EFORE THE INDUSTRIAL COMMISSIO

OF THE STATE OF NORTH DAKOTA

IN THE MATTER OF THE HEARING CALLED ON THE MOTION OF THE INDUSTRIAL COMMISSION OF NORTH DAKOTA TO CONSIDER THE TEMPORARY SPACING PATTERN FOR THE DEVELOPMENT OF THE DICKINSON-HEATH POOL IN STARK COUNTY, NORTH DAKOTA, AND PRESCRIBE SUCH SPECIAL FIELD RULES AS MAY BE NECESSARY.

CASE NO. 210
ORDER NO. 229

TEMPORARY ORDER OF THE COMMISSION

BY THE COMMISSION:

Pursuant to legal notice this cause came on for hearing at 9:30 a.m. on April 15, 1958, at Bismarck, North Dakota, before the Industrial Commission of North Dakota, hereinafter referred to as the 'Commission'.

NOW, on this 25 day of April, 1958, the Commission, a quorum being present, having considered the testimony adduced and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That geological and engineering evidence, presented to the Commission, bearing on the matter of well spacing indicates that the Dickinson-Heath Pool, as classified and defined by this temporary order should, for a period not to exceed eighteen (18) months from date of this order, be developed on a pattern of one well to 160 acres in order to drain efficiently the recoverable oil from said pool, assure orderly and uniform development, avoid the drilling of unnecessary wells, and prevent waste in a manner to protect correlative rights.

(3) That a temporary 160 acre spacing in the Heath Pool in this field will result in the efficient and economical development of the field as a whole and will operate so as to prevent waste and provide maximum ultimate recovery, will avoid the drilling of unnecessary wells and will protect correlative rights.

(4) That certain special field rules are necessary to prevent waste and protect against the pollution of surface waters.

IT IS THEREFORE ORDERED:

(1) The Dickinson-Heath Pool discovered by the Atlantic Refining Company's Kadrmas #1 well, located in the NE SE Section 31, Township 140 N., Range 96 W, is hereby classified and defined as that common source of supply of oil found below the bottom of the Minnelusa and above the Otter formations in and under the following described tracts of land in Stark County, North Dakota to wit:

Township 140 North, Range 96 West, 5th PM
All of sections 31 and 32, and the S/2 of Sections 29 and 30.

Township 139 North, Range 96, 5th PM
The N/2 of Sections 5 and 6.

together with those additional quarter sections, or governmental lots corresponding thereto, as may be proven productive by wells drilled as direct offsets to wells included in the limits as set forth above, provided further that such extensions of the pool boundaries shall include only sufficient acreage to form a spacing unit for such wells.

(2) That effective this date 160 acres per well is established as the temporary spacing for the development of the Dickinson-Heath Pool.

(3) That all wells drilled in the Dickinson-Heath Pool shall be located approximately in the center of the northeast quarter-quarter sections (or governmental lots corresponding thereto).

(4) That spacing units consist of any quarter section (or governmental lots corresponding thereto) containing not less than 140 acres as determined by, or in accordance with, governmental survey.

(5) That no well shall be drilled or produced in said pool except in conformity with the spacing pattern set forth above without special order of the Commission after due notice and hearing.

(6) That the following special field rules be, and the same are hereby enacted, and shall apply to the subsequent drilling and operation of wells in the Dickinson Heath Pool.

(a) That the casing program of all wells drilled hereafter in said pool shall include at least two strings of pipe set in accordance with the following program.

(i) The surface string shall consist of new or reconditioned pipe that has been previously tested to one thousand pounds (1000) per square inch. The casing shall be set and cemented at a point not higher than six hundred (600) feet below the surface of the ground. Cementing shall be by the pump and plug method, and sufficient cement shall be used to fill the annular space back of the pipe, to the surface of the ground, or the bottom of the cellar. Cement shall be allowed to stand a minimum of twelve (12) hours before drilling the plug or instituting tests.

(ii) The producing, or oil string, shall consist of new or reconditioned pipe that has been previously tested to three thousand (3000) pounds per square inch. Cementing shall be by the pump and plug method, and sufficient cement shall be used to fill one and one-half (1 1/2) times the annular space between the shoe and the top of the Amsden formation, but not less than 300 sacks of cement shall be used, and the cement shall be allowed to stand twenty-four (24) hours before drilling the plug or initiating tests.

(b) The producing, or oil string, shall be set at least as low as the top of the producing formation. The string shall be tested by either lowering the fluid level or by application of pump pressure. If the test is made by lowering the fluid level, the well shall be bailed dry or at least to a point midway to the bottom of the string and the top of the cement, behind the string, and shall be allowed to stand a minimum of two (2) hours. If, after that period, the fluid level shows a rise equivalent to two (2) per cent of the distance bailed the string shall be repaired so as to exclude water. Thereafter the casing shall be again tested in the same manner. If the test is made by application of pump pressure, a pressure of at least fifteen hundred (1500) pounds per square inch shall be applied. If, at the end of thirty (30) minutes this pressure drops one hundred and fifty (150) pounds per square inch or more, the string shall be repaired so as to exclude water. Thereafter the casing shall again be tested in the same manner. Further work shall not proceed until a satisfactory test has been obtained.

(c) All christmas tree fittings and well head connections shall have a working pressure of at least one thousand (1000) pounds per square inch or a test pressure of at least two thousand (2000) pounds per square inch.

(d) The gas-oil ratio of each well in the field shall be determined four times annually during the months of February, May, August, and November, and reported to the State Geologist within fifteen (15) days after the end of the month in which they are determined. All measurements shall be made under the supervision of the State Geologist or his designated representative.

(e) Any well with a gas-oil ratio of over two thousand (2000) cubic feet per barrel shall have the allowable oil production adjusted in accordance with Rule 506 in Industrial Commission's Order No. 1, General Rules and Regulations for the conservation of Crude Oil and Natural Gas for the State of North Dakota.

(f) The reservoir pressure of all flowing wells, and the static and working fluid levels of all pumping wells, shall be determined semi-annually during the months of May and November. The results thereof shall be reported to the State Geologist on or before the 15th of the month following the month in which the measurements were made. All pressure determinations shall be measured at or adjusted to a datum of five thousand three hundred feet (5300) below sea level and after the well has been shut in for a period of approximately forty-eight (48) hours. All reservoir pressure measurements, or fluid level determinations, shall be made under the supervision of the State Geologist, or his designated representative, and by methods approved by the State Geologist.

(7) That this order shall cover all the Dickinson-Heath common source of supply of crude oil and natural gas, as herein above defined, and shall continue in full force and effect for 18 months from the date hereof.

DONE, at Bismarck, North Dakota, this 25 day of April, 1958.

THE NORTH DAKOTA INDUSTRIAL COMMISSION

John E. Davis

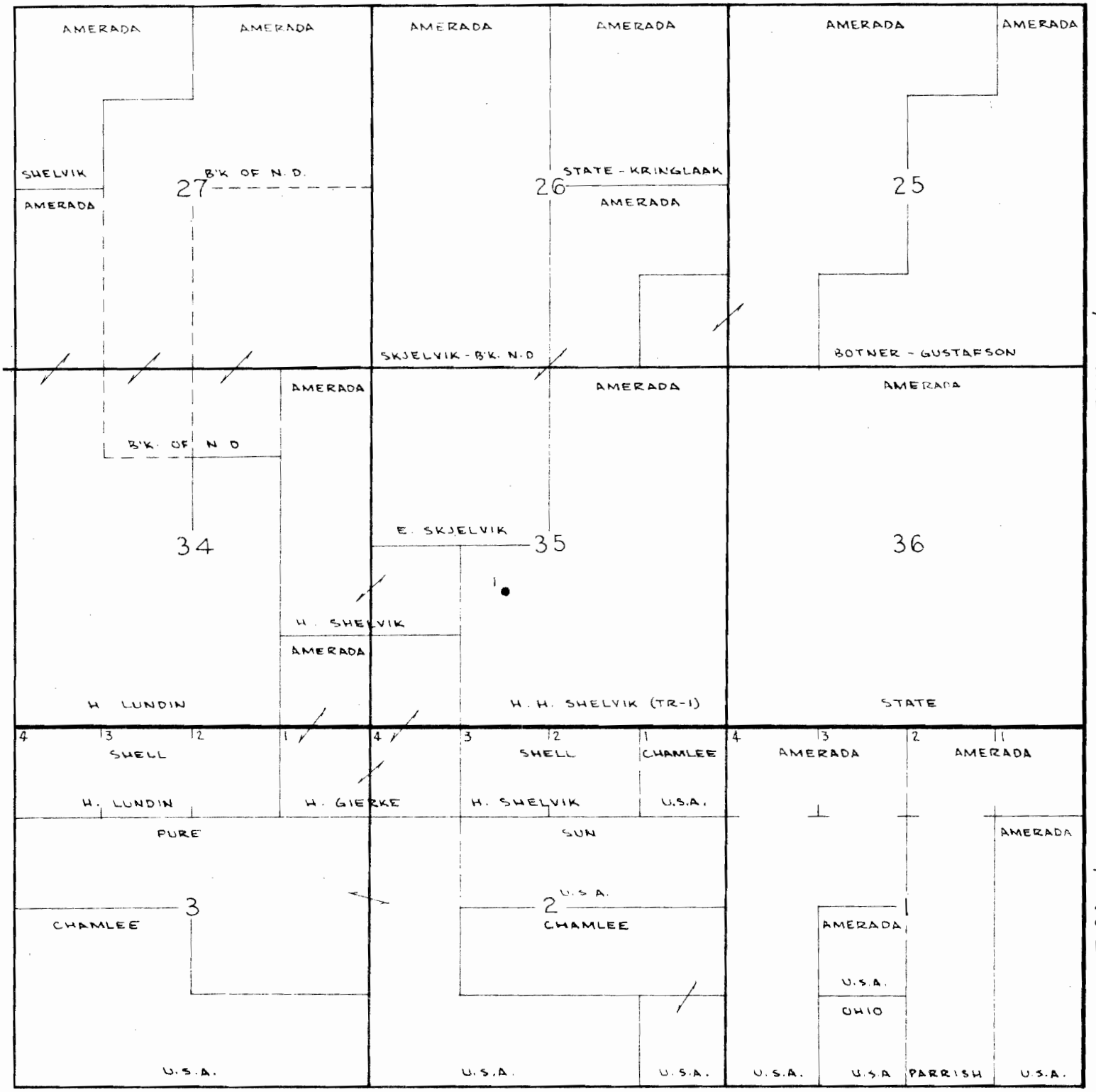
John E. Davis, Governor

Leslie R. Burgum

Leslie R. Burgum, Attorney General

Math Dahl

Math Dahl, Commissioner of Agriculture & Labor



NDIC Case #220
Amerada Petroleum Corporation
Exhibit I
4-15-58.

PORTION OF
McKENZIE COUNTY
NORTH DAKOTA

Scale: 1" = 2000'

THIS FORM MUST BE FILLED OUT AND HANDED TO THE REPORTER IN ATTENDANCE AT THE HEARING

STATE INDUSTRIAL COMMISSION

STATE OF NORTH DAKOTA

APPEARANCE

Place Bismarck, N.D. Date Apr 15, 1958 Docket No. 210

vs.

Name Wm R Pearce

Address Bismarck, N.D.

Appearing for Atlantic Refining Company

THIS FORM MUST BE FILLED OUT AND HANDED TO THE REPORTER IN ATTENDANCE AT THE HEARING

STATE INDUSTRIAL COMMISSION

STATE OF NORTH DAKOTA

APPEARANCE

Place Bismarck Date April 15, 1958 Docket No. 210

vs.

Name BRUCE VERNOR

Address Box 520, Casper, Wyoming

Appearing for The Atlantic Refining Company

STATEMENT OF VICTOR T. MCCAULEY

for the

Atlantic Refining Company

CASE NO. 210

April 15, 1958

It is the purpose of this testimony to present a brief well history of the Atlantic-Goodstein No. 1 Kadrmas, to recommend field limits for this new pay discovery, and to request a change in the nomenclature used when referring to this pay zone.

The Atlantic-Goodstein No. 1 Kadrmas is located in the NE/4 of the SE/4 of Section 31-140N-96W. It was originally scheduled as a confirmation well to the Leach Oil Corporation No. 1 Kalanek, located in the SW/4 of the NW/4 of Section 32, which is the Dickinson field discovery well. Exhibit No. 1 is a location map showing the temporary limits of the Dickinson-Madison pool and the location of the No. 1 Kadrmas and No. 1 Kalanek. The No. 1 Kalanek is producing from perforations in the Madison formation. To be more exact, it is producing from equivalents of the Nesson Main Pay and Midale zones.

The No. 1 Kadrmas was spudded on November 24, 1957, with R. L. Manning Company as the drilling contractor. Nine and 5/8 inch surface casing was set at 719 feet and cemented with 550 sacks of cement. The first indication of oil was encountered in the samples while drilling at a depth of 7797 feet near the base of the Pennsylvanian formations. A core from 7797 to 7827 feet included in the recovery approximately 11 feet of porous, oil stained sand,

occuring in several thin beds between 7797 and 7816 feet. The following drill stem test indicated probable production from this zone.

> Drill Stem Test No. 1, 7783 to 7830 feet, initial shut-in 39 minutes, tool open 2 hours, 18 minutes, final shut in 1 hour. Open with good blow of air, increased to strong in 5 minutes; had gas to surface in 1 hour, 45 minutes; recovered 3080 feet of free oil; initial shut-in pressure 3390#, initial flow pressure 135#, final flow pressure 775#, final shut-in pressure 3261#, initial hydrostatic pressure 4435#, and final hydrostatic pressure 4329#.

Further drilling and coring deepened the well to a total depth of 8970 feet to test the Madison zones producing in the No. 1 Kalanek. Three cores, from 8687 to 8737 feet, from 8737 to 8787 feet, and from 8790 to 8822 feet, covered the section presently producing at the No. 1 Kalanek. Drill stem tests 2, 4, and 5 separately tested intervals equivalent to the three sets of perforations in the Kalanek. Core No. 6 and Drill Stem Test No. 6 tested the zone equivalent to the Madison production at Fryburg field. The drill stem test results are listed below, but since core chips and core analysis have been filed with the State Geologist, I have not bothered to list them.

> Drill Stem Test No. 2, 8690 to 8737 feet, initial shut-in 30 minutes, tool open 2 hours, 15 minutes, final shut-in 45 minutes. Opened with weak blow of air, decreased to very weak at end of test; recovered 50 feet slightly oil-cut mud, 650 feet of slightly mud-cut salt water with a trace of oil; initial shut-in pressure 3930#, initial flow pressure 120#, final flow pressure 410#, final shut-in pressure 3580#, initial hydrostatic pressure 4740#, and final hydrostatic pressure 4725#.
>
> Drill Stem Test No. 3, 8747 to 8787 feet, packer failure.
>
> Drill Stem Test No. 4, 8742 to 8787 feet, initial shut-in 30 minutes, tool open 2 hours, 10 minutes, final shut-in 30 minutes. Opened with fair blow of air, decreased slightly in 15 minutes, dead in 38 minutes; recovered 310 feet of very slightly oil-cut muddy salt water (Sal. 201,000 ppm.); initial shut-in pressure

3640#, initial flow pressure 55#, final flow pressure 165#, final shut in pressure 3395#, initial hydrostatic pressure 4685#, and final hydrostatic pressure 4685#.

Drill Stem Test No. 5, 8794 to 8822 feet, initial shut in 45 minutes, tool open 40 minutes. Open with a faint flow of air, died in 1 hour; bypassed tool at 30 minutes, packer failed at 40 minutes; recovered 225 feet of mud with a trace of oil and gas; initial shut-in pressure 75, initial flow pressure 75#, final flow pressure 105#, no final shut-in pressure, initial hydrostatic pressure 4855#, and final hydrostatic pressure 4755#.

Drill Stem Test No. 6, 8895 to 8941 feet, initial shut-in 45 minutes, open 1 hour, 30 minutes, final shut-in 45 minutes. Open with very faint blow, decreased and died in 15 minutes; recovered 250 feet of slightly sulfur salt water cut mud with a rainbow of oil; initial shut-in pressure 85#, initial flow pressure 85#, final flow pressure 190#, final shut-in pressure 2810#, initial hydrostatic pressure 4895#, and final hydrostatic pressure 4885#.

After reaching a total depth of 8970 feet, a Gamma Ray-Neutron log, Laterolog, Caliper log, and Microlaterolog were run. Since neither the cores, drill stem tests or logs indicated any potential production from the Madison, the well was plugged back to further test the sand at the base of the Pennsylvanian. Cement plugs were spotted from 8850 to 8650 feet and from 8075 to 8000 feet. Five and one-half inch casing was set at 7943.35 feet and cemented with 650 sacks of cement. The casing was perforated from 7784 to 7818 feet with four shots per foot. An 11 and one-half hour swab test recovered 150 barrels of salt water, containing less than 2% oil. The perforations were squeezed with 150 sacks of cement and the well perforated from 7786 to 7816 feet, again with four shots per foot. During an attempted sand-oil fracture treatment, the formation took 5800 gallons of oil and 4900 pounds of sand with no breakdown at 7000 pounds. After swabbing to recover treating oil and to clean out the well,

a pump and tank battery were installed. Pump testing began on February 26, 1958. During the first 24 hour period the well produced 204.52 barrels of oil, 34.6° gravity, cut 0.6% with basic sediment and with no water. The gas-oil ratio is 54.5 cubic feet per barrel. This is the official completion gauge filed with the State Geologist. Pump tests continued for seven more days and these final gauges give a better estimate of the capacity of the well. Production declined at a decreasing rate and during the last 24 hour period, the well produced 152 barrels of oil. On regular production it has averaged 150 barrels of oil per day.

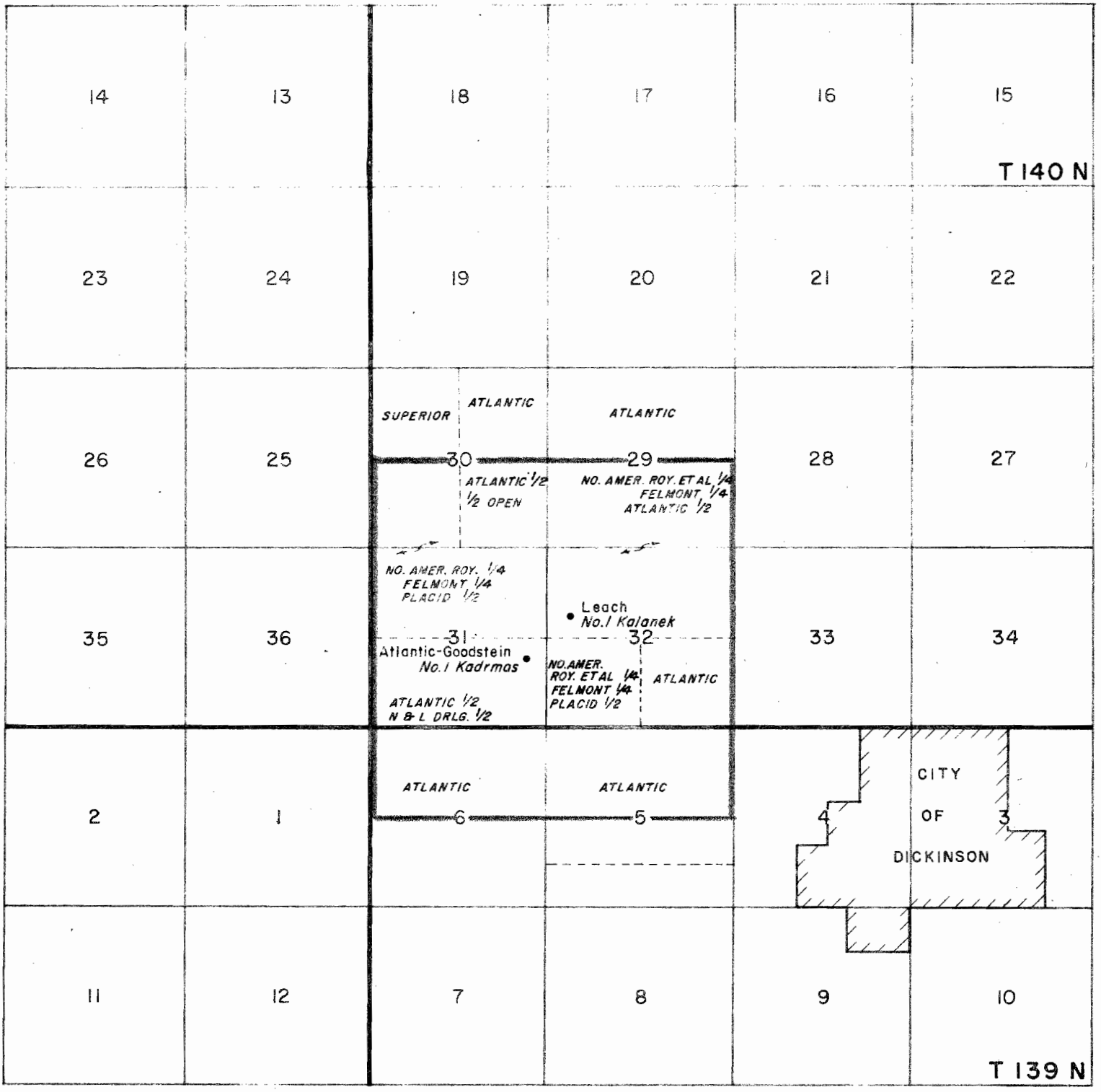
In Exhibit No. 2, I have plotted a simplified lithology of the section containing the producing sands against a portion of the Gamma Ray-Microlaterolog log. On the left are the stratigraphic equivalents as we presently correlate this part of the geologic column. As is evident from Exhibit No. 2, the sand occurs as a number of thin beds, interbedded with black shales. The sand itself is light gray, fine to very fine grained, with a variable amount of calcareous cement. Lithologically, it is very similar to the producing sand at the Scoria, Fryburg, and Belfield pools. In contrast to the Kadrmas, these other fields contain sand thicknesses of between 17 and 25 feet and the black shale interbeds are missing or have thinned greatly. Above the sand zone is found a series of dark brown to black, argillaceous, carbonaceous, ostracodal, limestones with black shale streaks and interbeds. Underlying the sand zone, we find approximately 33 feet of red, waxy, calcareous shale with limestone and sand stringers. Since we have no definitive names in North Dakota to use in subdividing the section into these units, I have borrowed the terms

Amsden, Alaskan Bench, and Tyler from the Montana terminology. Below the red shale we find the typical black, Heath shale. Except for the difference in the sand thickness noted above, this general stratigraphic sequence is approximately the same as that found in the Fryburg, Scoria, and Belfield pools.

Exhibit No. 3 is a cross section from the Fryburg pool through the single-well Belfield pool to the two Dickinson pool wells showing the stratigraphic relationships immediately above and below the post-Mississippian unconformity. This cross section summarizes graphically the comparisons just made between these fields. The direct correlation between the producing sand at the No. 1 Kadrmas and the sand at Fryburg and Belfield is obvious. Since the term is already widely accepted, we refer to it as the "Fryburg sand". In addition, the cross section also presents in very brief form some of the conclusions we have reached in our regional studies of this part of the State. We limit the Heath formation to the dark, calcareous, carbonaceous shales immediately overlying the Otter and refer the red, waxy shales and their associated sands to a younger period of deposition, herein called Tyler equivalent. A map of the contact of the two lithologies shows a fairly rugged topographic surface. In several cases, as in the Amerada No. 1 R. E. Newton (well No. 2 on the cross section), erosion has locally removed all of the Heath and has cut into the underlying Otter. All of our work thus far clearly indicates that the post-Big Snowy unconformity is as I have it shown on the cross section. We believe that all the producing sands in southwestern North Dakota are post-Heath in age and we recommend discontinuing use of the term "Heath" in referring to these productive units.

EXHIBIT 1

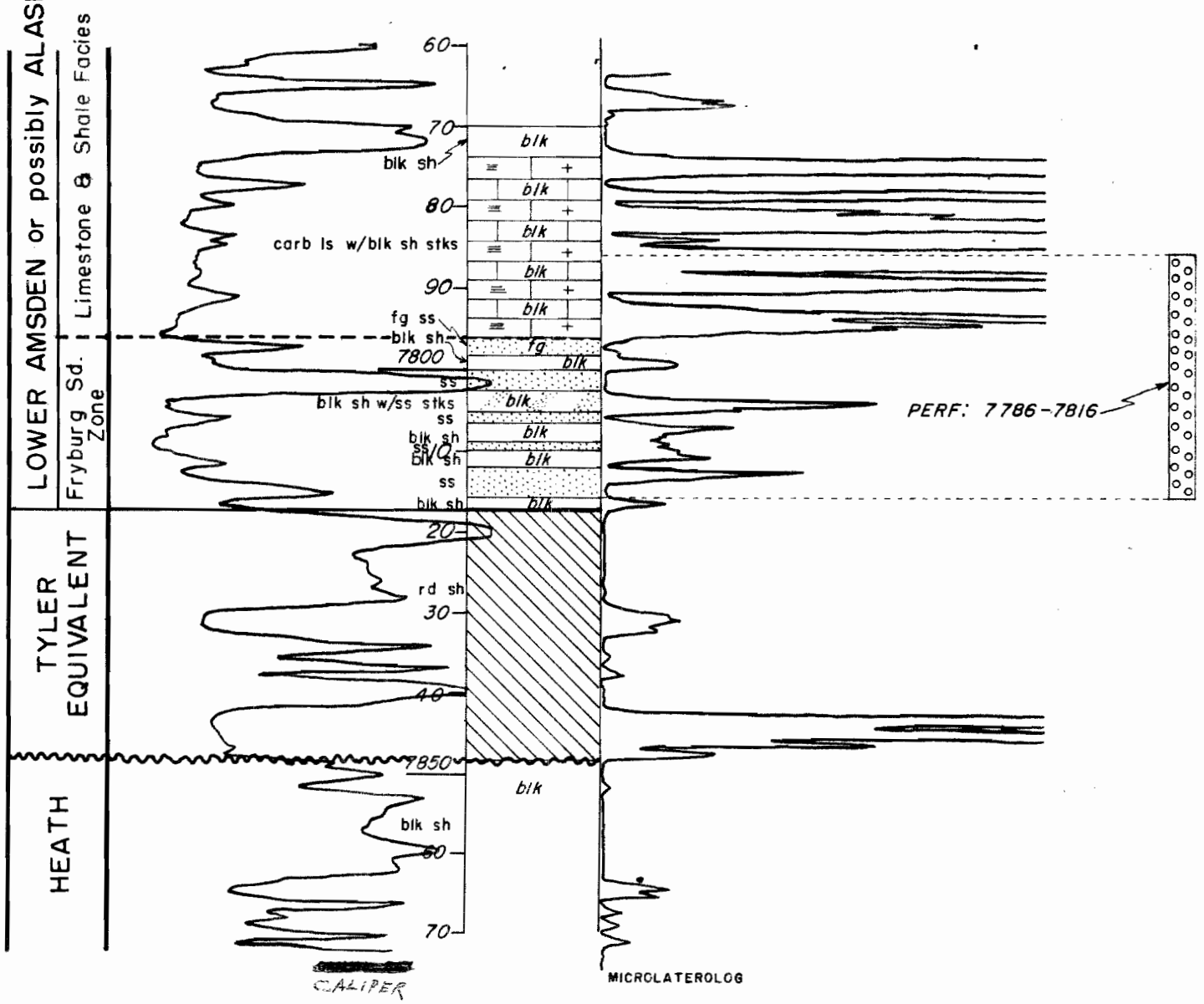
LOCATION MAP DICKINSON FIELD



ATLANTIC-GOODSTEIN
No. 1 Kadrmas

NE SE SEC. 31-140N-96W
STARK CO., N. DAK.

ELEV. 2495 ● T.D. 8970



1

AMERADA
No. 1-I Joubert
SE SE SEC. 4-139N-100W

2

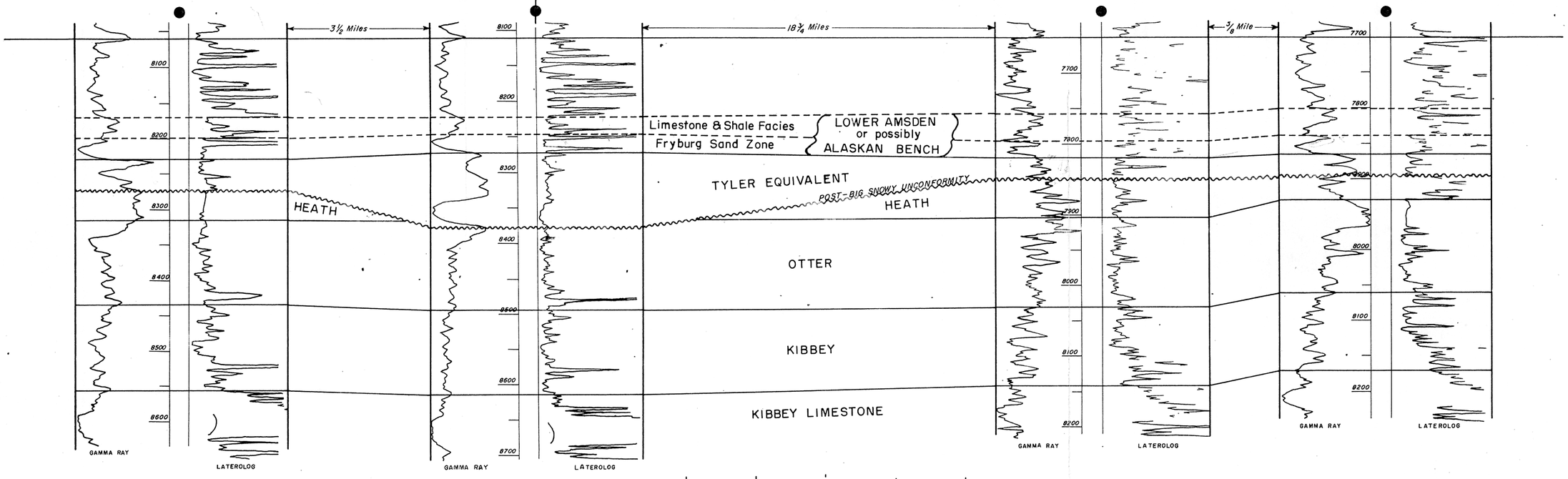
AMERADA
No. 1 Newton
NW SW SEC. 31-140N-99W

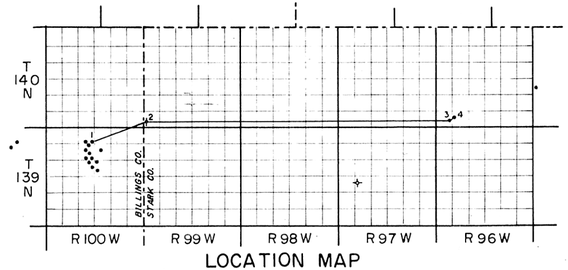
3

ATLANTIC-GOODSTEIN
No. 1 Kadrmas
NE SE SEC. 31-140N-96W

4

LEACH
No. 1 Kalanek
SW NW SEC. 32-140N-96W





LOCATION MAP
Billings & Stark Counties
Scale: 1"=32,000'

EAST-WEST STRATIGRAPHIC CROSS SECTION

FRYBURG BELFIELD & DICKINSON FIELDS

HORIZONTAL SCALE: (Not to scale)
VERTICAL SCALE: 1" = 100'
GEOLOGY: V. T. MC CAULEY
DRAFTING: L. A. SCHNEIDER
APRIL 7, 1958

TESTIMONY OF BRUCE VERNOR, THE ATLANTIC REFINING COMPANY

IN THE INDUSTRIAL COMMISSION OF NORTH DAKOTA

CASE NO. 210, APRIL 15, 1958

The Atlantic Refining Company, J.J. Kadrmas No. 1 Well discovered The Dickinson (Fryburg Sand) Field and is the only well in this pay in the field. This well was completed on February 26, 1958 pumping 203 barrels of oil and no water in 24 hours through perforations from 7786' to 7816', after fracture treatment of 4900 pounds of sand and 5800 gallons of gelled oil. The produced oil was 34.6° API gravity and the gas-oil ratio was 55 standard cubic feet per barrel. The well is now producing from 118 to 130 barrels of oil per day with a gas-oil ratio of 66 standard cubic feet per barrel. On February 9, 1958 the reservoir pressure after 24 hour shut-in was 3455 pounds at a datum of 5313' below sea level.

As Exhibit No. 4, Atlantic is submitting copies of the plug core analysis and full diameter core analysis on the Fryburg Sand in The Kadrmas No. 1 Well. The core analysis shows 11.5' of net sand. The average porosity from the plug cores is 11.3% and from the full diameter cores, 4.6%. The average plug core permeability is 78.6 millidarcies with values up to 488 millidarcies and the average full diameter core permeability is 10.6 millidarcies.

Atlantic economic calculations show that a well drilled on 160 acre spacing would be poor and a well drilled on 80 acre spacing would be uneconomical because of low reserves. Atlantic is selling the oil for $2.07 per barrel less 18.5¢ trucking cost. Our market has given termination notice because they cannot handle the oil since it has a pour point of 90°.

We believe the zones of high permeability will allow one well to drain 160 acres efficiently. Atlantic requests temporary 160 acre spacing to allow development of this field without drilling unnecessary wells.

Atlantic proposes these field rules:

I. Field Name

The Atlantic Refining Company submits the name of Dickinson(Fryburg Sand) Field as a proper field name in the area of the discovery well in the Fryburg Sand formation known as their J.J. Kadrmas No. 1 located in the approximate center of the NE/4 SE/4 Sec. 31, T-140-N, R-96-W, Stark County, North Dakota.

II. Field Limits

The Atlantic Refining Company submits that the tentative outline of the Dickinson (Fryburg Sand) Field consist of the same area as that previously prescribed by the Commission for the Dickinson (Madison) Field as follows:

Township 140 North, Range 96 West
S/2 Section 29
S/2 Section 30
All Section 31
All Section 32

Township 139 North, Range 96 West
N/2 Section 5
N/2 Section 6

III. Temporary Spacing

The Atlantic Refining Company submits the following as necessary to efficiently and economically develop the Dickinson(Fryburg Sand) Field to prevent waste, protect correlative rights; and prevent drilling of unnecessary wells.

1. That 160 acre spacing units be established as the temporary spacing for the Dickinson(Fryburg Sand) Field.

2. That spacing units be rectangular in shape and consist of 160 acres, more or less, lying within the same governmental quarter section.

3. That wells drilled in the Dickinson(Fryburg Sand) Field be located in the approximate center of the northeast quarter-quarter section.

IV. Special Field Rules

The Atlantic Refining Company submits that the following special field rules be enacted to apply to the subsequent drilling and operation of wells in the Dickinson(Fryburg Sand) Field.

1. That the casing program of all wells drilled hereafter in said Field shall include at least two strings of pipe set in accordance with the following program.

   a. The surface string shall consist of new or reconditioned pipe that has been previously tested to one thousand pounds (1000) per square inch. The casing shall be set and cemented at a point not higher than six hundred (600) feet below the surface of the ground. Cementing shall be by the pump and plug method, and sufficient cement shall be used to fill the annular space back of the pipe, to the surface of the ground, or the bottom of the cellar. Cement shall be allowed to stand a minimum of twelve (12) hours before drilling the plug or instituting tests.

   b. The producing, or oil string, shall consist of new or reconditioned pipe that has been previously tested to three thousand (3000) pounds per square inch. Cementing shall be by the pump and plug method, and sufficient cement shall be used to fill one and one-half (1½) times the annular space between the shoe and a point one thousand (1000) feet above the shoe, but not less than 3000 sacks of cement shall be used, and the cement shall be allowed to stand twenty-four (24) hours before drilling the plug or initiating tests.

2. The producing, or oil string, shall be set at least as low as the approximate top of the producing formation. The string shall be tested by either lowering the fluid level or by application of pump pressure. If the test is made by lowering the fluid level, the well shall be bailed dry or at least to a point midway to the bottom of the string and the top of the cement, behind the string, and shall be allowed to stand a minimum of two (2) hours. If, after that period, the fluid level shows a rise equivalent to two (2) percent of the distance bailed the string shall be repaired so as to exclude water. Thereafter the casing shall be again tested in the same manner. If the test is made by application of pump pressure, a pressure of at least fifteen hundred (1500) pounds per square inch shall be applied. If, at the end of thirty (30) minutes this pressure drops one hundred and fifty (150) pounds per square inch or more, the string shall be repaired and retested. There-after the casing shall again be tested in the same manner. Further work shall not proceed until a satisfactory test has been obtained.

3. All christmas tree fittings and well head connections shall have a working pressure of at least one thousand (1000) pounds per square inch or a test pressure of at least two thousand (2000) pounds per square inch, except on pumping wells those fittings above the tubing head may have a working pressure of five hundred (500) pounds per square inch or a test pressure of one thousand (1000) pounds per square inch.

4. The gas-oil ratio of each well in the field be determined semi annually in May and November, and reported to the State Geologist within fifteen (15) days after the end of the month in which they are determined. All measurements shall be made under the supervision of the State Geologist or his designated representative.

5. Any well with a gas-oil ratio of over two thousand (2000) cubic feet per barrel shall have the allowable oil production adjusted in accordance with Rule 506 in Industrial Commission's Order No. 1 General Rules and Regulations for the Conservation of Crude Oil and Natural Gas for the State of North Dakota.

6. The reservoir pressure of all flowing wells, and the static and working fluid levels of all pumping wells, shall be determined annually during May. The results shall be reported to the State Geologist the 15th of June. All pressure determinations shall be measured at or adjusted to a datum of 5,313 feet below sea level and after the well has been shut in for a period of approximately forty-eight (48) hours. All reservoir pressure measurements or fluid level determinations, shall be made under the supervision of the State Geologist, or his designated representative, and by methods approved by the State Geologist.

The Atlantic Refining Company
INCORPORATED — 1870
Chemical Engineering Group (P. E. Lab)

CORE ANALYSIS DATA — "PLUG ANALYSIS"

OPERATOR Atlantic | COUNTY Stark | CORE TYPE & DIA. Diamond 3½"

LEASE & WELL J. J. Kadrmas #1 | STATE North Dakota | HOW PACKED: [x] Sealed [ ] Unsealed

FIELD OR LOC. Dickinson Area | CORING FLUID Water Base | [ ] _____

CORE NO. RECOVERY DEPTH	POROSITY %	PERMEABILITY MD. Horiz.	PERMEABILITY MD. Vert.	COLOR INDEX NO.	SATURATION % PORE SPACE Oil	SATURATION % PORE SPACE Water	CHLORIDES ppm	DESCRIPTION
CORE #1 — 7797 - 7827 — Rec'y. 27 - Rec'd. 22' 2"								
7797-98	18.7	488.		4	18.5	—	—	Fine grained calcareous sandstone with few thin horizontal shale streaks.
	16.5		257.					
5" From 7798-99	16.3	319.		3-	3.7	—	—	Fine grained calcareous sandstone with thick and thin shale streaks.
	18.8		296.					
7799-7800	10.2	7.6	<0.05	0	0	—	—	Ditto
7800-01	6.8	0.10		0	0	—	—	Ditto
	11.3		0.10					
7801-02	0.8	<0.05		0	0	—	—	Shaly fine grained calcareous sandstone.
	0.7		<0.05					
7802-03	—	—	—	-	-	—	—	Shale
7803-05	18.2	<0.05	4.2	0	0	—	—	15" shale - 9" shaly sandstone.
7805-06	9.6	7.7		4	39.9	—	—	Shaly sandstone.
	10.9		2.8					
7806-07	2.3	0.10		2-	20.6	—	—	Fine grained calcareous sandstone.
	6.2		0.10					
7807-08	10.8	21.9		4	27.9	—	—	Fine grained sandstone.
	10.6		12.3					
7809'-10"-11	7.9	4.8		0	Tr.	—	—	Fine grained sandstone with several horizontal shale streaks.
	11.3		1.6					
7811-12	9.3	5.9		3	33.8	—	—	Ditto
	10.0		0.25					
7812-13	15.2	21.9		4	26.5	—	—	Fine to medium grained sandstone with several sandy shale streaks.
	16.5		18.3					
7813-14	11.6	113.		4	50.4	—	—	Ditto
	11.1		2.5					
7814-15	5.6	0.30		4	53.4	—	—	Fine grained sandstone with sandy shale streaks and inclusions.
	7.0		0.10					

ANALYST

CHECKED BY

NOTES:

Continued on Page 2.

DISTRIBUTION

DATE REPORTED 12/31/57
DATA REF. 570883, 570882 and 570881
APPROVED

The Atlantic Refining Company
INCORPORATED — 1870
Chemical Engineering Group (P. E. Lab)

CORE ANALYSIS DATA — "PLUG ANALYSIS"

OPERATOR Atlantic | COUNTY Stark | CORE TYPE & DIA. Diamond 3½"

LEASE & WELL J. J. Kadrmas #1 | STATE North Dakota | HOW PACKED: ☒ Sealed ☐ Unsealed

FIELD OR LOC. Dickinson Area | CORING FLUID Water Base | ☐ _____

CORE NO. RECOVERY DEPTH	POROSITY %	PERMEABILITY MD. Horiz.	PERMEABILITY MD. Vert.	COLOR INDEX NO.	SATURATION % PORE SPACE Oil	SATURATION % PORE SPACE Water	CHLORIDES ppm	DESCRIPTION
CORE #1 Continued:								
7815-16	3.1 2.5	0.05	0.05	Tr.	0	--	--	Fine grained calcareous sandstone.
7816-17	1.4 1.2	0.05	<0.05	0	0	--	--	Fine grained calcareous shaly sandstone.
7817-18	2.6 1.9	7.7	<0.05	0	0	--	--	5" shale - 7" shaly calcareous fine grained sandstone.
7818-19	--	--	--	-	-	--	--	Shale
7819-20	2.5 1.9	0.10	<0.05	0	0	--	--	Fine grained calcareous shaly sandstone.
7820-21	--	--	--	-	-	--	--	Shale

ANALYST H.E.Swan
CHECKED BY _____

NOTES:

DISTRIBUTION
B. E. Coles, E. Kraus,
R. O. Childers, G. P. Nathman,
T. O. Davis, B. B. Coester,
Dist. Geol., Bismarck, N.D.,
J. Whiteman, File

DATE REPORTED 12/31/57
DATA REF. 570881 & 570880

APPROVED R. V. Terrell

The Atlantic Refining Company
Chemical Engineering Group (P.E. Lab)
"FULL-DIAMETER" CORE ANALYSIS DATA

OPERATOR The Atlantic Refining Company COUNTY Stark CORE TYPE & DIAMETER Diamond 3-1/2"

LEASE & WELL J.J. Kadrmas No. 1 STATE North Dakota HOW PACKED: [X] Sealed [ ] Unsealed

FIELD OR LOCATION Dickinson Area CORING FLUID Water Base [ ]

Core No. Recovery Depth	Porosity %	Horizontal Permeability, Md. Maximum	90° From Maximum			Color Index No.	Saturation % Pore Space Oil	Water	Chlorides ppm	Length Analyzed Inches	Full-Diameter Description
CORE NO. 1 ---------- 7797' -- 7827' ---------- RECOVERY -- 27' ---------- RECEIVED -- 22'-2"											
7797-98'	8.4	36.4	35.2			—	—	—	—	6	Fine grained calcareous sandstone with a few thin horizontal shale streaks.
7800-01'	2.9	0.02	0.02			—	—	—	—	3	Fine grained calcareous shaly sandstone with several thin horizontal shale streaks.
7801-02'	0.8	0.01	0.01			—	—	—	—	3	Fine grained calcareous shaly sandstone with a few interconnected closed vertical fractures.
7806-07'	1.0	0.70	0.02			—	—	—	—	4	Sandstones with one closed vertical fracture.
7807-08'	2.9	3.5	4.2			—	—	—	—	3	Sandstone with one closed horizontal fracture.
7810-11'	2.0	0.04	0.03			—	—	—	—	4-1/2	Sandstone with two closed horizontal fractures.
7812-13'	11.5	23.8	23.7			—	—	—	—	3-1/2	Sandstone with one closed vertical fracture.
7814-1/2 - 15-1/2'	1.7	0.01	0.01			—	—	—	—	6-1/2	Sandstone with a few interconnecting closed vertical fractures.
7815-1/2 - 16-1/2'	2.2	0.02	0.01			—	—	—	—	5-1/2	Sandstone with several thin horizontal shale streaks.

Analyst Swan
CHECKED BY: JEH

NOTES:

DISTRIBUTION: Messrs.: B.E. Coles, E. Kraus, R.O. Childers, G.P. Nathman, T.O. Davis, B.B. Coester, District Geologist, Bismarck, N.D., J.M. Whiteman, L. E. Schneider, File

DATE REPORTED 2-27-58
DATA REF. 580073

APPROVED

TESTIMONY OF BRUCE VERNOR, THE ATLANTIC REFINING COMPANY

IN THE INDUSTRIAL COMMISSION OF NORTH DAKOTA

CASE NO. 210, APRIL 15, 1958

The Atlantic Refining Company, J.J. Kadrmas No. 1 Well discovered The Dickinson (Fryburg Sand) Field and is the only well in this pay in the field. This well was completed on February 26, 1958 pumping 203 barrels of oil and no water in 24 hours through perforations from 7786' to 7816', after fracture treatment of 4900 pounds of sand and 5800 gallons of gelled oil. The produced oil was 34.6° API gravity and the gas-oil ratio was 55 standard cubic feet per barrel. The well is now producing from 118 to 130 barrels of oil per day with a gas-oil ratio of 66 standard cubic feet per barrel. On February 9, 1958 the reservoir pressure after 24 hour shut-in was 3455 pounds at a datum of 5313' below sea level.

As Exhibit No. 4, Atlantic is submitting copies of the plug core analysis and full diameter core analysis on the Fryburg Sand in The Kadrmas No. 1 Well. The core analysis shows 11.5' of net sand. The average porosity from the plug cores is 11.3% and from the full diameter cores, 4.6%. The average plug core permeability is 78.6 millidarcies with values up to 488 millidarcies and the average full diameter core permeability is 10.6 millidarcies.

Atlantic economic calculations show that a well drilled on 160 acre spacing would be poor and a well drilled on 80 acre spacing would be uneconomical because of low reserves. Atlantic is selling the oil for $2.07 per barrel less 18.5¢ trucking cost. Our market has given termination notice because they cannot handle the oil since it has a pour point of 90°.

We believe the zones of high permeability will allow one well to drain 160 acres efficiently. Atlantic requests temporary 160 acre spacing to allow development of this field without drilling unnecessary wells.

Atlantic proposes these field rules:

I. Field Name

The Atlantic Refining Company submits the name of Dickinson(Fryburg Sand) Field as a proper field name in the area of the discovery well in the Fryburg Sand formation known as their J.J. Kadrmas No. L located in the approximate center of the NE/4 SE/4 Sec. 31, T-140-N, R-96-W, Stark County, North Dakota.

II. Field Limits

The Atlantic Refining Company submits that the tentative outline of the Dickinson (Fryburg Sand) Field consist of the same area as that previously prescribed by the Commission for the Dickinson (Madison) Field as follows:

Township 140 North, Range 96 West
S/2 Section 29
S/2 Section 30
All Section 31
All Section 32

Township 139 North, Range 96 West
N/2 Section 5
N/2 Section 6

III. Temporary Spacing

The Atlantic Refining Company submits the following as necessary to efficiently and economically develop the Dickinson(Fryburg Sand) Field to prevent waste, protect correlative rights; and prevent drilling of unnecessary wells.

1. That 160 acre spacing units be established as the temporary spacing for the Dickinson(Fryburg Sand) Field.

2. That spacing units be rectangular in shape and consist of 160 acres, more or less, lying within the same governmental quarter section.

3. That wells drilled in the Dickinson(Fryburg Sand) Field be located in the approximate center of the northeast quarter-quarter section.

IV. Special Field Rules

The Atlantic Refining Company submits that the following special field rules be enacted to apply to the subsequent drilling and operation of wells in the Dickinson(Fryburg Sand) Field.

1. That the casing program of all wells drilled hereafter in said Field shall include at least two strings of pipe set in accordance with the following program.

a. The surface string shall consist of new or reconditioned pipe that has been previously tested to one thousand pounds (1000) per square inch. The casing shall be set and cemented at a point not higher than six hundred (600) feet below the surface of the ground. Cementing shall be by the pump and plug method, and sufficient cement shall be used to fill the annular space back of the pipe, to the surface of the ground, or the bottom of the cellar. Cement shall be allowed to stand a minimum of twelve (12) hours before drilling the plug or instituting tests.

b. The producing, or oil string, shall consist of new or reconditioned pipe that has been previously tested to three thousand (3000) pounds per square inch. Cementing shall be by the pump and plug method, and sufficient cement shall be used to fill one and one-half (1½) times the annular space between the shoe and a point one thousand (1000) feet above the shoe, but not less than 3000 sacks of cement shall be used, and the cement shall be allowed to stand twenty-four (24) hours before drilling the plug or initiating tests.

2. The producing, or oil string, shall be set at least as low as the approximate top of the producing formation. The string shall be tested by either lowering the fluid level or by application of pump pressure. If the test is made by lowering the fluid level, the well shall be bailed dry or at least to a point midway to the bottom of the string and the top of the cement, behind the string, and shall be allowed to stand a minimum of two (2) hours. If, after that period, the fluid level shows a rise equivalent to two (2) percent of the distance bailed the string shall be repaired so as to exclude water. Thereafter the casing shall be again tested in the same manner. If the test is made by application of pump pressure, a pressure of at least fifteen hundred (1500) pounds per square inch shall be applied. If, at the end of thirty (30) minutes this pressure drops one hundred and fifty (150) pounds per square inch or more, the string shall be repaired and retested. Thereafter the casing shall again be tested in the same manner. Further work shall not proceed until a satisfactory test has been obtained.

3. All christmas tree fittings and well head connections shall have a working pressure of at least one thousand (1000) pounds per square inch or a test pressure of at least two thousand (2000) pounds per square inch, except on pumping wells those fittings above the tubing head may have a working pressure of five hundred (500) pounds per square inch or a test pressure of one thousand (1000) pounds per square inch.

4. The gas-oil ratio of each well in the field be determined semi annually in May and November, and reported to the State Geologist within fifteen (15) days after the end of the month in which they are determined. All measurements shall be made under the supervision of the State Geologist or his designated representative.

5. Any well with a gas-oil ratio of over two thousand (2000) cubic feet per barrel shall have the allowable oil production adjusted in accordance with Rule 506 in Industrial Commission's Order No. 1 General Rules and Regulations for the Conservation of Crude Oil and Natural Gas for the State of North Dakota.

6. The reservoir pressure of all flowing wells, and the static and working fluid levels of all pumping wells, shall be determined annually during May. The results shall be reported to the State Geologist the 15th of June. All pressure determinations shall be measured at or adjusted to a datum of 5,313 feet below sea level and after the well has been shut in for a period of approximately forty-eight (48) hours. All reservoir pressure measurements or fluid level determinations, shall be made under the supervision of the State Geologist, or his designated representative, and by methods approved by the State Geologist.

Case #210

THE ATLANTIC REFINING COMPANY
INCORPORATED - 1870
PETROLEUM PRODUCTS

DOMESTIC PRODUCING DEPARTMENT

ADDRESS REPLY TO:
P. O. BOX 520
CASPER, WYOMING

April 9, 1958

Felmont Oil Corp.
Box 132
Bismarck, North Dakota

Attn: Mr. John L. Perkins

Gentlemen:

The Industrial Commission of North Dakota has called a hearing for April 15, 1958 to establish temporary spacing, field boundries and field rules for the Dickinson(Fryburg Sand) Field discovered by the Atlantic Refining Co.-J.J. Kadrmas No. 1 well; located in the center of the NE/4 of the SE/4 of Section 31, T-140-N, R-96-W, Stark Co., North Dakota.

Atlantic will request temporary 160 acre spacing. Our economic analysis shows a well is very poor on 160 acre spacing and entirely uneconomical on 80 acre spacing because of low reserves. The pay is only 11.5 feet from core analysis.

The core analysis shows zones of excellent permeability and we believe a well will drain at least 160 acres.

If you agree with our request, please sign one copy of this letter and send it to The North Dakota Industrial Commission.

THE ATLANTIC REFINING CO.

J. O. Davis

T. O. DAVIS
Regional Petroleum Engineer

We support Atlantic's request.
Felmont Oil Corp.
by John L. Perkins

ATLANTIC

THE ATLANTIC REFINING COMPANY

INCORPORATED - 1870

PETROLEUM PRODUCTS

DOMESTIC PRODUCING DEPARTMENT
ROCKY MOUNTAIN REGION
R. T. COX, MANAGER
T. S. PAGE, LAND MANAGER
A. D. KLOXIN, OPERATIONS MANAGER

WYOMING NAT'L. BANK BLDG.
MAILING ADDRESS
P. O. BOX 520
CASPER, WYOMING

April 9, 1958

Trigood Oil Corp.
P.O. Box 1689
Casper, Wyoming

Attn: Mr. J. Spencer Winn

Dear Sir:

The Industrial Commission of North Dakota has called a hearing for April 15, 1958 to establish temporary spacing, field boundries and field rules for the Dickinson(Fryburg Sand) Field discovered by the Atlantic Refining Co.-J.J. Kadrmas No. 1 well; located in the center of the NE/4 of the SE/4 of Section 31, T-140-N, R-96-W, Stark Co., North Dakota.

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THE ATLANTIC REFINING CO.

J. O. Davis

T. O. DAVIS
Regional Petroleum Engineer

We support Atlantic's request.
Trigood Oil Corp.

By _____

April 9, 1958

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THE ATLANTIC REFINING CO.

T. O. DAVIS
Regional Potroleum Engineer

We support Atlantic's request.

The Superior Oil Co.

By J. L. Skeen
by J. B. Driver
4/12/58

THE ATLANTIC REFINING COMPANY
INCORPORATED - 1870
PETROLEUM PRODUCTS

DOMESTIC PRODUCING DEPARTMENT

ADDRESS REPLY TO:
P. O. BOX 520
CASPER, WYOMING

April 9, 1958

North American Royalties
P.O. Box 1476
Bismarck, North Dakota

Attn: Mr. Herbert G. Officer

Dear Sir:

The Industrial Commission of North Dakota has called a hearing for April 15, 1958 to establish temporary spacing, field boundries and field rules for the Dickinson(Fryburg Sand) Field discovered by the Atlantic Refining Co.-J.J.Kadrmas No. 1 well; located in the center of the NE/4 of the SE/4 of Section 31, T-140-N, R-96-W, Stark Co., North Dakota.

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THE ATLANTIC REFINING CO.

T. O. Davis

T. O. DAVIS
Regional Petroleum Engineer

4/11/58

We support Atlantic's request.
North American Royalties

By Herbert B. Officer

ATLANTIC

THE ATLANTIC REFINING COMPANY

INCORPORATED - 1870

PETROLEUM PRODUCTS

DOMESTIC PRODUCING DEPARTMENT
ROCKY MOUNTAIN REGION
R. T. COX, MANAGER
T. S. PACE, LAND MANAGER
A. D. KLOXIN, OPERATIONS MANAGER

WYOMING NAT'L. BANK BLDG.
MAILING ADDRESS
P. O. BOX 520
CASPER, WYOMING

April 9, 1958

Placid Oil Co.
319 Market St.
Shreveport, La.

Attn: Mr. Walter Fraker

Dear Sir:

The Industrial Commission of North Dakota has called a hearing for April 15, 1958 to establish temporary spacing, field boundries and field rules for the Dickinson(Fryburg Sand) Field discovered by the Atlantic Refining Co.-J.J. Kadrmas No. 1 well; located in the center of the NE/4 of the SE/4 of Section 31, T-140-N, R-96-W, Stark Co., North Dakota.

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THE ATLANTIC REFINING CO.
J. O. Davis
T. O. DAVIS
Regional Petroleum Engineer

We support Atlantic's request.
Placid Oil Co.
By Charles A. Barton

Hunt Oil Co.
Williston, North Dakota

Attn: Mr. Roy Taylor