

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS 1, TEXAS



REPLY TO
706 PATTERSON BLDG.
DENVER, COLORADO

October 4, 1957

Kansas-Nebraska Natural Gas Company, Inc.
300 North St. Joseph
Hastings, Nebraska

Attention: Mr. S. D. Ford, Jr.

Subject: Core Analysis
Excelsior Oil Corporation
Miller No. 3 Well
East Atwood Field
Logan County, Colorado

Gentlemen:

Diamond coring equipment and oil emulsion mud were used to core the interval from 4405 to 4422 feet in the Miller No. 3. Engineers of Core Laboratories, Inc. selected samples of recovered formation, and transported these samples to the Sterling laboratory for analysis. The results are presented in this report.

"D" sand from 4406 to 4407 feet is impermeable and nonproductive.

From 4409 to 4419 feet, the "D" sand exhibits comparatively low residual oil and high total water saturations, but these saturation conditions are attributed to excessive flushing of the cores by the drilling fluid filtrate as a result of the slow coring times which predominated throughout the interval. The zone is interpreted to be oil productive. Permeability values in the interval range from 36 to 557 millidarcys and average 195 millidarcys, and the total observed productive capacity is 1950 millidarcy-feet, adequate to support satisfactory rates of oil production without treatment. The porosity varies from 14.6 to 20.9 per cent and averages 17.8 per cent, and the connate water saturation is estimated to be 35 per cent of pore space.

Kansas-Nebraska Natural Gas Company, Inc.
Miller No. 3 Well

Page Two

Estimates of recoverable oil have been calculated for the "D" sand between 4409 and 4419 feet using the observed core analysis data in conjunction with estimated reservoir fluid characteristics considered applicable. These estimates are presented on page one of the report, and are subject to the conditions set forth in the body of and in the footnotes to the summary page.

We sincerely appreciate this opportunity to be of service to you, and trust that this report will prove useful in making a preliminary evaluation of "D" sand analyzed from this well.

Very truly yours,

Core Laboratories, Inc.

A handwritten signature in cursive script that reads "J D Harris". To the right of the signature is a small, stylized circular mark.

J. D. Harris,
District Manager

JDH:TLK:ds



CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

COMPANY EXCELSIOR OIL CORPORATION DATE ON 9/26/57 FILE NO. RP-2-1744 PC
 WELL MILLER NO. 3 DATE OFF 9/27/57 ENGRS. WEH, LAH
 FIELD EAST ATWOOD FORMATION "D" SAND ELEV. _____
 COUNTY LOGAN STATE COLORADO DRLG. FLD. OIL EMULSION CORES DIAMOND
 LOCATION C E/2 NW NW SEC 25-7N-53W REMARKS SAMPLED BY CLI ENGINEER.



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.

TABULAR DATA and INTERPRETATION

COMPLETION COREGRAPH

PERMEABILITY ○—○
MILLIDARCY

TOTAL WATER ○—○
PERCENT PORE SPACE

400 300 200 100 0

80 60 40 20 0

POROSITY X---X
PERCENT

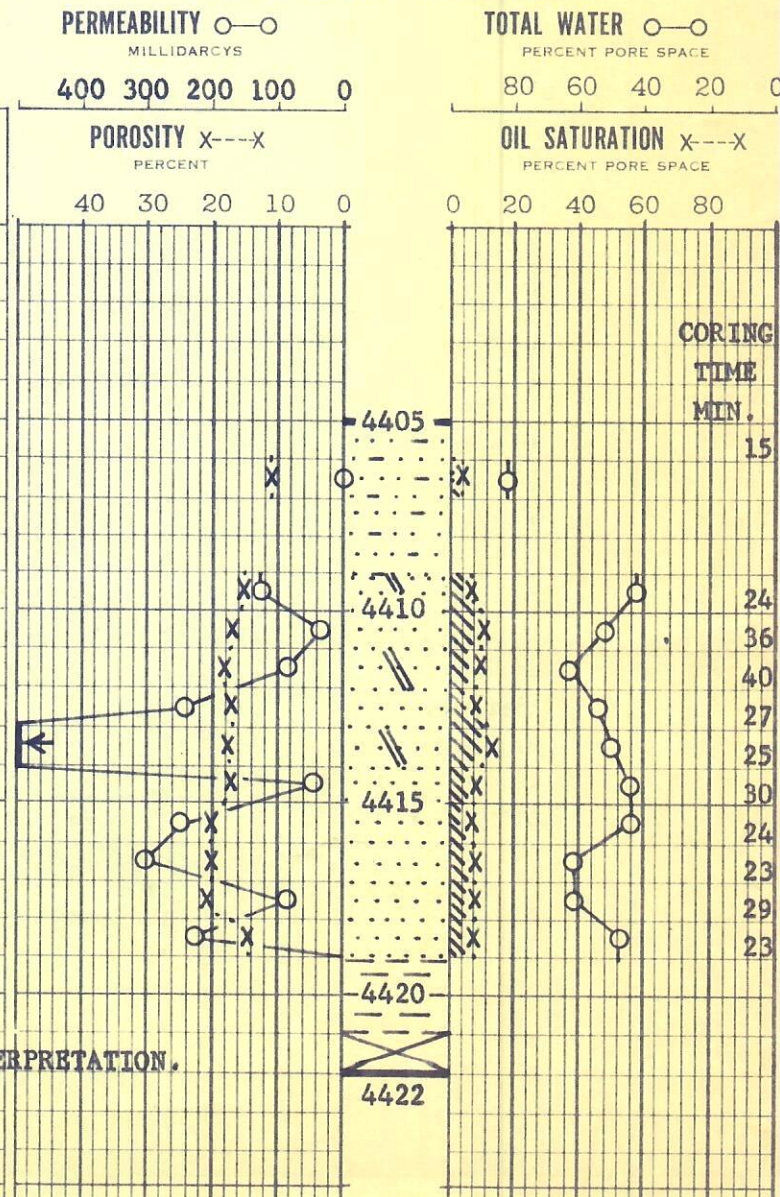
OIL SATURATION X---X
PERCENT PORE SPACE

40 30 20 10 0

0 20 40 60 80

CORING
TIME
MIN.
15

SAMPLE NUMBER	DEPTH FEET	PERM. MD.	POROSITY %	RESIDUAL SATURATION % PORE SPACE		VERTICAL PERMEA- BILITY	PROD.
				OIL	TOTAL WATER		
1	4406-07	0.0	11.0	4.5	81.6	0.0	
2	4409-10	125	15.2	7.2	42.0	43	OIL*
3	10-11	36	16.9	10.7	52.2	20	OIL*
4	11-12	82	18.4	10.3	63.1	61	OIL*
5	12-13	247	17.0	8.8	54.1	152	OIL*
6	13-14	557	17.6	14.2	50.0	475	OIL*
7	14-15	45	17.3	9.3	43.9	38	OIL*
8	15-16	250	20.1	7.0	43.8	143	OIL*
9	16-17	299	20.0	9.0	61.0	227	OIL*
10	17-18	84	20.9	8.6	60.8	53	OIL*
11	4418-19	227	14.6	8.2	47.2	165	OIL*



* REFER TO ATTACHED LETTER FOR CLARIFICATION OF INTERPRETATION.

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

25-7N-53W

Page 1 of 1 File RP-2-1744 PC
Well Miller No. 3

CORE SUMMARY AND CALCULATED RECOVERABLE OIL

FORMATION NAME AND DEPTH INTERVAL: "D" Sand 4409.0-4419.0

FEET OF CORE RECOVERED FROM ABOVE INTERVAL	10.0	AVERAGE TOTAL WATER SATURATION: PER CENT OF PORE SPACE	51.8
FEET OF CORE INCLUDED IN AVERAGES	10.0	AVERAGE CONNATE WATER SATURATION: PER CENT OF PORE SPACE (e)	35
AVERAGE PERMEABILITY: MILLIDARCY	195	OIL GRAVITY: °API (e)	40
PRODUCTIVE CAPACITY: MILLIDARCY-Feet	1950	ORIGINAL SOLUTION GAS-OIL RATIO: CUBIC FEET PER BARREL (e)	440
AVERAGE POROSITY: PER CENT	17.8	ORIGINAL FORMATION VOLUME FACTOR: BARRELS SATURATED OIL PER BARREL STOCK-TANK OIL (e)	1.30
AVERAGE RESIDUAL OIL SATURATION: PER CENT OF PORE SPACE	9.3	CALCULATED ORIGINAL STOCK-TANK OIL IN PLACE: BARRELS PER ACRE-FOOT	691

Calculated maximum solution gas drive recovery is 191 barrels per acre-foot, assuming production could be continued until reservoir pressure declined to zero psig. Calculated maximum water drive recovery is 562 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:

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

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.

These analyses, opinions or interpretations are based on observations and materials 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 representation as to the productivity, proper operation,