT PORE SPACE  
 0 20 40 60 80

\* DENOTES PLUGGED PERMEABILITY.

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS		POROSITY %	RESIDUAL SATURATION % PORE SPACE	
		MAX.	90°		OIL	TOTAL WATER
1	4805.0-06.0	<0.1	<0.1	4.6	3.3	91.6
2	4807.0-09.0	<0.1	*	7.0	1.7	89.7
3	09.0-10.8	0.9	0.6	6.3	5.3	81.8
4	4810.8-12.5	1.5	0.6	11.6	1.6	86.6
5	4818.0-20.0	<0.1	*	9.8	4.6	74.3
6	20.0-22.0	14	10	12.5	4.3	72.9
7	22.0-24.0	0.9	0.5	13.9	6.9	73.8
8	24.0-25.8	0.3	<0.1	14.2	8.1	67.6
9	25.8-27.5	1.0	0.5	13.8	5.2	73.4
10	27.5-29.0	0.4	0.3	18.8	4.5	68.9
11	29.0-30.0	5.5	<0.1	17.2	7.3	73.8
12	30.0-31.0	0.9	0.8	15.6	4.4	79.3
13	31.0-32.2	0.8	0.7	15.5	3.7	83.0
14	32.2-33.4	<0.1	<0.1	14.9	3.2	85.6
15	33.4-34.7	1.6	1.1	14.7	3.7	84.3
16	4834.7-35.7	1.5	1.0	14.1	3.0	88.0
17	4836.0-37.4	1.4	0.4	9.8	4.8	79.1
18	37.4-39.0	<0.1	<0.1	13.5	2.4	90.8
19	39.0-41.0	<0.1	<0.1	13.4	1.4	93.4
20	4841.0-43.0	2.3	0.8	12.7	1.3	91.8
21	4843.0-44.5	1.4	1.1	12.0	2.0	94.0
22	44.5-46.0	0.1	<0.1	11.3	1.1	94.3
23	46.0-47.8	0.2	<0.1	10.6	2.1	90.6
24	47.8-49.5	<0.1	<0.1	9.4	1.0	95.2

