CASE 2409: Application of TEXACO for a quintuple completion - G. L. Erwin "b" Well No. 2.

-ase No.

2409

-plication, Transcript,

-mall Exhibits, Etc.

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

COPY

March 20, 1962

Texaco Inc.
P. O. Box 728
Hobbs, New Mexico

Attention: Mr. H. M. Wade

Gentlemen:

Reference is made to your letter of March 14, 1962, wherein you request temporary allowables to be assigned to the Paddock, Blinebry, Drinkard, Diluro-Devonian, and Fusselman zones in your G. L. Erwin (b) NCT-2 Well No. 2, located in Unit J, Section 35, Township 24 South, Range 37 East, North Justis Field, Lea County, New Mexico. This well was previously approved a quintuple completion by Order No. R-2109 in the Drinkard, Siluro-Devonian, Fusselman, McKee, and Ellenburger zones.

Inasmuch as all of the proposed zones included in the subject well, with the exception of the Paddock, have previously been approved in multiple completions in the area, this office has no objection to such temporary assignment of allowable as each new zone is brought in, with the exception of said Paddock zone.

It is suggested that you make application for a hearing to amend Order No. R-2109 at your earliest convenience to conform to the actual completion of the well.

Very truly yours,

DANIEL S. NUTTER
Chief Engineer

DSN/og
cc: J. D. Ramey
Oil Conservation Commission
Hobbs, New Mexico

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE No. 2409
Order No. R-2109

APPLICATION OF TEXACO INC.
FOR A QUINTUPLE COMPLETION,
LEA COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on October 25, 1961, at Santa Fe, New Mexico, before Daniel S. Nutter, Examiner duly appointed by the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission," in accordance with Rule 1214 of the Commission Rules and Regulations.

NOW, on this 1st day of November, 1961, the Commission, a quorum being present, having considered the application, the evidence adduced, and the recommendations of the Examiner, Daniel S. Nutter, 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 the applicant, Texaco Inc., is the owner and operator of the G. L. Erwin "b" NCT-2 Well No. 2, located in Unit J, Section 35, Township 24 South, Range 37 East, NMPM, Lea County, New Mexico.

(3) That the applicant proposes to complete the above-described G. L. Erwin 'b" NCT-2 Well No. 2 as a quintuple completion (tubingless) in such a manner as to permit the production of oil from undesignated Drinkard, Siluro-Devonian, Fusselman and McKee pools through parallel strings of 2 3/8-inch casing and from the North Justis-Ellenburger Pool through a parallel string of 2 7/8-inch casing, all five casing strings to be cemented in a common well bore.

(4) That the mechanics of the proposed quintuple completion are feasible and in accord with good conservation practices.

(5) That approval of the subject application will neither cause waste nor impair correlative rights.

IT IS THEREFORE ORDERED:

(1) That the applicant, Texaco Inc., is hereby authorized to complete its G. L. Erwin "b" NCT-2 Well No. 2, located in Unit J of Section 35, Township 24 South, Range 37 East, NMPM, Lea County, New Mexico, as a quintuple completion (tubingless) in such a manner as to permit the production of oil from undesignated Drinkard, Siluro-Devonian, Fusselman and McKee pools through parallel strings of 2 3/8-inch casing and from the North Justis-Ellenburger Pool through a parallel string of 2 7/8-inch casing, all five casing strings to be cemented in a common well bore.

PROVIDED HOWEVER, That the applicant shall complete, operate, and produce said well in accordance with the provisions of Rule 112-A of the Commission Rules and Regulations.

PROVIDED FURTHER HOWEVER, That the applicant, upon the completion of the well, shall furnish to the Commission evidence that all the zones are adequately segregated from each other by cement and that the directional perforation of each individual casing string was successful.

PROVIDED FURTHER HOWEVER, That the applicant shall take annual zone segregation tests during the Annual Gas-Oil Ratio Test Period for the Ellenburger zone, or at such other times as the Secretary-Director of the Commission may prescribe.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year herein-above designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

EDWIN L. MECHEM, Chairman

E. S. WALKER, Member

A. L. PORTER, Jr., Member & Secretary

esr/

GOVERNOR
EDWIN L. MECHEM
CHAIRMAN

State of New Mexico
Oil Conservation Commission

LAND COMMISSIONER
E. S. JOHNNY WALKER
MEMBER

STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

P. O. BOX 871
SANTA FE

November 1, 1961

Mr. Charlie White
Gilbert, White & Gilbert
Box 787
Santa Fe, New Mexico

Re: Case No. 2408 2409
Order No. R-2104 & R-2109
Applicant:
TEXACO, INC.

Dear Sir:

Enclosed herewith are two copies of the above-referenced Commission order recently entered in the subject case.

Very truly yours,

A. L. Porter, Jr.

A. L. PORTER, Jr.
Secretary-Director

ir/

Carbon copy of order also sent to:

Hobbs OCC x
Artesia OCC
Aztec OCC
OTHER

TEXACO
INC.

PETROLEUM PRODUCTS

DOMESTIC PRODUCING DEPARTMENT
MIDLAND DIVISION

P. O. BOX 3109
MIDLAND, TEXAS

September 29, 1961

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Attn: Mr. A. L. Porter, Jr.

Gentlemen:

TEXACO Inc. respectfully requests that a hearing be set to consider its application for a quintuple tubingless completion for its G. L. Erwin "b" NCT-2 Well No. 2. The completions will be in the Undesignated Ellenburger, McKee, Fusselman, Siluro-Devonian, and Drinkard pools, Lea County, New Mexico. All five completions are anticipated to be oil and will be produced through individual strings of tubing cemented in a common well bore. In support of our application we wish to state the following facts:

1. TEXACO Inc. is the operator of the G. L. Erwin "b" NCT-2 lease containing 160 acres and consisting of the SE/4 of Section 35, T-24-S, R-37-E, Lea County, New Mexico.

2. The G. L. Erwin "b" NCT-2 Well No. 2 is located in Unit J, Section 35, T-24-S, R-37-E.

3. The Ellenburger is anticipated to be an oil completion through perforations 8400-8500' and will be produced through a string of 2-7/8" OD tubing cemented in the well bore.

4. The McKee is anticipated to be an oil completion through perforations 7900-8050' and will be produced through a string of 2-3/8" OD tubing cemented in the well bore.

5. The Fusselman is anticipated to be an oil completion through perforations 6950-7200' and will be produced through a string of 2-3/8" OD tubing cemented in the well bore.

6. The Siluro-Devonian is anticipated to be an oil completion through perforations 6700-6900' and will be produced through a string of 2-3/8" OD tubing cemented in the well bore.

7. The Drinkard is anticipated to be an oil completion through perforations 5950-6050' and will be produced through a string of 2-3/8" OD tubing cemented in the well bore.

8. It is anticipated that all five completions will flow initially.

Attached in triplicate is an application for quintuple completion and a plat of the G. L. Erwin "b" NCT-2 lease. It is respectfully requested that this hearing be set on your first available Examiner hearing docket.

Yours very truly,

TEXACO Inc.

J. E. Robinson, Jr.

J. E. Robinson, Jr.
Division Proration Engineer

CRB-MM
Attach.

OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

Date 10/27/61

CASE 2409 Hearing Date 9am 10/25/61 DSN @ SF

My recommendations for an order in the above numbered cases are as follows:

Enter an order approving the quintuple completion of Texaco's G. L. Erwin (b) NCT-2 Well No 2, loc NW/4 SE/4 Sec 35 T24S R37E to produce from ~~the~~ undesignated Drinkard, Siluro-Devonian, Fusselman and McKee formations through 2⅞ casing and from the N. Justis Ellenburger Pool through 2⅞ inch casing. All zone of said csg strings to be cemented in a common well bore.

(1.) Provide that upon completion of the well, operator shall furnish the Commission ~~evidence~~ that the zones are ~~adequately separate~~ segregated from each other by cement and that the directional perforation of the individual casing strings were successful. Also
(2.) provide for such segregation tests annually during the GOR test period for the Ellenburger zone

Ken Sullen

NEW MEXICO OIL CONSERVATION COMMISSION

SANTA FE, NEW MEXICO

7-3-58

Eff. 2-4-9

QUINTUPLE

APPLICATION FOR ~~DUAL~~ COMPLETION

Field Name	County	Date
Undesignated;Ellenburger,McKee, Fusselman,Siluro-Devonian & Drinkard	Lea	September 29, 1961

Operator	Lease	Well No.
TEXACO Inc.	G. L. Erwin "b" NCT-2	2

Location of Well	Unit	Section	Township	Range
	J	35	24-S	37-E

1. Has the New Mexico Oil Conservation Commission heretofore authorized the ~~DUAL~~ quintuple completion of a well in these same pools or in the same zones within one mile of the subject well? YES _____ NO X

2. If answer is yes, identify one such instance: Order No. _____ ; Operator, Lease, and Well No.:

3. The following facts are submitted:	Upper Zone	Lower Zone
a. Name of reservoir		
b. Top and Bottom of Pay Section (Perforations)	See Attachment	
c. Type of production (Oil or Gas)		
d. Method of Production (Flowing or Artificial Lift)		

4. The following are attached. (Please mark YES or NO)

quintuple

No a. Diagrammatic Sketch of the ~~DUAL~~ Completion, showing all casing strings, including size and setting, top of cement, perforated intervals, tubing strings, including diameters and setting depth, location and type of packers and side door chokes, and such other information as may be pertinent.

Yes b. Plat showing the location of all wells on applicant's lease, all offset wells on offset leases, and the names and addresses of operators of all leases offsetting applicant's lease.

quintuple

No c. Waivers consenting to such ~~DUAL~~ completion from each offset operator, or in lieu thereof, evidence that said offset operators have been furnished copies of the application.*

No d. Electrical log of the well or other acceptable log with tops and bottoms of producing zones and intervals of perforation indicated thereon. (If such log is not available at the time application is filed, it shall be submitted as provided by Rule 112-A.)

5. List all offset operators to the lease on which this well is located together with their correct mailing address.

J. B. Frost	2106 Tower Petr. Bldg.	Dallas 1, Texas
Parker Drilling Co.	Commerce Building	Houston, Texas
Amerada Petroleum Corp.	Drawer D	Monument, New Mexico
Western Natural Gas	1006 Main Street	Hobbs, New Mexico
J. C. Williamson	608 V&J Tower	Midland, Texas

6. Were all operators listed in Item 5 above notified and furnished a copy of this application? YES ____ NO X . If answer is yes, give date of such notification _____ .

CERTIFICATE: I, the undersigned, state that I am the Division Proration Engineer of the TEXACO Inc. _____ (company), and that I am authorized by said company to make this report; and that this report was prepared under my supervision and direction and that the facts stated therein are true, correct and complete to the best of my knowledge.

J. L. Robinson Jr.
Signature

* Should waivers from all offset operators not accompany an application for administrative approval, the New Mexico Oil Conservation Commission will hold the application for a period of twenty (20) days from date of receipt by the Commission's Santa Fe office. If, after said twenty-day period, no protest nor request for hearing is received by the Santa Fe office, the application will then be processed.

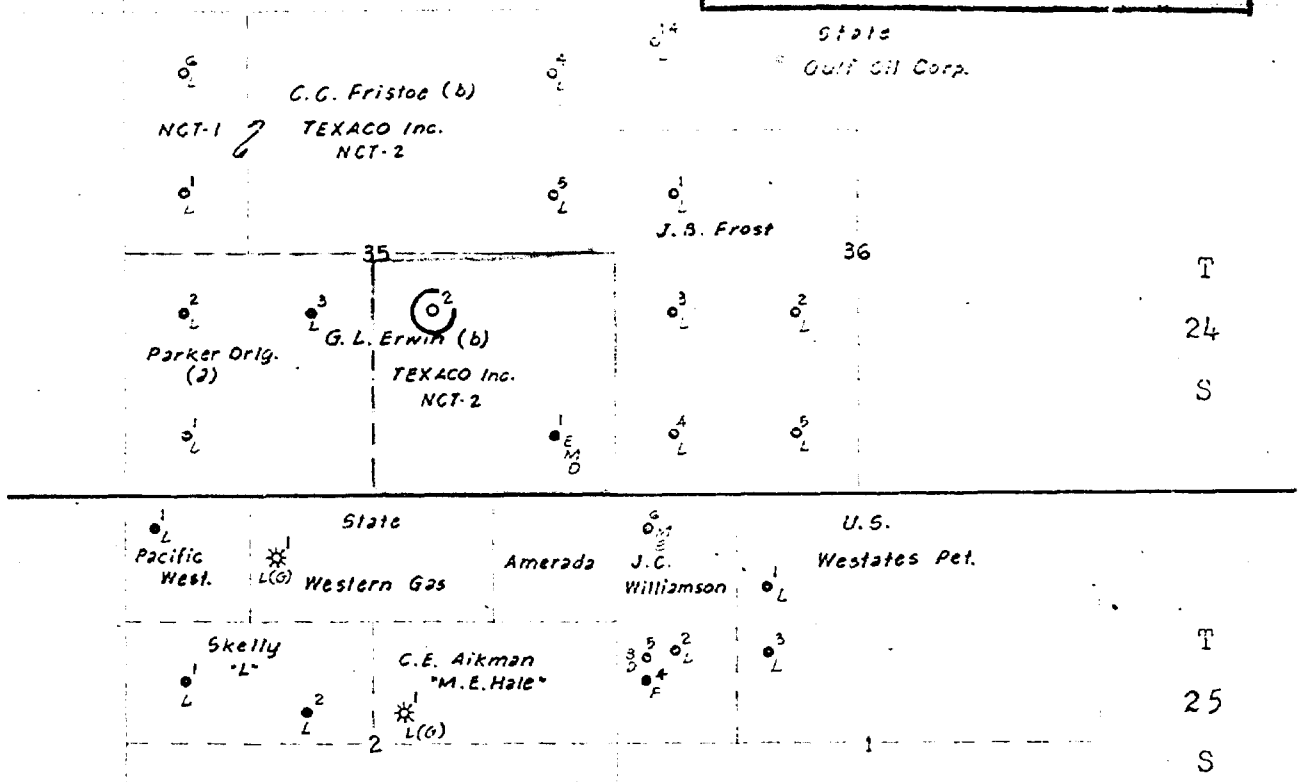
NOTE: If the proposed dual completion will result in an unorthodox well location and/or a non-standard proration unit in either or both of the producing zones, then separate application for approval of the same should be filed simultaneously with this application.

3. The following facts are submitted:

	ZONE V	ZONE W	ZONE X	ZONE Y	ZONE Z
a. Name of Reservoir	Drinkard	Siluro-Dev.	Fusselman	McKee	Ellenburger
b. Top and Bottom of Pay Section (Perforations)	5950'-6050'	6700'-6900'	6950'-7200'	7900'-8050'	8400'-8500'
c. Type of Production (oil or gas)	Oil	Oil	Oil	Oil	Oil
d. Method of Production (Flowing or artificial lift)	Flow	Flow (Est.)	Flow	Flow	Flow

R-37-E

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 1
CASE NO. 2407



LEGEND
L - Langlie Mattix
L(G) - Langlie Mattix (Gas)
E - Ellenburger, Undesignated
M - McKee, Undesignated
D - Drinkard, Undesignated
F - Fusselman, Undesignated
B - Blinebry, Undesignated

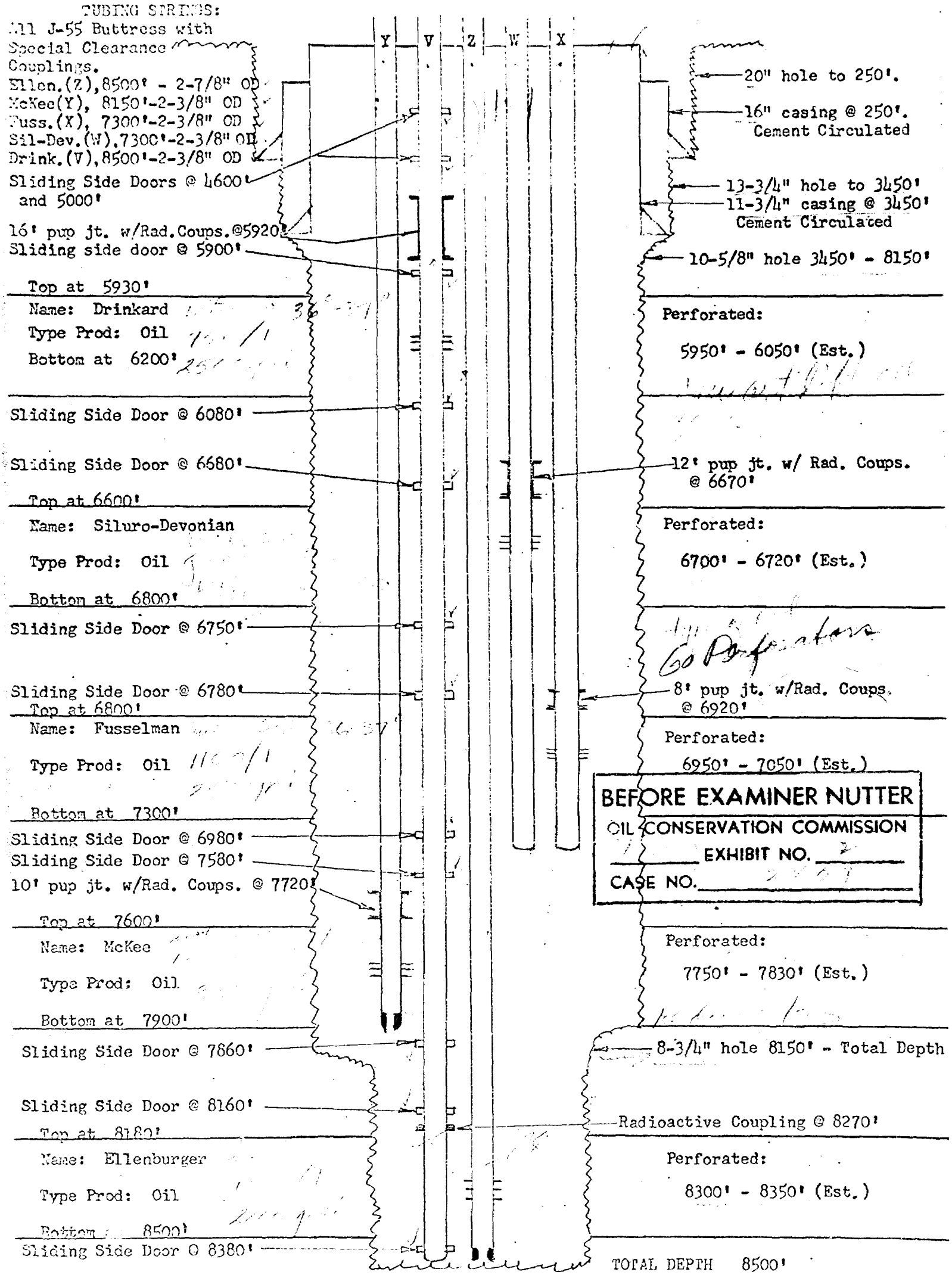
Scale: 1" = 2000'

PLAT OF TEXACO Inc. G. L. ERWIN "b" NCT-2 LEASE
AND OFFSET LEASES
Lea County, New Mexico
Scale: 1" = 2000'

OFFSET OPERATORS

J. B. Frost - 2106 Tower Petroleum Bldg. - Dallas 1, Texas
Parker Drilling Co. - Commerce Bldg. - Houston, Texas
Amerada - Drawer D - Monument, New Mexico
Western Gas - 1006 Main St. - Hobbs, New Mexico
J. C. Williamson - 608 V&J Tower - Midland, Texas

DIAGRAMATIC SKETCH - QUINTUPLE INSTALLATION (TUBINGLESS)
TEXACO INC. G. L. ERWIN (b) NCT-2 WELL NO. 2
UNDESIGNATED ELLENBURGER, MCKEE, FUSSELMAN, SILURO-DEVONIAN AND DRINKARD POOLS
LEA COUNTY, NEW MEXICO



BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
EXHIBIT NO. 2
CASE NO.

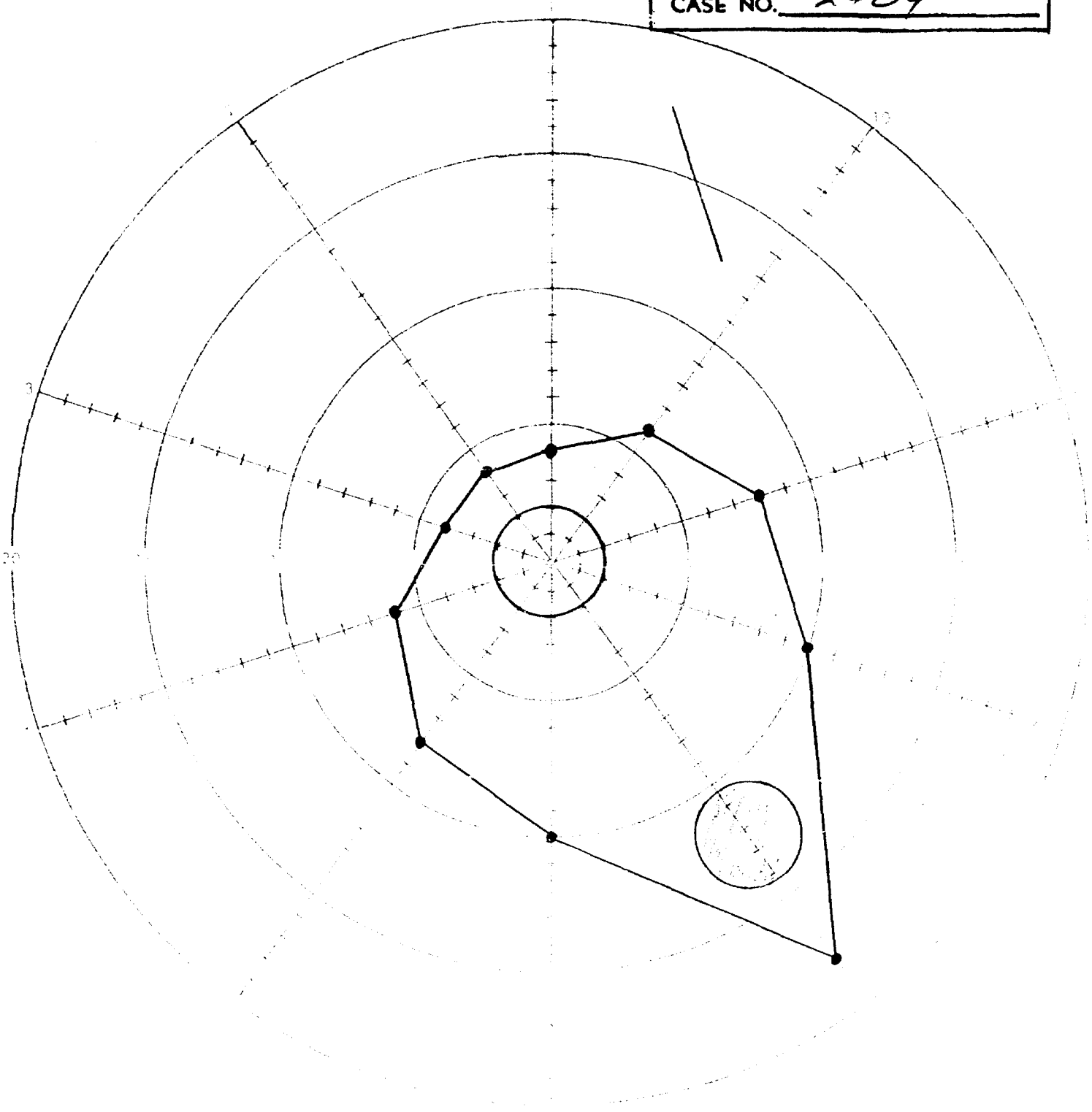
CEMENT PROGRAM ON FIVE TUBING (CASING) STRINGS: Cement through 2-7/8" OD String with 1700 sacks Incor, 8% gel. with retarder. Yield = 2.19 cubic feet per sack. Calculated cement top at 3000', assuming 65% fillup. Block squeeze through Otis Type "A" Sliding Side Doors with 50 to 100 sacks of Incor neat cement at each setting to assure zone isolation.

10/5/71 DRR

GO, INC.

ORIENTATION CHART

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Gulf EXHIBIT NO. 4
CASE NO. 2409



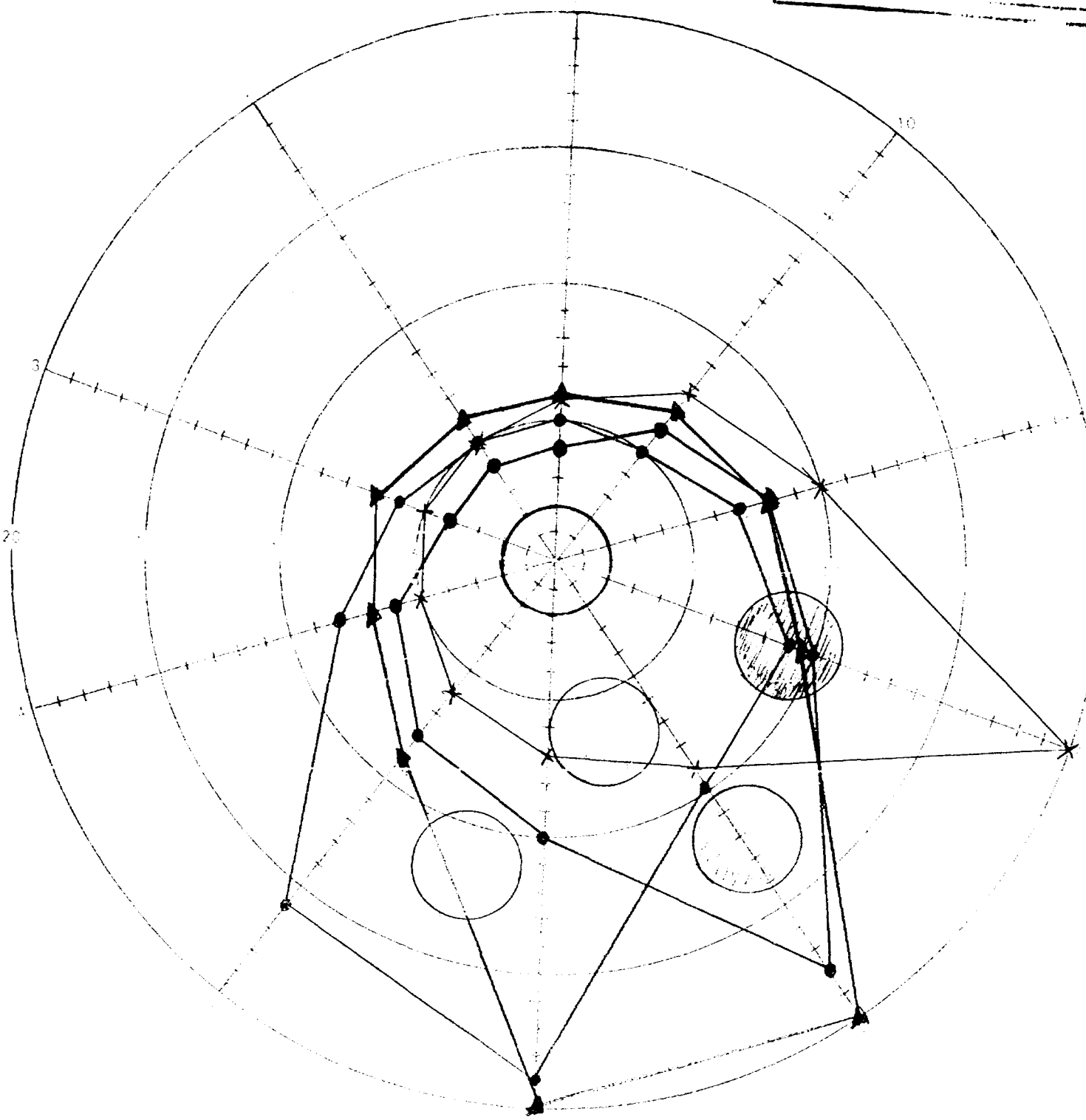
EXAMPLE OF TWO STRING ORIENTATION PROCEDURE

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Texaco EXHIBIT NO. 5
CASE NO. 2409

GO, INC.

ORIENTATION CHART

BEFORE E... ...ITTER
...IL CON... ...ION
CASE NO. ...



EXAMPLE OF FIVE STRING ORIENTATION PROCEDURE

... SPACE ... GENERAL TERMS AND CONDITIONS

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
October 25, 1961

EXAMINER HEARING

IN THE MATTER OF:
Application of Texaco Inc. for a quintuple completion, Lea County, New Mexic. Applicant, in the above-styled cause, seeks permission to complete its G. L. Erwin "b" NCT-2 Well No. 2, located in Unit J, Section 35, Township 24 South, Range 37 East, Lea County, New Mexico, as a quintuple completion (tubingless) in undesignated Ellenburger, McKee, Fusselman, Siluro-Devonian and Drinkard pool, with the production of oil from the McKee, Fusselman, Siluro-Devonian and Drinkard zones to be through parallel strings of 2 3/8-inch tubing and the production of oil from the Ellenburger-zone to be through a string of 2 7/8-inch tubing, all strings of tubing to be cemented in a common well bore.

CASE NO. 2409

BEFORE: Dan S. Nutter, Examiner.

TRANSCRIPT OF HEARING

EXAMINER NUTTER: We will call Case No. 2409.

MR. MORRIS: Application of Texaco Inc. for a quintuple completion, Lea County, New Mexico.

MR. WHITE: Charles White, of Gilbert White & Gilbert, appearing on behalf of the Applicant.

C. R. BLACK

called as a witness, by and on behalf of the Applicant, having been

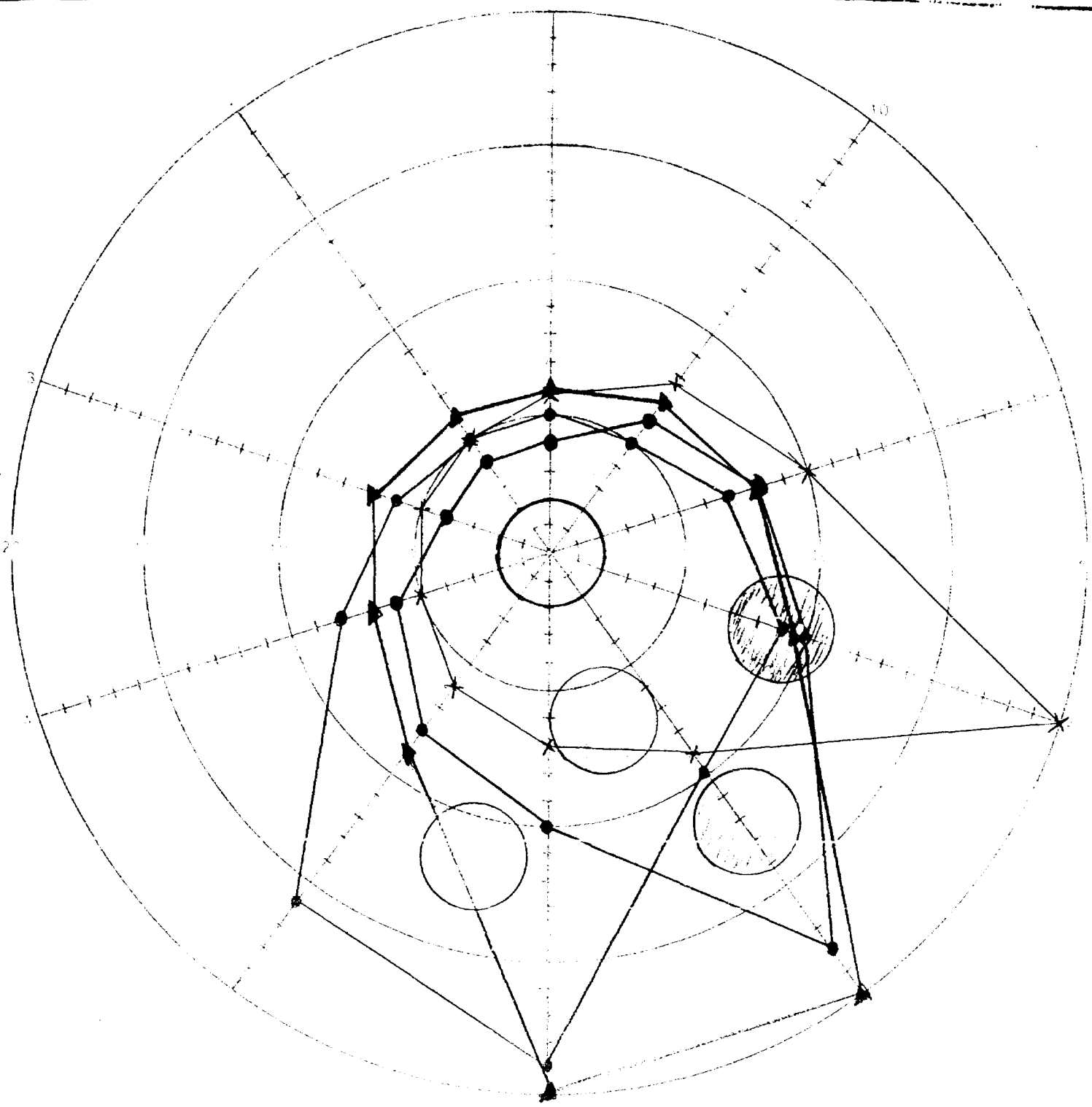
DEARNLEY-MEIER REPORTING SERVICE, Inc.
FARMINGTON, N. M.
PHONE 325-1182
ALBUQUERQUE, N. M.
PHONE 243-6691

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
Texaco EXHIBIT NO. 5
CASE NO. 2409

GO, INC.

ORIENTATION CHART

BEFORE [illegible] ITTER
IL CON[illegible] ION
CASE NO. [illegible]



EXAMPLE OF FIVE STRING ORIENTATION PROCEDURE

[illegible] GENERAL [illegible]

DEARNLEY-MEIER REPORTING SERVICE, Inc.
ALBUQUERQUE, N. M.
PHONE 243-6691
FARMINGTON, N. M.
PHONE 325-1182

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
October 25, 1961

EXAMINER HEARING

IN THE MATTER OF:
Application of Texaco Inc. for a quintuple completion, Lea County, New Mexic. Applicant, in the above-styled cause, seeks permission to complete its G. L. Erwin "b" NCT-2 Well No. 2, located in Unit J, Section 35, Township 24 South, Range 37 East, Lea County, New Mexico, as a quintuple completion (tubingless) in undesignated Ellenburger, McKee, Fusselman, Siluro-Devonian and Drinkard pool, with the production of oil from the McKee, Fusselman, Siluro-Devonian and Drinkard zones to be through parallel strings of 2 3/8-inch tubing and the production of oil from the Ellenburger-zone to be through a string of 2 7/8-inch tubing, all strings of tubing to be cemented in a common well bore.

CASE NO. 2409

BEFORE: Dan S. Nutter, Examiner.

TRANSCRIPT OF HEARING

EXAMINER NUTTER: We will call Case No. 2409.

MR. MORRIS: Application of Texaco Inc. for a quintuple completion, Lea County, New Mexico.

MR. WHITE: Charles White, of Gilbert White & Gilbert, appearing on behalf of the Applicant.

C. R. BLACK

called as a witness, by and on behalf of the Applicant, having been

first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. WHITE:

Q Will you state your full name.

A C. R. Black.

Q By whom are you employed and in what capacity?

A Texaco, Inc., as a petroleum engineer.

Q Have your professional qualifications previously been accepted by the Commission?

A Yes, they have.

Q Are you familiar with the subject application?

A Yes, I am.

Q Will you briefly state what Texaco seeks by the application?

A This is the application of Texaco for a quintuple tubingless completion. The well will be completed in the undesignated Ellenburger, McKee, Fusselman, Siluro-Devonian and Drinkard formations in Lea County, New Mexico. All of these formations we expect to be oil productive and each zone will be produced through an independent string of tubing set in a common well bore as casing.

Q What is the present status of the well, Mr. Black?

A This well has been staked. However, drilling operations have not commenced.

Q Will you refer to Exhibit 1 and explain that to the

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ALBUQUERQUE, N. M.
PHONE 243-6691
FARMINGTON, N. M.
PHONE 325-1182

DEARNLEY-MEIER REPORTING SERVICE, Inc.
ALBUQUERQUE, N. M.
PHONE 243-6691
FARMINGTON, N. M.
PHONE 325-1182

Examiner.

A Exhibit No. 1 is a plat showing the immediate area surrounding the Texaco G.L. Erwin "b" NCT-2 lease. This Exhibit shows the location of the proposed well, the G. L. Erwin "b" NCT Well No. 2. This well is located 1980 feet from the south and east lines of Section 35, Township 24 South, Range 37 East.

Q Does it show the offset wells?

A The offset well operators and their wells are also shown on the lease with the appropriate field designation being shown below each well and a legend at the base of the Exhibit to determine the appropriate field for each well. Also shown on this Exhibit is a list of the direct offset operators and their mailing addresses.

Q Will you refer to Exhibit 2 and explain that diagrammatic sketch?

A Exhibit No. 2 is a diagrammatic sketch of the proposed quintuple tubingless completion.

Q First, explain the hole size and casing program.

A It is proposed that we will drill a twenty-inch hole to 250 feet. At that point we will set sixteen-inch casing and cement will be circulated behind the casing. We will continue with a thirteen and three-quarters inch hole to 3450 feet. At that point we will set an 11 3/4-inch casing and cement will be circulated behind the casing. A ten and five-eighths inch hole will be drilled from 3450 feet to 8150 feet. At that point we

will reduce the pole size to eight and three-quarters inches and continue on to total depth of 8500 feet.

Q What is your cementing program?

A Upon reaching total depth we propose to run one string of two and seven inch OD buttress tubing. This string will be run to a total depth of 8500 feet. A string of two and three-eighths inch OD buttress tubing will be run and one string will be set at the total depth of 8500 feet. Another string will be set at approximately 7900 feet and the other two strings will be set at approximately 7300 feet. The two and seven-eighths string which is designated as string Z on Exhibit 2, will contain a drillable guide shoe and a casing cementing collar at the base of this string. The string designated Y will also contain a drillable guide shoe and cement collar. The other three strings will be plugged on the end. Now, the drillable guide shoe in string Z and W is equipped with a full flow guide shoe and will drop a ball and test the casing to ascertain pressure after the casing has been landed. The drill guide shoe is equipped so that at a certain pressure a pin will shear thus pulling this ball out of the bottom of the shoe. We will be able to cement through the full opening shoe.

Q Now, will you proceed about your primery casing program?

A The prime cement job will be through two strings of tubing. Initially, we will commence pumping through the two and seven-eighths string and at the time returns have reached the base

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of the string designated as string Y we will then commence pumping through both strings simultaneously. We will pump 1700 pounds and core eight per cent yield with a retarder. This has a yield of 2.19 cubic feet per sackand based on 65 per cent, fill-up will be 3000 feet, which will be up into the 11 3/4-inch casing.

Q Will you state in detail the squeezing cementing operations?

A Texaco feels that it is of primary importance to obtain complete zone isolation between each of the prospective pay zones before any or all of the zones are perforated. We propose to do this by squeezing above and below each prospective pay zone with 55 to 100 sacks of cement. Now, this squeezing operation will be conducted through an Otis type door, a sliding side door. On Exhibit 2 the side doors are set at 8380 feet, 8160 feet, 7860 feet, 7580 feet, 6980, 6780 feet and 6750, 6680, 5900 and then, that is above and below the prospective pay zones. We will set a sliding side door at approximately 4600 and another at 5000 feet. The queen formation is productive. However, the queen formation will be kicked off with the eleven and three-quarters inch casing. The Blinebry formation is productive in a well three quarters of a mile away. The Paddock or Glorietta has been found on drill stem test to be productive in the area. Also, the upper two sliding doors will be located between those zones and will afford complete isolation of all known productive zones in the area.

To explain and possibly clear up somewhat the Otis type door

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PHONE 243-6691

in the actual procedure we plan to go through, we will be working in this string labelled V, with a string of one and five-eighths inch drill pipe and on the bottom of this drill pipe we will have a string of tools consisting of tail pipe. We will have an Otis Type A tool to close these sliding doors on the bottom. We will open on bottom and have a six to ten foot sub and then we will open the tool at that point. We will go in the well all the way to bottom through each of the sliding doors. This is a cut away model of the Otis Type A sliding side door. It will be run in the well in this position. This is in the closed position. We will go through all the way through each of these to the lower most one with the closing tool. The closing tool will be run through it and then we will tick up on it and this sliding side door will be open. Once it is opened you can go all the way up out of the well, squeeze through these ports and as I said previously, squeeze with approximately 50 to 100 sacks of cement with 3000 to 3500 psi. We will then close the sliding side door with the closing tool which will be on the bottom. It will be required that we set back down through the tool closing the door at that time. We will circulate any excess cement left in the tubing string out of the hole.

Q Will that completely isolate your zone?

A Yes, in each of the twelve positions.

Q Will you point out the radio active couplings which are marked in red on Exhibit 2 and explain them?

DEARNLEY-MEIER REPORTING SERVICE, Inc.
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ALBUQUERQUE, N. M.
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ALBUQUERQUE, N. M.
PHONE 243-6691
FARMINGTON, N. M.
PHONE 325-1182

A They are installed on the tubing collars as they are run in the hole. The purpose of these couplings is to allow us to run one gama correlation log in the two and seven-eighths tubing which is designated as string Z. These couplings will give us a sharp increase in gama ray count when we pack them and therefore by running this one log in string Z we will have the collar location in regard to the formation we intend to perforate in each of the other four strings. This will eliminate the necessity of running a correlation log in each of the five strings.

Q Mr. Black, will you give us the crude characteristics of each zone?

A In the Ellenburger formation we anticipate an intermediate sweet crude with an API gravity of from 40 to 45 degrees. The GOR is 1000 to 1, the bottom hole pressure is approximately 2800 psi. It is anticipated that this will flow for approximately six or seven years. The Ellenburger formation will be perforated from 8300 to 8050. The McKee is expected to be an intermediate sweet crude with a 43 to 44 degree API gravity. The GOR should be 1400 to 1. The bottom hole pressure should be approximately 3200 psi and we anticipate that this zone will flow for approximately three years. The McKee will be perforated from 7750 to 7830. The Fusselman is expected to be an intermediate sweet crude with an API gravity of 36 to 37 degrees. The GOR should be approximately 1100 to 1. The bottom hole pressure should be approximately 2500 psi and we expect this zone to flow for about

three years. It will be perforated from 6950 to 7050 feet. The Siluro-Devonian, which is the only zone in the area that is not productive in the immediate area is the dark horse zone of this well. We expect an intermediate sweet crude, the gravity is unknown, the GOR is unknown, and the bottom hole pressure and flowing life of this zone is unknown. We estimate our perforations at 6700 to 6720 feet. The Drinkard formation will be an intermediate sweet crude with an API gravity of 36 to 37 degrees. The GOR is approximately 750 cubic feet per barrel. Bottom hole pressure is estimated to be 2500 psi with a flowing life in this zone of three years. The Drinkard will be perforated from 5950 to 6050 feet.

Q Mr. Black, will it be possible to artificially lift any or all of these zones should the need arise?

A If and when it becomes necessary they can be lifted by one of three methods: We can use hollow sucker rods or we can use a hydraulic pumping arrangement by using a string of three quarter inch power oil tubing or we can run a string of one inch tubing inside the casing string with gas lift valves installed and gas lift these zones.

Q Do you expect any corrosion or paraffin problems and if so, how will you cope with them?

A As far as corrosion in the Ellenburger, McKee and Fusselman formations, we don't anticipate any corrosion problems at all in these zones. As for the Siluro-Devonian zones, since it is an

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unknown zone, and the Drinkard we anticipate mild if any corrosion problems here. During the flowing life of these zones, the corrosion can be controlled by the inhibitor squeeze type treatment wherein you squeeze the corrosion inhibitor back into the formation. During the ordinary lifting period we will use the hollow sucker rods down the annulus. If we are using gas lift method, we can inject the inhibitor in the gas supply and if we are using the hydraulic pumping method we can inject the inhibitor down to the power oil supply.

As far as paraffin, the Ellenburger and McKee present no paraffin problem at all. The Drinkard and Siluro-Devonian we anticipate that if there are paraffin problems, they will be mild and we plan on plasticoating the upper portion of the Siluro-Devonian tubing. However, the Drinkard tubing will be the string designated as string V. You can see we will be working in this string of tubing and we fell that plasticoating above running in the well would not be beneficial. At the time the well is completed most of the plastic would probably be knocked off the tubing. The Fusselman we do expect paraffin problems and we plan on plasticoating the upper portion of this tubing string to cope with the problems.

Q Mr. Black, will you refer to Exhibit 3 and explain that, please.

A Exhibit 3 is an induction lateral log of our G. L. Erwin Well No. 1 which is located on Exhibit No. 1 660 feet from

the south and east lines of Section 35, Township 24 South, Range 37 East. Exhibit No. 3 has the tops of the known producing or believed to be producing formations in the area. This is the queen formation, the Glorietta, the Drinkard, Blinebry, Fusselman, Siluro-Devonian, McKee and Ellenburger.

Q In your opinion, will this proposed installation protect correlative rights and also be in the interests of conservation?

A In my opinion, I believe it is, yes.

Q Who does Texaco intend to employ to perforate?

A Just Go Perforators to do the perforating in this well.

EXAMINER NUTTER: How do you spell "go"?

THE WITNESS: Just G-o.

EXAMINER NUTTER: Does that conclude your testimony on direct?

MR. WHITE: Yes, it does.

EXAMINER NUTTER: Are there any questions of Mr. Black?

EXAMINATION

BY EXAMINER NUTTER:

Q Mr. Black, these upper sliding doors will squeeze from 4600 to 5000, is that correct?

A That's correct.

Q The queen is 3100?

A It will be protected by the 11 3/4-inch casing string. That will be set at 3450.

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Q And then the Blinebry is present in this area. What's the top of the Blinebry?

A Around 5000.

Q It's just below this iower sliding door?

A Yes, it is.

Q And there was one other formation, the Paddock.

A The Paddock is above the Drinkard and Blinebry.

Q It will be protected by the sqeeze through the sliding door on the 5900, is that correct?

A That's correct.

Q All of these sliding doors will be installed in one tubing?

A Installed in tubing V which will be a two and three-eighths inch OD buttress tubing.

Q You will operate this man drill through the doors with a string of one inch pipe?

A One and five-eighths inch drill pipe.

Q One and five-eighths?

A Yes.

Q Now, you mentioned the name of the company - - Is this also the name of the company that makes the radio active couplers?

A They furnish these radio active couplings to the Go Perforators.

EXAMINER NUTTER: Are there any further questions of Mr. Black?

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He may be excused.

(Witness excused)

MR. WHITE: We have one other witness, Mr. Gearhart.

MARVIN GEARHART

called as a witness by and on behalf of the Applicant, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. WHITE:

Q Mr. Gearhart, will you state your full name.

A Marvin Gearhart.

Q By whom are you employed, Mr. Gearhart, and in what capacity?

A I am employed by Go Perforators and I am Vice President.

Q Where are your offices located?

A Fort Worth, Texas.

Q Have you previously testified before this Oil Conservation Commission in New Mexico or the Commission itself?

A No, I haven't.

Q Will you state your educational background, please.

A I received a BS degree in mechanical engineering from Kansas State College in 1949.

Q Would you state your professional experience as an engineer?

A At that time I went to work for Well-Ex as a field

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engineer, and at the time I left Well-Ex, I was a radio activity logging engineer. I left to help form Go Perforators. We get the Go from the G in Gearhart and the O in Owen. We have been in business since 1955.

Q Have you been in personal charge of the perforation operations of your company and if so, to what extent?

A Yes, I have. I was in charge of the development of our device and the techniquesused in using it. I have supervised jobs in Texas, Oklahoma, off the Gulf Coast, off-shore California, and Canada.

Q Are you familiar with the subject application of Texaco?

A Yes, I am.

MR. WHITE: Are the witness's qualifications acceptable?

EXAMINER NUTTER: Yes, they are.

Q (By Mr. White) Mr. Gearhart, do you personally intend to direct and supervise the perforation operations on this particular well?

A Yes, I do.

Q Will you describe the techniques which will be employed on this well?

A We intend before we do any perforating to establish relative position of the pipes in the upper three zones that are to be perforated.

Q Refer to Exhibit 2.

A Referring to Exhibit No. 2, we will begin in the lower most string of the upper three zones and determine the relative position of the pipes at that depth and then proceed up the hole to the 6600 foot zone and on up to the upper zone.

Q You will determine the location of all five strings?

A That's right.

Q And then which string will be first perforated?

A We would perforate string V, W and X, the upper three zones first.

Q How will you determine the respective locations of each of these five strings of pipe?

A Our device consists of a combination of two tools one ratcheting mechanism attached to a gama ray detector that is directional. The ratchet mechanism is operated by lowering and raising the cable that the tool is run on taking a stroke of approximately two feet in length to shift its position. In tension stroke the line will make one complete revolution. As the ratchet is rotated through the various positions, we will run a radio active pail down each of the other parallel strings that runs beside the string that we are in with our directional gama ray detector. As these radio active pails are lowered up and down the detector, we will record their radio active counting rate. This continuing rate is then plotted on the chart which is a polar coordinate type.

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Q Do you have an example of a typical chart?

A Yes, I do. For purposes of making it easier we prepared an example with two strings using the same principles that are used.

MR. WHITE: Let the record show he is referring to what has been marked for identification as Exhibit 4.

EXAMINER NUTTER: The record will note it. You may proceed.

Q (By Mr. White) In your testimony will you make clear to which Exhibit you are referring to.

A From Exhibit 4, the simple two-string method, that position of the pipe when you lower the pail by the detector will cause a radio active high or peak that points toward the location of that pipe. We do the same thing in the other strings, plot by using various colors or dotted and dashed lines in plotting the relative position of each string of pipe.

Q So far, your testimony has been directed soley to determining the location of each string of pipe in the upper three zones. What is your next step in your procedure?

A Well, after it's been determined the relative position of the pipe it is preferrable to perforate a string of pipe that is right next to the formation rather than one possibly clustered between strings, so we would select the zones to be perforated and proceed to perforate.

Q And, what is your next step?

A We go back and this time with a directional gun attached to the device and repeat the previous procedure, only this time when we get our gun directed toward the formation away from the other strings of pipe, we perforate.

Q Will this operation verify the location which you previously determined?

A Yes, it will.

Q Proceed with the next step.

A Well, after doing the upper most zone we will proceed down the hole until all the zones have been perforated in this manner.

Q They will be perforated by the same procedure, in the same manner?

A Yes, over and over.

Q Mr. Gearhart, has this type of orienting procedure and the method of perforating proved successful in your other operations similar to this completion?

A Yes, very successful.

Q Have you had failures by using this type of procedure?

A No, we haven't. However, to this date four strings, or a quadruple, is the most we have directionally perforated in, but, in my opinion, there wouldn't be any other problems with the fifth string.

Q What additional difficulties, if any, would you encounter by completing five strings as opposed to, say, four

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strings?

A It's about the same. It may take a little more equipment and more time and more money.

MR. WHITE: At this time, we offer the Exhibits in evidence and that concludes our direct examination.

Do you have any further testimony?

THE WITNESS: No, I haven't.

EXAMINER NUTTER: Exhibits 1 through 5 will be entered in evidence.

Are there any questions of Mr. Gearhart?

He may be excused.

(Witness excused.)

MR. WHITE: That concludes our case.

EXAMINER NUTTER: Does anyone have anything they wish to offer in Case No. 2409?

We will take the case under advisement.

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STATE OF NEW MEXICO)
) ss
COUNTY OF SAN JUAN)

I, THOMAS F. HORNE, Court Reporter, in and for the County of San Juan, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings before the New Mexico Oil Conservation Commission was reported by me in machine shorthand and reduced to typewritten transcript under my personal supervision, and that the same is a true and correct record to the best of my knowledge, skill and ability.

Thomas F. Horne
Notary Public

My Commission expires:
10-2-63

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2409, heard by me on 10/25, 1961.

....., Examiner
New Mexico Oil Conservation Commission

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D E V I L S F O R K F I E L D

RIO ARRIBA COUNTY, N.M.

Bottom Hole Pressure
Buildup
Calculations

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
Mexico EXHIBIT No. 2-A
CASE 2409

DENIS PARK FIELD
Bottom Hole Pressure Survey
7-30-62 to 8-6-62

Well	Highest Measured Pressure	Extrapolated Pressure	Pressure by Horner's Method	Estimated Reservoir Pressure
Canyon Largo #89	1482	1600	N.A.	1541
Canyon Largo #106	1516	N.A.	N.A.	1512
Canyon Largo #118	1865	1933	N.A.	1933
NCRA-State #1	1848	1941	N.A.	1941
Edna #1	1127	1930	1748	1748
Edna #2	1709	1930	1843	1843
Edna #3	1398	1843	1622	1622
Miller A-1	1371	1575	N.A.	1473
Miller B-2	1114	1532	1324	1324
Miller B-4	1258	1838	1609	1609
Dashko B-1	1269	1486	1356	1356
Dashko B-2	931	1509	1286	1286
Largo Spur 1	1505	1615	1530	1530
Largo Spur 2	1505	N.A.	N.A.	1505
Largo Spur 3	1493	1674	N.A.	1542
Largo Spur 1-A	1383	1761	1582	1582
Zamorra 1	1499	N.A.	N.A.	1499
Byrd 1-23	932	1330	1071	1071
Byrd 5-23	728	955	765	765
Killarney 1	1454	N.A.	N.A.	----
Lybrook 1-19	1522	N.A.	N.A.	1522
New Mexico Fed.G-1	1436	1563	N.A.	1500

Bco Inc. Byrd 1-A

BHP Buildup
7-30-62 to 8-6-62

Cum. Prod. = 10,762 bbls

Arg. Stabilized Prod. Rate = 22 B/D

Pseudo Prod. Time $\bar{T} = \frac{10762}{22} = 489.2$ da

Shut in date ~~7-30-62~~

Date	Δt	$\frac{\Delta t}{\bar{T}+\Delta t}$	Pressure
8-1-62	2	0.00407	
8-3-62	4	0.00811	
8-6-62	7	0.0141	

Horner Calculation of Average Pressure

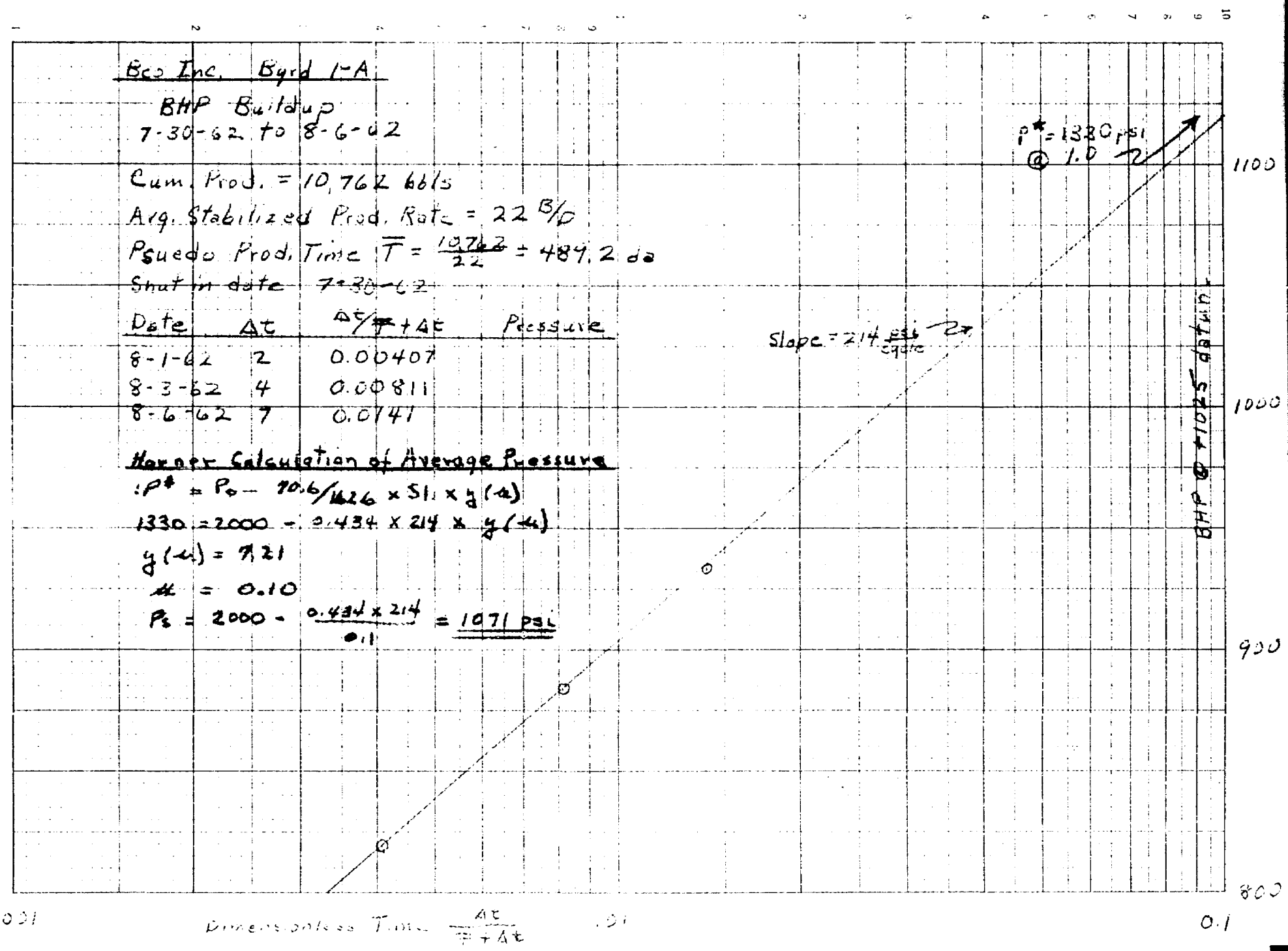
$P^* = P_o - 70.6/kh \times Si \times \frac{1}{2}(\alpha)$

$1330 = 2000 - 0.434 \times 214 \times \frac{1}{2}(\alpha)$

$\frac{1}{2}(\alpha) = 7.21$

$\alpha = 0.10$

$P_s = 2000 - \frac{0.434 \times 214}{0.1} = 1071$ psi



REOFFEN & HURD LARG SPUR #3

BNP 50.40-P
7-28-62 to 8-6-62
CUMULATIVE PRODUCTION = 374,156 mcf
AVG. STABILIZED PROD. RATE = 1013 MCFPD
PSEUDO PRODUCING TIME $\bar{T}$ = 371 da
SHUT IN 7-28-62

DATE	ΔT	$\Delta T / \bar{T} + \Delta T$	PRESSURE
8-1-62	4	0.0107	1765
8-6-62	9	0.0237	1742*

$P^* = 1674$ psia

SLOPE = 111 psi / cycle

HORNER CALCULATION of DATUM PRESSURE

$$P^* = P_0 - 70.6/162.6 \times SR \times \psi(w)$$

$$1674 = 2000 - 0.434 \times 111 \times \psi(w)$$

$$\psi(w) = 6.74$$

$w = 0.105$

$$P_s = 2000 - \frac{0.434 \times 111}{0.105}$$

$= 1542$ psia

* Pressure adjusted from that previously reported to map tubing gradient constant.

BHP @ 1025 DATUM

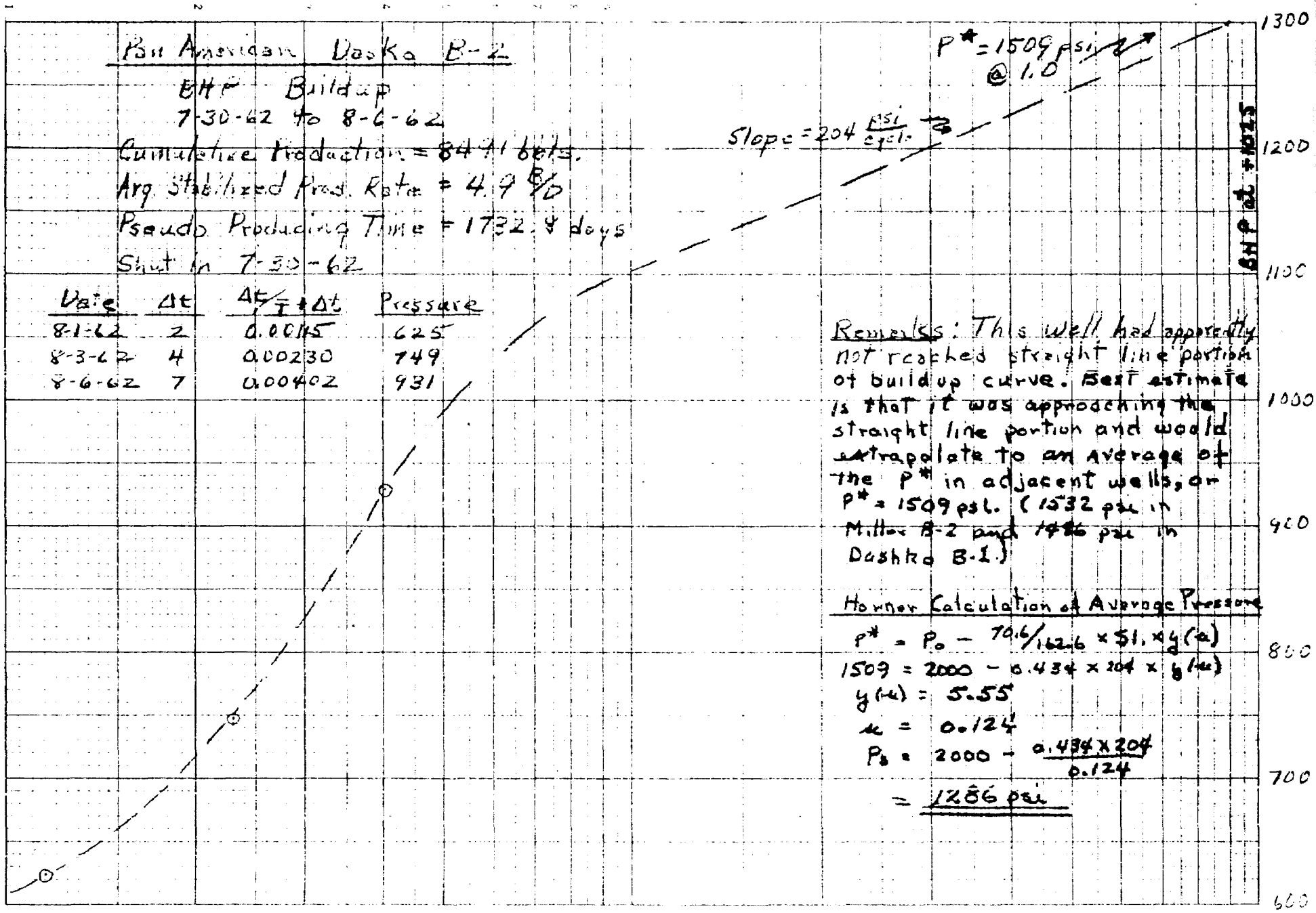
1630
1580
1530
1480

0.01 — DIMENSIONLESS TIME = $\frac{\Delta T}{\bar{T} + \Delta T}$ — 0.1 — 1.0

Pan American Dashka B-2

BHP Buildup
7-30-62 to 8-6-62
Cumulative Production = 8441 bbls.
Avg. Stabilized Prod. Rate = 4.9 B/D
Pseudo Producing Time = 1732.4 days
Shut in 7-30-62

Date	Δt	Δt/T+Δt	Pressure
8-1-62	2	0.00115	625
8-3-62	4	0.00230	749
8-6-62	7	0.00402	931



Remarks: This well had apparently not reached straight line portion of buildup curve. Best estimate is that it was approaching the straight line portion and would extrapolate to an average of the P* in adjacent wells, or P* = 1509 psi. (1532 psi in Miller B-2 and 1486 psi in Dashka B-1.)

Horner Calculation of Average Pressure

$P^* = P_o - \frac{70.6}{162.6} \times 51.4 \times y(u)$

$1509 = 2000 - 0.434 \times 204 \times y(u)$

$y(u) = 5.55$

$u = 0.124$

$P_s = 2000 - \frac{0.434 \times 204}{0.124}$

$= 1286$ psi

EL PASO NATURAL GAS COMPANY SAN JUAN 32-9 UNIT #89

BHP BUILDUP

7-18-62 to 8-1-62

CUMULATIVE PRODUCTION = 968,574 MCF

AVG. STABILIZED RATE SAND = 2450 MCFPD

PSEUDO PRODUCING TIME = 141 days

SHUT IN 7-18-62

DATE	ΔT	$\frac{\Delta T}{T + \Delta T}$	PRESSURE
8-1-62	14	0.0682	1472
8-3-62	16	0.0773	1478
8-6-62	19	0.0904	1482

HORNER CALCULATION INDICATES P_s = 1470 psi

PRESSURE BUILDUP PROBABLY FLATTENING PRIOR TO SURVEY.

BEST ESTIMATE of $P_s = \frac{1610 + 1482}{2} = 1541$ psi.

$P^* = 1600$ psi

SLOPE = 114 psi/cycle

BHP @ 1045' DATUM

1600

1550

1500

1450

0.01 DIMENSIONLESS TIME = $\frac{\Delta T}{T + \Delta T}$ 0.1 1.0

PAUL F. RUTLEDGE MILLER A-1

BHP BUILDUP

7-16-62 to 8-6-62

CUMULATIVE PRODUCTION = 372.607 MCF

AVG. STABILIZED PRODUCTION RATE = 1864 MCF/DA

PSEUDO PRODUCING TIME = 210.6 DAYS

SHUT IN 7-16-62

DATE	ΔT	ΔT/T+ΔT	PRESSURE
8-1-62	16	0.071	~~1355~~
8-3-62	18	0.079	1364
8-6-62	21	0.091	1371

HORNER CALCULATION of AVG. PRESSURE

$P^* = P_o - \frac{70.6}{162.6} \times SL \times y(u)$

$1575 = 2000 - 0.434 \times 191 \times y(u)$

$y(u) = 5.12$

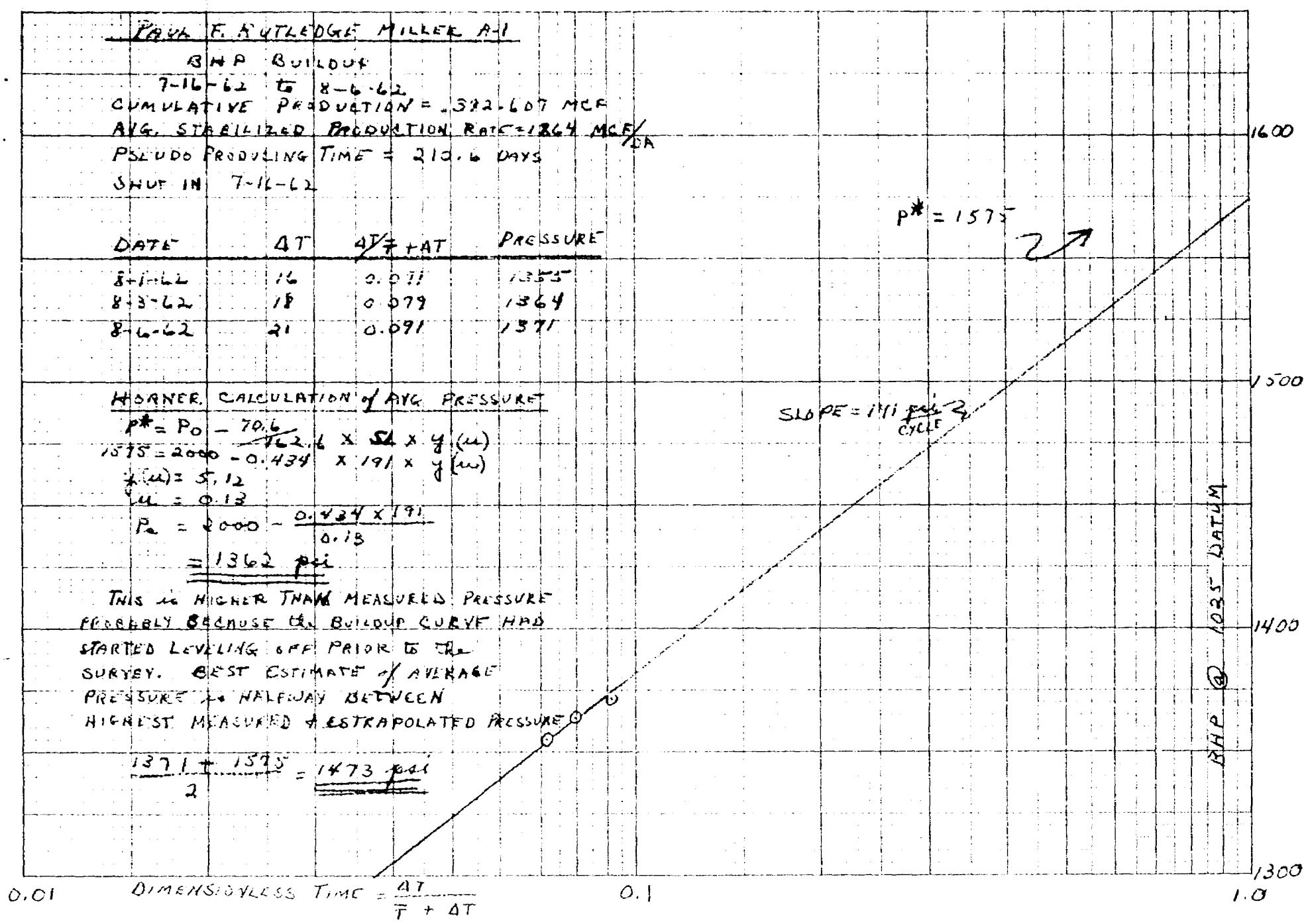
$u = 0.13$

$P_a = 2000 - \frac{0.434 \times 191}{0.13}$

$= 1362$ psi

THIS IS HIGHER THAN MEASURED PRESSURE PROBABLY BECAUSE THE BUILDUP CURVE HAD STARTED LEVELING OFF PRIOR TO THE SURVEY. BEST ESTIMATE of AVERAGE PRESSURE IS HALFWAY BETWEEN HIGHEST MEASURED & ESTRAPOLATED PRESSURE

$\frac{1371 + 1575}{2} = 1473$ psi



KEUFFEL & ESSER CO. SEMI-LOGARITHMIC 359-61

J. GREGORY MERRION + ASSOCIATES, MCRA-STATE #1

BHP BUILDUP

9-2-62 to 9-5-62

CUMULATIVE PRODUCTION = 343 BBLS

AVG. STABILIZED PROD. RATE = 188 B/D

PSEUDO-PRODUCING TIME = 1.82 DAYS = 43.8 hrs.

SHUT IN 11:45 A.M. SEPT. 2, 1962

DATE	ΔT - hrs.	$\frac{\Delta T}{T + \Delta T}$	PRESSURE
9-3-62	29.33	0.401	1757
9-4-62	44.0	0.501	1804
9-4-62	58.0	0.587	1830
9-5-62	73.25	0.625	1848

HORNER CALCULATION NOT APPLICABLE DUE TO SHORT PRODUCING HISTORY

$p^* = P_a = 1941$ psi

$p^* = P_a = 1941$ psi

SLOPE = 565 psi/CYCLE

BHP @ 7425' DATUM

2000

1900

1800

1700

0.01

DIMENSIONLESS TIME = $\frac{\Delta T}{T + \Delta T}$

0.1

1.0

K&E SEMI-LOGARITHMIC 359-61

PAN AMERICAN DASHKO B-1

BHP BUILDUP

7-30-62 to 8-6-62

CUMULATIVE PROD. = 47.933 BBLS.

AVG. STABILIZED PROD. RATE = 36.1 B/D

PSEUDO PRODUCING TIME = 1327.8 DAYS

SHUT IN 7-30-62

DATE AT	$\frac{\Delta T}{T+\Delta T}$	PRESSURE
8-1-62	0.0015	1217
8-6-62	0.0052	1249

HORNER CALCULATION OF AVG. PRESSURE:

$P^* = P_0 + \frac{70.6}{162.6} \times S1 \times y(m)$

$1486 = 2000 - 0.434 \times 95 \times y(m)$

$y(m) = 12.4$

$m = 0.064$

$P_i = 2000 - \frac{0.434 \times 95}{0.064}$

$= 1356$ psi

$P^* = 1486$ PSI @ 1.0

SLOPE = 95 PSI / CYCLE

1350

1300

1250

1200

BHP @ 1425' DATUM

0.001 DIMENSIONLESS TIME = $\frac{\Delta T}{T+\Delta T}$ 0.01 0.1

K&E SEMI-LOGARITHMIC 359-61

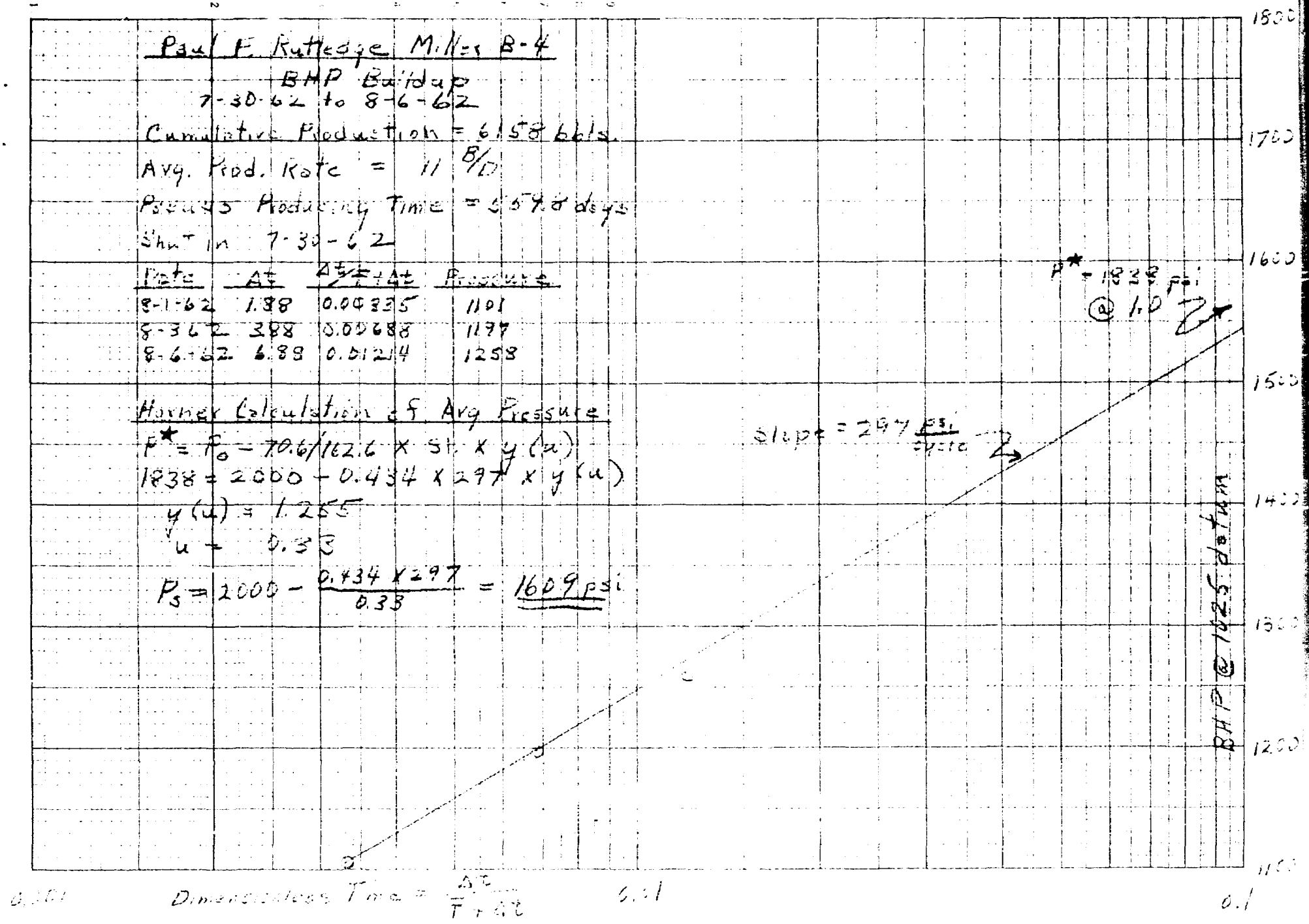
Paul E. Rutledge Mines B-4

BHP Buildup
7-30-62 to 8-6-62
Cumulative Production = 6158 bbls.
Avg. Prod. Rate = 11 B/D
Pseudo Producing Time = 557.8 days
Shut In 7-30-62

Date	Δt	$\frac{\Delta t}{t+\Delta t}$	Products
8-1-62	1.88	0.00335	1101
8-3-62	3.88	0.00688	1197
8-6-62	6.88	0.01214	1258

Horner Calculation of Avg Pressure

$P^* = P_o - 70.6/162.6 \times S_t \times y(u)$
$1838 = 2000 - 0.434 \times 297 \times y(u)$
$y(u) = 1.255$
$u = 0.33$
$P_s = 2000 - \frac{0.434 \times 297}{0.33} = \underline{\underline{1609 \text{ psi}}}$



Redtern & Hard Layo Spar 1-A

BHP Build up 7-28-62 to 8-6-62

Cumulative Production = 2053 bbls.

Avg. Stabilized Prod. Rate = 2.8 B/D

Pseudo Producing Time T = 732.2 days

Shut in 7-28-62

Date	Δt	$\frac{\Delta t}{T+\Delta t}$	Pressure
8-1-62	4	0.00542	1315
8-6-62	9	0.0121	1383

Horner Calculation of Avg. Pressure

$P^* = P_0 - 70.6/162.6 \times S_l \times y(u)$

$1761 = 2000 - 0.434 \times 194 \times y(u)$

$y(u) = 2.70$

$u = 0.197$

$P_s = 2000 - \frac{0.434 \times 194}{0.197} = 1582$ psi

P^* = 1761 psi @ 1.0

Slope = 194 psi/cycle

BHP @ 7225' datum

1660

1500

1400

1300

0.001 Dimensionless Time = $\frac{\Delta t}{T+\Delta t}$ 0.01 0.1

K&E SEMI-LOGARITHMIC 359 61

J. Gregory Merkel & Assoc. Edna #3

BHP Buildup

7-30-62 to 8-6-62

Cumulative Production = 8944 bbls

Avg. Stabilized Prod. Rate = 36 B/D

Stabilized Producing Time T = 245.7 days

Shut in 7-30-62

Date	$\frac{t}{}$	$\frac{\Delta t}{T+\Delta t}$	Pressure
8-1-62	2	0.00857	1243
8-3-62	4	0.01602	1356*
8-6-62	7	0.0277	1398*

Horner Calculation of Avg. Pressure

$p^* = p_0 - 70.6/162.6 \times 51 \times y(u)$

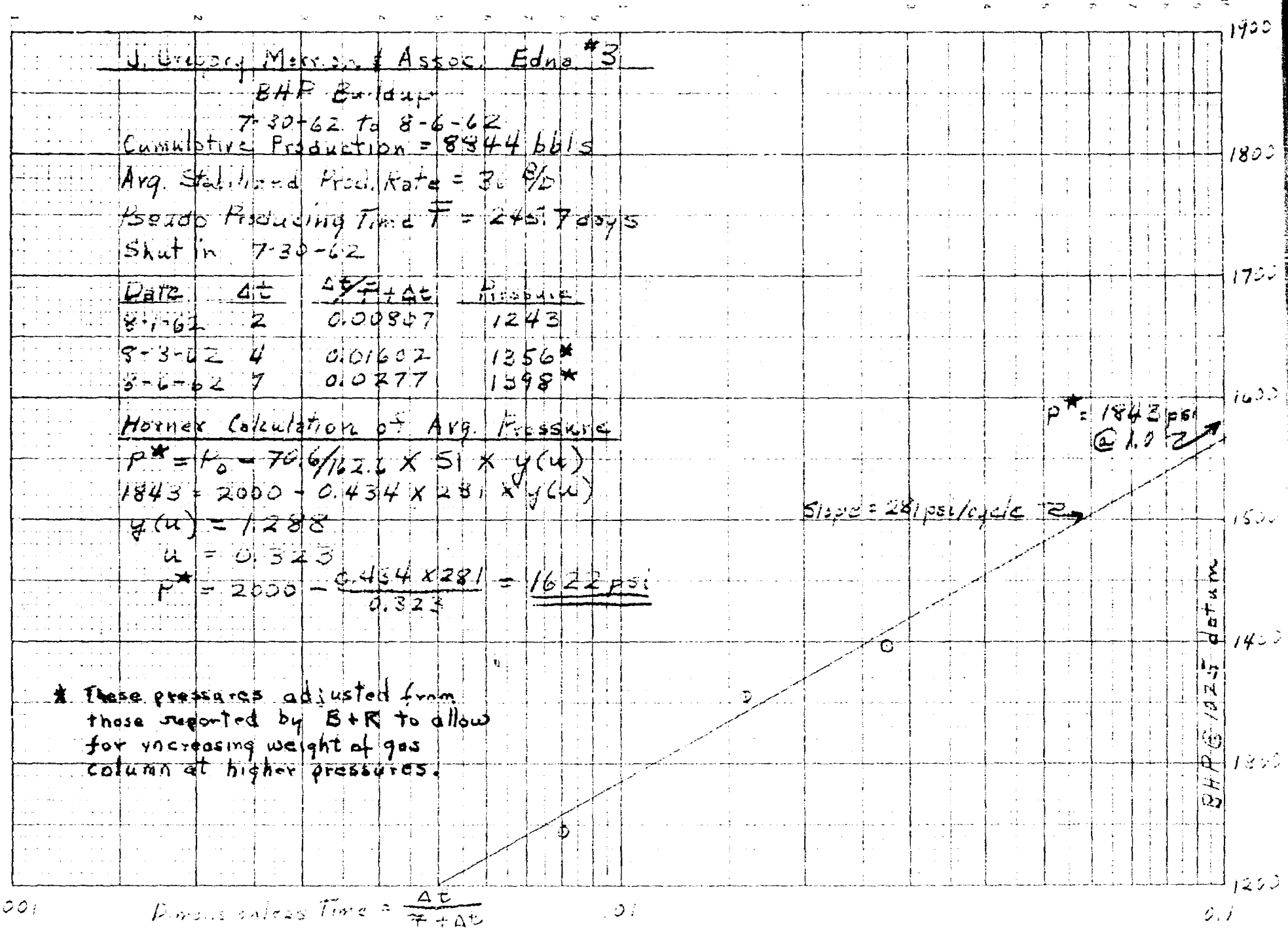
$1843 = 2000 - 0.434 \times 281 \times y(u)$

$y(u) = 1.288$

$u = 0.323$

$p^* = 2000 - \frac{0.434 \times 281}{0.323} = 1622$ psi

* These pressures adjusted from those reported by B+R to allow for increasing weight of gas column at higher pressures.



K&E SEMI LOGARITHMIC 359 61

J. Gregory Merrion + Assoc. Edna #1

BHP Buildup

7-30-62 to 8-6-62

Cumulative Production = 42,216 bbls

Avg. Stabilized Prod. Rate = 55 B/D

Pseudo Producing Time $T = \frac{42,216}{55} = 767.6$ da.

Shut in 7-30-62

Date	Δt	$\frac{T+\Delta t}{\Delta t}$	Pressure
8-1-62	2	0.0026	926
8-3-62	4	0.0052	1045
8-6-62	7	0.00944	1127

Horner Calculation of Avg. Pressure

$P^* = P_0 = 70.6/162.6 \times 51. \times y(u)$

$1930 = 2000 - 0.434 \times 387 \times y(u)$

$y(u) = 0.417$

$u = 0.64$

$P_s = 2000 - \frac{0.434 \times 387}{0.64} = \underline{1748 \text{ psi}}$

$P^* = 1930$ psi @ 1.0

Slope = 237 PSI/cycle

1600

1400

1200

1000

900

0.001

Dimensionless Time = $\frac{\Delta t}{T + \Delta t}$

0.01

0.1

K&E SEMI LOGARITHMIC 359-61

J. Gregory Merrion & Assoc Edna #2

BHP Buildup

7-30-62 to 8-6-62

Cumulative Production = 31,708 bbls

Avg. Stabilized Prod. Rate = 65 bbls/day

Pseudo Producing Time $T = \frac{31,708}{65} = 487.8$ days

Shut in: 7-30-62

Date	Δt	$\frac{\Delta t}{T+\Delta t}$	Pressure
8-6-62	7	0.014	1709

Remark: Only one pressure point available. Best estimate of P^* is 1930 psi.

Horner Calculation of Avg. Pressure

$P^* = P_0 - 70.6/162.6 \times 51 \times y(u)$

$1930 = 2000 - 0.434 \times 119 \times y(u)$

$y(u) = 1.36$

$u = 0.328$

$P_s = 2000 - \frac{0.434 \times 119}{0.328} = \underline{1843 \text{ psi}}$

Slope = 119 psi/cycle

BHP @ 1025' datum

2000

1900

1800

1700

.001

Dimensionless Time = $\frac{4t}{T+4t}$

.01

1.0

K&E SEMI-LOGARITHMIC 359 61
KEUFFEL & ESSER CO.
2 CYCLES X 70 DIVISIONS

Bob Ind. Hyd. 5-A

BHP Buildup

7-30-62 to 8-6-62

Cum. Prod. = 3384 bbls.

Stabilized Prod. Rate
Prior to shut in = 9 B/D

Producing time at shut in $T = \frac{3384}{9} = 376$ days

Shut in = 7-30-62

Date	Δt	$\Delta t / T + \Delta t$	Pressure
8-1-62	2 da.	0.00529	654
8-3-62	4 da.	0.01053	689
8-6-62	7 da.	0.0185	729

Horner Calculation of Avg. Pressure

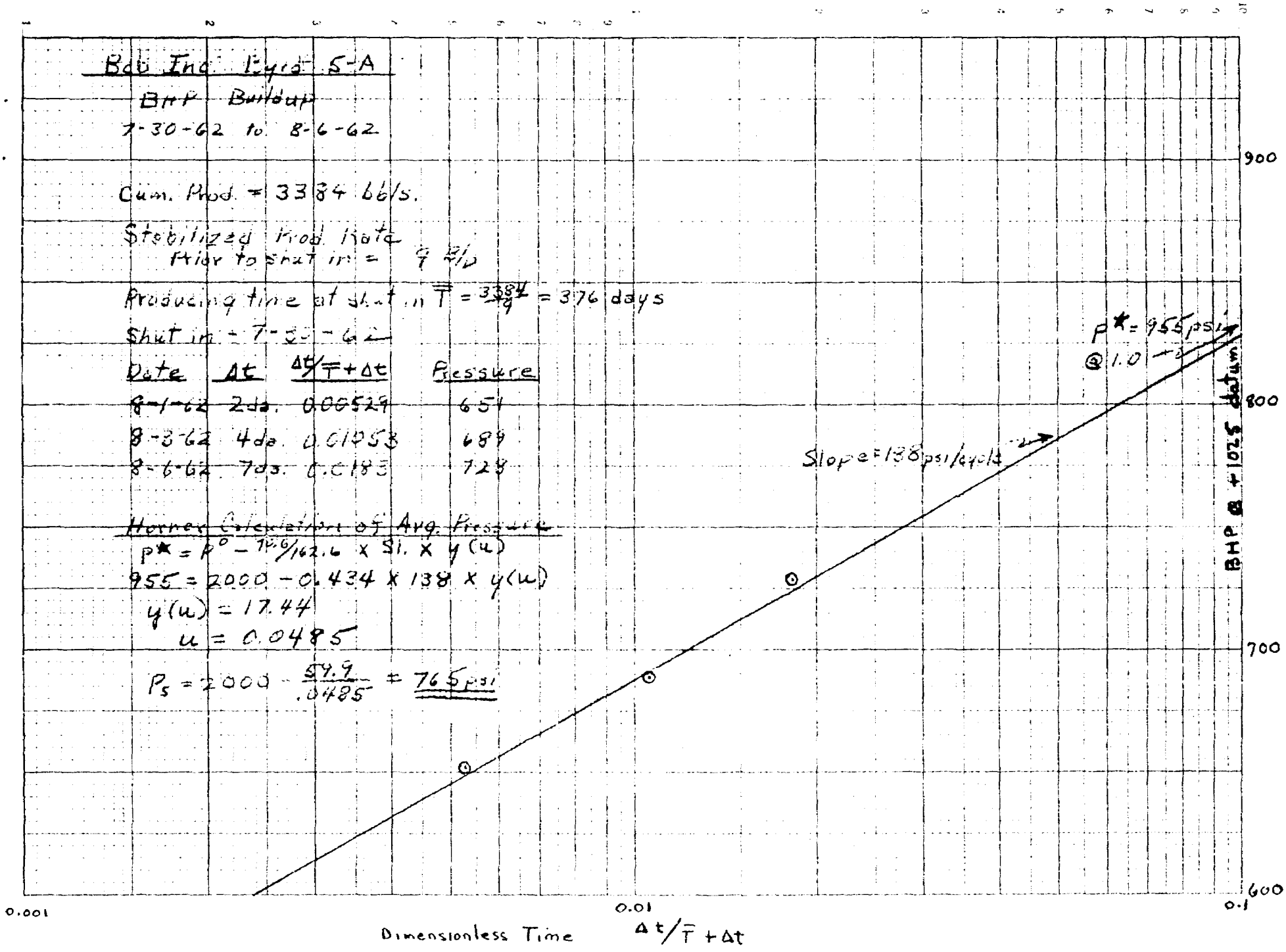
$P^* = P^o - 70.6/162.6 \times Sl. \times y(u)$

$955 = 2000 - 0.434 \times 138 \times y(u)$

$y(u) = 17.44$

$u = 0.0485$

$P_s = 2000 - \frac{57.9}{.0485} = \underline{765 \text{ psi}}$



El Paso Nat Gas Co. Canyon Largo Unit #112

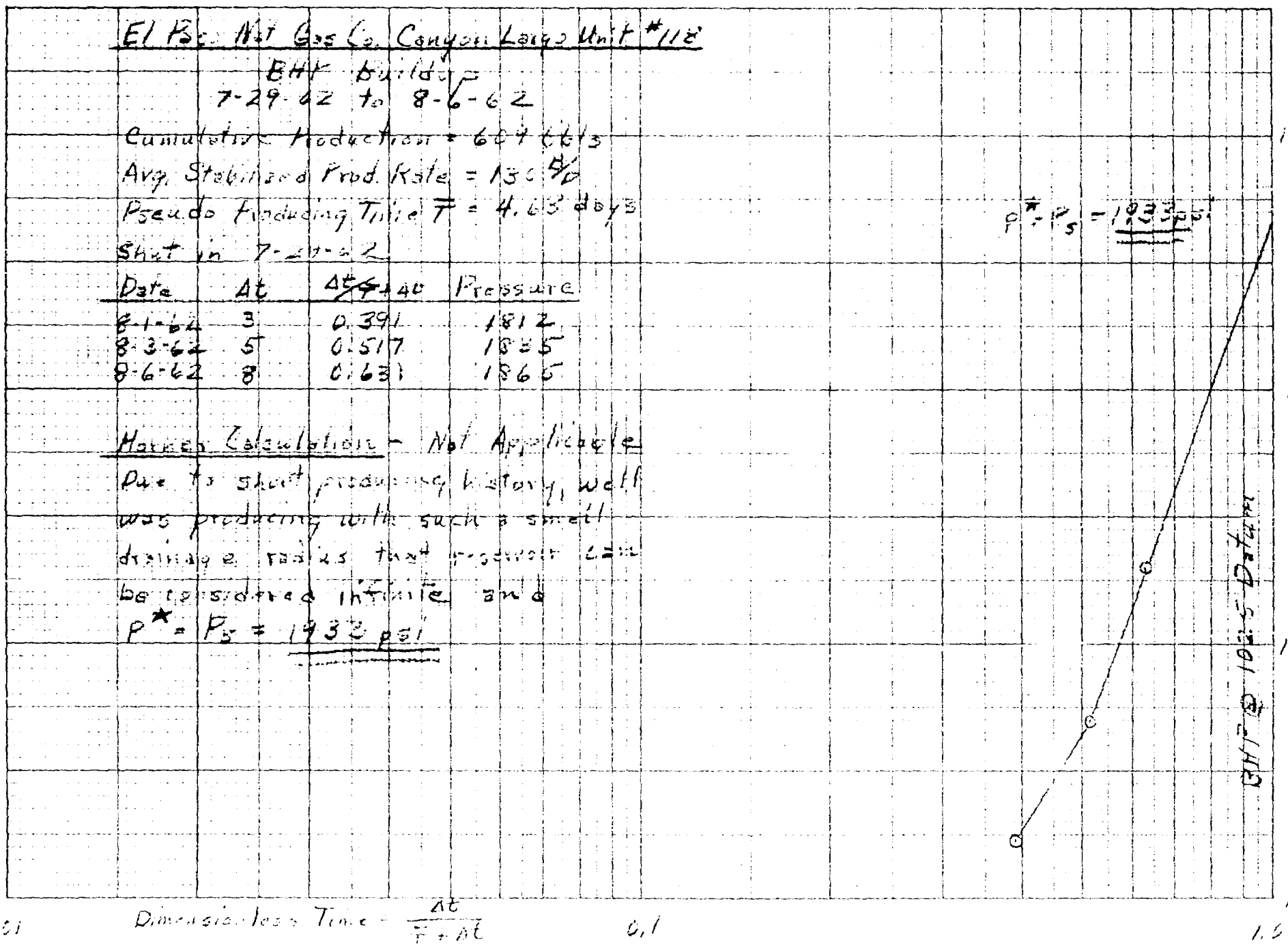
BHP Build-up
7-29-62 to 8-6-62

Cumulative Production = 644 Mcf
Avg. Stabilized Prod. Rate = 130 M/D
Pseudo Producing Time T = 4.63 days
Shut in 7-29-62

Date	Δt	$\frac{\Delta t}{T+\Delta t}$	Pressure
8-1-62	3	0.391	1812
8-3-62	5	0.517	1825
8-6-62	8	0.631	1865

Horner Calculation - Not Applicable
Due to short producing history, well was producing with such a small drainage radius that it could be considered infinite and
$P^* = P_s = 1932$ psi

$P^* - P_s = 1933 - 1865 = 68$ psi



359 61

Redfern & Herd Largo Spur #1

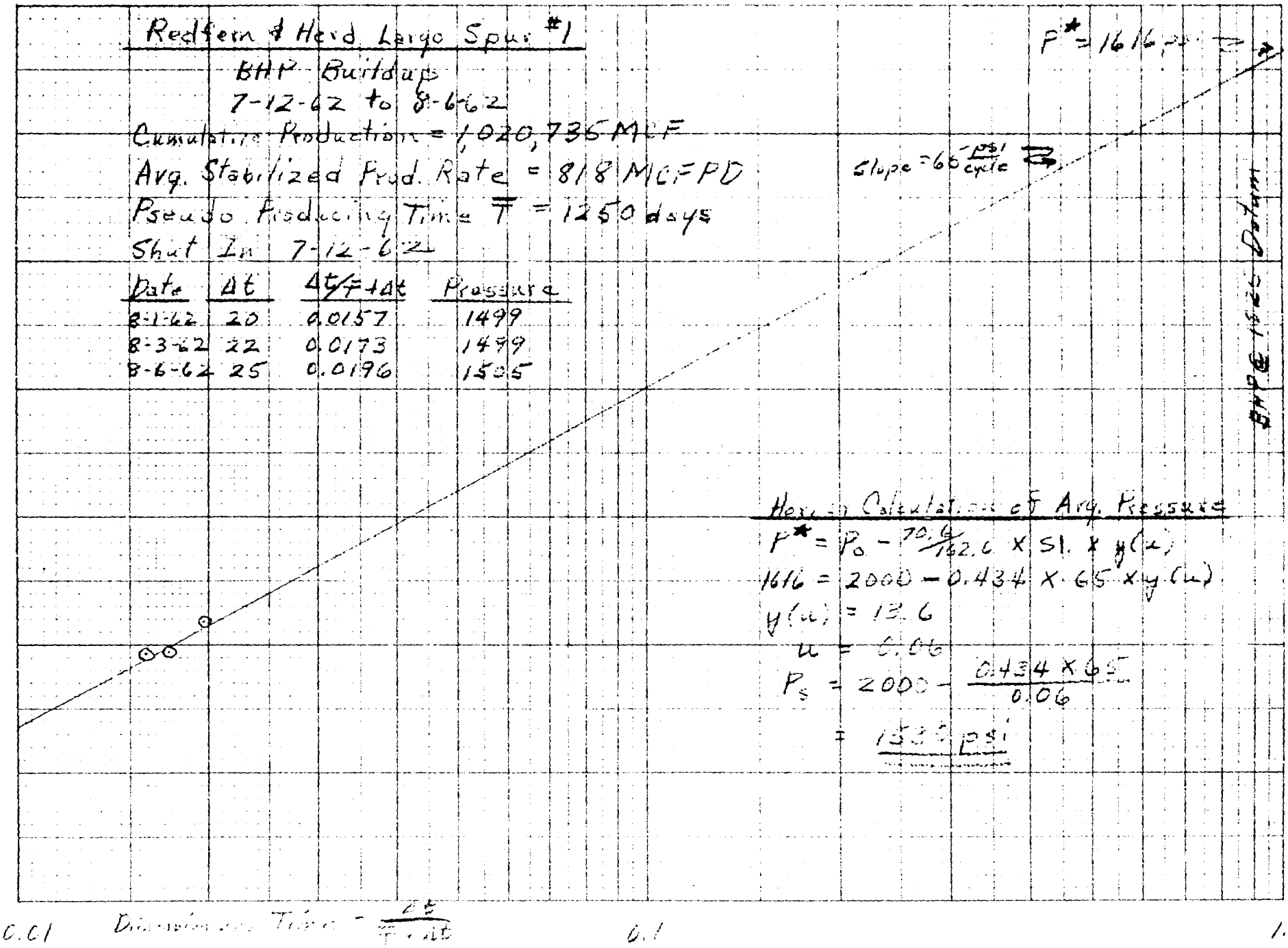
BHP Buildup
7-12-62 to 8-6-62

Cumulative Production = 1,020,736 MCF
Avg. Stabilized Prod. Rate = 818 MCFPD
Pseudo Producing Time $\mathcal{T}$ = 1250 days
Shut In 7-12-62

Date	Δt	$\frac{t}{\mathcal{T}+\Delta t}$	Pressure
8-1-62	20	0.0157	1499
8-3-62	22	0.0173	1499
8-6-62	25	0.0196	1505

$P^* = 1616$ psi

slope = 65 psi/cycle



Dimensionless Time = $\frac{\mathcal{T}}{\mathcal{T}+\Delta t}$

How to Calculate Avg. Pressure

$P^* = P_0 - \frac{70.6}{162.6} \times 51. \times y(u)$

$1616 = 2000 - 0.434 \times 65 \times y(u)$

$y(u) = 13.6$

$u = 0.06$

$P_s = 2000 - \frac{0.434 \times 65}{0.06}$

$= 1530$ psi

K&E SEMI-LOGARITHMIC 359-61

Paul F Kutledge Miller 8-2

BHP Buildup
7-30-62 to 8-6-62

Cumulative Production = 16,477 bbls
Avg Stabilized Prod. Rate = 17.5 B/D
Pseudo Producing Time = 941.5 days
Shut In 7-30-62

Date	Δt	$\frac{\Delta t}{t_p + \Delta t}$	Pressure
8-1-62	1.92	0.00235	1012
8-3-62	3.83	0.00405	1070
8-6-62	6.89	0.00725	1114

Horner Calculation for Avg. Pressure

$P^* = P_0 - \frac{70.6}{162.6} \times 51 \times y(u)$

$1532 = 2000 - 0.434 \times 193 \times y(k)$

$y(u) = 5.58$

$u = 0.124$

$P_s = 2000 - \frac{0.434 \times 193}{3.124}$

$= 1324$ psi

$P^* = 1532$ psi at 10^{100}

Slope 193 psi/cycle

1300

1200

1100

1000

BHP @ 1022.5 hours

0.001 — Dimensionless Time $\frac{\Delta t}{t_p + \Delta t}$ — 0.01 — 0.1

KOE SEMILOGARITHMIC 359-61

Skelly Oil Co. New Mexico Federal G-1

BHP Build-Up
7-23-62 to 8-6-62
Cumulative Production = 345,046 MCF
Avg. Stabilized Producing Rate = 1157 MCFPD
Pseudo Producing Time = 303.5 days
Shut in 7-23-62

Date	Δt	$\frac{\Delta t}{T+\Delta t}$	Pressure
8-1-62	9	0.031	1422
8-6-62	14	0.044	1434

Horner Calculations indicates P_s = 1444 psi
However, curve had probably begun to level off prior to running the survey.
Best estimate of average pressure is halfway between highest measured and extrapolated pressures.

$$P_s = \frac{1442 + 1543}{2} = 1493 \text{ psi}$$

$P^* = 1543$ psi

Slope = 93 psi/cycle

1550
1500
1450
1400

P_{wf} @ 1025 Datum

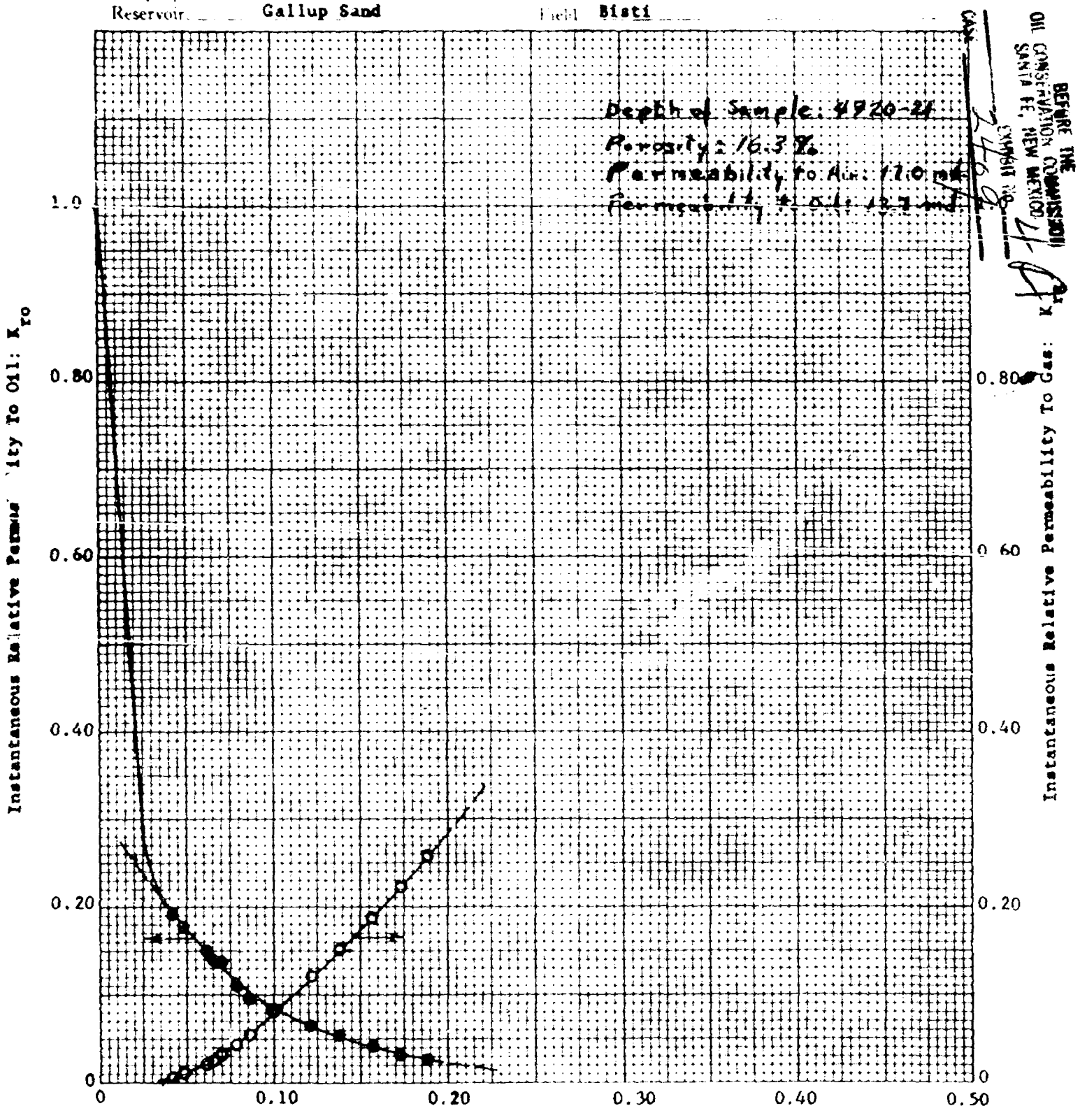
0.01 Dimensionless Time = $\frac{\Delta t}{T+\Delta t}$ 0.1 1.0

PETROLEUM TECHNOLOGISTS, INC

File No. BA-3042-S

INSTANTANEOUS RELATIVE PERMEABILITY TO GAS AND OIL VS. CORRESPONDING GAS PHASE SATURATION

Sample No. 2 The British-American
Company Oil Producing Company Well Maryo "B" No. 4 Depth 4920-21
Reservoir Gallup Sand Field Bisti



BEFORE THE OIL CONSERVATION COMMISSION SANTA FE, NEW MEXICO EXHIBIT NO. 4

Figure 1-5