CASE 6965: GETTY OIL COMPANY TO REOPEN
CASE NO. 6608, LEA COUNTY, NEW MEXICO

CASE NO.

6865

APPLICATION,
TRANSCRIPTS,
SMALL EXHIBITS,

ETC.

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO
9 April 1980

EXAMINER HEARING

IN THE MATTER OF:

Application of Getty Oil Company to re-open Case No. 6608, Lea County, New Mexico.

CASE 6865

BEFORE: Daniel S. Nutter

TRANSCRIPT OF HEARING

A P P E A R A N C E S

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I N D E X

E X H I B I T S

MR. NUTTER: We'll call next Case Number 6865.

MR. PADILLA: Application of Getty Oil Company to re-open Case Number 6608, Lea County, New Mexico.

MR. CARR: May it please the Examiner, I'm William F. Carr, Campbell & Black, P. A., Santa Fe, appearing on behalf of the applicant. I have two witnesses who need to be sworn.

(Witnesses sworn.)

HERMAN W. TERRY

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q. Will you state your name and place of residence?

A. My name is Herman W. Terry. I reside in Hobbs, New Mexico.

Q. Mr. Terry, by whom are you employed and in what capacity?

A. I'm employed by Getty Oil Company as the Area Engineer for the Hobbs Area.

Q. Have you previously testified before this Commission and had your credentials accepted and made a matter of record?

A. Yes, sir, I have.

Q. And were you qualified at that time, as a petroleum engineer?

A. Yes, sir, I was.

Q. Are you familiar with the application in this case and the subject area?

A. Yes, I am.

MR. CARR: Are the witness' qualifications acceptable?

MR. NUTTER: Yes, they are.

Q. Would you briefly state what Getty seeks with this application?

A. We seek -- the purpose of this hearing is to present evidence to establish the proper rate of production for wells in the Grama Ridge-Wolfcamp Pool.

Q. Mr. Terry, would you summarize the events which have led up to this hearing?

A. Yes, sir. The Getty 36 State Com No. 1 Wolfcamp, the Wolfcamp zone was initially tested July 4th, 1979, and an Examiner Hearing was held July 25th, 1979. At this hearing we requested permission to dually complete the well and we further requested temporary oil pool rules,

which provided for 160-acre spacing.

At this hearing it was indicated that with a producing GOR of 5082-to-1,the liquid gravity of 49.7 degrees, and the physical appearance of the liquid, that we were not sure if it was an oil or a gas reservoir.

We requested that the case be re-opened in January of 1980 to allow us time to get further data to determine the actual nature of the reservoir.

Order Number R-6088 entered by the Division on August 28th, 1979, provided for temporary oil pool rules, which provided for 160-acre spacing, and that the case be re-opened in January of 1980.

A re-combination of reservoir gas and liquid was obtained and analyzed by Core Laboratories in Dallas. This re-combination indicated that the Wolfcamp Pool present in this well was in fact a retrograde condensate gas reservoir. This evidence was introduced at the Examiner Hearing held on January 16th, 1980, and it was requested that the Wolfcamp be reclassified as a gas reservoir.

Order Number R-6088-B was entered by the Division on February 26th, 1980. This order reclassified the Grama Ridge-Wolfcamp as a retrograde gas condensate reservoir. It established special pool rules. It established a temporary daily allowable of 1500 Mcf per day, and

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it provided that the case be re-opened at an Examiner Hearing during May, 1980, to present evidence to establish the maximum efficient rate of withdrawal.

It further provided that the -- any cumulative casinghead gas overproduction at the beginning, as of March 1st, 1980, be the beginning status for the well, the gas -- as the beginning gas production status. The order allowed a maximum of three times the monthly allowable as the overproduced status for the well.

Because we were overproduced at this time, we shut the well in on March 4th, 1980. The well was re-opened on April 4th, 1980, at which time the overproduction status was within the three times the monthly allowable. It was opened at a rate of 1500 Mcf per day.

MR. NUTTER: Now the sequence of orders, the first order, 6088, was the one that created the pool and classified it as an oil pool.

A. Yes, sir.

MR. NUTTER: And 6088-A was that nunc pro tunc order that changed the effective date of the 6088 --

A. Yes, sir, I didn't mention that, but essentially all that did was change the effective date of the order.

MR. NUTTER: And 6088-B was the one that reclassified it as a gas reservoir.

A. Yes, sir, that's correct.

MR. NUTTER: Okay.

Q. Mr. Terry, will you refer to what has been marked for identification as Getty Exhibit Number One and review this for Mr. Nutter?

A. Yes, sir. This is a plat of the Grama Ridge area and the subject well, Getty 36 State Com No. 1 is indicated in red. The location of this well is 1980 from the north line, 1650 from the west line, Section 36, Township 21 South, Range 34 East.

This plat also shows several other wells that have been drilled to the Morrow in this area in Sections 1, 2, and 35. These are wells that we've drilled.

The nearest offset wells to the Getty 36 State Com No. 1 is the Getty 36 State Com No. 2, which was completed in December of 1979, and we are presently drilling the Getty 35 State No. 2; we're drilling below 12,000 feet.

Both of these wells have penetrated the Wolfcamp interval. In the Getty 36 State Com No. 2 this interval was found nonporous.

In the Getty 35 State No. 2 the correlative interval in the 36 -- productive interval in the 36-1 was not found in the 35-2 Well.

MR. NUTTER: Which well is the first one

that you mentioned, the Getty State Com No. 2?

A. Yes, sir, that's down in the southeast quarter.

MR. NUTTER: That's on the Sabine lease there?

A. Yes, sir.

MR. NUTTER: Okay, and the Wolfcamp was nonproductive in that one.

A. It was nonporous in that -- in that well.

MR. NUTTER: Okay.

A. It was not -- the same correlative interval was not present in the 35-2 that we are presently drilling.

Q. And the Getty State 36 No. 1 Well, then, is the only well producing from the Grama Ridge-Wolfcamp Gas Pool?

A. Yes, sir, it is.

Q. Mr. Terry, will you now refer to Exhibit Two and review that for Mr. Nutter?

A. Yes, sir, this is a diagrammatic sketch of the dual completion in the Getty 36 State Com No. 1. This has been presented at the other hearings. Basically, I'd like to point out that none of this has been changed. The well is still completed as it was originally completed. This indicates the Wolfcamp perforations to be from 11,320

to 11,335.

Q. Now, Mr. Terry, would you refer to both Exhibits Three and Four and explain the information contained thereon?

A. Yes, sir. Exhibit Three is a tabulation of daily test data. What it is, it's a representative test taken during the week indicated in the far lefthand column, and what I'd like to point out is that by looking at Exhibit Four, this is a graphical representation of this data tabulated in Exhibit Three, and from this it can be seen that beginning approximately the first part of November the gas producing rate has been approximately 2-million per day; the condensate production rate has steadily declined, with the result that our condensate yield has exhibited a steady decline.

This well has been produced on a constant choke size of 13/64ths with one exception, which I'd like to point out this anomaly here in the middle of January. This resulted when the well was shut in for a packer leakage test. When the well was re-opened it was produced for a short period of time on a 14/64ths inch choke at a rate of slightly over 3-million per day and 470 barrels of condensate per day.

MR. NUTTER: What was the size of the choke there?

A. That was 14/64ths inch choke.

The well was then returned to the 13/64ths and the production stabilized to 2-million a day.

The well -- this graph depicts production history up to March the 4th, when the well was shut in due to the overproduced status. The well, as I've indicated earlier, the well was open to production on April 4th at the million and a half per day rate.

Q. Will you now refer to Exhibit Number Five and review this for Mr. Nutter?

A. Exhibit Number Five is a tabulation of monthly -- total monthly production from the Getty 36 State Com No. 1 Wolfcamp completion through February of 1980. February's gas production has been estimated.

It indicates that the well has produced as of March 1st, 1980, a total of 82,258 barrels of condensate, and just over 417-million cubic feet of gas. These total cumulative production figures were used in our material balance calculations, which Mr. Eakin will present later.

Q. Do you have anything further to add to your testimony?

A. No, sir, I don't.

Q. Were Exhibits One through Five prepared either by you or under your direction and supervision?

A. Yes, they were.

MR. CARR: At this time, Mr. Nutter, we would offer into evidence Applicant's Exhibits One through Five.

MR. NUTTER: Exhibits One through Five will be admitted in evidence.

MR. CARR: I have nothing further on direct.

CROSS EXAMINATION

BY MR. NUTTER:

Q. Mr. Terry, after that packer leakage test, you said the well was opened up and put on a 14/64ths inch choke. How long did it produce on that choke?

A. Slightly over one day. It was just slightly over 24 hours, and actually we tried to put it back on the 13 and the choke was hard to read and it was determined later it was -- it was closer to a 14, rather than the 13 we --

Q. And it was on such a short period of time that that increased production isn't reflected in the total monthly production there.

A. No, it was just slightly over 24 hours at most.

Q. Uh-huh. And now you say that --

A. However, it was --

Q. -- since April the 4th the well has returned to an under three times overproduced status and was turned back on.

A. Yes, sir, that's correct.

Q. But it was shut in a total of about 30 days.

A. It was shut in a total of 30 days there and then on the packer leakage test it was shut in approximately 48 hours for that, in January.

Q. Well now, what choke size have you got it on now to hold it down to 1500?

A. I'm not -- I'm not sure.

Q. It would be something less than 13/64ths?

A. Yes, sir, something less than 13.

Q. And you're not trying to produce at the regular setting and then just shut it in for a few days --

A. No, sir.

Q. -- just to stay within that 1500 per day for the month.

A. No, sir, we've stabilized production at 1500 Mcf per day.

Q. Per day?

A. Yes, sir. We'll produce it all month at this rate.

Q. Now in this 36 No. 2, you say the Wolf-

camp was not porous a half a mile to the southeast of the subject well, and the Wolfcamp producing interval was not present in the 35-2 Well.

A. No, sir,the same correlative interval was not present in the 35-2. We did penetrate some Wolfcamp lower to the 36-1 productive interval.

Q. And those two wells are being taken on down to the Morrow, then?

A. Yes, sir, that's correct.

Q. Is the Morrow still producing in this subject well?

A. Yes, sir, it is.

Q. What's it making?

A. Almost 2-million a day.

MR. NUTTER: Are there any further questions of Mr. [illegible]? He may be excused.

MR. CARR: I'd call Mr. Jim Eakin.

JAMES E. EAKIN, JR.

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q. Will you state your name and place of

residence?

A. James E. Eakin, Junior, Midland, Texas.

Q. Mr. Eakin, by whom are you employed and in what capacity?

A. By Getty Oil Company in Midland as Lead Reservoir Engineer

Q. Have you previously testified before this Commission, had your credentials accepted and made a matter of record?

A. Yes, sir.

Q. And were you previously qualified as a petroleum engineer?

A. Yes, sir.

Q. Are you familiar with the subject application and the general area involved in this case?

A. Yes, sir, I am.

MR. CARR: Are the witness' qualifications accepted?

MR. NUTTER: Yes, they are.

Q. Will you please refer to what has been marked for identification as Getty's Exhibit Number Six and review for the Examiner the data contained thereon?

A. Exhibit Number Six is the build up test taken by Jarrel Service, Incorporated, of Hobbs, New Mexico. And this is a buildup test run with the well initially

producing at a rate of 2.2-million a day. The bomb was run in the hole on February 26, with the well flowing; pressures were measured at a depth of 10,485 feet, extrapolated to mid-perfs of 11,328 feet.

Flowing bottom hole pressure at the time the bomb was run in the hole was 3,963 psi. After being shutin on that day and after being shutin for a period of 72 hours, the final builtup pressure at mid-perfs of 11,328, was 4,600 psi.

The third page of this buildup data is a pressure gradient, flowing pressure gradient, taken on February 26th at the time -- prior to the time the well was shutin.

Page four is a semilog plot made by Jarrel Services of the data, showing shutin time versus bottom hole pressure.

Page five of this buildup test is the shutin pressure gradient taken at the end of the 72 hours on February 29th of 1980.

Q. Mr. Eakin, will you now refer to what has been marked Exhibit Number Seven and review this for Mr. Nutter?

A. Exhibit Number Seven is the final reservoir fluid study, prepared by Core Laboratories in Dallas on the subject well.

Since this data, or most of this data, was presented in the preliminary form on January 16th hearing, most of this has been submitted before and I will not go through all of the data again. I'll catch a few high points and note for you the additions to the data from the additional tests that Core Laboratories ran.

On the first page is a letter; indicated that dual samples were taken on September 9th, as Mr. Terry also recounted; that the recombined separator samples were entered into a PVT cell and analysis was then run on that. They determined that it was a retrograde gas condensate reservoir with a dewpoint of 5018 psi.

On page two I'll call attention to paragraphs two and three, which are additional paragraphs concerning the work done since the preliminary analysis. The main points to be gathered here is that a larger volume of the fluid was charged into a larger high pressure cell. As the -- a depletion study was run and as the fluid, or the gas was drawn off of the cell, it was analyzed for composition, and volume measurements were made in order to determine compressibilities or Z factors for the gas produced at each pressure step.

As described in the last -- or next to the last paragraph, the compositions and the volumetric data was used to calculate surface recoveries, and these

calculations should be pointed out that these were formed on the basis of reservoir fluid in place at the dewpoint pressure not the original reservoir pressure.

Page one of the analysis by Core Laboratories is the same as that in the preliminary study. I would call attention to the original reservoir pressure of 7,255 psig at 11,328. This is mid-perfs.

September 12th, 1979, a pressure test at that time indicated 6,846 pounds pressure.

Page two is a repeat of what was in the preliminary report.

The same for page three with the exception of the deviation factors being refined.

Page four is an additional page. This is the depletion study performed by Core Laboratories on the larger volume. This is a -- shows the analysis or the components of the produced well stream from that cell at the various pressures, beginning with the dewpoint pressure of 5,018 pounds and going down to 700 pounds in several steps.

Page five is further data concerning the calculated cumulative recovery during depletion and relates to the different components on the same pressure steps.

Page six is a repetition of the preliminary study; same data was presented there.

Page seven is a graphical representation of the depletion study, showing the components and their percentages as a function of pressure depletion.

Page eight is the deviation factor or the Z factor compressabilities for the well stream gas produced from the cell.

Page nine is the volume of well stream produced during depletion, from pages four and five. This begins with zero cum as of the dewpoint pressure, function of pressure.

Page ten is cumulative recovery during completion. I would point out that we have another exhibit in our analysis, Exhibit Eight, will put this particular recovery in a form which is directly -- can be directly read, as far as depletion pressures, instead of yields, that can be read directly.

Page eleven is the cumulative recovery of plant products in the well stream below dewpoint.

And page twelve is the retrograde liquid accumulation during depletion, percent of hydrocarbon pore space occupied by liquids below dewpoint. This is a repetition of the preliminary study, also.

Q. Mr. Eakin, will you now refer to Getty's Exhibit Number Eight and review this?

A Yes, sir. Exhibit Number Eight is an analysis of the Exhibit Seven and -- excuse me, Six and Seven that we have just covered. This was done by --

MR. NUTTER: Six was the Jarrel Services --

A The bottom hole pressure buildup, yes.

MR. NUTTER: -- report and Seven is the Core Lab report, right?

A Fluid analysis, that is correct, or PVT analysis.

I requested that Dr. Jim Varnon on my staff analyze the buildup data and the PVT analysis from Core Laboratories with the purpose in mind of determining the reserves, reservoir size, any increase in reserves that could be recovered by compression, the percent of recovery of the gas and of the liquids, and if the recovery efficiency was rate sensitive.

I'll take you through the analysis that he has here. We'll start with the cover letter as it brings out the high points of his detailed calculations in the attachment.

The analysis of both of these previous exhibits indicates that this is a limited reservoir, and this is confirmation of a buildup test that was taken in September of '79. The September '79 buildup analysis was not submitted previously because there was an apparent

mechanical failure of the recording equipment during that test and it threw a doubt on the validity of the data, and therefor it was not presented and we decided to wait until a later date and we had a little more cumulative production and we could tie down the reservoir withdrawals and get a material balance calculation that was valid for this well.

Original reservoir pressure, July 4th, '79, 7,255 psi. The buildup pressure on February 29th of 1980, 4,600 psi. That's a decrease of 2,655 psi, which does indicate considerable depletion in the reservoir.

MR. NUTTER: On that Jarrel's report, that 4600 is in the righthand column there. Where are those two columns? The first one is a --

A. The first one is the actual measured depth at which the pressure bomb was located, 10,485 feet.

MR. NUTTER: Uh-huh, that's the actual depth.

A. That's the actual depth of the pressure measuring device.

The second column, 11,328 feet, is the mid-perfs location, and this is an extrapolated pressure found at 10,485, using the pressure gradients.

MR. NUTTER: He did not lower the bomb to the mid-perfs, then.

A. No, sir, did not.

MR. NUTTER: So that's an extrapolated pressure to mid-perfs.

A. Yes, sir.

MR. NUTTER: Okay, go ahead.

A. All right. Transmissibility, or normally referred to as kh, was calculated from the buildup as 288 millidarcy feet.

Skin factor calculated as +17, which is rather high. I will explain that further down in the letter.

The reservoir pressure drawdown for the 2.2-million cubic feet per day rate was 193 psi.

Original separator gas reserves with surface compression, 2.46 billion cubic feet of gas. That is approximately 72 percent.

Q. That's without.

A. Excuse me, what did I say? Oh, without, pardon me. The first one here is without surface compression, 2.46 billion cubic feet of gas. This is approximately 72 percent of the original gas in place.

With surface compression the recovery would be 2.73 billion cubic feet of gas, or 80 percent recovery of the original gas in place. This would be an increase of 270 million cubic feet of gas, an increase of 8 percent.

MR. NUTTER: What kind of surface compression are you talking about there?

A. This would be taking pressure from zero wellhead pressure up to 500 pounds line pressure.

MR. NUTTER: In other words, you're producing down to zero surface pressure.

A. Zero surface pressure.

MR. NUTTER: And the other one would be just down to 500?

A. Down to the line pressure of 500 pounds.

MR. NUTTER: Okay, so this is down to --

A. We'll cover this a little bit more in detail in the -- his detailed analysis in the back. I'll go through this and point these out.

MR. NUTTER: Okay.

A. All right. The original condensate reserves without surface compression, 147,000 stock tank barrels. This is 18.9 percent recovery.

With surface compression, 151,000 stock tank barrels, a 19.4 percent recovery of the original liquids in place. This is an increase of 4000 barrels of condensate. This is only a half of 1 percent increase in recovery.

Further down in the letter he indicates that the large skin factor is caused by the narrow perforated interval in this well and can be eliminated at any time by

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additional perforations.

The perforated interval is approximately 16 feet out of a 116 feet gross pay, approximately 94 feet net pay. The small pressure drawdown, 193 psi, is the result of the large reservoir kh, good permeability, thick reservoir, and low production rate, 2.2 million per day, which is an indication that the rate could be increased considerably without any expected effect on the ultimate recovery.

Liquid yield, as indicated in his last paragraph summing this up, has dropped from 230 stock tank barrels per day -- excuse me, stock tank barrels per million, to 125 stock tank barrels per million, and it will continue to drop below 50 barrels per million.

Pressure maintenance, he indicates, is probably not feasible. We'll describe this later. And is less feasible as liquids drop out in the reservoir.

To eliminate confusion on the next three pages, which he has marked as Exhibits 1, 2, and 3, I will refer to those as the attachment exhibits, 1, 2, and 3.

If you would mark this attachment exhibit 1, or hold this place, and turn to the first page of his detailed analysis, and follow me through on the high points of his detailed analysis here.

Paragraph I, he describes that a log-log

plot was prepared of this buildup data, but that all of the afterflow had taken place before the first data point was recorded or indicated, and therefor the log-log plot was a flat line and had no significance, so therefor it was not included in this attachment.

Second paragraph, a semilog plot is Exhibit 1, which I asked you to hold the place there. The thing to note here is that this curve is typical of a limited reservoir and also of a good reservoir in its producing characteristics, in that it builds up rather rapidly, and you will note that at a shutin time of .25 Delta T, which is your shutin time in hours, approximately 15 minutes, almost all of the pressure has been builtup at that time, at about 40 pounds away from final buildup pressure.

Slope calculations of the final buildup stages on this well show a $\bar{P}$ of 4600 psig, slope of 30 psi per cycle, from which is calculated the 288 millidarcy feet, using 94 net feet of pay in this well, calculate a 3.1 millidarcies as permeability for the well.

Skin factor calculations are shown. The ΔP skin of 444 psi appears very high, and that's the reason the skin factor is calculated high, and this is really a restriction, partial restriction due to the limited number of perfs and it would have to be additionally perforated near the end of its life in order to draw the pressure on

down.

Pressure drawdown of the reservoir itself to achieve a 2.2 million rate is only 193 pounds, and this is a very small reservoir drawdown for the amount of depletion, the 2655 psi drawdown that we have had on the reservoir.

This is one indication that this well produces, or the reservoir produces, almost like a tank, which is similar to the cell in which Core Laboratories ran their analysis. This is indicative or significant later in this -- in his analysis here.

Page two of his detailed work, paragraph III, is basic data for buildup calculation, showing 94 feet of net pay in the wellbore; porosity of 15 percent; water saturation 20 percent; reservoir temperature, of course, 196 degrees Fahrenheit.

Paragraph IV a steady state rate prediction in which he calculated a rate that corresponds -- a theoretical rate which corresponds very well with the actual producing rate of 2.2 million.

Page three and page four is the determination of abandonment pressure of the reservoir. He goes through his calculations. Significantly, he has used the 200 pounds, or approximately 200 pounds as the reservoir differential in order for the well to produce down to aban-

donment pressures, and assumed a skin factor, or a ΔP skin of zero, presuming that we would additionally perforate the well in the later stages of its production.

On page four, top of page four, he indicates that with no surface compressor, Pwh, or wellhead pressure of 500 pounds line pressure, that the abandonment pressure in the reservoir would be 1300 psi.

With surface compressor, the wellhead pressure would be drawn down to zero compressor suction. The reservoir abandonment pressure would be 1000 psi.

We observed no water production at all for this well, other than, I believe, the very first day of production, which a little bit of the stimulation water.

On page four the reserves paragraph, paragraph VI, A, is the original gas in place calculation of 4.1 billion cubic feet of gas.

Page five, under B, is the reserves of gas and condensate, and this is shown graphically, this is taken from Core Laboratories depletion and flash calculations and is shown graphically as Exhibit 2, if you would turn to the attached Exhibit 2.

This is the cumulative production , cumulative separator gas scale at the bottom and the bottom curve, cumulative condensate stock tank barrels for the scale at the top and the top -- uppermost curve, versus

reservoir pressure. You can see the initial reservoir pressure of 7,255 pounds and the test in September of about 6846, and the current pressure indicated there of about 4600 psi.

The predicted data, this is an unusual reservoir, the predicted data from Core Laboratories information and from their analysis, is the solid line; another evidence that this is producing similar to a tank or similar to Core Laboratories analysis is that the field data, the points located within the circles, fall almost on top of the predicted line.

This is almost a textbook case. We seldom ever see this in actual practice.

By looking at -- reading in at the abandonment reservoir pressures, you can read directly the cumulative gas and the cumulative condensate to be recovered from this reservoir.

Back on page five of his detailed work, these numbers -- we've outlined these numbers. Lower portion of the page, without surface compression, the abandonment pressure reservoir-wise would be 1300 psig; gas reserves, 2,460 MMCF; condensate reserves, 147,000 stock tank barrels.

With surface compression, reservoir abandonment pressure of 1000 psig; gas reserves, 2,760 -- excuse me, 2,730 MMCF; condensate reserves of 151,000 barrels.

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On page six, C, --

MR. NUTTER: Excuse me, Exhibit 2 there, which shows your cumulative condensate and separator gas, this is taking it down to that reservoir abandonment pressure of 1300 pounds, isn't it?

A. Yes, it is extrapolated on down to 1000. You can see the dashed line is the extrapolation of those --

MR. NUTTER: Right, where their points meet there at 1300, apparently.

A. Yes.

MR. NUTTER: And that's the -- where you get the 147,000 barrels of condensate and the 2700 -- or wait a minute -- and 2460 --

A. Yes, sir.

MR. NUTTER: -- million cubic feet.

A. Yes, sir. The only reason these curves cross at that point is that -- the way the scale was presented. A different scale would have had them cross at different points.

By readingit at 1000 pounds and extrapolated lines on this, you'd come out with these other -- the other reserve numbers.

MR. NUTTER: Go ahead.

A. Okay. On page six, paragraph C, liquid yield versus cumulative gas production, is the attachment

Exhibit 3, another example of the field data falling very close to the prediction, and another indication of it being produced like a tank.

This is a slightly different representation, or presentation, compared to I believe it was Exhibit Four, where Mr. Terry presented, showing yields and producing rates versus time. This is the yield versus cumulative gas production.

You'll notice that the prediction has a very sharp drop in the yields, and it also indicated that the field data is following this very well, not that we're happy about that.

Paragraph D on page six is a reservoir radius, or calculations that can be used to determine approximate reservoir extent. Calculations from 4.1 billion cubic feet of gas indicate an acre feet of 2,585. From this using the net pay observed in the wellbore of 94 feet, a circular reservoir would have a radius of 618 feet. This is equivalent to approximately 28 acres in areal extent.

If an average pay thickness of the reservoir is used of 47 feet, you come up with 873 feet for the radius and equivalent acreage of 55 acres. This is a very small reservoir, obviously.

MR. NUTTER: What was the 618 feet?

A. The 618 feet is equivalent to approxi-

mately 28 acres.

MR. NUTTER: 28 acres.

A. And the 873, approximately 55 acres.

This limited reservoir is confirmed by the Exhibit One, the plat that Mr. Terry presented, showing that the nearest wells, which are approximately half a mile in distance from this well, have not penetrated the same interval.

On page seven, paragraph E, Mr. Varnon has prepared some additional information and some remarks concerning the additional recovery.

It shows that the original gas in place, 4.1 billion cubic feet of gas; shows a recovery of approximately 80 percent; original stock tank liquids in place of 778,000 stock tank barrels, with a recovery efficiency of approximately 19 percent.

He indicates in his write-up here in this last main paragraph, the pressure depletion will give excellent gas recovery but will leave some 627,000 stock tank barrels of condensate in the ground. It may be advisable to consider some type of inert gas pressure maintenance project, but there are some discouraging factors to be considered with any type of pressure maintenance on this reservoir.

First, is that due to the limited size and the wells that have already been drilled offsetting this,

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near offsets, and then we have not penetrated, and probably will not penetrate this reservoir with any other wells, that the potential reserves are not large enough to support much, if any, expense to develop any source of injection gas, whether it be inert, nitrogen, CO_2, any type of additional recovery for pressure maintenance.

The reservoir pressure is already below dewpoint and he indicates that retrograde dropout is about 70 percent of the maximum already.

MR. NUTTER: It's already achieved 70 percent dropout?

A. Dropout, of what it would dropout, and its revaporization with inert gas is, or may not be possible.

Sould another well be drilled -- should another well penetrate this, the recovery would be not the best, sweep efficiency would not be the best with a two-well reservoir, sweeping between two wells. We would not get a pattern effect or areal sweep; probably channel straight through is the case most times with either water injection, waterflood operations, or gas injection or cycling project.

Q. Now, Mr. Eakin, you may have testified to this, but let me be sure I understand it. Is this reservoir, in your opinion, rate sensitive?

A. There are a couple of things that we can mention concerning whether or not it's rate sensitive,

based on exhibits that we've seen and data of drilling the well.

We have had no indication of any kind that this reservoir contains any mobile fines, or any movable small particles in the reservoir that might move toward the wellbore and plug it, causing a restriction or reducing the ability due to rate.

There's no indication of any water influx to the reservoir. It appears to be a closed reservoir, depletion type drive, and therefo; a restriction of the rate in order to have withdrawals less than a water influx to maintain the pressure above the dewpoint is not -- is not feasible. And on this basis, if there is no water influx, it's not possible to outrun a drive mechanism, a water drive type mechanism, since there's no water drive.

This data is confirmed, or the rate sensitivity is confirmed, partially by Exhibit Four, if you'll refer to that, at the same size choke, a 13/64ths, held a constant rate of about 2-million a day for several months, approximately November, October and November, through March with no indication at the surface that there was any problems with producing -- or with production.

The reservoir pressure has been estimated to be below dewpoint, approximately mid to late January of 1980, and you can then see by the exhibit Four that there was

no drastic change in the producing characteristics either by rate or by yield, and that the well is also capable of producing 3 billion a day with no significant changes to rates or yields, shown on that same exhibit.

Q. Do you have a recommendation to make to the Examiner concerning the maximum rates with withdrawal from this reservoir?

A. We would recommend the rate of 3-million cubic feet a day, based on the capabilities or capacities of the production facilities on that lease.

Q. And are you requesting that this order be made retroactive to March 1, 1980?

A. Yes, sir, we are asking that it be made retroactive to March 1, which was the date the last order set the rate of a million and a half a day until a maximum effective rate could be determined. We ask that it be made retroactive to that.

Q. Mr. Eakin, in your opinion will granting this application be in the interest of conservation, the prevention of waste, and the protection of correlative rights?

A. Yes, sir, I do.

Q. Have you reviewed Exhibits Six through Eight and can you testify from your own information and your own knowledge as to their accuracy?

A. Yes, sir.

MR. CARR: At this time, Mr. Examiner, we would offer into evidence Getty Exhibits Six through Eight.

MR. NUTTER: Getty Exhibits Six through Eight will be admitted in evidence.

CROSS EXAMINATION

BY MR. NUTTER:

Q. Now, Mr. Eakin, you've likened this a number of times in your testimony to producing gas out of a tank.

A. Yes, sir, that's right.

Q. We've already got 70 percent of the liquids in the gas have dropped out in the reservoir, and we can see that the condensate production is going down rather rapidly, which I suppose is a reflection of this condensate having dropped out --

A. Yes, sir.

Q. -- and not being producable now.

A. Yes, sir. The assumption is that the -- and the calculations that the -- in Mr. Varnon's analysis -- that the liquid that has dropped out is not mobile.

Q. Just dropped out to the bottom of the tank and it's sitting there?

A. Well, it's not actually a tank. That would be great. We could put a pump on it and produce it. It does -- the reason we say it produces like a tank is that the pressure response throughout the reservoir, because it is a small reservoir, because of the permeability and porosity in this reservoir, that the pressure response to the boundaries is very rapid, similar to what you would have in a tank. It is similar in its producing characteristics. It is not a tank; it only represents it.

Q. Yeah, well, I can see when you're talking about a radius of drainage of either 618 or 873 feet that you don't have a very large reservoir there, and of course, the smaller the reservoir, the less effect a rapid drawdown would have.

What I had visualized on this reservoir was a bigger structure and with a high rate of withdrawal, a rapid depletion of pressure around the wellbore with a resultant dropout of fluids and a reduction of the permeability of the reservoir's gas, because of the liquids that had dropped out around the wellbore. But you don't feel that's happening here?

A. No, sir, it does not appear to be.

Q. You're having a more --

A. The rapid response.

Q. You're having a more uniform dropout

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throughout the reservoir.

A. That is correct, sir.

Q. Because of its small size.

A. Right, pressure is coming down in the entire reservoir very rapidly, or I say timewise very rapidly from the response. The response to the boundaries of the reservoir is very rapid and therefor your pressure is coming down throughout the reservoir --

Q. Uniformly.

A. -- uniformly, and the pressure, the drop-out appears to be throughout the reservoir with no response -- or no restriction in rate due to dropout of the liquids near the wellbore.

Q. I'd like to figure out some way where we could write an order that's going to produce 627,000 stock tank barrels of condensate that Varnon says is in the ground and going to stay there.

A. I wish we could, too. I could point out that in quite a few of the oil reservoirs that are depletion type drive, that 19 - 20 percent, some of our reservoirs, the San Andres and others, that 15 percent recovery by primary methods is -- is normal, and requires waterflooding when the reservoirs are large enough.

Q. Well, we have some depletion type reservoirs that get 35 percent, too,

MR. NUTTER: Are there any further questions of Mr. Eakin? He may be excused.

Do you have anything further, Mr. Carr?

MR. CARR: Nothing further, Mr. Nutter.

MR. NUTTER: Does anyone have anything to offer in Case Number 6865?

We'll take the case under advisement.

(Hearing concluded.)

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REPORTER'S CERTIFICATE

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

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I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 6865 heard by me on 4/9 1980.

Examiner
Oil Conservation Division

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO
9 April 1980

EXAMINER HEARING

IN THE MATTER OF:

Application of Getty Oil Company to re-open Case No. 6608, Lea County, New Mexico. CASE 6865

BEFORE: Daniel S. Nutter

TRANSCRIPT OF HEARING

A P P E A R A N C E S

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I N D E X

E X H I B I T S

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MR NUTTER: We'll call next Case Number 6865.

MR. PADILLA: Application of Getty Oil Company to re-open Case Number 6608, Lea County, New Mexico.

MR. CARR: May it please the Examiner, I'm William F. Carr, Campbell & Black, P. A., Santa Fe, appearing on behalf of the applicant. I have two witnesses who need to be sworn.

(Witnesses sworn.)

HERMAN W. TERRY

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q Will you state your name and place of residence?

A My name is Herman W. Terry. I reside in Hobbs, New Mexico.

Q Mr. Terry, by whom are you employed and in what capacity?

A I'm employed by Getty Oil Company as the Area Engineer for the Hobbs Area.

Q. Have you previously testified before this Commission and had your credentials accepted and made a matter of record?

A. Yes, sir, I have.

Q. And were you qualified at that time, as a petroleum engineer?

A. Yes, sir, I was.

Q. Are you familiar with the application in this case and the subject area?

A. Yes, I am.

MR. CARR: Are the witness' qualifications acceptable?

MR. NUTTER: Yes, they are.

Q. Would you briefly state what Getty seeks with this application?

A. We seek -- the purpose of this hearing is to present evidence to establish the proper rate of production for wells in the Grama Ridge-Wolfcamp Pool.

Q. Mr. Terry, would you summarize the events which have led up to this hearing?

A. Yes, sir. The Getty 36 State Com No. 1 Wolfcamp, the Wolfcamp zone was initially tested July 4th, 1979, and an Examiner Hearing was held July 25th, 1979. At this hearing we requested permission to dually complete the well and we further requested temporary oil pool rules,

which provided for 160-acre spacing.

At this hearing it was indicated that with a producing GOR of 5082-to-1,the liquid gravity of 49.7 degrees, and the physical appearance of the liquid, that we were not sure if it was an oil or a gas reservoir.

We requested that the case be re-opened in January of 1980 to allow us time to get further data to determine the actual nature of the reservoir.

Order Number R-6088 entered by the Division on August 28th, 1979, provided for temporary oil pool rules, which provided for 160-acre spacing, and that the case be re-opened in January of 1980.

A re-combination of reservoir gas and liquid was obtained and analyzed by Core Laboratories in Dallas. This re-combination indicated that the Wolfcamp Pool present in this well was in fact a retrograde condensate gas reservoir. This evidence was introduced at the Examiner Hearing held on January 16th, 1980, and it was requested that the Wolfcamp be reclassified as a gas reservoir.

Order Number R-6088-B was entered by the Division on February 26th, 1980. This order reclassified the Grama Ridge-Wolfcamp as a retrograde gas condensate reservoir. It established special pool rules. It established a temporary daily allowable of 1500 Mcf per day, and

it provided that the case be re-opened at an Examiner Hearing during May, 1980, to present evidence to establish the maximum efficient rate of withdrawal.

It further provided that the -- any cumulative casinghead gas overproduction at the beginning, as of March 1st, 1980, be the beginning status for the well, the gas -- as the beginning gas production status. The order allowed a maximum of three times the monthly allowable as the overproduced status for the well.

Because we were overproduced at this time, we shut the well in on March 4th, 1980. The well was re-opened on April 4th, 1980, at which time the overproduction status was within the three times the monthly allowable. It was opened at a rate of 1500 Mcf per day.

MR. NUTTER: Now the sequence of orders, the first order, 6088, was the one that created the pool and classified it as an oil pool.

A. Yes, sir.

MR. NUTTER: And 6088-A was that nunc pro tunc order that changed the effective date of the 6088 --

A. Yes, sir, I didn't mention that, but essentially all that did was change the effective date of the order.

MR. NUTTER: And 6088-B was the one that reclassified it as a gas reservoir.

A. Yes, sir, that's correct.

MR. NUTTER: Okay.

Q. Mr. Terry, will you refer to what has been marked for identification as Getty Exhibit Number One and review this for Mr. Nutter?

A. Yes, sir. This is a plat of the Grama Ridge area and the subject well, Getty 36 State Com No. 1 is indicated in red. The location of this well is 1980 from the north line, 1650 from the west line, Section 36, Township 21 South, Range 34 East.

This plat also shows several other wells that have been drilled to the Morrow in this area in Sections 1, 2, and 35. These are wells that we've drilled.

The nearest offset wells to the Getty 36 State Com No. 1 is the Getty 36 State Com No. 2, which was completed in December of 1979, and we are presently drilling the Getty 35 State No. 2; we're drilling below 12,000 feet.

Both of these wells have penetrated the Wolfcamp interval. In the Getty 36 State Com No. 2 this interval was found nonporous.

In the Getty 35 State No. 2 the correlative interval in the 36 -- productive interval in the 36-1 was not found in the 35-2 well.

MR. NUTTER: Which well is the first one

that you mentioned, the Getty State Com No. 2?

A. Yes, sir, that's down in the southeast quarter.

MR. NUTTER: That's on the Sabino lease there?

A. Yes, sir.

MR. NUTTER: Okay, and the Wolfcamp was nonproductive in that one.

A. It was nonporous in that -- in that well.

MR. NUTTER: Okay.

A. It was not -- the same correlative interval was not present in the 35-2 that we are presently drilling.

Q. And the Getty State 36 No. 1 Well, then, is the only well producing from the Grama Ridge-Wolfcamp Gas Pool?

A. Yes, sir, it is.

Q. Mr. Terry, will you now refer to Exhibit Two and review that for Mr. Nutter?

A. Yes, sir, this is a diagrammatic sketch of the dual completion in the Getty 36 State Com No. 1. This has been presented at the other hearings. Basically, I'd like to point out that none of this has been changed. The well is still completed as it was originally completed. This indicates the Wolfcamp perforations to be from 11,320

to 11,335.

Q Now, Mr. Terry, would you refer to both Exhibits Three and Four and explain the information contained thereon?

A Yes, sir. Exhibit Three is a tabulation of daily test data. What it is, it's a representative test taken during the week indicated in the far lefthand column, and what I'd like to point out is that by looking at Exhibit Four, this is a graphical representation of this data tabulated in Exhibit Three, and from this it can be seen that beginning approximately the first part of November the gas producing rate has been approximately 2-million per day; the condensate production rate has steadily declined, with the result that our condensate yield has exhibited a steady decline.

This well has been produced on a constant choke size of 13/64ths with one exception, which I'd like to point out this anomaly here in the middle of January. This resulted when the well was shut in for a packer leakage test. When the well was re-opened it was produced for a short period of time on a 14/64ths inch choke at a rate of slightly over 3-million per day and 470 barrels of condensate per day.

MR. NUTTER: What was the size of the choke there?

A. That was 14/64ths inch choke.

The well was then returned to the 13/64ths and the production stabilized to 2-million a day.

The well -- this graph depicts production history up to March the 4th, when the well was shut in du to the overproduced status. The well, as I've indicated earlier, the well was open to production on April 4th at the million and a half per day rate.

Q. Will you now refer to Exhibit Number Five and review this for Mr. Nutter?

A. Exhibit Number Five is a tabulation of monthly -- total monthly production from the Getty 36 State Com No. 1 Wolfcamp completion through February of 1980. February's gas production has been estimated.

It indicates that the well has produced as of March 1st, 1980, a total of 82,258 barrels of condensate, and just over 417-million cubic feet of gas. These total cumulative production figures were used in our material balance calculations, which Mr. Eakin will present later.

Q. Do you have anything further to add to your testimony?

A. No, sir, I don't.

Q. Were Exhibits One through Five prepared either by you or under your direction and supervision?

A. Yes, they were.

MR. CARR: At this time, Mr. Nutter, we would offer into evidence Applicant's Exhibits One through Five.

MR. NUTTER: Exhibits One through Five will be admitted in evidence.

MR. CARR: I have nothing further on direct.

CROSS EXAMINATION

BY MR. NUTTER:

Q. Mr. Terry, after that packer leakage test, you said the well was opened up and put on a 14/64ths inch choke. How long did it produce on that choke?

A. Slightly over one day. It was just slightly over 24 hours, and actually we tried to put it back on the 13 and the choke was hard to read and it was determined later it was -- it was closer to a 14, rather than the 13 we --

Q. And it was on such a short period of time that that increased production isn't reflected in the total monthly production there.

A. No, it was just slightly over 24 hours at most.

Q. Uh-huh. And now you say that --

A. However, it was --

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Q -- since April the 4th the well has returned to an under three times overproduced status and was turned back on.

A Yes, sir, that's correct.

Q But it was shut in a total of about 30 days.

A It was shut in a total of 30 days there and then on the packer leakage test it was shut in approximately 48 hours for that, in January.

Q Well now, what choke size have you got it on now to hold it down to 1500?

A I'm not -- I'm not sure.

Q It would be something less than 13/64ths?

A Yes, sir, something less than 13.

Q And you're not trying to produce at the regular setting and then just shut it in for a few days --

A No, sir.

Q -- just to stay within that 1500 per day for the month.

A No, sir, we've stabilized production at 1300 Mcf per day.

Q Per day?

A Yes, sir. We'll produce it all month at this rate.

Q Now in this 36No. 2, you say the Wolf-

camp was not porous a half a mile to the southeast of the subject well, and the Wolfcamp producing interval was not present in the 35-2 Well.

A. No, sir, the same correlative interval was not present in the 35-2. We did penetrate some Wolfcamp lower to the 36-1 productive interval.

Q. And those two wells are being taken on down to the Morrow, then?

A. Yes, sir, that's correct.

Q. Is the Morrow still producing in this subject well?

A. Yes, sir, it is.

Q. What's it making?

A. Almost 2-million a day.

MR. NUTTER: Are there any further questions of Mr. Terry? He may be excused.

MR. CARR: I'd call Mr. Jim Eakin.

JAMES E. EAKIN, JR.

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q. Will you state your name and place of

residence?

A. James E. Eakin, Junior, Midland, Texas.

Q. Mr. Eakin, by whom are you employed and in what capacity?

A. By Getty Oil Company in Midland as Lead Reservoir Engineer.

Q. Have you previously testified before this Commission, had your credentials accepted and made a matter of record?

A. Yes, sir.

Q. And were you previously qualified as a petroleum engineer?

A. Yes, sir.

Q. Are you familiar with the subject application and the general area involved in this case?

A. Yes, sir, I am.

MR. CARR: Are the witness' qualifications accepted?

MR. NUTTER: Yes, they are.

Q. Will you please refer to what has been marked for identification as Getty's Exhibit Number Six and review for the Examiner the data contained thereon?

A. Exhibit Number Six is the build up test taken by Jarrel Service, Incorporated, of Hobbs, New Mexico. And this is a buildup test run with the well initially

producing at a rate of 2.2-million a day. The bomb was run in the hole on February 26, with the well flowing; pressures were measured at a depth of 10,485 feet, extrapolated to mid-perfs of 11,328 feet.

Flowing bottom hole pressure at the time the bomb was run in the hole was 3,963 psi. After being shutin on that day and after being shutin for a period of 72 hours, the final builtup pressure at mid-perfs of 11,328, was 4,600 psi.

The third page of this buildup data is a pressure gradient, flowing pressure gradient, taken on February 26th at the time -- prior to the time the well was shutin.

Page four is a semilog plot made by Jarrel Services of the data, showing shutin time versus bottom hole pressure.

Page five of this buildup test is the shutin pressure gradient taken at the end of the 72 hours on February 29th of 1980.

Q. Mr. Eakin, will you now refer to what has been marked Exhibit Number Seven and review this for Mr. Nutter?

A. Exhibit Number Seven is the final reservoir fluid study, prepared by Core Laboratories in Dallas on the subject well.

Since this data, or most of this data, was presented in the preliminary form on January 16th hearing, most of this has been submitted before and I will not go through all of the data again. I'll catch a few high points and note for you the additions to the data from the additional tests that Core Laboratories ran.

On the first page is a letter; indicated that dual samples were taken on September 9th, as Mr. Terry also recounted; that the recombined separator samples were entered into a PVT cell and analysis was then run on that. They determined that it was a retrograde gas condensate reservoir with a dewpoint of 5018 psi.

On page two I'll call attention to paragraphs two and three, which are additional paragraphs concerning the work done since the preliminary analysis. The main points to be gathered here is that a larger volume of the fluid was charged into a larger high pressure cell. As the -- a depletion study was run and as the fluid, or the gas was drawn off of the cell, it was analyzed for composition, and volume measurements were made in order to determine compressibilities or Z factors for the gas produced at each pressure step.

As described in the last -- or next to the last paragraph, the compositions and the volumetric data was used to calculate surface recoveries, and these

calculations should be pointed out that these were formed on the basis of reservoir fluid in place at the dewpoint pressure not the original reservoir pressure.

Page one of the analysis by Core Laboratories is the same as that in the preliminary study. I would call attention to the original reservoir pressure of 7,255 psig at 11,328. This is mid-perfs.

September 12th, 1979, a pressure test at that time indicated 6,846 pounds pressure.

Page two is a repeat of what was in the preliminary report.

The same for page three with the exception of the deviation factors being refined.

Page four is an additional page. This is the depletion study performed by Core Laboratories on the larger volume. This is a -- shows the analysis or the components of the produced well stream from that cell at the various pressures, beginning with the dewpoint pressure of 5,018 pounds and going down to 700 pounds in several steps.

Page five is further data concerning the calculated cumulative recovery during depletion and relates to the different components on the same pressure steps.

Page six is a repetition of the preliminary study; same data was presented there.

Page seven is a graphical representation of the depletion study, showing the components and their percentages as a function of pressure depletion.

Page eight is the deviation factor or the Z factor compressabilities for the well stream gas produced from the cell.

Page nine is the volume of well stream produced during depletion, from pages four and five. This begins with zero cum as of the dewpoint pressure, function of pressure.

Page ten is cumulative recovery during completion. I would point out that we have another exhibit in our analysis, Exhibit Eight, will put this particular recovery in a form which is directly -- can be directly read, as far as depletion pressures, instead of yields, that can be read directly.

Page eleven is the cumulative recovery of plant products in the well stream below dewpoint.

And page twelve is the retrograde liquid accumulation during depletion, percent of hydrocarbon pore space occupied by liquids below dewpoint. This is a repetition of the preliminary study, also.

Q Mr. Eakin, will you now refer to Getty's Exhibit Number Eight and review this?

A. Yes, sir. Exhibit Number Eight is an analysis of the Exhibit Seven and -- excuse me, Six and Seven that we have just covered. This was done by --

MR. NUTTER: Six was the Jarrel Services --

A. The bottom hole pressure buildup, yes.

MR. NUTTER: -- report and Seven is the Core Lab report, right?

A. Fluid analysis, that is correct, or PVT analysis.

I requested that Dr. Jim Varnon on my staff analyze the buildup data and the PVT analysis from Core Laboratories with the purpose in mind of determining the reserves, reservoir size, any increase in reserves that could be recovered by compression, the percent of recovery of the gas and of the liquids, and if the recovery efficiency was rate sensitive.

I'll take you through the analysis that he has here. We'll start with the cover letter as it brings out the high points of his detailed calculations in the attachment.

The analysis of both of these previous exhibits indicates that this is a limited reservoir, and this is confirmation of a buildup test that was taken in September of '79. The September '79 buildup analysis was not submitted previously because there was an apparent

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mechanical failure of the recording equipment during that test and it threw a doubt on the validity of the data, and therefor it was not presented and we decided to wait until a later date and we had a little more cumulative production and we could tie down the reservoir withdrawals and get a material balance calculation that was valid for this well.

Original reservoir pressure, July 4th, '79, 7,255 psi. The buildup pressure on February 29th of 1980, 4,600 psi. That's a decrease of 2,655 psi, which does indicate considerable depletion in the reservoir.

MR. NUTTER: On that Jarrel's report, that 4600 is in the righthand column there. Where are those two columns? The first one is a --

A. The first one is the actual measured depth at which the pressure bomb was located, 10,485 feet.

MR. NUTTER: Uh-huh, that's the actual depth.

A. That's the actual depth of the pressure measuring device.

The second column, 11,328 feet, is the mid-perfs location, and this is an extrapolated pressure found at 10,485, using the pressure gradients.

MR. NUTTER: He did not lower the bomb to the mid-perfs, then.

A. No, sir, did not.

MR. NUTTER: So that's an extrapolated pressure to mid-perfs.

A. Yes, sir.

MR. NUTTER: Okay, go ahead.

A. All right. Transmissibility, or normally referred to as kh, was calculated from the buildup as 288 millidarcy feet.

Skin factor calculated as +17, which is rather high. I will explain that further down in the letter.

The reservoir pressure drawdown for the 2.2-million cubic feet per day rate was 193 psi.

Original separator gas reserves with surface compression, 2.46 billion cubic feet of gas. That is approximately 72 percent.

Q. That's without.

A. Excuse me, what did I say? Oh, without, pardon me. The first one here is without surface compression, 2.46 billion cubic feet of gas. This is approximately 72 percent of the original gas in place.

With surface compression the recovery would be 2.73 billion cubic feet of gas, or 80 percent recovery of the original gas in place. This would be an increase of 270 million cubic feet of gas, an increase of 8 percent.

MR. NUTTER: What kind of surface compression are you talking about there?

A. This would be taking pressure from zero wellhead pressure up to 500 pounds line pressure.

MR. NUTTER: In other words, you're producing down to zero surface pressure.

A. Zero surface pressure.

MR. NUTTER: And the other one would be just down to 500?

A. Down to the line pressure of 500 pounds.

MR. NUTTER: Okay, so this is down to --

A We'll cover this a little bit more in detail in the -- his detailed analysis in the back. I'll go through this and point these out.

MR NUTTER: Okay.

A All right. The original condensate reserves without surface compression, 147,000 stock tank barrels. This is 18.9 percent recovery.

With surface compression, 151,000 stock tank barrels, a 19.4 percent recovery of the original liquids in place. This is an increase of 4000 barrels of condensate. This is only a half of 1 percent increase in recovery.

Further down in the letter he indicates that the large skin factor is caused by the narrow perforated interval in this well and can be eliminated at any time by

additional perforations.

The perforated interval is approximately 16 feet out of a 116 feet gross pay, approximately 94 feet net pay. The small pressure drawdown, 193 psi, is the result of the large reservoir kh, good permeability, thick reservoir, and low production rate, 2.2 million per day, which is an indication that the rate could be increased considerably without any expected effect on the ultimate recovery.

Liquid yield, as indicated in his last paragraph summing this up, has dropped from 230 stock tank barrels per day -- excuse me, stock tank barrels per million, to 125 stock tank barrels per million, and it will continue to drop below 50 barrels per million.

Pressure maintenance, he indicates, is probably not feasible. We'll describe this later. And is less feasible as liquids drop out in the reservoir.

To eliminate confusion on the next three pages, which he has marked as Exhibits 1, 2, and 3, I will refer to those as the attachment exhibits, 1, 2, and 3.

If you would mark this attachment exhibit 1, or hold this place, and turn to the first page of his detailed analysis, and follow me through on the high points of his detailed analysis here.

Paragraph I, he describes that a log-log

plot was prepared of this buildup data, but that all of the afterflow had taken place before the first data point was recorded or indicated, and therefor the log-log plot was a flat line and had no significance, so therefor it was not included in this attachment.

Second paragraph, a semilog plot is Exhibit 1, which I asked you to hold the place there. The thing to note here is that this curve is typical of a limited reservoir and also of a good reservoir in its producing characteristics, in that it builds up rather rapidly, and you will note that at a shutin time of .25 Delta T, which is your shutin time in hours, approximately 15 minutes, almost all of the pressure has been builtup at that time, at about 40 pounds away from final buildup pressure.

Slope calculations of the final buildup stages on this well show a $\bar{P}$ of 4600 psig, slope of 30 psi per cycle, from which is calculated the 288 millidarcy feet, using 94 net feet of pay in this well, calculate a 3.1 millidarcies as permeability for the well.

Skin factor calculations are shown. The Δp skin of 444 psi appears very high, and that's the reason the skin factor is calculated high, and this is really a restriction, partial restriction due to the limited number of perfs and it would have to be additionally perforated near the end of its life in order to draw the pressure on

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down.

Pressure drawdown of the reservoir itself to achieve a 2.2 million rate is only 193 pounds, and this is a very small reservoir drawdown for the amount of depletion, the 2655 psi drawdown that we have had on the reservoir.

This is one indication that this well produces, or the reservoir produces, almost like a tank, which is similar to the cell in which Core Laboratories ran their analysis. This is indicative or significant later in this -- in his analysis here.

Page two of his detailed work, paragraph III, is basic data for buildup calculation, showing 94 feet of net pay in the wellbore; porosity of 15 percent; water saturation 20 percent; reservoir temperature, of course, 196 degrees Fahrenheit.

Paragraph IV a steady-state rate prediction in which he calculated a rate that corresponds -- a theoretical rate which corresponds very well with the actual producing rate of 2.2 million.

Page three and page four is the determination of abandonment pressure of the reservoir. He goes through his calculations. Significantly, he has used the 200 pounds, or approximately 200 pounds as the reservoir differential in order for the well to produce down to aban-

donment pressures, and assumed a skin factor, or a ΔP skin of zero, presuming that we would additionally perforate the well in the later stages of its production.

On page four, top of page four, he indicates that with no surface compressor, Pwh, or wellhead pressure of 500 pounds line pressure, that the abandonment pressure in the reservoir would be 1300 psi.

With surface compressor, the wellhead pressure would be drawn down to zero compressor suction. The reservoir abandonment pressure would be 1000 psi.

We observed no water production at all for this well, other than, I believe, the very first day of production, which a little bit of the stimulation water.

On page four the reserves paragraph, paragraph VI, A, is the original gas in place calculation of 4.1 billion cubic feet of gas.

Page five, under B, is the reserves of gas and condensate, and this is shown graphically, this is taken from Core Laboratories depletion and flash calculations and is shown graphically as Exhibit 2, if you would turn to the attached Exhibit 2.

This is the cumulative production , cumulative separator gas scale at the bottom and the bottom curve, cumulative condensate stock tank barrels for the scale at the top and the top -- uppermost curve, versus

reservoir pressure. You can see the initial reservoir pressure of 7,255 pounds and the test in September of about 6846, and the current pressure indicated there of about 4600 psi.

The predicted data, this is an unusual reservoir, the predicted data from Core Laboratories information and from their analysis, is the solid line; another evidence that this is producing similar to a tank or similar to Core Laboratories analysis is that the field data, the points located within the circles, fall almost on top of the predicted line.

This is almost a textbook case. We seldom ever see this in actual practice.

By looking at -- reading in at the abandonment reservoir pressures, you can read directly the cumulative gas and the cumulative condensate to be recovered from this reservoir.

Back on page five of his detailed work, these numbers -- we've outlined these numbers. Lower portion of the page, without surface compression, the abandonment pressure reservoir-wise would be 1300 psig; gas reserves, 2,460 MMCF; condensate reserves, 147,000 stock tank barrels.

With surface compression, reservoir abandonment pressure of 1000 psig; gas reserves, 2,760 -- excuse me, 2,730 MMCF; condensate reserves of 151,000 barrels.

On page six, C, --

MR. NUTTER: Excuse me, Exhibit 2 there, which shows your cumulative condensate and separator gas, this is taking it down to that reservoir abandonment pressure of 1300 pounds, isn't it?

A. Yes, it is extrapolated on down to 1000. You can see the dashed line is the extrapolation of those --

MR. NUTTER: Right, where their points meet there at 1300, apparently.

A. Yes.

MR. NUTTER: And that's the -- where you get the 147,000 barrels of condensate and the 2700 -- or wait a minute -- and 2460 --

A. Yes, sir.

MR. NUTTER: -- million cubic feet.

A. Yes, sir. The only reason these curves cross at that point is that -- the way the scale was presented. A different scale would have had them cross at different points.

By readingit at 1000 pounds and extrapolated lines on this, you'd come out with these other -- the other reserve numbers.

MR. NUTTER: Go ahead.

A. Okay. On page six, paragraph C, liquid yield versus cumulative gas production, is the attachment

Exhibit 3, another example of the field data falling very close to the prediction, and another indication of it being produced like a tank.

This is a slightly different representation, or presentation, compared to I believe it was Exhibit Four, where Mr. Terry presented, showing yields and producing rates versus time. This is the yield versus cumulative gas production.

You'll notice that the prediction has a very sharp drop in the yields, and it also indicated that the field data is following this very well, not that we're happy about that.

Paragraph D on page six is a reservoir radius, or calculations that can be used to determine approximate reservoir extent. Calculations from 4.1 billion cubic feet of gas indicate an acre feet of 2,585. From this, using the net pay observed in the wellbore of 94 feet, a circular reservoir would have a radius of 618 feet. This is equivalent to approximately 28 acres in areal extent.

If an average pay thickness of the reservoir is used of 47 feet, you come up with 873 feet for the radius and equivalent acreage of 55 acres. This is a very small reservoir, obviously.

MR. NUTTER: What was the 618 feet?

A. The 618 feet is equivalent to approxi-

mately 28 acres.

MR. NUTTER: 28 acres.

A. And the 873, approximately 55 acres.

This limited reservoir is confirmed by the Exhibit One, the plat that Mr. Terry presented, showing that the nearest wells, which are approximately half a mile in distance from this well, have not penetrated the same interval.

On page seven, paragraph E, Mr. Varnon has prepared some additional information and some remarks concerning the additional recovery.

It shows that the original gas in place, 4.1 billion cubic feet of gas; shows a recovery of approximately 80 percent; original stock tank liquids in place of 778,000 stock tank barrels, with a recovery efficiency of approximately 19 percent.

He indicates in his write-up here in this last main paragraph, the pressure depletion will give excellent gas recovery but will leave some 627,000 stock tank barrels of condensate in the ground. It may be advisable to consider some type of inert gas pressure maintenance project, but there are some discouraging factors to be considered with any type of pressure maintenance on this reservoir.

First, is that due to the limited size and the wells that have already been drilled offsetting this,

near offsets, and then we have not penetrated, and probably will not penetrate this reservoir with any other wells, that the potential reserves are not large enough to support much, if any, expense to develop any source of injection gas, whether it be inert, nitrogen, CO_2, any type of additional recovery for pressure maintenance.

The reservoir pressure is already below dewpoint and he indicates that retrograde dropout is about 70 percent of the maximum already.

MR. NUTTER: It's already achieved 70 percent dropout?

A. Dropout, of what it would dropout, and its revaporization with inert gas is, or may not be possible.

Sould another well be drilled -- should another well penetrate this, the recovery would be not the best, sweep efficiency would not be the best with a two-well reservoir, sweeping between two wells. We would not get a pattern effect or areal sweep; probably channel straight through is the case most times with either water injection, waterflood operations, or gas injection or cycling project.

Q. Now, Mr. Eakin, you may have testified to this, but let me be sure I understand it. Is this reservoir, in your opinion, rate sensitive?

A. There are a couple of things that we can mention concerning whether or not it's rate sensitive,

based on exhibits that we've seen and data of drilling the well.

We have had no indication of any kind that this reservoir contains any mobile fines, or any movable small particles in the reservoir that might move toward the wellbore and plug it, causing a restriction or reducing the ability due to rate.

There's no indication of any water influx to the reservoir. It appears to be a closed reservoir, depletion type drive, and therefor a restriction of the rate in order to have withdrawals less than a water influx to maintain the pressure above the dewpoint is not -- is not feasible. And on this basis, if there is no water influx, it's not possible to outrun a drive mechanism, a water drive type mechanism, since there's no water drive.

This data is confirmed, or the rate sensitivity is confirmed, partially by Exhibit Four, if you'll refer to that, at the same size choke, a 13/64ths, held a constant rate of about 2-million a day for several months, approximately November, October and November, through March with no indication at the surface that there was any problems with producing -- or with production.

The reservoir pressure has been estimated to be below dewpoint, approximately mid to late January of 1980, and you can then see by the exhibit Four that there was

no drastic change in the producing characteristics either by rate or by yield, and that the well is also capable of producing 3 billion a day with no significant changes to rates or yields, shown on that same exhibit.

Q. Do you have a recommendation to make to the Examiner concerning the maximum rates with withdrawal from this reservoir?

A. We would recommend the rate of 3-million cubic feet a day, based on the capabilities or capacities of the production facilities on that lease.

Q. And are you requesting that this order be made retroactive to March 1, 1980?

A. Yes, sir, we are asking that it be made retroactive to March 1, which was the date the last order set the rate of a million and a half a day until a maximum effective rate could be determined. We ask that it be made retroactive to that.

Q. Mr. Eakin, in your opinion will granting this application be in the interest of conservation, the prevention of waste, and the protection of correlative rights?

A. Yes, sir, I do.

Q. Have you reviewed Exhibits Six through Eight and can you testify from your own information and your own knowledge as to their accuracy?

A. Yes, sir.

MR. CARR: At this time, Mr. Examiner, we would offer into evidence Getty Exhibits Six through Eight.

MR. NUTTER: Getty Exhibits Six through Eight will be admitted in evidence.

CROSS EXAMINATION

BY MR. NUTTER:

Q. Now, Mr. Eakin, you've likened this a number of times in your testimony to producing gas out of a tank.

A. Yes, sir, that's right.

Q. We've already got 70 percent of the liquids in the gas have dropped out in the reservoir, and we can see that the condensate production is going down rather rapidly, which I suppose is a reflection of this condensate having dropped out --

A. Yes, sir.

Q. -- and not being producable now.

A. Yes, sir. The assumption is that the -- and the calculations that the -- in Mr. Varnon's analysis -- that the liquid that has dropped out is not mobile.

Q. Just dropped out to the bottom of the tank and it's sitting there?

A. Well, it's not actually a tank. That would be great. We could put a pump on it and produce it.

It does -- the reason we say it produces like a tank is that the pressure response throughout the reservoir, because it is a small reservoir, because of the permeability and porosity in this reservoir, that the pressure response to the boundaries is very rapid, similar to what you would have in a tank. It is similar in its producing characteristics. It is not a tank; it only represents it.

Q. Yeah, well, I can see when you're talking about a radius of drainage of either 618 or 873 feet that you don't have a very large reservoir there, and of course, the smaller the reservoir, the less effect a rapid drawdown would have.

What I had visualized on this reservoir was a bigger structure and with a high rate of withdrawal, a rapid depletion of pressure around the wellbore with a resultant dropout of fluids and a reduction of the permeability of the reservoir's gas, because of the liquids that had dropped out around the wellbore. But you don't feel that's happening here?

A. No, sir, it does not appear to be.

Q. You're having a more --

A. The rapid response.

Q. You're having a more uniform dropout

throughout the reservoir.

A That is correct, sir.

Q Because of its small size.

A Right, pressure is coming down in the entire reservoir very rapidly, or I say timewise very rapidly from the response. The response to the boundaries of the reservoir is very rapid and therefor your pressure is coming down throughout the reservoir --

Q Uniformly.

A -- uniformly, and the pressure, the drop-out appears to be throughout the reservoir with no response -- or no restriction in rate due to dropout of the liquids near the wellbore.

Q I'd like to figure out some way where we could write an order that's going to produce 627,000 stock tank barrels of condensate that Varnon says is in the ground and going to stay there.

A I wish we could, too. I could point out that in quite a few of the oil reservoirs that are depletion type drive, that 19 - 20 percent, some of our reservoirs, the San Andres and others, that 15 percent recovery by primary methods is -- is normal, and requires waterflooding when the reservoirs are large enough.

Q Well, we have some depletion type reservoirs that get 35 percent, too,

MR. NUTTER: Are there any further questions of Mr. Eakin? He may be excused.

Do you have anything further, Mr. Carr?

MR. CARR: Nothing further, Mr. Nutter.

MR. NUTTER: Does anyone have anything to offer in Case Number 6865?

We'll take the case under advisement.

(Hearing concluded.)

SALLY W. BOYD, C.S.R.
Rt. 1 Box 193-B
Santa Fe, New Mexico 87501
Phone (505) 455-7409

REPORTER'S CERTIFICATE

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

_____

SALLY W. BOYD, C.S.R.
Rt. 1 Box 193-B
Santa Fe, New Mexico 87501
Phone (505) 435-7409

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 6865, heard by me on 4/9 1980.

Examiner
Oil Conservation Division

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

LARRY KEHOE
SECRETARY

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SANTA FE, NEW MEXICO 87501
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April 24, 1980

Mr. William F. Carr
Campbell and Black
Attorneys at Law
Post Office Box 2208
Santa Fe, New Mexico

Re: CASE NO. 6865
ORDER NO. R-6088-C

Applicant:

Getty Oil Company

Dear Sir:

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

Yours very truly,

JOE D. RAMEY
Director

JDR/fd

Copy of order also sent to:

Hobbs OCD x
Artesia OCD x
Aztec OCD

Other

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 6865
Order No. R-6098-C

APPLICATION OF GETTY OIL COMPANY TO REOPEN CASE NO. 6608, LEA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 9 a.m. on April 9, 1980, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 24th day of April, 1980, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

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

(2) That by its Orders Nos. R-6088 and R-6088-A, the Division created and defined the Grama Ridge-Wolfcamp Pool effective September 1, 1979, and classified the same as an oil pool pending further study.

(3) That by its Order No. R-6088-B, the Division reclassified said Grama Ridge-Wolfcamp Pool as a retrograde gas condensate pool effective March 1, 1980, promulgated special rules for said pool, including a production limitation of 1500 MCF of gas per day, and ordered reopening of the case at an examiner hearing during May, 1980, to permit the operators in said pool to appear and present evidence to establish the proper rates of production for wells in the pool.

(4) That pursuant to the application of Getty Oil Company filed March 6, 1980, this cause came on for hearing on April 9, 1980, and Case No. 6608 was reopened to consider evidence relating to the proper rates of production for wells in the Grama Ridge-Wolfcamp Gas Pool.

(5) That the evidence presented clearly establishes that the Grama Ridge-Wolfcamp Gas Pool is producing from a retrograde gas condensate reservoir.

(6) That the reservoir covers an extremely limited geographic area, perhaps no more than 55 acres, and that the transmissibility of the reservoir is relatively high.

(7) That due to the small reservoir size and its high transmissibility, the reservoir experiences a relatively low pressure drawdown at a production rate of 2200 MCF/day, and appears to be non-rate sensitive at least up to this rate of production.

(8) That analysis of all data available indicates that a maximum production rate of 2500 MCF of gas per day for each well in the Grama Ridge-Wolfcamp Gas Pool will not cause waste nor impair correlative rights, and should be approved.

(9) That Rule 4 of the Special Rules and Regulations for the Grama Ridge-Wolfcamp Gas Pool should be amended to read in its entirety as follows:

> "RULE 4. A gas well on a standard unit in the Grama Ridge-Wolfcamp Gas Pool shall be permitted to produce no more than 2,500 MCF of gas per day at standard surface conditions during the effective period of these pool rules. This shall be known as the daily allowable."

(10) That this order should be effective March 1, 1980.

IT IS THEREFORE ORDERED:

(1) That effective March 1, 1980, Rule 4 of the Special Rules and Regulations for the Grama Ridge-Wolfcamp Gas Pool, as promulgated by Division Order No. R-6088-B effective March 1, 1980, is hereby amended to read in its entirety as follows:

> "RULE 4. A gas well on a standard unit in the Grama Ridge-Wolfcamp Gas Pool shall be permitted to produce no more than 2,500 MCF of gas per day at standard surface conditions during the effective period of these pool rules. This shall be known as the daily allowable."

(2) That Order No. 4 of "It Is Further Ordered" of said Order No. R-6088-B, which called for Case No. 6608 to be reopened in May, 1980, to hear evidence as to proper rates of production for wells in the subject pool, is hereby stricken.

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

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

JOE D. RAMEY
Director

SEAL

ed/

Docket No. 9-80

Dockets Nos. 12-80 and 13-80 are tentatively set for April 23 and May 7, 1980. Applications for hearing must be filed at least 22 days in advance of hearing date.

DOCKET: EXAMINER HEARING - WEDNESDAY - APRIL 9, 1980

9 A.M. - OIL CONSERVATION DIVISION CONFERENCE ROOM,
STATE LAND OFFICE BUILDING, SANTA FE, NEW MEXICO

The following cases will be heard before Daniel S. Nutter, Examiner, or Richard L. Stamets, Alternate Examiner:

CASE 6850: In the matter of the hearing called by the Oil Conservation Division on its own motion to permit Jack F. Grimm, N. B. Hunt, George R. Brown, Am-Arctic, Ltd., The Travelers Indemnity Company, and all other interested parties to appear and show cause why the Mobil 32 Well No. 1 located in Unit D of Section 32, Township 25 South, Range 1 East, Dona Ana County, should not be plugged and abandoned in accordance with a Division-approved plugging program.

CASE 6851: In the matter of the hearing called by the Oil Conservation Division on its own motion to consider amendments to its SPECIAL RULES FOR APPLICATIONS FOR WELLHEAD PRICE CEILING CATEGORY DETERMINATIONS as promulgated by Division Order No. R-5878 and amended by R-5878-A. The proposed amendments would make said SPECIAL RULES conform to FERC Order No. 65 which promulgated final regulations implementing filing requirements of the Natural Gas Policy Act of 1978.

CASE 6852: In the matter of the hearing called by the Oil Conservation Division on its own motion to consider special rules and procedures for the designation of "tight formations" or "tight sands" as outlined in the FERC interim rules and regulations issued February 20, 1980, relating to Section 107(b) of the Natural Gas Policy Act of 1978.

CASE 6853: Application of Caribou Four Corners, Inc. for compulsory pooling, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Cha Cha-Gallup Pool underlying the N/2 NE/4 of Section 18, Township 29 North, Range 14 West, to be dedicated to a well to be drilled at a standard location thereon. Also to be considered will be the cost of drilling and completing said well and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 6854: Application of Jack A. Cole for an unorthodox gas well location, Rio Arriba County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of his Apache Hills Well No. 6, 1526 feet from the North line and 1843 feet from the West line of Section 17, Township 23 North, Range 3 West, Ballard-Pictured Cliffs Pool, the NW/4 of said Section 17 to be dedicated to the well.

CASE 6841: (Continued from March 26, 1980, Examiner Hearing)

Application of CIG Exploration, Inc. for two non-standard gas proration units, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval of two non-standard gas proration units in Township 16 South, Range 28 East, the first being 219.6 acres comprising Lots 1 thru 8 of Section 1 and the second being 219.92 acres comprising Lots 1 thru 8 of Section 2, for the Wolfcamp, Pennsylvanian, and Mississippian formations, each unit to be dedicated to a well to be drilled at a standard location thereon.

CASE 6855: Application of Dome Petroleum Corporation for an unorthodox well location, McKinley County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of its Santa Fe 3 Well No. 1 to be drilled 1220 feet from the North line and 900 feet from the West line of Section 3, Township 21 North, Range 10 West.

CASE 6856: Application of Texaco Inc. for downhole commingling, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval for the downhole commingling of Blinebry, Tubb-Drinkard, and Fusselman production in the wellbore of its C. C. Fristoe "B" Federal NCT-2 Well No. 6 located in Unit H of Section 34, Township 24 South, Range 37 East, Justis Field.

CASE 6857: Application of Holly Energy, Inc. for an unorthodox gas well location, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of its State 14 Well No. 1, a Morrow test to be drilled 660 feet from the South line and 990 feet from the East line of Section 14, Township 18 South, Range 28 East, the S/2 of said Section 14 to be dedicated to the well.

CASE 6843: (Continued from March 26, 1980, Examiner Hearing)

Application of Yates Petroleum Corporation for two compulsory poolings, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Yeso formation underlying two 40-acre proration units, the first being the SE/4 SE/4 and the second being the SW/4 SE/4 of Section 6, Township 19 South, Range 25 East, Penasco Draw Field, each unit to be dedicated to a well to be drilled at a standard location thereon. Also to be considered will be the cost of drilling and completing said wells and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the wells and a charge for risk involved in drilling said wells.

CASE 6858: Application of H. L. Brown, Jr. for gas well commingling, Roosevelt County, New Mexico. Applicant, in the above-styled cause, seeks authority to commingle Bluitt-Wolfcamp gas and condensate production from ten federal wells located as follows: Units K and F of Section 33 and L of 34, Township 7 South, Range 37 East; Units D and L of Section 3, C and J of 4, I of 5, C of 9 and G of 10; and one fee well in D of 10, all in Township 8 South, Range 37 East. Applicant would separate and meter the gas and condensate production from each well, then recombine the well's stream and commingle all wells into a small gasoline plant. Allocation of gas and condensate to each well would be on the basis of wellhead meter readings and allocation of gasoline plant production would be on the basis of gas production and BTU content at each well.

CASE 6859: Application of R & G Drilling Company for an unorthodox gas well location, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of a well to be drilled 1890 feet from the North line and 1830 feet from the East line of Section 28, Township 28 North, Range 11 West, Kutz-Fruitland Pool, the NE/4 of said Section 28 to be dedicated to the well.

CASE 6860: Application of Flag-Redfern Oil Company for an exception to Order No. R-3221, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks an exception to Order No. R-3221 to permit disposal of produced brine into an unlined surface pit located in Unit P of Section 3, Township 19 South, Range 31 East.

CASE 6861: Application of Zia Energy, Inc. for pool creation, special pool rules, and an NGPA determination, Lea County, New Mexico. Applicant, in the above-styled cause, seeks the creation of a new San Andres oil pool for its State "C" Well No. 1 located in Unit F of Section 17, Township 22 South, Range 37 East, and special rules therefor, including a provision for a limiting gas-oil ratio of 10,000 to 1. Applicant further seeks a new onshore reservoir determination for said State "C" Well No. 1.

CASE 6837: (Continued from March 26, 1980, Examiner Hearing)

Application of Curtis Little for compulsory pooling, Rio Arriba County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Dakota formation underlying the W/2 of Section 7, Township 25 North, Range 3 West, to be dedicated to a well to be drilled at a standard location thereon. Also to be considered will be the cost of drilling and completing said well and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the well and a charge for risk involved in drilling said well.

CASE 6862: Application of ARCO Oil and Gas Company for an unorthodox oil well location, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of its State 157 "D" Well No. 11 drilled 2123 feet from the South line and 1644 feet from the East line of Section 12, Township 22 South, Range 36 East, Drinkard Pool, the NW/4 SE/4 of said Section 12 to be dedicated to the well.

CASE 6863: Application of Bass Enterprises Production Co. for a dual completion, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval for the dual completion (conventional) of its Big Eddy Unit Well No. 72 located in Unit R of Section 3, Township 21 South, Range 28 East, to produce undesignated Atoka and Morrow gas thru parallel strings of tubing.

CASE 6864: Application of Grace Petroleum Corporation for an unorthodox gas well location, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox location of its Smith Ranch Well No. 11, to be drilled 1980 feet from the North line and 660 feet from the West line of Section 11, Township 20 South, Range 33 East, Teas-Penn Gas Pool, the N/2 of said Section 11 to be dedicated to the well.

Docket No. 9-80

CASE 6846: (Amended)

In the matter of Case No. 6846 being amended to reflect that the location for the unorthodox location of the well on the second unit is 330 feet from the North line and 2310 feet from the East line of Section 13, Township 21 South, Range 36 East, Lea County.

CASE 6846: (Continued from March 26, 1980, Examiner Hearing)

Application of Doyle Hartman for two compulsory poolings, two non-standard gas proration units, and two unorthodox well locations, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order pooling all mineral interests in the Eumont Gas Pool underlying two 80-acre non-standard gas proration units, the first being the S/2 NE/4 of Section 13, Township 21 South, Range 36 East, to be dedicated to a well to be drilled at an unorthodox location 1650 feet from the North line and 2310 feet from the East line of said Section 13, and the second being the N/2 NE/4 of said Section 13 to be dedicated to a well to be drilled at an unorthodox location 330 feet from the North line and 2310 feet from the East line of said Section 13. Also to be considered will be the cost of drilling and completing said wells and the allocation of the cost thereof as well as actual operating costs and charges for supervision. Also to be considered will be the designation of applicant as operator of the wells and a charge for risk involved in drilling said wells.

CASE 6865: Application of Getty Oil Company to reopen Case No. 6608, Lea County, New Mexico. Applicant, in the above-styled cause, seeks to reopen Case No. 6608 for consideration of the establishment of maximum efficient rates of withdrawal from the Grama Ridge-Wolfcamp Gas Pool.

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Docket No. 10-80

DOCKET: EXAMINER HEARING - WEDNESDAY - APRIL 16, 1980

8:45 A.M. - OIL CONSERVATION DIVISION CONFERENCE ROOM,
STATE LAND OFFICE BUILDING, SANTA FE, NEW MEXICO

The following cases will be heard befor Richard L. Stamets, Examiner, or Daniel S. Nutter, Alternate Examiner:

ALLOWABLE: (1) Consideration of the allowable production of gas for May, 1980, from fifteen prorated pools in Lea, Eddy, and Chaves Counties, New Mexico.

(2) Consideration of the allowable production of gas for May, 1980, from four prorated pools in San Juan, Rio Arriba, and Sandoval Counties, New Mexico.

****

Docket No. 11-80

DOCKET: COMMISSION HEARING - WEDNESDAY - APRIL 16, 1980

OIL CONSERVATION COMMISSION - 9 A.M. - ROOM 205
STATE LAND OFFICE BUILDING, SANTA FE, NEW MEXICO

CASE 6609: (DE NOVO) (Continued from March 11, 1980, Commission Hearing)

Application of Napeco Inc. for pool creation and special pool rules, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks the creation of a new Strawn oil pool for its Benson Deep Unit Well No. 1 located in Unit O of Section 33, Township 18 South, Range 30 East, and special rules therefor, including 160-acre spacing and standard well locations.

Upon application of Yates Petroleum Corporation and Napeco Inc. this case will be heard De Novo pursuant to the provisions of Rule 1220. Applicants allege this is not an "oil" pool but is a "volatile" oil pool.

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO
16 January 1980

EXAMINER HEARING

IN THE MATTER OF:

Case 6608 being reopened pursuant to the provisions of Order No. R-6088. CASE 6608

BEFORE: Daniel S. Nutter

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: Ernest L. Padilla, Esq.
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico 87501

For the Applicant: William F. Carr, Esq.
CAMPBELL & BLACK P. A.
Jefferson Plaza
Santa Fe, New Mexico 87501

I N D E X

E X H I B I T S

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MR. NUTTER: Call next Case Number 6608.

MR. PADILLA: In the matter of Case 6608 being reopened pursuant to Order No. R-6688, which order created the Grama Ridge-Wolfcamp Pool with temporary special rules and regulations with provisions for 160-acre spacing.

MR. CARR: May it please the Examiner, my name is William F. Carr, Campbell and Black, P. A., appearing on behalf of the applicant.

I have two witnesses who need to be sworn.

(Witnesses sworn.)

HERMAN W. TERRY

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q. Will you state your full name and place of residence?

A. My name is Herman W. Terry. I reside at Hobbs, New Mexico.

Q. Mr. Terry, by whom are you employed and

in what capacity?

A. I'm employed by Getty Oil Company and I'm the area engineer for the Hobbs Area.

Q. Have you previously testified before this commission and had your credentials accepted and made a matter of record?

A. Yes, I have.

Q. Are you familiar with the application in this case?

A. Yes, I am.

Q. And the subject matter of the case?

A. Yes, I am.

Q. Are you the witness that testified in the previous hearing?

A. Yes, sir, I am.

MR. CARR: Are the witness' qualifications accepted?

MR. NUTTER: Mr. Terry, will you briefly summarize the events which led up to this hearing today?

A. Yes, sir. We brought this matter to hearing in August. We requested approval to dually complete our Getty 36 State Com Well No. 1. We also requested that the Grama Ridge-Wolfcamp Pool be created with temporary special rules and regulations, which provided for 160-acre spacing.

During the course of this hearing we stated that based on the data that we had at that time that we weren't sure if it were an oil reservoir or a gas reservoir, and this is based on the initial producing GOR of 5082-to-1 and the gravity of the produced fluid being 4907.

And so we asked simply for temporary pool rules until we could obtain additional data to substantiate whether it was an oil reservoir or gas reservoir.

MR. CARR: And, Mr. Nutter, since the prior -- or since this case is limited just to the question of whether we have an oil or a gas reservoir, and then the spacing question, which is necessarily a part of that, we're not going to re-introduce the plat or the structure map or the log. They're in the record in this case already, if that's all right with you.

MR. NUTTER: Providing conditions haven't been changed.

MR. CARR: Not in regard to any of those.

Q. Mr. Terry, will you please refer to what has been marked for identification as Getty's Exhibit A, and explain to the Examiner what this is and what it shows?

A. Exhibit A is a diagrammatic sketch of our Getty 36 State Com Well No. 1. This was the well that was the subject of the original hearing.

This well was drilled at 1980 feet from the north line, 1650 feet from the west line of Section 36, Township 21 South, Range 34 East, in Lea County, New Mexico.

The well has been dually completed. We've set -- and we have 2-3/8ths -- a dual string of 2-3/8ths inch N-80 8-round tubing in the well. The zones are separated by a Baker Model-DB packer, set at 12,000 feet; further separated by a Baker Model AL-5 dual packer, set at 10,505 feet.

We have 20-inch casing set at 40 feet; 13-3/8ths inch casing set at 1100 feet; 9-5/8ths inch casing set at 5502; 7 inch casing set at 11,114 feet; we have a 4-1/2 inch liner set at 13,266 feet.

The well was drilled to a total depth of 13,349 feet. Wolfcamp perforations are from 11,320 to 11,335 feet. Morrow perforations are 12,940 feet to 12,950 feet.

We have five 20-foot blast joints opposite the Wolfcamp perforations.

Q And this well is completed in such a fashion as to enable Getty to meter each zone separately, is that correct?

A Yes, it is.

Q Will you please refer to Exhibit B and review the data contained thereon for Mr. Nutter?

A. Exhibit B is a list of well tests that we've obtained from the Getty 36 State Com Well No. 1 from the Wolfcamp completion. This data has been obtained since the well has been completed since the original hearing.

It lists -- this is strictly well tests data. It indicates Mcf gas per day, condensate in barrels per day, the amount of water per day, and the producing gas/oil ratio.

Q. Will you now refer to Getty Exhibit C and review this for the Examiner?

MR. NUTTER: Before you go to that, on Exhibit B these are just -- this is a summary of a whole bunch of well tests, is that correct?

A. Yes. Well, this -- we actually test the well every day with -- it's metered separately. We get a separate gauge daily. This is just a summary of representative well tests from each week.

MR. NUTTER: So this is just a summary of a whole bunch of different producing days, then, --

A. Yes, sir.

MR. NUTTER: -- throughout the year.

A. Yes, sir. We actually, the way we meter the gas separately and the fluid is kept separate, so we actually get a well test every day.

Q. Will you now refer to Exhibit C?

A. Exhibit C is simply the previous information in a graphical form, showing the -- there again, this is well tests, showing condensate production per day and water production per day.

Q. Will you now refer to Exhibit D and review this for the Examiner?

A. Exhibit D is the previous information put in a graphical form. It indicates gas production per day and the producing gas/oil ratio per day.

Q. Mr. Terry, what conclusions can you reach about the characteristic of this reservoir?

A. There are no definite conclusions based upon this data alone; however, I can say that it is consistent with the production data that would be expected from a retrograde condensate gas reservoir.

Q. And there is another witness who will testify and present a reservoir fluid analysis to support this position?

A. Yes, sir, there is.

Q. Mr. Terry, what acreage is dedicated in the Morrow formation in this well?

A. The north half of Section 36.

Q. And the original case included a 160-acre-- the original case applied only to the northwest quarter of Section 36, being 160 acres, is that right?

A. Yes, sir, that's correct.

Q. Do you believe, based on the information you have available to you that it would be appropriate to dismiss that portion of this case which relates to 160-acre spacing?

A. Yes, I do.

Q. In your opinion, will granting this application be in the interest of conservation, the prevention of waste, and the protection of correlative rights?

A. Yes, I do.

Q. What is the present status of this well in terms of its allowable?

A. The well is presently overproduced on gas production, based upon the temporary pool -- oil pool rules, based on the depth bracket allowable for 160 acres, and the gas/oil ratio penalty,we're presently overproduced grossly on gas.

Q. And do you request that this order be expedited to avoid the possibility of having to shut this well in?

A. Yes, I do.

Q. Were Exhibits A through D prepared either by you or under your direction and supervision?

A. Yes, sir, they were.

MR. CARR: At this time, Mr. Examiner,

we would offer Getty Exhibits A through D.

MR. NUTTER: Getty's EXhibits A through D will be admitted in evidence.

MR. CARR: Pass the witness.

CROSS EXAMINATION

BY MR. NUTTER:

Q. Well, Mr. Terry, as I understand it, in the original hearing here we determined that at least on a temporary basis the well would be classified as an oil reservoir.

A. Yes, sir, that is correct.

Q. And put on 160-acre oil well spacing for a temporary period of time.

A. Yes, sir, that is correct.

Q. And now you have made your determination that it's probably a retrograde condensate gas reservoir.

A. Yes, sir, we have.

Q. And you want it to be classified as a gas reservoir and take this 160-acre -- well, I guess you just want to dispense with all of the pool rules here.

A. Yes, sir, we want to dispense with all of the temporary pool rules related to the Wolfcamp.

Q. And have it classified as a gas reservoir and then it would come under gas reservoir rules.

A. Yes, sir, that's what we're proposing.

Q. Are you proposing any special rules for a retrograde condensate gas reservoir?

A. No, sir, we're not.

Q. Sometimes withdrawals from retrograde condensate reservoirs have to be restricted in order to not have too much of that condensate drop out in the reservoir prematurely and be left there, don't they?

A. Yes, sir, that's correct. We've got a preliminary report from CORE Lab that gives us a great deal of information. Once we get a -- we're still to receive a final report, and when we get the final report it will give us more information that we can make calculations to determine the optimum rate to produce this reservoir to prevent leaving this condensate.

Q. Is your other witness going to testify to any optimum rates of production?

A. No, sir, that -- that information is not available. That will be coming in -- the information necessary to make these calculations will be in a final report that we haven't received from CORE Lab as yet.

Q. When do you expect to get that from CORE Lab?

A. I would say within six weeks to two months.

MR. NUTTER: Are there any other questions of this witness? He may be excused.

MR. CARR: I'll call James Eakin.

JAMES E. EAKIN, JR.

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q. Will you state your full name and place of residence?

A. I'm James E. Eakin, Junior, Midland, Texas.

Q. Mr. Eakin, by whom are you employed and in what capacity?

A. Getty Oil Company as a Lead Reservoir Engineer, Midland District Office.

Q. Have you previously testified before this Commission and had your credentials accepted and made a matter of record?

A. No, I have not.

Q. Will you summarize for the Examiner your educational background and your work experience?

A. All right. I'm a 1959 petroleum en-

gineering graduate from the University of Oklahoma; worked the last twenty years as a petroleum engineer, a brief time for Magnolia Petroleum Company and a testing company in south Texas before being employed by Getty Oil Company in 1962.

The last seventeen and a half years I have been with Getty, the last seven and a half in Midland District Office. And our Midland District Office covers the West Texas and southeast Lea County.

Q. And you're familiar with the application in this case?

A. Yes.

MR. CARR: Are the witness' qualifications acceptable?

MR. NUTTER: Yes, they are.

Q. Mr. Eakin, will you please refer to what has been marked for identification as Getty Exhibit E and review the information contained in there for Mr. Nutter?

A. Yes, sir. Exhibit E is a preliminary fluid analysis report prepared by CORE Laboratories on samples taken on our Getty 36 State Com No. 1.

The duplicate samples were obtained from the separation facilities on the subject well on September 9th, 1979, at our direction. This was taken by Tefteller, Incorporated, out of Midland. They caught

these pressure samples, saved them, and shipped them to CORE Laboratories in DAllas.

Under our request CORE Laboratories analyzed the fluid to determine whether or not this was a gas reservoir or an oil reservoir, and the additional data required for proper separation and efficient recovery from this reservoir.

The basic information concerning the test itself, the samples were analyzed. They were then recombined physically in the laboratory and the producing gas and liquid ratio at which the samples were caught in the field, they were adjusted to the separator conditions, the ratios that were calculated were adjusted to reservoir conditions. The sample was charged into a high pressure visual cell in which the temperature and pressure can be maintained at reservoir conditions. The -- there's a window in the cell in which you can observe whether or not the fluid contained therein is either gas or liquid and determine whether or not there was a bubble point or a dewpoint at various pressures.

The sample was submitted -- or subjected to a constant composition, constant temperature expansion. The fluid was observed through the window and a retrograde dewpoint was observed at 5018 psig. It was also observed that the fluid was in a gaseous state at reservoir conditions.

Original reservoir pressure for this well, this reservoir, was 7255 psig. We call your attention to page one of the attachments of data to the letter.

Page one of this data is operator-provided information on bottom hole pressures and the sampling tests, or well test data, at the time the samples were caught.

We call your attention to formation characteristics, the first portion of this, original reservoir pressure 7255 psig at 11,328, which is approximate mid-perforations of the Wolfcamp in this well.

Liquid gravity shown here is also 49.7 degrees API, as previously testified by Mr. Terry.

The date of sampling was September the 9th. The pressures were run, showed that the flowing bottom hole pressure at the time the sample was taken was 6092 pounds; that both of these, the original reservoir pressure and the pressure at the time of sampling were above the dewpoint of 5018 pounds.

The well test data at the time this was taken is shown in the very lower portion of this page. A producing rate of 650.54 barrels per day; a gas/oil ratio calculated to be 4438 cubic feet per barrel. This is also -- can be converted to a condensate yield of 225.33 barrels per minute. And the temperature was extrapolated from a

bottom hole pressure report down to 196 degrees at mid perfs.

Page two of the data is a hydrocarbon analysis of both the separator gas and the separator liquids. I call your attention to the last in the components, the lefthand column, heptanes plus, total well stream low percent is 9.64 percent. To the best of my knowledge and checking on existing oil reservoirs known to be retrograde condensate reservoirs, a rule of thumb shows that there are no oil reservoirs below 11 percent, lower percent on heptanes plus, and this, of course, is below that.

I refer you to page three. On page three you have the pressure volume relations of the reservoir fluids at the reservoir temperature of 196 degrees. This was done with the sample cell measuring the volumes, relative volumes, at each pressure point.

Indicated is the 7255 initial reservoir pressure and the retrograde dewpoint pressure of 5018 pounds.

Page four of the analysis indicated retrograde condensation percentages as a portion of the hydrocarbon -- or reservoir hydrocarbon pore space at reservoir conditions. Shown here is the dewpoint, showing no liquid percent at 5018 pounds, or above, and that as the pressure was depleted in the cell, that the percent of liquid hydrocarbons increased, which is characteristic of a retrograde condensate reservoir, and approximately 3150

the maximum percent of hydrocarbon recovery or -- excuse me. The maximum percent of hydrocarbon pore space occupied by liquids was about 37.1 percent. This is also indicated in the letter.

Below this pressure the hydrocarbons tend to vaporize again and recovery of the liquids would increase.

Page five of this exhibit is a graphic representation of this same data on page four, in which you can see no -- zero percent liquids above 5018 pounds. It increases, the liquid percent increases until it reaches approximately 3150 pounds, and then again decreases as the reservoir pressure decreases.

This is a characteristic curve of a retrograde condensate reservoir.

Q. Mr. Eakin, it is your conclusion that what you have here is a gas reservoir, not an oil reservoir, is that correct?

A. That is correct, from observation or review of other retrograde condensate reservoir analysis, and this analysis, that it meets rule of thumb guidelines, as well as the actual observation of gas in the cell at reservoir condtions and a dewpoint exists -- retrograde dewpoint exists at 5018 pounds. It is a gas reservoir.

Q. Have you reviewed Exhibit E and can you

testify as to its accuracy?

A. Yes. I believe the information contained therein is accurate.

Q. In your opinion will classifying this as a gas reservoir be in the interests of conservation, the prevention of waste, and the protection of correlative rights?

A. Yes, it would.

MR. CARR: At this time, Mr. Examiner, we would offer into evidence Getty Oil Company Exhibit E.

MR. NUTTER: Getty Exhibit E will be admitted in evidence.

MR. CARR: I have nothing further on direct.

CROSS EXAMINATION

BY MR. NUTTER:

Q. Mr. Eakin, this Exhibit E is entirely data which was supplied to you from CORE Labs.

Now, Mr. Terry awhile ago mentioned that CORE Lab will be sending in its final report within some six weeks or so.

A. Yes, sir.

Q. At that time do they have sufficient reservoir information they could make a recommendation as

to what proper withdrawals are, or do they just furnish you with parameters regarding the -- this liquid and the gaseous production itself from the well and you make the determination as to what the proper rate of withdrawal is?

A. They normally provide the data and the determination of the rate of withdrawals and the recoveries expected would be determined on an economic basis by Getty Oil.

Q. But they make the actual determination as to what the proper rate of withdrawal from the reservoir is?

A. No, they do not make that proper rate of withdrawal. They give -- as an example here, they show the composition of the gas on its withdrawal, as stated in the letter, in page two of the letter, shows that -- the method of -- second sample will be analyzed.

Also would point out in the first paragraph of page two of the letter, again, that the maximum accumulation of hydrocarbons in the pore space, which would be -- remain in the reservoir in approximately 37 percent. This is at a reservoir pressure of 3150. This is not -- this is not recovery at the surface. This is what would be left in the reservoir, which is in the range of even a water drive oil reservoir.

Q. Do you know if there's any -- if there's

any water drive present in this reservoir at all?

A. There appears -- we do not know what the drive mechanism is at the present time, but it does not appear to be a water drive.

Q. You made water on that first test that Mr. Terry had, I think, and no water produced since then.

A. That is correct.

Q. I believe.

A. We believe most of that to be filtrate water or load water from the stimulation.

Q. I see. And what is the current bottom hole pressure in the reservoir?

A. The current bottom hole pressure in the reservoir is shown in the report, on September 12th was 6846 at mid perfs.

Q. Well, that was September. You don't know what the current bottom hole pressure is?

A. No, we have not run any samples, or any tests since that date.

Q. Well now, what is your recommendation, Mr. -- Mr. Eakin, that the pool would be reclassified as a retrograde gas condensate reservoir?

A. Yes, sir.

Q. And that the pool rules that we have today be rescinded and that it just be classified as a gas

reservoir?

A. Yes, sir.

Q. Do you have any recommendations at this time as to what the proper rate of withdrawal should be from this gas reservoir?

A. No, sir, we do not.

Q. Do you think that after you get your final report from CORE Lab that you'll be in a better position to make the determination as to what the proper rates of withdrawal should be?

A. I would think we would be in a much better position to determine at that time.

Q. Would you have objection to an order reclassifying the well -- the pool at this time as a retrograde gas condensate reservoir on a very limited temporary basis, pending the determination as to what proper rates of withdrawal should be?

A. No, sir. As we see right now, we do not -- it does not appear that the rate of production will inherently affect the recovery from the reservoir.

Q. Well, so far it hasn't anyway.

A. Yes.

Q. And what's your opinion as to when you will have this data from CORE Lab and when you could make a presentation to this Division?

A. Our latest information was this past Friday from CORE Laboratories and they had not yet started the fluid analysis with the backlog that they have in fluid analyses to be run. Our best estimate would be six weeks to two months. This is pure estimate.

Q. And then another month for you to prepare a case?

A. I would presume so.

MR. NUTTER: Are there any other questions of the witness? He may be excused.

Do you have anything further, Mr. Carr?

MR. CARR: Nothing further, Mr. Nutter.

MR. NUTTER: Does anyone have anything they wish to offer in Case Number 6608?

We'll take the case under advisement.

(Hearing concluded.)

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Phone (505) 455-7409

REPORTER'S CERTIFICATE

I, SALLY W. BOYD, a Certified Shorthand Reporter, DO HEREBY CERTIFY that the foregoing and attached Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd C.S.R.
Sally W. Boyd, C.S.R.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 6608, heard by me on 1/16 1980.

, Examiner
Oil Conservation Division

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STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO
16 January 1980

EXAMINER HEARING

IN THE MATTER OF:

Case 6608 being reopened pursuant to the provisions of Order No. R-6088. CASE 6608

BEFORE: Daniel S. Nutter

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: Ernest L. Padilla, Esq.
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico 87501

For the Applicant: William F. Carr, Esq.
CAMPBELL & BLACK P. A.
Jefferson Plaza
Santa Fe, New Mexico 87501

I N D E X

E X H I B I T S

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I have two witnesses who need to be sworn.

(Witnesses sworn.)

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BY MR. CARR:

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A. I'm employed by Getty Oil Company and I'm the area engineer for the Hobbs Area.

Q. Have you previously testified before this commission and had your credentials accepted and made a matter of record?

A. Yes, I have.

Q. Are you familiar with the application in this case?

A. Yes, I am.

Q. And the subject matter of the case?

A. Yes, I am.

Q. Are you the witness that testified in the previous hearing?

A. Yes, sir, I am.

MR. CARR: Are the witness' qualifications accepted?

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A. Yes, sir. We brought this matter to hearing in August. We requested approval to dually complete our Getty 36 State Com Well No. 1. We also requested that the Grama Ridge-Wolfcamp Pool be created with temporary special rules and regulations, which provided for 160-acre spacing.

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MR. CARR: Not in regard to any of those.

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A. Yes, sir.

MR. NUTTER: -- throughout the year.

A. Yes, sir. We actually, the way we meter the gas separately and the fluid is kept separate, so we actually get a well test every day.

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A. There are no definite conclusions based upon this data alone; however, I can say that it is consistent with the production data that would be expected from a retrograde condensate gas reservoir.

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Q. And the original case included a 160-acre -- the original case applied only to the northwest quarter of Section 36, being 160 acres, is that right?

A Yes, sir, that's correct.

Q Do you believe, based on the information you have available to you that it would be appropriate to dismiss that portion of this case which relates to 160-acre spacing?

A Yes, I do.

Q In your opinion, will granting this application be in the interest of conservation, the prevention of waste, and the protection of correlative rights?

A Yes, I do.

Q What is the present status of this well in terms of its allowable?

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Q And do you request that this order be expedited to avoid the possibility of having to shut this well in?

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Q Were Exhibits A through D prepared either by you or under your direction and supervision?

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DIRECT EXAMINATION

BY MR. CARR:

Q. Will you state your full name and place of residence?

A. I'm James E. Eakin, Junior, Midland, Texas.

Q. Mr. Eakin, by whom are you employed and in what capacity?

A. Getty Oil Company as a Lead Reservoir Engineer, Midland District Office.

Q. Have you previously testified before this Commission and had your credentials accepted and made a matter of record?

A. No, I have not.

Q. Will you summarize for the Examiner your educational background and your work experience?

A. All right. I'm a 1959 petroleum en-

gineering graduate from the University of Oklahoma; worked the last twenty years as a petroleum engineer, a brief time for Magnolia Petroleum Company and a testing company in south Texas before being employed by Getty Oil Company in 1962.

The last seventeen and a half years I have been with Getty, the last seven and a half in Midland District Office. And our Midland District Office covers the West Texas and southeast Lea County.

Q And you're familiar with the application in this case?

A Yes.

MR. CARR: Are the witness' qualifications acceptable?

MR. NUTTER: Yes, they are.

Q Mr. Eakin, will you please refer to what has been marked for identification as Getty Exhibit E and review the information contained in there for Mr. Nutter?

A Yes, sir. Exhibit E is a preliminary fluid analysis report prepared by CORE Laboratories on samples taken on our Getty 36 State Com No. 1.

The duplicate samples were obtained from the separation facilities on the subject well on September 9th, 1979, at our direction. This was taken by Tefteller, Incorporated, out of Midland. They caught

these pressure samples, saved them, and shipped them to CORE Laboratories in DAllas.

Under our request CORE Laboratories analyzed the fluid to determine whether or not this was a gas reservoir or an oil reservoir, and the additional data required for proper separation and efficient recovery from this reservoir.

The basic information concerning the test itself, the samples were analyzed. They were then recombined physically in the laboratory and the producing gas and liquid ratio at which the samples were caught in the field, they were adjusted to the separator conditions, the ratios that were calculated were adjusted to reservoir conditions. The sample was charged into a high pressure visual cell in which the temperature and pressure can be maintained at reservoir conditions. The -- there's a window in the cell in which you can observe whether or not the fluid contained therein is either gas or liquid and determine whether or not there was a bubble point or a dewpoint at various pressures.

The sample was submitted -- or subjected to a constant composition, constant temperature expansion. The fluid was observed through the window and a retrograde dewpoint was observed at 5018 psig. It was also observed that the fluid was in a gaseous state at reservoir conditions.

SALLY W. BOYD, C.S.R.
Rt. 1 Box 193-B
Santa Fe, New Mexico 87501
Phone (505) 455-7409

Original reservoir pressure for this well, this reservoir, was 7255 psig. We call your attention to page one of the attachments of data to the letter.

Page one of this data is operator-provided information on bottom hole pressures and the sampling tests, or well test data, at the time the samples were caught.

We call your attention to formation characteristics, the first portion of this, original reservoir pressure 7255 psig at 11,328, which is approximate mid-perforations of the Wolfcamp in this well.

Liquid gravity shown here is also 49.7 degrees API, as previously testified by Mr. Terry.

The date of sampling was September the 9th. The pressures were run, showed that the flowing bottom hole pressure at the time the sample was taken was 6092 pounds; that both of these, the original reservoir pressure and the pressure at the time of sampling were above the dewpoint of 5018 pounds.

The well test data at the time this was taken is shown in the very lower portion of this page. A producing rate of 650.54 barrels per day; a gas/oil ratio calculated to be 4438 cubic feet per barrel. This is also -- can be converted to a condensate yield of 225.33 barrels per minute. And the temperature was extrapolated from a

bottom hole pressure report down to 196 degrees at mid perfs.

Page two of the data is a hydrocarbon analysis of both the separator gas and the separator liquids. I call your attention to the last in the components, the lefthand column, heptanes plus, total well stream low percent is 9.64 percent. To the best of my knowledge and checking on existing oil reservoirs known to be retrograde condensate reservoirs, a rule of thumb shows that there are no oil reservoirs below 11 percent, lower percent on heptanes plus, and this, of course, is below that.

I refer you to page three. On page three you have the pressure volume relations of the reservoir fluids at the reservoir temperature of 196 degrees. This was done with the sample cell measuring the volumes, relative volumes, at each pressure point.

Indicated is the 7255 initial reservoir pressure and the retrograde dewpoint pressure of 5018 pounds.

Page four of the analysis indicated retrograde condensation percentages as a portion of the hydrocarbon -- or reservoir hydrocarbon pore space at reservoir conditions. Shown here is the dewpoint, showing no liquid percent at 5018 pounds, or above, and that as the pressure was depleted in the cell, that the percent of liquid hydrocarbons increased, which is characteristic of a retrograde condensate reservoir, and approximately 3150

the maximum percent of hydrocarbon recovery or -- excuse me. The maximum percent of hydrocarbon pore space occupied by liquids was about 37.1 percent. This is also indicated in the letter.

Below this pressure the hydrocarbons tend to vaporize again and recovery of the liquids would increase.

Page five of this exhibit is a graphic representation of this same data on page four, in which you can see no -- zero percent liquids above 5018 pounds. It increases, the liquid percent increases until it reaches approximately 3150 pounds, and then again decreases as the reservoir pressure decreases.

This is a characteristic curve of a retrograde condensate reservoir.

Q. Mr. Eakin, it is your conclusion that what you have here is a gas reservoir, not an oil reservoir, is that correct?

A. That is correct, from observation or review of other retrograde condensate reservoir analysis, and this analysis, that it meets rule of thumb guidelines, as well as the actual observation of gas in the cell at reservoir condtions and a dewpoint exists -- retrograde dewpoint exists at 5018 pounds. It is a gas reservoir.

Q. Have you reviewed Exhibit E and can you

testify as to its accuracy?

A. Yes. I believe the information contained therein is accurate.

Q. In your opinion will classifying this as a gas reservoir be in the interests of conservation, the prevention of waste, and the protection of correlative rights?

A. Yes, it would.

MR. CARR: At this time, Mr. Examiner, we would offer into evidence Getty Oil Company Exhibit E.

MR. NUTTER: Getty Exhibit E will be admitted in evidence.

MR. CARR: I have nothing further on direct.

CROSS EXAMINATION

BY MR. NUTTER:

Q. Mr. Eakin, this Exhibit E is entirely data which was supplied to you from CORE Labs.

Now, Mr. Terry awhile ago mentioned that CORE Lab will be sending in its final report within some six weeks or so.

A. Yes, sir.

Q. At that time do they have sufficient reservoir information they could make a recommendation as

to what proper withdrawals are, or do they just furnish you with parameters regarding the -- this liquid and the gaseous production itself from the well and you make the determination as to what the proper rate of withdrawal is?

A. They normally provide the data and the determination of the rate of withdrawals and the recoveries expected would be determined on an economic basis by Getty Oil.

Q. But they make the actual determination as to what the proper rate of withdrawal from the reservoir is?

A. No, they do not make that proper rate of withdrawal. They give -- as an example here, they show the composition of the gas on its withdrawal, as stated in the letter, in page two of the letter, shows that -- the method of -- second sample will be analyzed.

Also would point out in the first paragraph of page two of the letter, again, that the maximum accumulation of hydrocarbons in the pore space, which would be -- remain in the reservoir in approximately 37 percent. This is at a reservoir pressure of 3150. This is not -- this is not recovery at the surface. This is what would be left in the reservoir, which is in the range of even a water drive oil reservoir.

Q. Do you know if there's any -- if there's

any water drive present in this reservoir at all?

A. There appears -- we do not know what the drive mechanism is at the present time, but it does not appear to be a water drive.

Q. You made water on that first test that Mr. Terry had, I think, and no water produced since then.

A. That is correct.

Q. I believe.

A. We believe most of that to be filtrate water or load water from the stimulation.

Q. I see. And what is the current bottom hole pressure in the reservoir?

A. The current bottom hole pressure in the reservoir is shown in the report, on September 12th was 6846 at mid perfs.

Q. Well, that was September. You don't know what the current bottom hole pressure is?

A. No, we have not run any samples, or any tests since that date.

Q. Well now, what is your recommendation, Mr. -- Mr. Eakin, that the pool would be reclassified as a retrograde gas condensate reservoir?

A. Yes, sir.

Q. And that the pool rules that we have today be rescinded and that it just be classified as a gas

reservoir?

A. Yes, sir.

Q. Do you have any recommendations at this time as to what the proper rate of withdrawal should be from this gas reservoir?

A. No, sir, we do not.

Q. Do you think that after you get your final report from CORE Lab that you'll be in a better position to make the determination as to what the proper rates of withdrawal should be?

A. I would think we would be in a much better position to determine at that time.

Q. Would you have objection to an order reclassifying the well -- the pool at this time as a retrograde gas condensate reservoir on a very limited temporary basis, pending the determination as to what proper rates of withdrawal should be?

A. No, sir. As we see right now, we do not -- it does not appear that the rate of production will inherently affect the recovery from the reservoir.

Q. Well, so far it hasn't anyway.

A. Yes.

Q. And what's your opinion as to when you will have this data from CORE Lab and when you could make a presentation to this Division?

A. Our latest information was this past Friday from CORE Laboratories and they had not yet started the fluid analysis with the backlog that they have in fluid analyses to be run. Our best estimate would be six weeks to two months. This is pure estimate.

Q. And then another month for you to prepare a case?

A. I would presume so.

MR. NUTTER: Are there any other questions of the witness? He may be excused.

Do you have anything further, Mr. Carr?

MR. CARR: Nothing further, Mr. Nutter.

MR. NUTTER: Does anyone have anything they wish to offer in Case Number 6608?

We'll take the case under advisement.

(Hearing concluded.)

SALLY W. BOYD, C.S.R.
Rt. 1 Box 193-B
Santa Fe, New Mexico 87501
Phone (505) 455-7409

REPORTER'S CERTIFICATE

I, SALLY W. BOYD, a Certified Shorthand Reporter, DO HEREBY CERTIFY that the foregoing and attached Transcript of Hearing before the Oil Conservation Division was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

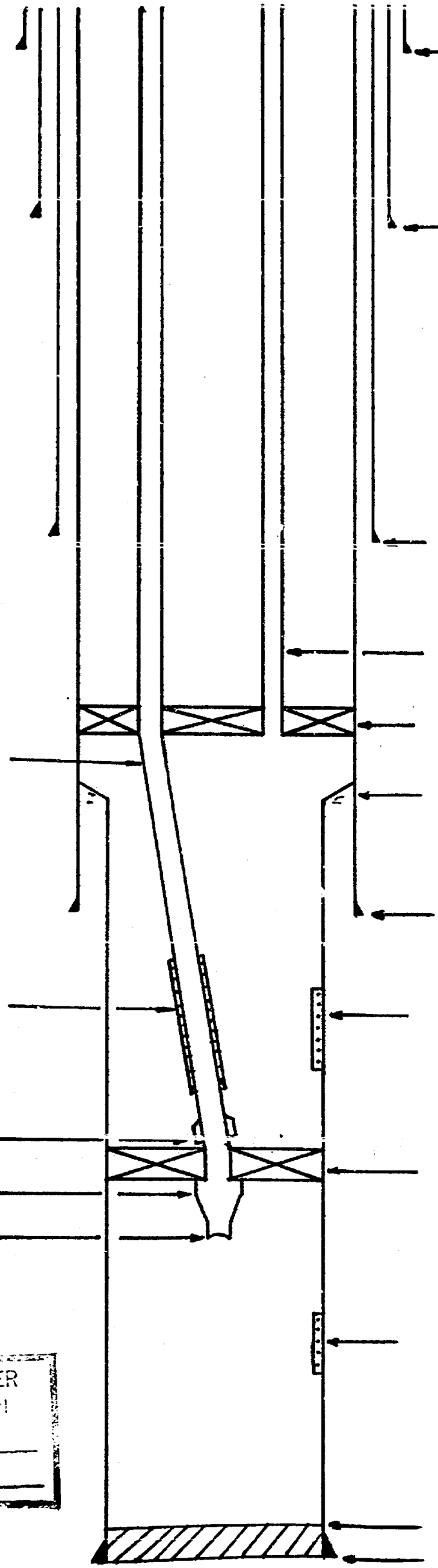
Sally W. Boyd, C.S.R.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 6608, heard by me on 1/16 1980.

, Examiner
Oil Conservation Division

SALLY W. BOYD, C.S.R.
Rt. 1 Box 193-B
Santa Fe, New Mexico 87501
Phone (505) 455-7409

LEA COUNTY, NEW MEXICO



20",94# H-40 @ 40'
w/3 yds. Ready-Mix

13 3/8", 48#, H-40
@ 1100'. Circulate
17 sxs to surface

9 5/8",36#, S-80 &
K-55 at 5502'.
Circulate 125 sxs
cement surface

2 3/8", N-80 8rd tbg

Baker Model "AL-5"
Dual pkr. at 10,505'
w/2 3/8" x 1.81"
Model "F" nipple
Liner top at 10,815'
Squeezed w/100 sxs

2 3/8", N-80 8rd tbg.

7", 26# N-80 & S-95
@ 11,114'. Cement
top by worth Well
Temp. at 3570'.

5-20' blast joints

Wolfcamp perfs.
11,320-11,335'

3 11/16" x 26' x 1.81'
"ER" tbg.
Receptacle w/1.87' BPC
Model "F" profile
3 1/2' x 6' mill-out
2 3/8" x 10' pup joint

Baker Model "DB"
pkr. @ 12,000'

Morrow perfs.
12,940-12,950'

Plug back TD 13,266'

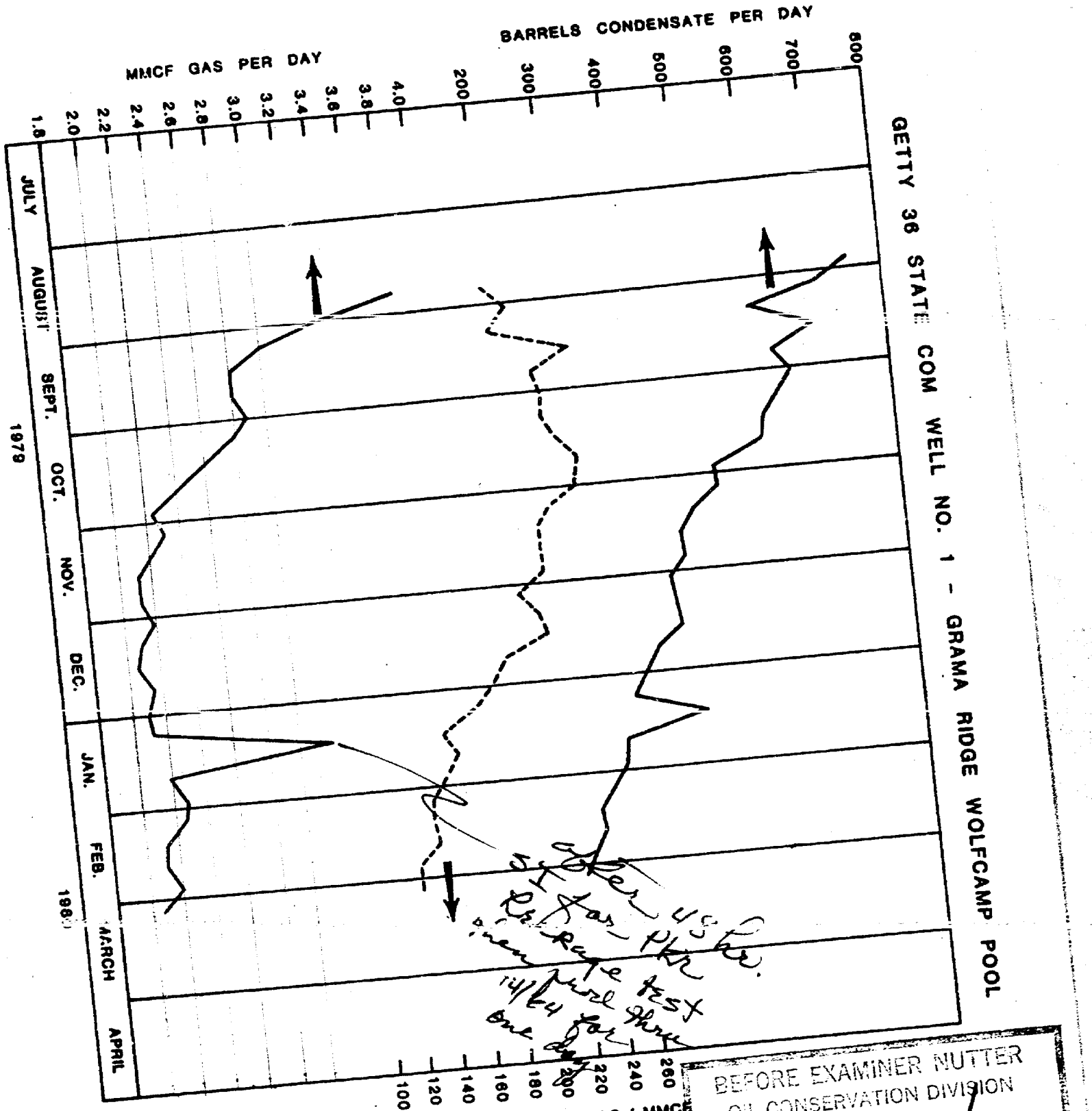
4 1/2" 11.6# S-95 @
13,349'

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
EXHIBIT NO. 2
CASE NO. 6865

DAILY TEST DATA
GETTY "36" STATE COM. WELL NO. 1
WOLFCAMP

Week of	Condensate Bbls.	Gas (MCF)	CON. YIELD (BBLS./MCF)
Aug. 27	750	3.82	196.33
Sep. 3	700	3.32	210.84
Sep. 10	590	2.99	197.98
Sep. 17	685	2.80	244.64
Sep. 24	620	2.80	221.42
Oct. 1	645	2.86	225.52
Oct. 8	620	2.77	223.82
Oct. 15	600	2.59	231.66
Oct. 22	590	2.42	243.80
Oct. 29	515	2.14	240.65
Nov. 5	518	2.3	225.21
Nov. 12	475	2.2	215.91
Nov. 19	455	2.11	215.63
Nov. 26	458	2.12	216.03
Dec. 3	435	2.18	199.54
Dec. 10	442	2.09	211.48
Dec. 17	445	2.06	216.02
Dec. 24	105	2.1	189.25
Dec. 31	380	2.1	180.95
Jan. 7	360	2.12	169.81
Jan. 14	470	3.190	147.34
Jan. 21	341	2.192	155.57
Jan. 28	336	2.274	147.76
Feb. 4	313	2.258	138.62
Feb. 11	292	2.132	136.96
Feb. 18	295	2.117	139.75
Feb. 25	274	2.202	124.43
Mar. 3	260	2.077	125.18

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
Getty EXHIBIT NO. 3
CASE NO. 6865



13/64" constant choke size except after plug back test - used 14/64" choke

GETTY 36 STATE COM. NO. - WOLFCAMP
PRODUCTION DATA

MONTH	CONDENSATE, BBL.	GAS, MCF
August, 79	4,864	19,492
Sept., 79	16,150	74,619
Oct., 79	17,660	76,388
Nov., 79	13,439	61,611
Dec., 79	12,244	64,464
Jan., 80	10,412	64,131
Feb., 80	7,489	57,200*
Total	82,258	417,905

*estimated

Well was opened after buildup at 11 a.m. on February 29, 1980. Hence, total estimated production through February is approximately the production prior to the start of the buildup.

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
Getty EXHIBIT NO. 5
CASE NO. 6865

JARREL SERVICES, INC.

POST OFFICE BOX 1654 PHONE 505 393-5366
HOBBS, NEW MEXICO 88240

COMPANY: Getty Oil Company

WELL: Getty 36 State Com, No. 1 FIELD: Undesignated - Wolfcamp

CHRONOLOGICAL PRESSURE DATA

DATE	STATUS OF WELL	TIME	ELASPED TIME HRS.	MIN.	SURFACE PRESSURE TBG	CSG	BHP @ (-7636) 10485'	11328' PSIG
1980								
2/26	Flowing. Run Flowing Gradient w/Tandem Bombs & Set Bombs off @ 10485'	10:30 AM	0	00	2346	PKR	3840	3963
	Shut in	11:00	0	30	2346	-	3840	3963
	"	11:03	0	03	-	-	4045	4408
	"	11:06	0	06	-	-	4154	4517
	"	11:09	0	09	-	-	4179	4542
	"	11:12	0	12	-	-	4186	4549
	"	11:15	0	15	-	-	4192	4555
	"	11:20	0	20	-	-	4192	4555
	"	11:25	0	25	-	-	4192	4555
	"	11:30	0	30	-	-	4192	4555
	"	11:45	0	45	-	-	4192	4555
	"	12:00 N	1	00	-	-	4192	4555
	"	1:00 PM	2	00	-	-	4199	4562
	"	2:00	3	00	-	-	4205	4568
	"	3:00	4	00	-	-	4205	4568
	"	4:00	5	00	-	-	4205	4568
	"	5:00	6	00	-	-	4212	4575
	"	6:00	7	00	-	-	4212	4575
	"	7:00	8	00	-	-	4212	4575
	"	8:00	9	00	-	-	4218	4581
	"	9:00	10	00	-	-	4218	4581
	"	10:00	11	00	-	-	4218	4581
	"	11:00	12	00	-	-	4218	4581
	"	12:00 MN	13	00	-	-	4218	4581
2/27	"	1:00 AM	14	00	-	-	4218	4581
	"	2:00	15	00	-	-	4218	4531
	"	3:00	16	00	-	-	4218	4581
	"	4:00	17	00	-	-	4218	4581
	"	5:00	18	00	-	-	4218	4581
	"	6:00	19	00	-	-	4218	4581
	"	7:00	20	00	-	-	4218	4581
	"	8:00	21	00	-	-	4218	4581
	"	9:00	22	00	-	-	4218	4581
	"	10:00	23	00	-	-	4218	4581
	"	11:00	24	00	-	-	4218	4581
	"	12:00 N	25	00	-	-	4218	4581
	"	1:00 PM	26	00	-	-	4224	4587
	"	2:00	27	00	-	-	4224	4587
	"	3:00	28	00	-	-	4224	4587
	"	4:00	29	00	-	-	4224	4587

WELL: Getty 36 State Com. No. 1
PAGE: 2

DATE	STATUS OF WELL	TIME	ELASPED TIME HRS.	MIN.	SURFACE PRESSURE TBG	CSG	BHP @ (-7636) 10485'	11328'PS
	Shut in	5:00	30	00	-	-	4224	4587
	"	6:00	31	00	-	-	4224	4587
	"	7:00	32	00	-	-	4224	4587
	"	8:00	33	00	-	-	4224	4587
	"	9:00	34	00	-	-	4224	4587
	"	10:00	35	00	-	-	4224	4587
	"	11:00	36	00	-	-	4224	4587
	"	12:00 MN	37	00	-	-	4224	4587
2/28	"	1:00 AM	38	00	-	-	4224	4587
	"	2:00	39	00	-	-	4224	4587
	"	3:00	40	00	-	-	4224	4587
	"	4:00	41	00	-	-	4231	4594
	"	5:00	42	00	-	-	4231	4594
	"	6:00	43	00	-	-	4231	4594
	"	7:00	44	00	-	-	4231	4594
	"	8:00	45	00	-	-	4231	4594
	"	9:00	46	00	-	-	4231	4594
	"	10:00	47	00	-	-	4231	4594
	"	11:00	48	00	-	-	4231	4594
	"	12:00 N	49	00	-	-	4231	4594
	"	1:00 PM	50	00	-	-	4231	4594
	"	2:00	51	00	-	-	4231	4594
	"	3:00	52	00	-	-	4231	4594
	"	4:00	53	00	-	-	4231	4594
	"	5:00	54	00	-	-	4231	4594
	"	6:00	55	00	-	-	4231	4594
	"	7:00	56	00	-	-	4231	4594
	"	8:00	57	00	-	-	4231	4594
	"	9:00	58	00	-	-	4231	4594
	"	10:00	59	00	-	-	4237	4600
	"	11:00	60	00	-	-	4237	4600
	"	12:00 MN	61	00	-	-	4237	4600
2/29	"	1:00 AM	62	00	-	-	4237	4600
	"	2:00	63	00	-	-	4237	4600
	"	3:00	64	00	-	-	4237	4600
	"	4:00	65	00	-	-	4237	4600
	"	5:00	66	00	-	-	4237	4600
	"	6:00	67	00	-	-	4237	4600
	"	7:00	68	00	-	-	4237	4600
	"	8:00	69	00	-	-	4237	4600
	"	9:00	70	00	-	-	4237	4600
	"	10:00	71	00	-	-	4237	4600
	Fished Bombs & Run Static Gradient	11:00	72	00	2731	-	4237	4600

JARREL SERVICES, INC.

POST OFFICE BOX 1654 PHONES 505 393-5396 — 393-8274

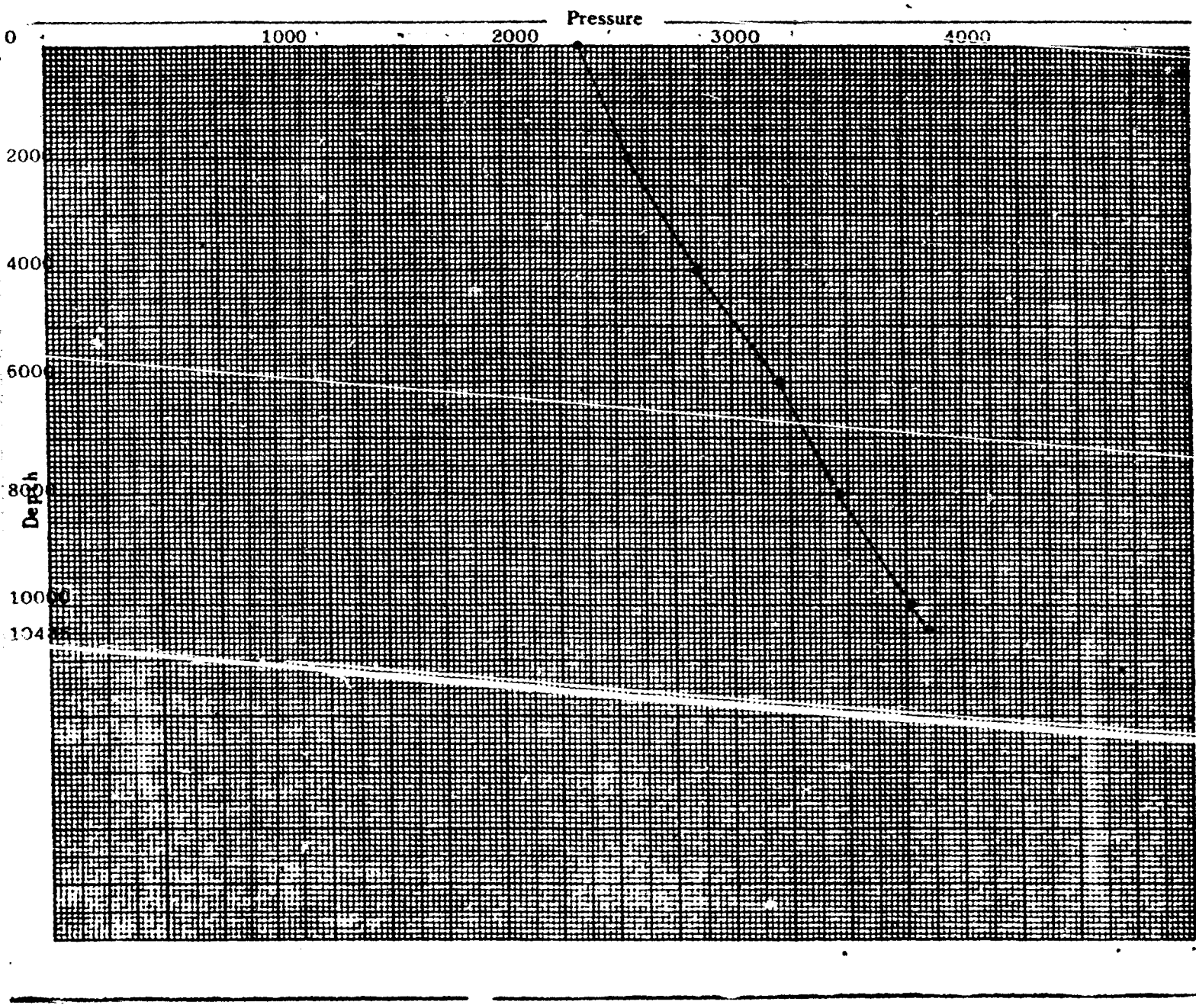
HOBBS, NEW MEXICO 88240

OPERATOR Getty Oil Company
FIELD Undesignated
FORMATION Wolfcamp
LEASE Getty 36 State Com WELL #1
COUNTY Lea STATE New Mexico
DATE Feb. 26, 1980 TIME 8:00 AM
Status Flowing
Test Depth 10485'
Time S. I. - Last test date -
Tub Pres. 2346 BHP last test -
Cas. Pres. Dual BHP change -
Elev. 3692'KB-23 Fluid top Flowing
Datum (-7636) ** Water top -
Temp. @ 174°F Run by JSI #21
Cal. No. A13676N Chart No. 1

BOTTOM HOLE PRESSURE RECORD

Depth		Pressure	Gradient
0		2346	-
2000		2558	.106
4000		2859	.151
6000		3205	.173
8000		3468	.132
10000		3769	.151
10485		3840	.146
11328	(-7636)	3963 * **	(.146)

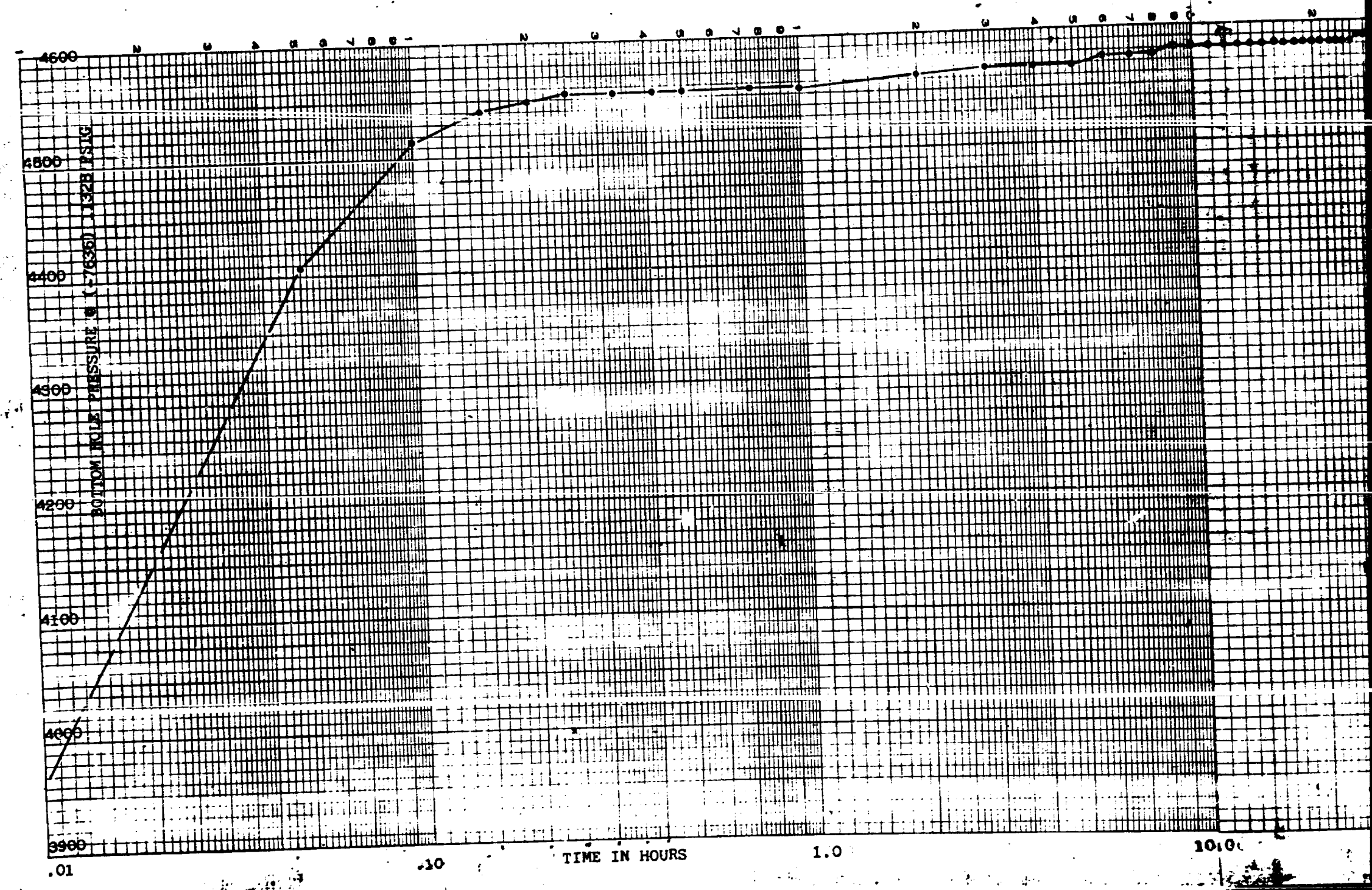
* EXTRAPOLATED PRESSURE
** MIDPOINT OF CASING PERFORATIONS



NO. 340R-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

JARREL SERVICES, INC.



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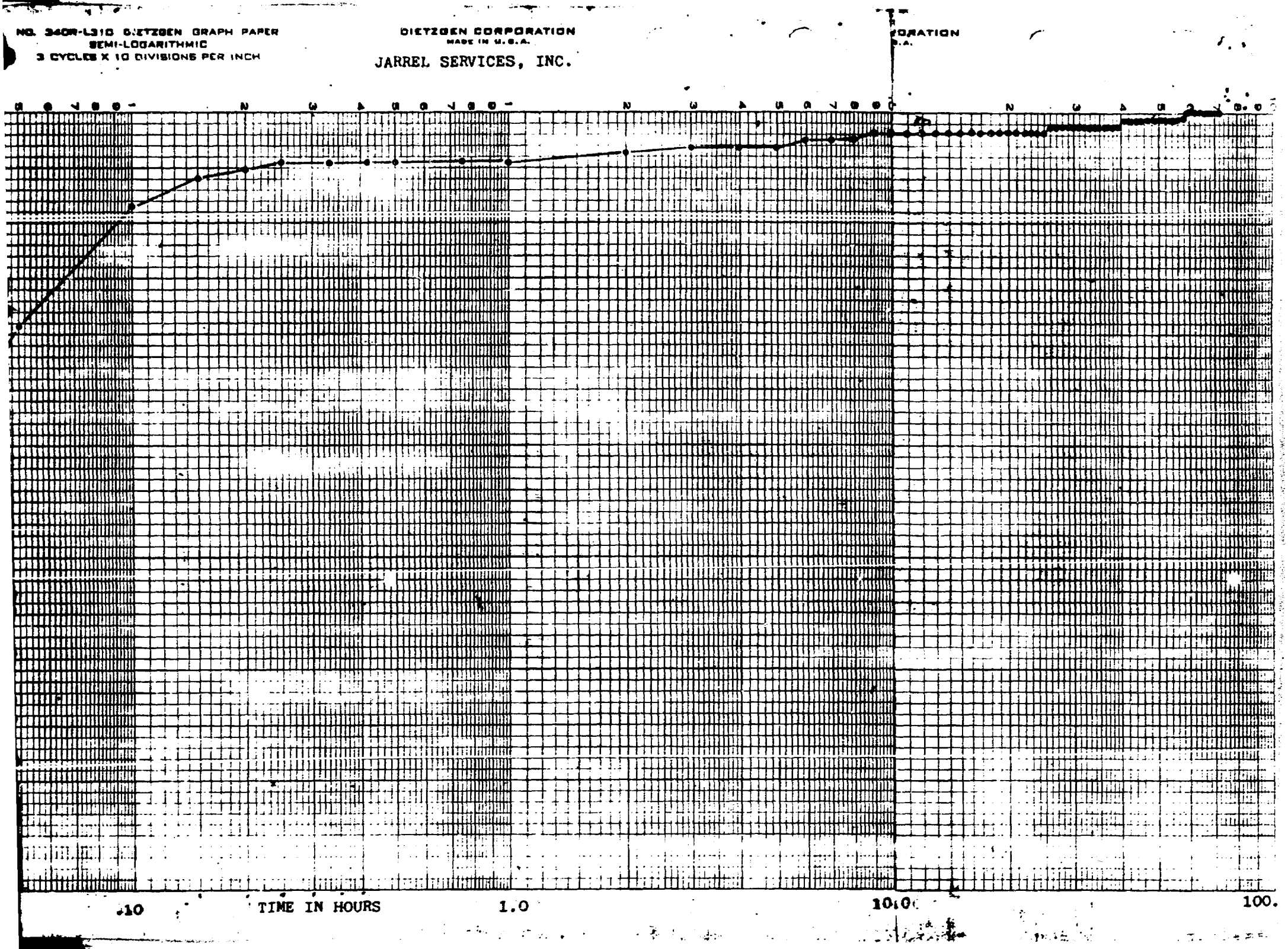


JARREL SERVICES, INC.

POST OFFICE BOX 1664 PHONES 505 393-5388 — 393-8274

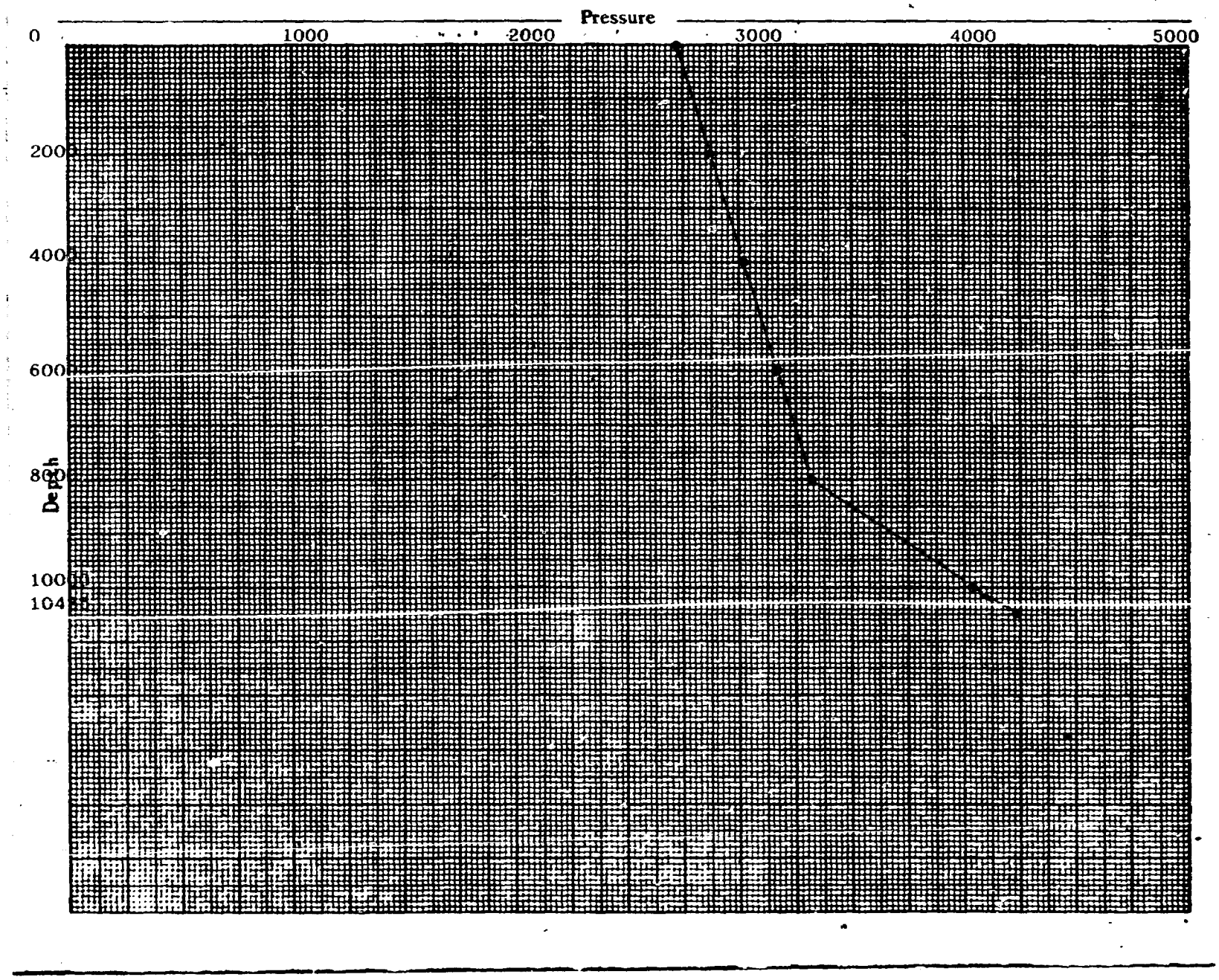
HOBBS, NEW MEXICO 88240

OPERATOR Getty Oil Company
FIELD Undesignated
FORMATION Wolfcamp
LEASE Getty 36 State Com WELL #1
COUNTY Lea STATE New Mexico
DATE Feb. 29, 1980 TIME 11:00 AM
Status Shut in
Test Depth 10485'
Time S. I. 72 hrs. Last test date 7/4/79
Tub Pres. 2731 BHP last test 7057 @ 10450'
Cas. Pres. PKR BHP change 2457# Loss
Elev. 3692'KB-23 Fluid top 8000'
Datum (-7636) ** Water top 9000'
Temp. @ 174°F Run by JSI #16
Cal. No. A13676N Chart No. 2

BOTTOM HOLE PRESSURE RECORD

Depth		Pressure	Gradient
0		2731	-
2000		2874	.072
4000		3020	.073
6000		3168	.074
8000		3318	.075
10000		4028	.355
10485		4237	.431
11328	(-7636)	4600 * **	(.431)

* EXTRAPOLATED PRESSURE
** MIDPOINT OF CASING PERFORATIONS



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75207

Reservoir Fluid Study

for

GETTY OIL COMPANY

State 36 No. 1 Well
Wildcat
Lea County, New Mexico

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75207

January 23, 1980

RESERVOIR FLUID DIVISION

Getty Oil Company
P.O. Box 730
Hobbs, NM 82240

Attention: Mr. Peter Botes

Subject: Reservoir Fluid Study
State 36 No. 1 Well
Wildcat
Lea County, New Mexico
Our File Number: RFL 79619

Gentlemen:

Duplicate samples of separator gas and separator liquid were collected from the subject well by Tefteller, Inc. on September 9, 1979. These samples were forwarded to our Dallas laboratory for use in a reservoir fluid study, the results of which are presented on the following pages.

Upon arrival in the laboratory, the separator gas was analyzed through heptanes plus using chromatography, while the separator liquid was also analyzed through heptanes plus using low temperature fractional distillation equipment along with chromatography. After the separator gas flow rate was corrected using factors which are shown on page one, the producing gas-liquid ratio was calculated to be 4438 cubic feet of separator gas at 15.025 psia and 60°F. per barrel of stock tank liquid at 60°F. In the laboratory, it was determined that this was the equivalent of 3588 standard cubic feet of separator gas per barrel of separator liquid at 490 psig and 78°F. The measured compositions of the separator products were used in conjunction with this producing gas-liquid ratio to calculate the composition of the producing well stream material. These compositions are shown on page two. In the laboratory, the separator products were physically recombined to this producing gas-liquid ratio for use in the entire reservoir fluid study.

A portion of the reservoir fluid was charged to a high pressure visual cell and heated to the reservoir temperature of 196°F. During constant composition expansion pressure-volume relations performed at this temperature, the fluid existed as a single-phase gas at pressures above 5018 psig at which pressure a retrograde dew point was observed. A comparison of this dew point pressure to the reservoir pressure, 6846 psig, measured on September 12, 1979 indicates that the fluid currently exists in the reservoir in an undersaturated condition. The results of the pressure-volume relation measurements are shown on page three.

The sample in the cell was repressured to a single-phase condition after which it was subjected to a constant volume depletion. After the sample volume was established at the dew point pressure, the sample was subjected to a series of pressure expansions and constant pressure displacements with each displacement terminating at the original sample volume at the dew point pressure. During each of these displacements, the volume of retrograde liquid accumulation was monitored. These data, which are reported on pages six and twelve, show that the maximum accumulation of liquid is approximately 37.1 percent of the hydrocarbon pore space occurring at approximately 3150 psig. The liquid saturation at atmospheric pressure and 196°F. was 24.5 percent of the hydrocarbon pore space.

A larger volume of the reservoir fluid was once again charged to a bigger high pressure cell heated to 196°F. where the constant volume depletion was repeated. During this particular depletion, the equilibrium gas phase at each of the depletion pressure levels was charged to low temperature fractional distillation equipment where along with chromatography its composition was measured. Also determined was the volumetric production of the vapor phase from pressure to pressure where the various deviation factor z were measured down to 700 psig. A summary of these volumetric and compositional data is reported on page four.

The above compositions and volumetric data were used in conjunction with published equilibrium ratio data to calculate the surface recoveries that may be expected as the reservoir pressure declines. These calculations were performed on the basis of one million standard cubic feet of reservoir fluid inplace at the dew point pressure, 5018 psig and 196°F. Assumed in these calculations was a plant efficiency of 100 percent. These volumetric data are reported in tabular form on page five.

We wish to thank Getty Oil Company for this opportunity to be of service. If you should have any questions regarding these data or we can be of further assistance, please do not hesitate to contact us.

Very truly yours,

CORE LABORATORIES, INC.

P. L. Moses, Manager
Reservoir Fluid Analysis

PLM:FBV:bt
6 cc: Addressee
1 cc: Mr. Jim Eakin
Getty Oil Co.
P.O. Box 1231
Midland, TX 79702

CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Company Getty Oil Company | Date Sampled September 9, 1979

Well State 36 No. 1 | County Lea

Field Wildcat | State New Mexico

FORMATION CHARACTERISTICS

Formation Name	Wolfcamp
Date First Well Completed	July 2, 1979
Original Reservoir Pressure	7255 PSIG @ 11328 Ft.
Original Produced Gas-Liquid Ratio	5082 SCF/Bbl
Production Rate	752 Bbls/Day
Separator Pressure and Temperature	PSIG °F.
Liquid Gravity at 60°F.	49.7 °API
Datum	7636 Ft. Subsea

WELL CHARACTERISTICS

Elevation	3692 KB Ft.
Total Depth	13266 PBTD Ft.
Producing Interval	11320-11335 Ft.
Tubing Size and Depth	2-3/8 In. to 10495 Ft.
Open Flow Potential	7.82 (Estimated) MMSCF/Day
Last Reservoir Pressure	6846 PSIG @ 11328 Ft.
Date	September 12, 1979
Reservoir Temperature	187* °F. @ 10505 Ft.
Status of Well	Flowing
Pressure Gauge	Amerada

SAMPLING CONDITIONS

Flowing Tubing Pressure		3510 PSIG
Flowing Bottom Hole Pressure		6092 PSIG
Primary Separator Pressure		490 PSIG
Primary Separator Temperature		78 °F.
Secondary Separator Pressure		PSIG
Secondary Separator Temperature		°F.
Field Stock Tank Liquid Gravity		49.7 °API @ 60°F.
Primary Separator Gas Production Rate		2887 MSCF/Day
Pressure Base	15.025 PSIA	
Temperature Base	60 °F.	
Compressibility Factor (F_{pv})	1.0477	
Gas Gravity (Laboratory)	0.688	
Gas Gravity Factor (F_g)	1.2056	
Stock Tank Liquid Production Rate @ 60°F.		650.54 Bbls/Day
Primary Separator Gas/Stock Tank Liquid Ratio		4438 SCF/Bbl
	or	225.33 Bbls/MMSCF
Sampled by		TI

REMARKS:
*Temperature extrapolated to mid-point of perforation = 196°F.

CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Well State 36 No. 1

Hydrocarbon Analyses of Separator Products and Calculated Well Stream

Component	Separator Liquid Mol Percent	Separator Gas Mol Percent	Separator Gas GPM	Well Stream Mol Percent	Well Stream GPM
Hydrogen Sulfide	0.00	0.00		0.00	
Carbon Dioxide	0.00	0.12		0.10	
Nitrogen	0.16	1.14		0.94	
Methane	11.74	81.81		67.81	
Ethane	8.81	10.87	2.964	10.46	1.428
Propane	9.79	3.92	1.100	5.09	0.300
iso-Butane	2.49	0.50	0.167	0.90	0.685
n-Butane	7.04	0.91	0.293	2.13	0.302
iso-Pentane	3.33	0.18	0.067	0.81	0.336
n-Pentane	3.83	0.18	0.067	0.91	0.503
Hexanes	5.63	0.10	0.042	1.21	6.563
Heptanes plus	47.18	0.27	0.125	9.64	10.117
	100.00	100.00	4.825	100.00	

Properties of Heptanes plus

API gravity @ 60°F.	44.5		
Specific gravity @ 60/60°F.	0.8041		0.802
Molecular weight	171	103 (assumed)	169

Calculated separator gas gravity (air=1.000) = 0.688

Calculated gross heating value for separator gas = 1224 BTU per cubic foot of dry gas @ 15.025 psia and 60°F.

Primary separator gas collected @ 490 psig and 78 °F.

Primary separator liquid collected @ 490 psig and 78 °F.

Primary separator gas/separator liquid ratio	3588	SCF/Bbl @ 78°F.
Primary separator liquid/stock tank liquid ratio	1.237	Bbls @78°F/per Bbl @60°F.
Primary separator gas/well stream ratio	800.17	MSCF/MMSCF
Stock tank liquid/well stream ratio	180.30	Bbls/MMSCF

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Well State 36 No. 1

Pressure-Volume Relations of Reservoir Fluid at 196°F.
(Constant Composition Expansion)

Pressure PSIG		Relative Volume	Deviation Factor Z
8000		0.8946	1.482
7630		0.9034	1.427
7255	Original Reservoir Pressure	0.9115	1.369(1)
7100		0.9172	1.348
6700		0.9291	1.289
6300		0.9421	1.229
6000		0.9532	1.185
5700		0.9655	1.140
5450		0.9769	1.103
5300		0.9843	1.081
5150		0.9929	1.060
5050		0.9974	1.044
5018	Dew Point Pressure	1.0000	1.040(2)
5008		1.0006	
4950		1.0049	
4850		1.0119	
4700		1.0240	
4500		1.0422	
4250		1.0687	
3950		1.1089	
3500		1.1860	
3000		1.3198	
2500		1.5253	
2000		1.8695	
1600		2.3295	
1300		2.8763	
1000		3.7825	

(1) Gas expansion factor = 1.572 MSCF/Bbl.
(2) Gas expansion factor = 1.433 MSCF/Bbl.

Depletion Study at 196°F.

Hydrocarbon Analyses of Produced Well Stream - Mol Percent

Component	Reservoir Pressure - PSIG							
	5018	4300	3600	2800	2000	1300	700	700*
Carbon Dioxide	0.10	0.10	0.10	0.10	0.11	0.12	0.14	0.04
Nitrogen	0.94	1.12	1.19	1.20	1.15	1.08	1.03	0.05
Methane	67.81	73.54	76.22	78.13	78.75	78.34	75.34	14.37
Ethane	10.46	10.44	10.41	10.34	10.66	11.10	12.23	7.27
Propane	5.09	4.80	4.57	4.40	4.42	4.66	5.70	7.16
iso-Butane	0.90	0.80	0.73	0.67	0.66	0.71	0.94	2.12
n-Butane	2.13	1.84	1.62	1.47	1.41	1.52	1.97	5.21
iso-Pentane	0.81	0.68	0.59	0.52	0.48	0.48	0.54	2.56
n-Pentane	0.91	0.74	0.63	0.54	0.49	0.49	0.56	2.87
Hexanes	1.21	0.81	0.57	0.42	0.34	0.33	0.40	5.87
Heptanes plus	9.64	5.13	3.37	2.21	1.53	1.17	1.15	52.48
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Molecular weight of heptanes plus	169	133	124	115	109	106	107	180
Specific gravity of heptanes plus	0.801	0.777	0.770	0.759	0.752	0.749	0.750	0.808
Deviation Factor - Z								
Equilibrium gas	1.040	0.911	0.845	0.820	0.847	0.888	0.935	
Two-phase	1.040	0.952	0.878	0.812	0.752	0.682	0.559	
Well Stream produced-								
Cumulative percent of initial	0.000	6.304	14.855	28.142	44.651	60.178	73.736	
GPM from Smooth Compositions								
Propane plus	10.117	5.906	4.489	3.580	3.131	3.066	3.650	
Butanes plus	8.689	4.559	3.207	2.345	1.891	1.758	2.051	
Pentanes plus	7.704	3.701	2.443	1.650	1.218	1.032	1.105	

*Composition of equilibrium liquid phase.

Calculated Cumulative Recovery During Depletion

Cumulative Recovery per MMSCF of Original Fluid	Initial in Place	Reservoir Pressure - PSIG 5018	4300	3600	2800	2000	1300	700
Well Stream - MSCF	1000	0	63.04	148.55	281.42	446.51	601.78	737.36
Normal Temperature Separation*								
Stock Tank Liquid - Barrels	189.70	0	5.58	10.36	15.01	18.90	21.09	
Primary separator gas-MSCF	789.49	0	55.38	133.93	259.64	418.40	571.04	
Second stage gas - MSCF	45.62	0	1.70	3.25	4.86	6.31	6.46	
Stock tank gas - MSCF	26.80	0	1.10	2.13	3.23	4.24	4.55	
Total "Plant Products" in Primary Separator Gas - Gallons								
Propane	833	0	62	151	293	478	676	
Butanes (total)	342	0	27	68	134	221	326	
Pentanes plus	185	0	15	37	75	125	200	
Total "Plant Products" in Second Stage Separator Gas-Gallons								
Propane	161	0	6.3	12.1	18.1	23.6	24.0	
Butanes (total)	72	0	3.1	6.0	9.0	11.9	12.1	
Pentanes plus	37	0	1.6	3.1	4.8	6.4	6.5	
Total "Plant Products" in Well Stream - Gallons								
Propane	1428	0	85	195	359	563	766	983
Butanes (total)	965	0	54	119	212	323	436	564
Pentanes plus	7704	0	233	442	661	863	1023	1173

*Primary separator at 490 psig and 78°F.; second stage separator at 70 psig and 75°F.; and stock tank at 70°F., except 1300 psig well stream where primary separator is at 200 psig and 78°F.

Retrograde Condensation During Gas Depletion at 196°F.

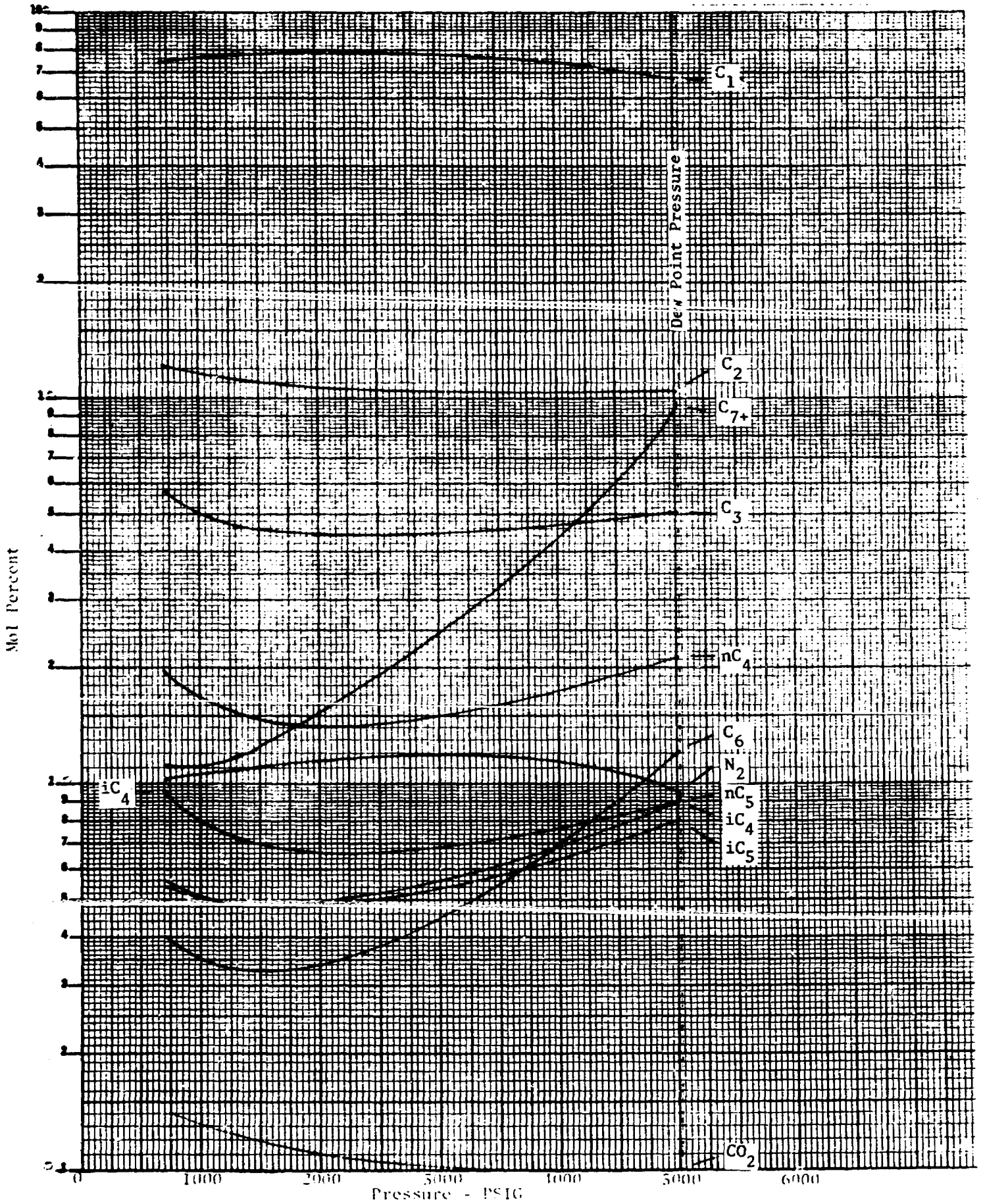
Pressure PSIG		Retrograde Liquid Volume Percent of Hydrocarbon Pore Space
5018	Dew Point Pressure	0.0
5012		0.8
5008		1.4
4950		11.2
4850		17.8
4700		23.7
4500		28.6
4300		32.9
3600		36.7
2800		37.0
2000		35.2
1300		32.5
700		29.7
0		24.5

Properties of Zero PSIG Residual Liquid

API Gravity @ 60°F.	43.6
Specific gravity @ 60/60°F.	0.8080
Molecular weight	181

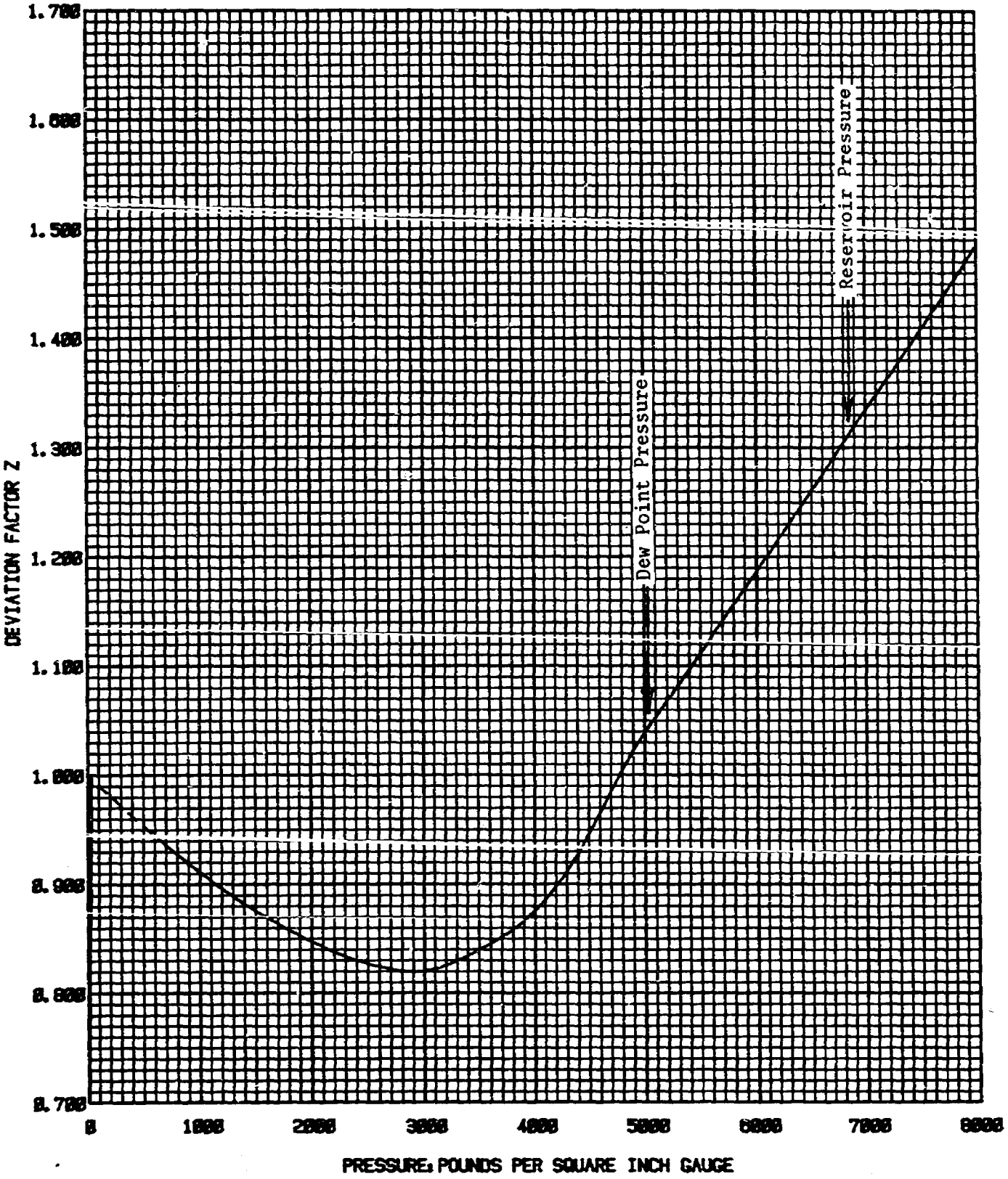
Hydrocarbon Analyses of Produced Well Stream
During Depletion at 190°F.

Page 7 of 12
File RFL 79619
Well State 36 No. 1



DEVIATION FACTOR Z OF WELL STREAM DURING DEPLETION AT 198°F.

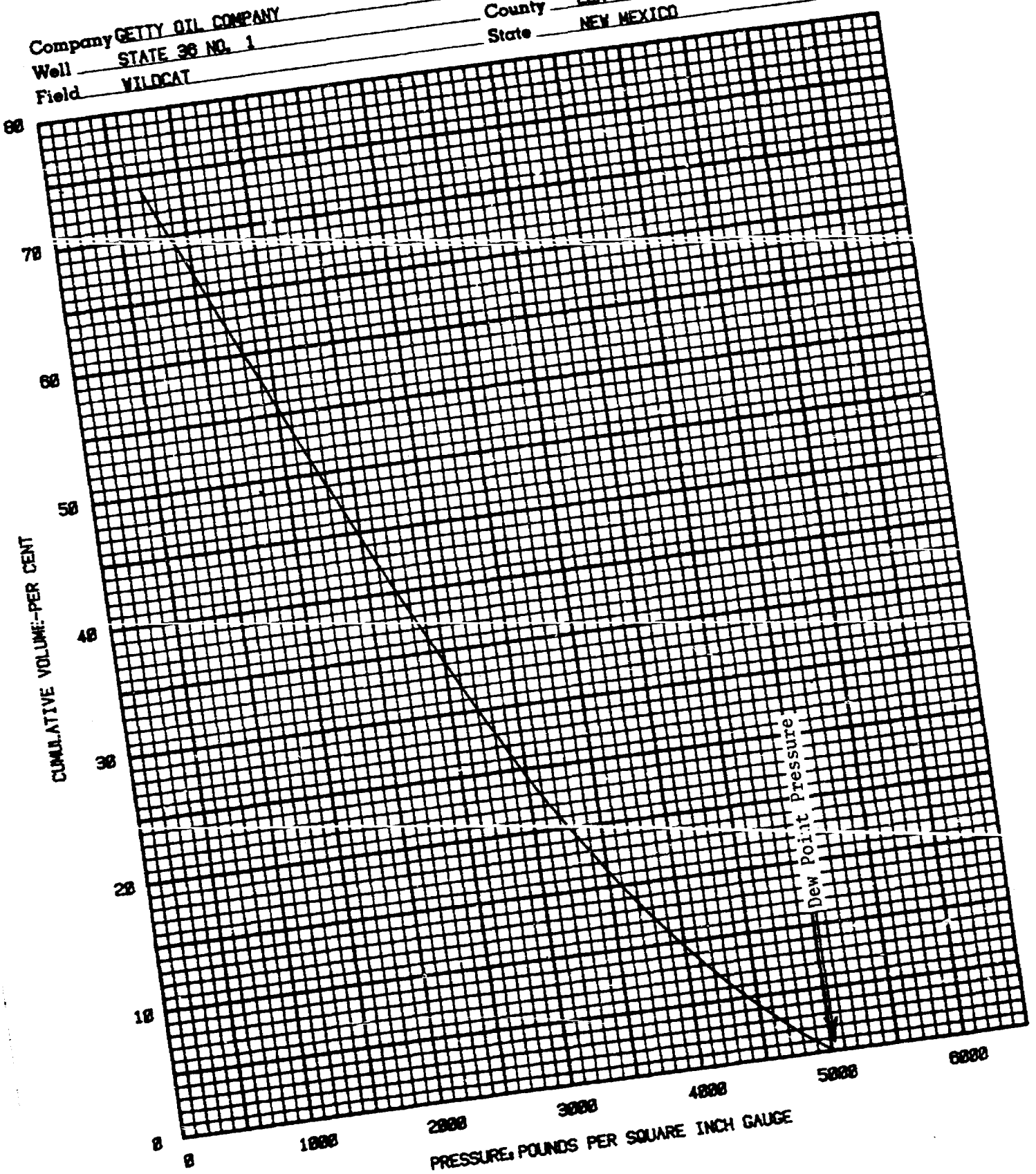
Company GETTY OIL COMPANY — Formation WOLFCAMP
Well STATE 36 NO. 1 — County LEA
Field WILDCAT — State NEW MEXICO



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

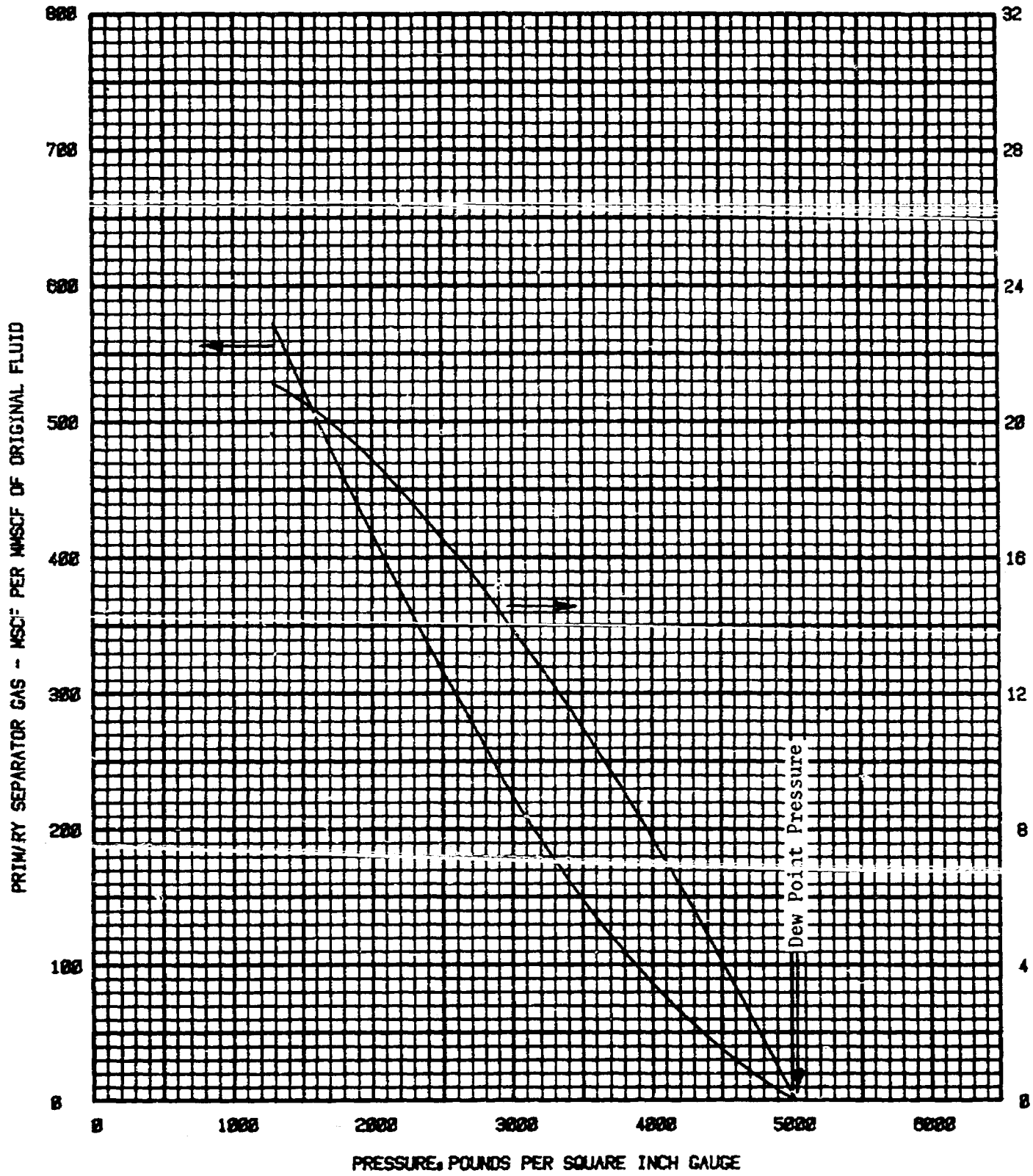
VOLUME OF WELL STREAM PRODUCED DURING DEPLETION

Company GETTY OIL COMPANY
Well STATE 36 NO. 1
Field WILDCAT
Formation WOLFCAMP
County LEA
State NEW MEXICO



CUMULATIVE RECOVERY DURING DEPLETION

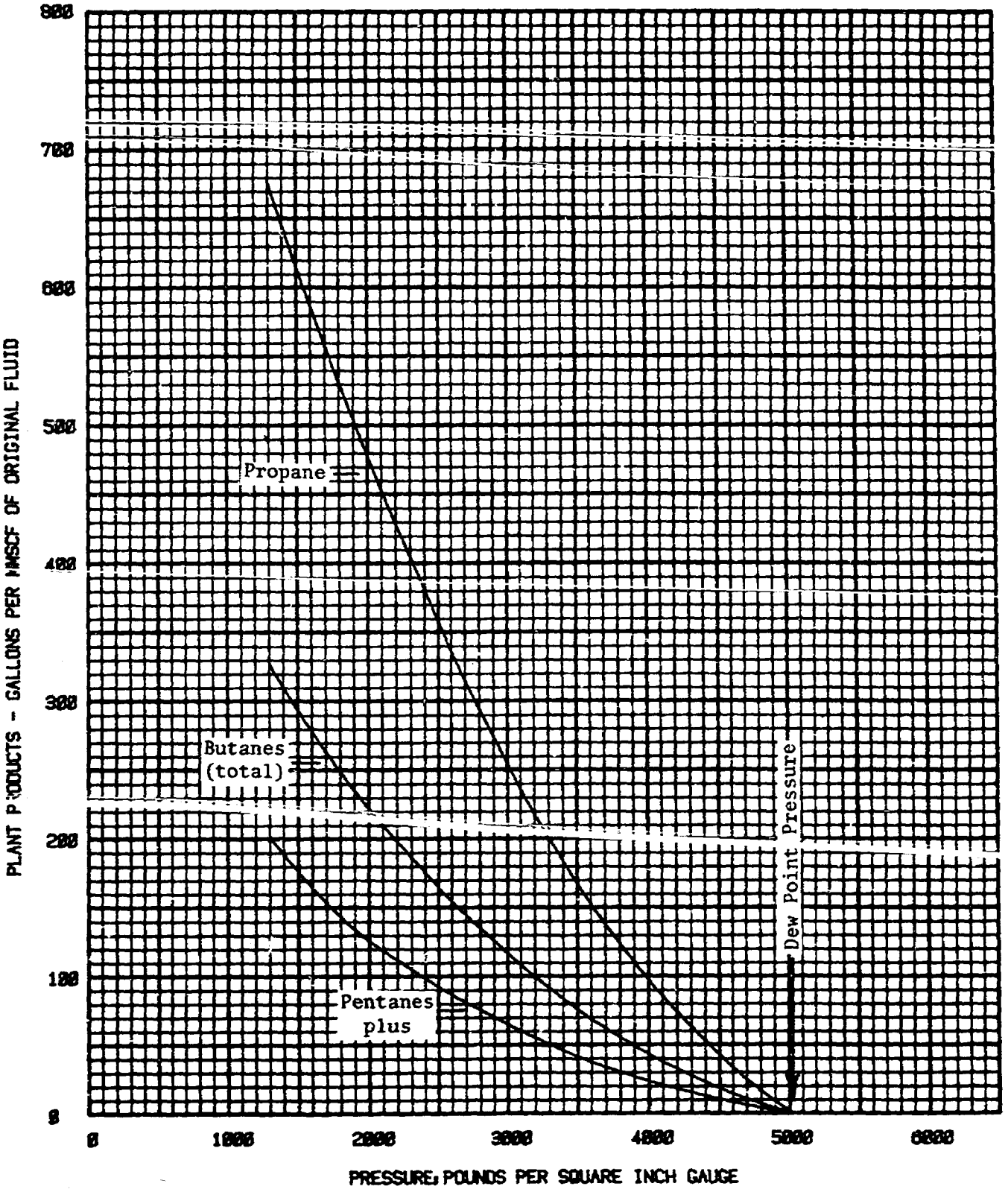
Company GETTY OIL COMPANY — Formation WOLFCAMP
Well STATE 36 NO. 1 — County LEA
Field WILDCAT — State NEW MEXICO



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

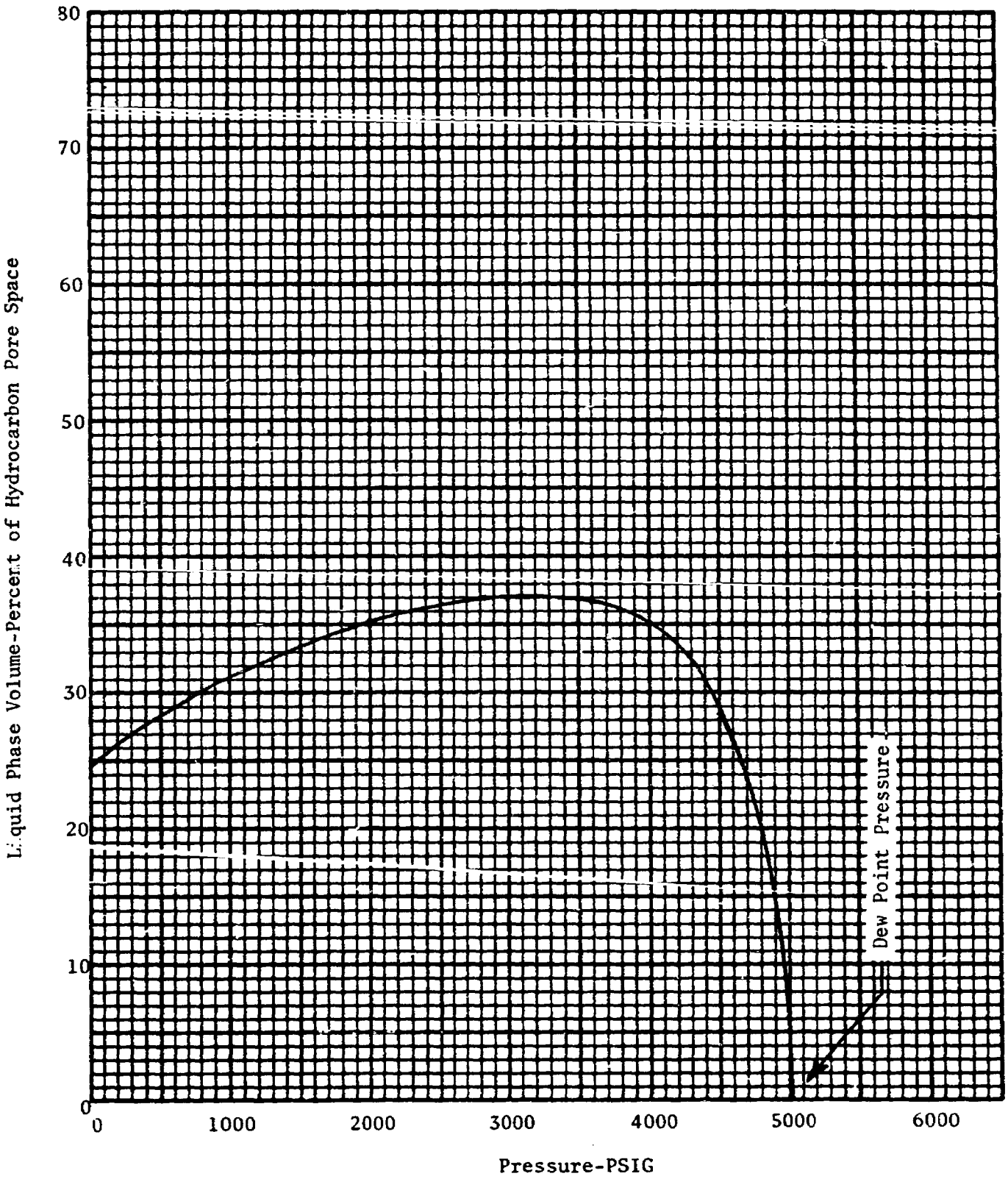
CUMULATIVE RECOVERY-PLANT PRODUCTS IN WELLSTREAM

Company GETTY OIL COMPANY — Formation WOLFCAMP
Well STATE 36 NO. 1 — County LEA
Field WILDCAT — State NEW MEXICO



Retrograde Liquid Accumulation During Depletion at 196°F.

Company Getty Oil Company **Formation** Wolfcamp
Well State 36 No. 1 **County** Lea
Field Wildcat **State** New Mexico



INTER-OFFICE CORRESPONDENCE

Getty Oil Company

Midland, Texas
March 21, 1980

TO: MR. J. E. EAKIN

FROM: JIM VARNON

SUBJECT: GETTY 36 STATE COM. WELL NO. 1 (WOLFCAMP)
PRESSURE BUILDUP (2/26-29/80) AND PVT ANALYSIS

Attached is an analysis of pressure and PVT data. The wealth of data for this well makes it possible to accurately predict reservoir performance. The current pressure test confirms the limited reservoir size shown by an earlier pressure test in September 1979. Summary of the analysis is:

Original Pressure @ 7/4/79	= 7255 psi
Pressure @ 2/29/80	= 4600 psi at mid perfs
Transmissibility (kh)	= 288 md-ft
Skin Factor	= +17
Pressure Drawdown ($\bar{P} - P_{wf} - \Delta P_{skin}$)	= 193 psi for 2 million/day
Original Separator Gas Reserves	
down to 500m without surface compression	= 2.46 BCF (72% of orig gas in place
down to 0 psig. with surface compression	= 2.73 BCF (80% recovery)
Original Condensate Reserves	
without surface compression	= 147 MSTB 18.9% recovery
with surface compression	= 151 MSTB 19.4% recovery

The large skin factor is caused by the narrow perforated interval and could be eliminated at any time by additional perfs. The small pressure drawdown results from large reservoir kh and low production rate (2200 mcfpd), and shows that the rate could be increased two or three-fold with no expected effect on ultimate recovery.

Recovery factors are 80% for gas and 19% for condensate. Liquid yield has dropped from 230 STB/MMCF to 125 and it will continue to drop sharply to below 50. Pressure maintenance is probably not feasible and becomes less feasible as liquids dropout in the reservoir.

Reserves listed above assume that the well will never produce water, that the skin will be removed by workover, and that retrograde liquid is nonmobile.

16' perfs out of 160' feet of pay

Jim Varnon

Jim Varnon

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
Getty EXHIBIT NO. 8
CASE NO. 6865

JEV:slw
Attach.
cc: Mr. H. W. Terry

K·E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6010

SEMILOG PLOT
PRESSURE BUILDUP 2/22-29/90
GETTY 36 STATE WELL #1 (WOLFCAMP)

4600

BHP@ 11328' (psig)

4500

4400

.01 .1 1 10 100

Δt (hrs)

$\bar{P}$ = 4600 psig

m = 30 psi/cycle

$$kh = \frac{162.6\, q B \mu}{m} = \frac{(162.6)(2200)(0.69)(0.035)}{30}$$

kh = 288 md-ft

k = 288/94 = 3.1 md

$$S = 1.151\left[\frac{P_{1hr} - P_{wf}}{m} - \log\frac{k}{\phi\mu C_t r_w^2} + 3.23\right]$$

$$S = 1.151\left[\frac{4550-3963}{30} - \log\frac{3.1\times10^{-6}}{(0.15)(0.035)(77)(0.1)} + 3.23\right]$$

S = +17

$\Delta P_{skin} = (0.87)(s)(m) = (0.87)(17)(30) = 444$ psi

$\Delta P_{drawdown} = \bar{P} - P_{wf} - \Delta P_{skin} = 4600 - 3963 - 444 = 193$

Exhibit 1

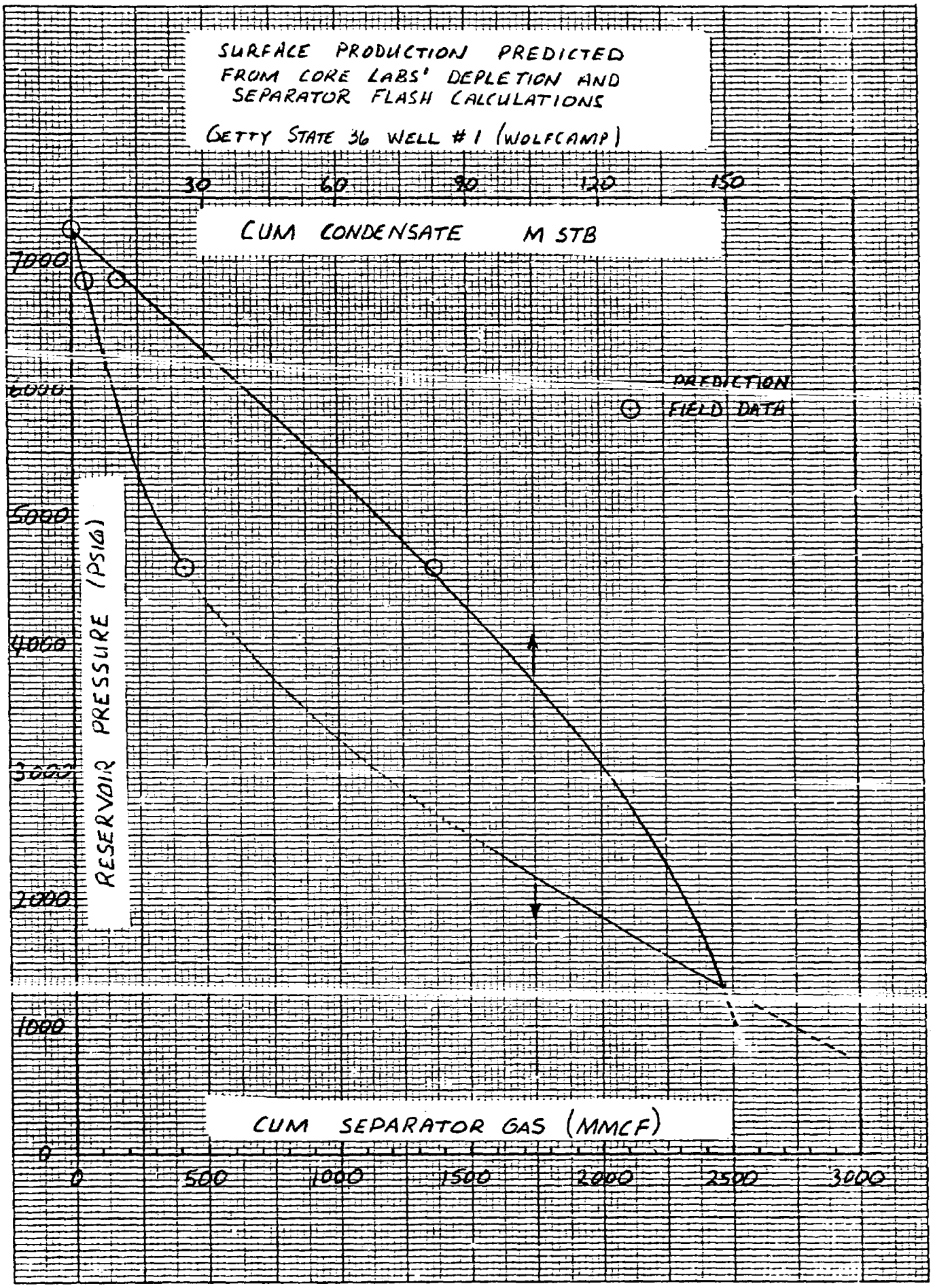


Exhibit 2

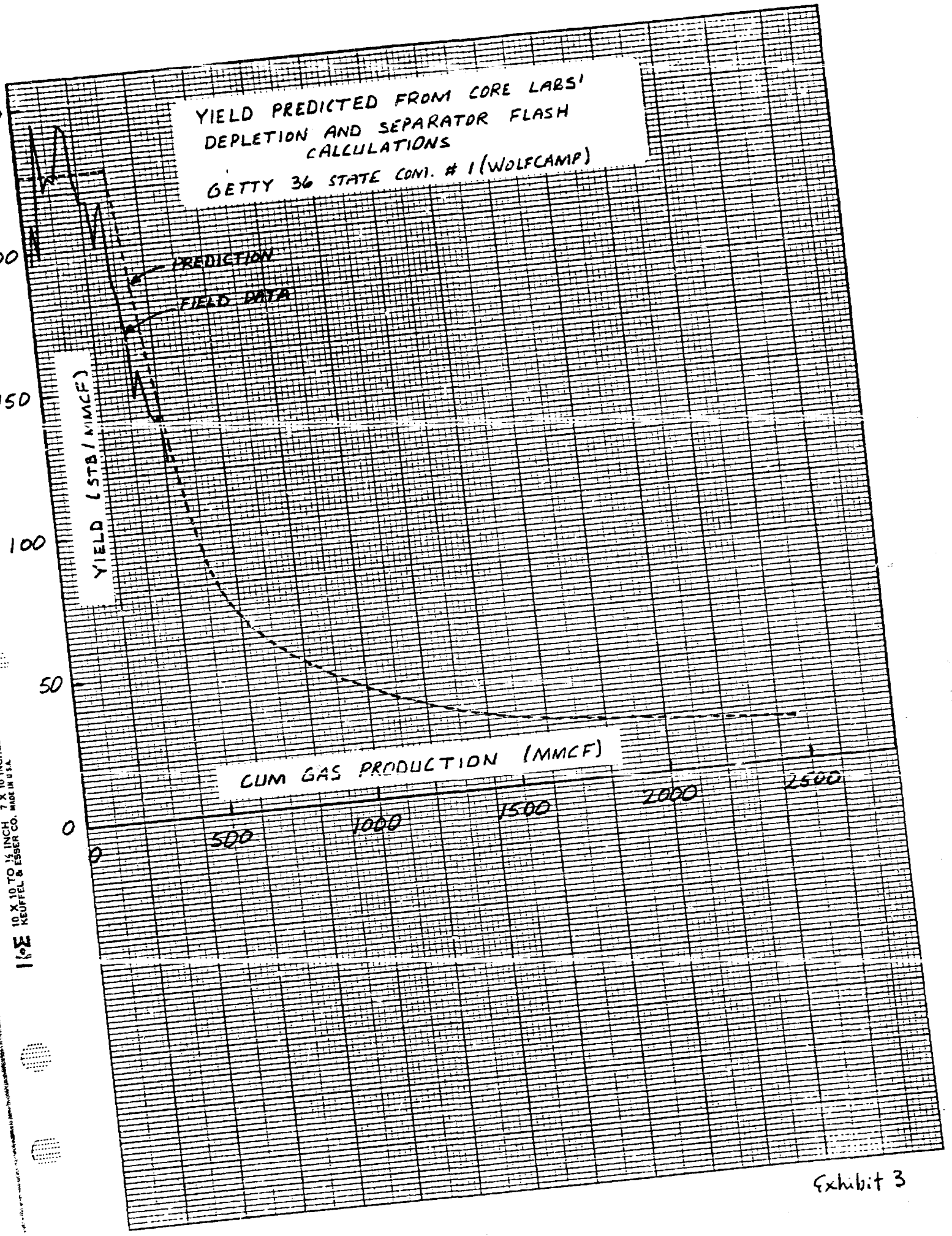


Exhibit 3

Getty

GETTY 36 STATE COM WELL No. 1
ANALYSIS OF PRESSURE BUILDUP (2/26-29/80)

I. Log-log Plot

Afterflow was almost completed before the first data point. The log-log plot is just a flat line and is not included here

II Semilog Plot (Exhibit 1)

The semilog plot exhibits the leveling off typical of a limited reservoir. The early hump in the semilog curve also occurred in the buildup run in Sept 1979. It is apparently caused by phase segregation in the tubing. Reservoir and completion properties are shown on the figure. The large skin factor is caused by the partial perforation (16' perf'd versus 116' gross pay) and could be eliminated at any time.

Note the small drawdown pressure (193 psi) relative to the pressure depletion (2655 psi since discovery). The reservoir is being depleted like a constant pressure tank. This well is capable of producing at a much higher rate with no foreseeable detriment to ultimate recovery.

III BASIC DATA FOR BUILDUP CALCULATIONS

$h = 94$ ft

$\phi = 0.15$

$S_{wi} = 0.20$

$T = 196\ ^\circ F = 656\ ^\circ R$

Fluid = Gas Condensate (PVT Analysis is available)

Mobile Fluid = Gas @ 4600 psi (Retrograde Liquid is nonmobile)

z @ 4600 psi = 0.965 (PVT Report page 9)

$T_c = 461\ ^\circ R$ (Calculated from composition)

$P_c = 642$ psia (Calculated from composition)

$T_r = 656/461 = 1.4$

$P_r = 4615/642 = 7.2$

$\gamma = 1.07$ (Calculated from composition)

$$c_g = \frac{1}{P} - \frac{1}{z}\frac{\partial z}{\partial P} = \frac{1}{4615} - \frac{1}{0.965}(121 \times 10^{-6}) = 91 \times 10^{-6}\ psi^{-1}$$

$$c_t = S_g c_g + S_w c_w + c_f = 77 \times 10^{-6}\ psi^{-1}$$

$$B_g = 5.04\frac{zT}{P} = \frac{(5.04)(0.965)(656)}{4615} = 0.69\ \frac{bbl}{MCF}$$

$\mu_g = 0.035$ cp (Carr-Kobayashi correlation for $\gamma = 1.07$)

IV STEADY-STATE RATE PREDICTION

$$q_{sc} = \frac{0.00708\,kh}{\mu B}\frac{\Delta P}{\ln r_e/r_w} = \frac{(0.00708)(288)}{(0.035)(0.69)}\frac{193}{\ln \frac{875}{0.316}} = 2050\ \frac{MCF}{DAY}$$

Note: $\Delta P = \bar{P} - P_{wf} - \Delta P_{skin} = 4400 - 3963 - 444 = 193$ psi

V. ABANDONMENT PRESSURE

$$\bar{P}_{abd} = P_{wf} + \Delta P_{drawdown} + \Delta P_{skin}$$

From equations commonly used in gas well testing, the flowing BHP can be estimated from wellhead pressure.

$$P_{wf} = e^{\frac{K}{3}} \sqrt{P_{wh}^2 + q^2 \left(\frac{\sqrt{\gamma} L}{c}\right)^2} \qquad (1)$$

where P_{wf} = flowing BHP, psi

P_{wh} = wellhead pressure, psi

$K = \gamma L / 53.35 \bar{T}_f$

L = tubing length = 11328'

$\bar{T}_f$ = average flowing temperature, °R = 598 °R

$\bar{z}$ = average z-factor from bottom-hole to wellhead

q = well rate, MCF/DAY = 2200

$c = 1118 d^{8/3} / \sqrt{\bar{T}_f} = 325$ for $d = 2''$

In the Feb 1980 pressure test, drawdown ΔP was 192 psi and skin ΔP was 444 psi. Use drawdown ΔP = 200, although rate will decline some at this drawdown since formation volume factor increases with depletion faster than viscosity decreases. Use skin ΔP = 0 since the skin can be eliminated by workover.

$$\bar{P}_{abd} = P_{wf} + 200 \qquad (2)$$

Equations (1) and (2) can be solved for $\bar{P}_{abd}$ given any wellhead pressure. In order to get γ and $\bar{z}$, it is necessary to assume $\bar{P}_{abd}$, so the calculation is iterative. Results of this calculation for the two cases

of interest are:

I. No Surface Compressor : $P_{wh} = 500$: $\bar{P}_{abd} = 1300$ psi

II. With Surface Compressor : $P_{wh} = 0$: $\bar{P}_{abd} = 1000$ psi

These abandonment pressures assume zero water production.

VI. RESERVES

A. Original-Gas-In-Place B_g Material Balance @ 4600 psi

$G(B_g - B_{gi}) = G_p B_g$ where B_g is a two-phase B

$$B_g = 5.04 \frac{zT}{P} \quad \frac{bbl}{MCF}$$

$$B_{gi} = \frac{(5.04)(1.369)(656)}{7255+15} = 0.6226 \qquad z_i = 1.369 \text{ from PVT data}$$

$$B_g = \frac{(5.04)(0.989)(656)}{4600+15} = 0.7085 \qquad z_t = 0.989 \text{ " " "}$$

G_p = cum. production of wet gas + condensate + stock tank vapor

= 417905 MCF + 82258 STB + Vapor

= ~~717105~~ MCF + 61300 MCF + 12500

= 492000 MCF

$$G = OGIP = \frac{(492000)(0.7085)}{0.7085 - 0.6226} = 4.1 \text{ BCF}$$

Note: Condensate production is converted to gas equivalent by

$$\frac{SCF}{STB} = \frac{350 \gamma_o}{M_o} \frac{RT_{sc}}{P_{sc}} = \frac{(350)(0.78)}{139} \frac{(10.73)(520)}{14.7} = 745 \frac{SCF}{STB}$$

where $\gamma_o = \frac{141.5}{API+131.5} = 0.78$ and $M_o = \frac{6084}{API-5.9} = 139$ for API = 49.7°

B. Reserves of Gas and Condensate (Exhibit 2)

Surface production can be easily predicted from Core Labs' PVT cell depletion and flash calculations to the produced well stream. These calculations are performed by Core Labs on the basis of 1.0 MMCF of reservoir fluid at the dew point, 5018 psig. Correcting to the original reservoir pressure given a basis of 1.097 MMCF at original pressure, 7255 psig, meaning that 0.097 MMCF per 1.0 MMCF are produced above the dew point. Adding this recovery to that given on page 5 of the Core Labs report, and proportioning up to the reservoir size of 4100 MMCF by the factor 4100/1.097, gives immediately the cumulative surface production versus reservoir pressure (Exhibit 2). Note how accurately the prediction matches the field performance to date. Reserves for any abandonment pressure can be read directly from this plot.

Without surface compression: $\bar{P}_{abd}$ = 1300 psig

Gas Reserves = 2460 MMCF

Condensate Reserves = 147 MSTB

With surface compression: $\bar{P}_{abd}$ = 1000 psig

Gas Reserves = 2730 MMCF

Condensate Reserves = 151 MSTB

These recoveries assume that the well will never produce any water and that retrograde liquid is nonmobile.

C. Liquid Yield versus Cumulative Gas Production (Exhibit 3)

Instantaneous yield is not reported in Core Labs' separator flash calculation results. It can be computed by plotting cumulative liquid versus cumulative gas and taking slopes. Exhibit 3 shows the results along with a comparison to actual field performance to date.

D. Reservoir Radius

$$\frac{7758\, Ah\, \phi\, S_g}{B_{gi}} = OGIP = 4.1 \times 10^9 \text{ SCF}$$

$$Ah = \frac{(4.1\times10^9)(B_{gi})}{7758\, \phi\, S_g} = \frac{(4.1\times10^9)(0.000587)}{(7758)(0.15)(0.8)}$$

$$Ah = 2585 \text{ acre-ft} = 112.6\times10^6 \text{ ft}^2$$

$$\pi r^2 h = 112.6 \times 10^6$$

$$r = \sqrt{\frac{112.6\times10^6}{h\pi}}$$

$r = 618$ ft if average $h = 94'$ 28 acres

$r = 873$ ft if average $h = 47'$ 55 acres

Getty

E. Remarks on Recovery Efficiency

Original Gas in Place = 4100 MMCF

Original Separator Gas in Place = $(4100 \text{ MMCF})\left(\frac{835 \text{ MCF}}{1.0 \text{ MMCF}}\right) = 3424$ MMCF

Ultimate Recovery w/ compression = 2730 MMCF

Gas Recovery Efficiency = 2730/3424 = 80 %

Original Stock Tank Liq in Place = $(4100 \text{ MMCF})\left(\frac{189.7 \text{ STB}}{1.0 \text{ MMCF}}\right) = 778$ MSTB

Ultimate Recovery w/ compression = 151 MSTB

Condensate Recovery Efficiency = 151/778 = 19 %

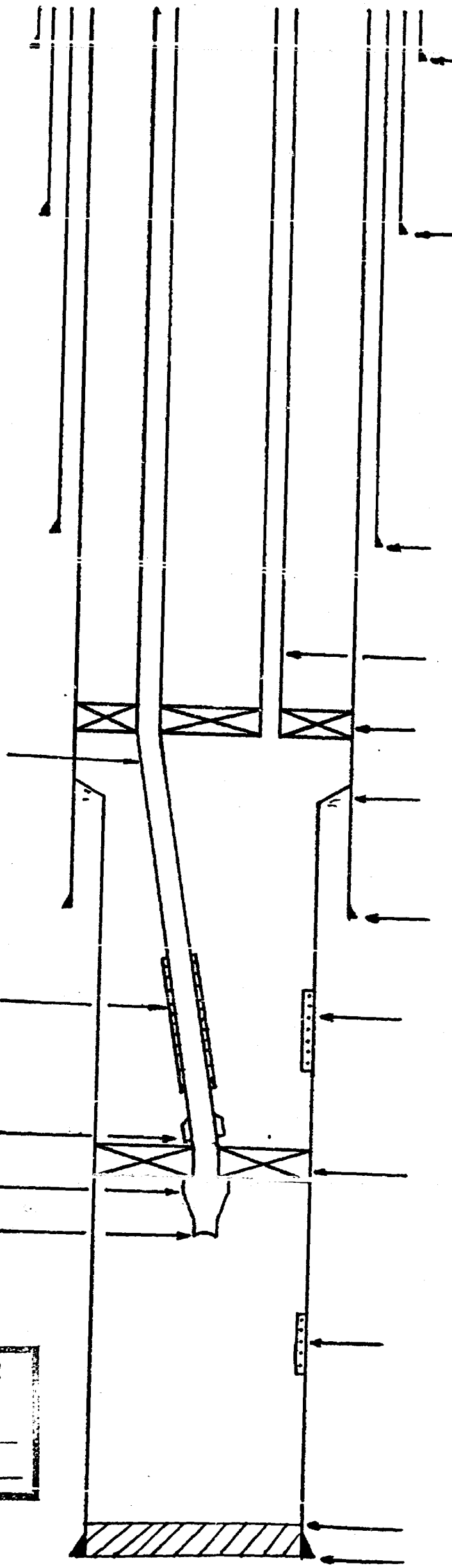
Pressure depletion will give excellent gas recovery but will leave some 627,000 STB of condensate in the ground. It may be advisable to consider some type of inert gas pressure maintenance project. Discouraging features are:

1. We will probably never have a second well in the reservoir.
2. These potential reserves are not large enough to support much expense in developing a source of injection gas.
3. Reservoir pressure is already below the dew point and retrograde dropout is 70% of the maximum. Revaporization with inert gas pressure may not be possible.

Encouraging features are the favorable reservoir characteristics, [illegible], permeable, and probably narrow areally, giving rise to the possibility of a vertical, gravity stabilized flood.

Water injection is out of the question because it would seriously jeopardize gas reserves.

LEA COUNTY, NEW MEXICO



20",94# H-40 @ 40'
w/3 yds. Ready-Mix

13 3/8", 48#, H-40
@ 1100'. Circulate
17 sxs to surface

9 5/8",36#, S-80 &
K-55 at 5502'.
Circulate 125 sxs
cement surface

2 3/8", N-80 8rd tbg

Baker Model "AL-5"
Dual pkr. at 10,505'
w/2 3/8" x 1.81"
Model "F" nipple
Liner top at 10,815'
Squeezed w/100 sxs

2 3/8", N-80 8rd tbg.

7", 26# N-80 & S-95
@ 11,114'. Cement
top by Worth Well
Temp. at 3570'.

5-20' blast joints

Wolfcamp perfs.
11,320-11,335'

3 11/16" x 26' x 1.81'
"ER" tbg.
Receptacle w/1.87' BFC
Model "F" profile

Baker Model "DB"
pkr. @ 12,000'

3 1/2' x 6' mill-out

2 3/8" x 10' pup joint

Morrow perfs.
12,940-12,950'

Plug back TD 13,266'

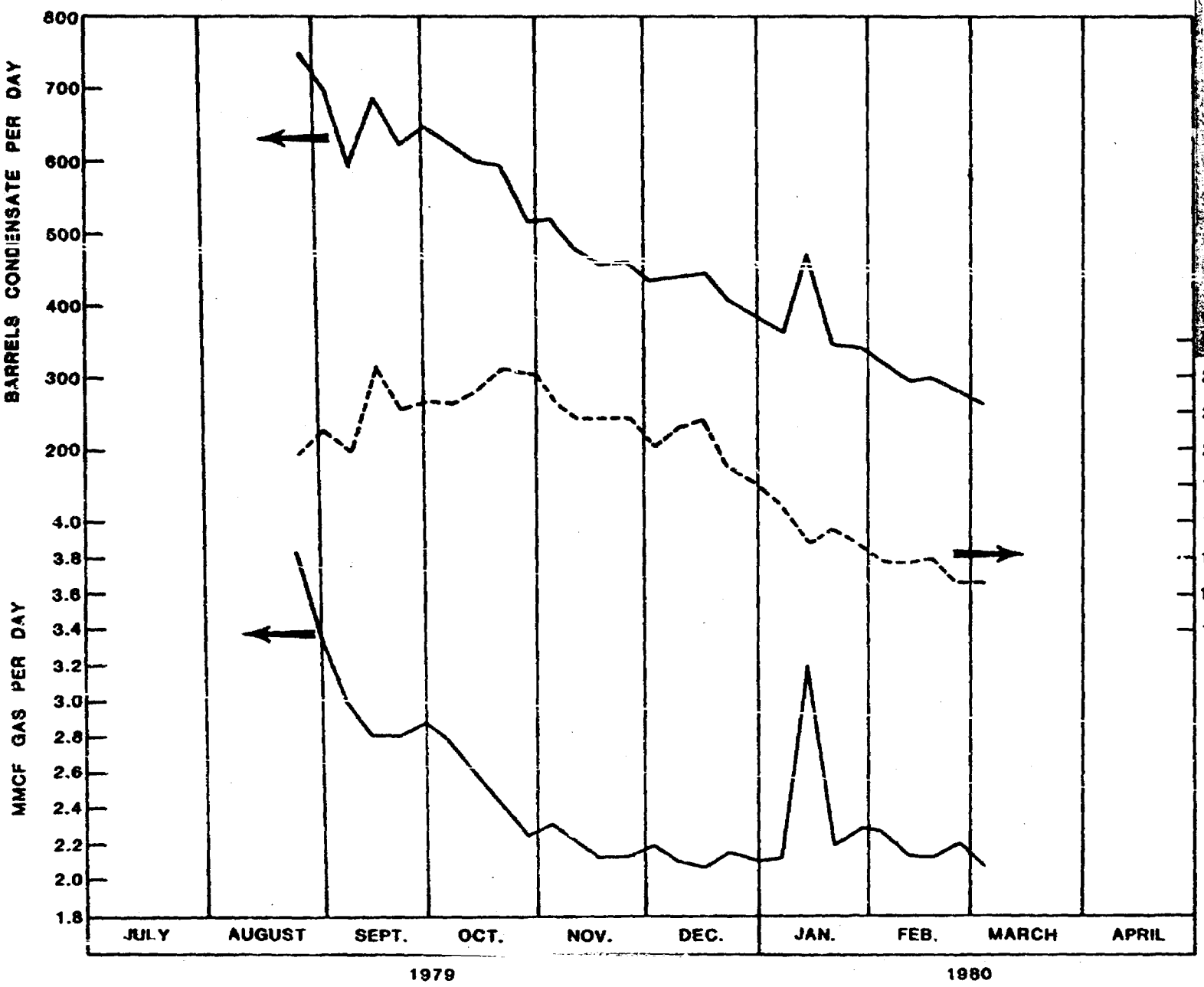
4 1/2" 11.6# S-95 @
13,349'

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
EXHIBIT NO. 2
CASE NO. 6865

DAILY TEST DATA
GETTY "36" STATE COM. WELL NO. 1
WOLFCAMP

Week of	Condensate Bbls.	Gas (MMCF)	CON. YIELD (BBLS./MCF)
Aug. 27	750	3.82	196.33
Sep. 3	700	3.32	210.84
Sep. 10	590	2.98	197.98
Sep. 17	685	2.80	244.64
Sep. 24	620	2.80	221.42
Oct. 1	645	2.86	225.52
Oct. 8	620	2.77	223.82
Oct. 15	600	2.59	231.66
Oct. 22	590	2.42	243.80
Oct. 29	515	2.14	240.65
Nov. 5	518	2.3	225.21
Nov. 12	475	2.2	215.91
Nov. 19	455	2.11	215.63
Nov. 26	458	2.12	216.03
Dec. 3	435	2.18	199.54
Dec. 10	442	2.09	211.48
Dec. 17	445	2.06	216.02
Dec. 24	105	2.1	199.25
Dec. 31	380	2.1	180.95
Jan. 7	360	2.12	169.81
Jan. 14	470	3.190	147.34
Jan. 21	341	2.192	155.57
Jan. 28	336	2.274	147.76
Feb. 4	313	2.258	138.62
Feb. 11	292	2.132	136.96
Feb. 18	295	2.117	139.75
Feb. 25	274	2.202	124.43
Mar. 3	260	2.077	125.18

GETTY 36 STATE COM WELL NO. 1 - GRAMA RIDGE WOLFCAMP POOL



BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
EXHIBIT NO. 4
CASE NO. 6865

GETTY 36 STATE COM. NO. 1 - WOLFCAMP
PRODUCTION DATA

MONTH	CONDENSATE, BBL.	GAS, MCF
August, 79	4,864	19,492
Sept., 79	16,150	74,619
Oct., 79	17,660	76,388
Nov., 79	13,439	61,611
Dec., 79	12,244	64,464
Jan., 80	10,412	64,131
Feb., 80	7,489	57,200*
Total	82,258	417,905

*estimated

Well was opened after buildup at 11 a.m. on February 29, 1980. Hence, total estimated production through February is approximately the production prior to the start of the buildup.

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
Getty EXHIBIT NO. 5
CASE NO. 6865

JARREL SERVICES, INC.

POST OFFICE BOX 1654 PHONE 505 393-3117
HOBBS, NEW MEXICO 88240

COMPANY: Getty Oil Company

WELL: Getty 36 State Com. No. 1 FIELD: Undesignated - Wolfcamp

CHRONOLOGICAL PRESSURE DATA

DATE	STATUS OF WELL	TIME	ELASPED TIME HRS.	ELASPED TIME MIN.	SURFACE PRESSURE TBG	SURFACE PRESSURE CSG	BHP @ (-7636 ') 10485'	BHP @ (-7636 ') 11328' PSIG
1980								
2/26	Flowing. Run Flowing Gradient w/Tandem Bombs & Set Bombs off @ 10485'	10:30 AM	0	00	2346	PKR	3840	3963
	Shut in	11:00	0	30	2346	–	3840	3963
	"	11:03	0	03	–	–	4045	4408
	"	11:06	0	06	–	–	4154	4517
	"	11:09	0	09	–	–	4179	4542
	"	11:12	0	12	–	–	4186	4549
	"	11:15	0	15	–	–	4192	4555
	"	11:20	0	20	–	–	4192	4555
	"	11:25	0	25	–	–	4192	4555
	"	11:30	0	30	–	–	4192	4555
	"	11:45	0	45	–	–	4192	4555
	"	12:00 N	1	00	–	–	4192	4555
	"	1:00 PM	2	00	–	–	4199	4562
	"	2:00	3	00	–	–	4205	4568
	"	3:00	4	00	–	–	4205	4568
	"	4:00	5	00	–	–	4205	4568
	"	5:00	6	00	–	–	4212	4575
	"	6:00	7	00	–	–	4212	4575
	"	7:00	8	00	–	–	4212	4575
	"	8:00	9	00	–	–	4218	4581
	"	9:00	10	00	–	–	4218	4581
	"	10:00	11	00	–	–	4218	4581
	"	11:00	12	00	–	–	4218	4581
	"	12:00 MN	13	00	–	–	4218	4581
2/27	"	1:00 AM	14	00	–	–	4218	4581
	"	2:00	15	00	–	–	4218	4581
	"	3:00	16	00	–	–	4218	4581
	"	4:00	17	00	–	–	4218	4581
	"	5:00	18	00	–	–	4218	4581
	"	6:00	19	00	–	–	4218	4581
	"	7:00	20	00	–	–	4218	4581
	"	8:00	21	00	–	–	4218	4581
	"	9:00	22	00	–	–	4218	4581
	"	10:00	23	00	–	–	4218	4581
	"	11:00	24	00	–	–	4218	4581
	"	12:00 N	25	00	–	–	4218	4581
	"	1:00 PM	26	00	–	–	4224	4587
	"	2:00	27	00	–	–	4224	4587
	"	3:00	28	00	–	–	4224	4587
	"	4:00	29	00	–	–	4224	4587

WELL: Getty 36 State Com. No. 1
PAGE: 2

DATE	STATUS OF WELL	TIME	ELASPED TIME HRS.	ELASPED TIME MIN.	SURFACE PRESSURE TBG	SURFACE PRESSURE CSG	BHP @ (-7636) 10485'	BHP @ (-7636) 11328'PS
	Shut in	5:00	30	00	-	-	4224	4587
	"	6:00	31	00	-	-	4224	4587
	"	7:00	32	00	-	-	4224	4587
	"	8:00	33	00	-	-	4224	4587
	"	9:00	34	00	-	-	4224	4587
	"	10:00	35	00	-	-	4224	4587
	"	11:00	36	00	-	-	4224	4587
	"	12:00 MN	37	00	-	-	4224	4587
2/28	"	1:00 AM	38	00	-	-	4224	4587
	"	2:00	39	00	-	-	4224	4587
	"	3:00	40	00	-	-	4224	4587
	"	4:00	41	00	-	-	4231	4594
	"	5:00	42	00	-	-	4231	4594
	"	6:00	43	00	-	-	4231	4594
	"	7:00	44	00	-	-	4231	4594
	"	8:00	45	00	-	-	4231	4594
	"	9:00	46	00	-	-	4231	4594
	"	10:00	47	00	-	-	4231	4594
	"	11:00	48	00	-	-	4231	4594
	"	12:00 N	49	00	-	-	4231	4594
	"	1:00 PM	50	00	-	-	4231	4594
	"	2:00	51	00	-	-	4231	4594
	"	3:00	52	00	-	-	4231	4594
	"	4:00	53	00	-	-	4231	4594
	"	5:00	54	00	-	-	4231	4594
	"	6:00	55	00	-	-	4231	4594
	"	7:00	56	00	-	-	4231	4594
	"	8:00	57	00	-	-	4231	4594
	"	9:00	58	00	-	-	4231	4594
	"	10:00	59	00	-	-	4237	4600
	"	11:00	60	00	-	-	4237	4600
	"	12:00 MN	61	00	-	-	4237	4600
2/29	"	1:00 AM	62	00	-	-	4237	4600
	"	2:00	63	00	-	-	4237	4600
	"	3:00	64	00	-	-	4237	4600
	"	4:00	65	00	-	-	4237	4600
	"	5:00	66	00	-	-	4237	4600
	"	6:00	67	00	-	-	4237	4600
	"	7:00	68	00	-	-	4237	4600
	"	8:00	69	00	-	-	4237	4600
	"	9:00	70	00	-	-	4237	4600
	"	10:00	71	00	-	-	4237	4600
	Fished Bombs & Run Static Gradient	11:00	72	00	2731	-	4237	4600

JARREL SERVICES, INC.

POST OFFICE BOX 1654 PHONES 505 393-5398 — 393-8274

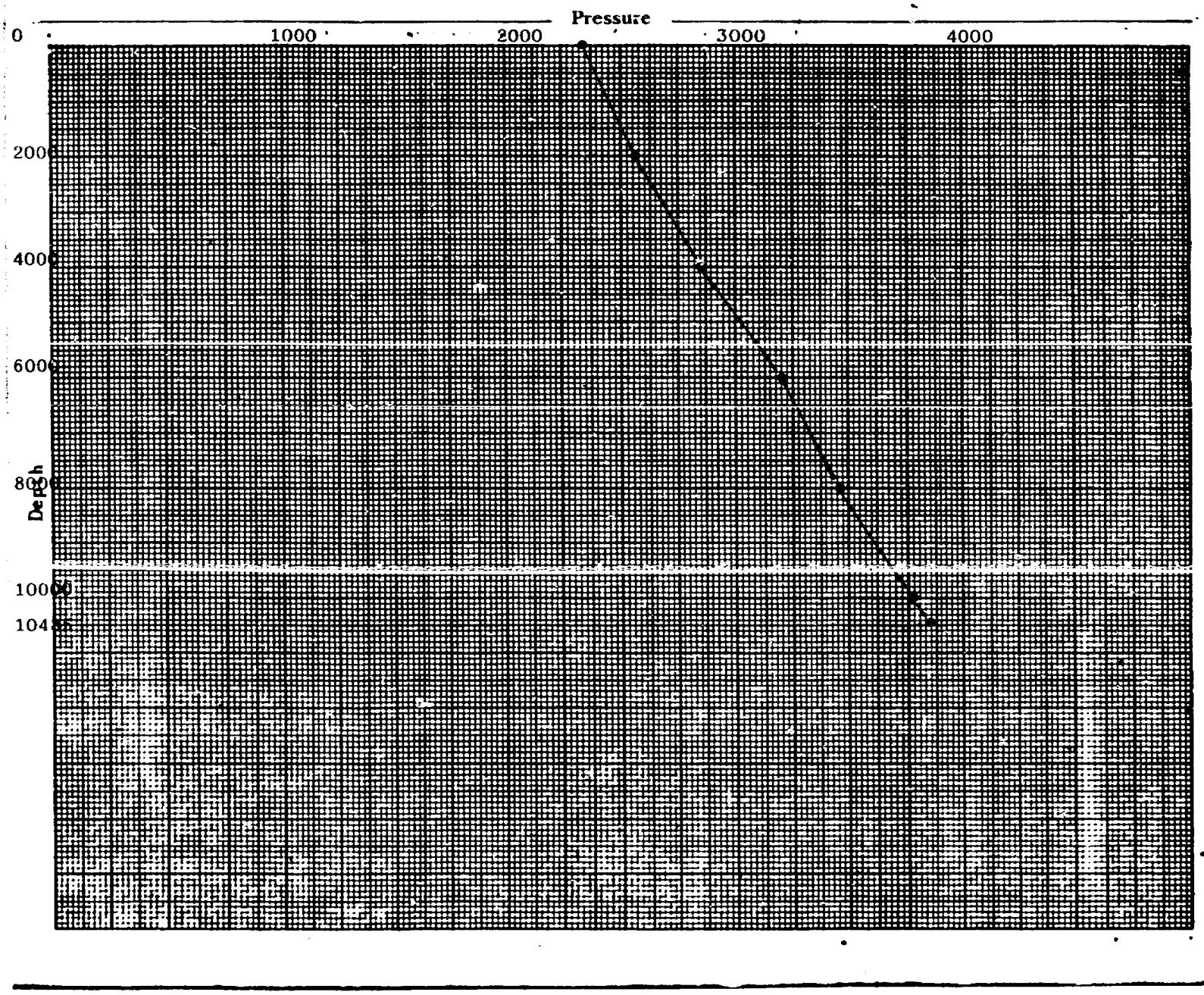
HOBBS, NEW MEXICO 88240

OPERATOR Getty Oil Company
FIELD Undesignated
FORMATION Wolfcamp
LEASE Getty 36 State Com WELL #1
COUNTY Lea STATE New Mexico
DATE Feb. 26, 1980 TIME 8:00 AM
Status Flowing
Test Depth 10485'
Time S. I. - Last test date -
Tub Pres. 2346 BHP last test -
Cas. Pres. Dual BHP change -
Elev. 3692'KB-23 Fluid top Flowing
Datum (-7636) ** Water top -
Temp. @ 174°F Run by JSI #21
Cal. No. A13676N Chart No. 1

BOTTOM HOLE PRESSURE RECORD

Depth	Pressure	Gradient
0	2346	-
2000	2558	.106
4000	2859	.151
6000	3205	.173
8000	3468	.132
10000	3769	.151
10485	3840	.146
11328 (-7636)	3963 * **	(.146)

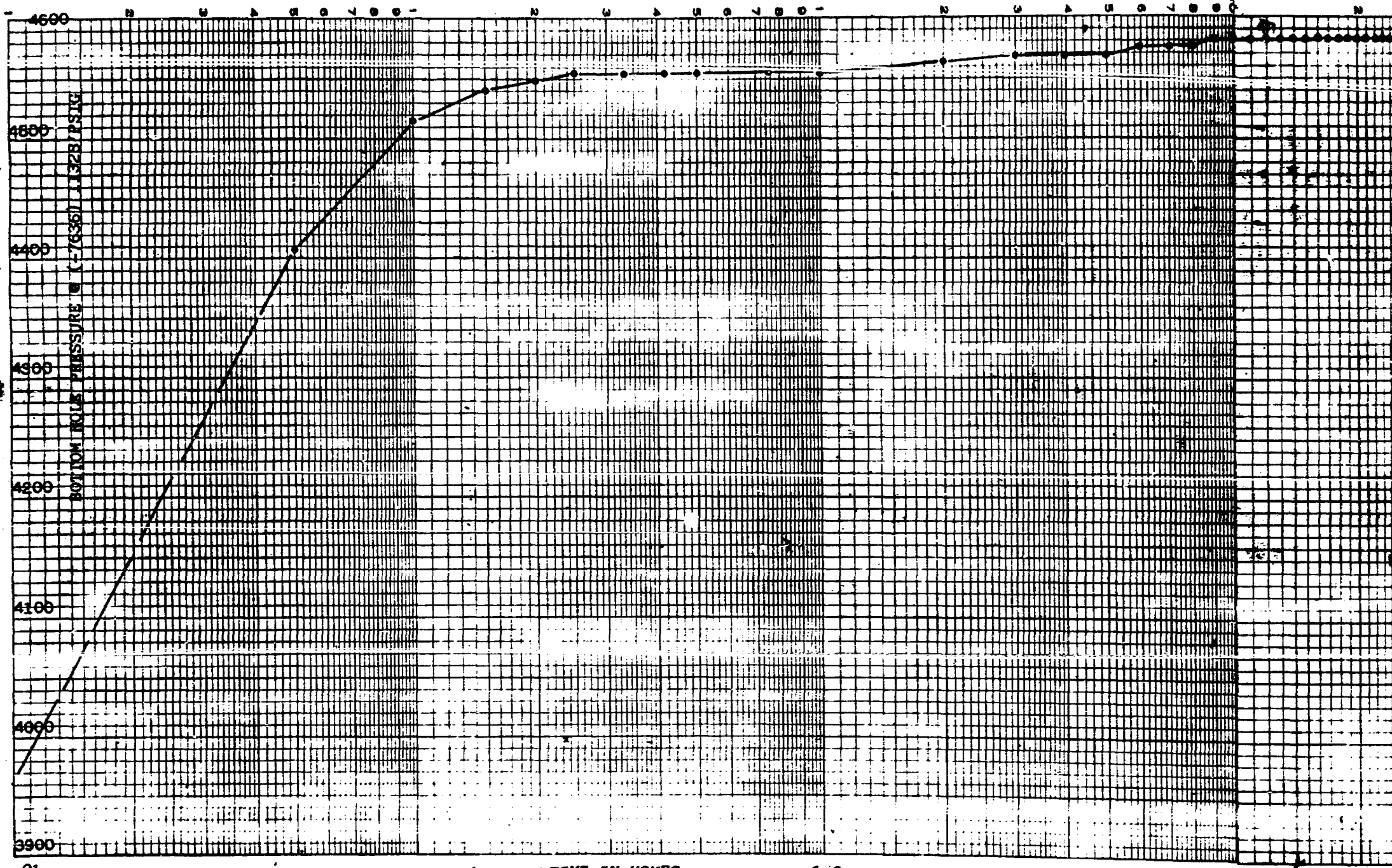
* EXTRAPOLATED PRESSURE
** MIDPOINT OF CASING PERFORATIONS



NO. 340R-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

JARREL SERVICES, INC.



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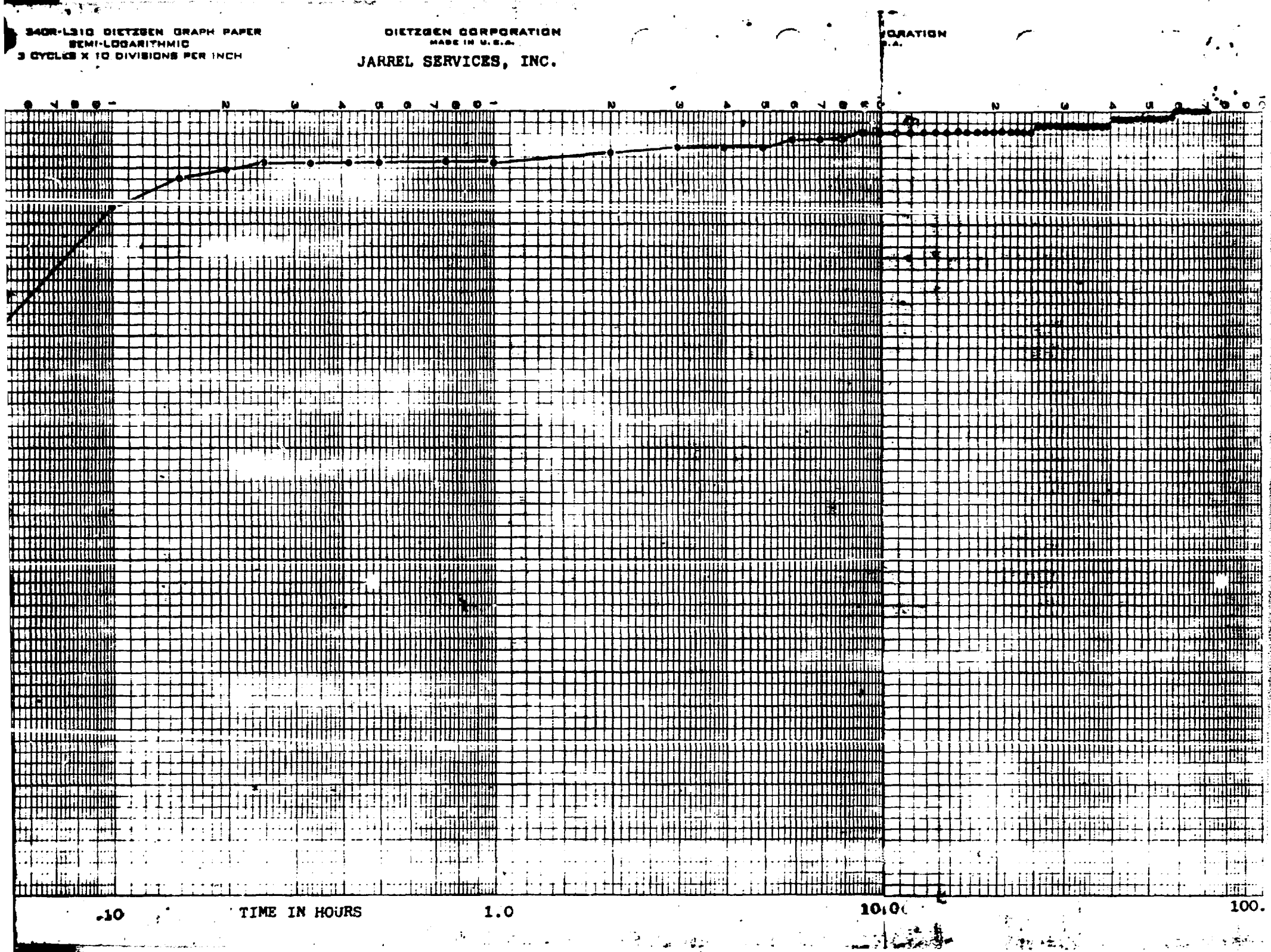


JARREL SERVICES, INC.

POST OFFICE BOX 1654 PHONES 505 393-5388 — 393-8274

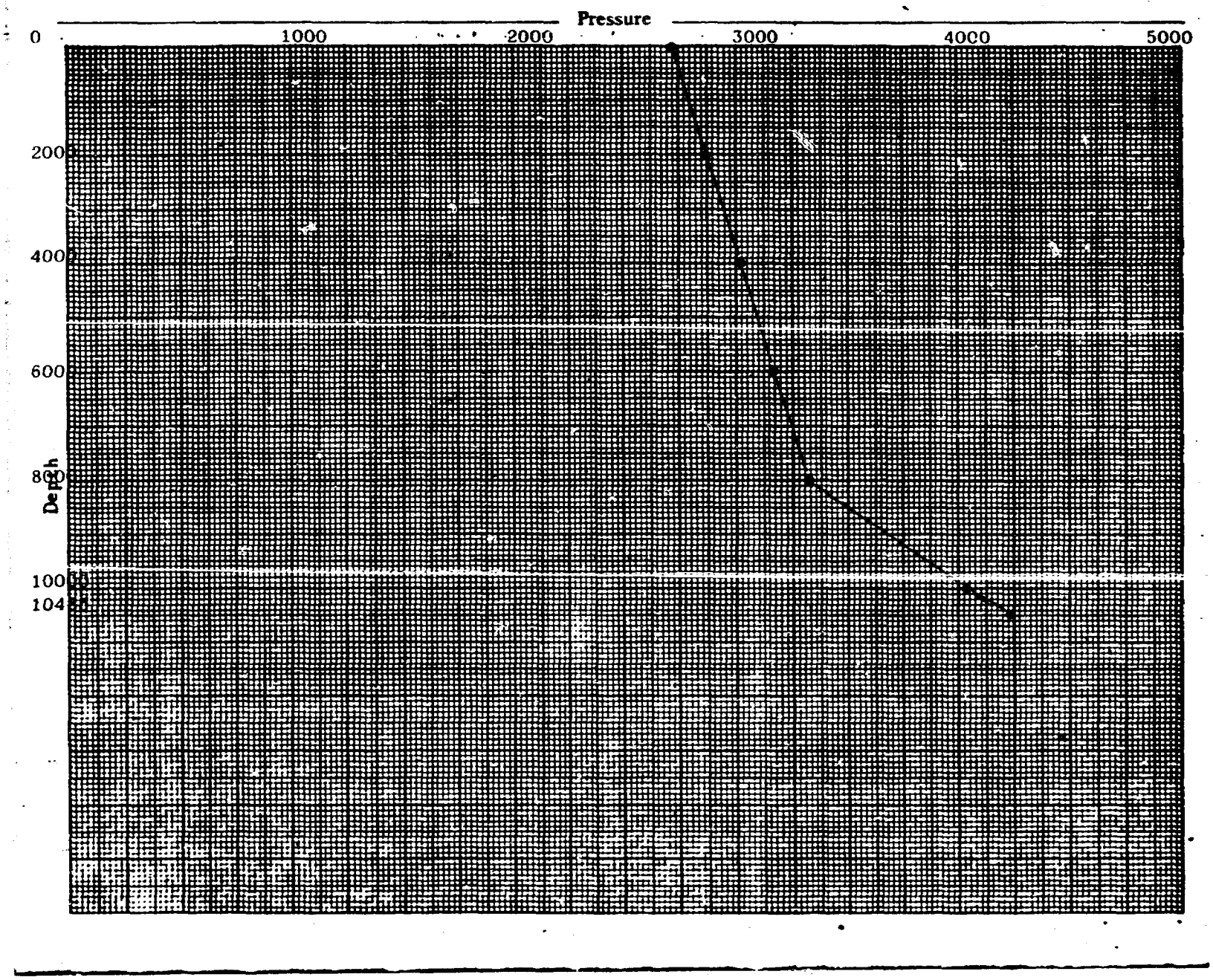
HOBBS, NEW MEXICO 88240

OPERATOR Getty Oil Company
FIELD Undesignated
FORMATION Wolfcamp
LEASE Getty 36 State Com WELL #1
COUNTY Lea STATE New Mexico
DATE Feb. 29, 1980 TIME 11:00 AM
Status Shut in
Test Depth 10485'
Time S. I. 72 hrs. Last test date 7/4/79
Tub Pres. 2731 BHP last test 7057 @ 10450'
Cas. Pres. PKR BHP change 2457# Loss
Elev. 3692' KB-23 Fluid top 8000'
Datum (-7636) ** Water top 9000'
Temp. @ 174°F Run by JST #16
Cal. No. A13676N Chart No. 2

BOTTOM HOLE PRESSURE RECORD

Depth	Pressure	Gradient
0	2731	-
2000	2874	.072
4000	3020	.073
6000	3168	.074
8000	3318	.075
10000	4028	.355
10485	4237	.431
11328 (-7636)	4600 * **	(.431)

* EXTRAPOLATED PRESSURE
** MIDPOINT OF CASING PERFORATIONS



CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75207

Reservoir Fluid Study

for

GETTY OIL COMPANY

State 36 No. 1 Well
Wildcat
Lea County, New Mexico

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75207

January 23, 1980

RESERVOIR FLUID DIVISION

Getty Oil Company
P.O. Box 730
Hobbs, NM 82240

Attention: Mr. Peter Botes

Subject: Reservoir Fluid Study
State 36 No. 1 Well
Wildcat
Lea County, New Mexico
Our File Number: RFL 79619

Gentlemen:

Duplicate samples of separator gas and separator liquid were collected from the subject well by Tefteller, Inc. on September 9, 1979. These samples were forwarded to our Dallas laboratory for use in a reservoir fluid study, the results of which are presented on the following pages.

Upon arrival in the laboratory, the separator gas was analyzed through heptanes plus using chromatography, while the separator liquid was also analyzed through heptanes plus using low temperature fractional distillation equipment along with chromatography. After the separator gas flow rate was corrected using factors which are shown on page one, the producing gas-liquid ratio was calculated to be 4438 cubic feet of separator gas at 15.025 psia and 60°F. per barrel of stock tank liquid at 60°F. In the laboratory, it was determined that this was the equivalent of 3588 standard cubic feet of separator gas per barrel of separator liquid at 490 psig and 78°F. The measured compositions of the separator products were used in conjunction with this producing gas-liquid ratio to calculate the composition of the producing well stream material. These compositions are shown on page two. In the laboratory, the separator products were physically recombined to this producing gas-liquid ratio for use in the entire reservoir fluid study.

A portion of the reservoir fluid was charged to a high pressure visual cell and heated to the reservoir temperature of 196°F. During constant composition expansion pressure-volume relations performed at this temperature, the fluid existed as a single-phase gas at pressures above 5018 psig at which pressure a retrograde dew point was observed. A comparison of this dew point pressure to the reservoir pressure, 6846 psig, measured on September 12, 1979 indicates that the fluid currently exists in the reservoir in an undersaturated condition. The results of the pressure-volume relation measurements are shown on page three.

The sample in the cell was repressured to a single-phase condition after which it was subjected to a constant volume depletion. After the sample volume was established at the dew point pressure, the sample was subjected to a series of pressure expansions and constant pressure displacements with each displacement terminating at the original sample volume at the dew point pressure. During each of these displacements, the volume of retrograde liquid accumulation was monitored. These data, which are reported on pages six and twelve, show that the maximum accumulation of liquid is approximately 37.1 percent of the hydrocarbon pore space occurring at approximately 3150 psig. The liquid saturation at atmospheric pressure and 196°F. was 24.5 percent of the hydrocarbon pore space.

A larger volume of the reservoir fluid was once again charged to a bigger high pressure cell heated to 196°F. where the constant volume depletion was repeated. During this particular depletion, the equilibrium gas phase at each of the depletion pressure levels was charged to low temperature fractional distillation equipment where along with chromatography its composition was measured. Also determined was the volumetric production of the vapor phase from pressure to pressure where the various deviation factor z were measured down to 700 psig. A summary of these volumetric and compositional data is reported on page four.

The above compositions and volumetric data were used in conjunction with published equilibrium ratio data to calculate the surface recoveries that may be expected as the reservoir pressure declines. These calculations were performed on the basis of one million standard cubic feet of reservoir fluid inplace at the dew point pressure, 5018 psig and 196°F. Assumed in these calculations was a plant efficiency of 100 percent. These volumetric data are reported in tabular form on page five.

We wish to thank Getty Oil Company for this opportunity to be of service. If you should have any questions regarding these data or we can be of further assistance, please do not hesitate to contact us.

Very truly yours,

CORE LABORATORIES, INC.

P. L. Moses, Manager
Reservoir Fluid Analysis

PLM:FBV:bt
6 cc: Addressee
1 cc: Mr. Jim Eakin
Getty Oil Co.
P.O. Box 1231
Midland, TX 79702

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Company Getty Oil Company — Date Sampled September 9, 1979

Well State 36 No. 1 — County Lea

Field Wildcat — State New Mexico

FORMATION CHARACTERISTICS

Formation Name	Wolfcamp	
Date First Well Completed	July 2, 1979	
Original Reservoir Pressure	✓ 7255 PSIG @ 11328	Ft.
Original Produced Gas-Liquid Ratio	5082	SCF/Bbl
Production Rate	752	Bbls/Day
Separator Pressure and Temperature	PSIG	°F.
Liquid Gravity at 60°F.	49.7	°API
Datum	7636	Ft. Subsea

WELL CHARACTERISTICS

Elevation	3692 KB	Ft.
Total Depth	13266 PBTD	Ft.
Producing Interval	11320-11335	Ft.
Tubing Size and Depth	2-3/8 In. to 10495	Ft.
Open Flow Potential	7.82 (Estimated)	MMSCF/Day
Last Reservoir Pressure	✓ 6846 PSIG @ 11328	Ft.
Date	September 12, 1979	
Reservoir Temperature	187* °F. @ 10505	Ft.
Status of Well	Flowing	
Pressure Gauge	Amerada	

SAMPLING CONDITIONS

Flowing Tubing Pressure		3510	PSIG
Flowing Bottom Hole Pressure		6092	PSIG
Primary Separator Pressure		490	PSIG
Primary Separator Temperature		78	°F.
Secondary Separator Pressure			PSIG
Secondary Separator Temperature			°F.
Field Stock Tank Liquid Gravity		49.7	°API @ 60°F.
Primary Separator Gas Production Rate		2887	MSCF/Day
Pressure Base	15.025 PSIA		
Temperature Base	60 °F.		
Compressibility Factor (F_{pv})	1.0477		
Gas Gravity (Laboratory)	0.688		
Gas Gravity Factor (F_g)	1.2056		
Stock Tank Liquid Production Rate @ 60°F.		650.54	Bbls/Day
Primary Separator Gas/Stock Tank Liquid Ratio		4438	SCF/Bbl
	or	225.33	Bbls/MMSCF
Sampled by		TI	

REMARKS:
*Temperature extrapolated to mid-point of perforation = 196°F.

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Well State 36 No. 1

Hydrocarbon Analyses of Separator Products and Calculated Well Stream

Component	Separator Liquid Mol Percent	Separator Gas Mol Percent	Separator Gas GPM	Well Stream Mol Percent	Well Stream GPM
Hydrogen Sulfide	0.00	0.00		0.00	
Carbon Dioxide	0.00	0.12		0.10	
Nitrogen	0.16	1.14		0.94	
Methane	11.74	81.81		67.81	
Ethane	8.81	10.87	2.964	10.46	
Propane	9.79	3.92	1.100	5.09	1.428
iso-Butane	2.49	0.50	0.167	0.90	0.300
n-Butane	7.04	0.91	0.293	2.13	0.685
iso-Pentane	3.33	0.18	0.067	0.81	0.302
n-Pentane	3.83	0.18	0.067	0.91	0.336
Hexanes	5.63	0.10	0.042	1.21	0.503
Heptanes plus	47.18	0.27	0.125	9.64	6.563
	100.00	100.00	4.825	100.00	10.117

Properties of Heptanes plus			
API gravity @ 60°F.	44.5		
Specific gravity @ 60/60°F.	0.8041		0.802
Molecular weight	171	103 (assumed)	169

Calculated separator gas gravity (air=1.000) = 0.688

Calculated gross heating value for separator gas = 1224 BTU per cubic foot of dry gas @ 15.025 psia and 60°F.

Primary separator gas collected @ 490 psig and 78 °F.

Primary separator liquid collected @ 490 psig and 78 °F.

Primary separator gas/separator liquid ratio	3588	SCF/Bbl @ 78°F.
Primary separator liquid/stock tank liquid ratio	1.237	Bbls @78°F/per Bbl @60°F.
Primary separator gas/well stream ratio	800.17	MSCF/MMSCF
Stock tank liquid/well stream ratio	180.30	Bbls/MMSCF

Pressure-Volume Relations of Reservoir Fluid at 196°F.
(Constant Composition Expansion)

Pressure PSIG		Relative Volume	Deviation Factor Z
8000		0.8946	1.482
7630		0.9034	1.427
7255	Original Reservoir Pressure	0.9115	1.369(1)
7100		0.9172	1.348
6700		0.9291	1.289
6300		0.9421	1.229
6000		0.9532	1.185
5700		0.9655	1.140
5450		0.9769	1.103
5300		0.9843	1.081
5150		0.9929	1.060
5050		0.9974	1.044
5018	Dew Point Pressure	1.0000	1.040(2)
5008		1.0006	
4950		1.0049	
4850		1.0119	
4700		1.0240	
4500		1.0422	
4250		1.0687	
3950		1.1089	
3500		1.1860	
3000		1.3198	
2500		1.5253	
2000		1.8695	
1600		2.3295	
1300		2.8763	
1000		3.7825	

(1) Gas expansion factor = 1.572 MSCF/Bbl.
(2) Gas expansion factor = 1.433 MSCF/Bbl.

Depletion Study at 196°F.

Hydrocarbon Analyses of Produced Well Stream - Mol Percent

Component	Reservoir Pressure - PSIG							
	5018	4300	3600	2800	2000	1300	700	700*
Carbon Dioxide	0.10	0.10	0.10	0.10	0.11	0.12	0.14	0.04
Nitrogen	0.94	1.12	1.19	1.20	1.15	1.08	1.03	0.05
Methane	67.81	73.54	76.22	78.13	78.75	78.34	75.34	14.37
Ethane	10.46	10.44	10.41	10.34	10.66	11.10	12.23	7.27
Propane	5.09	4.80	4.57	4.40	4.42	4.66	5.70	7.16
iso-Butane	0.90	0.80	0.73	0.67	0.66	0.71	0.94	2.12
n-Butane	2.13	1.84	1.62	1.47	1.41	1.52	1.97	5.21
iso-Pentane	0.81	0.68	0.59	0.52	0.48	0.48	0.54	2.56
n-Pentane	0.91	0.74	0.63	0.54	0.49	0.49	0.56	2.87
Hexanes	1.21	0.81	0.57	0.42	0.34	0.33	0.40	5.87
Heptanes plus	9.64	5.13	3.37	2.21	1.53	1.17	1.15	52.48
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Molecular weight of heptanes plus	169	133	124	115	109	106	107	180
Specific gravity of heptanes plus	0.801	0.777	0.770	0.759	0.752	0.749	0.750	0.808
Deviation Factor - Z								
Equilibrium gas	1.040	0.911	0.845	0.820	0.847	0.888	0.935	
Two-phase	1.040	0.952	0.878	0.812	0.752	0.682	0.559	
Well Stream produced- Cumulative percent of initial	0.000	6.304	14.855	28.142	44.651	60.178	73.736	
GPM from Smooth Compositions								
Propane plus	10.117	5.906	4.489	3.580	3.131	3.066	3.650	
Butanes plus	8.689	4.559	3.207	2.345	1.891	1.758	2.051	
Pentanes plus	7.704	3.701	2.443	1.650	1.218	1.032	1.105	

*Composition of equilibrium liquid phase.

Calculated Cumulative Recovery During Depletion

Cumulative Recovery per MMSCF of Original Fluid	Initial in Place	Reservoir Pressure - PSIG 5018	4300	3600	2800	2000	1300	700
Well Stream - MSCF	1000	0	63.04	148.55	281.42	446.51	601.78	737.36
Normal Temperature Separation*								
Stock Tank Liquid - Barrels	189.70	0	5.58	10.36	15.01	18.90	21.09	
Primary separator gas-MSCF	789.49	0	55.38	133.93	259.64	418.40	571.04	
Second stage gas - MSCF	45.62	0	1.70	3.25	4.86	6.31	6.46	
Stock tank gas - MSCF	26.80	0	1.10	2.13	3.23	4.24	4.55	
Total "Plant Products" in Primary Separator Gas - Gallons								
Propane	833	0	62	151	293	478	676	
Butanes (total)	342	0	27	68	134	221	326	
Pentanes plus	185	0	15	37	75	125	200	
Total "Plant Products" in Second Stage Separator Gas-Gallons								
Propane	161	0	6.3	12.1	18.1	23.6	24.0	
Butanes (total)	72	0	3.1	6.0	9.0	11.9	12.1	
Pentanes plus	37	0	1.6	3.1	4.8	6.4	6.5	
Total "Plant Products" in Well Stream - Gallons								
Propane	1428	0	85	195	359	563	766	983
Butanes (total)	985	0	54	119	212	323	436	564
Pentanes plus	7704	0	233	442	661	863	1023	1173

*Primary separator at 490 psig and 78°F.; second stage separator at 70 psig and 75°F.; and stock tank at 70°F., except 1300 psig well stream where primary separator is at 200 psig and 78°F.

CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Well State 36 No. 1

Retrograde Condensation During Gas Depletion at 196°F.

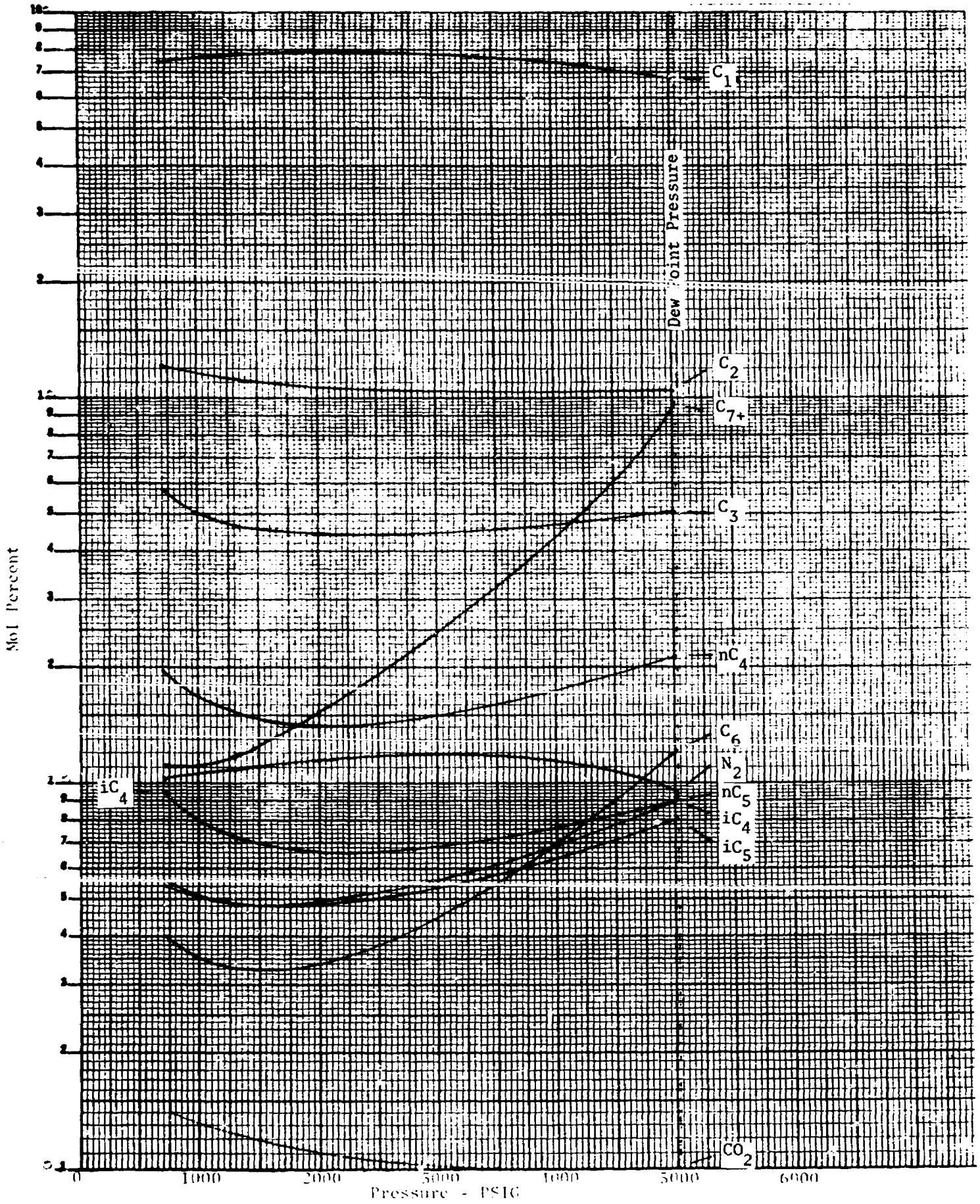
Pressure PSIG	Retrograde Liquid Volume Percent of Hydrocarbon Pore Space
5018 Dew Point Pressure	0.0
5012	0.8
5008	1.4
4950	11.2
4850	17.8
4700	23.7
4500	28.6
4300	32.9
3600	36.7
2800	37.0
2000	35.2
1300	32.5
700	29.7
0	24.5

Properties of Zero PSIG Residual Liquid

API Gravity @ 60°F.	43.6
Specific gravity @ 60/60°F.	0.8080
Molecular weight	181

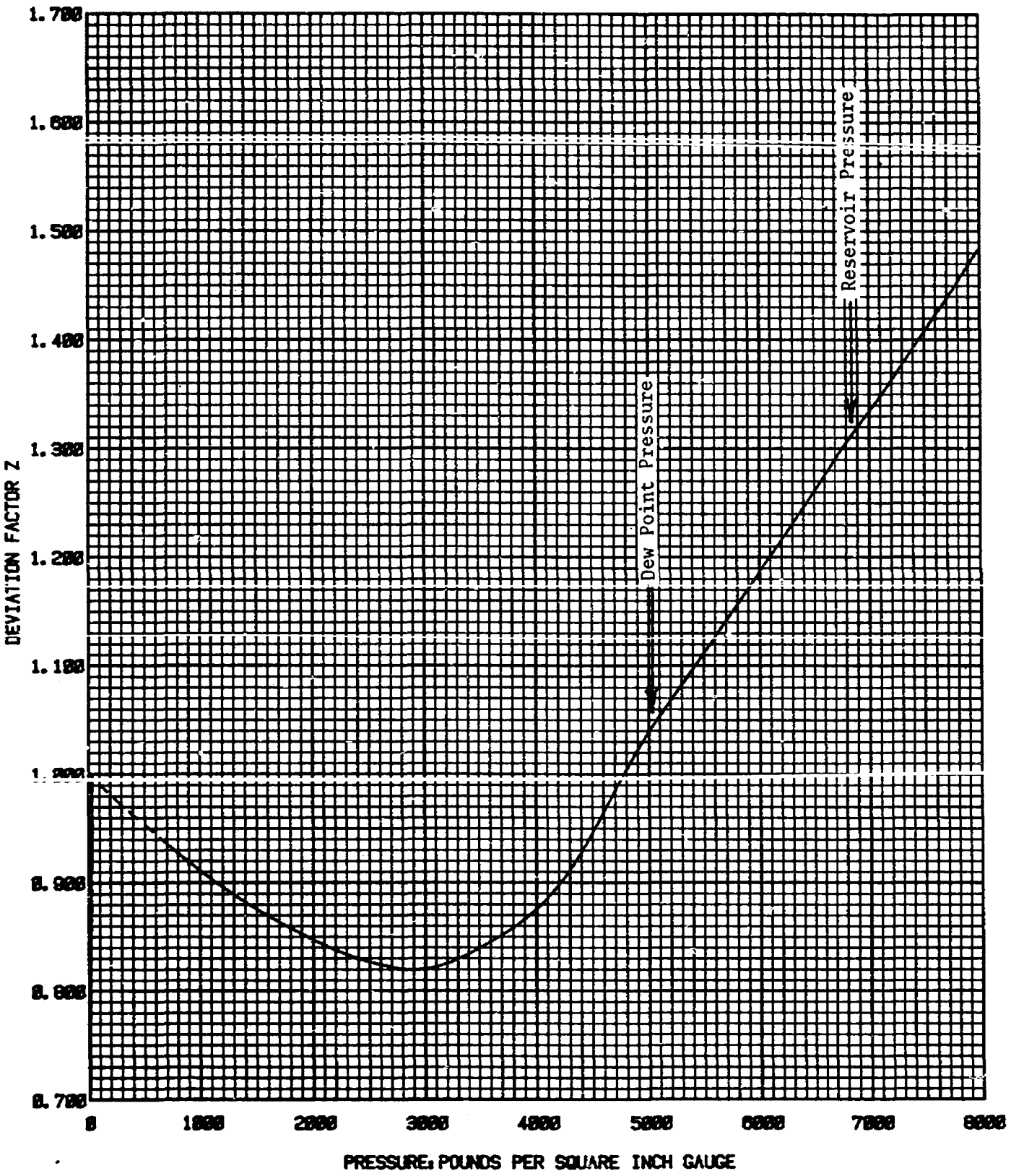
Hydrocarbon Analyses of Produced Well Stream
During Depletion at 190°F.

Page 7 of 12
File RH-79619
Well State SC No. 1



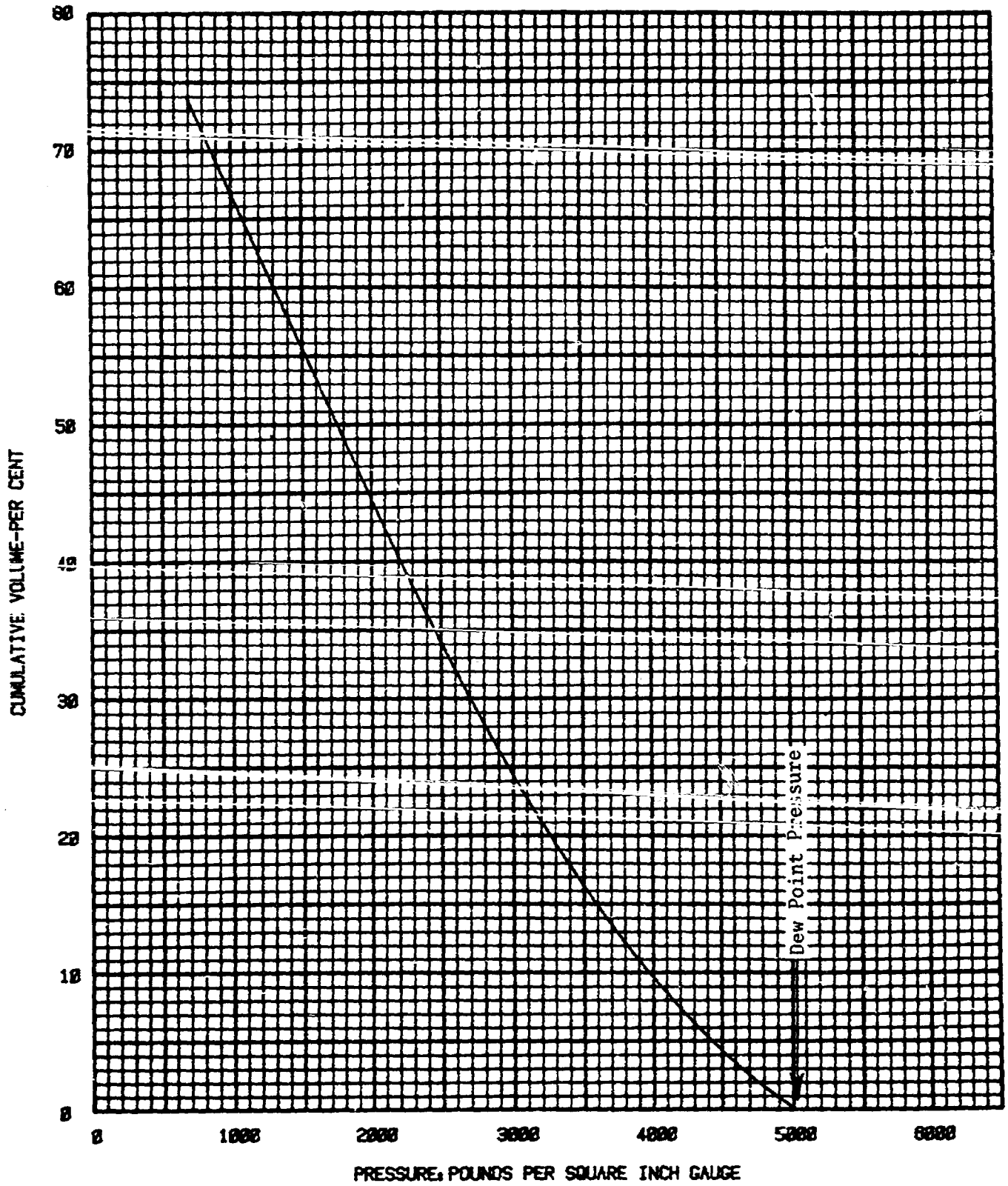
DEVIATION FACTOR Z OF WELL STREAM DURING DEPLETION AT 198°F.

Company GETTY OIL COMPANY — Formation WOLFCAMP
Well STATE 36 NO. 1 — County LEA
Field WILDCAT — State NEW MEXICO



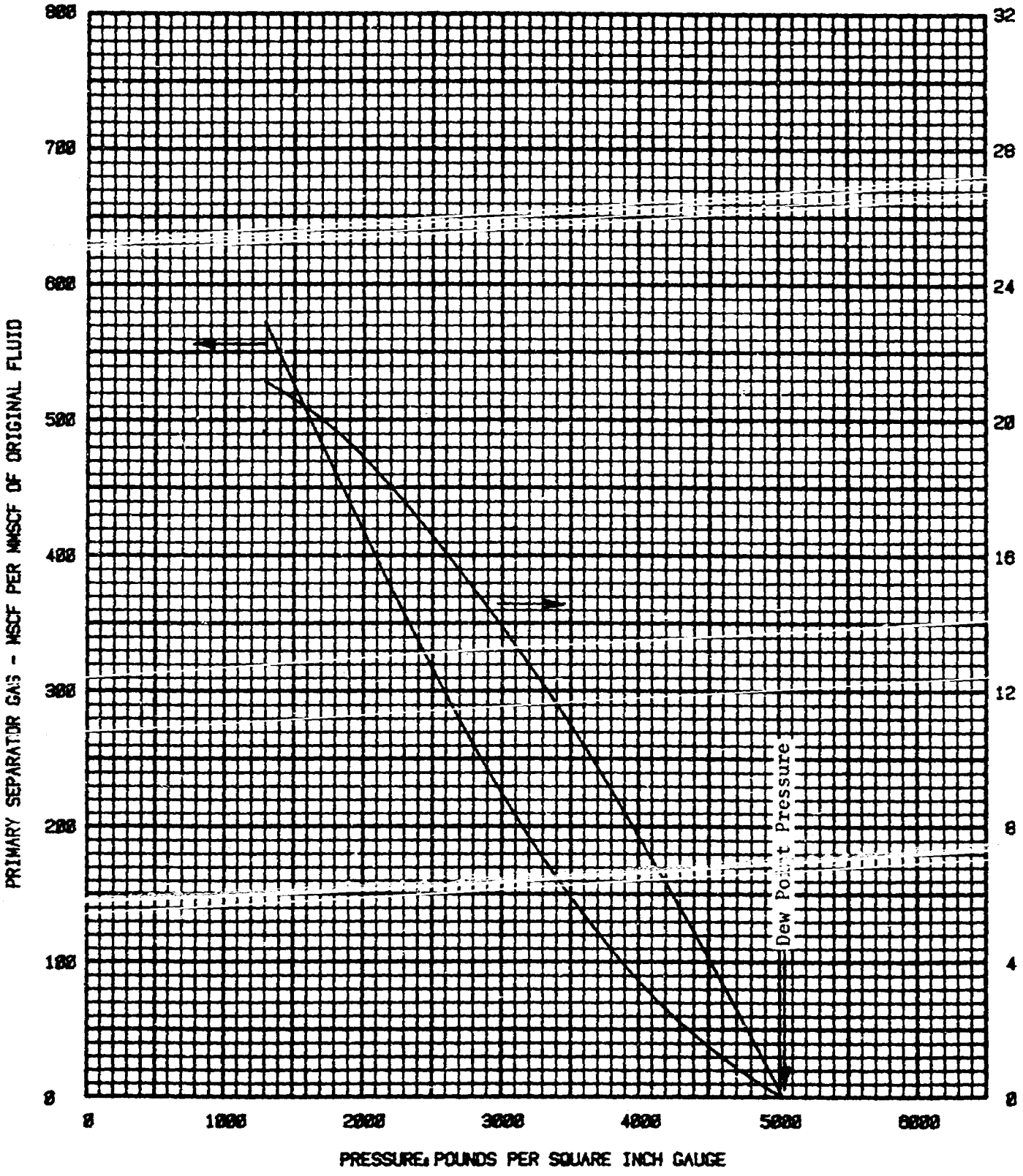
VOLUME OF WELL STREAM PRODUCED DURING DEPLETION

Company GETTY OIL COMPANY — Formation WOLFCAMP
Well STATE 36 NO. 1 — County LEA
Field WILDCAT — State NEW MEXICO



CUMULATIVE RECOVERY DURING DEPLETION

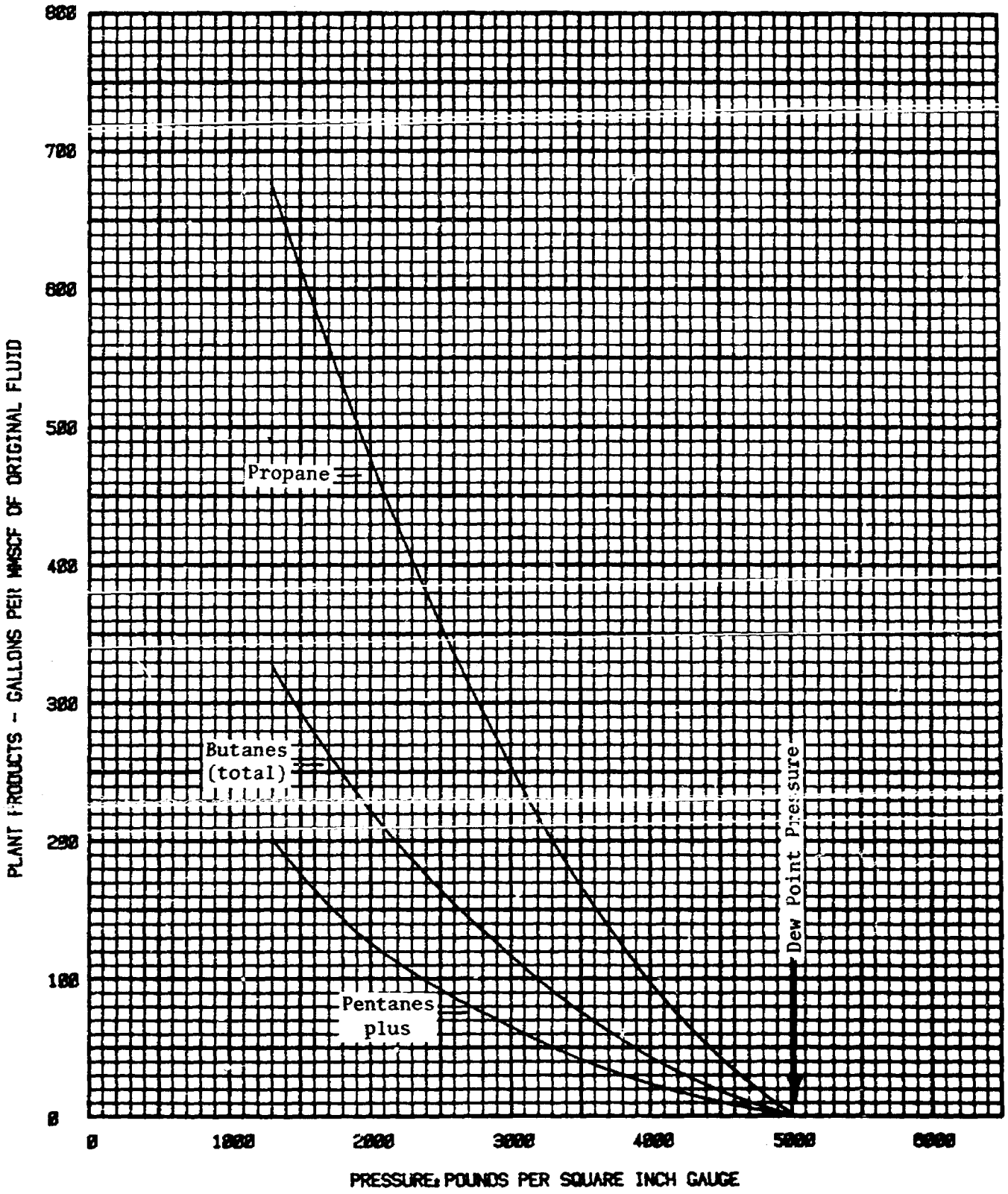
Company GETTY OIL COMPANY — Formation WOLFCAMP
Well STATE 36 NO. 1 — County LEA
Field WILDCAT — State NEW MEXICO



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

CUMULATIVE RECOVERY-PLANT PRODUCTS IN WELLSTREAM

Company GETTY OIL COMPANY Formation WOLFCAMP
Well STATE 36 NO. 1 County LEA
Field WILDCAT State NEW MEXICO

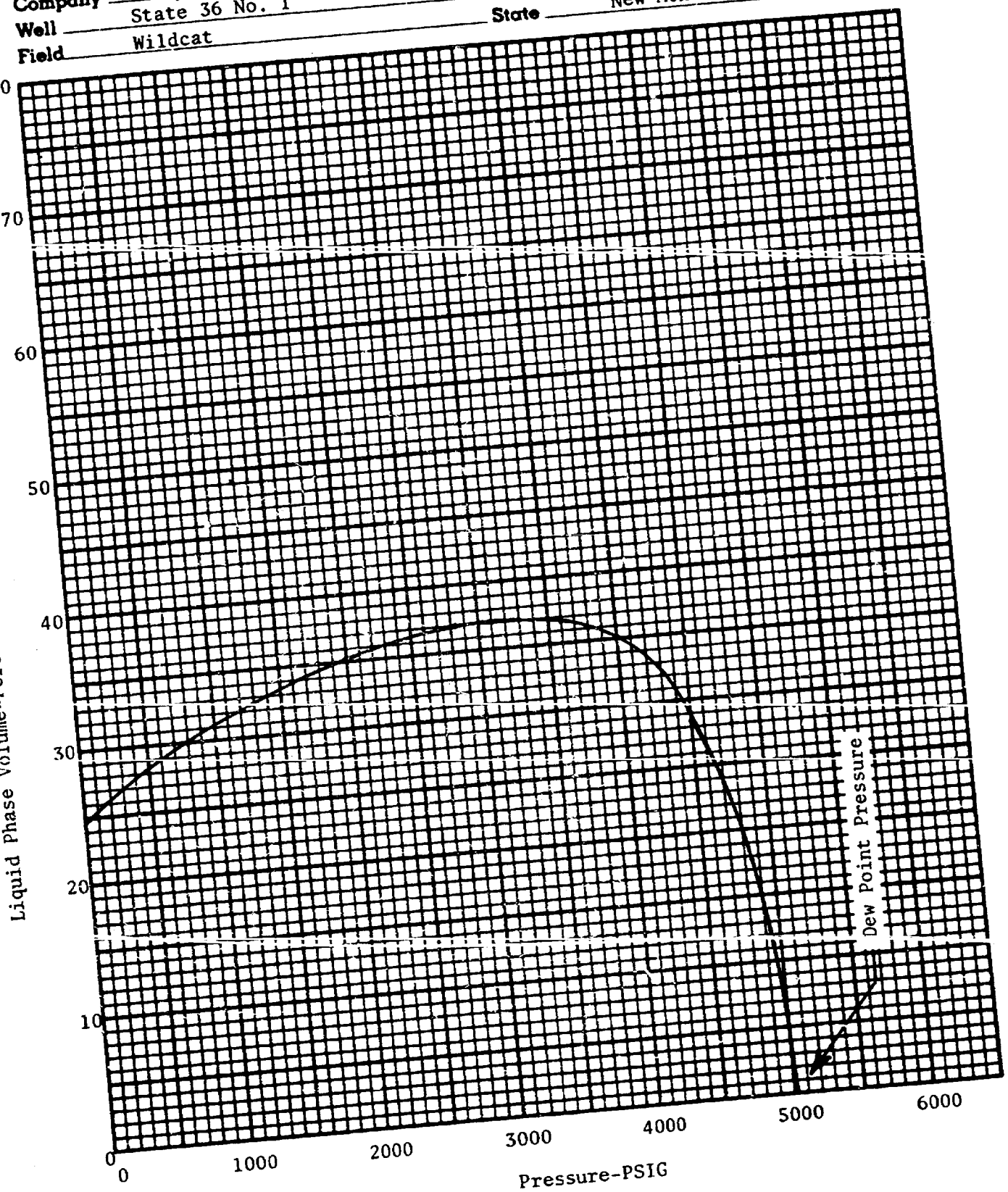


CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Retrograde Liquid Accumulation During Depletion at 196°F.

Company Getty Oil Company
Well State 36 No. 1
Field Wildcat
Formation Wolfcamp
County Lea
State New Mexico



INTER-OFFICE CORRESPONDENCE

Getty Oil Company

Midland, Texas
March 21, 1980

TO: MR. J. E. EAKIN

FROM: JIM VARNON

SUBJECT: GETTY 36 STATE COM. WELL NO. 1 (WOLFCAMP)
PRESSURE BUILDUP (2/26-29/80) AND PVT ANALYSIS

Attached is an analysis of pressure and PVT data. The wealth of data for this well makes it possible to accurately predict reservoir performance. The current pressure test confirms the limited reservoir size shown by an earlier pressure test in September 1979. Summary of the analysis is:

Original Pressure @ 7/4/79	= 7255 psi
Pressure @ 2/29/80	= 4600 psi
Transmissibility (kh)	= 288 md-ft
Skin Factor	= +17
Pressure Drawdown ($\bar{P} - P_{wf} - \Delta P_{skin}$)	= 193 psi
Original Separator Gas Reserves	
without surface compression	= 2.46 BCF
with surface compression	= 2.73 BCF
Original Condensate Reserves	
without surface compression	= 147 MSTB
with surface compression	= 151 MSTB

The large skin factor is caused by the narrow perforated interval and could be eliminated at any time. The small pressure drawdown results from large reservoir kh and low production rate (2200 mcfpd), and shows that the rate could be increased two or three-fold with no expected effect on ultimate recovery.

Recovery factors are 80% for gas and 19% for condensate. Liquid yield has dropped from 230 STB/MMCF to 125 and it will continue to drop sharply to below 50. Pressure maintenance is probably not feasible and becomes less feasible as liquids dropout in the reservoir.

Reserves listed above assume that the well will never produce water, that the skin will be removed by workover, and that retrograde liquid is nonmobile.

Jim Varnon
Jim Varnon

JEV:slw
Attach.
cc: Mr. H. W. Terry

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KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6010

SEMILOG PLOT
PRESSURE BUILDUP 2/22-29/80
GETTY 36 STATE WELL #1 (WOLFCAMP)

BHP@ 11328' (psig)

4500

4400

.01 .1 1 10 100

Δt (hrs)

$\bar{P}$ = 4600 psig

m = 30 psi/cycle

$$kh = \frac{162.6\, q B \mu}{m} = \frac{(162.6)(2200)(0.69)(0.035)}{30}$$

kh = 288 md-ft

k = 288/94 = 3.1 md

$$S = 1.151\left[\frac{P_{1hr} - P_{wf}}{m} - \log\frac{k}{\phi\mu C_t r_w^2} + 3.23\right]$$

$$S = 1.151\left[\frac{4550-3963}{30} - \log\frac{3.1\times10^{6}}{(0.15)(0.035)(77)(0.1)} + 3.23\right]$$

S = +17

$\Delta P_{skin} = (0.87)(s)(m) = (0.87)(17)(30) = 444$ psi

$\Delta P_{drawdown} = \bar{P} - P_{wf} - \Delta P_{skin} = 4600 - 3963 - 444 = 193$

Exhibit 1

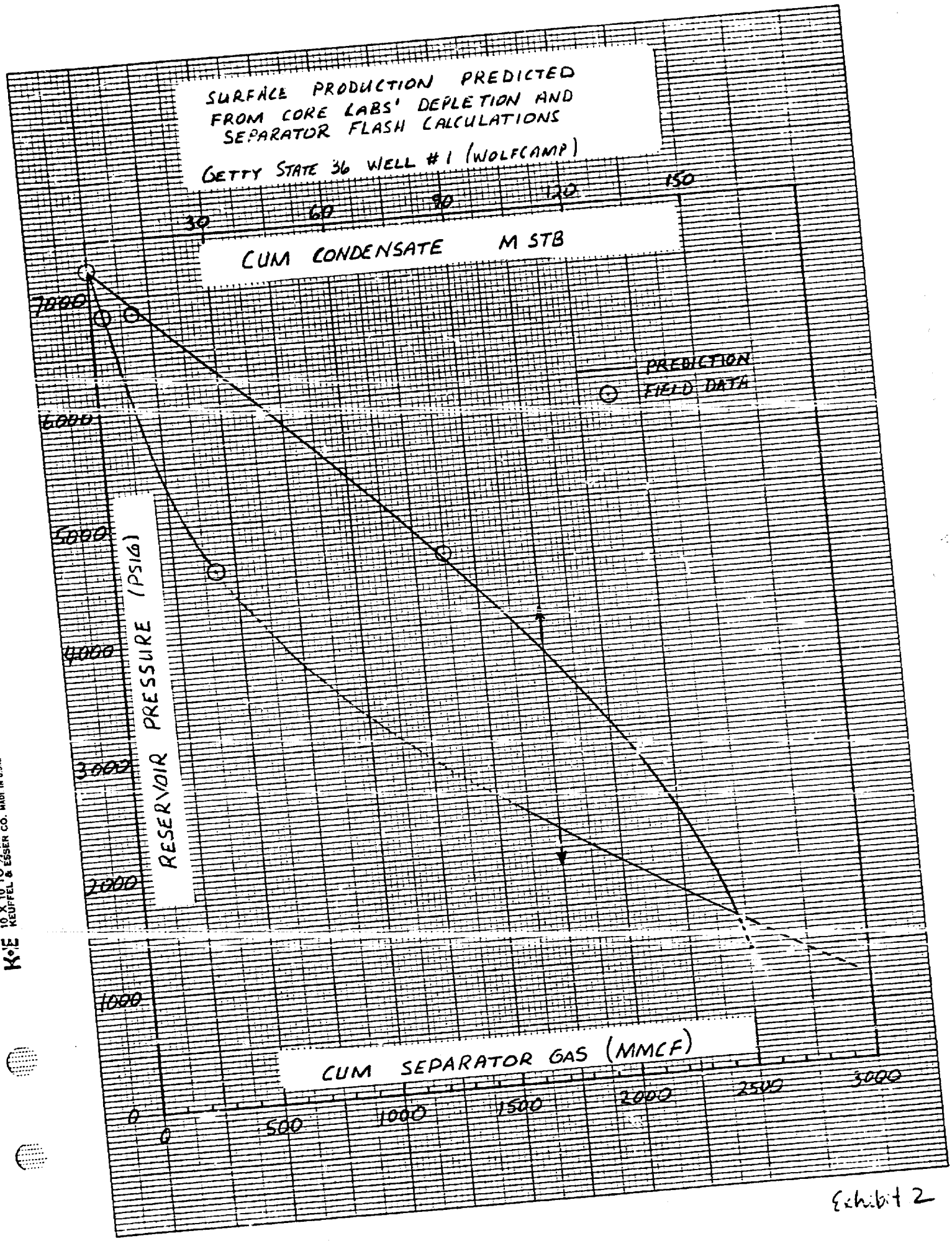

Exhibit 2

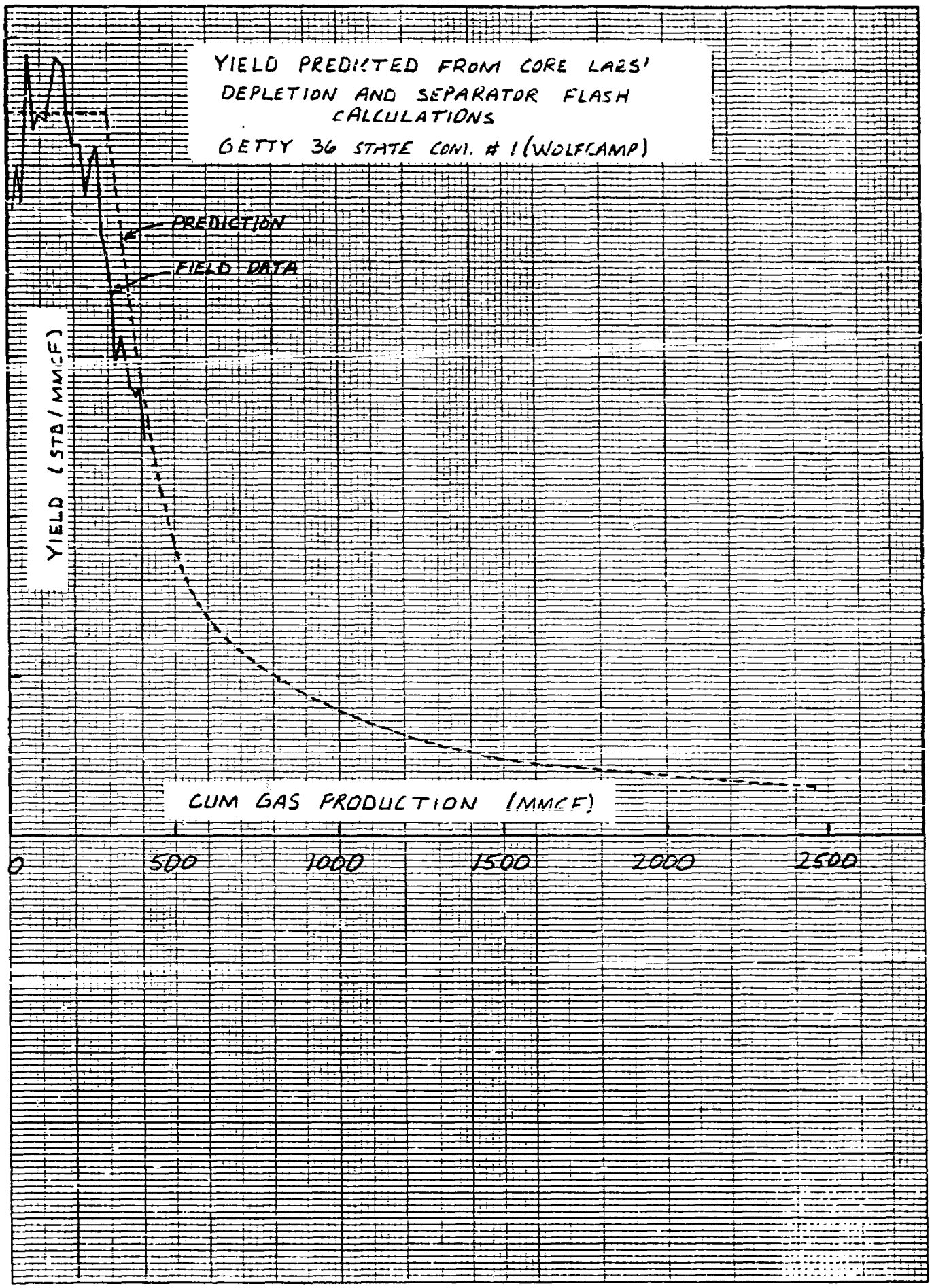

Exhibit 3

GETTY 36 STATE COM. WELL No. 1
ANALYSIS OF PRESSURE BUILDUP (2/26-29/80)

I. Log-log Plot

Afterflow was almost completed before the first data point. The log-log plot is just a flat line and is not included here.

II Semilog Plot (Exhibit 1)

The semilog plot exhibits the leveling off typical of a limited reservoir. The early hump in the semilog curve also occurred in the buildup run in Sept 1979. It is apparently caused by phase segregation in the tubing. Reservoir and completion parameters are shown on the figure. The large skin factor is caused by the partial penetration (11' perf'd versus 116' gross pay) and could be eliminated at any time.

Note the small drawdown pressure (193 psi) relative to the pressure depletion (2655 psi since discovery). The reservoir is being depicted like a constant pressure tank. This well is capable of producing at a much higher rate with no foreseeable detriment to ultimate recovery.

III BASIC DATA FOR BUILDUP CALCULATIONS

$h = 94$ ft

$\phi = 0.15$

$S_w = 0.20$

$T = 196\,^\circ F = 656\,^\circ R$

Fluid = Gas Condensate (PVT Analysis is available)

Mobile Fluid = Gas @ 4600 psi (Retrograde Liquid is nonmobile)

j @ 4600 psi = 0.965 (PVT Report page 9)

$T_c = 461\,^\circ R$ (Calculated from composition)

$P_c = 642$ psia (Calculated from composition)

$T_r = 656/461 = 1.4$

$P_r = 4615/642 = 7.2$

$\gamma = 1.07$ (Calculated from composition)

$$c_g = \frac{1}{P} - \frac{1}{j}\frac{\partial j}{\partial P} = \frac{1}{4615} - \frac{1}{0.965}(121\times10^{-6}) = 91\times10^{-6}\ psi^{-1}$$

$$c_t = S_g c_g + S_w c_w + c_f = 77\times10^{-6}\ psi^{-1}$$

$$B_g = 5.04\frac{zT}{P} = \frac{(5.04)(0.965)(656)}{4615} = 0.69\ \frac{bbl}{MCF}$$

$\mu_g = 0.035$ cp (Carr-Kobayashi correlation for $\gamma = 1.07$)

IV STEADY-STATE RATE PREDICTION

$$q_{sc} = \frac{0.00708\,kh}{\mu B}\frac{\Delta P}{\ln r_e/r_w} = \frac{(0.00708)(288)}{(0.035)(0.69)}\frac{193}{\ln\frac{875}{0.316}} = 2050\ \frac{MCF}{Day}$$

Note: $\Delta P = \bar{P} - P_{wf} - \Delta P_{skin} = 4600 - 3963 - 444 = 193$ psi

V. ABANDONMENT PRESSURE

$$\bar{P}_{abd} = P_{wf} + \Delta P_{drawdown} \pm \Delta P_{skin}$$

From equations commonly used in gas well testing, the flowing BHP can be estimated from wellhead pressure.

$$P_{wf} = e^{\frac{K}{3}} \sqrt{P_{wh}^2 + q^2 \left(\frac{\sqrt{\gamma L}}{c}\right)^2} \qquad (1)$$

where P_{wf} = flowing BHP, psi
P_{wh} = wellhead pressure, psi
$K = \gamma L / 53.35\, T_f$
L = tubing length = 11328'
T_f = average flowing temperature, °R = 598 °R
γ = average z-factor from bottom-hole to wellhead
q = well rate, MCF/DAY = 2200
$c = 1118\, d^{8/3} / \sqrt{T_f}$ = 325 for d = 2"

In the Feb 1980 pressure test, drawdown ΔP was 193 psi and skin ΔP was 444 psi. Use drawdown ΔP = 200, although rate will decline some at this drawdown since formation volume factor increases with depletion faster than viscosity decreases. Use skin ΔP = 0 since the skin can be eliminated by workover.

$$\bar{P}_{abd} = P_{wf} + 200 \qquad (2)$$

Equations (1) and (2) can be solved for $\bar{P}_{abd}$ given any wellhead pressure. In order to get γ and z, it is necessary to assume $\bar{P}_{abd}$, so the calculation is iterative. Results of this calculation for the two cases

of interest are:

I. No Surface Compressor : $P_{wh} = 500$: $\bar{P}_{abd} = 1300$ psi

II. With Surface Compressor : $P_{wh} = 0$: $\bar{P}_{abd} = 1000$ psi

These abandonment pressures assume zero water production.

VI. RESERVES

A. Original-Gas-In-Place B_g Material Balance @ 4600 psi

$G(B_g - B_{gi}) = G_p B_g$ where B_g is a two-phase B

$$B_g = 5.04 \frac{zT}{P} \quad \frac{bbl}{MCF}$$

$$B_{gi} = \frac{(5.04)(1.369)(656)}{7255+15} = 0.6226 \qquad z_i = 1.369 \text{ from PVT data.}$$

$$B_g = \frac{(5.04)(0.989)(656)}{4600+15} = 0.7085 \qquad z_t = 0.989 \text{ " " "}$$

G_p = cum production of wet gas + condensate + stock tank vapor

= 41795 MCF + 82258 STB + Vapor

= 41795 MCF + 61300 MCF + 12500

= 492000 MCF

$$G = OGIP = \frac{(492000)(0.7085)}{0.7085 - 0.6226} = 4.1 \text{ BCF}$$

Note: Condensate production is converted to gas equivalent by

$$\frac{SCF}{STB} = \frac{350 \gamma_o}{M_o} \frac{RT_{sc}}{P_{sc}} = \frac{(350)(0.78)}{139} \frac{(10.73)(520)}{14.7} = 745 \frac{SCF}{STB}$$

where $\gamma_o = \frac{141.5}{API+131.5} = 0.78$ and $M_o = \frac{6084}{API-5.9} = 139$ for API = 49.7°

B. Reserves of Gas and Condensate (Exhibit 2)

Surface production can be easily predicted from Core Labs' PVT cell depletion and flash calculations to the produced well stream. These calculations are performed by Core Labs on the basis of 1.0 MMCF of reservoir fluid at the dew point, 5018 psig. Correcting to the original reservoir pressure given a basis of 1.097 MMCF at original pressure, 7255 psig, meaning that 0.097 MMCF per 1.0 MMCF are produced above the dew point. Adding this recovery to that given on page 5 of the Core Labs report, and proportioning up to the reservoir size of 4100 MMCF by the factor 4100/1.097, gives immediately the cumulative surface production versus reservoir pressure (Exhibit 2). Note how accurately the prediction matches the field performance to date. Reserves for any abandonment pressure can be read directly from this plot.

Without surface compression: $\bar{P}_{abd}$ = 1300 psig

Gas Reserves = 2460 MMCF

Condensate Reserves = 147 MSTB

With surface compression: $\bar{P}_{abd}$ = 1000 psig

Gas Reserves = 2730 MMCF

Condensate Reserves = 151 MSTB

These recoveries assume that the well will never produce any water and that retrograde liquid is nonmobile.

C. Liquid Yield versus Cumulative Gas Production (Exhibit 3)

Instantaneous yield is not reported in Core Labs' separator flash calculation results. It can be computed by plotting cumulative liquid versus cumulative gas and taking slopes. Exhibit 3 shows the results along with a comparison to actual field performance to date.

D. Reservoir Radius

$$\frac{7758\, Ah\, \phi\, S_g}{B_{gi}} = OGIP = 4.1 \times 10^9 \text{ SCF}$$

$$Ah = \frac{(4.1\times10^9)(B_{gi})}{7758\, \phi\, S_g} = \frac{(4.1\times10^9)(0.000587)}{(7758)(0.15)(0.8)}$$

$$Ah = 2585 \text{ acre-ft} = 112.6\times10^6 \text{ ft}^2$$

$$\pi r^2 h = 112.6\times10^6$$

$$r = \sqrt{\frac{112.6\times10^6}{h\pi}}$$

$r = 618$ ft if average $h = 94'$

$r = 873$ ft if average $h = 47'$

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E. Remarks on Recovery Efficiency

Original Gas in Place = 4100 MMCF

Original Separator Gas in Place = $(4100 \text{ MMCF})\left(\frac{935 \text{ MCF}}{1.0 \text{ MMCF}}\right) = 3424$ MMCF

Ultimate Recovery w/ compression = 2730 MMCF

Gas Recovery Efficiency = 2730/3424 = 80 %

Original Stock Tank Liq in Place = $(4100 \text{ MMCF})\left(\frac{189.7 \text{ STB}}{1.0 \text{ MMCF}}\right) = 778$ MSTB

Ultimate Recovery w/ compression = 151 MSTB

Condensate Recovery Efficiency = 151/778 = 19 %

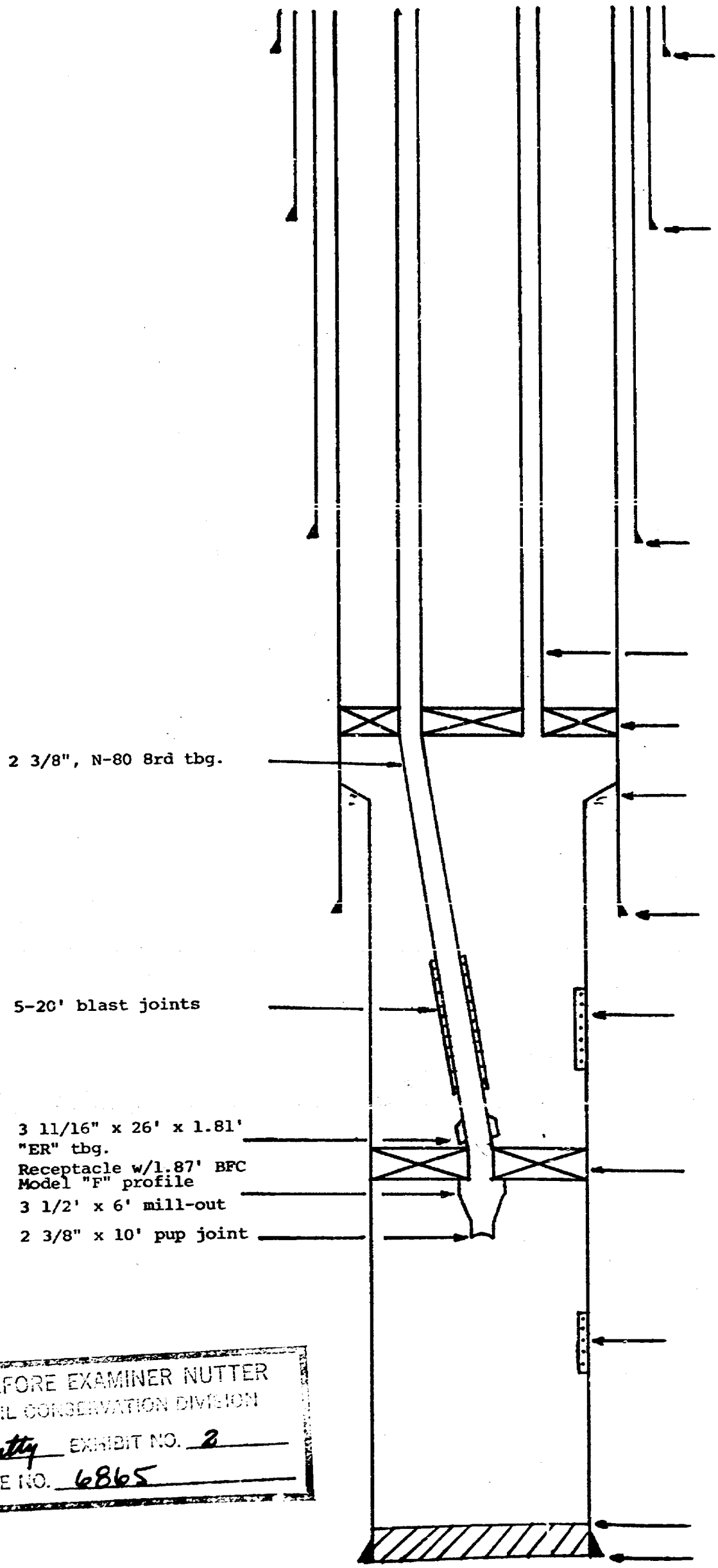
Pressure depletion will give excellent gas recovery but will leave some 627,000 STB of condensate in the ground. It may be advisable to consider some type of inert gas pressure maintenance project. Discouraging features are:

1. We will probably never have a second well in the reservoir.
2. These potential reserves are not large enough to support much expense in developing a source of injection gas.
3. Reservoir pressure is already below the dew point and retrograde dropout is 70% of the maximum. Revaporization with inert gas pressure may not be possible.

Encouraging features are the favorable reservoir characteristics, thick, permeable, and probably narrow areally, giving rise to the possibility of a vertical, gravity stabilized flood.

Water injection is out of the question because it would seriously jeopardize gas reserves.

GETTY "36" STATE COM. NO. 1
MORROW-WOLFCAMP DUAL COMPLETION
LEA COUNTY, NEW MEXICO



20",94# H-40 @ 40'
w/3 yds. Ready-Mix

13 3/8", 48#, H-40
@ 1100'. Circulate
17 sxs to surface

9 5/8",36#, S-80 &
K-55 at 5502'.
Circulate 125 sxs
cement surface

2 3/8", N-80 8rd tbg

Baker Model "AL-5"
Dual pkr. at 10,505'
w/2 3/8" x 1.81"
Model "F" nipple
Liner top at 10,815'
Squeezed w/100 sxs

2 3/8", N-80 8rd tbg.

7", 26# N-80 & S-95
@ 11,114'. Cement
top by Worth Well
Temp. at 3570'.

5-20' blast joints

Wolfcamp perfs.
11,320-11,335'

3 11/16" x 26' x 1.81'
"ER" tbg.
Receptacle w/1.87' BFC
Model "F" profile
3 1/2' x 6' mill-out
2 3/8" x 10' pup joint

Baker Model "DB"
pkr. @ 12,000'

Morrow perfs.
12,940-12,950'

Plug back TD 13,266'

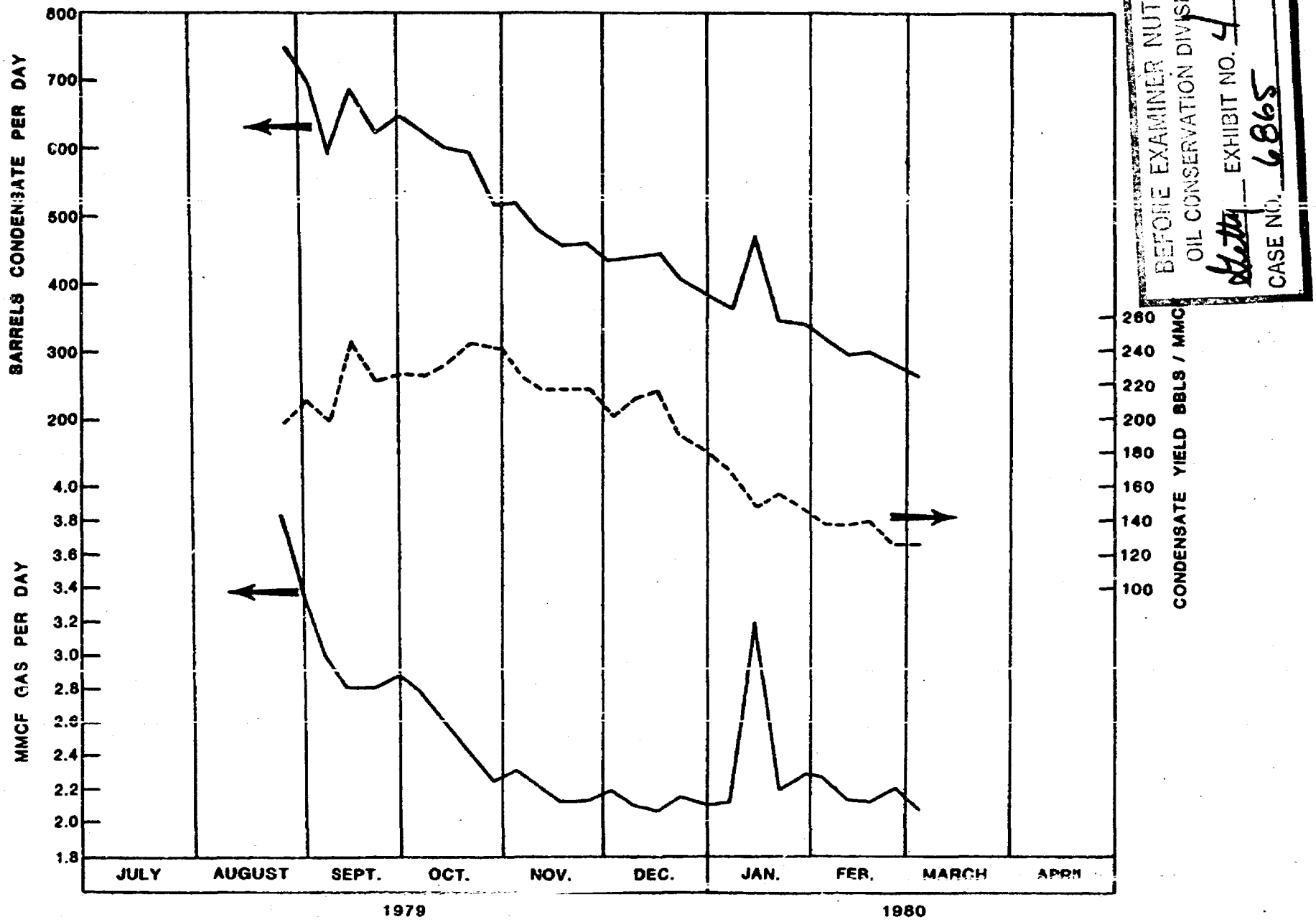
4 1/2" 11.6# S-95 @
13,349'

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
Getty EXHIBIT NO. 2
CASE NO. 6865

DAILY TEST DATA
GETTY "36" STATE COM. WELL NO. 1
WOLFCAMP

Week of	Condensate Bbls.	Gas (MMCF)	CON. YIELD (BBLS./MCF)
Aug. 27	750	3.82	196.33
Sep. 3	700	3.32	210.84
Sep. 10	590	2.98	197.98
Sep. 17	685	2.80	244.64
Sep. 24	620	2.80	221.42
Oct. 1	645	2.86	225.52
Oct. 8	620	2.77	223.82
Oct. 15	600	2.59	231.66
Oct. 22	590	2.42	243.80
Oct. 29	515	2.14	240.65
Nov. 5	518	2.3	225.21
Nov. 12	475	2.2	215.91
Nov. 19	455	2.11	215.63
Nov. 26	458	2.12	216.03
Dec. 3	435	2.18	199.54
Dec. 10	442	2.09	211.48
Dec. 17	445	2.06	216.02
Dec. 24	105	2.1	189.25
Dec. 31	380	2.1	180.95
Jan. 7	360	2.12	169.81
Jan. 14	470	3.190	147.34
Jan. 21	341	2.192	155.57
Jan. 28	336	2.274	147.76
Feb. 4	313	2.258	138.62
Feb. 11	292	2.132	136.96
Feb. 18	295	2.117	139.75
Feb. 25	274	2.202	124.43
Mar. 3	260	2.077	125.18

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
Getty EXHIBIT NO. 3
CASE NO. 6865



GETTY 36 STATE COM. NO. 1 - WOLFCAMP
PRODUCTION DATA

MONTH	CONDENSATE, BBL.	GAS, MCF
August, 79	4,864	19,492
Sept., 79	16,150	74,619
Oct., 79	17,660	76,388
Nov., 79	13,439	61,611
Dec., 79	12,244	64,464
Jan., 80	10,412	64,131
Feb., 80	7,489	57,200*
Total	82,258	417,905

*estimated

Well was opened after buildup at 11 a.m. on February 29, 1980. Hence, total estimated production through February is approximately the production prior to the start of the buildup.

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
Getty EXHIBIT NO. 5
CASE NO. 6865

JARREL SERVICES, INC.

POST OFFICE BOX 1654 PHONE 505 393-3309
HOBBS, NEW MEXICO 88240

COMPANY: Getty Oil Company

WELL: Getty 36 State Com. No. 1 **FIELD:** Undesignated - Wolfcamp

CHRONOLOGICAL PRESSURE DATA

DATE	STATUS OF WELL	TIME	ELASPED TIME HRS.	MIN.	SURFACE PRESSURE TBG	CSG	BHP @ (-7636) 10485'	11328' PSIG
1980								
2/26	Flowing. Run Flowing Gradient w/Tandem Bombs & Set Bombs off @ 10485'	10:30 AM	0	00	2346	PKR	3840	3963
	Shut in	11:00	0	30	2346	–	3840	3963
	"	11:03	0	03	–	–	4045	4408
	"	11:06	0	06	–	–	4154	4517
	"	11:09	0	09	–	–	4179	4542
	"	11:12	0	12	–	–	4186	4549
	"	11:15	0	15	–	–	4192	4555
	"	11:20	0	20	–	–	4192	4555
	"	11:25	0	25	–	–	4192	4555
	"	11:30	0	30	–	–	4192	4555
	"	11:45	0	45	–	–	4192	4555
	"	12:00 N	1	00	–	–	4192	4555
	"	1:00 PM	2	00	–	–	4199	4562
	"	2:00	3	00	–	–	4205	4568
	"	3:00	4	00	–	–	4205	4568
	"	4:00	5	00	–	–	4205	4568
	"	5:00	6	00	–	–	4212	4575
	"	6:00	7	00	–	–	4212	4575
	"	7:00	8	00	–	–	4212	4575
	"	8:00	9	00	–	–	4218	4581
	"	9:00	10	00	–	–	4218	4581
	"	10:00	11	00	–	–	4218	4581
	"	11:00	12	00	–	–	4218	4581
	"	12:00 MN	13	00	–	–	4218	4581
2/27	"	1:00 AM	14	00	–	–	4218	4581
	"	2:00	15	00	–	–	4218	4581
	"	3:00	16	00	–	–	4218	4581
	"	4:00	17	00	–	–	4218	4581
	"	5:00	18	00	–	–	4218	4581
	"	6:00	19	00	–	–	4218	4581
	"	7:00	20	00	–	–	4218	4581
	"	8:00	21	00	–	–	4218	4581
	"	9:00	22	00	–	–	4218	4581
	"	10:00	23	00	–	–	4218	4581
	"	11:00	24	00	–	–	4218	4581
	"	12:00 N	25	00	–	–	4218	4581
	"	1:00 PM	26	00	–	–	4224	4587
	"	2:00	27	00	–	–	4224	4587
	"	3:00	28	00	–	–	4224	4587
	"	4:00	29	00	–	–	4224	4587

WELL: Getty 36 State Com. No. 1
PAGE: 2

DATE	STATUS OF WELL	TIME	ELASPED TIME HRS.	MIN.	SURFACE PRESSURE TBG	CSG	BHP @ (-7636) 10485'	11328'PS
	Shut in	5:00	30	00	-	-	4224	4587
	"	6:00	31	00	-	-	4224	4587
	"	7:00	32	00	-	-	4224	4587
	"	8:00	33	00	-	-	4224	4587
	"	9:00	34	00	-	-	4224	4587
	"	10:00	35	00	-	-	4224	4587
	"	11:00	36	00	-	-	4224	4587
	"	12:00 MN	37	00	-	-	4224	4587
2/28	"	1:00 AM	38	00	-	-	4224	4587
	"	2:00	39	00	-	-	4224	4587
	"	3:00	40	00	-	-	4224	4587
	"	4:00	41	00	-	-	4231	4594
	"	5:00	42	00	-	-	4231	4594
	"	6:00	43	00	-	-	4231	4594
	"	7:00	44	00	-	-	4231	4594
	"	8:00	45	00	-	-	4231	4594
	"	9:00	46	00	-	-	4231	4594
	"	10:00	47	00	-	-	4231	4594
	"	11:00	48	00	-	-	4231	4594
	"	12:00 N	49	00	-	-	4231	4594
	"	1:00 PM	50	00	-	-	4231	4594
	"	2:00	51	00	-	-	4231	4594
	"	3:00	52	00	-	-	4231	4594
	"	4:00	53	00	-	-	4231	4594
	"	5:00	54	00	-	-	4231	4594
	"	6:00	55	00	-	-	4231	4594
	"	7:00	56	00	-	-	4231	4594
	"	8:00	57	00	-	-	4231	4594
	"	9:00	58	00	-	-	4231	4594
	"	10:00	59	00	-	-	4237	4600
	"	11:00	60	00	-	-	4237	4600
	"	12:00 MN	61	00	-	-	4237	4600
2/29	"	1:00 AM	62	00	-	-	4237	4600
	"	2:00	63	00	-	-	4237	4600
	"	3:00	64	00	-	-	4237	4600
	"	4:00	65	00	-	-	4237	4600
	"	5:00	66	00	-	-	4237	4600
	"	6:00	67	00	-	-	4237	4600
	"	7:00	68	00	-	-	4237	4600
	"	8:00	69	00	-	-	4237	4600
	"	9:00	70	00	-	-	4237	4600
	"	10:00	71	00	-	-	4237	4600
	Fished Bombs & Run Static Gradient	11:00	72	00	2731	-	4237	4600

JARREL SERVICES, INC.

POST OFFICE BOX 1654 PHONES 505 393-5396 — 393-8274

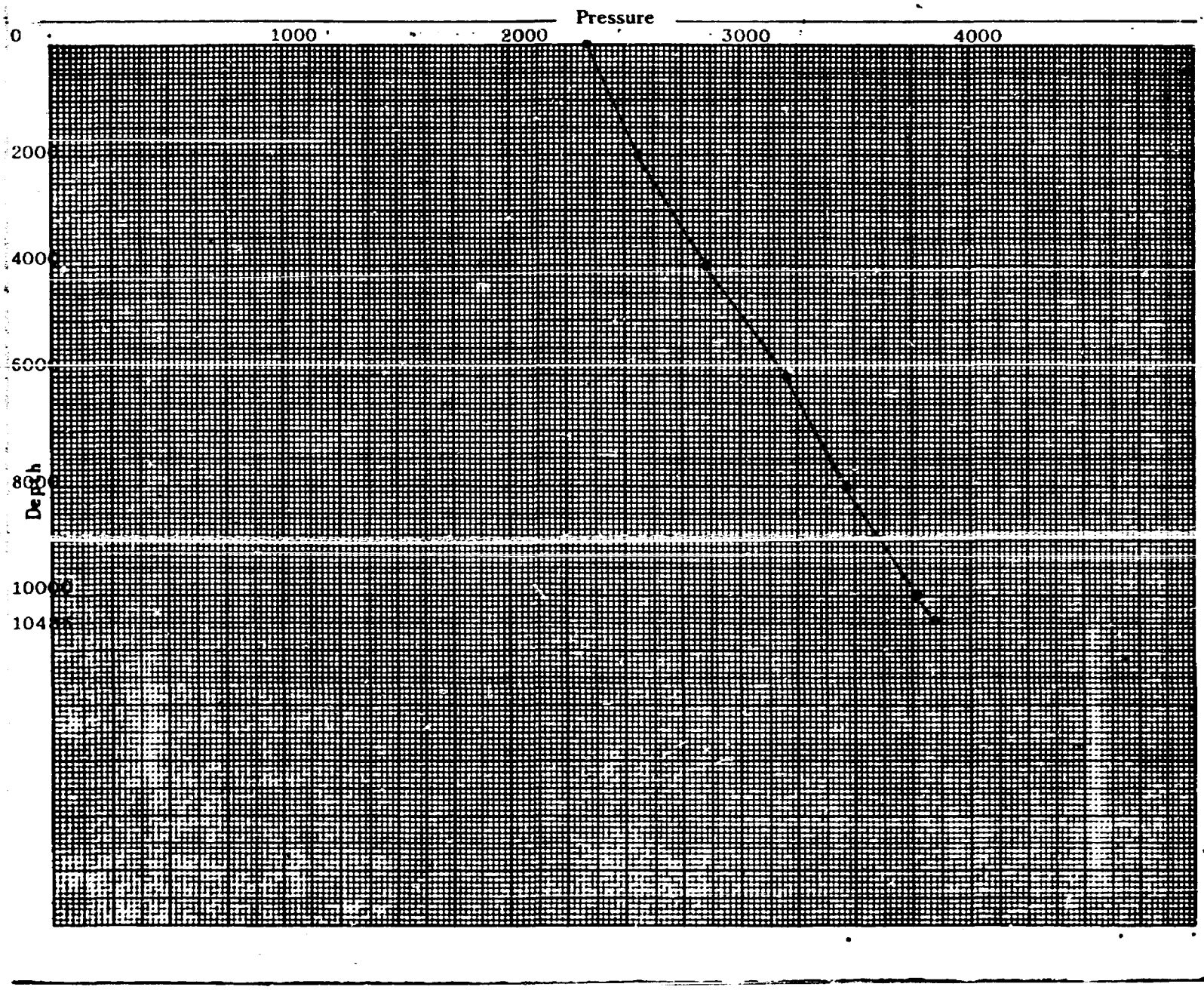
HOBBS, NEW MEXICO 88240

OPERATOR Getty Oil Company
FIELD Undesignated
FORMATION Wolfcamp
LEASE Getty 36 State Com WELL #1
COUNTY Lea STATE New Mexico
DATE Feb. 26, 1980 TIME 8:00 AM
Status Flowing
Test Depth 10485'
Time S. I. - Last test date -
Tub Pres. 2346 BHP last test -
Cas. Pres. Dual BHP change -
Elev. 3692'KB-23 Fluid top Flowing
Datum (-7636) ** Water top -
Temp. @ 174°F Run by JSI #21
Cal. No. A13676N Chart No. 1

BOTTOM HOLE PRESSURE RECORD

Depth	Pressure	Gradient
0	2346	-
2000	2558	.106
4000	2859	.151
6000	3205	.173
8000	3468	.132
10000	3769	.151
10485	3840	.146
11328 (-7636)	3963 * **	(.146)

* EXTRAPOLATED PRESSURE
** MIDPOINT OF CASING PERFORATIONS



NO. 340R-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

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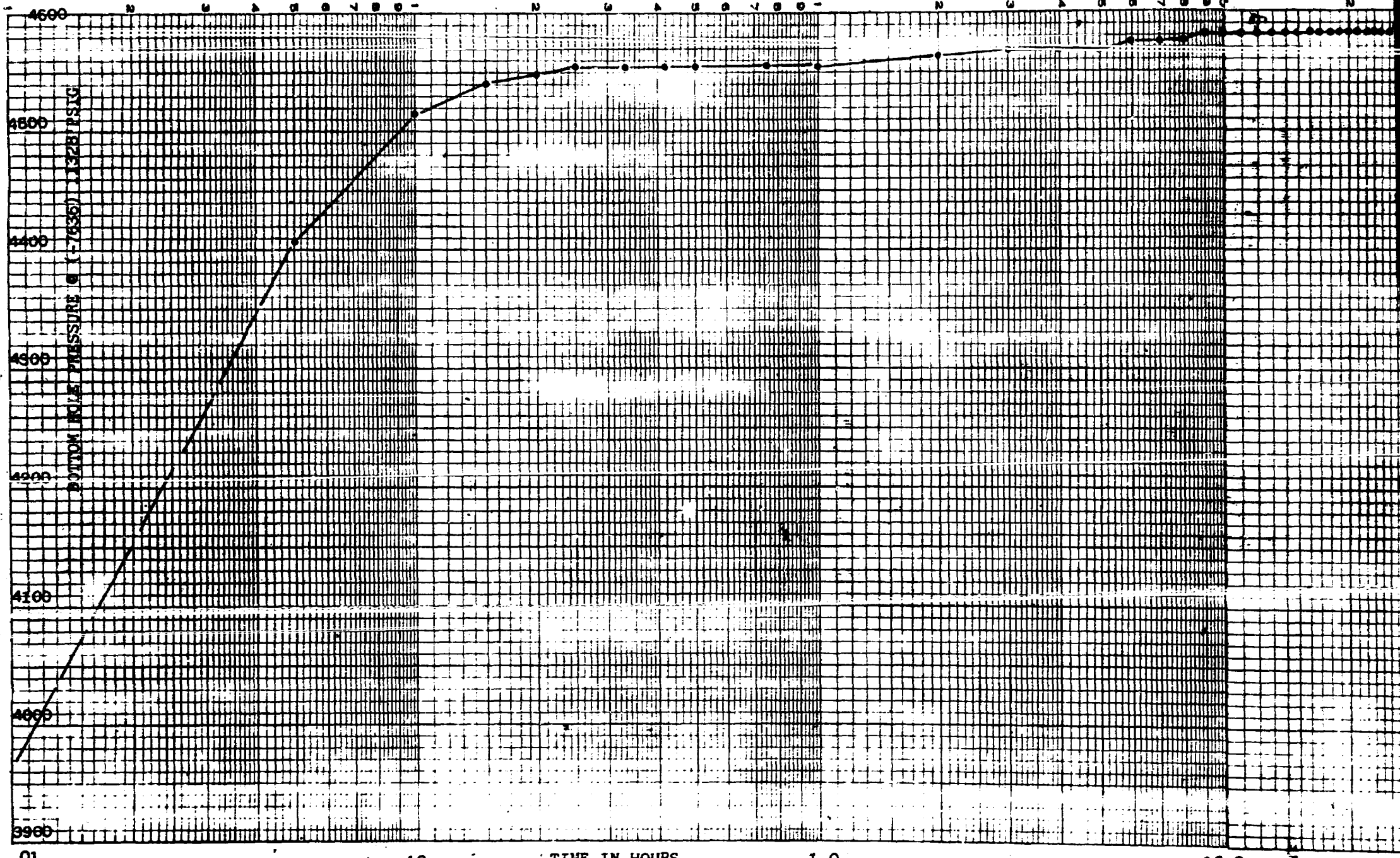

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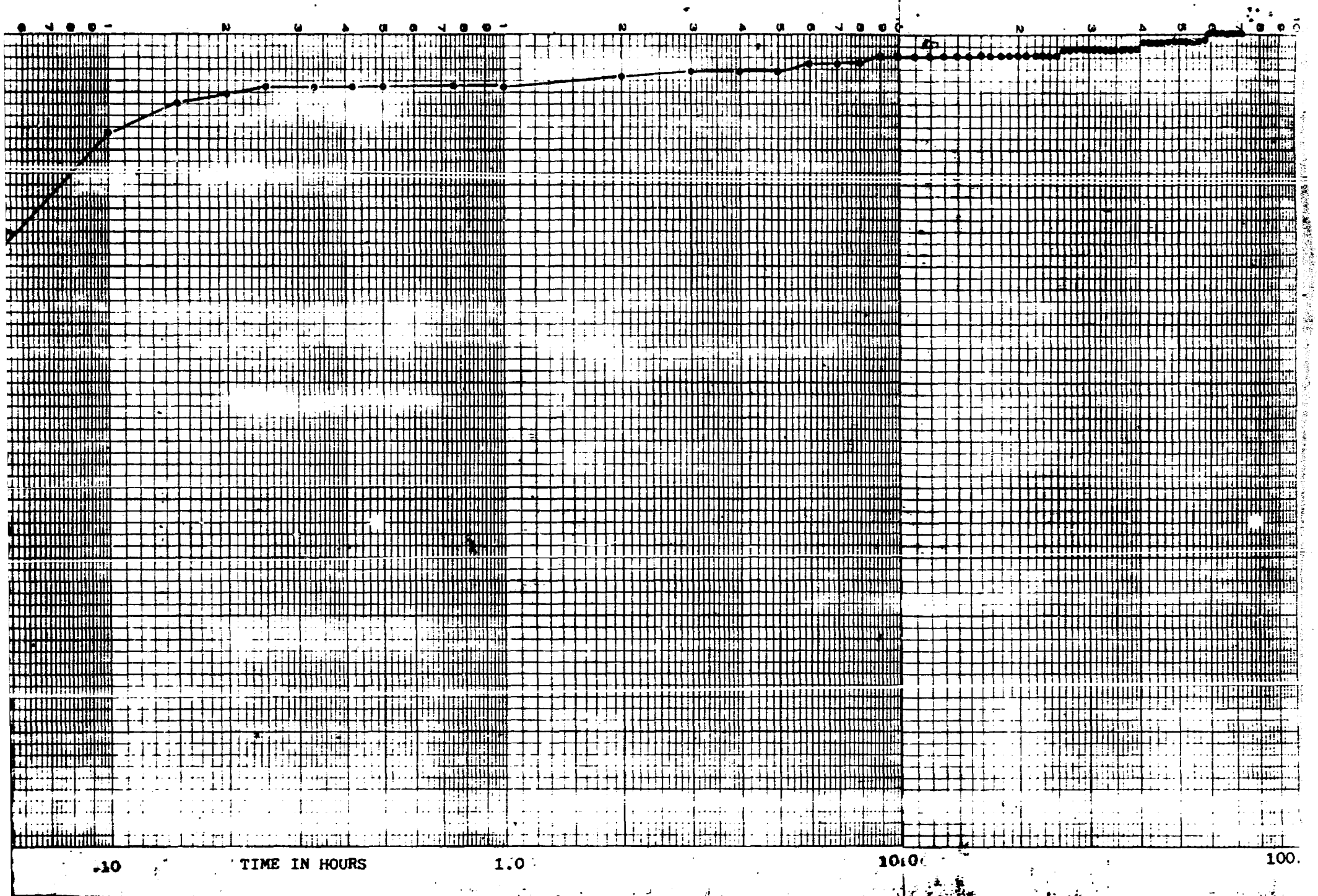


JARREL SERVICES, INC.

POST OFFICE BOX 1654 PHONES 505 393-5306 — 393-8274

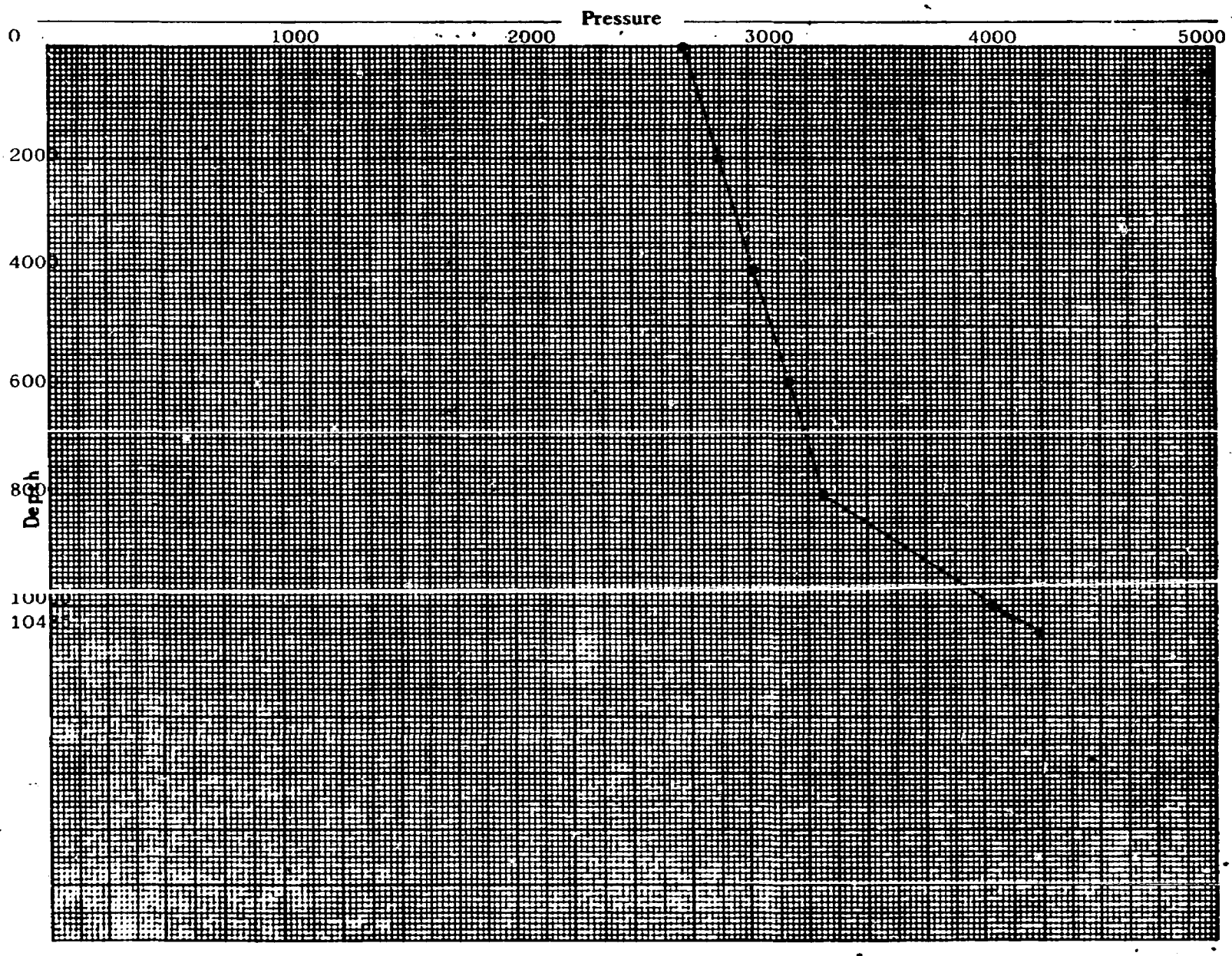
HOBBS, NEW MEXICO 88240

OPERATOR Getty Oil Company
FIELD Undesignated
FORMATION Wolfcamp
LEASE Getty 36 State Com WELL #1
COUNTY Lea STATE New Mexico
DATE Feb. 29, 1980 TIME 11:00 AM
Status Shut in
Test Depth 10485'
Time S. I. 72 hrs. Last test date 7/4/79
Tub Pres. 2731 BHP last test 7057 @ 10450'
Cas. Pres. PKR BHP change 2457# Loss
Elev. 3692'KB-23 Fluid top 8000'
Datum (-7636) ** Water top 9000'
Temp. @ 174°F Run by JSI #16
Cal. No. A1367GN Chart No. 2

BOTTOM HOLE PRESSURE RECORD

Depth		Pressure	Gradient
0		2731	-
2000		2874	.072
4000		3020	.073
6000		3168	.074
8000		3318	.075
10000		4028	.355
10485		4237	.431
11328	(-7636)	4600 * **	(.431)

* EXTRAPOLATED PRESSURE
** MIDPOINT OF CASING PERFORATIONS



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75207

Reservoir Fluid Study

for

GETTY OIL COMPANY

State 36 No. 1 Well
Wildcat
Lea County, New Mexico

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75207

January 23, 1980

RESERVOIR FLUID DIVISION

Getty Oil Company
P.O. Box 730
Hobbs, NM 82240

Attention: Mr. Peter Botes

Subject: Reservoir Fluid Study
State 36 No. 1 Well
Wildcat
Lea County, New Mexico
Our File Number: RFL 79619

Gentlemen:

Duplicate samples of separator gas and separator liquid were collected from the subject well by Tefteller, Inc. on September 9, 1979. These samples were forwarded to our Dallas laboratory for use in a reservoir fluid study, the results of which are presented on the following pages.

Upon arrival in the laboratory, the separator gas was analyzed through heptanes plus using chromatography, while the separator liquid was also analyzed through heptanes plus using low temperature fractional distillation equipment along with chromatography. After the separator gas flow rate was corrected using factors which are shown on page one, the producing gas-liquid ratio was calculated to be 4438 cubic feet of separator gas at 15.025 psia and 60°F. per barrel of stock tank liquid at 60°F. In the laboratory, it was determined that this was the equivalent of 3588 standard cubic feet of separator gas per barrel of separator liquid at 490 psig and 78°F. The measured compositions of the separator products were used in conjunction with this producing gas-liquid ratio to calculate the composition of the producing well stream material. These compositions are shown on page two. In the laboratory, the separator products were physically recombined to this producing gas-liquid ratio for use in the entire reservoir fluid study.

A portion of the reservoir fluid was charged to a high pressure visual cell and heated to the reservoir temperature of 196°F. During constant composition expansion pressure-volume relations performed at this temperature, the fluid existed as a single-phase gas at pressures above 5018 psig at which pressure a retrograde dew point was observed. A comparison of this dew point pressure to the reservoir pressure, 6846 psig, measured on September 12, 1979 indicates that the fluid currently exists in the reservoir in an undersaturated condition. The results of the pressure-volume relation measurements are shown on page three.

The sample in the cell was repressured to a single-phase condition after which it was subjected to a constant volume depletion. After the sample volume was established at the dew point pressure, the sample was subjected to a series of pressure expansions and constant pressure displacements with each displacement terminating at the original sample volume at the dew point pressure. During each of these displacements, the volume of retrograde liquid accumulation was monitored. These data, which are reported on pages six and twelve, show that the maximum accumulation of liquid is approximately 37.1 percent of the hydrocarbon pore space occurring at approximately 3150 psig. The liquid saturation at atmospheric pressure and 196°F. was 24.5 percent of the hydrocarbon pore space.

A larger volume of the reservoir fluid was once again charged to a bigger high pressure cell heated to 196°F. where the constant volume depletion was repeated. During this particular depletion, the equilibrium gas phase at each of the depletion pressure levels was charged to low temperature fractional distillation equipment where along with chromatography its composition was measured. Also determined was the volumetric production of the vapor phase from pressure to pressure where the various deviation factor z were measured down to 700 psig. A summary of these volumetric and compositional data is reported on page four.

The above compositions and volumetric data were used in conjunction with published equilibrium ratio data to calculate the surface recoveries that may be expected as the reservoir pressure declines. These calculations were performed on the basis of one million standard cubic feet of reservoir fluid inplace at the dew point pressure, 5018 psig and 196°F. Assumed in these calculations was a plant efficiency of 100 percent. These volumetric data are reported in tabular form on page five.

We wish to thank Getty Oil Company for this opportunity to be of service. If you should have any questions regarding these data or we can be of further assistance, please do not hesitate to contact us.

Very truly yours,

CORE LABORATORIES, INC.

P. L. Moses, Manager
Reservoir Fluid Analysis

PLM:FBV:bt
6 cc: Addressee
1 cc: Mr. Jim Eakin
Getty Oil Co.
P.O. Box 1231
Midland, TX 79702

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Company Getty Oil Company — Date Sampled September 9, 1979

Well State 36 No. 1 — County Lea

Field Wildcat — State New Mexico

FORMATION CHARACTERISTICS

Formation Name	Wolfcamp	
Date First Well Completed	July 2, 1979	
Original Reservoir Pressure	7255 PSIG @ 11328	Ft.
Original Produced Gas-Liquid Ratio	5082	SCF/Bbl
Production Rate	752	Bbls/Day
Separator Pressure and Temperature	PSIG	°F.
Liquid Gravity at 60°F.	49.7	°API
Datum	7636	Ft. Subsea

WELL CHARACTERISTICS

Elevation	3692 KB	Ft.
Total Depth	13266 PBTD	Ft.
Producing Interval	11320-11335	Ft.
Tubing Size and Depth	2-3/8 In. to 10495	Ft.
Open Flow Potential	7.82 (Estimated)	MMSCF/Day
Last Reservoir Pressure	6846 PSIG @ 11328	Ft.
Date	September 12, 1979	
Reservoir Temperature	187* °F. @ 10505	Ft.
Status of Well	Flowing	
Pressure Gauge	Amerada	

SAMPLING CONDITIONS

Flowing Tubing Pressure	3510	PSIG
Flowing Bottom Hole Pressure	6092	PSIG
Primary Separator Pressure	490	PSIG
Primary Separator Temperature	78	°F.
Secondary Separator Pressure		PSIG
Secondary Separator Temperature		°F.
Field Stock Tank Liquid Gravity	49.7	°API @ 60°F.
Primary Separator Gas Production Rate	2887	MSCF/Day
Pressure Base	15.025 PSIA	
Temperature Base	60 °F.	
Compressibility Factor (F_{pv})	1.0477	
Gas Gravity (Laboratory)	0.688	
Gas Gravity Factor (F_g)	1.2056	
Stock Tank Liquid Production Rate @ 60°F.	650.54	Bbls/Day
Primary Separator Gas/Stock Tank Liquid Ratio	4438	SCF/Bbl
or	225.33	Bbls/MMSCF
	TJ	

Sampled by

REMARKS:
*Temperature extrapolated to mid-point of perforation = 196°F.

CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Well State 36 No. 1

Hydrocarbon Analyses of Separator Products and Calculated Well Stream

Component	Separator Liquid Mol Percent	Separator Gas Mol Percent	Separator Gas GPM	Well Stream Mol Percent	Well Stream GPM
Hydrogen Sulfide	0.00	0.00		0.00	
Carbon Dioxide	0.00	0.12		0.10	
Nitrogen	0.16	1.14		0.94	
Methane	11.74	81.81		67.81	
Ethane	8.81	10.87	2.964	10.46	
Propane	9.79	3.92	1.100	5.09	1.428
iso-Butane	2.49	0.50	0.167	0.90	0.300
n-Butane	7.04	0.91	0.293	2.13	0.685
iso-Pentane	3.33	0.18	0.067	0.81	0.302
n-Pentane	3.83	0.18	0.067	0.91	0.336
Hexanes	5.63	0.10	0.042	1.21	0.503
Heptanes plus	47.18	0.27	0.125	9.64	6.563
	100.00	100.00	4.825	100.00	10.117

Properties of Heptanes plus

API gravity @ 60°F.	44.5		
Specific gravity @ 60/60°F.	0.8041		0.802
Molecular weight	171	103 (assumed)	169

Calculated separator gas gravity (air=1.000) = 0.688

Calculated gross heating value for separator gas = 1224 BTU per cubic foot of dry gas @ 15.025 psia and 60°F.

Primary separator gas collected @ 490 psig and 78 °F.

Primary separator liquid collected @ 490 psig and 78 °F.

Primary separator gas/separator liquid ratio	3588	SCF/Bbl @ 78°F.
Primary separator liquid/stock tank liquid ratio	1.237	Bbls @78°F/per Bbl @60°F.
Primary separator gas/well stream ratio	800.17	MSCF/MMSCF
Stock tank liquid/well stream ratio	180.30	Bbls/MMSCF

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Well State 36 No. 1

Pressure-Volume Relations of Reservoir Fluid at 196°F.
(Constant Composition Expansion)

Pressure PSIG		Relative Volume	Deviation Factor Z
8000		0.8946	1.482
7630		0.9034	1.427
7255	Original Reservoir Pressure	0.9115	1.369(1)
7100		0.9172	1.348
6700		0.9291	1.289
6300		0.9421	1.229
6000		0.9532	1.185
5700		0.9655	1.140
5450		0.9769	1.103
5300		0.9843	1.081
5150		0.9929	1.060
5050		0.9974	1.044
5018	Dew Point Pressure	1.0000	1.040(2)
5008		1.0006	
4950		1.0049	
4850		1.0119	
4700		1.0240	
4500		1.0422	
4250		1.0687	
3950		1.1089	
3500		1.1860	
3000		1.3198	
2500		1.5253	
2000		1.8695	
1600		2.3295	
1200		2.8763	
1000		3.7023	

(1) Gas expansion factor = 1.572 MSCF/Bbl.
(2) Gas expansion factor = 1.433 MSCF/Bbl.

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 79619

Well State 36 No. 1

Depletion Study at 196°F.

Hydrocarbon Analyses of Produced Well Stream - Mol Percent

Component	Reservoir Pressure - PSIG							
	5018	4300	3600	2800	2000	1300	700	700*
Carbon Dioxide	0.10	0.10	0.10	0.10	0.11	0.12	0.14	0.04
Nitrogen	0.94	1.12	1.19	1.20	1.15	1.08	1.03	0.05
Methane	67.81	73.54	76.22	78.13	78.75	78.34	75.34	14.37
Ethane	10.46	10.44	10.41	10.34	10.66	11.10	12.23	7.27
Propane	5.09	4.80	4.57	4.40	4.42	4.66	5.70	7.16
iso-Butane	0.90	0.80	0.73	0.67	0.66	0.71	0.94	2.12
n-Butane	2.13	1.84	1.62	1.47	1.41	1.52	1.97	5.21
iso-Pentane	0.81	0.68	0.59	0.52	0.48	0.48	0.54	2.56
n-Pentane	0.91	0.74	0.63	0.54	0.49	0.49	0.56	2.87
Hexanes	1.21	0.81	0.57	0.42	0.34	0.33	0.40	5.87
Heptanes plus	9.64	5.13	3.37	2.21	1.53	1.17	1.15	52.48
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Molecular weight of heptanes plus	169	133	124	115	109	106	107	180
Specific gravity of heptanes plus	0.801	0.777	0.770	0.759	0.752	0.749	0.750	0.808
Deviation Factor - Z								
Equilibrium gas	1.040	0.911	0.845	0.820	0.847	0.888	0.935	
Two-phase	1.040	0.952	0.878	0.812	0.752	0.682	0.559	
Well Stream produced-								
Cumulative percent of initial	0.000	6.304	14.855	28.142	44.651	60.178	73.736	
GPM from Smooth Compositions								
Propane plus	10.117	5.906	4.489	3.580	3.131	3.066	3.650	
Butanes plus	8.689	4.559	3.207	2.345	1.891	1.758	2.051	
Pentanes plus	7.704	3.701	2.443	1.650	1.218	1.032	1.105	

*Composition of equilibrium liquid phase.

Calculated Cumulative Recovery During Depletion

Cumulative Recovery per MMSCF of Original Fluid	Initial in Place	Reservoir Pressure - PSIG 5018	4300	3600	2800	2000	1300	700
Well Stream - MSCF	1000	0	63.04	148.55	281.42	446.51	601.78	737.36
Normal Temperature Separation*								
Stock Tank Liquid - Barrels	189.70	0	5.58	10.36	15.01	18.90	21.09	
Primary separator gas-MSCF	789.49	0	55.38	133.93	259.64	418.40	571.04	
Second stage gas - MSCF	45.62	0	1.70	3.25	4.86	6.31	6.46	
Stock tank gas - MSCF	26.80	0	1.10	2.13	3.23	4.24	4.55	
Total "Plant Products" in Primary Separator Gas - Gallons								
Propane	833	0	62	151	293	478	676	
Butanes (total)	342	0	27	68	134	221	326	
Pentanes plus	185	0	15	37	75	125	200	
Total "Plant Products" in Second Stage Separator Gas-Gallons								
Propane	161	0	6.3	12.1	18.1	23.6	24.0	
Butanes (total)	72	0	3.1	6.0	9.0	11.9	12.1	
Pentanes plus	37	0	1.6	3.1	4.8	6.4	6.5	
Total "Plant Products" in Well Stream - Gallons								
Propane	1428	0	85	195	359	563	766	983
Butanes (total)	985	0	54	119	212	323	436	564
Pentanes plus	7704	0	233	442	661	863	1023	1173

*Primary separator at 490 psig and 78°F.; second stage separator at 70 psig and 75°F.; and stock tank at 70°F., except 1300 psig well stream where primary separator is at 200 psig and 78°F.

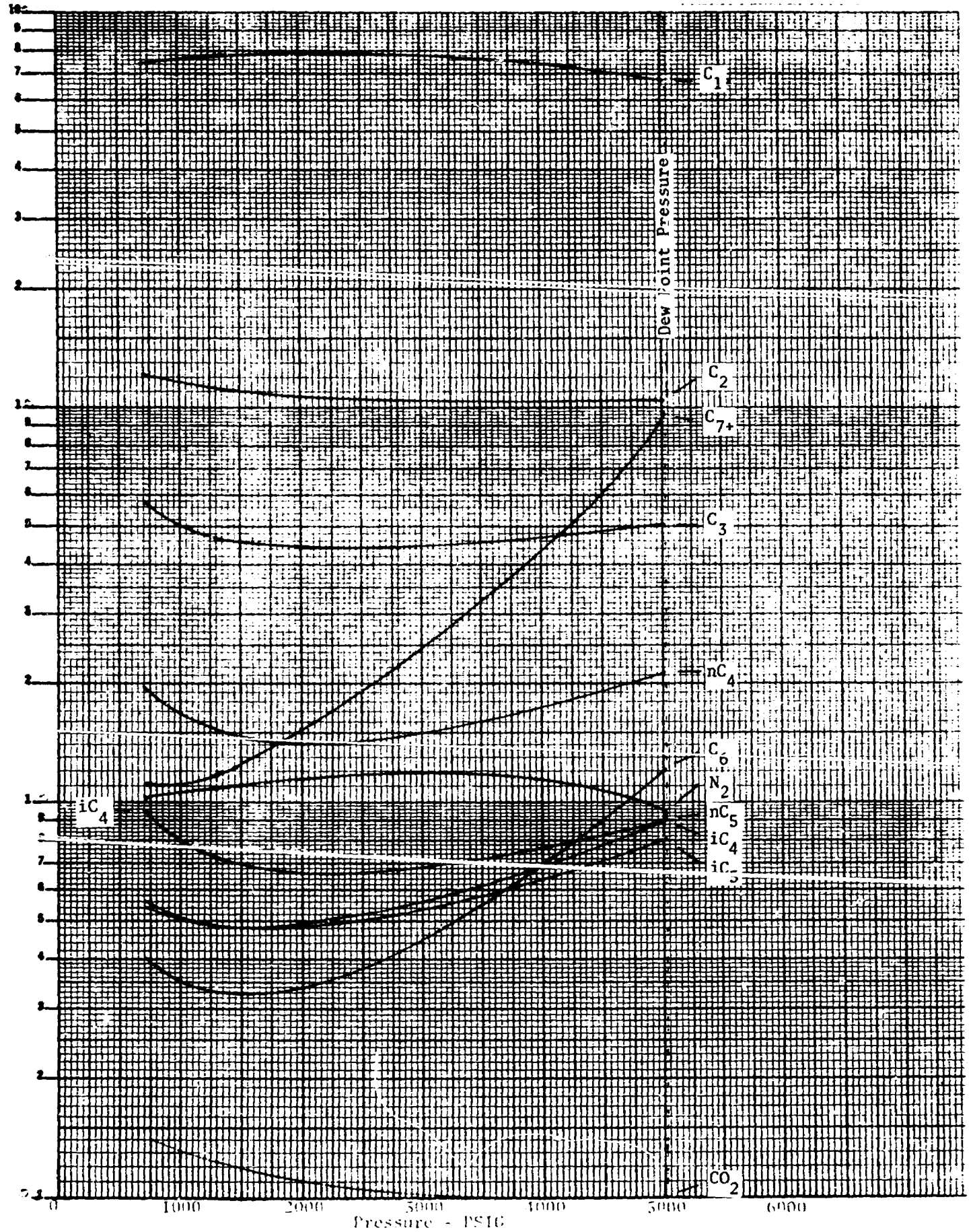
Retrograde Condensation During Gas Depletion at 196°F.

Pressure PSIG	Retrograde Liquid Volume Percent of Hydrocarbon Pore Space
5018 Dew Point Pressure	0.0
5012	0.8
5008	1.4
4950	11.2
4850	17.8
4700	23.7
4500	28.6
4300	32.9
3600	36.7
2800	37.0
2000	35.2
1300	32.5
700	29.7
0	24.5

Properties of Zero PSIG Residual Liquid

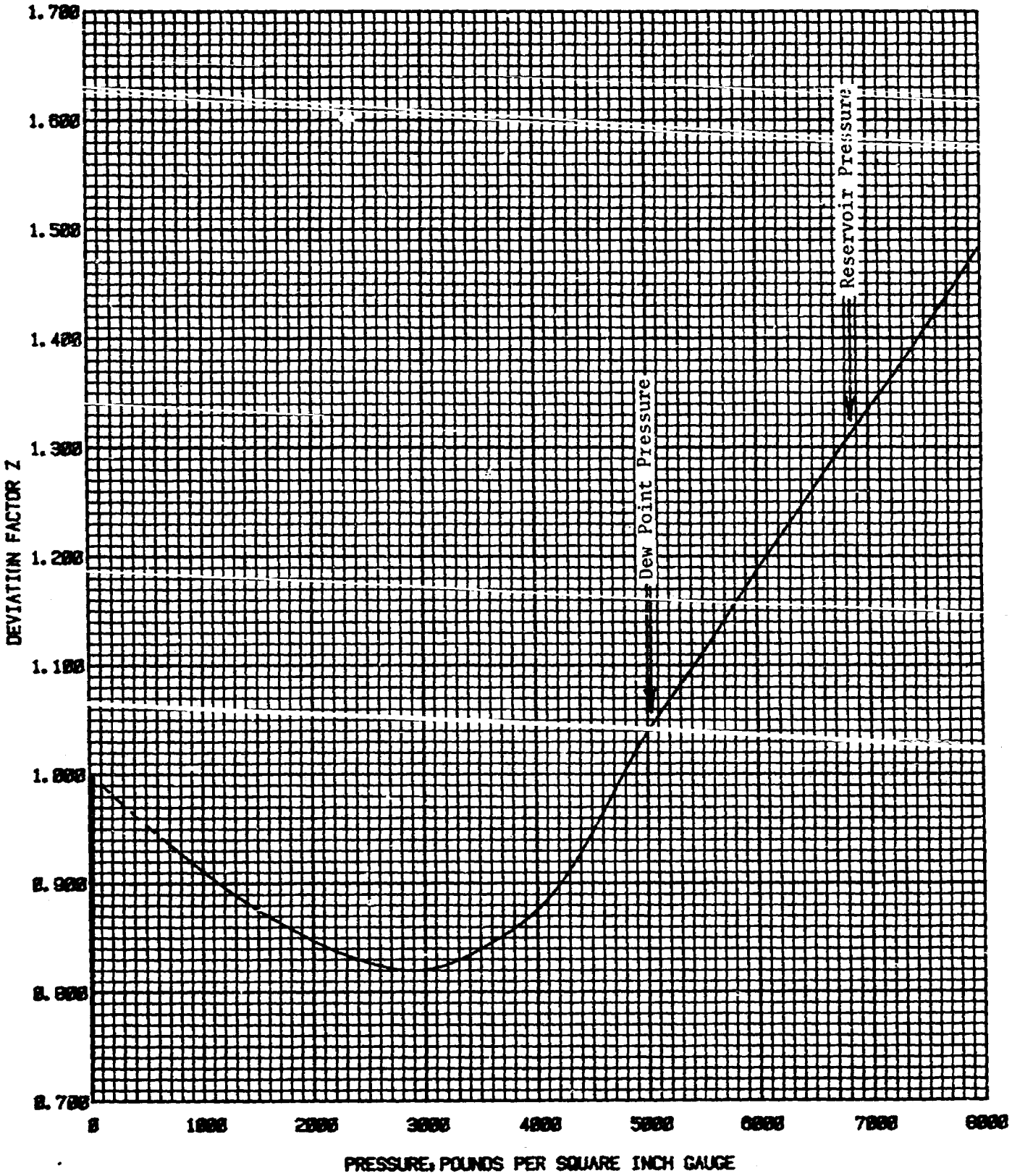
API Gravity @ 60°F.	43.6
Specific gravity @ 60/60°F.	0.8080
Molecular weight	181

Hydrocarbon Analyses of Produced Well Stream
During Depletion at 190°F.



DEVIATION FACTOR Z OF WELL STREAM DURING DEPLETION AT 196°F.

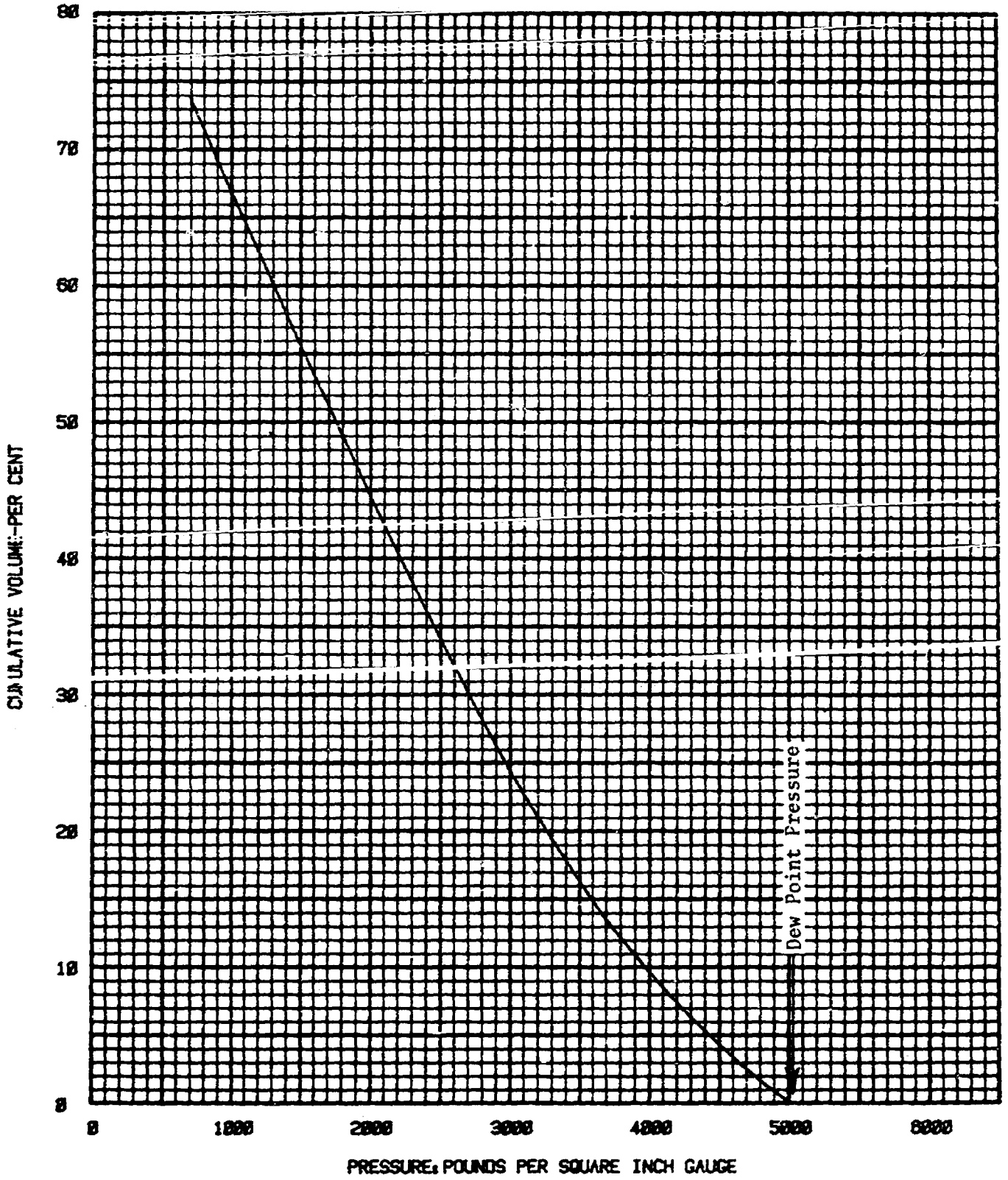
Company GETTY OIL COMPANY Formation WOLFCAMP
Well STATE 36 NO. 1 County LEA
Field WILDCAT State NEW MEXICO



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

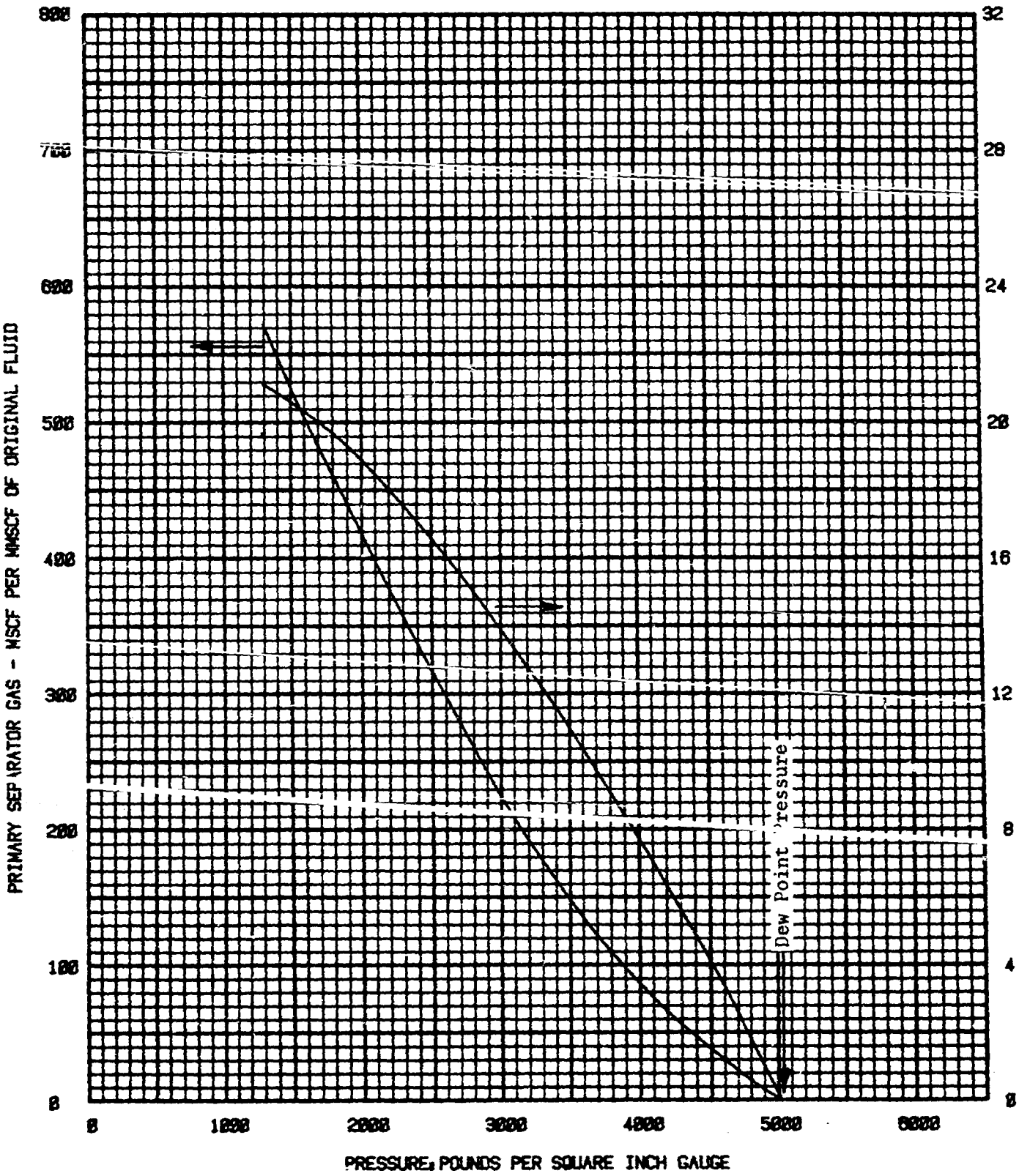
VOLUME OF WELL STREAM PRODUCED DURING DEPLETION

Company GETTY OIL COMPANY — Formation WOLFCAMP
Well STATE 36 NO. 1 — County LEA
Field WILDCAT — State NEW MEXICO



CUMULATIVE RECOVERY DURING DEPLETION

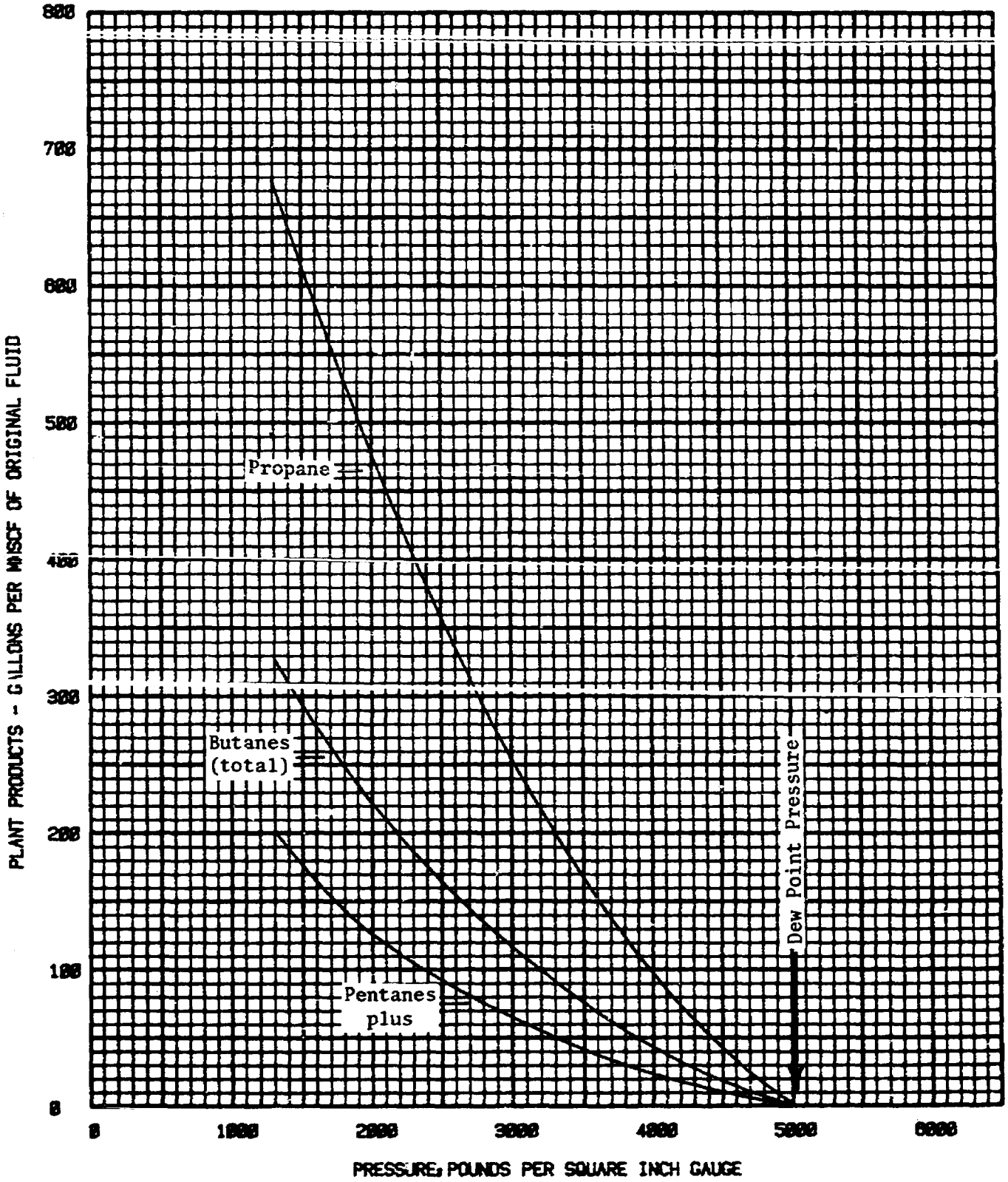
Company GETTY OIL COMPANY — Formation WOLFCAMP
Well STATE 36 NO. 1 — County LEA
Field WILDCAT — State NEW MEXICO



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

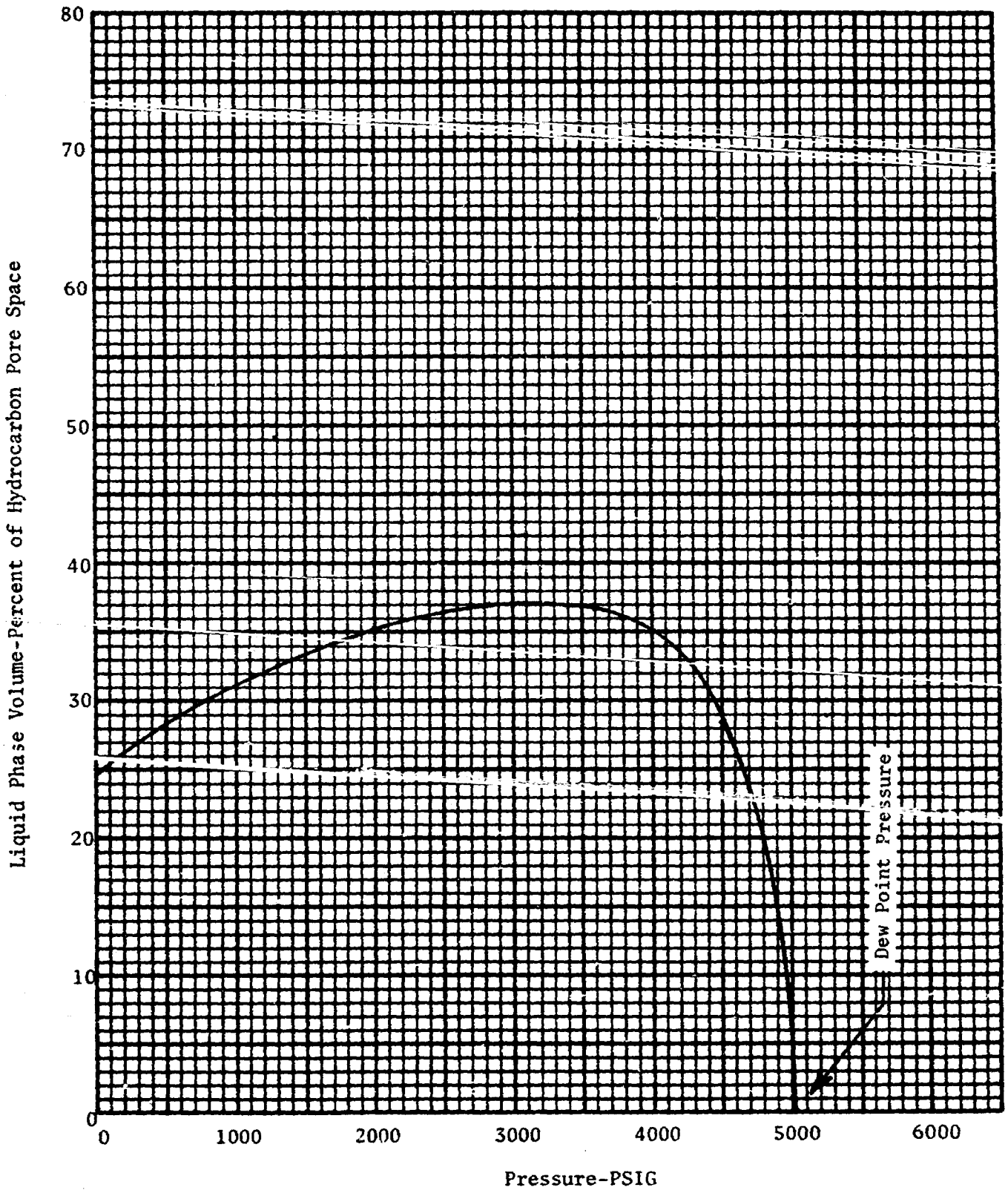
CUMULATIVE RECOVERY-PLANT PRODUCTS IN WELLSTREAM

Company GETTY OIL COMPANY — Formation WOLFCAMP
Well STATE 36 NO. 1 — County LEA
Field WILDCAT — State NEW MEXICO



Retrograde Liquid Accumulation During Depletion at 196°F.

Company Getty Oil Company **Formation** Wolfcamp
Well State 36 No. 1 **County** Lea
Field Wildcat **State** New Mexico



INTER-OFFICE CORRESPONDENCE

Getty Oil Company

Midland, Texas
March 21, 1980

TO: MR. J. E. EAKIN

FROM: JIM VARNON

SUBJECT: GETTY 36 STATE COM. WELL NO. 1 (WOLFCAMP)
PRESSURE BUILDUP (2/26-29/80) AND PVT ANALYSIS

Attached is an analysis of pressure and PVT data. The wealth of data for this well makes it possible to accurately predict reservoir performance. The current pressure test confirms the limited reservoir size shown by an earlier pressure test in September 1979. Summary of the analysis is:

Original Pressure @ 7/4/79	= 7255 psi
Pressure @ 2/29/80	= 4600 psi
Transmissibility (kh)	= 288 md-ft
Skin Factor	= +17
Pressure Drawdown ($\bar{P} - P_{wf} - \Delta P_{skin}$)	= 193 psi
Original Separator Gas Reserves	
without surface compression	= 2.46 BCF
with surface compression	= 2.73 BCF
Original Condensate Reserves	
without surface compression	= 147 MSTB
with surface compression	= 151 MSTB

The large skin factor is caused by the narrow perforated interval and could be eliminated at any time. The small pressure drawdown results from large reservoir kh and low production rate (2200 mcfpd), and shows that the rate could be increased two or three-fold with no expected effect on ultimate recovery.

Recovery factors are 80% for gas and 19% for condensate. Liquid yield has dropped from 220 STB/MMCF to 135 and is still continuing to drop sharply to below 50. Pressure maintenance is probably not feasible and becomes less feasible as liquids dropout in the reservoir.

Reserves listed above assume that the well will never produce water, that the skin will be removed by workover, and that retrograde liquid is nonmobile.

Jim Varnon
Jim Varnon

BEFORE EXAMINER NUTTER
OIL CONSERVATION DIVISION
Getty EXHIBIT NO. 8
CASE NO. 6865

JEV:slw
Attach.
cc: Mr. H. W. Terry

K•Σ SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6010

SEMILOG PLOT
PRESSURE BUILDUP 2/26-29/80
GETTY 36 STATE WELL #1 (WOLFCAMP)

4600

BHP @ 11328' (psig)

4500

4400

.01 .1 1 10 100

Δt (hrs)

$\bar{P}$ = 4600 psig

m = 30 psi/cycle

$$kh = \frac{162.6\, q B \mu}{m} = \frac{(162.6)(2200)(0.69)(0.035)}{30}$$

kh = 288 md-ft

k = 288/94 = 3.1 md

$$S = 1.151\left[\frac{P_{1hr} - P_{wf}}{m} - \log\frac{k}{\phi\mu c_t r_w^2} + 3.23\right]$$

$$S = 1.151\left[\frac{4550-3963}{30} - \log\frac{3.1\times10^{0}}{(0.15)(0.035)(77)(0.1)} + 3.23\right]$$

S = +17

$\Delta P_{skin} = (0.87)(s)(m) = (0.87)(17)(30) = 444$ psi

$\Delta P_{drawdown} = \bar{P} - P_{wf} - \Delta P_{skin} = 4600 - 3963 - 444 = 193$

Exhibit 1

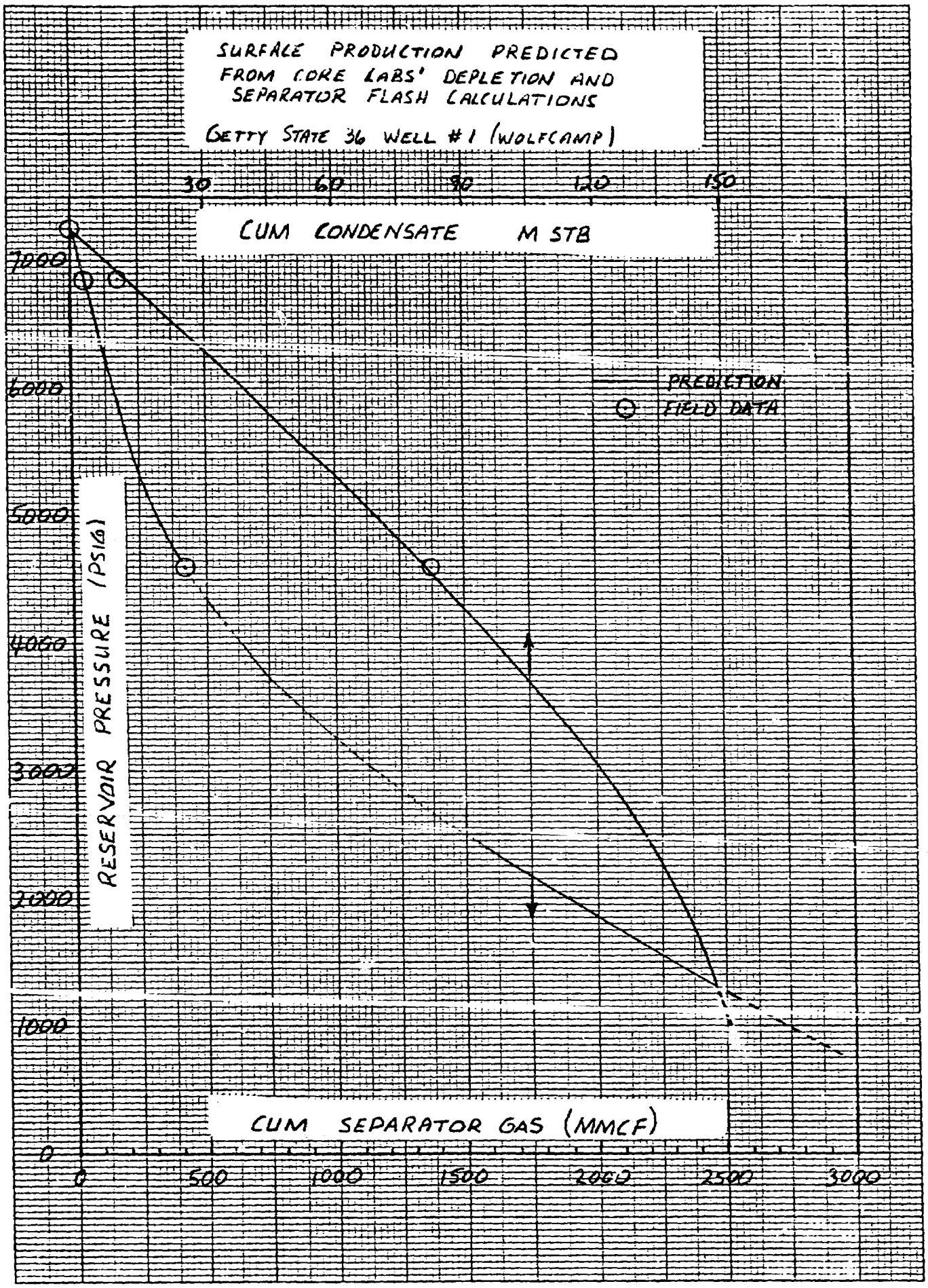


Exhibit 2

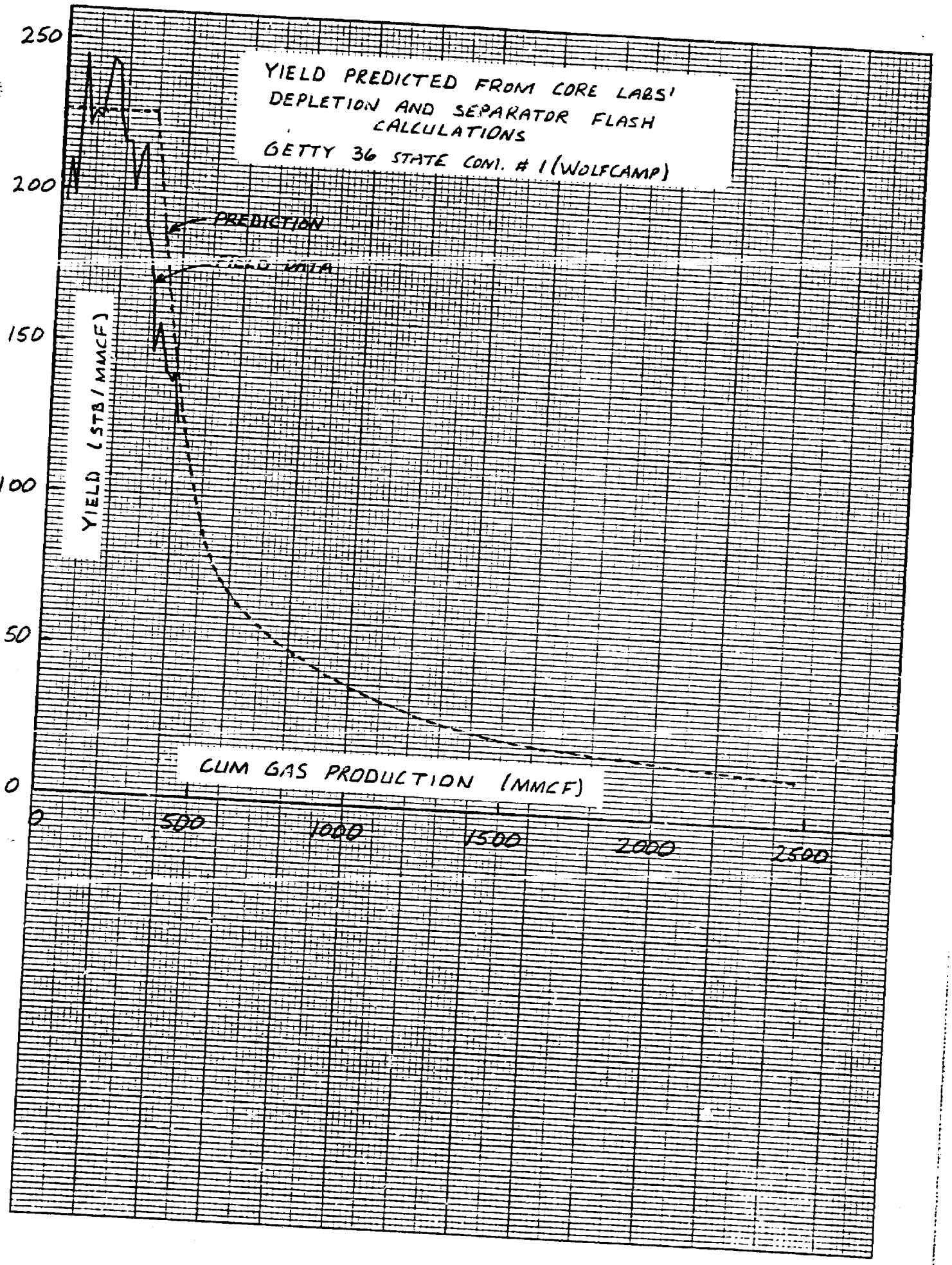


Exhibit 3

GETTY 36 STATE COM. WELL No. 1
ANALYSIS OF PRESSURE BUILDUP (2/26-29/80)

I. Log-log Plot

Afterflow was almost completed before the first data point. The log-log plot is just a flat line and is not included here.

II. Semilog Plot (Exhibit 1)

The semilog plot exhibits the leveling off typical of a limited reservoir. The early hump in the semilog curve also occurred in the buildup run in Sept 1979. It is apparently caused by phase segregation in the tubing. Reservoir and completion properties are shown on the figure. The large skin factor is caused by the partial perforation (16' perf'd versus 116' gross pay) and could be eliminated at any time.

Note the small drawdown pressure (193 psi) relative to the pressure depletion (2655 psi since discovery). The reservoir is being depleted like a constant pressure tank. This well is capable of producing at a much higher rate with no foreseeable detriment to ultimate recovery.

III BASIC DATA FOR BUILDUP CALCULATIONS

$h = 94$ ft

$\phi = 0.15$

$S_w = 0.20$

$T = 196\,^\circ F = 656\,^\circ R$

Fluid = Gas Condensate (PVT Analysis is available)

Mobile Fluid = Gas @ 4600 psi (Retrograde Liquid is nonmobile)

z @ 4600 psi = 0.965 (PVT Report page 9)

$T_c = 461\,^\circ R$ (Calculated from composition)

$P_c = 642$ psia (Calculated from composition)

$T_r = 656/461 = 1.4$

$P_r = 4615/642 = 7.2$

$\gamma = 1.07$ (Calculated from composition)

$$c_g = \frac{1}{P} - \frac{1}{z}\frac{\partial z}{\partial P} = \frac{1}{4615} - \frac{1}{0.965}(121\times10^{-6}) = 91\times10^{-6}\ psi^{-1}$$

$$c_t = S_g c_g + S_w c_w + c_f = 77\times10^{-6}\ psi^{-1}$$

$$B_g = 5.04\frac{\bar{z}T}{\bar{P}} = \frac{(5.04)(0.965)(656)}{4615} = 0.69\ \frac{bbl}{MCF}$$

$\mu_g = 0.035$ cp (Carr-Kobayashi correlation for $\gamma = 1.07$)

IV STEADY-STATE RATE PREDICTION

$$q_{sc} = \frac{0.00708\,kh}{\mu B}\frac{\Delta P}{\ln r_e/r_w} = \frac{(0.00708)(288)}{(0.035)(0.69)}\frac{193}{\ln\frac{875}{0.316}} = 2050\ \frac{MCF}{Day}$$

Note: $\Delta P = \bar{P} - P_{wf} - \Delta P_{skin} = 4600 - 3963 - 444 = 193$ psi

V. ABANDONMENT PRESSURE

$$\bar{P}_{abd} = P_{wf} + \Delta P_{drawdown} + \Delta P_{skin}$$

From equations commonly used in gas well testing, the flowing BHP can be estimated from wellhead pressure.

$$P_{wf} = e^{\frac{K}{\bar{z}}} \sqrt{P_{wh}^2 + q^2 \left(\frac{\sqrt{\bar{z}} L}{c}\right)^2} \qquad (1)$$

where P_{wf} = flowing BHP, psi

P_{wh} = wellhead pressure, psi

$K = \bar{\gamma} L / 53.35 T_f$

L = tubing length = 11328'

T_f = average flowing temperature, °R = 598 °R

$\bar{z}$ = average z-factor from bottom-hole to wellhead

q = well rate, MCF/day = 2200

$c = 1118 d^{2/3} / \sqrt{T_f}$ = 325 for d = 2"

In the Feb 1980 pressure test, drawdown ΔP was 193 psi and skin ΔP was 444 psi. Use drawdown ΔP = 200, although rate will decline some at this drawdown since formation volume factor increases with depletion faster than viscosity decreases. Use skin ΔP = 0 since the skin can be eliminated by workover.

$$\bar{P}_{abd} = P_{wf} + 200 \qquad (2)$$

Equations (1) and (2) can be solved for $\bar{P}_{abd}$ given any wellhead pressure. In order to get $\bar{\gamma}$ and $\bar{z}$, it is necessary to assume $\bar{P}_{abd}$, so the calculation is iterative. Results of this calculation for the two cases

of interest are:

I. No Surface Compresser : $P_{wh} = 500$: $\bar{P}_{abd} = 1300$ psi

II. With Surface Compresser : $P_{wh} = 0$: $\bar{P}_{abd} = 1000$ psi

These abandonment pressures assume zero water production.

VI. RESERVES

A. Original-Gas-In-Place By Material Balance @ 4600 psi

$G(B_g - B_{gi}) = G_p B_g$ where B_g is a two-phase B

$$B_g = 5.04 \frac{zT}{P} \quad \frac{bbl}{MCF}$$

$$B_{gi} = \frac{(5.04)(1.369)(656)}{7255+15} = 0.6226 \qquad z_i = 1.369 \text{ from PVT data}$$

$$B_g = \frac{(5.04)(0.989)(656)}{4600+15} = 0.7085 \qquad z_t = 0.989 \text{ " "}$$

G_p = cum. production of wet gas + condensate + stock tank vapor

= 417905 MCF + 82258 STB + Vapor

= 417905 MCF + 61300 MCF + 12500

= 492 000 MCF

$$G = OGIP = \frac{(492000)(0.7085)}{0.7085 - 0.6226} = 4.1 \text{ BCF}$$

Note: Condensate production is converted to gas equivalent by

$$\frac{SCF}{STB} = \frac{350 \gamma_o}{M_o} \frac{RT_{sc}}{P_{sc}} = \frac{(350)(0.78)}{139} \frac{(10.73)(520)}{14.7} = 745 \frac{SCF}{STB}$$

where $\gamma_o = \frac{141.5}{API+131.5} = 0.78$ and $M_o = \frac{6084}{API-5.9} = 139$ for API = 49.7°

Getty

B. Reserves of Gas and Condensate (Exhibit 2)

Surface production can be easily predicted from Core Labs' PVT cell depletion and flash calculations to the produced well stream. These calculations are performed by Core Labs on the basis of 1.0 MMCF of reservoir fluid at the dew point, 5018 psig. Correcting to the original reservoir pressure given a basis of 1.097 MMCF at original pressure, 7255 psig, meaning that 0.097 MMCF per 1.0 MMCF are produced above the dew point. Adding this recovery to that given on page 5 of the Core Labs report, and proportioning up to the reservoir size of 4100 MMCF by the factor 4100/1.097, gives immediately the cumulative surface production versus reservoir pressure (Exhibit 2). Note how accurately the prediction matches the field performance to date. Reserves for any abandonment pressure can be read directly from this plot.

Without surface compression: $\bar{P}_{abd}$ = 1300 psig

Gas Reserves = 2460 MMCF

Condensate Reserves = 147 MSTB

With surface compression: $\bar{P}_{abd}$ = 1000 psig

Gas Reserves = 2730 MMCF

Condensate Reserves = 151 MSTB

These recoveries assume that the well will never produce any water and that retrograde liquid is nonmobile.

C. Liquid Yield versus Cumulative Gas Production (Exhibit 3)

Instantaneous yield is not reported in Core Labs' separator flash calculation results. It can be computed by plotting [illegible] cumulative gas and taking slopes. Exhibit 3 shows the results along with a comparison to actual field performance to date.

D. Reservoir Radius

$$\frac{7758\ Ah\phi S_g}{B_{gi}} = OGIP = 4.1 \times 10^9\ SCF$$

$$Ah = \frac{(4.1\times10^9)(B_{gi})}{7758\,\phi S_g} = \frac{(4.1\times10^9)(0.007587)}{(7758)(0.15)(0.8)}$$

$$Ah = 2585\ acre\text{-}ft = 112.6\times10^6\ ft^2$$

$$\pi r^2 h = 112.6 \times 10^6$$

$$r = \sqrt{\frac{112.6\times10^6}{h\pi}}$$

$r = 618$ ft if average $h = 94'$

$r = 873$ ft if average $h = 47'$

E. Remarks on Recovery Efficiency

Original Gas in Place = 4100 MMCF

Original Separator Gas in Place = $(4100 \text{ MMCF})\left(\frac{835 \text{ MCF}}{1.0 \text{ MMCF}}\right) = 3424$ MMCF

Ultimate Recovery w/ compression = 2730 MMCF

Gas Recovery Efficiency = 2730/3424 = 80 %

Original Stock Tank Liq in Place = $(4100 \text{ MMCF})\left(\frac{189.7 \text{ STB}}{1.0 \text{ MMCF}}\right) = 778$ MSTB

Ultimate Recovery w/ compression = 151 MSTB

Condensate Recovery Efficiency = 151/778 = 19 %

Pressure depletion will give excellent gas recovery but will leave some 627,000 STB of condensate in the ground. It may be advisable to consider some type of inert gas pressure maintenance project. Discouraging features are:

1. We will probably never have a second well in the reservoir.
2. These potential reserves are not large enough to support much expense in developing a source of injection gas.
3. Reservoir pressure is already below the dew point and retrograde dropout is 70% of the maximum. Revaporization with inert gas pressure may not be possible.

Encouraging features are the favorable reservoir characteristics, thick, permeable, and probably narrow areally, giving rise to the possibility of a vertical, gravity stabilized flood.

Water injection is out of the question because it would seriously jeopardize gas reserves.

CAMPBELL AND BLACK, P.A.
LAWYERS

JACK M. CAMPBELL
BRUCE D. BLACK
MICHAEL B. CAMPBELL
WILLIAM F. CARR
PAUL R. CALDWELL

POST OFFICE BOX 2208
JEFFERSON PLACE
SANTA FE, NEW MEXICO 87501
TELEPHONE (505) 988-4421

March 6, 1980

Case 6865

Mr. Joe D. Ramey
Division Director
Oil Conservation Division
New Mexico Department of Energy
and Minerals
Post Office Box 2088
Santa Fe, New Mexico 87501

Re: Application of Getty Oil Company to Reopen Case No. 6608 to Establish Maximum Rates of Withdrawal for the Gramma Ridge-Wolfcamp Gas Pool, Lea County, New Mexico

Dear Mr. Ramey:

Enclosed in triplicate is the application of Getty Oil Company in the above-referenced matter.

The applicant requests that this matter be included on the docket for the examiner hearing scheduled to be held on April 9, 1980.

Very truly yours,

William F. Carr

WFC:lr

Enclosures

cc: Mr. James E. Eakin, Jr.

BEFORE THE

OIL CONSERVATION DIVISION

NEW MEXICO DEPARTMENT OF ENERGY AND MINERALS

IN THE MATTER OF THE APPLICATION OF GETTY OIL COMPANY TO REOPEN CASE NO. 6608 TO ESTABLISH MAXIMUM RATES OF WITHDRAWAL FOR THE GRAMMA RIDGE-WOLFCAMP GAS POOL, LEA COUNTY, NEW MEXICO.

Case ~~6608~~ 6865

APPLICATION

Comes now, GETTY OIL COMPANY, by and through its undersigned attorneys and hereby makes application to reopen case 6608 for consideration of the establishment of maximum rates of withdrawal from the Gramma Ridge-Wolfcamp Gas Pool, Lea County, New Mexico, and in support thereof, would show the Commission:

1. That by Order No. R-6088, dated August 28, 1979, the Division created, defined and classified the Gramma Ridge-Wolfcamp Oil Pool, Lea County, New Mexico and established temporary special rules and regulations for the development thereof.

2. That pursuant to the provisions of Order No. R-6088 this case was reopened to allow the operator of the subject pool to appear and show whether or not the Gramma Ridge-Wolfcamp Pool was an oil reservoir or a gas reservoir.

3. That on February 26, 1980, the Division entered its Order R-6088-B classifying that Gramma Ridge-Wolfcamp as a retrograde gas condensate reservoir and redesignating the pool as the Gramma Ridge-Wolfcamp Gas Pool.

4. That said order $-6088-B further provided that the case should be reopened during May of 1980 to permit the operators in said pool to appear and present evidence to establish the proper rates of production for wells in the subject pool.

5. That Getty Oil Company is the only operator in the Gramma Ridge-Wolfcamp Gas Pool and is prepared to present evidence as to the proper rates of production for wells in the subject pool.

6. That at present, the only well in the Gramma Ridge-Wolfcamp Gas Pool is the Getty "36" State Com. No. 1 Well which is currently shut in due to its overproduced casinghead gas production status.

7. That reopening the case in March of 1980 and establishment of maximum rates of withdrawal from the pool at that time will enable the operator to prudently develop the Gramma Ridge-Wolfcamp Gas Pool.

8. That any order resulting from this hearing increasing the allowable for this pool should be made retroactive to March 1, 1980.

WHEREFORE, Applicant prays that this application be set for hearing before the Division's duly appointed examiner and that after notice and hearing as required by law, the Division enter its order granting the application and making such other and further provisions as may be proper in the premises.

Respectfully submitted,

CAMPBELL AND BLACK, P.A.

By William F. Carr

William F. Carr
Attorneys for Applicant
Post Office Box 2208
Santa Fe, New Mexico 87501
Telephone: (505) 988-4421

BEFORE THE

OIL CONSERVATION DIVISION

NEW MEXICO DEPARTMENT OF ENERGY AND MINERALS

IN THE MATTER OF THE APPLICATION OF GETTY OIL COMPANY TO REOPEN CASE NO. 6608 TO ESTABLISH MAXIMUM RATES OF WITHDRAWAL FOR THE GRAMMA RIDGE-WOLFCAMP GAS POOL, LEA COUNTY, NEW MEXICO.

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7. That reopening the case in March of 1980 and establishment of maximum rates of withdrawal from the pool at that time will enable the operator to prudently develop the Gramma Ridge-Wolfcamp Gas Pool.

8. That any order resulting from this hearing increasing the allowable for this pool should be made retroactive to March 1, 1980.

WHEREFORE, Applicant prays that this application be set for hearing before the Division's duly appointed examiner and that after notice and hearing as required by law, the Division enter its order granting the application and making such other and further provisions as may be proper in the premises.

Respectfully submitted,

CAMPBELL AND BLACK, P.A.

By s/ William F. Carr

William F. Carr
Attorneys for Applicant
Post Office Box 2208
Santa Fe, New Mexico 87501
Telephone: (505) 988-4421

BEFORE THE

OIL CONSERVATION DIVISION

NEW MEXICO DEPARTMENT OF ENERGY AND MINERALS

IN THE MATTER OF THE APPLICATION OF GETTY OIL COMPANY TO REOPEN CASE NO. 6608 TO ESTABLISH MAXIMUM RATES OF WITHDRAWAL FOR THE GRAMMA RIDGE-WOLFCAMP GAS POOL, LEA COUNTY, NEW MEXICO.

Case ~~6608~~ 6865

APPLICATION

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1. That by Order No. R-6088, dated August 28, 1979, the Division created, defined and classified the Gramma Ridge-Wolfcamp Oil Pool, Lea County, New Mexico and established temporary special rules and regulations for the development thereof.

2. That pursuant to the provisions of Order No. R-6088 this case was reopened to allow the operator of the subject pool to appear and show whether or not the Gramma Ridge-Wolfcamp Pool was an oil reservoir or a gas reservoir.

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7. That reopening the case in March of 1980 and establishment of maximum rates of withdrawal from the pool at that time will enable the operator to prudently develop the Gramma Ridge-Wolfcamp Gas Pool.

8. That any order resulting from this hearing increasing the allowable for this pool should be made retroactive to March 1, 1980.

WHEREFORE, Applicant prays that this application be set for hearing before the Division's duly appointed examiner and that after notice and hearing as required by law, the Division enter its order granting the application and making such other and further provisions as may be proper in the premises.

Respectfully submitted,

CAMPBELL AND BLACK, P.A.

By /s/ William F. Carr

William F. Carr
Attorneys for Applicant
Post Office Box 2208
Santa Fe, New Mexico 87501
Telephone: (505) 988-4421

ROUGH

fd/

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
DIVISION FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 6865
Order No. R-6088-C

APPLICATION OF GETTY OIL COMPANY
TO REOPEN CASE NO. 6608, LEA
COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 9 a.m. on April 9, 1980, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this_____day of April, 1980, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

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

(2) That by its Orders Nos. R-6088 and R-6088-A, the Division created and defined the Grama Ridge-Wolfcamp Pool effective September 1, 1979, and classified the same as an oil pool pending further study.

(3) That by its Order No. R-6088-B, the Division reclassified said Grama Ridge-Wolfcamp Pool as a retrograde gas condensate pool effective March 1, 1980, promulgated special rules for said pool, including a production limitation of 1500 MCF of gas per day, and ordered reopening of the case at an examiner hearing during May, 1980, to permit the operators in said pool to appear and present evidence to establish the proper rates of production for wells in the pool.

(4) That pursuant to the application of Getty Oil Company filed March 6, 1980, this cause came on for hearing on April 9, 1980, and Case No. 6608 was reopened to consider evidence relating to the proper rates of production for wells in the Grama Ridge-Wolfcamp Gas Pool.

(5) That the evidence presented clearly establishes that the Grama Ridge-Wolfcamp Gas Pool is producing from a retrograde gas condensate reservoir.

(6) That the reservoir covers an extremely limited geographic area, perhaps no more than 55 acres, and that the transmissibility of the reservoir is relatively high.

(7) That due to the small reservoir size and its high transmissibility, the reservoir experiences a relatively low pressure drawdown at a production rate of 2200 MCF/day, and appears to be non-rate sensitive at least up to this rate of production.

(8) That analysis of all data available indicates that a maximum production rate of 2500 MCF of gas per day for each well in the Grama Ridge-Wolfcamp Gas Pool will ~~xxx~~ not cause waste nor impair correlative rights, and should be approved.

(9) That Rule 4 of the Special Rules and Regulations for the Grama Ridge-Wolfcamp Gas Pool should be amended to read in its entirety as follows:

"RULE 4. A gas well on a standard unit in the Grama Ridge-Wolfcamp Gas Pool shall be permitted to produce no more than 2,500 MCF of gas per day at standard surface conditions during the effective period of these pool rules. This shall be known as the daily allowable."

(10) That this order should be effective March 1, 1980.

IT IS THEREFORE ORDERED:

(1) That effective March 1, 1980, Rule 4 of the Special Rules and Regulations for the Grama Ridge-Wolfcamp Gas Pool, as promulgated by Division Order No. R-6088-B effective March 1, 1980, is hereby amended to read in its entirety as follows:

"RULE 4. A gas well on a standard unit in the Grama Ridge-Wolfcamp Gas Pool shall be permitted to produce no more than 2,500 MCF of gas per day at standard surface conditions during the effective period of these pool rules. This shall be known as the daily allowable."

(2) That Order No. 4 of "It Is Further Ordered" of said

Order No. R-6088-B, which called for Case No. 6608 to be reopened in May, 1980, to hear evidence as to proper rates of production for wells in the subject pool, is hereby stricken.

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

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