

CASE 1979: Application of ATLANTIC  
FOR WATER Injection project in  
RESEARCH CENTER OIL FIELD.

Casa No.

1979

Application, Transcript,  
Small Exhibits, Etc.

intercontinental company

North American Producing Division  
New Mexico-Arizona District  
Post Office Box 1497  
Farmington, New Mexico 87401  
Telephone 505 325 7527



January 30, 1974

*Cons 14/1*

Mr. N. O. Frederick (4)  
Area Oil and Gas Supervisor  
United States Geological Survey  
P. O. Drawer 1857  
Roswell, New Mexico 88201

Oil Conservation Commission (4)  
of The State of New Mexico  
P. O. Box 2088  
Santa Fe, New Mexico 87501

Commissioner of Public Lands (3) All Working Interest Owners  
The State of New Mexico (See Attached List)  
State Land Office Building  
Santa Fe, New Mexico 87501

*negative file not in  
document*

Re: Plan of Development  
Horseshoe - Gallup Unit  
San Juan County, New Mexico

Gentlemen:

As required, the attached Plan of Development and Operation  
for the subject property is submitted for your information.

Very truly yours,

*C. E. Cardwell Jr.*

C. E. Cardwell, Jr.

RWH/nc

Att.

Horseshoe - Gallup Unit  
San Juan County, New Mexico  
Plan of Development and Operation  
For the Year 1974

ATLANTIC RICHFIELD COMPANY  
Unit Operator

Review of the Last Plan of Development Period

During 1973 there were no additions or contractions of either the Unit Area or the Participating Area. No wells were converted or additional wells drilled during this period.

The oil production declined from 1495 BOPD in January, 1973 to 1106 BOPD in December, 1973. This was a normal waterflood decline due to reduction in oil percentage of the produced fluid.

The water injection rate remained fairly constant through out the year at an average of 24,297 RWPD.

There were only minor changes made in well status since the report of last year.

Plan of Development for 1974

No significant operational changes are planned for 1974. There are presently no plans to convert or drill any additional wells in 1974.

It is understood that this plan may be modified at any time when changing conditions warrant it.



# Statistical Summary

## Horseshoe - Gallup Unit

Well Status	1-1-73	1-1-74
Producing	116	115
Injection	67	67
Water Supply	2	2
Shut-in		34
Producing	33	54
Injection	54	3
Water Supply	3	
TOTAL	275	275

Oil Production (S.T.B.)	1973	Cumulative 1-1-74
Daily Average	1,277	--
Total for Year	466,215	26,757,852
Since Unitization	--	16,135,053

Gas Production (M.C.F.)		
Daily Average	20	--
Total for Year	7,368	6,222,704
Since Unitization	--	1,648,007

Water Production(S.T.B.)		
Daily Average	16,832	--
Total for Year	6,143,853	50,057,142
Since Unitization	--	50,020,652

Water Injection (S.T.B.)		
Daily Average	24,297	--
Total for Year	8,868,363	129,023,231
Since Unitization	--	114,944,502

WORKING INTEREST OWNER

Horseshoe - Gallup Unit

Mr. David Altman  
125 South Clark Street  
Chicago, Illinois 60603

Amax Petroleum  
900 Town & Country Lane, Suite 400  
Houston, Texas 77024

J. Douglas Collister  
4203 Avenida LaResolana NE  
Albuquerque, New Mexico 87110

Continental Oil Company  
Pacific Western Life Building  
152 North Durbin  
Casper, Wyoming 82601

Richard W. Dammann  
380 Madison Avenue  
New York, New York 10017

El Paso Natural Gas Products Company  
Box 3986  
Odessa, Texas 79760

EPROC Associates  
Box 776  
Durango, Colorado 81301

Helbing & Podpechan  
Box 549  
Claremore, Oklahoma 74017

J. Felix Hickman  
Box 12307  
El Paso, Texas 79912

Mobil Oil Corporation  
P. O. Box 633  
Midland, Texas 79701

Reynolds Mining Corporation  
Oil & Gas Division  
P. O. Box 9177  
Corpus Christi, Texas 78403

Robert D. Snow  
2000 National Bank of Tulsa Bldg.  
Tulsa, Oklahoma 74103

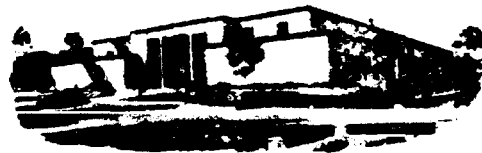
Sohio Petroleum Company  
970 First National Office Bldg.  
Oklahoma City, Oklahoma 73102

Mrs. Eleanor F. Spiegel  
Box 1042  
Albuquerque, New Mexico 87103

Tenneco Oil Company  
Box 2511  
Houston, Texas 77001

Texaco, Incorporated  
Box 2100  
Denver, Colorado 80201

State of New Mexico



Commissioner of Public Lands

ALEX J. ARMIJO  
COMMISSIONER

July 27, 1972

P. O. Box 1148  
SANTA FE, NEW MEXICO

Atlantic Richfield Company  
1860 Lincoln Street, Suite 501  
Denver, Colorado 80203

Re: Plan of Development  
Horseshoe-Gallup Unit  
San Juan County, New Mexico

ATTENTION: Mr. C. E. Cardwell, Jr.

Gentlemen:

The Commissioner of Public Lands has this date approved your 1972 Plan of Development for the captioned unit, which proposes no operational changes nor drilling or conversion of wells during 1972. This approval is subject to like approval by the United States Geological Survey and the Oil Conservation Commission.

We are retaining two copies for our files and returning one approved copy to you.

Please remit a Three (\$3.00) Dollar filing fee.

Very truly yours,

RAY D. GRAHAM, Director  
Oil and Gas Department

AJA/RDG/s  
encls. 1  
cc:

USGS-Roswell, New Mexico (cpy of ltr only)  
OCC-Santa Fe, New Mexico (cpy of ltr only)

**OIL CONSERVATION COMMISSION**  
P. O. BOX 2088  
SANTA FE, NEW MEXICO 87501

September 22, 1972

Atlantic Richfield Company  
1960 Lincoln Street, Suite 501  
Denver, Colorado 80203

Attention: Mr. C. E. Cardwell, Jr.

Re: 1972 Plan of Development  
Horseshoe-Gallup Unit  
San Juan County, New Mexico

Gentlemen:

This is to advise that the New Mexico Oil Conservation Commission has this date approved the 1972 Plan of Development dated July 5, 1972, for the Horseshoe-Gallup Unit, San Juan County, New Mexico, subject to like approval by the United States Geological Survey and the Commissioner of Public Lands of the State of New Mexico.

Two approved copies of the program are returned herewith.

Very truly yours,

A. L. PORTER, Jr.  
Secretary-Director

ALP/JEK/og

cc: Commissioner of Public Lands - Santa Fe  
United States Geological Survey - Roswell



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY  
Drawer 1857  
Roswell, New Mexico 88201

IN REPLY REFER TO:

July 25, 1972

Atlantic Richfield Company  
1860 Lincoln Street, Suite 501  
Denver, Colorado 80203

Attention: Mr. C. E. Cardwell, Jr.

Gentlemen:

On this date, your 1972 plan of development for the Horseshoe Gallup unit area, San Juan County, New Mexico, in which you propose no significant changes in the continuation of waterflood operations and the drilling of no additional wells, was approved. Such approval is subject to like approval by the appropriate officials of the State of New Mexico.

One approved copy of the plan is enclosed.

Sincerely yours,

10RIG. 11

N. G. FREDERICK  
Area Oil and Gas Supervisor

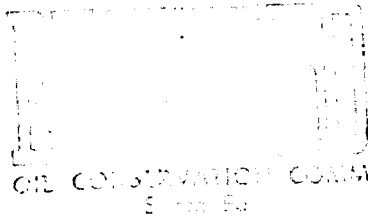
cc:  
Washington (w/cy plan)  
Farmington (w/cy plan)  
Durango (w/cy plan)  
✓ NMOC, Santa Fe (ltr only)  
Com. Pub. Lands, Santa Fe (ltr only)

JAGilham:ds

Atlantic Richfield Company

North American Producing Division  
Rocky Mountain District  
1860 Lincoln St. - Suite 501  
Denver, Colorado 80203  
Telephone 303 266 2461

C. E. Cardwell, Jr.  
District Manager



July 5, 1972

Mr. John A. Anderson (4)  
Regional Oil and Gas Supervisor  
United States Geological Survey  
P.O. Drawer 1857  
Roswell, New Mexico 88201

Oil Conservation Commission (3)  
of The State of New Mexico  
P.O. Box 2088  
Santa Fe, New Mexico 87501

Commissioner of Public Lands (3)  
The State of New Mexico  
State Land Office Building  
Santa Fe, New Mexico 87501

All Working Interest Owners  
(See Attached List)

Re: Plan of Development  
Horseshoe - Gallup Unit  
San Juan County, New Mexico

Gentlemen:

As required, the attached Plan of Development and Operation  
for the subject property is submitted for your information.

Very truly yours,

*C. E. Cardwell Jr.*  
C. E. Cardwell, Jr.

APB:var

Att.

Horseshoe - Gallup Unit  
San Juan County, New Mexico  
Plan of Development and Operation  
For the Year 1972

ATLANTIC RICHFIELD COMPANY  
Unit Operator

Review of the Last Plan of Development Period

In, 1971, there were no additions or contractions of either the Unit Area or the Participating Area. No wells were converted or additional wells drilled during this period.

The oil production during 1971 declined from 1989 BOPD in January to 1854 BOPD in December. This was a normal waterflood decline due to reduction in oil percentage of the produced fluid.

The water injection rate remained fairly constant averaging about 32,000 BWPD. Water production rose from 16,500 BWPD average in 1970 to 17,000 BWPD average in 1971.

During 1971, no producing and two (2) additional injection wells were shut down due to uneconomical operation. As in the past, these wells have been preserved for possible future use and the essential equipment has been left intact. Attached is a statistical summary of the 1971 operations.

Plan of Development for 1972

No significant operational changes are planned for 1972. There are no plans to convert or drill any additional wells in 1972.

Approved September 22 1972  
A. H. Porter  
Secretary-Director

NEW MEXICO OIL CONSERVATION COMMISSION

Statistical Summary  
Horseshoe - Gallup Unit

Well Status (1-1-72)

Producing	123
Injection	78
Water Supply	3
Shut-in	
Producing	26
Injection	43
Water Supply	<u>2</u>

TOTAL 275

Oil Production (S.T.B.)

1971

Cumulative 1-1-72

Daily Average	1,857	---
Total for Year	677,972	25,656,452
Since Unitization	--	15,033,653

Gas Production (M.C.F.)

Daily Average	30	---
Total for Year	10,813	6,205,000
Since Unitization	--	1,630,303

Water Production (S.T.B.)

Daily Average	17,056	---
Total for Year	6,225,611	37,251,138
Since Unitization	--	37,214,648

Water Injection (S.T.B.)

Daily Average	32,080	---
Total for Year	11,709,129	108,870,229
Since Unitization	--	94,791,500



WORKING INTEREST OWNER

HORSESHOE - GALLUP UNIT

Altman, Kurlander, & Weiss  
209 South LaSalle Street  
Suite 711  
Chicago, Illinois 60604

Atlas Corporation  
707 National Bank of Tulsa Building  
Tulsa, Oklahoma 74103

J. Douglas Collister  
4203 Avenida LaResolana NE  
Albuquerque, New Mexico 87110

Continental Oil Company  
Pacific Western Life Building  
152 North Durbin  
Casper, Wyoming 82601

Richard W. Dammann  
380 Madison Avenue  
New York, New York 10017

El Paso Natural Gas Products Company  
Box 3986  
Odessa, Texas 79760

EPROC Associates  
Box 776  
Durango, Colorado 81301

Helbing & Podpechan  
Box 549  
Claremore, Oklahoma 74017

J. Felix Hickman  
Box 12307  
El Paso, Texas 79912

Mobil Oil Corporation  
P.O. Box 633  
Midland, Texas 79701

Reynolds Mining Corporation  
Box 109  
Corpus Christi, Texas 78403

Robert D. Snow  
2000 National Bank of Tulsa Bldg.  
Tulsa, Oklahoma 74103

Sohio Petroleum Company  
970 First National Office Bldg.  
Oklahoma City, Oklahoma 73102

Mrs. Eleanor F. Spiegel  
Box 1042  
Albuquerque, New Mexico 87103

Tenneco Oil Company  
Box 2511  
Houston, Texas 77001

Texaco, Incorporated  
Box 2100  
Denver, Colorado 80201

BEFORE THE  
OIL CONSERVATION COMMISSION  
Santa Fe, New Mexico  
June 1, 1960

EXAMINER HEARING

IN THE MATTER OF:

Application of The Atlantic Refining Company for an order authorizing a water injection project in the Horseshoe-Gallup Oil Pool, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks an order authorizing the injection of water, for purposes of pressure maintenance and/or secondary recovery, into the Horseshoe-Gallup Oil Pool through 15 wells located in Sections 19, 20, 29, 30 and 31, Township 31 North, Range 16 West, San Juan County, New Mexico. Applicant further requests that special rules and regulations be promulgated governing the operation of this water injection project including the assignment of a project allowable.

Case 1979

BEFORE: Elvis A. Utz, Examiner

TRANSCRIPT OF HEARING

MR. UTZ: Case 1979.

MR. PAYNE: Application of The Atlantic Refining Company for an order authorizing a water injection project in the Horseshoe-Gallup Oil Pool, San Juan County, New Mexico.

MR. HINKLE: I want to enter an appearance, Clarence Hinkle, Hervey, Dow and Hinkle on behalf of Atlantic Refining Company. I would like to have the witness sworn.

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(Witness sworn.)

MR. UIZ: Any other appearances?

MR. DAVIS: The Humble has a statement they will make.

(Atlantic's Exhibits Nos. 1, 2 & 3  
marked for identification.)

BRUCE VERNOR

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. HINKLE:

Q Your name is Bruce Vernor?

A That's correct.

Q Employed by The Atlantic Refining Company?

A Yes.

Q In what capacity?

A I am Area Reservoir Engineer in our Rocky Mountain Region.

Q Where is that located?

A Casper, Wyoming. The region covers the Four Corners in addition to Colorado, Wyoming, Montana, North and South Dakota.

Q It covers the San Juan area in the Gallup portion of the field, Horseshoe-Gallup Field?

A Yes.

Q Have you previously testified before the Commission?

A I have.

Q In several cases?

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A In four that I can think of.

Q Have you made an independent study of the Horseshoe-Gallup Pool?

A Yes, I have.

Q How recent has that been?

A It was made in November and December of 1959.

Q Has that continued up-to-date?

A Yes, it has.

Q Are you familiar with the application which has been filed in this case by The Atlantic?

A Yes, I am.

Q Refer to Atlantic's Exhibit No. 1 and explain what it is, what it shows.

A Exhibit No. 1 is a plat of The Atlantic Refining Company's leases in the Horseshoe-Gallup Oil Pool and the two miles surrounding those leases. It shows the proposed project area, the proposed injection wells; those colored in green and circled are single zone injection wells, those with triangles are dual zone injection wells also colored red. It shows the wells drilled in the area. They are all completed, all producing wells or abandoned producers, are or were completed in the Lower Gallup. It also shows the offset operators and royalty owners in the area.

Q Is this substantially the same as the exhibit attached to the application as Exhibit A?



A Yes, it is. It's been revised to bring it up-to-date by addition of a few wells drilled since the application was filed. The only other change, the change in the title.

Q Does Atlantic own the leases which are shown in the outline as the project area?

A Yes, we do.

Q What is the character of the land involved, that is whether State or Indian?

A Oh, excuse me. It's Navajo Indian leases. We have two four-section blocks which we refer to as our Navajo and Navajo "B" leases, which are Navajo tribal leases.

Q How many acres are involved in the project area?

A 3,640 acres, approximately.

Q Can you give to the Commission a description of the acreage, a legal description?

A Yes, I can. It's all in Township 31 North, Range 36 West, NMPM; Section 18, the South Half of the Southwest Quarter; Section 19, all, except the Northeast Quarter of the Northeast Quarter; Section 20, the South Half, the South Half of the Northwest Quarter, and the Southwest Quarter of the Northeast Quarter; Sections 29 and 30, all; Section 31, all, except the Southwest Quarter of the Southwest Quarter; and all of Section 32.

Q I believe you have stated that you have made a study of the Horseshoe-Gallup Oil Pool. Have you prepared or compiled a



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PHONE CH 3-6691

report covering the result of your study?

A Yes, I have.

Q Will you refer to Atlantic's Exhibit No. 2 and I'll ask you whether or not that is the report that you referred to?

A Yes, it is.

Q Would you explain briefly to the Commission what the report shows and the conclusions you have reached in the report?

A Some general discussion first. The Horseshoe-Gallup Oil Pool is located roughly twenty miles West and eight miles North of Farmington, New Mexico. The field is basically a stratigraphic trap on all the defined edges of the field the pay or pays grade into shale, the only undefined areas in the Southeast end of the field, there has been no water found as yet and you can see by looking at Page 1 of the white section of the figures, which is a structure map, that the field is a long and narrow bar, and if there were any water discovered at the extreme Southeast end it would have essentially no effect on the producing characteristics of the field.

Page 2 is a longitudinal cross section which I'm sure you'll recognize. It was El Paso's Exhibit No. 5, El Paso Natural Gas Products Company Exhibit No. 5 in Case 1596 on February 18, 1959. I call your attention to it merely to show that it is in the report.

The average net pay of the zones combined is 17.8 feet and average porosity of 16.1 percent. There is a summary of the



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reservoir properties for the field on Page 4 of the yellow section of the report. The liquid, average liquid permeability is 82 millidarcies; average connate water, 32.4 percent; initial pressure at plus 4175 datum is 215, also the saturation pressure is 215 pounds for Atlantic's portion of the reservoir. Reservoir temperature, 87 degrees. The developed area at the time of the report was about 10,200 acres. There were 234 wells in August of '59, which is the last count we had. We calculated the original oil in place as 770 barrels per acre foot.

Regarding the fluid properties, we obtained a bottom hole sample on the Atlantic Navajo No. 5 well. Figures 5, 6, 7, and 8 of the white section show the formation volume factor, the gas solubility and the gas conversion factor and the oil viscosity. Page 4 is a summary of some of these properties repeating the pressures and reservoir temperature, the solution gas-oil ratio is 147 standard cubic feet per stock tank barrel. The formation volume factor at 215 psig is 1.10 reservoir barrels per stock tank barrel; 42 gravity oil; 1.63 centipoise oil viscosity at bubble point conditions; and the oil compressibility just above the bubble point, 7 barrels per million barrels per down change in pressure; and just below the bubble point it increases to 4.6 barrels per million barrels per pound change in pressure.

Page 18 of the white section of the report is the average relative permeability ratio curve which we use in our primary



recovery calculations. The following pages show the individual curves which went into this average curve. In our obtaining the average curve for the two zones, we found that they were so similar that we used a single curve. There was very little difference in the average for the two.

For primary performance we made a solution gas drive material balance calculation, since we have a stratigraphic trap here. The pressure and gas-oil ratio versus recovery are shown on Page 29 of the white section, and we see a recovery of about 12.3 percent to 35 pounds pressure which corresponds to an abandonment economic limit of about three barrels a day.

Our predicted rates for primary are shown on Page 30, and we predict a gradual decline in reservoir, in producing rate which we see today, to about the end of 1960 or early '61. We then anticipate a sharp decline in the overall producing rate for the field.

The water flood portion of the study was based on a modified style calculation, our flood pattern for our own leases includes a five spot type pattern on the edges of the lease where the permeabilities are lower. We found that in the areas of higher permeability we are limited by producing rate and not by injection capacity, so that a nine spot, or three producing wells per injection well, was quite adequate.

It's even quite possible that the five spots around the edge of our leases will be sufficient to give a peripheral drive to the center. Page 33 gives the average performance of what we would





call a typical five spot. It's based on the average properties, we show on that gas production, cumulative water injection, cumulative water production and cumulative oil production. This average five spot produced about 490,000 stock tank barrels of oil over a fifteen year period, requiring 2.3 million barrels of water injection, and there would be about 1.6 million barrels produced.

Our primary recovery, as I mentioned, we calculate as 12.3 percent or 95 barrels of oil per acre foot, from water flood calculations we estimate a total recovery of 51 percent primary and secondary or 392 barrels of oil per acre foot.

Page 30, again, shows our predicted water flood performance, strictly speaking that's five spot performance for the entire field or five spot average applied to the whole field. This is not materially different than five spot and nine spot combined for the entire field. Excuse me, not quite for the entire field, this study was limited to the area South and East of the Humble Oil and Refining Company's lease or South of the area we considered as bounded by the North line of Sections 13, 14, 15 in 31 North, 17 West.

With an early start on water injection there's very little free gas saturation in the reservoir, in the order of four to five percent. We can obtain fillup quickly and be able to maintain or increase rates of production. The time of this study we estimated about 400,000 barrels per month allowable. The current allowable



is that high, but the unit allowable wasn't 60 barrels a day when the study was made nor were there quite as many wells in the field.

We calculate this 400,000 barrel a month rate can be maintained for about nine years, with the decline thereafter in total life in about fifteen years. The field allowable, at the time of the study, was about 328,000 barrels. Page 1 of the report shows our conclusions. We concluded first that the primary recovery will be small, the order of 12.3 percent, that the rates are declining in the field today, that they will decline more sharply around the end of 1960 or early 1961, that water flooding or, well, I should say pressure maintenance in this case, will increase ultimate recovery to 51 percent of the oil in place, and we feel the proper time to install this pressure maintenance project to forestall the abrupt decline is mid-1960.

Q Do you have any figures on the production to date in this area on the Atlantic leases?

A I have one item I would like to go through first. Atlantic recommended, as a result of the study, that an engineering committee be formed to consider and design a satisfactory water flood. That committee has met since November 8 in that connection and it is progressing nicely. Its work should lead to unification.

Q Do you have any figures on the production history up to date?

A The Atlantic Navajo Lease, through April, 1960, produced



1,312,732 barrels and the Navajo "B" Lease, 191,596 barrels.

Q What is the state of depletion, or approximately so at the present time?

A It's quite early in the life of the reservoir. It has been roughly three or four percent of the original oil in place produced. The rates, however, are less than top allowable now and for Atlantic's lease they are dropping. The Atlantic Navajo Lease had an allowable of 3,100, excuse me, production of 3,155 barrels a day in April, 1960, and allowable was 3160. If every well had top allowable, which in April was 60 barrels a day, that would be 3600 barrels a day.

The Navajo "B" Lease produced 411 barrels a day in April with a 506 barrel a day allowable, its top at 60 barrels a day per well would be 960 barrels. The allowable on the "B" Lease has been as high as 814 barrels a day, in September, 1959, so we have substantial decline already on the "B" Lease and we are declining, our rates are declining on the edges of our Navajo Lease.

Q Do you have any particular reasons for the desirability of inaugurating the water flood at this time?

A We wish to maintain or increase our producing rates and starting the project now will give us a quick fillup because of a low gas saturation required less excess capacity on the injection equipment.

Q Can you give in any more detail to the Commission your



proposed plan in connection with this project?

A Well, our present or initial proposal is for 15 injection wells, six of them dual, nine of them single. On Exhibit 1, the single injection wells are colored in green, the dual injection wells are colored in red, and are triangles. Where there are two zones present, for control of the frontal advance we have used dual injection wells, where there are not we have used single injection wells.

Our plan is to expand the flood to cover the entire lease up to the lease boundaries at such time as a unit is effective in the field. In expanding the lease we would add the following wells on the "B" Lease. We would add the Navajo "B" 6 as a single injector, the "B" 2 as a dual, on the Navajo Lease we would add the 8, 19, 30, 6, 11, 4, 3, 2, 14 and 27 as dual injection wells and 15 and 25 and a proposed number 67 which would be located in the Northwest of the Southwest of Section 28, or just East of our Navajo 34. That would be on a strip along the Navajo Ute Reservation boundary on the East side of our leases.

Just East of our Navajo 34 we also have two more wells on that strip, the 65 and 67, which would be dual injection wells under that plan. This would give us a total of 18 duals, 14 singles or 32 injection wells under full development.

Q This plan, of course, that you have mentioned, there, would be subject to change if you found conditions different?



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PHONE CH 3-6691

ALBUQUERQUE, NEW MEXICO

A Yes, we would like --

Q And would be subject to administrative approval?

A We would like to ask administrative approval for conversion of additional injection wells in the project area if it becomes necessary.

Q Have you filed with the application logs of all of the initial injection wells?

A Yes, we have. They were Exhibit B attached to the application.

Q Do you have any further comment with respect to those logs?

A No, I don't.

Q Did you file, in connection with the application, your casing program that is as used in the injection wells?

A We have the casing program, including the size of the casing and the setting depth and the number of sacks of cement, included as Exhibit C.

Q Do you have anything to add to the exhibit which has been filed?

A No, I do not.

Q What is your proposed source of water supply for this project?

A We propose to use the Morrison formation. We have drilled a water source well to test the Morrison, the Navajo "B"



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PHONE CH 3-6691

ALBUQUERQUE, NEW MEXICO

No. 1-W which is in the Southeast Quarter of Section 19 in the project area. The Morrison is perforated in the interval 2,220 feet to 2,752. There are a number of smaller zones perforated within that approximately 530 foot interval.

We have requested permission from the Navajo tribe to use this water for injection purposes. We do not have a reply from them now. However, in talking to them last week they told us we should have an answer in about two weeks.

Q Have you had an analysis made of the water, the Morrison water?

A Yes, we have. It was filed, I believe, as part of the Exhibit D with our application, including a copy of the letter to the State Engineer.

Q You have then complied with the Oil Conservation Commission memo 558, January 31, 1958?

A Yes, we have.

Q Do you have any comments with respect to the proposed water supply as to it being adequate or anything of that kind?

A We have not fully tested our water supply. We have not installed a turbine type pump to be able to test it at high rates. We do have a small pumping unit on it for the testing purposes of the type we have elsewhere in the field with the capacity of about 120 barrels a day. The well was capable of producing this rate with no apparent drawdown. The Humble well in the, also completed



in the Morrison, potential for 922 barrels of water per day. We see no reason why our well shouldn't be as good.

Q Is the Morrison formation a thick formation?

A Yes, it is 5,000 feet thick.

Q And apt to carry a good source of water?

A Yes. It is my understanding that the Morrison is a blanket sand over the area and in communication with the outcrop.

Q Is The Atlantic requesting a project allowable in connection with this case?

A Yes, we are.

Q Can you state to the Commission what you are requesting?

A I'll read Section 6-B of our application. "Applicant therefore requests that the area hereinabove described be designated as the project area and that an allowable formula be fixed therefor and in connection therewith recommends the adoption of special field rules governing the injection of water into that portion of the Horseshoe-Gallup Oil Pool above described covering the following: (b) is transfer of allowables from injection wells to producing wells within the project area and transfer of allowable for producing wells which, for more efficient operation of the project, are shut-in or curtailed because of high gas-oil ratio, or shut-in for any of the following reasons: Pressure regulation, control of pattern or sweep efficiencies, or to observe changes in pressures or progress of the flood fronts."



Q Is that all you are requesting?

A We also have a request for an overall project allowable which may be produced from any well or wells in the project area in any proportion, the project allowable to be calculated each month by multiplying the current normal unit allowable for a 40 acre proration unit times the number of 40 acre proration units in the project area having located thereon either producing wells or wells used for injection purposes or wells which are shut-in or curtailed for conservation purposes. Provided, however --

Q Well, now, that that you read is in the application?

A Yes.

Q That's what you are requesting?

A Yes.

Q At this time do you desire to present any modification of that?

A I would like to add another section to Section 6.

Q Or proviso to it?

A Yes. Provided, however, that the project allowable shall be effective when it has been shown administratively that there has been a sufficient response from water injection to justify the increased allowable, such administrative approval to be considered after due notice to lease owners within two miles of the project area. In the event of objection or protest, a hearing will be held.





Q That is what you are requesting at the present time?

A Yes.

Q Are there any special field rules that you would like to propose to the Commission in connection with this matter?

A Before we cover that I would like to make a few comments about our proposal for project allowable. I believe that any lesser treatment would be discriminatory against pressure maintenance projects. Depleted water floods are given this sort of treatment under Rule 701. We believe the Commission should be encouraging pressure maintenance projects. In many fields the pressure will recover substantially more oil due to shrinkage. In other words, field waste can occur if water flooding is delayed to primary depletion.

Gas producing rates would usually be stabilized and producing life lengthened allowing smaller gas plants and better gas plant economics; that is in many cases, or some cases, gas plants could be economically constructed that otherwise would not be built and gas would be flared.

Q Do you have any other suggested rules to propose?

A Yes, we do. They are Section 6 (a) and, (d), rather, of our application. "Gas equivalent credit for water injected to be applied to any well producing with gas-oil ratio greater than 2000 cubic feet per barrel." The formula for this is Exhibit 3 and it is substantially --



Q That's Atlantic Exhibit 3?

A Atlantic 3, which is attached to Exhibit 1, and it's substantially identical to the rule in Bisti. In fact, we were real careless and it even says Rule 7 at the top of it. It's changed only to give the calculated "Z" factors for the gas in Horseshoe-Gallup and the factors look a little bit unusual in the higher pressure ranges. This is due to the low reduced temperature we are operating. That's a portion of the "Z" curve which comes almost straight down and gives quite extreme super-compressibility factors.

MR. UTZ: These were arrived at by test?

A They were arrived at by calculation from a gas analysis, using a, calculating from the "Z" factor or rather the critical pressure and temperature for each component, arriving at a critical suitable temperature and pressure to get the "Z" factors.

Q Do you have any further comment with respect to the adoption of rules by the Commission, special field rules?

A Of course we are advocating other rules and regulations which the Commission feels to be necessary.

Q I believe that you have stated that an engineering committee has been formed and has been active in studying the Horseshoe-Gallup area. What progress has been made, if any?

A Well, this engineering subcommittee of the Horseshoe-Gallup operators' committee was formed in January of 1960 and it



has met for about eight weeks. Since that time we have excellent progress, and I think its work will result in the unitization. We have seen nothing so far to be a major deterrent to unitization.

Q I believe in your application there you asked for administrative approval to include this in a unit if it should be formed?

A Actually what we asked for is permission to expand our limited water flood to the entire lease on the effective date of a unit agreement covering all or a substantial portion of the Horseshoe-Gallup Pool.

This would allow us to put about a third of the area we have considered under flood, the date a unit is effective, and then concentrate on putting the rest of the area under water flood if we should be designated as operator.

Q Going back to your study, has The Atlantic taken an active part in connection with the study?

A Yes, we have. I am chairman of the engineering subcommittee and we contemplated committing our acreage to this unit when it's formed.

Q State whether or not in your opinion the inauguration of water injection at this time would be in the interest of conservation and prevention of waste.

A I do believe it very definitely would be in the interest of conservation and prevention of waste.

Q Is it your opinion that water injection along the lines



proposed will promote the greatest ultimate recovery from this area?

A I do. I believe that it will. There are other injection methods which can be contemplated. The known missible processes are not practical in this particular reservoir because the pressure required for missibility between propane and gas is higher than the pressure we think we can tolerate in this reservoir.

Q That's due to shallow depth?

A Yes.

MR. HINKLE: That's all. I would like to offer in evidence Exhibits 1, 2 and 3 of Atlantic.

MR. UTZ: Without objection Exhibits 1, 2 and 3 will be entered into the record.

MR. HINKLE: That's all I have.

CROSS EXAMINATION

BY MR. UTZ:

Q I note that your injection well pattern has left you open at both ends, so to speak, up and down the trend. Do you have any particular reason for this?

A Well, we aren't able to carry that pattern all the way to lease lines at this time since we won't have immediately injection on the offset leases. This pattern is designed to allow us to operate for a period of time that will allow unitization to occur so we can expand the entire flood. Under a unitized operation



the open ended aspect of it wouldn't make any difference. The center portion of the lease is the area that we would put nine spot injection wells in, or possibly we might not even need all the injection wells we have designed. It's quite possible that we may be able to flood it peripherally from the five spot injection wells.

Our proposed ultimate pattern does fill out the center section with injection wells too. Every other well on the West lease line would be an injection well and every other well along the East lease line, well, every one of our wells on the East lease line would be with the particular arrangement there that we contemplate that probably the whole row of wells would be injection wells.

MR. UTZ: Any other questions?

MR. PAYNE: Yes, sir.

BY MR. PAYNE:

Q Mr. Vernon, how many wells are on the two leases involved there, both injection and producing?

A Seventy-six, sixteen in the Navajo "B" and sixty on the Navajo Lease.

Q Do you propose, in the near future, to convert at least 15 to injection?

A Yes, sir.

Q I believe your proposal is, as modified, is to give top unit allowable to all injection wells and all producing wells



which have received a response, is that right?

A That's essentially it. That's after --

MR. HINKLE: It would be approved administratively.

A That's right. We wouldn't ask for it initially.

Q What do you have in mind as to what is a response?

A We believe that we should be able to show that a substantial number of the wells on the lease have received a production increase from water injection operations.

Q Well, let me put it this way, take the well in the Southeast corner of the Southeast Quarter of the Section 31 which is considerably removed from the nearest injection well.

A Southeast, Southeast of 31?

Q Yes, sir.

A That would be No. 27.

Q Well, take No. 1 clear down there in the lower right-hand corner of your exhibit.

A Well, under our ultimate plan we have injection wells down in that portion of the lease too.

Q Yes, but what do you propose as the allowable for this well in the meantime?

A Well, I admit it would be difficult to have a response of No. 1 from the injection wells as set out. However, No. 1 is top allowable right now.

Q How many of these wells are top allowable, Mr. Vernor?



A I don't have that number at my fingertips. However, we have an allowable of about 3150 out of 3600 which we have if all the wells were top. Let me see.

Q You are talking about this lease?

A No, that's just the Navajo Lease. The Navajo "B" Lease is only three wells with top allowable. Just a minute and I'll answer the other question too. There are 11 wells on the Navajo Lease which do not have top allowable which means, 60 wells in the lease would be 49 which do have top allowable.

Q Now, of those 11, how many of them do you propose to convert to injection wells?

A Well, let's see, 9, 24, two of those 11 would be initially converted to injection wells and four or five, that would be injection wells under the expanded flood.

Q Now, assuming that your project allowable, not looking at leases, that your project allowable was top unit allowable times the number of 40 acre tracts with a well on them, that would be 4560 barrels, right?

A Yes. I believe that's correct. This is -- yes.

Q If this project were in operation right now just as outlined here and was a water flood, rather than a pressure maintenance project, what would be its computed allowable?

A I haven't done that particular calculation. If you are referring to Section 701 that defines --



Q How many wells do you have that are either injection wells or directly or diagonally offsetting, offsets of an injection well?

A We have 15 injection wells and we have 15 wells on injection and 24 wells, 34 which are diagonal or direct offsets.

Q I counted 45 total.

A I got 49, we aren't far apart.

Q Let's take the higher figure.

A All right.

Q And multiply it by 52, what do you get?

A About 2808.

Q So that this project allowable, as proposed, would be almost doubled the allowable that would be allowed if this were a water flood?

A The other wells remaining on the lease also would have to have their allowables added to that I believe. They already have allowables.

Q Yes, that's right, some of which are top?

A Yes.

Q Now, assuming this were a water flood project and it was completely in operation, in other words, you had half injection wells and half producing wells, then your allowable would still be less than the allowable proposed here, wouldn't it, because you would be using 52 as a base figure rather than the 60 which is normal unit allowable that we are assuming.





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A That's true. However, we're also open to it being 35 barrels a day or even less. We aren't asking for exemption from market demand prorationing.

Q It has been some time since the allowable in the Northwest has declined substantially, hasn't it?

A Yes, it has.

Q Now, in your opinion, is there more risk in a water flood operation or in pressure maintenance operation?

A I don't believe I can give you a blanket answer to that question.

Q Well, let's say the pressure maintenance project which is using water injection rather than gas or LFG.

A Well, I wasn't even thinking about that aspect of it. Just solely water injection projects. I think it would depend on the field involved. For instance here I would give a high chance factor of success. I could see a similar project where the operators hadn't done as much coring and gathered as much data as the operators in the Horseshoe have done. That might be a higher risk solely because they wouldn't know too much about it. I'm not trying to evade your question, I really don't know.

Q You feel that the project will result in a greater recovery of oil from this pool than will be achieved otherwise?

A Yes.

Q Do you feel that the difference would be sufficient to



pay for the cost of converting the wells to injection and operating the project?

A Yes.

Q You also feel, do you not, that the Commission should give some incentive to an operator in order to initiate a pressure maintenance project?

A Yes.

Q Some incentive other than the allowable that the wells would normally get?

A Yes, I believe they should.

Q Now, do you believe that an order which would give only the injection well top unit allowable for each and every one, and the producing well, the allowable which it's capable of making up to top unit allowable, is a sufficient incentive to initiate a pressure maintenance project?

A I believe in many cases it would be sufficient incentive. However, it seems to me that it would be, a more appropriate allowable, would be the one which we proposed.

Q Which would, assuming that the allowable stayed relatively constant or go up, which would be considerably more than a water flood project would get?

A Yes, so long as the Northwest unit allowable stays above 52.

Q Yes.

A Yes.

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Q Assuming that you got only top unit allowable for the injection well, it would encourage the operator to put additional wells on injection, would it not, and get a very efficient sweep of the oil?

A Yes, it would.

Q Why do you believe, Mr. Vernor, that a producing well should get top unit allowable even though it can't produce it?

A Well, I look at it rather from the individual well standpoint, the reservoir standpoint, and I think that that is an appropriate allowable treatment for the reservoir.

Q You do believe in the transfer of allowables from well to well in the project?

A Yes, sir.

Q And if each producing well had top unit allowable that would give you a larger amount to transfer around as you saw fit?

A That's right.

Q How deep are these wells, Mr. Vernor?

A They range from about 1200 feet to 15, 1600 feet.

Q Are you familiar with the orders that the Commission recently entered relative to the Sunray-MidContinent project in the Bisti?

A Well, are you referring to the one as the result of a hearing last week?

Q Yes, sir.



A No, I'm not familiar with it.

Q Well, it provided, Mr. Vernor, that each injection well would receive top unit allowable regardless of its ability to produce prior to conversion and that each producing well would receive what it could produce up to top unit allowable. I take it that you feel that sort of an allowable provision is what you might call then unduly restrictive?

A I feel it's much less restrictive than the allowable formula in the previous order in the Sunray's case which I'm familiar with. I think it approaches what we're asking for.

Q There has been some improvement then?

A Substantially. Before, you were fixed on injection wells, if it had five barrel a day capacity beforehand, you had no way ever to give it any additional credit.

Q Which might in turn lead to an inefficient pattern because an operator would be hesitant to convert a low producing well to injection or might have?

A It might. It might.

MR. PAYNE: I believe that's all. Thank you.

MR. UTZ: Are there other questions?

BY MR. UTZ:

Q Mr. Vernor, this is a very low gas-oil ratio pool then?

A Our wells produce with a fairly low gas-oil ratio. I believe there are wells elsewhere in the pool that have high ratios.



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Q How high, do you know?

A I believe that some of Pan American's wells have ratios above the 2,000. I think they are high enough that they are penalized in their allowable.

Q In your particular part of the pool this Rule 7 wouldn't be of any particular benefit to you, would it?

A No, I put it in because this is something that might occur. We could have some high ratios on some areas of the lease prior to full effect of the water flood. It's added flexibility. I can't foresee immediately that we'll need it, but I see one ratio of Pan American's of 4418. The highest one I see of Atlantic's is about 508, so this is no immediate problem.

MR. UTZ: Are there other questions? If there are none the witness may be excused.

(Witness excused.)

MR. UTZ: Other statements in this case?

MR. DAVIS: William S. Davis, Humble Oil and Refining Company, a Delaware Corporation, Midland, Texas, as an operator in the Horseshoe-Gallup Pool, believes that the proposed water injection project is in the best interest of conservation and urges its approval. We would like to endorse a project allowable equal to the top unit allowable to all injection wells and to producing wells after it has been demonstrated that response has been obtained throughout the project area as a result of the injection program.



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MR. SPANN: Charlie Spann of Grantham, Spann and Sanchez, Albuquerque, New Mexico, appearing for El Paso Natural Gas Products Company. I would like to state on behalf of El Paso, for the record, that we do not desire to protest this application in view of the amendment or proviso made to proposed Rule C in the application. Assuming that that provision or one of similar import is included in the rules as finally adopted, we have no objection or protest to the application.

MR. UTZ: Any other statements? Do you have anything further?

MR. HINKLE: No.

MR. UTZ: The case will be taken under advisement.

STATE OF NEW MEXICO )  
: SS  
COUNTY OF BERNALILLO )

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 10th day of June, 1960.

My commission expires:  
June 19, 1963.

*Ada Dearnley*  
Notary Public-Court Reporter  
I do hereby certify that the foregoing is  
a complete record of the proceedings in  
the Examiner hearing of Case No. 1929  
heard by me on June 1, 1960.

*[Signature]*  
Examiner  
New Mexico Oil Conservation Commission



BEFORE THE OIL CONSERVATION COMMISSION  
OF THE STATE OF NEW MEXICO

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

CASE No. 1979  
Order No. R-1699

APPLICATION OF THE ATLANTIC REFINING  
COMPANY FOR A PRESSURE MAINTENANCE  
PROJECT IN THE HORSESHOE-GALLUP OIL  
POOL, SAN JUAN COUNTY, NEW MEXICO,  
AND FOR THE PROMULGATION OF SPECIAL  
RULES GOVERNING THE OPERATION OF  
SAID PROJECT.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on  
June 1, 1960, at Santa Fe, New Mexico, before Elvis A. Uts,  
Examiner duly appointed by the Oil Conservation Commission of  
New Mexico, hereinafter referred to as the "Commission," in  
accordance with Rule 1214 of the Commission Rules and Regula-  
tions.

NOW, on this 10th day of June, 1960, the Commission, a  
quorum being present, having considered the application, the  
evidence adduced, and the recommendations of the Examiner,  
Elvis A. Uts, and being fully advised in the premises,

FINDS:

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

(2) That the applicant, The Atlantic Refining Company, pro-  
poses to institute a pressure maintenance project in the Horseshoe-  
Gallup Oil Pool, San Juan County, New Mexico, by the injection of  
water into the Gallup formation through 15 wells initially, all  
of which wells are within the proposed project area which consists  
of the following-described acreage:

TOWNSHIP 31 NORTH, RANGE 16 WEST, 2NPM

Section 18: S/2 SW/4  
Section 19: W/2, W/2 E/2, SE/4 NE/4 and the  
E/2 SE/4  
Section 20: S/2, S/2 NW/4 and the SW/4 NE/4  
Section 29: All  
Section 30: All  
Section 31: E/2, E/2 W/2, NW/4 SW/4 and the W/2 NW/4  
Section 32: All

(3) That the applicant proposes that each month an allowable be established for the Horseshoe-Gallup Pressure Maintenance Project, said allowable to be determined by multiplying the current Northwest New Mexico normal unit allowable for a 40-acre proration unit times the number of 40-acre proration units in the project area on which an injection well is located, plus a normal unit allowable for each 40-acre proration unit on which is located a producing well which has received a response to the water injection, plus an amount for each 40-acre proration unit on which a producing well is located which has not received a response to water injection equal to the well's ability to produce up to normal unit allowable.

(4) That the "response" feature of the applicant's proposed project allowable formula would add considerably to the complexity of administering the project allowable, and it is not necessary from the standpoint of conservation or the protection of correlative rights, nor is it warranted on the basis of economics.

(5) That the necessary investment in order to develop a pressure maintenance project is based in large part on the total number of injection wells required for the efficient operation of the project, and the assignment of a top unit allowable to each injection well, together with the expected increased oil recovery, is an entirely adequate incentive for an operator to initiate a pressure maintenance project.

(6) That the allowable assigned to any producing well in the project area should be no greater than the demonstrated ability of the well to produce, subject to top unit allowable for the Pool. In the case of curtailed or shut-in producing wells, the allowable should be no greater than the demonstrated ability of such well to produce as reflected by a 24-hour test at a stabilized rate of production immediately prior to such shut-in or curtailment. In no event should such allowable be greater than the current normal unit allowable for the Horseshoe-Gallup Oil Pool during the month of transfer.

(7) That the applicant also proposes that an administrative procedure be established whereby the pressure maintenance project may be expanded for good cause shown, and whereby additional wells in the project area may be converted to water injection.

(8) That Special Rules and Regulations for the operation of the Horseshoe-Gallup Pressure Maintenance Project should be promulgated and, for operational convenience, such rules should provide certain flexibility in authorizing the production of the project allowable from any well or wells in the project in any proportion, provided that no well in the project area which directly or diagonally offsets a well outside the project area producing from the same common source of supply should be allowed



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to produce in excess of two times top unit allowable for the Horseshoe-Gallup Oil Pool.

IT IS THEREFORE ORDERED:

(1) That the applicant be and the same is hereby authorized to institute a Pressure Maintenance Project in the Horseshoe-Gallup Oil Pool, San Juan County, New Mexico, by the injection of water into the Gallup formation through the following-described wells in Township 31 North, Range 16 West:

Navajo "B" Well No. 1, Unit H, Section 19
Navajo "B" Well No. 3, Unit P, Section 19
Navajo "B" Well No. 4, Unit J, Section 19
Navajo "B" Well No. 5, Unit F, Section 19
Navajo "B" Well No. 7, Unit N, Section 20
Navajo "B" Well No. 8, Unit L, Section 20
Navajo "A" Well No. 22, Unit J, Section 29
Navajo "A" Well No. 23, Unit F, Section 29
Navajo "A" Well No. 24, Unit D, Section 29
Navajo "A" Well No. 26, Unit B, Section 29
Navajo "A" Well No. 9, Unit B, Section 30
Navajo "A" Well No. 16, Unit H, Section 31
Navajo "A" Well No. 17, Unit B, Section 31
Navajo "A" Well No. 28, Unit J, Section 31
Navajo "A" Well No. 29, Unit F, Section 31

(2) That special rules and regulations governing the operation of The Atlantic Refining Company Horseshoe-Gallup Pressure Maintenance Project, San Juan County, New Mexico, be and the same are hereby promulgated as follows, effective July 1, 1960:

SPECIAL RULES AND REGULATIONS FOR THE ATLANTIC  
REFINING COMPANY HORSESHOE-GALLUP PRESSURE  
MAINTENANCE PROJECT

RULE 1. The project area of The Atlantic Refining Company Horseshoe-Gallup Pressure Maintenance Project, hereinafter referred to as the Project, San Juan County, New Mexico shall comprise that area described as follows:

TOWNSHIP 31 NORTH, RANGE 16 WEST, NMPM

Section 18:	S/2 of the SW/4
Section 19:	W/2, W/2 E/2, SE/4 NE/4 and the E/2 SE/4
Section 20:	E/2, S/2 NW/4, SW/4 NE/4
Section 29:	All
Section 30:	All
Section 31:	E/2, E/2 W/2, NW/4 SW/4 and the W/2 NW/4
Section 32:	All

RULE 2. The allowable for the Project shall be the sum of the allowables of the several wells within the project area, including those wells which are shut-in, curtailed, or used as injection wells. Allowables for all wells shall be determined in a manner hereinafter prescribed.

RULE 3. Allowables for injection wells may be transferred to producing wells within the project area, as may the allowables for producing wells which, in the interest of more efficient operation of the Project, are shut-in or curtailed because of high gas-oil ratio or are shut-in for any of the following reasons: pressure regulation, control of pattern or sweep efficiencies, or to observe changes in pressures or changes in characteristics of reservoir liquids or progress of sweep.

RULE 4. The allowable assigned to any well which is shut-in or which is curtailed in accordance with the provisions of Rule 3, which allowable is to be transferred to any well or wells in the project area for production, shall in no event be greater than its ability to produce during the test prescribed by Rule 6, below, or greater than the current top unit allowable for the pool during the month of transfer, whichever is less.

RULE 5. The allowable assigned to any injection well on a 40-acre proration unit shall be top unit allowable for the Horseshoe-Gallup Oil Pool.

RULE 6. The allowable assigned to any well which is shut-in or curtailed in accordance with Rule 3, shall be determined by a 24-hour test at a stabilized rate of production, which shall be the final 24-hour period of a 72-hour test throughout which the well should be produced in the same manner and at a constant rate. The daily tolerance limitation set forth in Commission Rule 502 I (a) and the limiting gas-oil ratio (2,000 to 1) for the Horseshoe-Gallup Oil Pool shall be waived during such tests. The project operator shall notify all operators offsetting the well, as well as the Commission, of the exact time such tests are to be conducted. Tests may be witnessed by representatives of the offsetting operators and the Commission, if they so desire.

RULE 7. The allowable assigned to each producing well in the Project shall be equal to the well's ability to produce or to top unit allowable for the Horseshoe-Gallup Oil Pool, whichever is less, provided that any producing well in the project area which directly or diagonally offsets a well outside the project area producing from the same common source of supply shall not produce in excess of two times top unit allowable for the pool. Each producing well shall be subject to the limiting gas-oil ratio (2,000 to 1) for the Horseshoe-Gallup Oil Pool, except that any well or wells within the project area producing with a gas-oil ratio in excess of 2,000 cubic feet of gas per barrel of oil may be

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produced on a "net" gas-oil ratio basis, which net gas-oil ratio shall be determined by applying credit for daily average gas injected, if any, into the Horseshoe-Gallup Oil Pool within the project area to such high gas-oil ratio well. The daily adjusted oil allowable for any well receiving gas injection credit shall be determined in accordance with the following formula:

$$A_{adj} = \frac{TUA \times F_a \times 2,000}{\frac{P_g - I_g}{P_o}}$$

where:

- $A_{adj}$  = the well's daily adjusted allowable
- $TUA$  = top unit allowable for the pool
- $F_a$  = the well's acreage factor
- $P_g$  = average daily volume of gas produced by the well during the preceding month, cubic feet
- $I_g$  = the well's allocated share of the daily average gas injected during the preceding month, cubic feet
- $P_o$  = average daily volume of oil produced by the well during the preceding month, barrels

In no event shall the amount of injected gas being credited to a well be such as to cause the net gas-oil ratio,  $\frac{P_g - I_g}{P_o}$ , to

be less than 2,000 cubic feet of gas per barrel of oil produced.

**RULE 8.** Credit for daily average net water injected into the Horseshoe-Gallup Oil Pool through any injection well located within the project area may be converted to its gas equivalent and applied to any well producing with a gas-oil ratio in excess of two thousand cubic feet of gas per barrel of oil. Total credit for net water injected in the project area shall be the gas equivalent volume of the daily average net water injected during a one-month period. The daily average gas equivalent of net water injected shall be computed in accordance with the following formula:

$$E_g = (V_{w \text{ inj}} - V_{w \text{ prod}}) \times 5.61 \times \frac{P_a}{15.025} \times \frac{520^\circ}{T_r} \times \frac{1}{Z}$$

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where:

- $E_g$  = Average daily gas equivalent of net water injected, cubic feet
- $V_{w\ inj}$  = Average daily volume of water injected, barrels
- $V_{w\ prod}$  = Average daily volume of water produced, barrels
- 5.61 = Cubic foot equivalent of one barrel of water
- $P_a$  = Average reservoir pressure at mid-point of the pay-zones of Horseshoe-Gallup Oil Pool in project area, psig + 12.01, as determined from most recent survey
- 15.025 = Pressure base, psi
- 520° = Temperature base of 60°F expressed as absolute temperature
- $T_r$  = Reservoir temperature of 87°F expressed as absolute temperature (547°R)
- $Z$  = Compressibility factor from analysis of Horseshoe-Gallup gas at average reservoir pressure,  $P_a$ , interpolated from compressibility tabulation below:

Reservoir Pressure	Z	Reservoir Pressure	Z	Reservoir Pressure	Z
50	.9725	300	.8325	550	.6560
100	.9465	350	.8030	600	.6135
150	.9215	400	.7710	650	.5655
200	.8885	450	.7220	700	.5220
250	.8600	500	.6900	750	.4630
				800	.3935

**RULE 9.** Each month the project operator shall, within three days after the normal unit allowable for Northwest New Mexico has been established, submit to the Commission a Pressure Maintenance Project Operator's Report, on a form prescribed by the Commission, outlining thereon the data required, and requesting allowables for each of the several wells in the Project as well as the total Project allowable. The aforesaid Pressure Maintenance Project Operator's Report shall be filed in lieu of Form C-120 for the Project.

**RULE 10.** The Commission shall, upon review of the report and

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CASE No. 1979  
Order No. R-1699

after any adjustments deemed necessary, calculate the allowable for each well in the Project for the next succeeding month in accordance with these rules. The sum of the allowables so calculated shall be assigned to the Project and may be produced from the wells in the Project in any proportion except that no well in the Project which directly or diagonally offsets a well outside the Project producing from the same common source of supply shall produce in excess of two times top unit allowable for the Pool.

RULE 11. The conversion of producing wells to injection, the drilling of additional wells for injection, and expansion of the project area shall be accomplished only after approval of the same by the Secretary-Director of the Commission. To obtain such approval, the Project operator shall file proper application with the Commission, which application, if it seeks authorization to convert additional wells to injection or to drill additional injection wells shall include the following:

- (1) A plat showing the location of proposed injection well, all wells within the project area, and offset operators, locating wells which offset the project area.
- (2) A schematic drawing of the proposed injection well which fully describes the casing, tubing, perforated interval, and depth showing that the injection of gas or water will be confined to the Gallup formation.
- (3) A letter stating that all offset operators to the proposed injection well have been furnished a complete copy of the application and the date of notification.

The Secretary-Director may approve the proposed injection well, if within 20 days after receiving the application, no objection to the proposal is received. The Secretary-Director may grant immediate approval, provided waivers of objection are received from all offset operators.

Expansion of the project area may be approved by the Secretary-Director of the Commission administratively when good cause is shown therefor.

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



STATE OF NEW MEXICO  
OIL CONSERVATION COMMISSION

*John Burroughs*  
JOHN BURROUGHS, Chairman

*Murray E. Morgan*  
MURRAY E. MORGAN, Member

*A. L. Porter, Jr.*  
A. L. PORTER, JR., Member & Secretary

BEFORE THE OIL CONSERVATION COMMISSION  
OF THE STATE OF NEW MEXICO

APPLICATION OF THE ATLANTIC  
REFINING COMPANY FOR AN ORDER  
AUTHORIZING THE INJECTION OF  
WATER FOR PRESSURE MAINTENANCE  
AND SECONDARY RECOVERY PURPOSES  
INTO THE UPPER AND LOWER TOCITO  
ZONES OF THE LOWER GALLUP FORMA-  
TIONS UNDERLYING APPLICANT'S  
NAVAJO AND NAVAJO "B" LEASES IN  
THE HORSESHOE-GALLUP OIL POOL  
PURSUANT TO RULE 701 OF THE  
RULES AND REGULATIONS OF THE  
NEW MEXICO OIL CONSERVATION  
COMMISSION

CASE NUMBER 2979

TO THE HONORABLE OIL CONSERVATION COMMISSION  
OF THE STATE OF NEW MEXICO:

Comes THE ATLANTIC REFINING COMPANY, a corporation with a certificate of authority to do business in the State of New Mexico with offices at Dallas, Texas, and hereby makes application to the New Mexico Oil Conservation Commission for an order authorizing the injection of water for pressure maintenance and secondary recovery purposes into the upper and lower Tocito zones of the lower Gallup formations underlying the Navajo and Navajo "B" leases of applicant situated in the Horseshoe-Gallup Oil Pool, San Juan County, New Mexico, pursuant to Rule 701 of the Commission, and in support thereof respectfully shows:

1. That there is attached hereto, made a part hereof and for purposes of identification marked Exhibit "A", a plat showing the Navajo and Navajo "B" leases of applicant situated in the Horseshoe-Gallup Oil Pool, together with the location of all wells drilled thereon and all wells drilled within a radius of two miles from the proposed injection wells hereinafter referred to, together with the formation from which said wells are producing. Said Exhibit "A" also

shows the location of the proposed injection wells and the ownership of the respective leasehold interests within a radius of two miles from applicant's oil and gas leases.

2. That as indicated from Exhibit "A" attached hereto, the proposed project area consists of the following described lands:

Township 31 North, Range 16 West, N.M.P.M.

Section 18: S $\frac{1}{2}$ SW $\frac{1}{4}$   
Section 19: All, except NE $\frac{1}{4}$ NE $\frac{1}{4}$   
Section 20: S $\frac{1}{2}$ , S $\frac{1}{2}$ NW $\frac{1}{4}$ , SW $\frac{1}{4}$ NE $\frac{1}{4}$   
Section 29: All  
Section 30: All  
Section 31: All, except SW $\frac{1}{4}$ SW $\frac{1}{4}$   
Section 32: All

containing 3,640 acres, more or less.

3. That there is also filed herewith and for purposes of identification marked Exhibit "B", electrical logs of the proposed injection wells, being the following: Navajo #9, #16, #17, #22, #23, #24, #26, #28, #29, #1-B, #3-B, #4-B, #5-B, #7-B and #8-B.

4. That there is also attached hereto, made a part hereof and for purposes of identification marked Exhibit "C", a description of the casing program of the proposed injection wells referred to in the preceding paragraph.

5. Applicant proposes to inject water through the injection wells above referred to into the upper and lower Tocito zones of the lower Gallup formation, the water to be injected at rates between 10 and 2,200 barrels per day. The upper Tocito is found between 1144 feet and 1181 feet below the surface and the lower Tocito between 1235 feet and 1251 feet below the surface in the Atlantic Navajo #17 well located in the NW $\frac{1}{4}$ NE $\frac{1}{4}$  Section 31, Township 31 North, Range 16 West.

Applicant proposes to obtain the water for injection purposes from its Navajo "B" #1-W located in the SE $\frac{1}{4}$  Section 19, which

well is completed in the Morrison formation. That there is attached hereto, made a part hereof and for purposes of identification marked Exhibit "D", a copy of a letter to the Office of the State Engineer with water analysis report from said well attached which complies with Commission Memorandum #5-58 dated January 31, 1958.

6. That applicant is the sole owner of the oil and gas leases referred to as Atlantic's Navajo and Navajo "B" leases shown on Exhibit "A" attached hereto and believes that it will be in the interest of conservation and the prevention of waste to inaugurate a water injection program for pressure maintenance and secondary recovery purposes as soon as possible by the injection of water into the injection wells above referred to and to later utilize other wells for injection purposes so as to promote the greatest ultimate recovery of oil and gas from said formation. Applicant therefore requests that the area hereinabove described be designated as the project area and that an allowable formula be fixed therefor and in connection therewith recommends the adoption of special field rules governing the injection of water into that portion of the Horseshoe-Gallup Oil Pool above described covering the following:

(a) The conversion of the producing wells listed in Exhibit "C" to water injection wells and conversion of additional producing wells to water injection wells upon approval of the Secretary Director of the Commission.

(b) Transfer of allowables from injection wells to producing wells within the project area and transfer of allowable for producing wells which, for more efficient operation of the project, are shut-in or curtailed because of high gas-oil ratio, or shut-in for any of the following reasons: Pressure regulation, control of pattern or sweep efficiencies, or to observe changes in pressures or progress of the flood fronts.

(c) Assignment of a project allowable which may be produced from any well or wells in the project area in any proportion, the project allowable to be calculated each month by multiplying the current normal unit allowable for a 40-acre proration unit times the number of 40-acre proration units in the project area having located thereon either producing wells or wells used for injection purposes or wells which are shut-in or curtailed for conservation purposes.



(d) Gas equivalent credit for water injected to be applied to any well producing with gas-oil ratio greater than 2000 cubic feet per barrel.

(e) Permission to expand the water injection program by administrative approval to include all of applicant's Navajo and Navajo "B" leases on the effective date of any unit agreement which may be formed covering all or a substantial portion of the Horseshoe-Gallup Oil Pool.


(f) Such other rules and regulations which the Commission deems to be necessary.

WHEREFORE, applicant requests that this application be set down for hearing before an examiner after due notice as required by law and the rules and regulations of the Commission.

Respectfully submitted,

THE ATLANTIC REFINING COMPANY

By

  
attly.

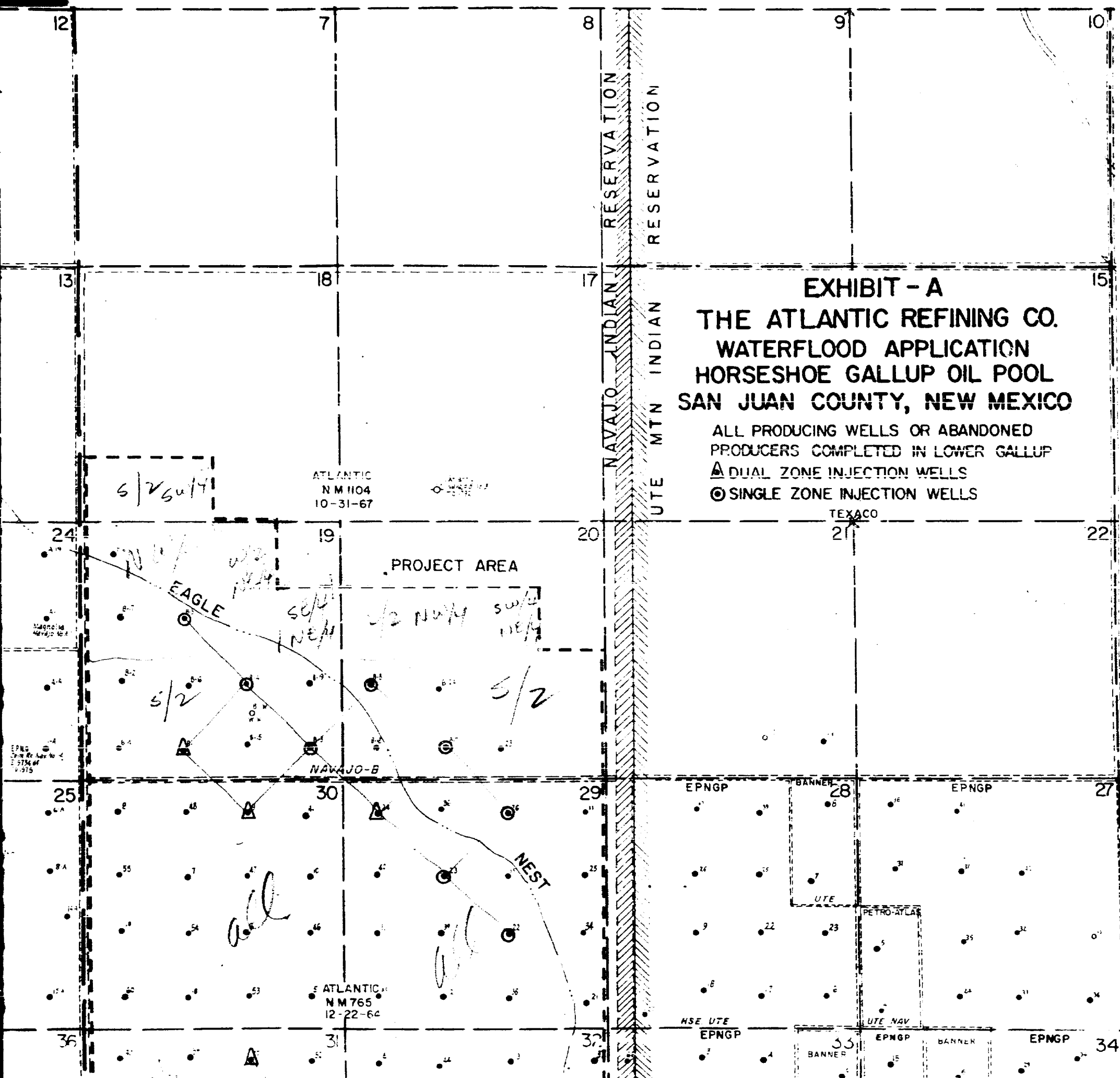
~~HERVEY~~ DOW & HINKLE

By

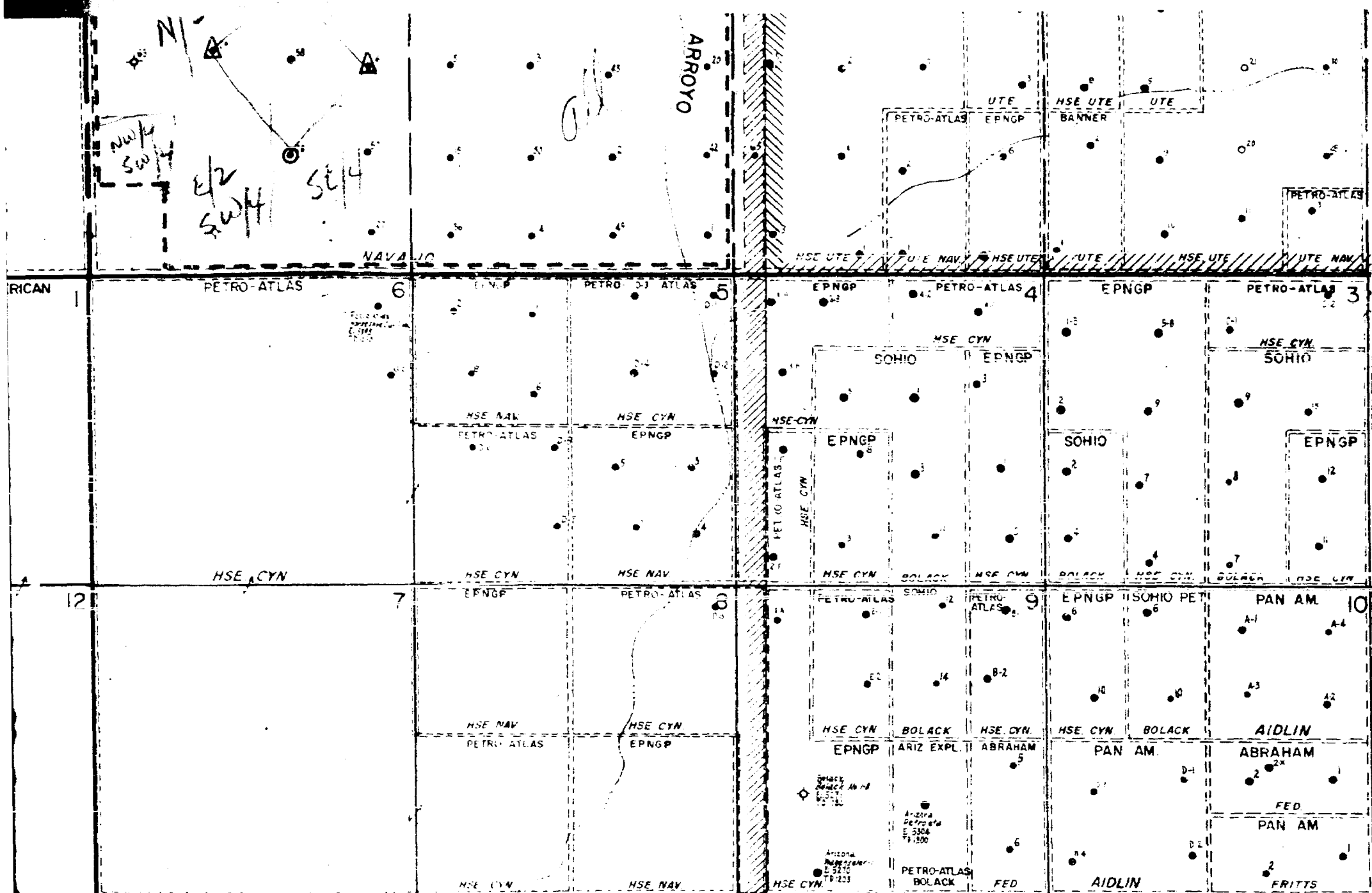
  
Roswell, New Mexico  
Attorneys for Applicant

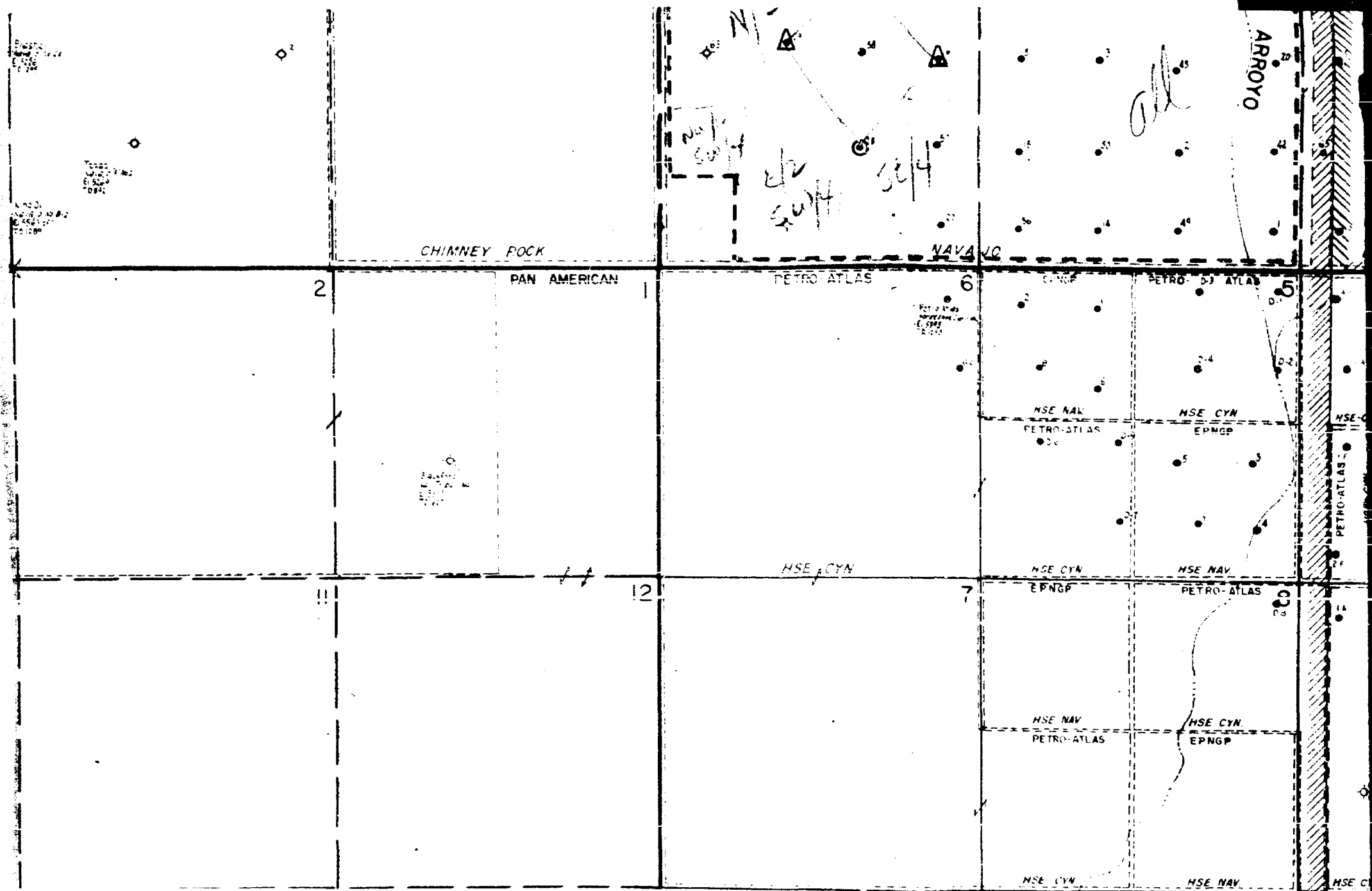
**EXHIBIT - A**  
**THE ATLANTIC REFINING CO.**  
**WATERFLOOD APPLICATION**  
**HORSESHOE GALLUP OIL POOL**  
**SAN JUAN COUNTY, NEW MEXICO**

ALL PRODUCING WELLS OR ABANDONED  
PRODUCERS COMPLETED IN LOWER GALLUP  
▲ DUAL ZONE INJECTION WELLS  
◎ SINGLE ZONE INJECTION WELLS









## EXHIBIT "C"

DESCRIPTION OF CASING PROGRAM OF INJECTION WELLS  
THE ATLANTIC REFINING COMPANY APPLICATION FOR AN ORDER  
AUTHORIZING WATER INJECTION ON ITS NAVAJO AND NAVAJO "B" LEASES

<u>Lease and Well Number</u>	<u>Surface Casing</u>			<u>Producing Casing</u>			<u>Well Locations</u>	
	<u>Size</u>	<u>Setting Depth</u>	<u>Cement Sacks</u>	<u>Size</u>	<u>Setting Depth</u>	<u>Cement Sacks</u>	<u>All in T31N - R16W</u>	<u>San Juan Co., N. Mex.</u>
							<u>Unit</u>	<u>Section</u>
Navajo 9	8 5/8	102.07	125	5 1/2	1446.72	135	B	30
16	8 5/8	100.90	115	5 1/2	1300.73	130	H	31
17	8 5/8	98.80	115	5 1/2	1286.00	130	B	31
22	8 5/8	98.97	115	5 1/2	1362.52	130	J	29
23	8 5/8	103.64	115	5 1/2	1379.01	130	F	29
24	8 5/8	95.70	115	4 1/2	1409.82	160	D	29
26	8 5/8	99.75	115	4 1/2	1347.09	190	B	29
28	8 5/8	94.26	115	4 1/2	1306.25	150	J	31
29	8 5/8	101.49	115	5 1/2	1366.00	130	F	31
Navajo "B" 1	8 5/8	102.06	115	5 1/2	1577.21	150	N	19
3	8 5/8	103.65	115	4 1/2	1446.21	180	P	19
4	8 5/8	97.47	115	4 1/2	1474.27	190	J	19
5	8 5/8	98.05	115	4 1/2	1487.72	195	F	19
7	8 5/8	98.03	115	4 1/2	1513.40	225	N	20
8	8 5/8	100.09	100	4 1/2	1588.24	150	L	20

Exhibit D

The Office of the State Engineer  
Post Office Box 1079  
Santa Fe, New Mexico

Gentlemen:

In compliance with the New Mexico Oil Conservation Commissions' Memorandum No. 5-58, dated January 31, 1958, The Atlantic Refining Company is furnishing the following information:

1. Copy of our application to waterflood the Atlantic Navajo and Navajo 'B' Leases in the Horseshoe-Gallup Oil Pool, San Juan County, New Mexico.
2. The water source will be the Atlantic Navajo 'B' No. 1-W well located in the Horseshoe-Gallup Field in the SW/4 of Section 19 - T31N - R16W, San Juan County, New Mexico, and other wells in the project area if necessary.
3. The water will be produced from the Morrison formation which occurs between 2106 feet and 2862 feet in the Atlantic Navajo 'B' No. 1-W.
4. A copy of a water analysis is enclosed.

# CHEMICAL ENGINEERING GROUP WATER ANALYSIS REPORT

PN 3-60-63

To: T. O. Davis, File

Date Collected: 3-18, 19  
Source of Sample: Wellhead, Navajo B #1-W

Date Rec'd: 3-21-60

Date Rec'd: 3-23-60

Date Rec'd: 3-23-60

Date Rec'd: 3-23-60

Lab. No. 15,901

San Juan Co., New Mexico

## CHEMICAL ANALYSIS

CONSTITUENTS	Mg. liter	CONSTITUENTS	Mg. liter	CONSTITUENTS	Mg. liter
1. Total Solids	7,615	6. Calcium	192	11. Sulfates	4,570
2. pH	7.9	7. Magnesium	32	12. Carbonates	0
3. Sp. Grav. 60°F.	1.006	8. Iron 4 as Fe (6.7 FeS)	300	13. H.S.	0
4. Res. 68°F.		9. Chlorides	305	14. Hydroxide Ba	0
5. Sodium	2,215	10. Bicarbonates	305		
Pattern Code					

A9A9AoAo: AoB5J5Ao

## INTERPRETATION

PROBLEM:

CONCLUSION:

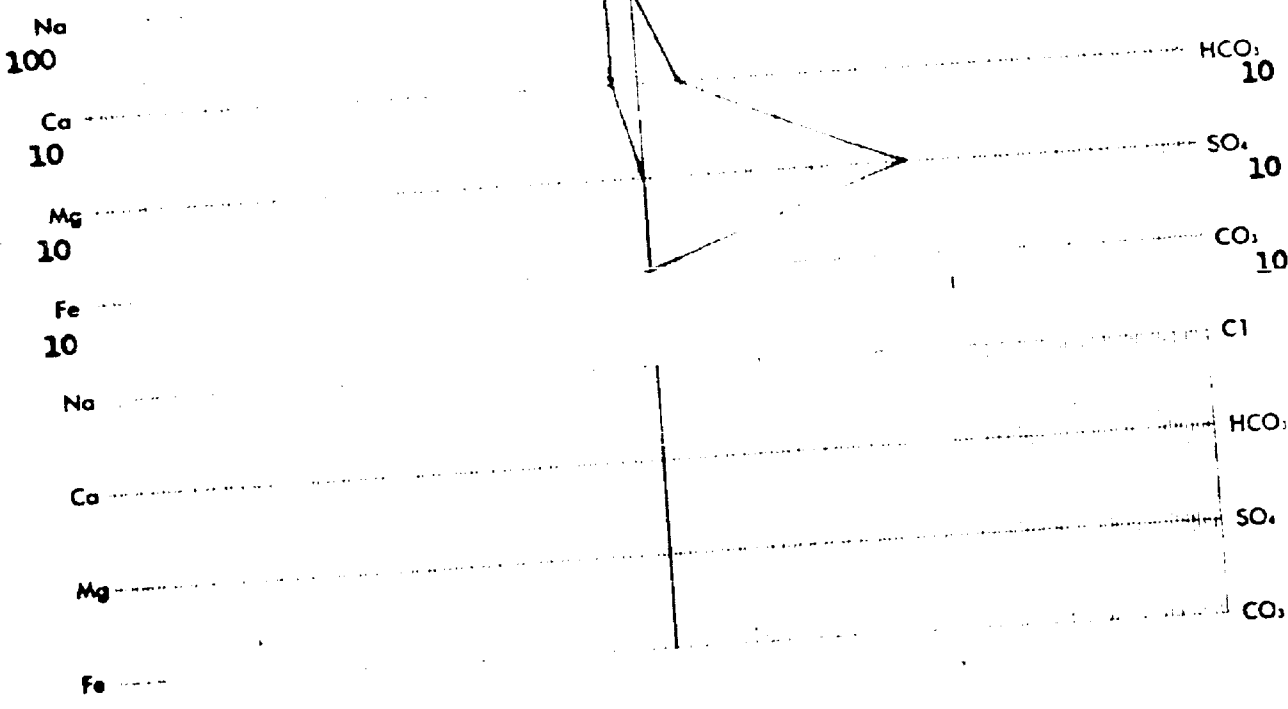
REMARKS:

ATLANTIC COST \$14.74  
COMMERCIAL COST \$28.00

AUTHORIZED BY T.O. Davis  
CHARGE TO Navajo B #1-W

Approved by HENRY LEWELLING

Reported by MONTE KAPLAN





No. 15-60

DOCKET: EXAMINER HEARING JUNE 1, 1960

Oil Conservation Commission 9 a.m., Mabry Hall, State Capitol, Santa Fe, N.M.  
The following cases will be heard before Elvis A. Utz, Examiner, or Oliver E. Payne, Attorney, as alternate Examiner:

CASE 1970: Application of Gulf Oil Corporation for approval of a gas-oil dual completion. Applicant, in the above-styled cause, seeks permission to dually complete its Lea-State "AQ" Well No. 8, located in Unit E of Section 32, Township 19 South, Range 35 East, Lea County, New Mexico, in such a manner as to permit the production of gas from the East Pearl-Seven Rivers Gas Pool and the production of oil from the Pearl Queen Pool through the casing-tubing annulus and 2-3/8 inch tubing respectively, utilizing a retrievable type packer to separate the two producing horizons.

CASE 1971: Application of Gulf Oil Corporation for permission to commingle the production from two separate pools. Applicant, in the above-styled cause, seeks permission to commingle the Blinebry oil production with the Tubb gas condensate from all wells presently completed or hereafter drilled on its Evelyn Lineberry lease, consisting of the N/2 SW/4 of Section 29, Township 22 South, Range 38 East, Lea County, New Mexico, after separately metering the Blinebry oil production.

CASE 1972: Application of Gulf Oil Corporation for permission to commingle the production from several separate pools. Applicant, in the above-styled cause, seeks permission to commingle the Blinebry oil production with the Blinebry gas condensate and Tubb gas condensate from all wells on its T. R. Andrews lease comprising the E/2 of Section 32, Township 22 South, Range 38 East, Lea County, New Mexico, after separately metering the Blinebry oil production.

CASE 1973: Application of Graridge Corporation for approval of the unorthodox locations of three water injection wells. Applicant, in the above-styled cause, seeks approval of an unorthodox location for three water injection wells to be located in the SE/4 NE/4 of Section 28, Township 18 South, Range 28 East, Artesia Pool, Eddy County, New Mexico.

- CASE 1974: Application of C. T. Robertson for an order authorizing a water flood project. Applicant, in the above-styled cause, seeks an order authorizing him to institute a water flood project in the Coyote-Queen Pool, Chaves County, New Mexico, by the injection of water into the Queen formation through six wells located in Sections 11 and 14, Township 11 South, Range 27 East.
- CASE 1975: Application of Amerada Petroleum Corporation for approval of, an oil-oil dual completion. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its State LM "T" Well No. 5, located in Unit A, Section 36, Township 23 South, Range 36 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Jalmat Gas Pool and the production of oil from the Langlie-Mattix Pool through parallel strings of 1-inch tubing and 2-3/8 inch tubing respectively, utilizing a retrievable type packer to separate the two producing horizons.
- CASE 1976: Application of Caulkins Oil Company for approval of a gas-gas dual completion and for the establishment of a non-standard gas unit. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its Reuter PC-297 well in such a manner as to permit the production of gas from the South Blanco-Pictured Cliffs Gas Pool and the production of gas from the Dakota Producing Interval through parallel of 1 1/4-inch and 2 3/8 inch tubing respectively. Applicant further seeks an order establishing a non-standard gas unit to be dedicated to the subject well in the Dakota Producing Interval consisting of the SW/4 of Section 15 and the NW/4 of Section 22, Township 26 North, Range 6 West, Rio Arriba County, New Mexico.
- CASE 1977: Application of Hondo Oil & Gas Company for approval of an automatic custody transfer system. Applicant, in the above-styled cause, seeks an order authorizing the installation of an automatic custody transfer system to handle the production from the Empire-Abo Pool from all wells presently completed or hereafter drilled on the Hondo-Western-Yates State 647 lease, which lease consists of acreage in Sections 25, 26, 34, 35, and 36, all in Township 17 South, Range 28 East, Eddy County, New Mexico.

- CASE 1978: Application of Shell Oil Company for an order authorizing two salt water disposal wells. Applicant, in the above-styled cause, seeks an order authorizing the disposal of produced salt water through its State ETA Well No. 1, located in the NE/4 NE/4 of Section 8, Township 16 South, Range 35 East, Lea County, New Mexico, with the injection to be in the Wolfcamp formation in the interval from 10,365 feet to 10,463 feet. Applicant further seeks an order authorizing the disposal of produced salt water through its State EDA Well No. 2, located in the SW/4 SW/4 of Section 7, Township 16 South, Range 35 East, Lea County, New Mexico, with injection to be in the Wolfcamp formation in the interval from 10,712 feet to 10,734 feet.
- CASE 1979: Application of The Atlantic Refining Company for an order authorizing a water injection project in the Horseshoe-Gallup Oil Pool, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks an order authorizing the injection of water, for purposes of pressure maintenance and/or secondary recovery, into the Horseshoe-Gallup Oil Pool through 15 wells located in Sections 19, 20, 29, 30 and 31, Township 31 North, Range 16 West, San Juan County, New Mexico. Applicant further requests that special rules and regulations be promulgated governing the operation of this water injection project including the assignment of a project allowable.
- CASE 1980: Application of Hudson and Hudson for nine unorthodox locations. Applicant, in the above-styled cause, seeks an order authorizing the drilling of wells at nine 5-spot locations on its Puckett "A" Lease, Maljamar Pool, Lea and Eddy Counties, New Mexico, said wells to be located in the 40-acre units hereinafter described, and within 100 feet of the indicated corner thereof.
- SW Corner Unit O, Section 13, and the following wells in Section 24:
- |                   |                   |
|-------------------|-------------------|
| SE Corner Unit D; | SE Corner Unit F; |
| NW Corner Unit C; | NE Corner Unit G; |
| SW Corner Unit B; | NW Corner Unit K; |
| NW Corner Unit A; | NW Corner Unit I; |
- all in Township 17 South, Range 31 East, Eddy County.

CASE 1981:

Application of El Paso Natural Gas Company for an order amending the special pool rules for the Blanco-Mesaverde Gas Pool. Applicant, in the above-styled cause, seeks an order amending the special pool rules for the Blanco-Mesaverde Gas Pool, Rio Arriba and San Juan Counties, New Mexico, to authorize district supervisors to approve "slim hole" completions in the Blanco-Mesaverde Gas Pool, regardless of depth.

CASE 1982:

Application of Otto Reynolds for an unorthodox oil well location. Applicant, in the above-styled cause, seeks approval of an unorthodox oil well location for his Wood Well No. 1, located 330 feet from the South line and 1629 feet from the West line of Section 14, Township 29 North, Range 11 West, San Juan County, New Mexico.

CASE 1983:

Application of Ralph Love for permission to commingle the production from several separate leases. Applicant, in the above-styled cause, seeks permission to commingle the production from an undesignated Delaware pool from several separate leases comprising the N/2 NW/4 of Section 17 and the E/2 NE/4 and the E/2 NW/4 of Section 18, Township 25 South, Range 30 East, Eddy County, New Mexico.

CASE 1984:

Application of Mountain States Petroleum Corporation for an unorthodox gas well location and for a 183-acre non-standard gas unit. Applicant, in the above-styled cause, seeks approval of an unorthodox gas well location for a well to be drilled 1050 feet from the North line and 750 feet from the West line of partial Section 31, Township 26 North, Range 2 West, Rio Arriba County, New Mexico. Applicant further seeks the establishment of a 183-acre non-standard gas unit in the Pine Lakes-Pictured Cliffs Gas Pool consisting of all of said partial Section 31 to be dedicated to the subject well.

CASE 1985:

Application of Charles Lovcless, Jr. for a 280-acre non-standard gas unit. Applicant, in the above-styled cause, seeks the establishment of a 280-acre non-standard gas unit in the Atoka-Pennsylvanian Gas Pool consisting of the NE/4 NE/4, W/2 NE/4, NW/4 of Section 11, Township 18 South, Range 26 East, or in the alternative to force pool all mineral interest owners in the SE/4 NE/4 of said Section 11 in the above-Pennsylvanian Gas Pool with the interests of those in the above-described non-standard unit in said pool. Said unit is to be dedicated to a well to be drilled 1650 feet from the North and West lines of said Section 11, Township 18 South, Range 26 East, Eddy County, New Mexico.

-5-

Docket No. 15-60

CASE 1986:

Application of J. M. Welch for a gas-oil dual completion. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of his Etz Well No. 3, located in the NE/4 SE/4 of Section 13, Township 16 South, Range 30 East, Eddy County, New Mexico, in such a manner as to produce gas from the Penrose sand of the Queen formation and to produce oil from the Lovington sand of the San Andres formation in the Henshaw (San Andres) Pool, through the casing-tubing annulus and 2-inch tubing respectively, utilizing a retrievable type packer to separate the two producing horizons.

*Ex-119*

J. M. HERVEY 1874-1953

HIRSH M. DOW  
CLARENCE E. HINKLE  
W. E. BONDURANT, JR.  
GEORGE H. HUNKER, JR.  
HOWARD C. BRATTON  
S. B. CHRISTY, IV.  
LEWIS C. COX, JR.

PAUL W. EATON, JR.  
ROBERT L. COOPER, JR.

LAW OFFICES  
HERVEY, DOW & HINKLE

HINKLE BUILDING  
ROSWELL, NEW MEXICO

TELEPHONE MAIN 2-0010  
POST OFFICE BOX 547

May 11, 1960

Mr. A. L. Porter, Jr., Secretary-Director  
New Mexico Oil Conservation Commission  
P. O. Box 871  
Santa Fe, New Mexico

Dear Mr. Porter:

We enclose in triplicate application of The Atlantic Refining Company for an order authorizing the injection of water in the upper and lower Tooto zones of the lower Gallup formation underlying the Navajo and Navajo "B" leases in the Horseshoe-Gallup Oil Pool pursuant to Rule 701 of the Commission. You will also find enclosed in triplicate Exhibit "B" which are the well logs to be filed in connection with the application.

We would like to have this application set down at the next examiner hearing, if possible. Please send us a copy of the notice.

Yours sincerely,

HERVEY, DOW & HINKLE

By

*Robert L. Cooper, Jr.*  
*mailed 5-11-60*  
*CEH/bp*  
*Encl.*

*Robert L. Cooper, Jr.*  
*mailed 5-11-60*  
*CEH/bp*  
*Encl.*

*Robert L. Cooper, Jr.*  
*mailed 5-11-60*  
*CEH/bp*  
*Encl.*

CEH/bp  
Encl.

cc: The Atlantic Refining Company

*Robert L. Cooper, Jr.*  
*mailed 5-11-60*  
*CEH/bp*  
*Encl.*

OIL CONSERVATION COMMISSION  
SANTA FE, NEW MEXICO

Date 6-2-60

CASE 1979

Hearing Date 6-1-60

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

1. Grant Atlantic request for a secondary recovery project in the Horseshoe Valley oil Pool.

2. Unit Area to consist:

31 N - 16 W

Sec. 18, S/2 SW/4

" 19, W/2, W/2 E/2, SE/4 NE/4, E/2 SE/4.

" 20, S/2, S/2 NW/4, SW/4 NE/4.

" 29, All

" 30, All

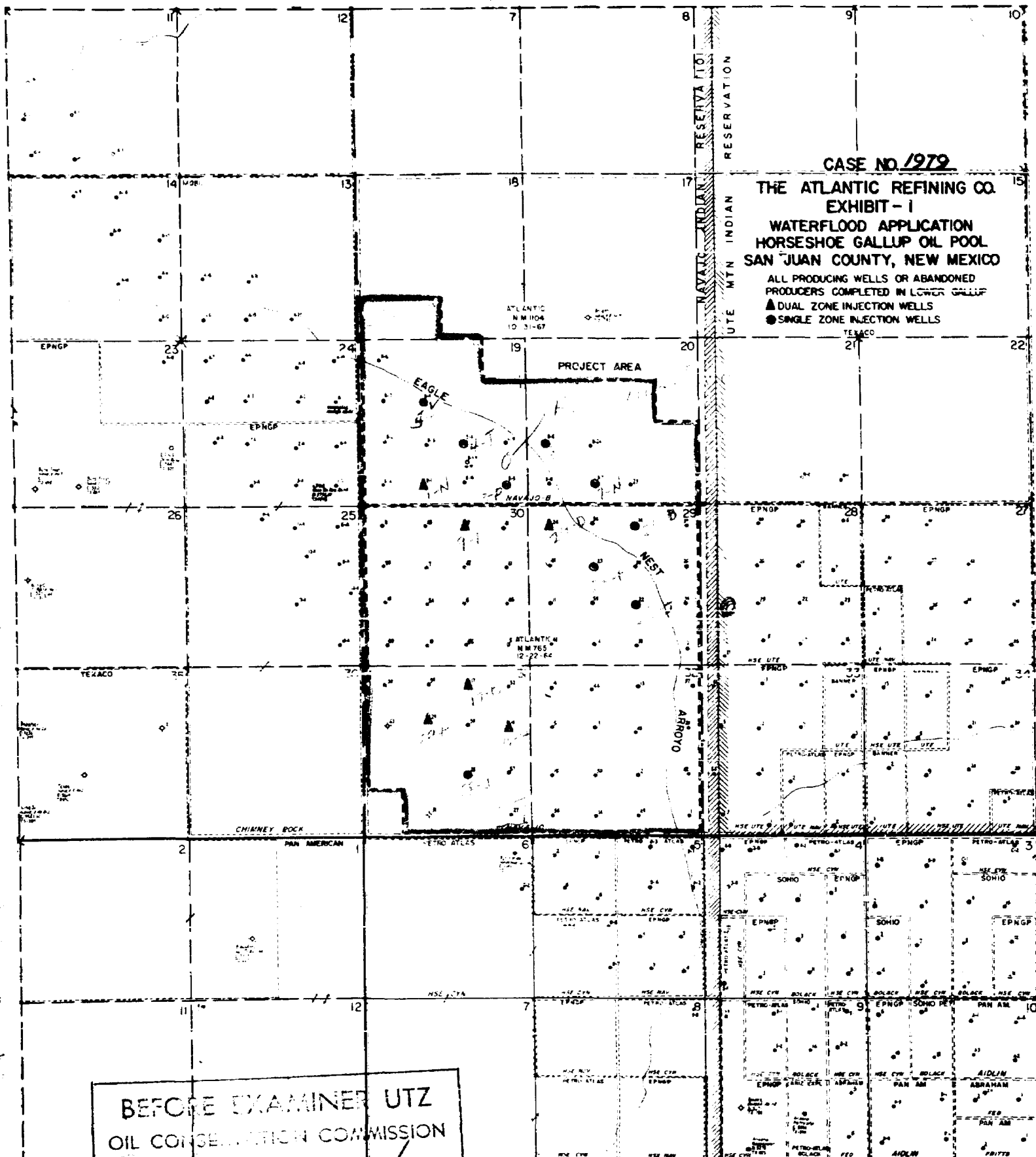
" 31, E/2, E/2 W/4, NW/4 SW/4, W/2 NW/4

" 32 All

Balance of Recommendation attached

*Wm. W. W.*

T31 NR16W



BEFORE EXAMINER UTZ  
OIL CONSERVATION COMMISSION

Case Exhibit NO. 1  
CASE NO. 1979



Case No. 1979  
The Atlantic Refining Co.  
Exhibit No. 3

PROPOSED GAS EQUIVALENT CREDIT FOR WATER INJECTION

HORSESHOE-GALLUP OIL POOL, SAN JUAN COUNTY, NEW MEXICO

**RULE 7.** Credit for daily average net water injected into the Horseshoe-Gallup Oil Pool through any injection well located within the project area may be converted to its gas equivalent and applied to any well producing with a gas-oil ratio in excess of two thousand cubic feet of gas per barrel of oil. Total credit for net water injected in the project area shall be the gas equivalent volume of the daily average net water injected during a one-month period. The daily average gas equivalent of net water injected shall be computed in accordance with the following formula:

$$E_g = (V_{w \text{ inj}} - V_{w \text{ prod}}) \times 5.61 \times \frac{P_a}{15.025} \times \frac{520^\circ}{T} \times \frac{1}{Z}$$

where:

$E_g$  = Average daily gas equivalent of net water injected, cubic feet

$V_{w \text{ inj}}$  = Average daily volume of water injected, barrels

$V_{w \text{ prod}}$  = Average daily volume of water produced, barrels

5.61 = Cubic feet equivalent of one barrel of water

$P_a$  = Average reservoir pressure at mid-point of the pay-zones of the Horseshoe-Gallup Oil Pool in project area, psig + 12.05 as determined from most recent survey.

15.025 = Pressure base, psi

520° = Temperature base of 60°F expressed as absolute temperature

$T_g$  = Reservoir temperature of 87°F expressed as absolute temperature

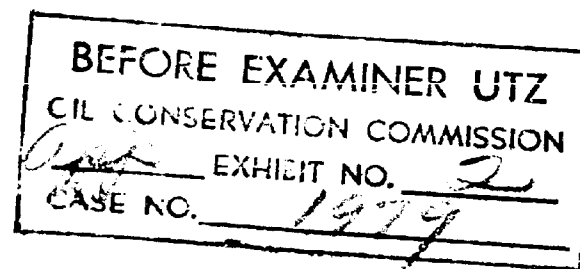
$Z$  = Compressibility factor from analysis of Horseshoe-Gallup gas at average reservoir pressure,  $P_a$ , interpolated from compressibility tabulation below:

Reservoir Pressure	Z	Reservoir Pressure	Z
50	.9725	450	.7220
100	.9465	500	.6900
150	.9215	550	.6560
200	.8885	600	.6135
250	.8600	650	.5655
300	.8325	700	.5220
350	.8030	750	.4630
400	.7710	800	.3935

CASE No. 1979  
THE ATLANTIC REFINING CO.  
EXHIBIT No. 2

HORSESHOE GALLUP FIELD  
SAN JUAN COUNTY, NEW MEXICO

WATERFLOOD STUDY  
UPPER AND LOWER TOCITO



THE ATLANTIC REFINING COMPANY

HORSESHOE GALLUP FIELD  
SAN JUAN COUNTY, NEW MEXICO

WATERFLOOD STUDY  
UPPER AND LOWER TOCITO

THE ATLANTIC REFINING COMPANY

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## S U M M A R Y

### INTRODUCTION

Since early in the life of the Horseshoe-Gallup Field it has been apparent that the normal producing mechanism will be solution-gas drive and that some form of fluid injection would be needed to maintain producing rates and increase recovery. A review of various fluid injection processes indicated that water injection would be the best. Low pressure gas injection is inefficient and the low reservoir pressure and shallow producing depths preclude use of miscible fluid injection, including high pressure gas injection. Accordingly, this report assembles reservoir data on the field, predicts the primary recovery performance, and shows the gain that will result from pressure maintenance by water injection. The calculated performance of an average 80-acre five-spot flood pattern is shown.

In this study, the extreme northwest extension of the field (north of Section 15, T-31-N, R-17-W) was not included.

### CONCLUSIONS

The following conclusions are drawn from this study:

1. Primary oil recovery will be small--being approximately 12.3% of the oil in-place or 95 barrels per acre-foot.
2. Primary producing rates are beginning to decline. The rate of decline will increase sharply by the end of 1960.
3. Waterflooding will increase ultimate recovery to 51% of the total oil in-place or to 392 barrels per acre-foot.
4. An adequate source of water for flooding is probably available from the Dakota formation.

RECOMMENDATIONS

1. Waterflood operations should be started immediately in the field.
2. The operators should work out a cooperative plan for location of injection and producing wells.

## DISCUSSION

### FIELD BACKGROUND

#### Location

The Horseshoe-Gallup Field is located in San Juan County, New Mexico, approximately twenty miles west and about eight miles north of the town of Farmington, New Mexico.

#### Discovery

The field was discovered June 22, 1957 by the Arizona Explorations, Inc., Horseshoe Canyon "B" #1 well located in the NW/4 NW/4, Section 3, Township 30 North, Range 16 West, San Juan County, New Mexico. This well was drilled to a total depth of 1780' and had an initial potential of 120 BPD of 42° gravity oil.

#### Geology

The Horseshoe-Gallup Field is located in the southwestern part of the San Juan Basin. The oil reservoir trends northwest and southeast and is a stratigraphic trap approximately thirteen miles long and up to three miles wide. The Lower Gallup sandstone formation ranges in depth from about 800 feet at its northwestern end to about 5200 feet at the southeastern end. A structure map contoured on the Gallup sandstone (except for the extreme northwest end of the field) is shown on Page 1 of the Tables and Figures Section of this report. Its productive interval is composed of two sand sections known as the Upper and Lower Tocito. These sands are shown on longitudinal cross section A-A', page 2. The trace of this cross section is shown on the structure map. The average net thickness of the combined Upper and Lower Tocito is 17.8 feet and the average porosity is 16.1%. The two sands are continuous, however, the Upper Tocito changes into a shale in the northwestern part of the field and is not present as a pay zone. On the other hand, the Lower Tocito is not as wide, laterally, as the Upper Tocito.

## RESERVOIR PROPERTIES

### Summary

The following table lists average reservoir properties of the Tocito zones in the Horseshoe-Gallup Field determined from available geological, core, and PVT data:

Porosity (%)	16.1
Permeability, <del>md.</del> (md.) <i>Liquid</i>	82
Connate Water (%)	32.4
Initial Pressure (psig at +4175 datum)	215
Saturation Pressure (psig at +4175')	215
Reservoir Temperature (°F)	87
Area (developed acres)	10,200
Spacing (acres/well)	40
Number of wells (Aug. 1959)	234
Average Net Pay (Lower plus Upper Tocito) (ft.)	17.8
Original Oil in-place (bbls/ac.ft.)	770

### Core Data

Analyses run on diamond cores taken in 45 wells were available. Thirty of these wells were on Atlantic's Navajo "A" and "B" leases. There were 398 core samples from the Upper Tocito whose permeability was 1 md. or greater. From the Lower Tocito, 345 samples had a permeability of 1 md. or greater. Four hundred and sixty-five Upper Tocito samples and 478 Lower Tocito samples had porosity values of 12% or greater.

The available core data were punched onto IBM cards for sorting, arranging in order of ascending permeability and porosity, and printing. Using permeabilities of 1 md., or above, graphs of air permeability versus per cent of total samples were constructed for the Upper and Lower Tocito, pages 9 and 10. These plots were



divided into five equal groups (based on number of samples) and average permeability determined for each group. With this average permeability and Atlantic's restored-state data, an average water saturation was determined for each of the five groups.

Porosity distribution curves (pages 13 and 14) were drawn in the same manner as the permeability distribution curves but using porosities of 12%, or above. The 12% porosity value corresponds approximately to 1 md. permeability. These plots were also divided into five equal groups based on number of samples and average porosity determined for each of the groups. With each group's respective average porosity and water saturation, an effective oil porosity was calculated for each group. This effective porosity versus per cent of total number of samples is shown on pages 15 and 16.

From the effective porosity distribution curves, the average effective oil porosity--porosity  $\times$  (1 - connate water saturation)--of the Upper and Lower Tocito was determined to be 10.8% and 11.0%, respectively.

#### Fluid Properties

Atlantic obtained a bottom hole fluid sample from their Navajo #5 well on August 13, 1959. In order to obtain a sample representative of both the Upper and Lower Tocito zones, it was collected above the Upper zone at which point the pressure in the well bore was 150 pounds. The PVT study was run showing a 150# psi saturation pressure; however, to make this data compatible with actual reservoir conditions, the curves were extrapolated to 215 psi, the initial reservoir pressure. The formation volume factor, gas solubility, gas conversion factor, and oil viscosity versus pressure plots are shown as pages 5, 6, 7, and 8. The fluid properties are summarized on page 4.

#### Relative Permeability

Atlantic's Chemical Engineering Laboratory ran  $k_g/k_o$  curves on nine selected plugs from the Upper and Lower Tocito whose permeability corresponded to each of the five sample groups discussed in the Core Data Section. These curves were then

combined at equal flowing gas-oil ratios or at equal  $k_g/k_o$ 's. The curves for the Upper and Lower Tocito were so similar that only one curve was drawn. The average  $k_g/k_o$  versus effective oil saturation curve is shown on page 18. Pages 19 through 27 are the individual  $k_g/k_o$  curves plotted versus oil saturation. Page 17 is a relative permeability data summary.

#### PRIMARY PERFORMANCE

Since the field is limited around practically all its perimeter by lack of porous producing formation, solution gas drive will be the predominant producing mechanism. No water-oil contact has yet been found and, if one exists, it will not contribute to recovery in any significant degree. With the average relative permeability curve and the PVT data previously described, a solution gas drive performance calculation was run using the IBM 650 computer. The results of this calculation are shown on page 29. Under natural depletion, 12.3% of the initial oil in-place will be recovered to a 35 psig reservoir abandonment pressure, which corresponds to an economic limit of about 3 BOPD. This results in 95 barrels per acre-foot recovery by primary means out of 770 barrels per acre-foot originally in place.

Productivity index decline calculations were also run on the IBM 650 computer, the results of which are shown on page 31. Using these P.I. decline results, the field's future producing rates were predicted and are shown on page 30. This curve shows that the rate will decline slowly until late in 1960, after which the rate will drop rapidly.

Past performance of the Horseshoe-Gallup oil pool is shown on page 34. Development drilling is nearly complete with the limits of the pool almost completely defined.

## WATERFLOOD PERFORMANCE

### Approach

Examination of the core properties previously discussed shows a wide variation in permeabilities and porosities in the Upper and Lower Tociito sands which will cause the waterflood front to advance in a non-uniform manner. In order to calculate quantitatively the advance of the flood front, we have treated the reservoir as a system of parallel, separate, uniform layers each of which have different permeabilities, porosities, and residual oil values. The procedure involves the following steps:

- (1) The core properties (permeability and porosity) were arranged in ascending order as shown on pages 9, 10, 13, and 14.
- (2) The reservoir was arbitrarily divided into five layers of uniform thickness. Core properties were assigned to these layers according to the per cent incidence shown on the above mentioned figures.
- (3) Performances based on the core properties were calculated and averaged to obtain an average performance of each layer.
- (4) The total reservoir performance was determined by summing the average behavior of individual layer performances.

Several assumptions were made to facilitate this calculation. These are that (1) the reservoir is repressured and is operating under a constant pressure drop from injection wells to producing wells, (2) there is no cross-flow between layers, and (3) there is no flow of oil behind the waterflood front in any of the layers. The last assumption is consistent with laboratory observations of waterflood performance of water wet reservoirs. Based on the laboratory flooding tests of fresh cores taken from the Horseshoe-Gallup Field, it was concluded that the reservoir is water wet. Page 28 presents the results of the fresh core waterfloods.

### Flood Pattern

The choice of the flooding pattern is dependent on several factors. These are (1) the mobility ratio (this is the mobility of the water divided by the mobility of the oil), (2) the permeability of the reservoir, (3) field oil rate (capacity or allowable control). From the fluid and rock properties, a mobility ratio equal to one was calculated. This means that both water and oil have the same ease of movement in the reservoir. As a result, one injection well can supply enough water to support one producing well. This situation describes a five-spot development.

The second factor which must be examined in choosing a pattern is the permeability of the formation. The higher the permeability, the higher will be the total number of barrels of water that can be injected per day and the higher will be the resulting oil rate. The five-spot pattern gives the maximum throughput rate for a one to one mobility ratio situation. This leads into the third consideration which is the oil rate.

If the Horseshoe-Gallup Field were to be produced at capacity, the optimum pattern to support that rate would be the five-spot. However, in view of the probable restriction of the field oil rate below capacity, a variation from the five-spot pattern can be used in flooding the field. In the center areas of the field where injection capacities are high, fewer injection wells are needed to support the oil rate. In this area a nine-spot pattern (three producing wells per one injection well) or a peripheral type pattern might be used. The edges of the field have lower permeabilities and thicknesses and, here, a five-spot pattern is required to support the oil rate.

### Throughput Rate

Throughput rate can be defined as a steady state total rate (oil plus water) which can be produced from a particular well pattern by imposing a given pressure drop. In magnitude, it is equal to the pressure drop across the system divided

by the total resistance of the system. To determine the maximum capacity rate, a pressure drop of 1180 psi was used based on the assumptions of 1200 psi bottom hole injection pressure (less than formation breakdown) and 20 psi bottom hole producing pressure. Since the mobility of the water is equal to the mobility of the oil, the throughput rate is constant after fill-up. The steady state throughput rate after fill-up was calculated by the use of an equation for the five-spot developed by Morris Muskat.

#### Typical Performance

To obtain the over-all performance, the volumes injected and produced were added at a given time to produce the over-all performance. Page 33 shows the performance of a typical five-spot area. The over-all properties of this five-spot are the same as those listed under the section entitled "Reservoir Properties - Summary." The graph on page 33 shows that the typical 80-acre five-spot will produce about 490,000 stock tank barrels of oil in 15 years. In order to produce this amount of oil, 2.3 million barrels of water must be injected, and 1.6 million barrels of water will be produced.

The waterflood results are summarized on page 32. On an acre-foot basis, primary recovery is estimated to be 95 bbl/acre-foot. The total recovery estimated from primary plus waterflood is 392 bbls/acre-foot which amounts to 51% of the initial oil in-place.

Page 30 shows the results of the five-spot flooding performance (which gives approximately the same results as using five-spots in combination with nine-spots) applied to the field as a whole compared to the primary field performance. As shown, the increase in oil rate to 400,000 barrels per month occurs rapidly. By starting the waterflood early in the field life, there is little gas space to fill up (the initial gas saturation is estimated to be 4.8 per cent of the pore volume when flooding operations begin). Our calculations show that the rate of about

400,000 stock tank barrels per month can be maintained for about nine years. At that time, the oil productivity declines because of the increasing amounts of water being produced.

#### Water Source

The Dakota formation should provide an ample supply of water for waterflood purposes. Atlantic drilled the Navajo #45 well through the Dakota formation to a total depth of 2078 feet. The Dakota sand was topped at 1816 feet and extended to 2063 feet with a few shale breaks. Two cores were cut (1846 to 1896 and 1989 to 2039) and two drill stem tests were taken. From 61 feet of analyzed core, 44 feet had an average air permeability of 167 mds. Results of the two DST's are tabulated below:

Test No.	Depth		Flow Period	Shut-In Period	Recovery	Flow Pressures	Final Shut-in Pressure
	From	To					
1	1849	1896	90 min.	30 min.	1585' water	119-701	745
2	1992	2039	90 min.	30 min.	1762' water	299-806	809

Analysis of the water recovered in DST #1 showed 4,996 ppm. total solids with a pH of 7.0. The solids constituents were as follows:

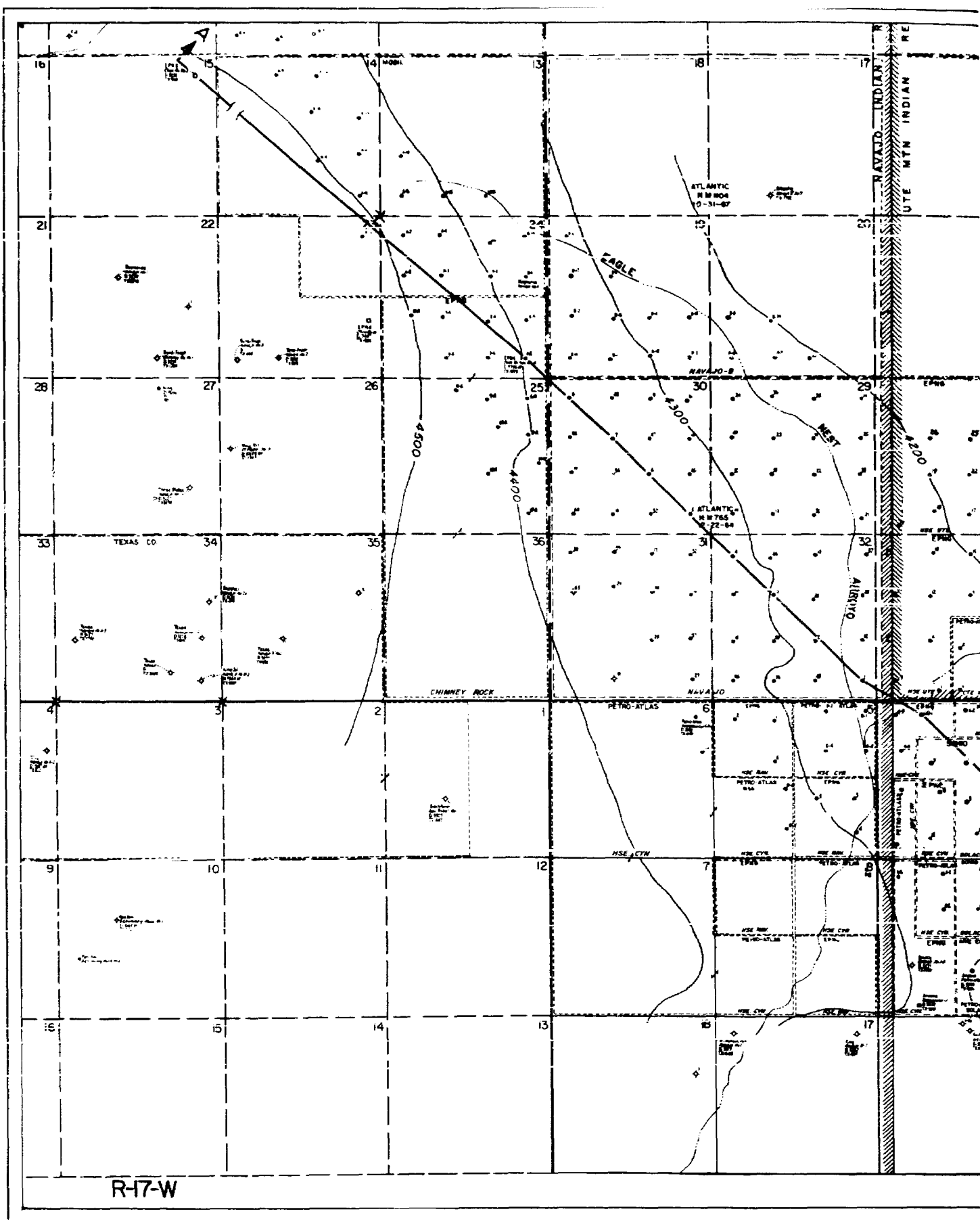
Sodium	1578 ppm
Calcium	24 ppm
Magnesium	1 ppm
Iron	0 ppm
Barium	0 ppm
Chloride	284 ppm
Bicarbonate	625 ppm
Sulfate	2484 ppm
Carbonate	0 ppm
Hydroxide	0 ppm

The Dakota sands are expected to be well developed in all areas of the field so water source wells could be located where they would be most convenient.

# HORSESHOE-GALLUP FIELD STUDY

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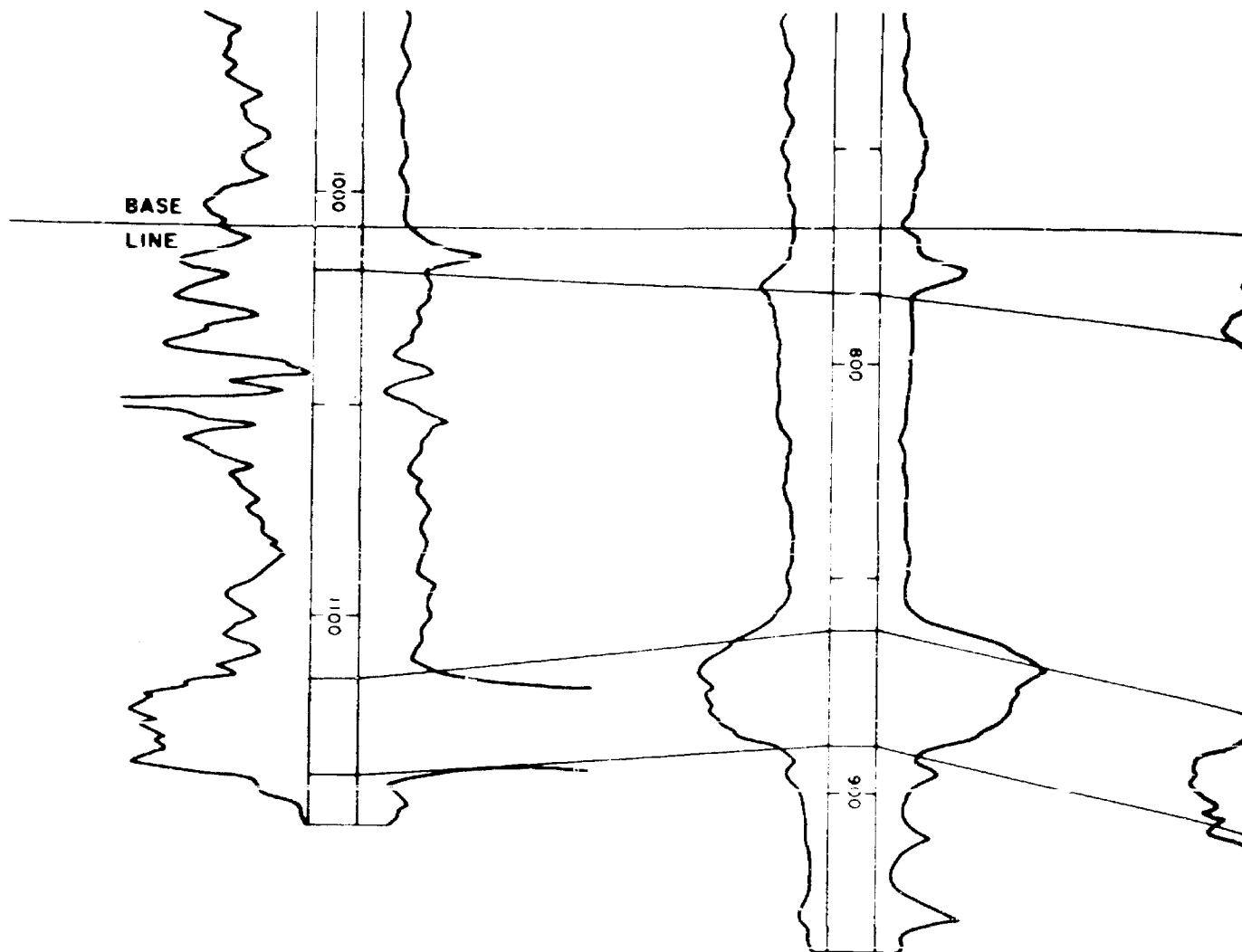
1

2

R.L. BAYLESS  
5 NAVAJO  
NW/4 NE/4 SEC 5, T31N, R17W

E.P.N.G. PRODUCTS CO.  
2 CHIMNEY ROCK  
NE/4 NE/4 SEC 15, T31N, R17W

EJ  
1-  
SE/4



A	1	2
BASE		
LINE		

3

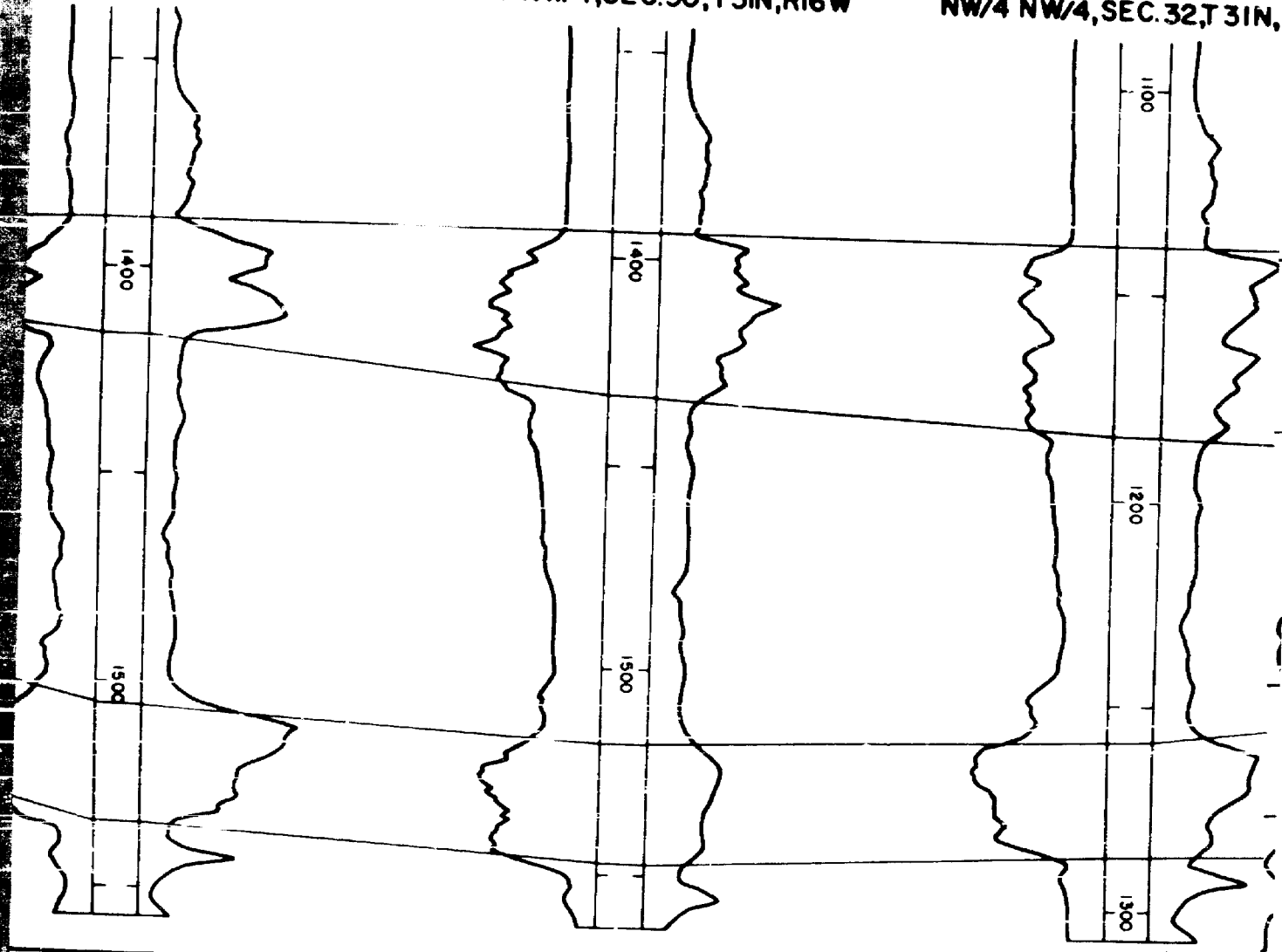
P.N.G PRODUCTS CO.  
A CHIMNEY ROCK  
SE/4, SEC. 24, T. 31N, R. 17W

4

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SE/4 NW/4, SEC. 30, T. 31N, R. 16W

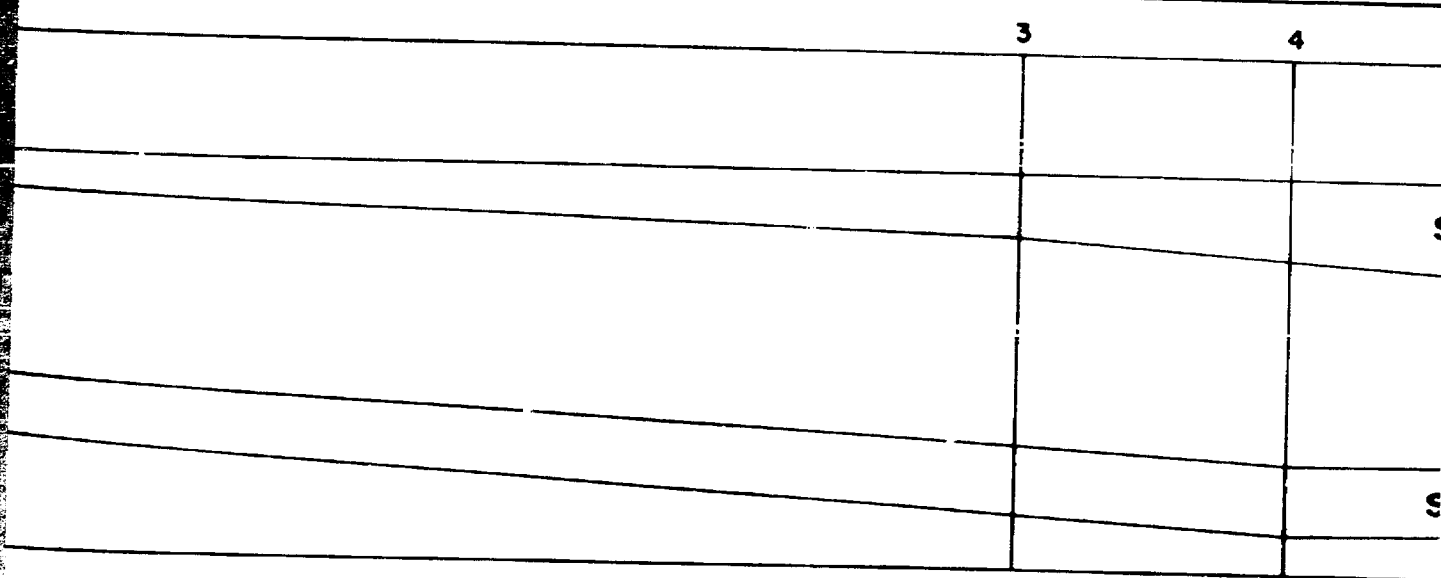
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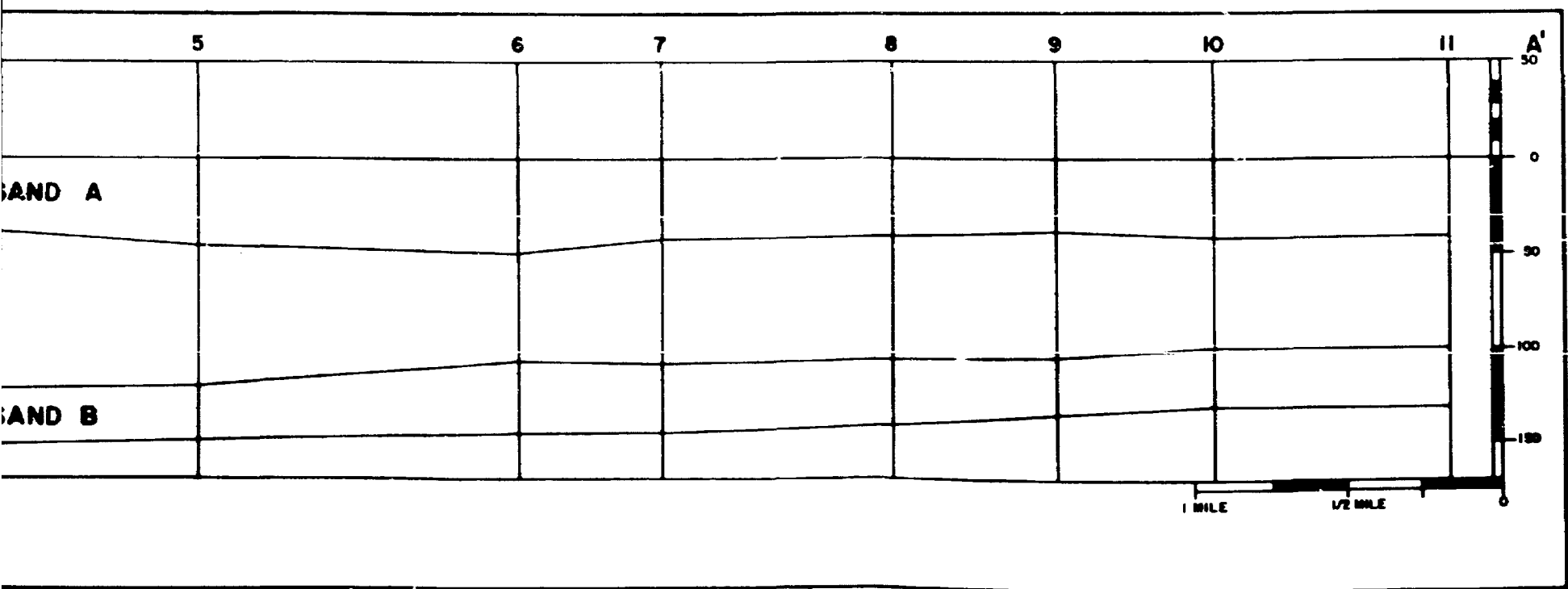
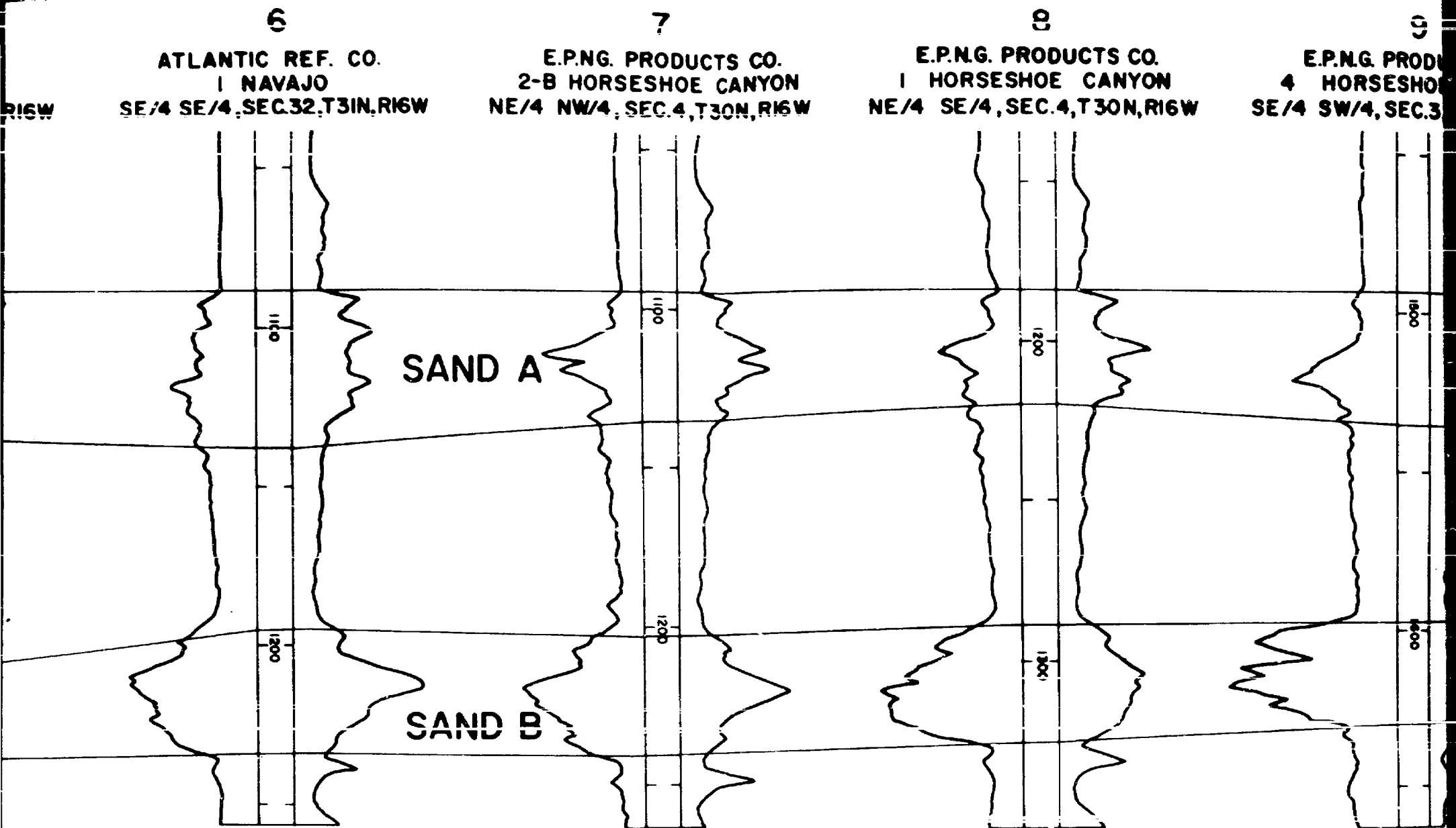


3

4

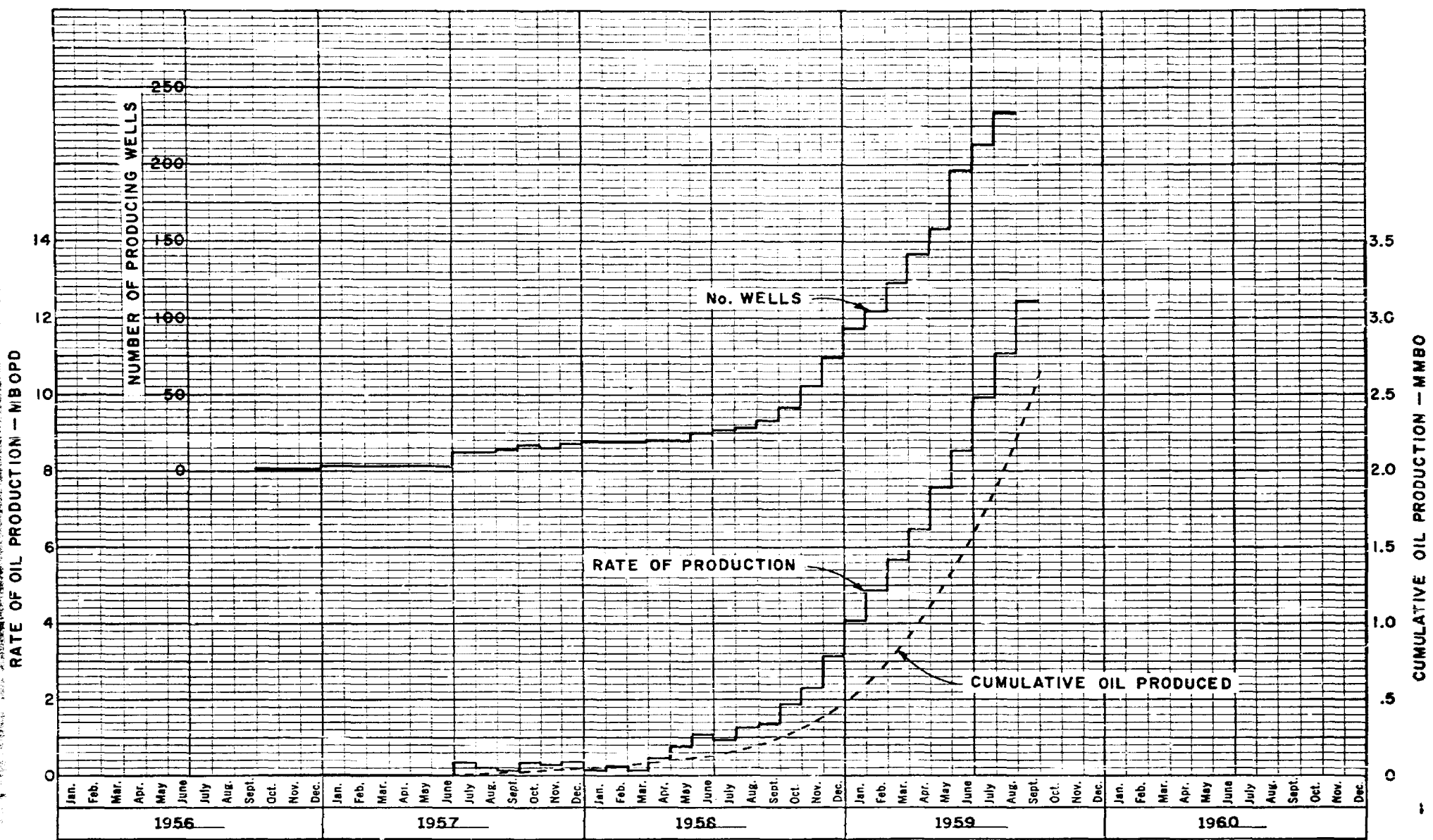


CROSS SECTION A-A' WITH HORIZONTAL SCALE





PERFORMANCE HISTORY  
HORSESHOE GALLUP OIL FIELD  
UPPER AND LOWER TOCITO



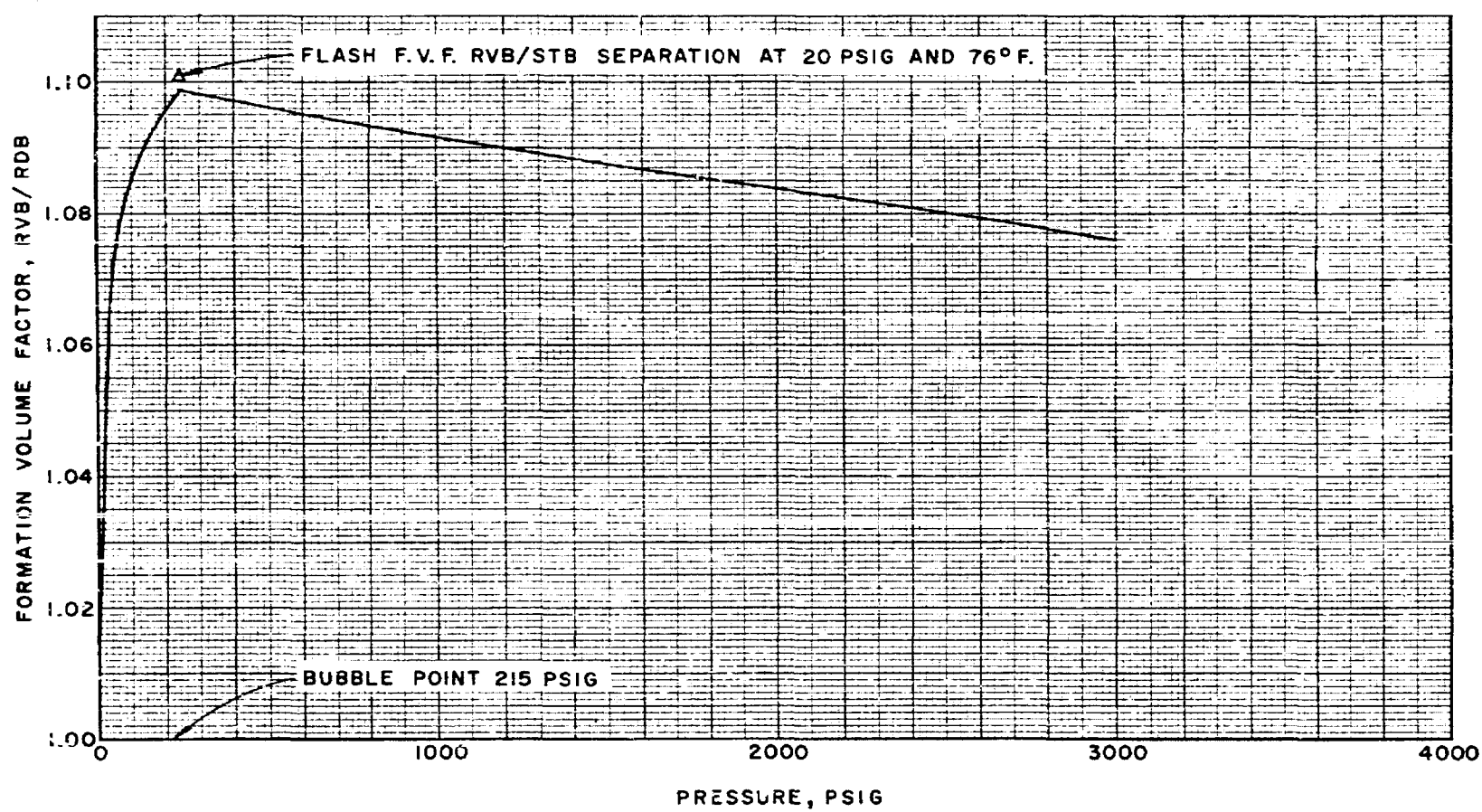
HORSESHOE-GALLUP FIELD

SUMMARY OF FLUID PROPERTIES

Original Reservoir Pressure	215 psig at +4175 datum
Saturation Pressure	215 psig at + 4175 datum
Reservoir Temperature	87 °F
Solution Gas-Oil Ratio	147 SCF/STB
Formation Volume Factor at 215 psig	1.10 rvb/STB
Crude Oil Gravity at 60 °F	42 °API
Oil Viscosity at 215 psig and 87 °F	1.63 cp.
Water Viscosity at 87 °F	0.88 cp.
Oil Compressibility at 87 °F	$7 \times 10^{-6}$ vol/vol/psi slightly above bubble point
	$4.6 \times 10^{-3}$ vol/vol/psi slightly below bubble point

# FORMATION VOLUME FACTORS

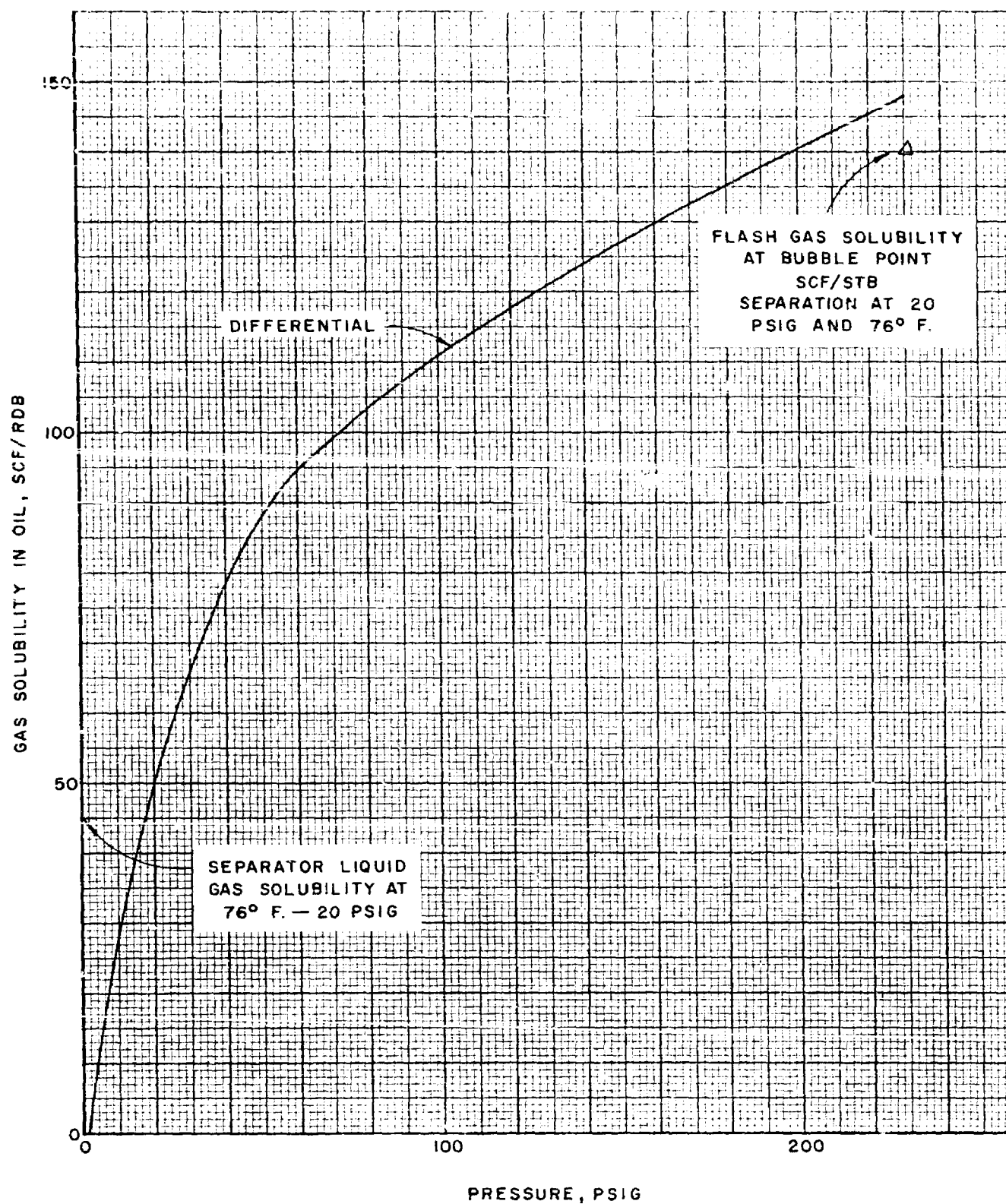
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GALLUP SAND  
HORSESHOE - GALLUP FIELD  
SAN JUAN COUNTY, NEW MEXICO





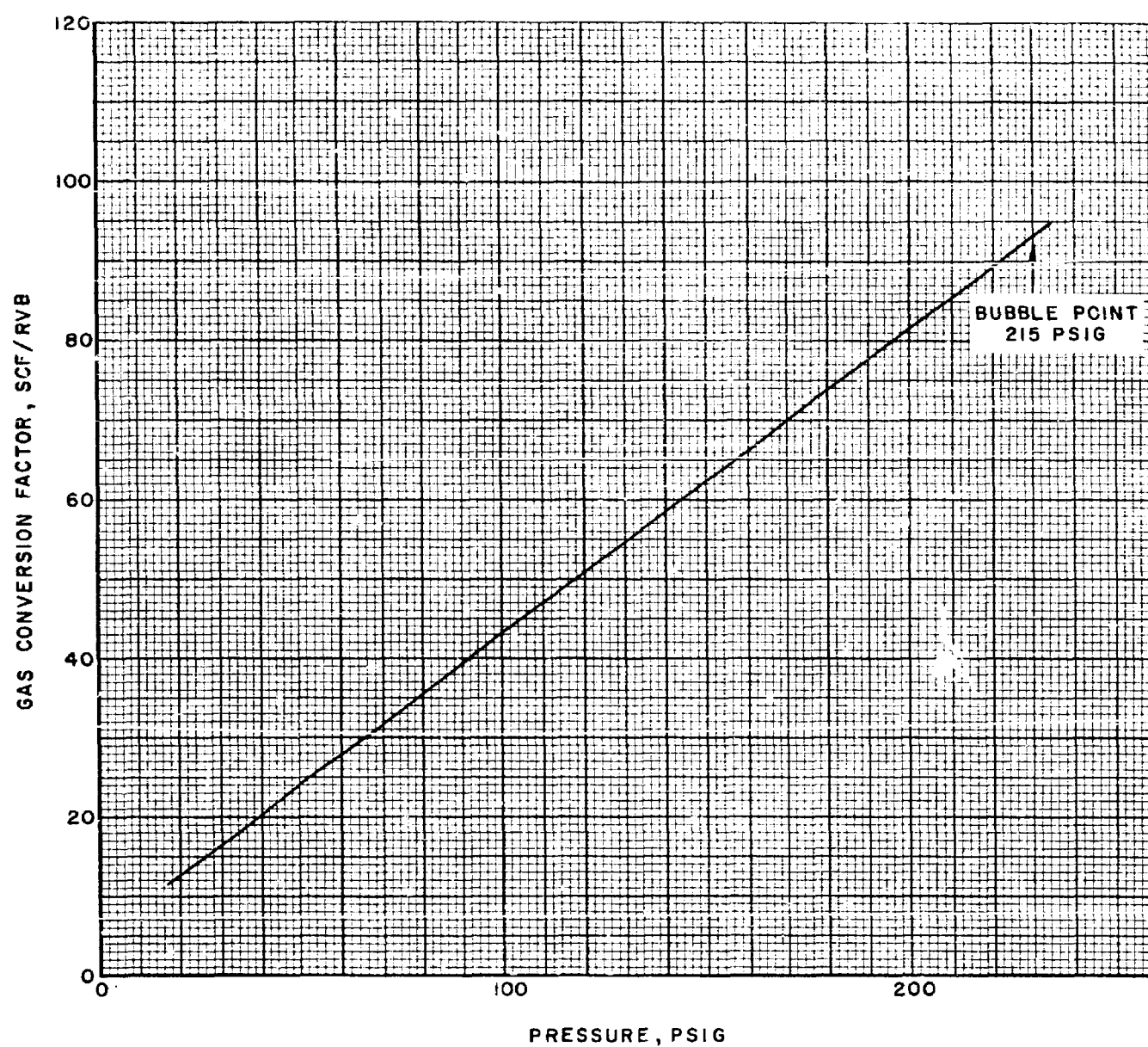
TOTAL SOLUTION GAS SOLUBILITIES AND  
GAS SOLUBILITY IN SEPARATOR LIQUID

NAVAJO NO 5 WELL  
GALLUP SAND  
HORSESHOE - GALLUP FIELD  
SAN JUAN COUNTY, NEW MEXICO



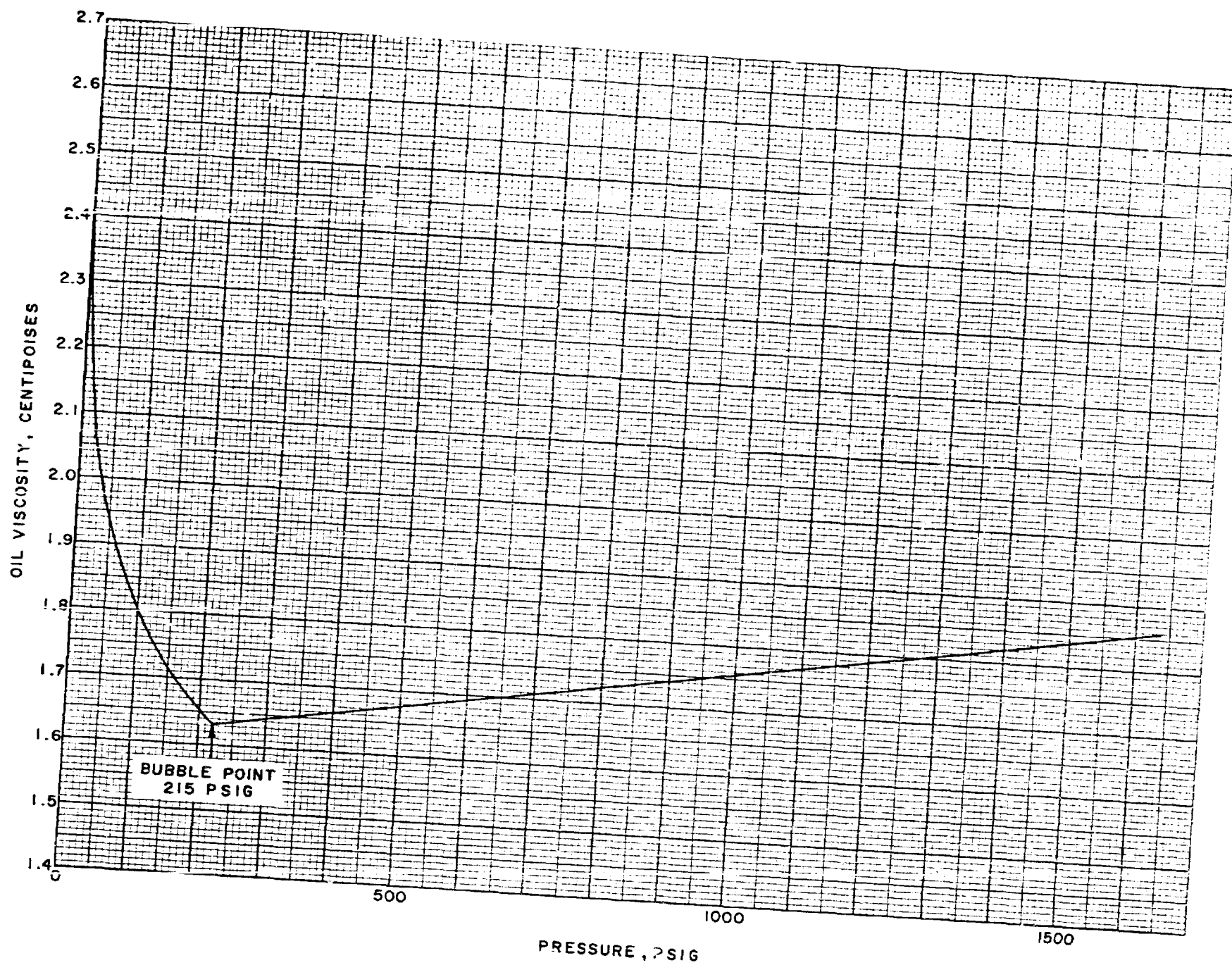
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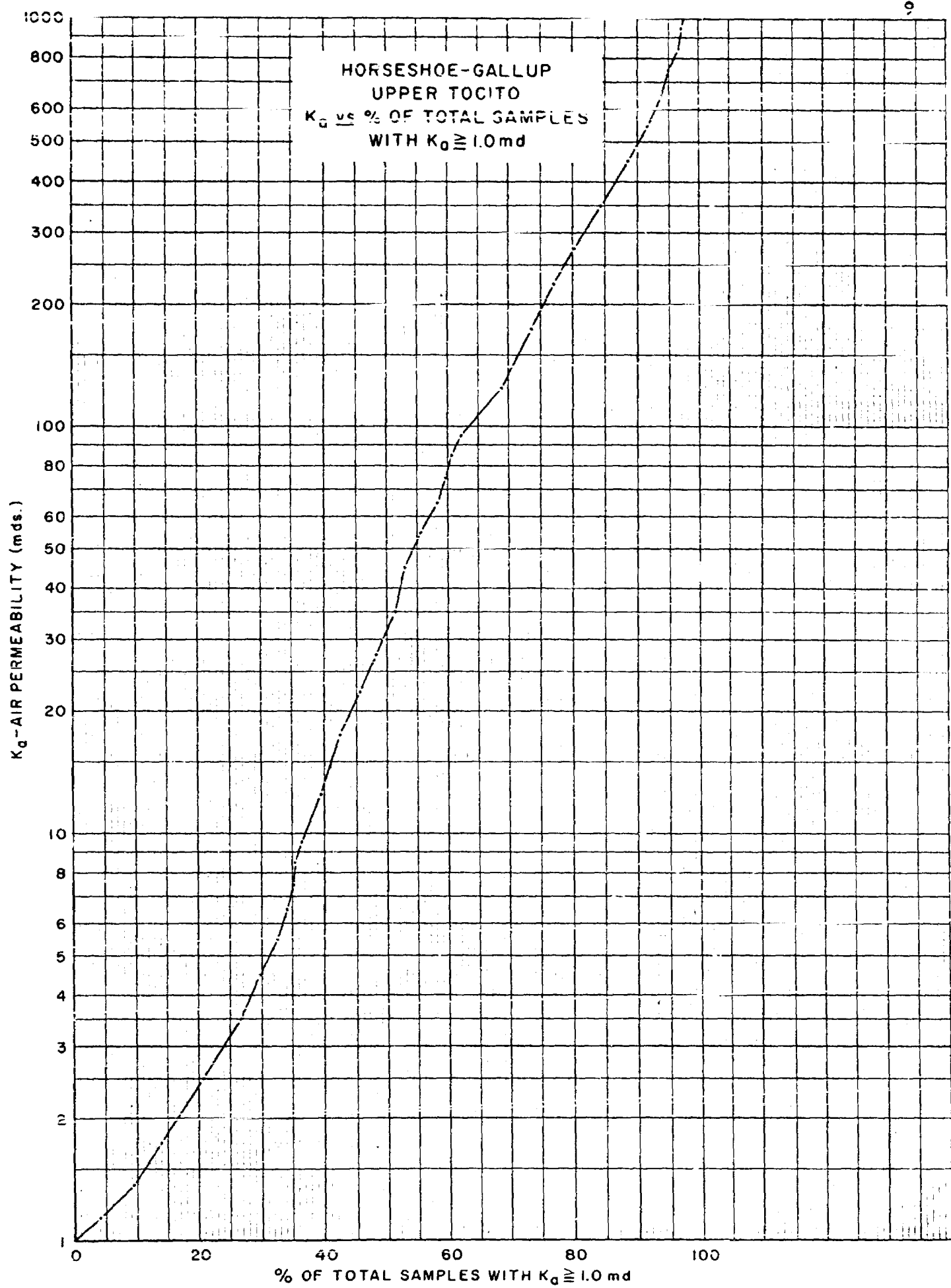
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GALLUP SAND  
HORSESHOE - GALLUP FIELD  
SAN JUAN COUNTY, NEW MEXICO

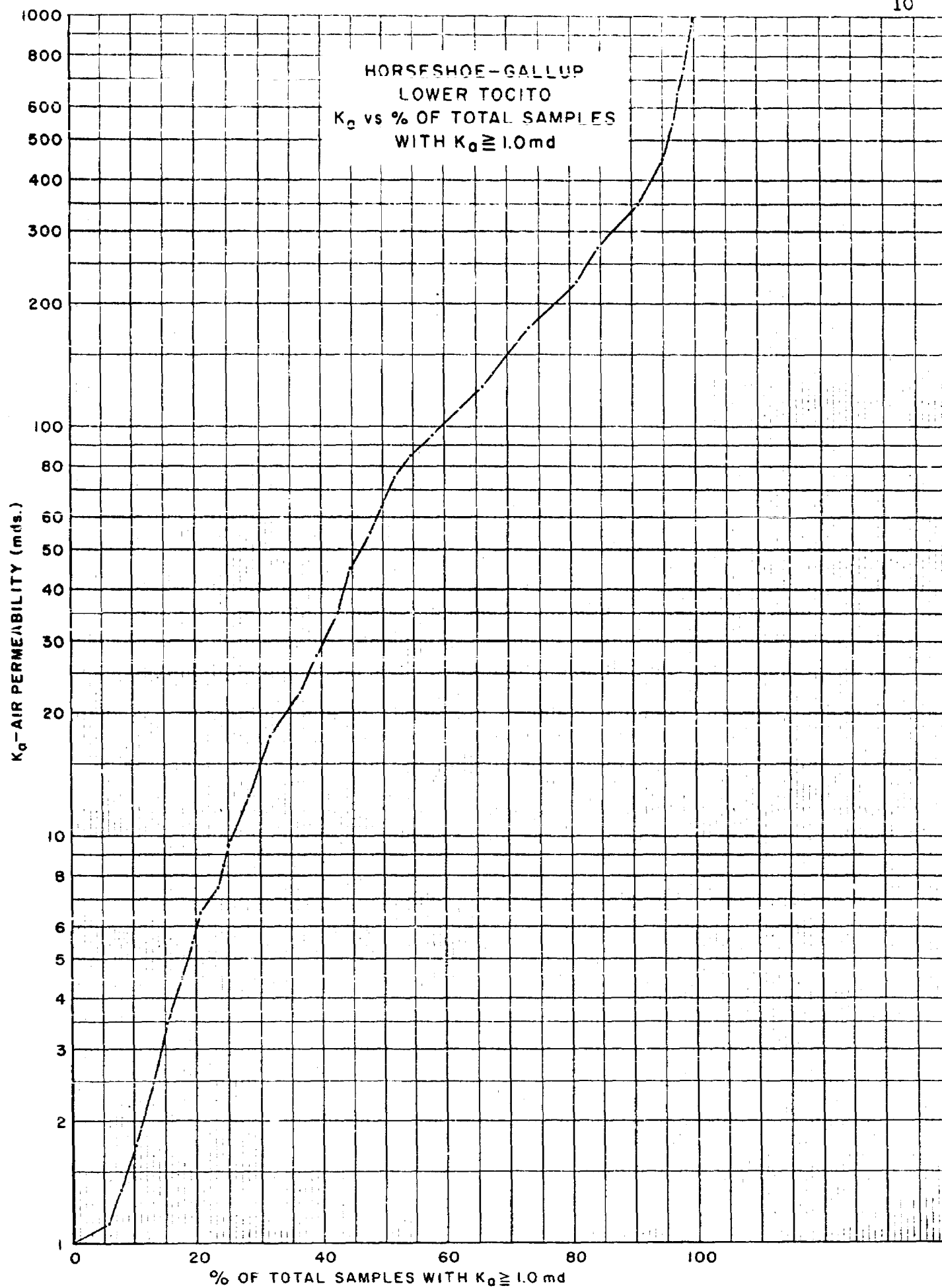


# OIL VISCOSITY

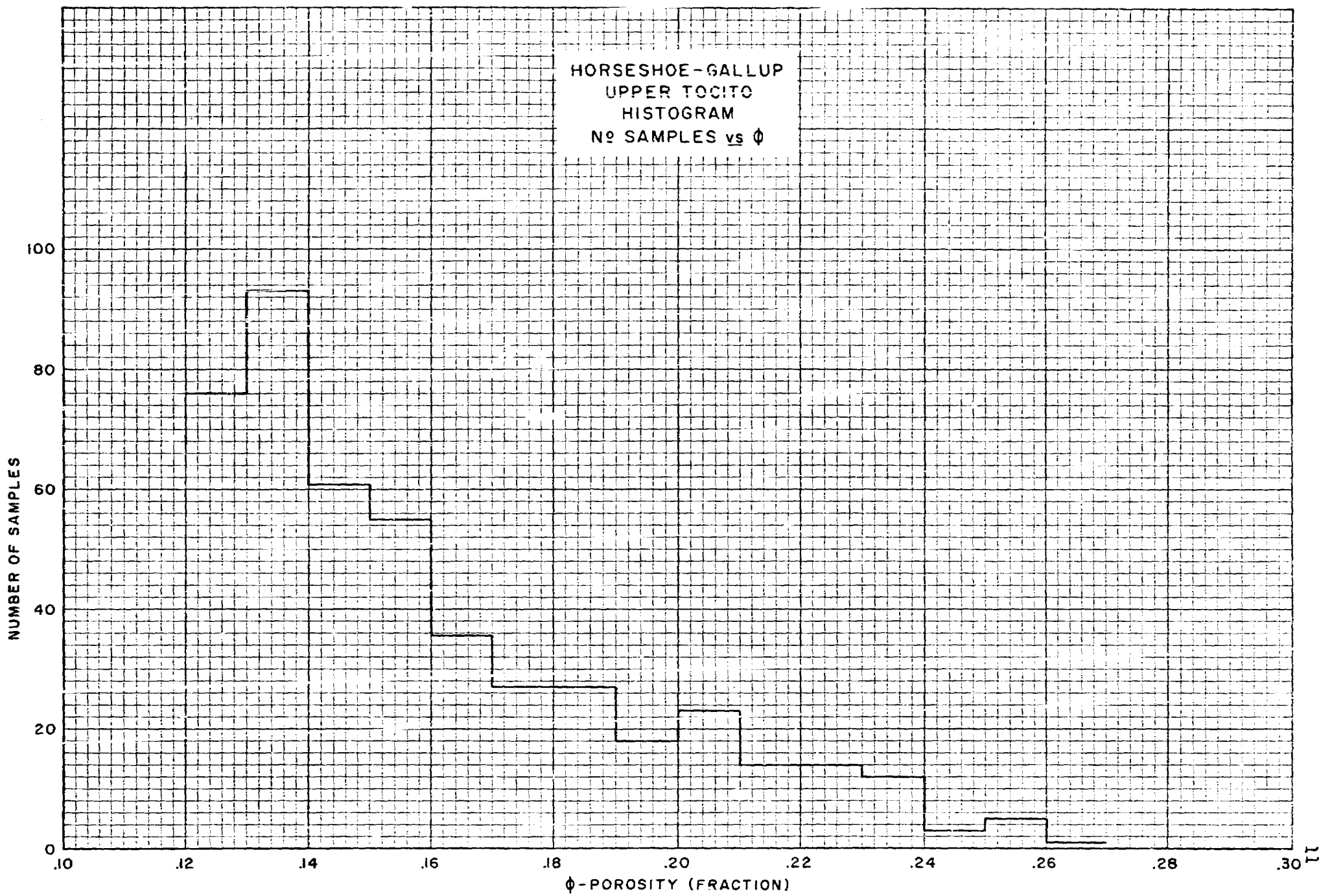
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GALLUP SAND  
HORSESHOE - GALLUP FIELD  
SAN JUAN COUNTY, NEW MEXICO

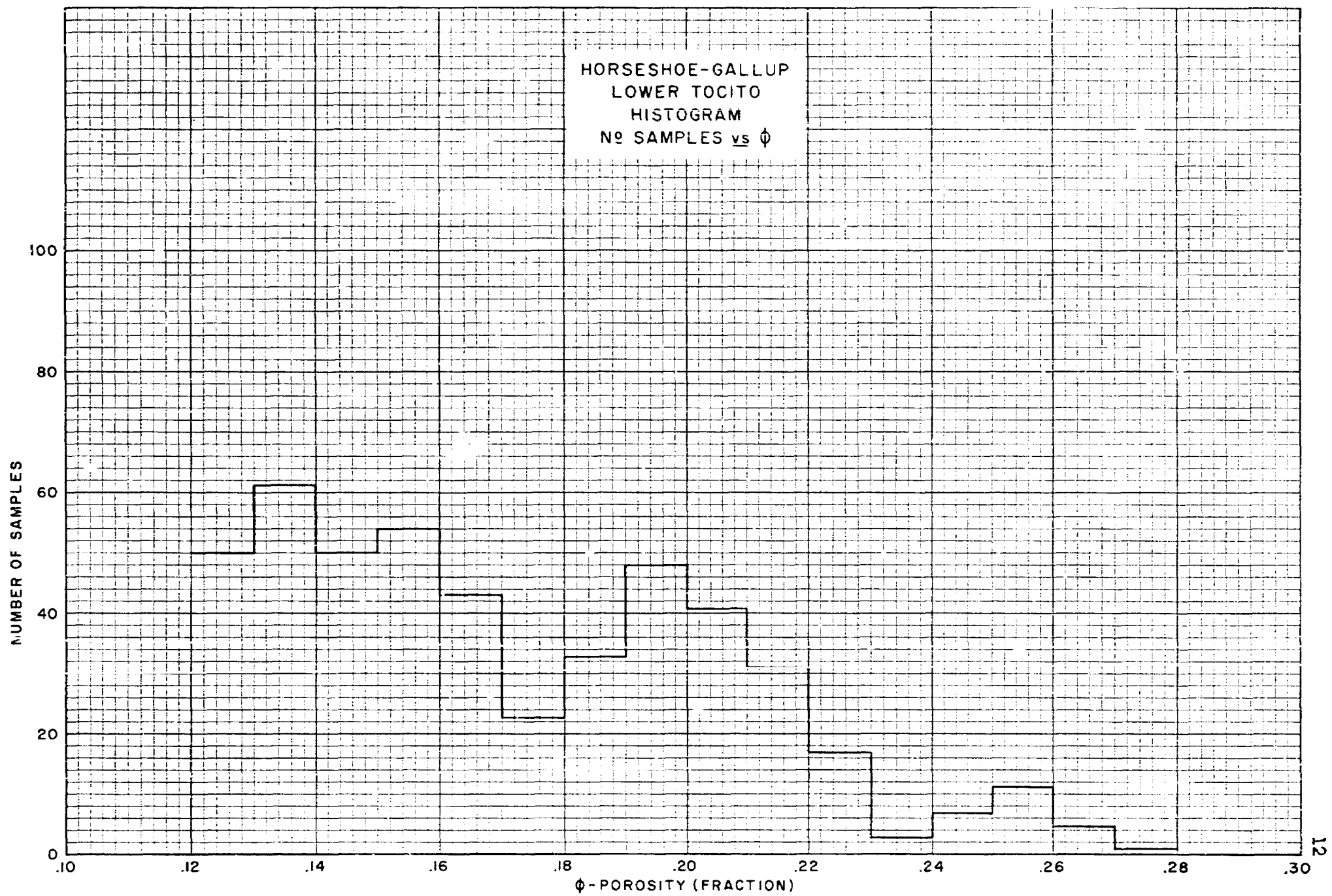




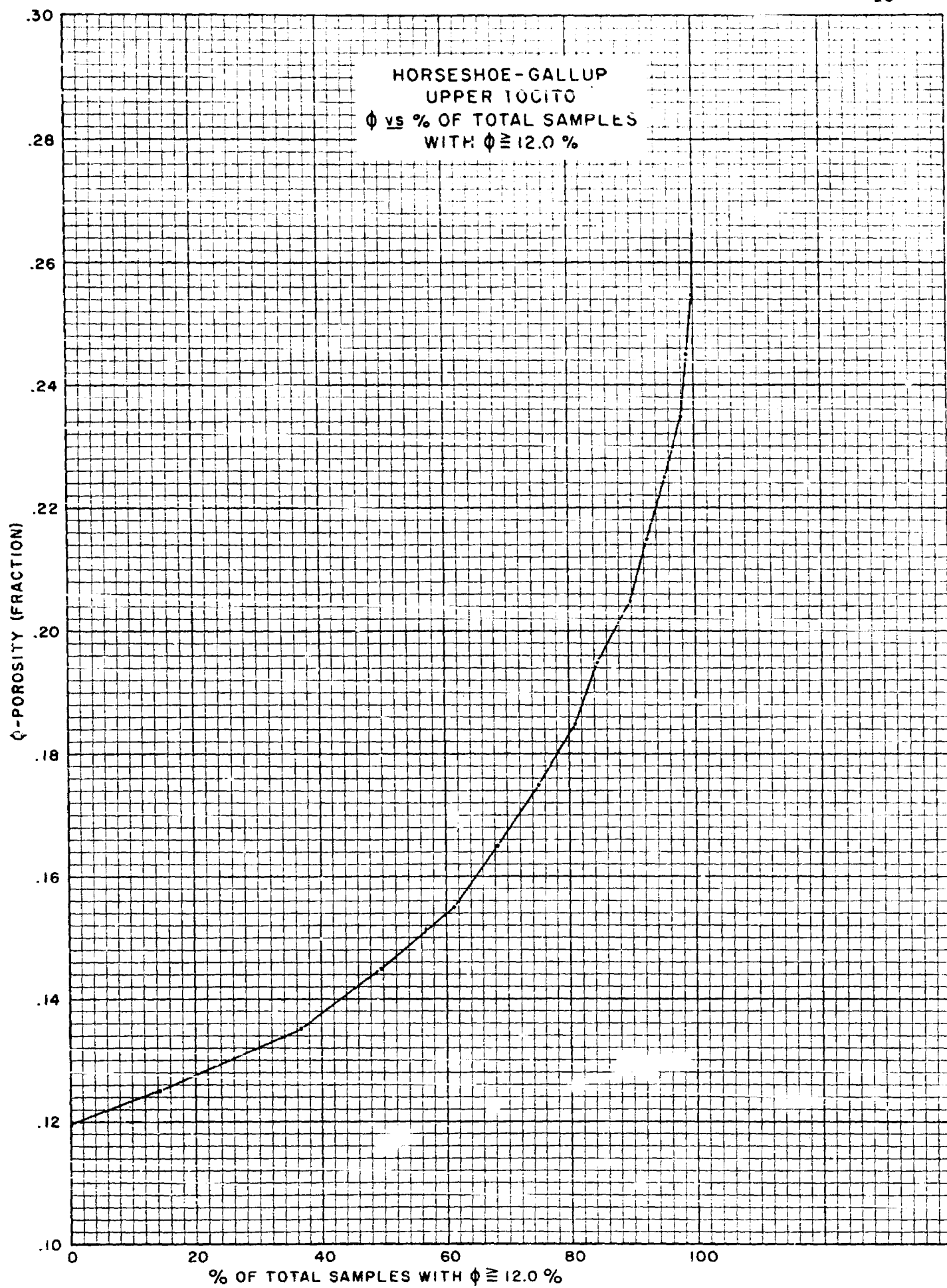


HORSESHOE-GALLUP  
UPPER TOCITO  
HISTOGRAM  
No SAMPLES vs  $\phi$

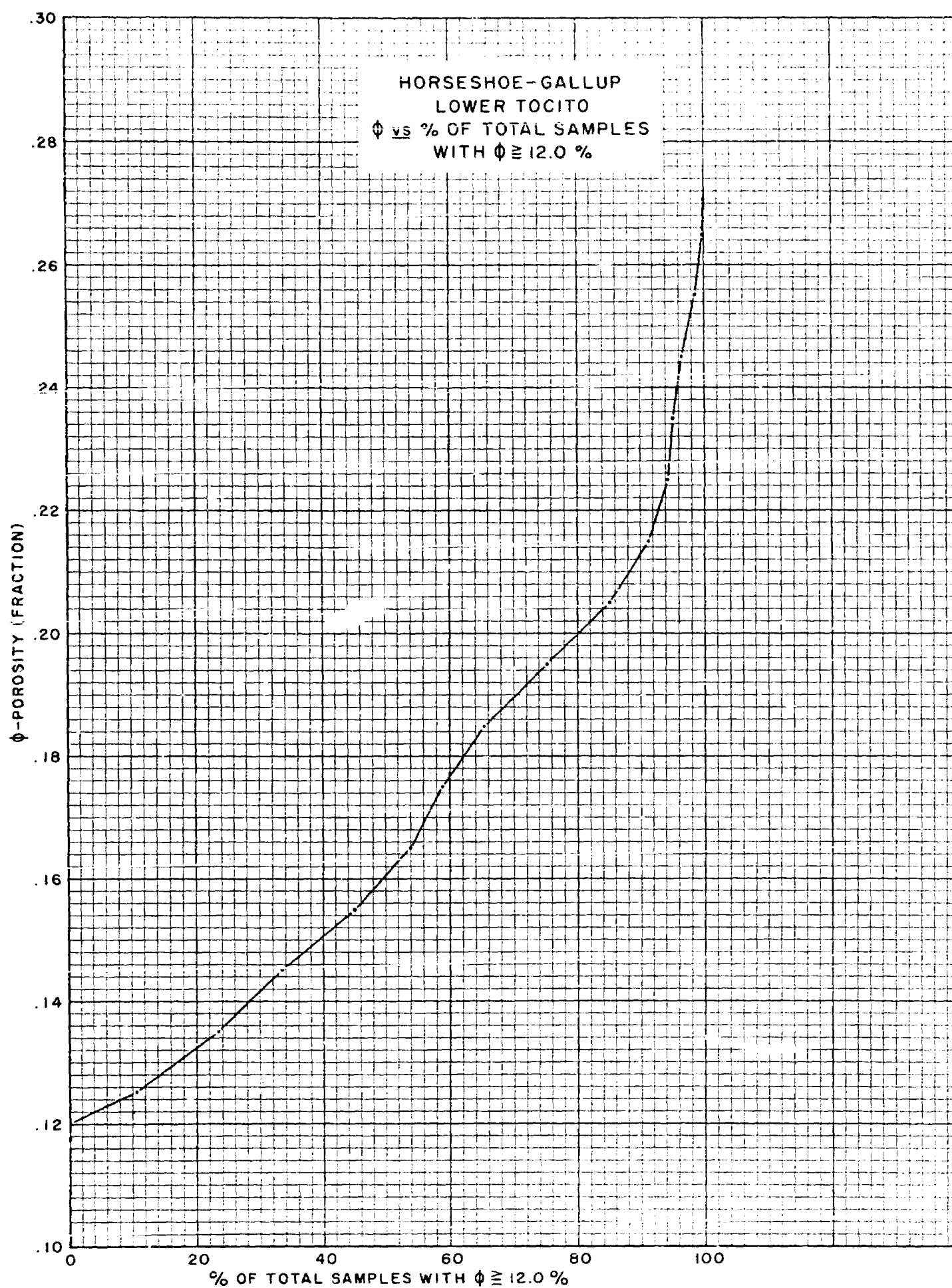


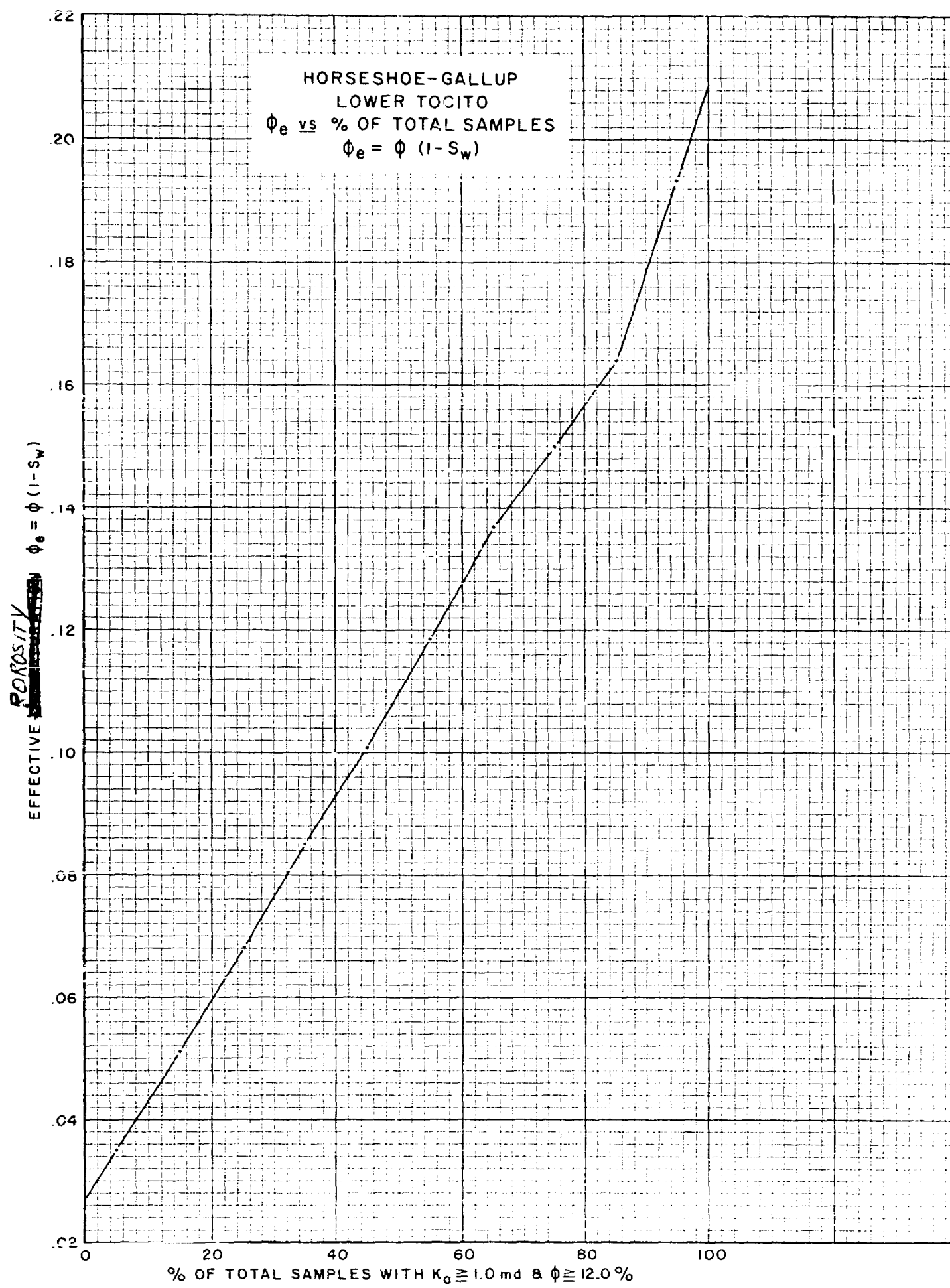


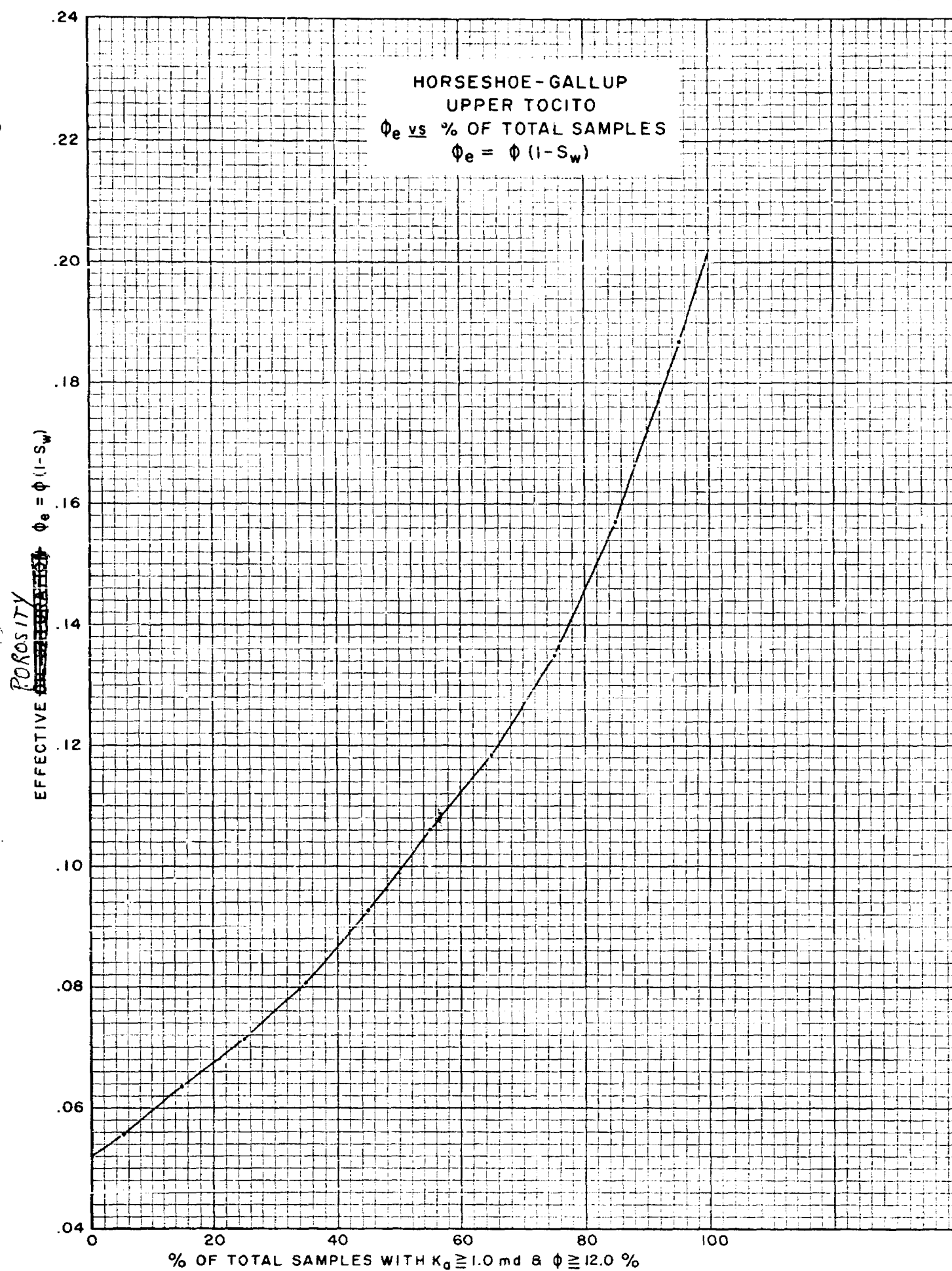




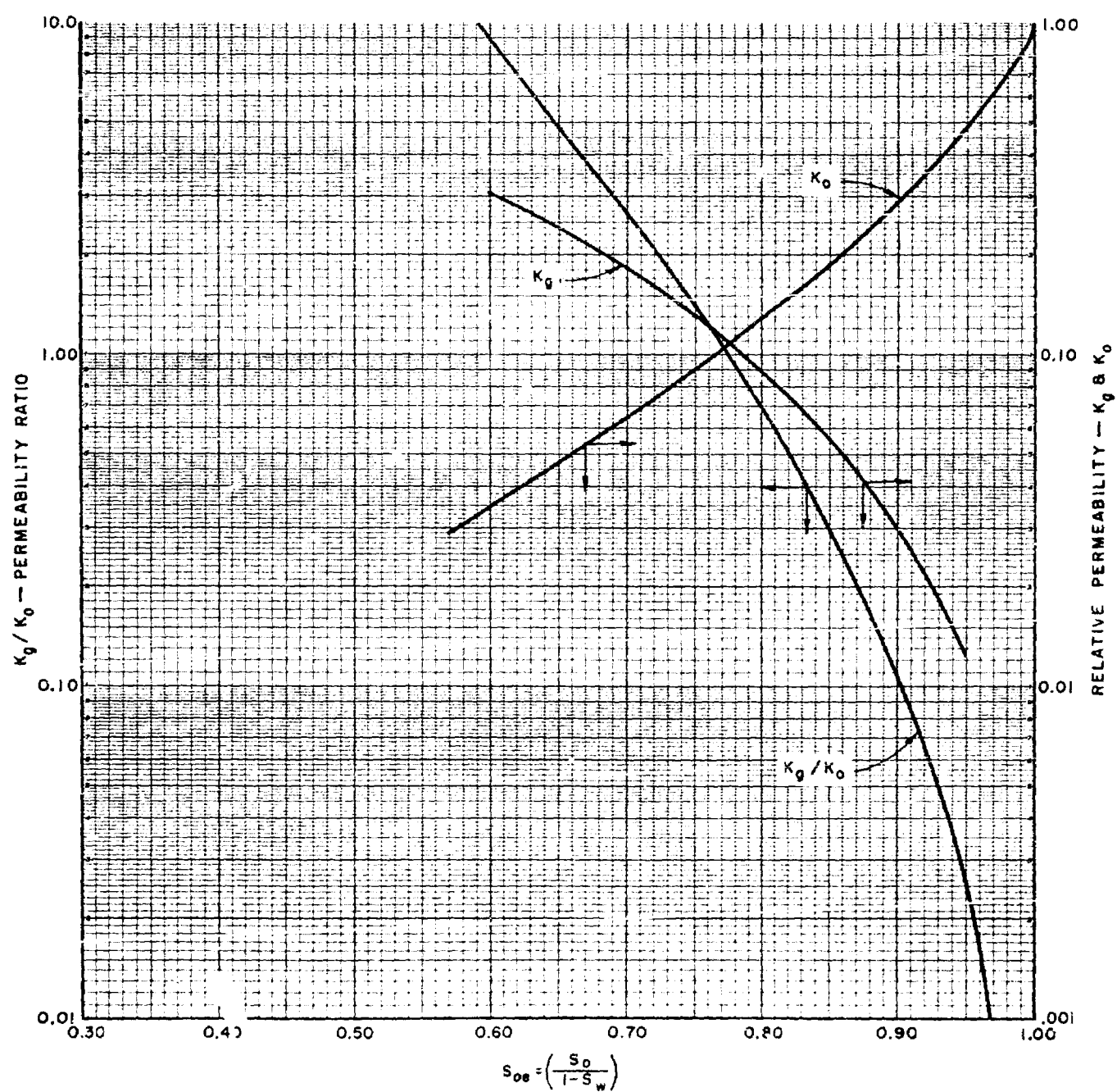








HORSESHOE GALLUP AVERAGE  
RELATIVE PERMEABILITY CURVE  
UPPER AND LOWER TOCITO

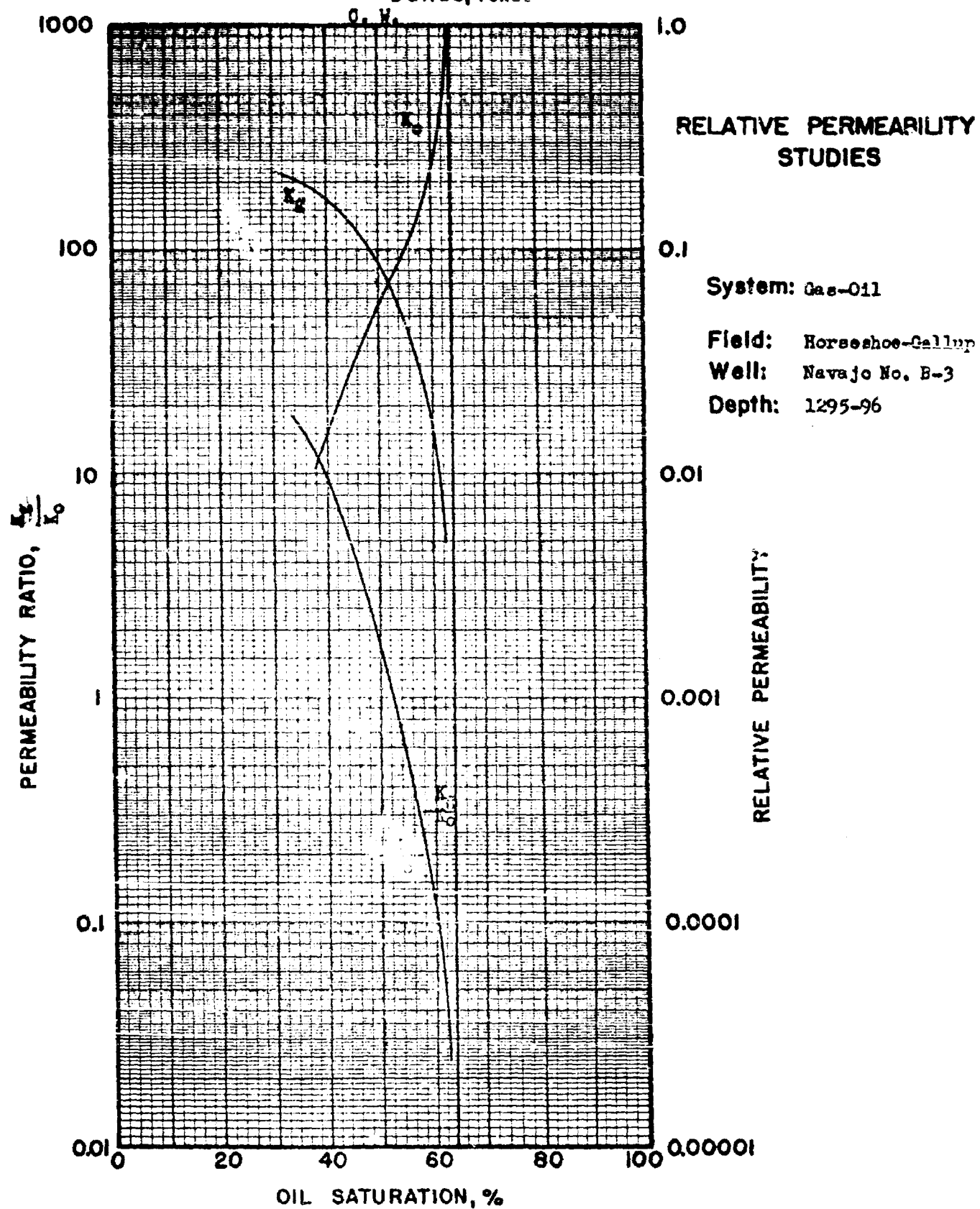


## THE ATLANTIC REFINING COMPANY

PETROLEUM ENGINEERING SECTION

CHEMICAL ENGINEERING GROUP

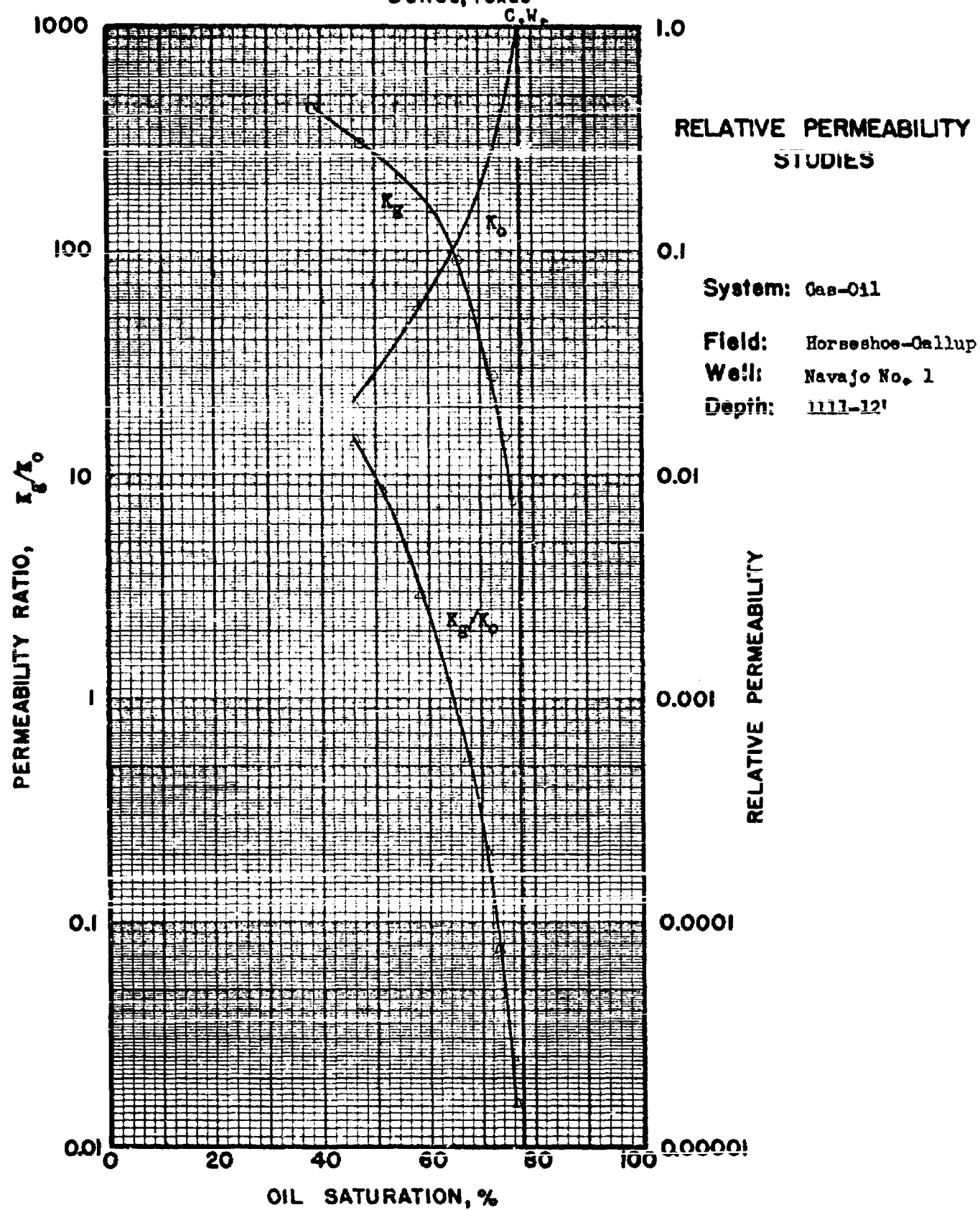
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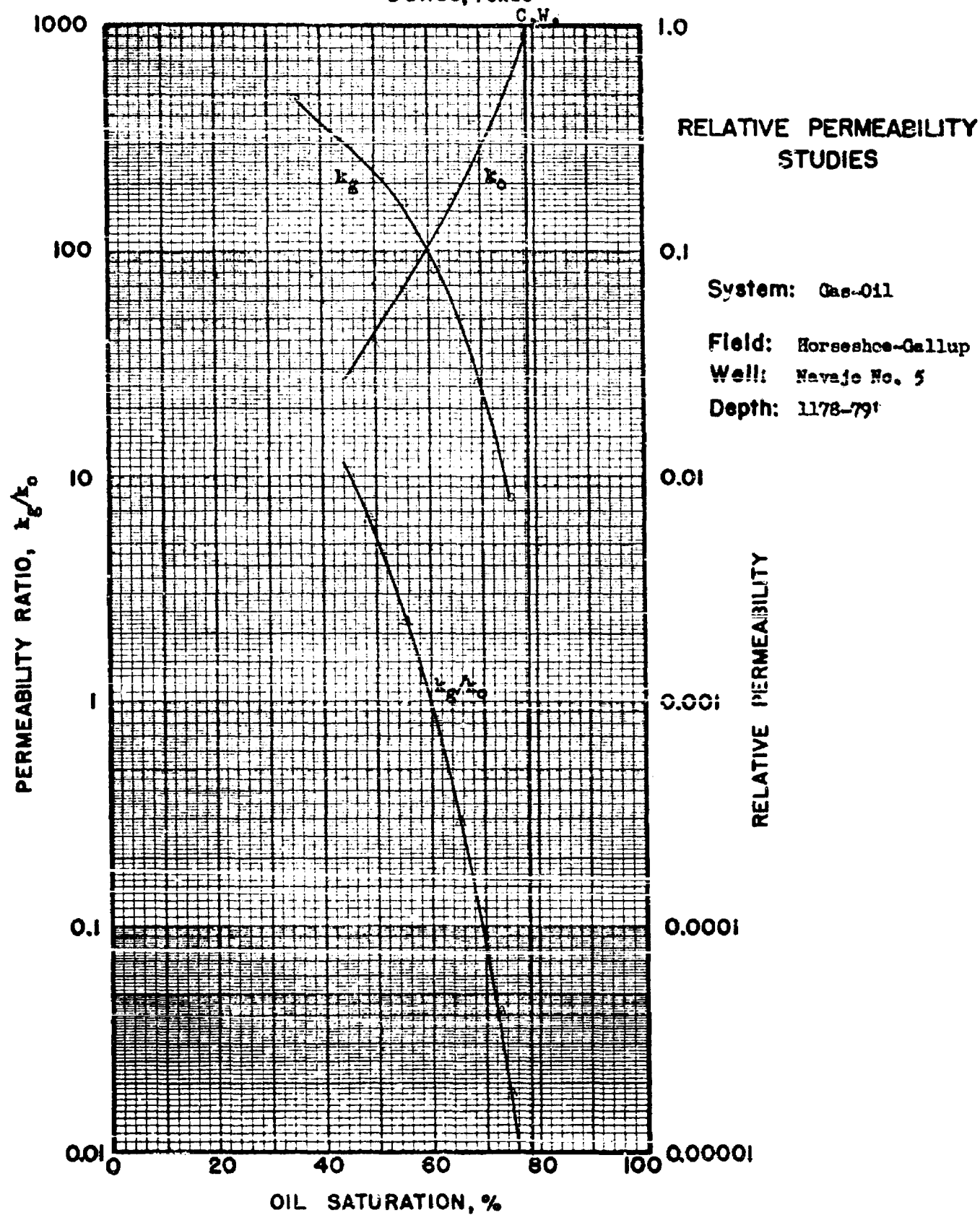
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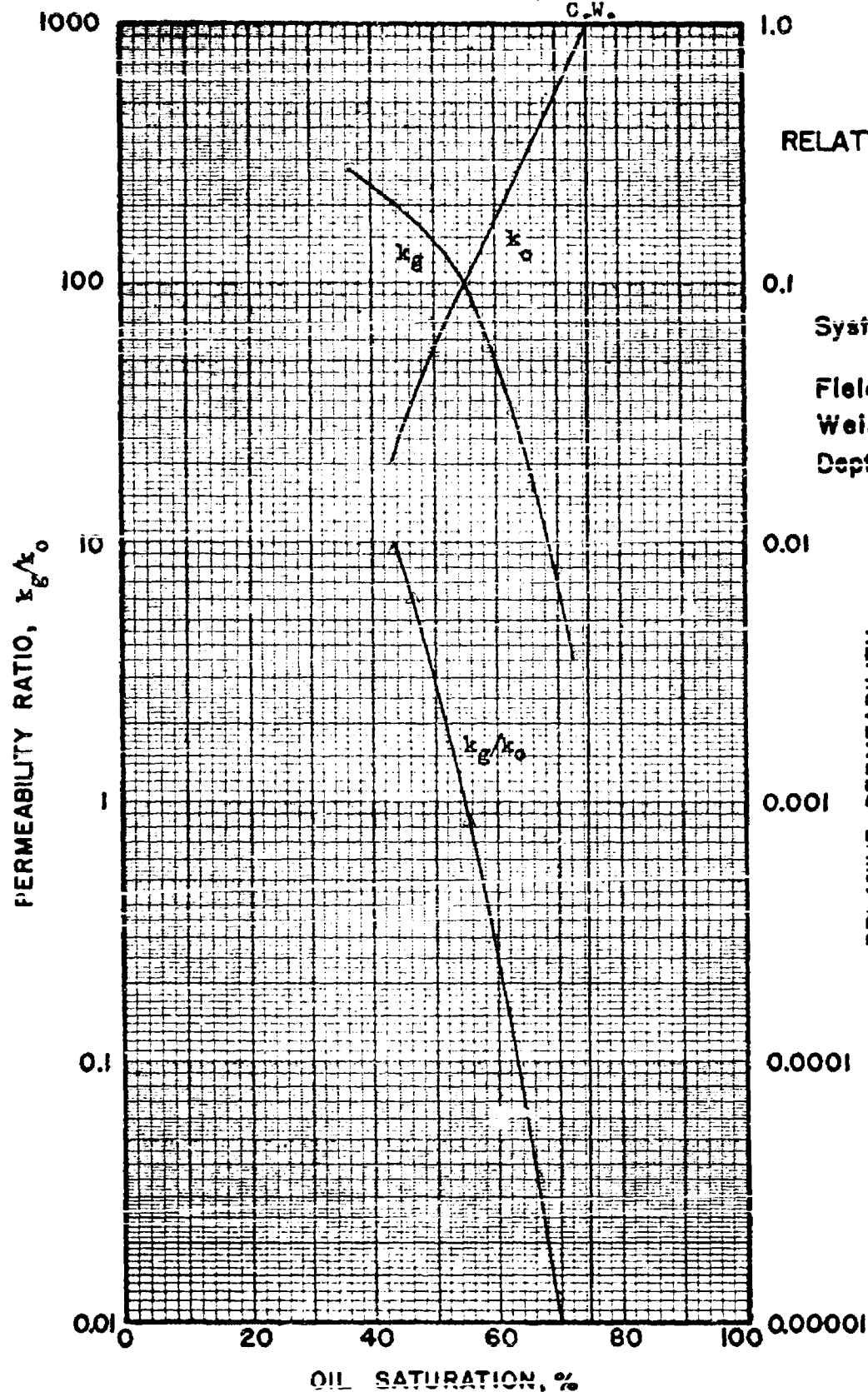


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Dallas, Texas

C.W.



## RELATIVE PERMEABILITY STUDIES

System: Gas-Oil

Field: Horseshoe-Gallup

Well: Navajo No. 1

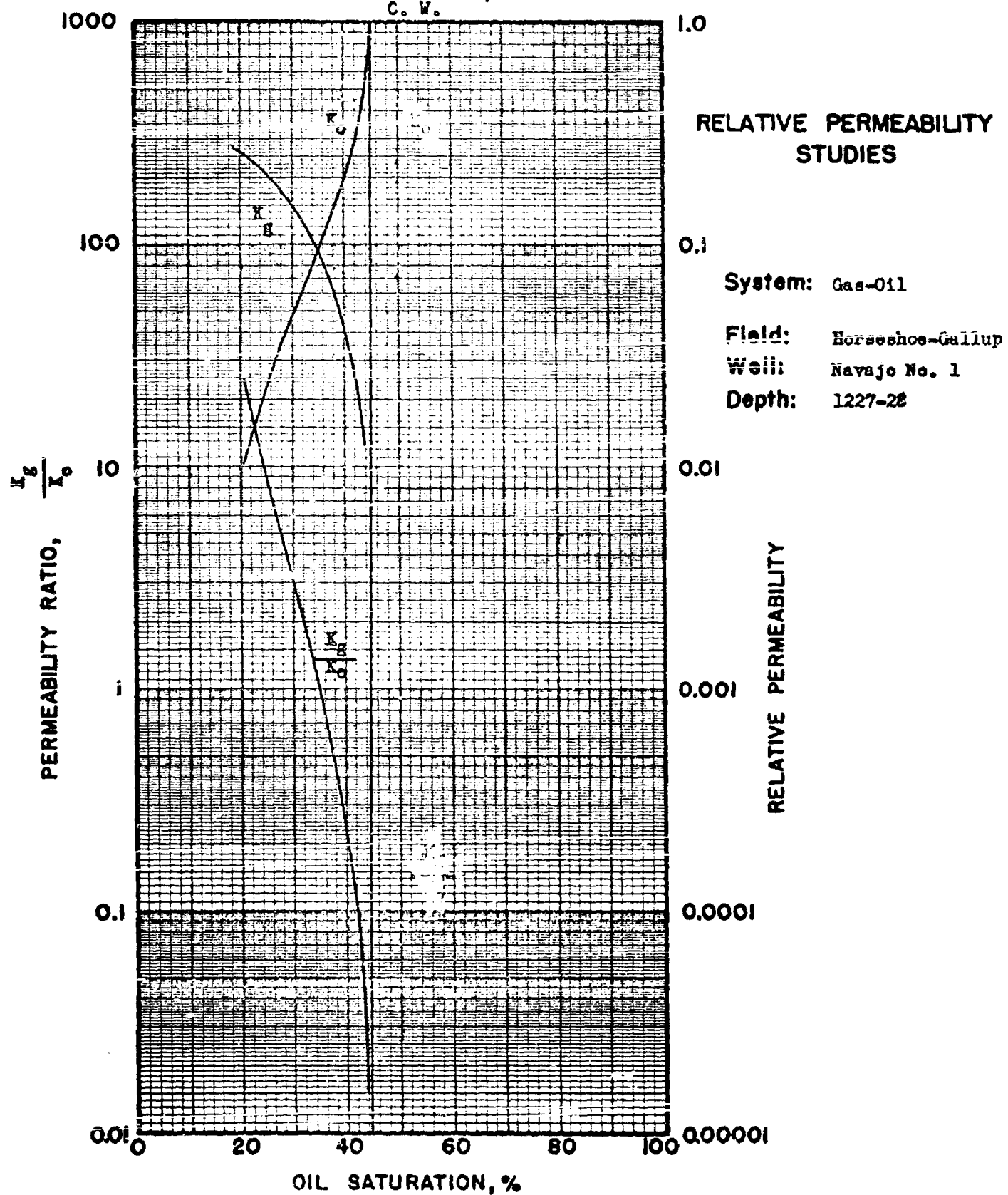
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Dallas, Texas  
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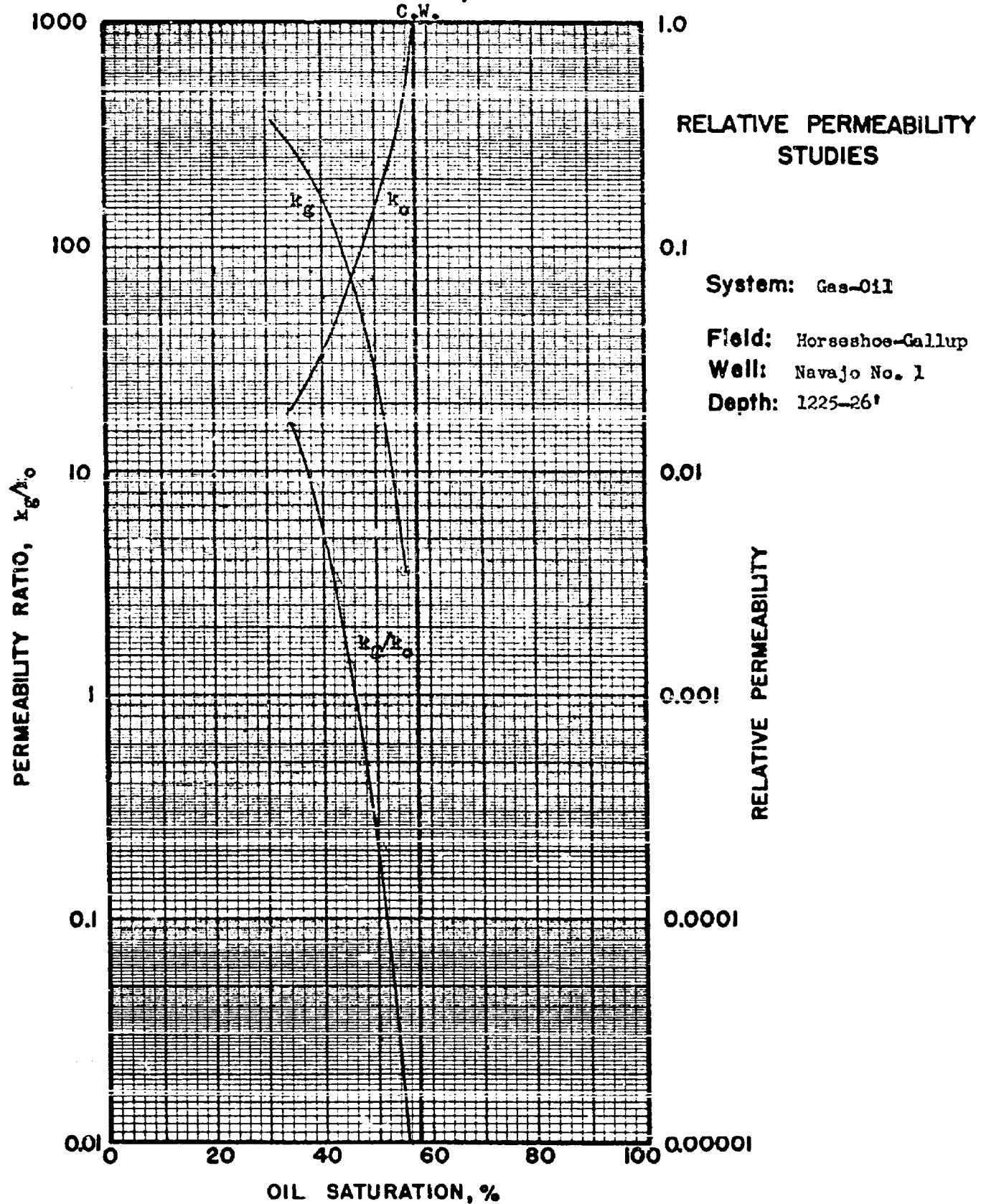


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Dallas, Texas

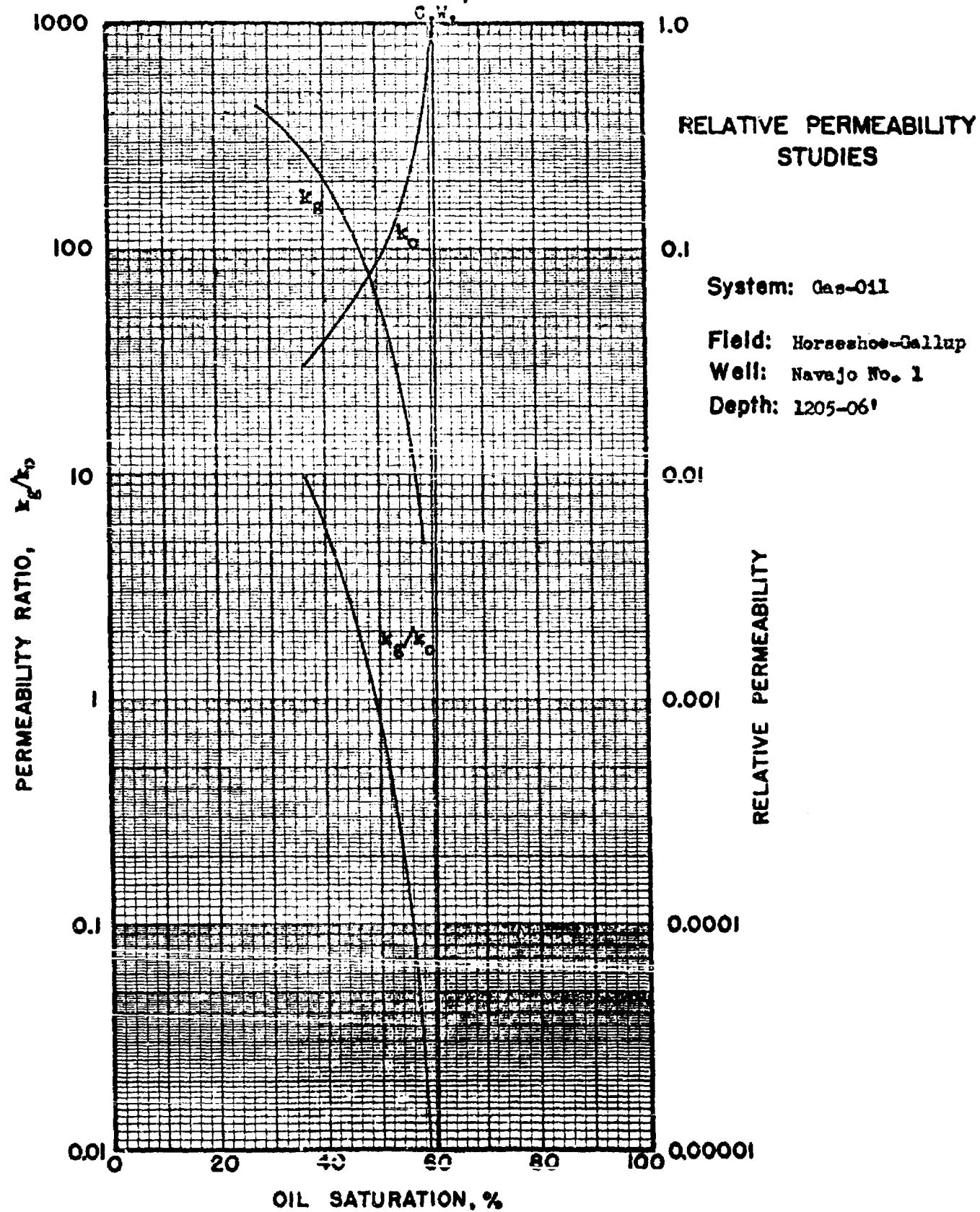
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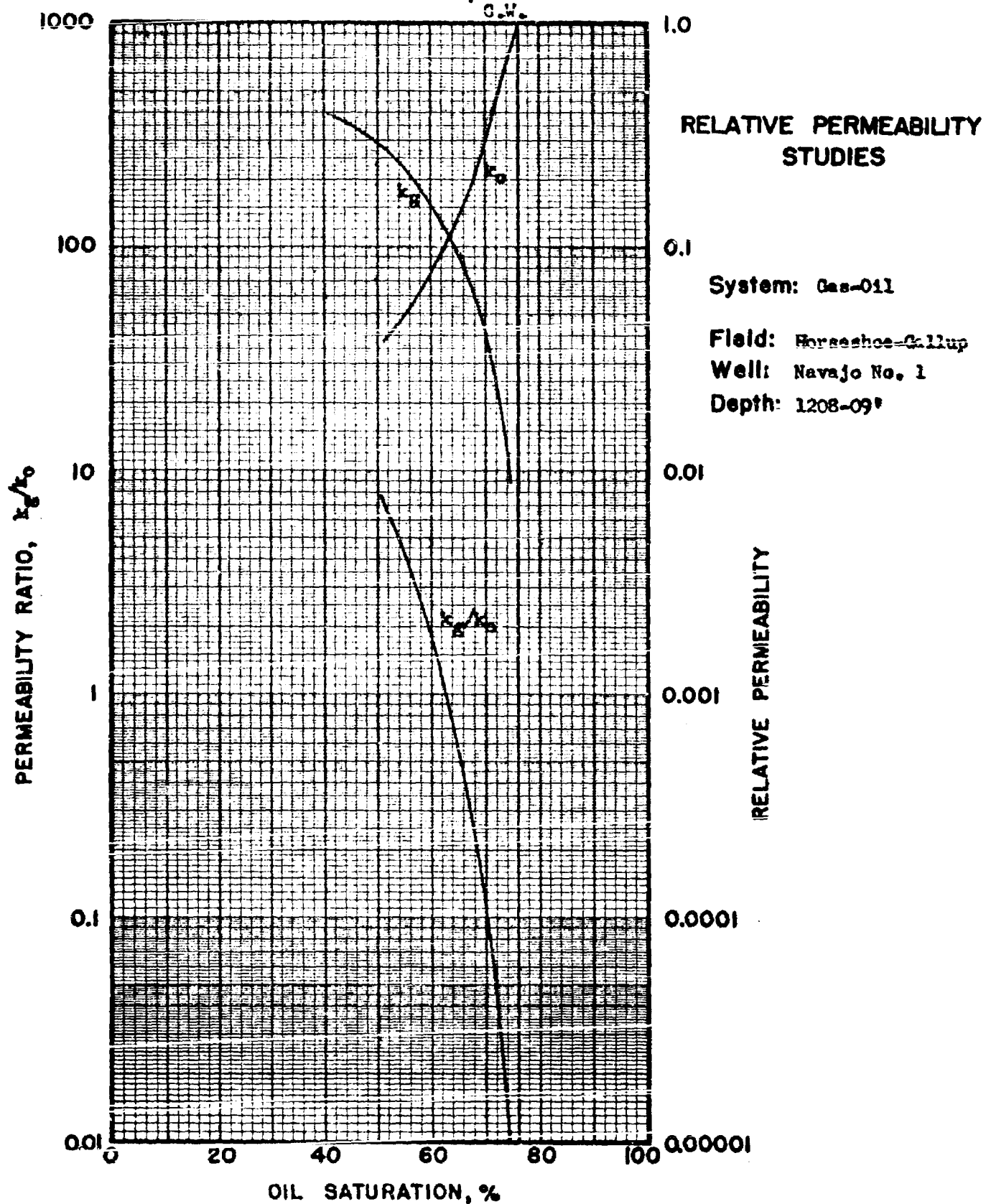
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Dallas, Texas

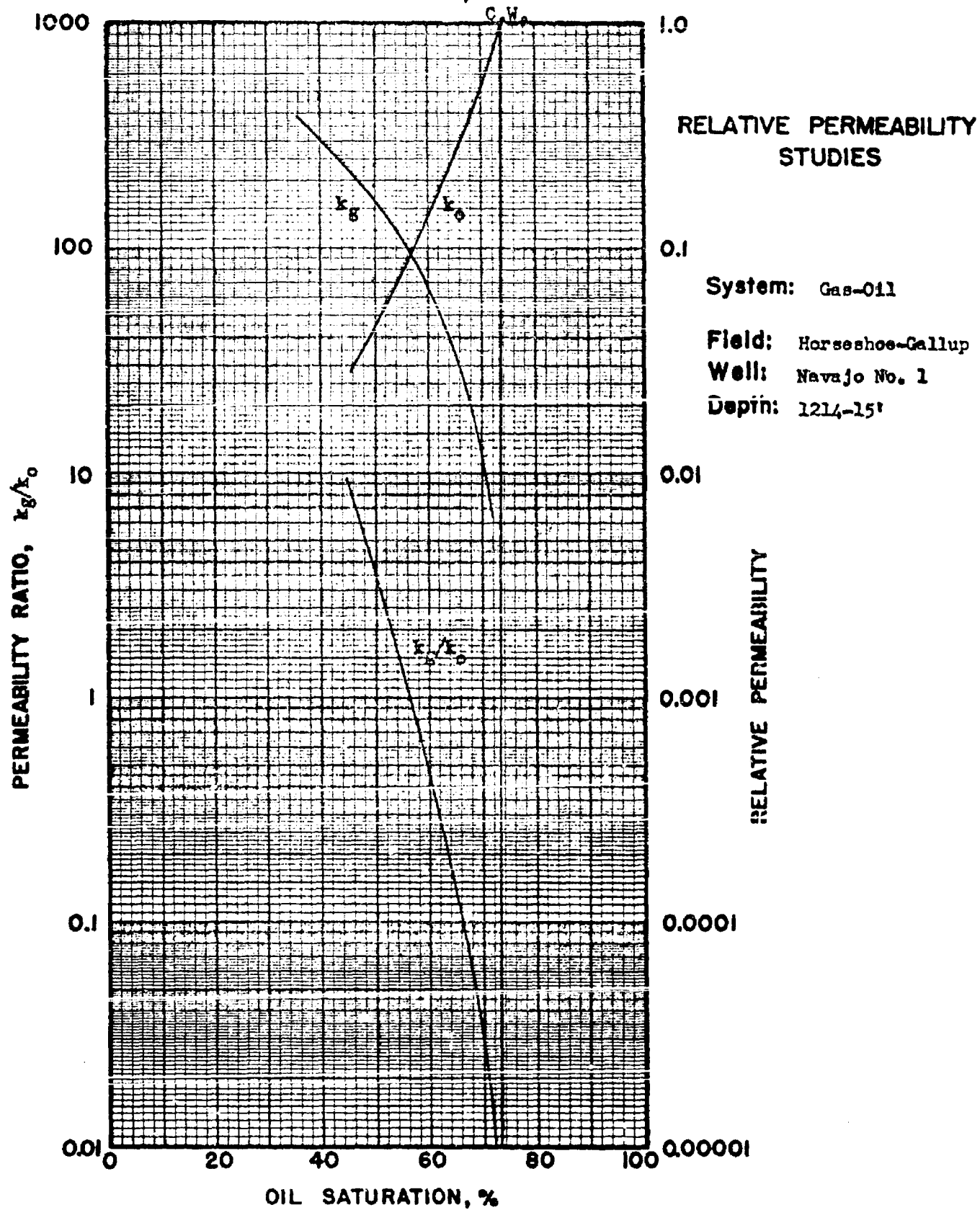
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Dallas, Texas



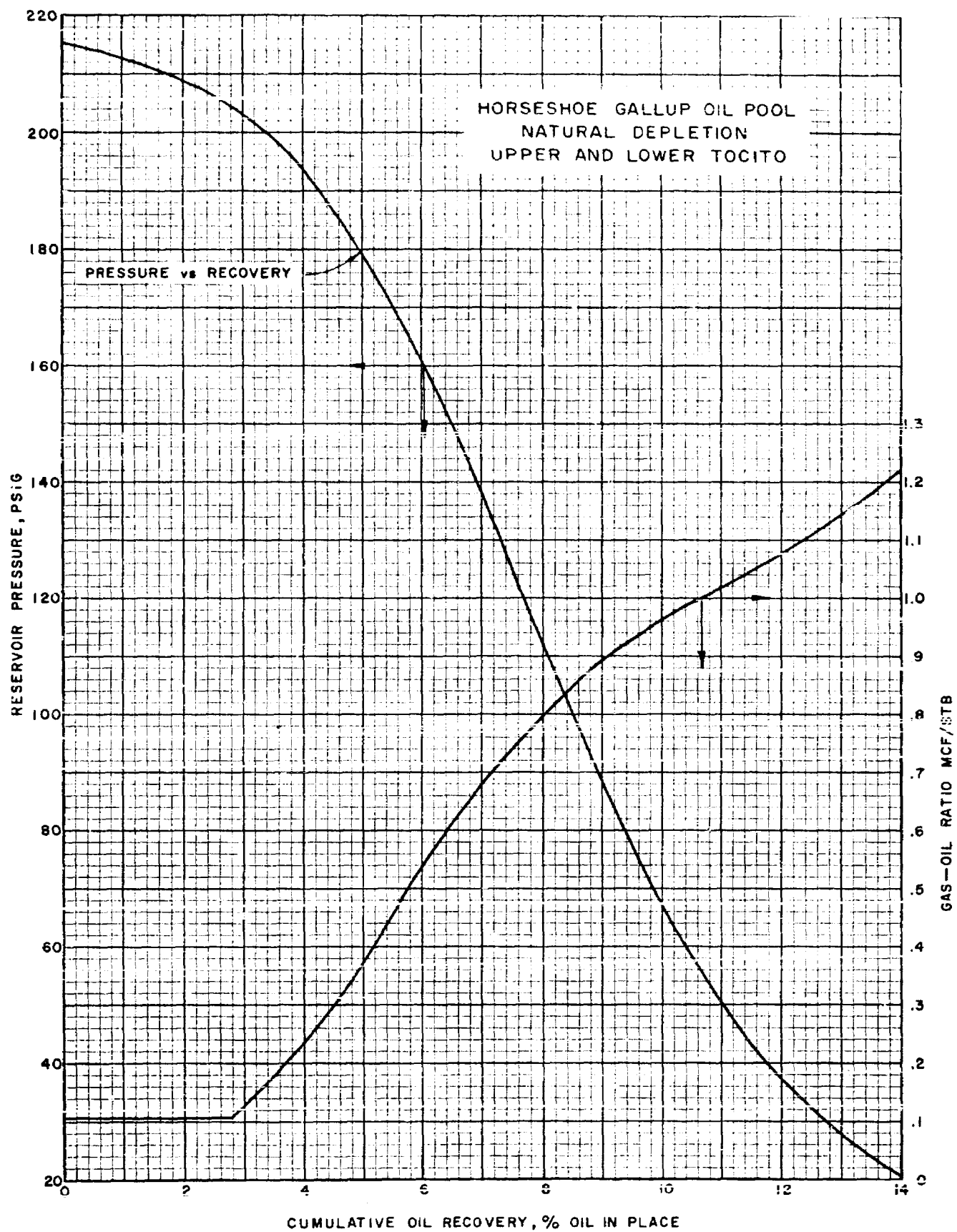
CHEMICAL ENGINEERING GROUP  
RESTORED STATE LABORATORY  
DATA SUMMARY

SUBJECT: Fresh Core Waterflood Results

WELL: Navajo #5                      STATE: New Mexico  
FIELD: Horseshoe Gallup            COUNTY: San Juan                      FORMATION: Tocito (Gallup)

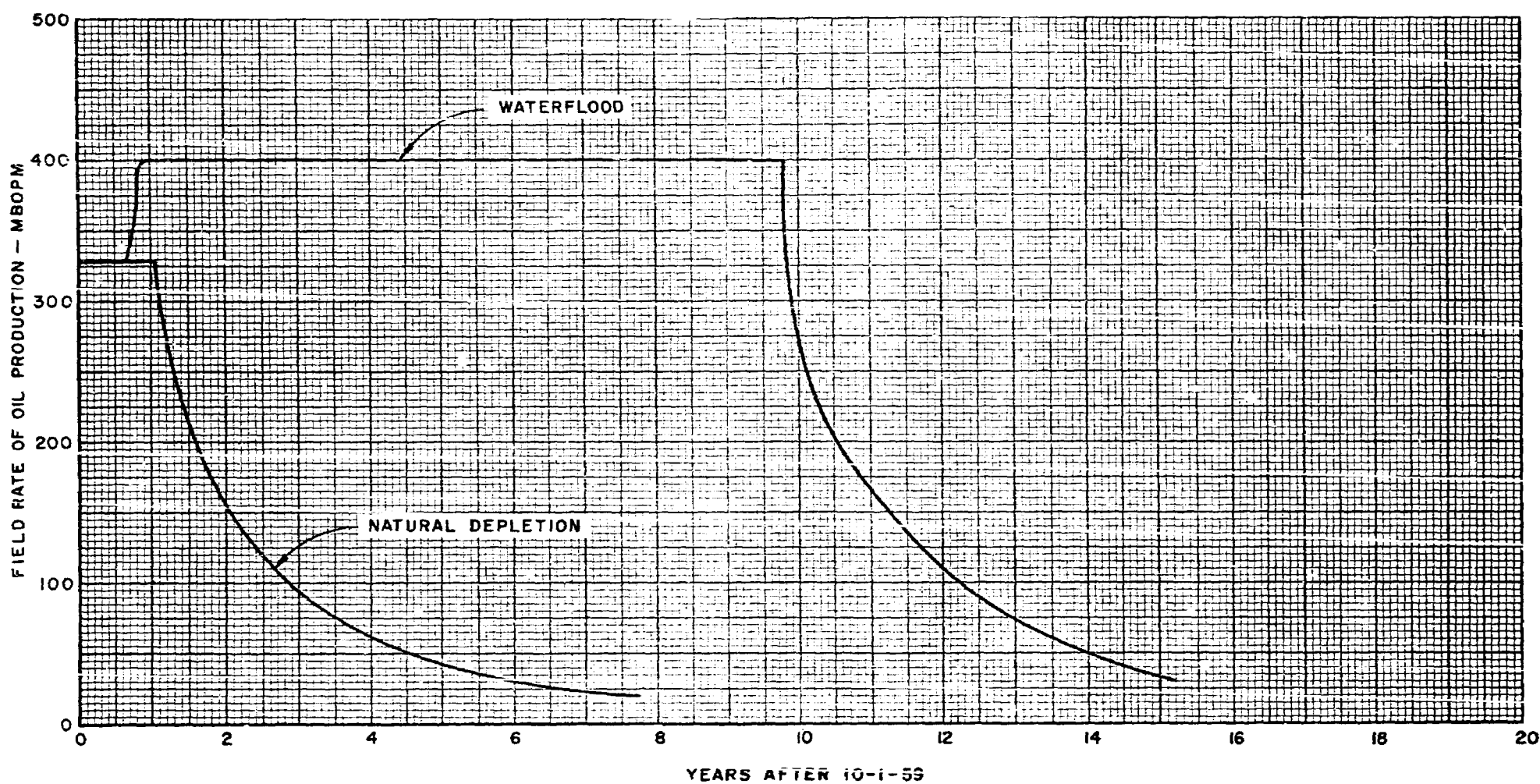
Depth, Ft.	Permeability, md.			Porosity, %	Interstitial Water %, After Centrifuge with Oil at 200 psi	Residual Oil to Watertlood % P. V.
	To Air	To Oil at C.W.	To Brine at R.O.			
<u>Upper Tocito</u>						
1165-66	4.6	2.3	.21	11.3	18.4	51.3
1177-78	1128	795	221	17.9	31.5	22.2
1177-78	287	210	72.3	14.2	40.7	29.7
1195-96	1.1	.33	.02	7.1	26.1	52.2
<u>Lower Tocito</u>						
1282-83	50.8	30.1	14.2	18.5	35.2	26.7
1291-92	87.2	47.5	29.3	20.3	31.7	25.1
1297-98	228	119	66.1	21.0	31.3	18.9
1301	260	163	70.3	22.9	36.4	20.7
1281-82	159	98.3	45.7	20.2	16.1	31.6
1286	133	75.5	34.1	21.0	26.7	23.5
1290-91	170	109	56.1	20.8	25.2	27.9
1296-97	147	76.3	44.2	18.0	34.3	26.5
1302	190	105	50.4	19.9	29.4	23.2

$$\gamma_w / \gamma_o = 1.86$$

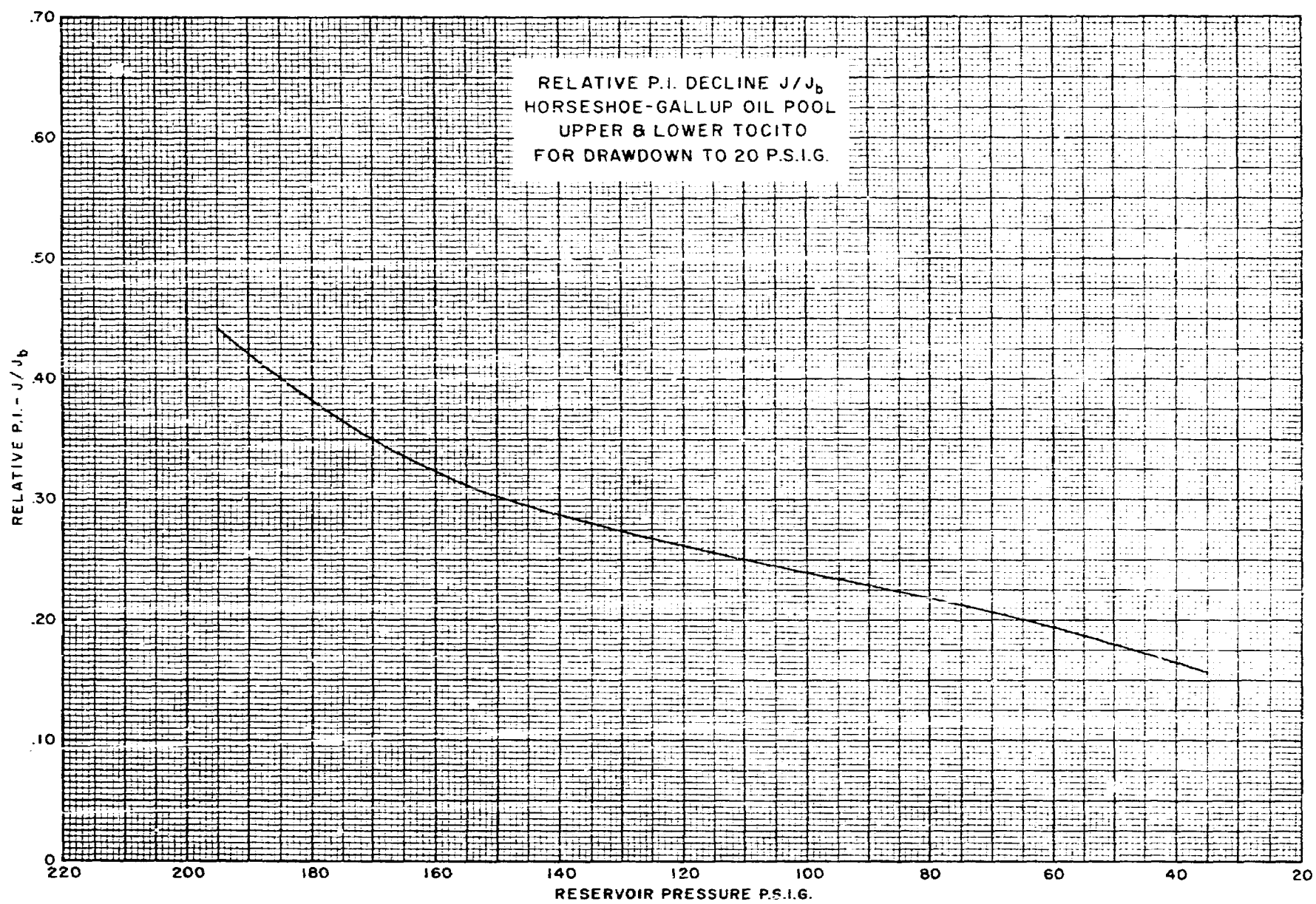




FIELD OIL RATE vs TIME  
FUTURE PRIMARY AND SECONDARY  
HORSESHOE GALLUP OIL POOL  
UPPER AND LOWER TOCITO





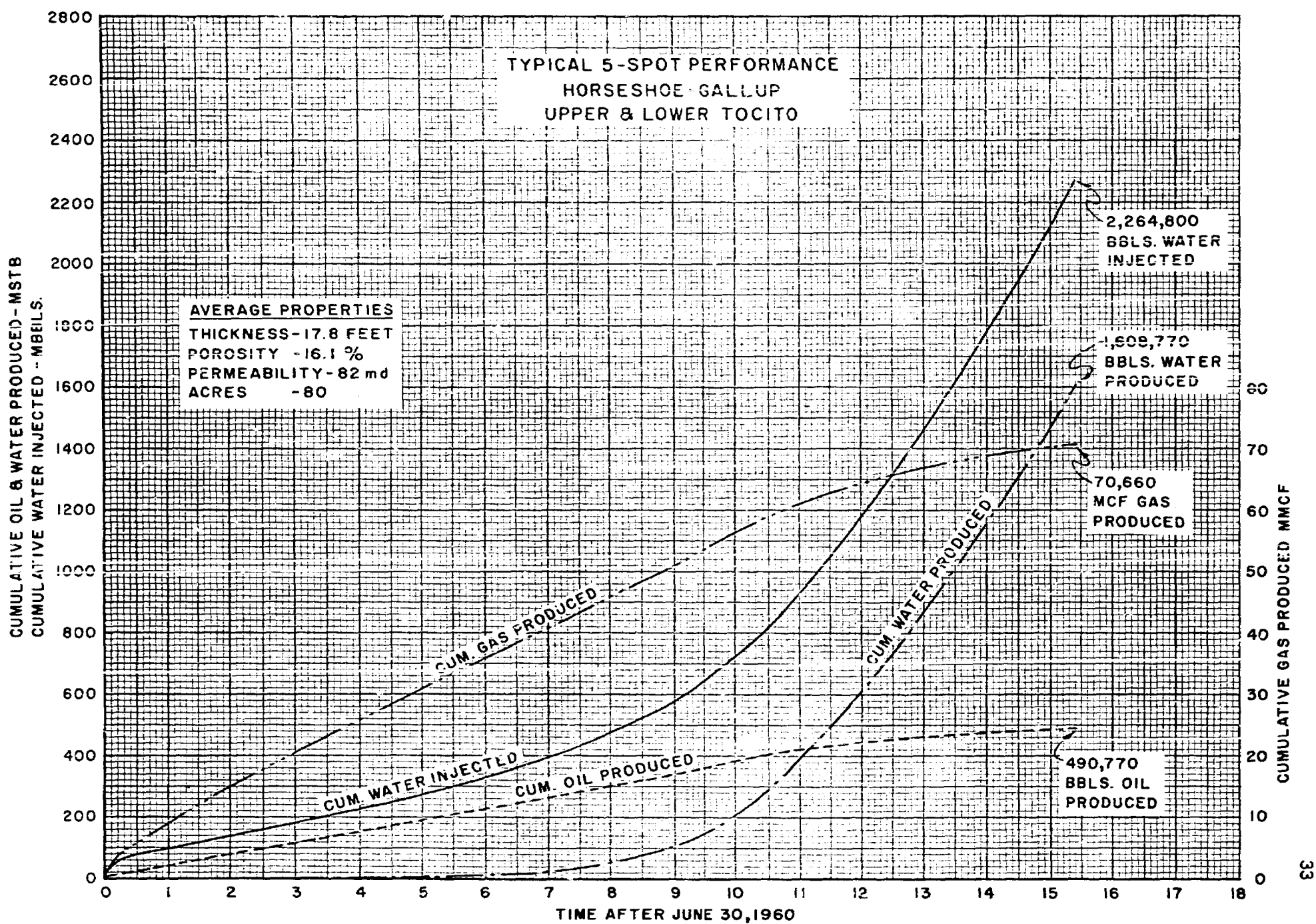


PERFORMANCE SUMMARYPrimary

Estimated Primary Recovery % OIP	12.3%
Primary Recovery, bbl/acre-ft.	95
Estimated Primary Recovery to Start of Waterflood, bbl/acre-ft.	46

Secondary

Average Residual Oil	27.7% of pore volume
Estimated Gas Saturation at Start of Flood	4.8% of pore volume
Conformance Factor	86%
Added Oil Recovery by Waterflood, bbl/acre-ft.	297



CASE 1979: EL PASO NATURAL GAS  
PRODUCTS  
DE NOVO HEARING -- September 14, 1960

Case No.

1979

Application, Transcript,  
Small Exhibits, Etc.

BEFORE THE  
OIL CONSERVATION COMMISSION  
Santa Fe, New Mexico  
September 14, 1960

IN THE MATTER OF:

Application of El Paso Natural Gas Products Company  
for a hearing de novo before the Oil Conservation  
Commission in Case No. 1969, Order No. R-1699, which  
was an application by The Atlantic Refining Company  
for a pressure maintenance project in the Horseshoe-  
Gallup Oil Pool, San Juan County, New Mexico.

Case  
No. 1979

BEFORE:

Mr. A. L. Porter  
Mr. Murray Morgan

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: Case No. 1979.

MR. PAYNE: Mr. Commissioner, the applicant in this case  
has recommended that it be dismissed. Counsel for El Paso Natural  
Gas Products Company has recommended that this case be dismissed.  
Is that correct, Mr. Spann?

MR. SPANN: Technically, I withdrew the application for a  
de novo hearing which you approved, so there just is no application  
pending.

MR. PORTER: I think the action the Commission should take  
on it is to go ahead and dismiss the case. If the application  
should be re-filed we will re-advertise the case.



DEARNLEY-MEIER REPORTING SERVICE, Inc.

PHONE CH 1-6691

ALBUQUERQUE, NEW MEXICO

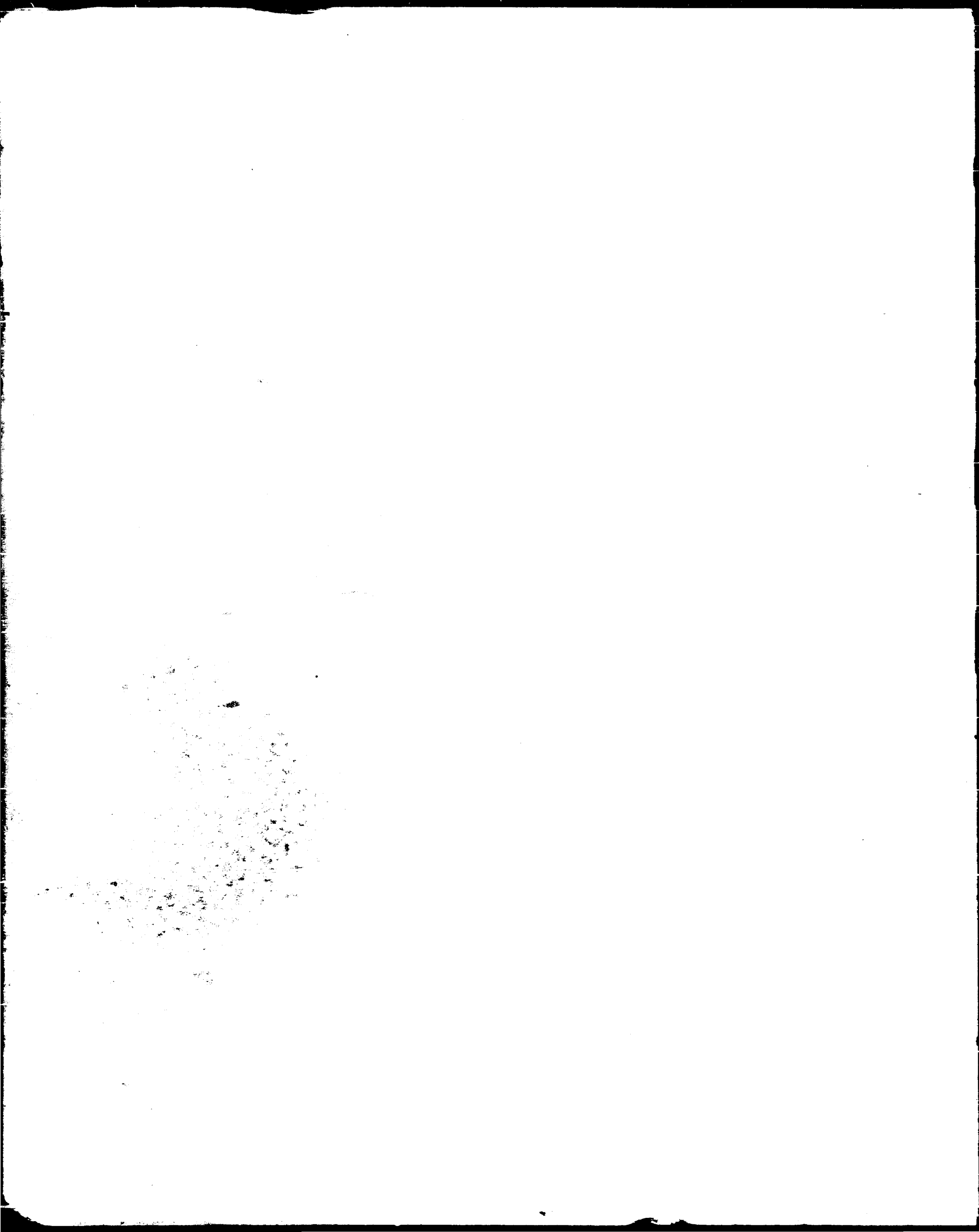
STATE OF NEW MEXICO )  
 ) ss  
COUNTY OF BERNALILLO )

I, JUNE PAIGE, Court Reporter, do hereby certify that the foregoing and attached Transcript of Proceedings before the New Mexico Oil Conservation Commission was reported by me in Stenotype and reduced to typewritten transcript under my personal supervision, and that the same is a true and correct record to the best of my knowledge, skill and ability.

WITNESS my hand this 20th day of September, 1960, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

June Paige  
Court Reporter







BEFORE THE  
OIL CONSERVATION COMMISSION  
SANTA FE, NEW MEXICO  
AUGUST 17, 1960

IN THE MATTER OF:

Application of El Paso Natural Gas Products  
Company for a hearing de novo before the Oil  
Conservation Commission in Case No. 1979,  
Order No. R. 1699, which was an application  
by the Atlantic Refining Company for a pressure  
maintenance project in the Horseshoe-Gallup Oil  
Pool, San Juan County, New Mexico.

Case No. 1979

BEFORE:

Honorable John Burroughs  
Mr. Murray Morgan

TRANSCRIPT OF HEARING

MR. PAYNE: Referring to Case 1979 --

MR. SPANN: I would like to request that case be con-  
tinued until the next regular hearing in September.

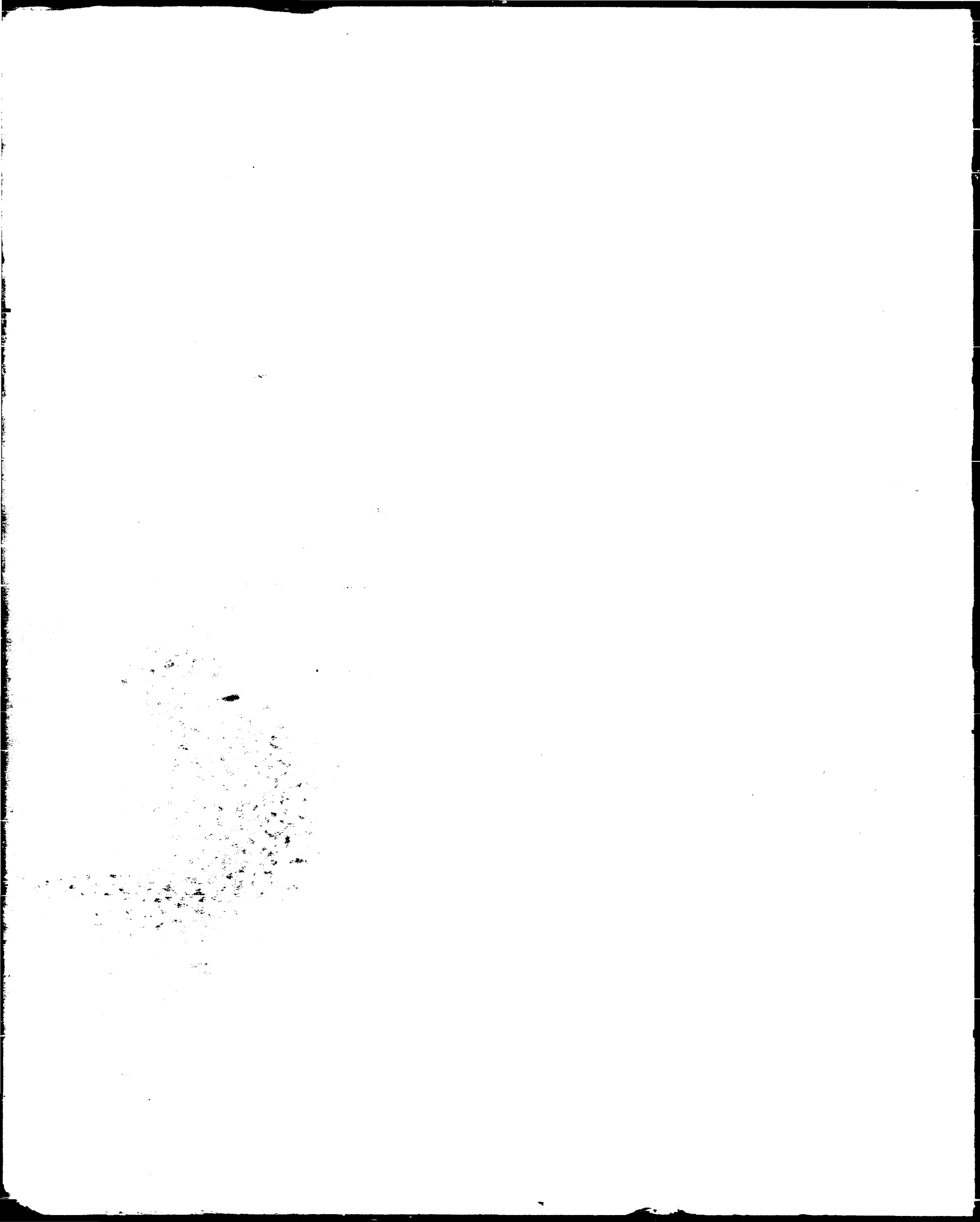
MR. PAYNE: Is there an objection to the motion of  
counsel for Atlantic Refining Company? The case will be continued  
until the next regular hearing.

DEARNLEY-MEIER REPORTING SERVICE, Inc.

PHONE CH 3-6691

ALBUQUERQUE, NEW MEXICO





STATE OF NEW MEXICO     )  
                                  ) ss  
COUNTY OF BERNALILLO    )

I, JUNE PAIGE, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 6th day of September, 1960.

June Paige  
Notary Public-Court Reporter

My Commission Expires:

May 11, 1964.

DEARNLEY-MELER REPORTING SERVICE, Inc.

PHONE CH 3-6691

ALBUQUERQUE, NEW MEXICO



GRANTHAM, SPANN AND SANCHEZ

ATTORNEYS AT LAW  
604 SIMMS BUILDING  
POST OFFICE BOX 1031  
ALBUQUERQUE, NEW MEXICO

EVERETT M. GRANTHAM  
CHARLES C. SPANN  
MAURICE SANCHEZ  
~~EDWARD H. STANLEY~~

TELEPHONE  
CHAPEL 3-3525

SEP 11 1960  
September 7, 1960

A. L. Porter, Secretary  
Oil Conservation Commission  
P O Box 871  
Santa Fe, New Mexico

Dear Mr. Porter:

Re: O.C.C. Case No. 1979, Order No. R1699  
Application for de novo hearing, Horseshoe-  
Gallup Oil Pool, San Juan Co., N.M.

I enclose herewith a Withdrawal of Application for de novo hearing in the above entitled and numbered cause for your approval.

I understand from my client that they have arrived at an understanding with Atlantic Refining Company, the original applicant, which takes care of the problem in connection with the special rules that were established.

I am directing a copy to the attorneys for the applicant and requesting that if either you or the applicant have any question concerning this matter you advise.

Very truly yours,

GRANTHAM, SPANN AND SANCHEZ

CCS:RW  
copy:  
Howard C. Bratton, Esq.

By: 

RECEIVED  
JUN 1 1979

BEFORE THE OIL CONSERVATION COMMISSION  
OF THE STATE OF NEW MEXICO

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

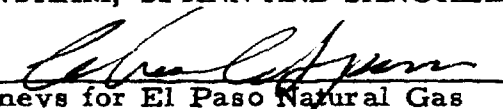
Case No. 1979  
Order No. R-1699

APPLICATION OF THE ATLANTIC REFINING  
COMPANY FOR A PRESSURE MAINTENANCE  
PROJECT IN THE HORSESHOE-GALLUP OIL  
POOL, SAN JUAN COUNTY, NEW MEXICO,  
AND FOR THE PROMULGATION OF SPECIAL  
RULES GOVERNING THE OPERATION OF  
SAID PROJECT.

WITHDRAWAL OF APPLICATION

Comes now El Paso Natural Gas Products Company, applicant  
for de novo hearing in the above entitled and numbered cause, and hereby  
wuthdraws said application and consents and agrees that the setting on said  
application heretofore made may be vacated.

GRANTHAM, SPANN AND SANCHEZ

By:   
Attorneys for El Paso Natural Gas  
Products Company

APPROVED:

\_\_\_\_\_  
Secretary  
Oil Conservation Commission

No. 26-60

DOCKET: REGULAR HEARING: WEDNESDAY, SEPTEMBER 14, 1960

Oil Conservation Commission - 9 a.m., Mabry Hall, State Capitol, Santa Fe, N.M.

- ALLOWABLE
- (1) Consideration of the oil allowable for October, 1960.
  - (2) Consideration of the allowable production of gas for October, 1960, from six prorated pools in Lea County, New Mexico, also consideration of the allowable production of gas from seven prorated pools in San Juan, Rio Arriba, and Sandoval Counties, New Mexico, for October, 1960.

CONTINUED CASE

CASE 1979: Application of El Paso Natural Gas Products Company for a hearing de novo before the Oil Conservation Commission in Case No. 1979, Order No. R-1699, which was an application by The Atlantic Refining Company for a pressure maintenance project in the Horseshoe-Gallup Oil Pool, San Juan County, New Mexico.

NEW CASES

CASE 2069: Application of Benson-Montin-Greer Drilling Corporation for the creation of a new oil pool for Gallup production and for the promulgation of temporary special rules and regulations for said pool. Applicant, in the above-styled cause, seeks an order creating a new pool for Gallup production consisting of the E/2 of Section 7, all of Sections 8 and 17, the W/2 of Section 9, the W/2 of Section 16 and the E/2 of Section 18, all in Township 28 North, Range 13 West, San Juan County, New Mexico. Applicant further seeks the promulgation of special rules and regulations governing said pool including a provision for temporary 60-acre oil proration units. Applicant also requests that allowables for wells in said pool may be transferred to other wells in the pool so that interference tests may be conducted.

CASE 2070: Application of the Oil Conservation Commission on its own motion to consider the Revision of Rule 311 to provide that a sediment oil destruction permit must be utilized within ten days after approval thereof.

CASE 2071: Northwestern New Mexico nomenclature case calling for an order for the extension of existing pools in San Juan and Rio Arriba Counties, New Mexico:

- (a) Extend the Aztec-Pictured Cliffs Pool to include:

TOWNSHIP 30 NORTH, RANGE 10 WEST, NMPM

Section 8: S/2

Section 9: SW/4

- (b) Extend the Ballard-Pictured Cliffs Pool to include:

TOWNSHIP 24 NORTH, RANGE 5 WEST, NMPM,  
Section 15: SE/4

TOWNSHIP 24 NORTH, RANGE 6 WEST, NMPM  
Section 17: SE/4

- (c) Extend the Pine Lake-Pictured Cliffs Pool to include:

TOWNSHIP 26 NORTH, RANGE 2 WEST, NMPM,  
Section 31: All (partial)

- (d) Extend the South Blanco-Pictured Cliffs Pool to include:

TOWNSHIP 27 NORTH, RANGE 5 WEST, NMPM,  
Section 28: SW/4  
Section 29: S/2  
Section 30: SE/4  
Section 33: NW/4

TOWNSHIP 27 NORTH, RANGE 6 WEST, NMPM,  
Section 9: SE/4

- (e) Extend the Tapacito-Pictured Cliffs Pool to include:

TOWNSHIP 26 NORTH, RANGE 3 WEST, NMPM  
Section 31: N/2

- (f) Extend the Escrito-Gallup Oil Pool to include:

TOWNSHIP 24 NORTH, RANGE 7 WEST, NMPM,  
Section 17: SW/4  
Section 25: NW/4

- (g) Extend the Horseshoe-Gallup Oil Pool to include:

TOWNSHIP 30 NORTH, RANGE 16 WEST, NMPM  
Section 2: SW/4 NE/4  
Section 15: S/2 NE/4

TOWNSHIP 31 NORTH, RANGE 16 WEST, NMPM,  
Section 21: SW/4 SE/4 & SE/4 SW/4

- (h) Extend the Verde-Gallup Oil Pool to include:

TOWNSHIP 31 NORTH, RANGE 14 WEST, NMPM

Section 30: S/2 SW/4

Section 31: N/2 NW/4

- (i) Extend the Angels Peak-Dakota Pool to include:

TOWNSHIP 27 NORTH, RANGE 9 WEST, NMPM,

Section 7: All

TOWNSHIP 28 NORTH, RANGE 10 WEST, NMPM,

Section 10: All (partial)

Section 11: All (partial)

Section 14: S/2

Section 15: E/2

TOWNSHIP 28 NORTH, RANGE 11 WEST, NMPM,

Section 36: E/2

TOWNSHIP 29 NORTH, RANGE 10 WEST, NMPM,

Section 34: S/2

- (j) Extend the West Blanco-Dakota Pool to include:

TOWNSHIP 32 NORTH, RANGE 12 WEST, NMPM

Section 32: E/2

- (k) Extend the West Kutz-Dakota Pool to include:

TOWNSHIP 27 NORTH, RANGE 12 WEST, NMPM,

Section 8: S/2

Section 17: N/2

CASE 2072:

Southeastern New Mexico nomenclature case calling for an order creating new pools and extending existing pools in Lea and Eddy Counties, New Mexico:

- (a) Create a new oil pool, for Abo production, designated as the Cedar Lake-Abo Pool, and described as:

TOWNSHIP 17 SOUTH, RANGE 31 EAST, NMPM,

Section 20: SW/4



- (b) Create a new oil pool, for San Andres production, designated as the West Garrett-San Andres Pool, and described as:

TOWNSHIP 16 SOUTH, 38 EAST, NMPM,  
Section 29: NW/4

- (c) Create a new gas pool for Devonian production, designated as the Henshaw-Devonian Gas Pool and described as:

TOWNSHIP 16 SOUTH, RANGE 30 EAST, NMPM,  
Section 24: NW/4

- (d) Create a new oil pool for Devonian production, designated as the Lea-Devonian Pool, and described as:

TOWNSHIP 20 SOUTH, RANGE 34 EAST, NMPM,  
Section 12: SW/4

- (e) Create a new oil pool for Yates and Seven Rivers production, designated as the West Tonto-Yates and Seven Rivers Pool, and described as:

TOWNSHIP 19 SOUTH, RANGE 33 EAST, NMPM,  
Section 18: N/2

- (f) Extend the Anderson Ranch-Wolfcamp Pool, to include:

TOWNSHIP 15 SOUTH, RANGE 32 EAST, NMPM,  
Section 32: E/2 SE/4  
Section 33: W/2 W/2

- (g) Extend the West Crossroads-Devonian Pool, to include:

TOWNSHIP 9 SOUTH, RANGE 36 EAST, NMPM,  
Section 31: NE/4

- (h) Extend the East Dayton-Grayburg Pool, to include:

TOWNSHIP 18 SOUTH, RANGE 27 EAST, NMPM,  
Section 28: N/2 SW/4

- (i) Extend the Dollarhide-Queen Pool, to include

TOWNSHIP 24 SOUTH, RANGE 38 EAST, NMPM,  
Section 19: NE/4

- (j) Extend the Dublin-Devonian Pool, to include:

TOWNSHIP 26 SOUTH, RANGE 38 EAST, NMPM,  
Section 7: SW/4

- (k) Extend the East E. K. Queen Pool, to include:

TOWNSHIP 18 SOUTH, RANGE 34 EAST, NMPM,  
Section 22: S/2 SW/4  
Section 27: N/2 NW/4

- (l) Extend the North Hackberry-Yates Pool to include:

TOWNSHIP 19 SOUTH, RANGE 31 EAST, NMPM,  
Section 29: S/2 NW/4 and N/2 SW/4

- (m) Extend the Mescalero-Pennsylvanian Pool, to include:

TOWNSHIP 10 SOUTH, RANGE 32 EAST, NMPM,  
Section 33: NW/4

- (n) Extend the Pearl-Queen Pool, to include:

TOWNSHIP 19 SOUTH, RANGE 35 EAST, NMPM,  
Section 32: SE/4

- (o) Extend the Ranger Lake-Pennsylvanian Pool, to include:

TOWNSHIP 12 SOUTH, RANGE 34 EAST, NMPM,  
Section 34: E/2 NW/4

- (p) Extend the Warren-Drinkard Pool, to include:

TOWNSHIP 20 SOUTH, RANGE 38 EAST, NMPM,  
Section 36: NW/4

GRANTHAM, SPANN AND SANCHEZ  
ATTORNEYS AT LAW  
904 SIMMS BUILDING  
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ALBUQUERQUE, NEW MEXICO

EVERETT M. GRANTHAM  
CHARLES C. SPANN  
MAURICE SANCHEZ  
FRED M. STANDLEY

TELEPHONE  
CHAPEL 3-3525

August 2, 1960

Mr. A. L. Porter, Secretary  
Oil Conservation Commission  
P. O. Box 871  
Santa Fe, N. M.

In Re: O. C. C. Case No. 1979  
Application for De Novo Hearing  
Horseshoe-Gallup Oil Pool  
San Juan County, New Mexico

Dear Mr. Porter:

Reference is made to the above case which has been set for hearing before the Commission on August 17, 1960. El Paso Natural Gas Products Company, the applicant for the De Novo hearing has arranged a conference with the Atlantic Refining Company for August 23rd and 24th at which time it is hoped that the differences between these companies in regard to the pressure maintenance program in the Horseshoe-Gallup Oil Pool, will be resolved. Accordingly, it was felt advisable to request that the hearing be continued until September in order that the parties would have an opportunity to resolve their difficulties.

I would, therefore, like to request that the August 17th hearing be vacated and the matter be set down for hearing in September. If there is any objection to this, please advise us immediately.

Very truly yours,

GRANTHAM, SPANN AND SANCHEZ

By 

CCS:MI

cc: Mr. Howard C. Bratton  
Mr. R. L. Hamblin

*Handwritten notes:*  
Reviewed by  
Sept 14 by hearing  
mailed 9-1-60

GRANTHAM, SPANN AND SANCHEZ  
ATTORNEYS AT LAW  
804 SIMMS BUILDING  
POST OFFICE BOX 11031  
ALBUQUERQUE, NEW MEXICO

EVERETT M. GRANTHAM  
CHARLES C. SPANN  
MAURICE SANCHEZ  
FRED M. STANDLEY

TELEPHONE  
CHAPEL 3-3525

JUL 7 1960 21

Mr. A. L. Porter, Secretary  
Oil Conservation Commission  
P. O. Box 871  
Santa Fe, New Mexico

In Re: CASE NO. 1979 - ORDER R-1699  
APPLICATION OF THE ATLANTIC REFINING COMPANY  
FOR A PRESSURE MAINTENANCE PROJECT IN THE  
HORSESHOE-GALLUP OIL POOL, SAN JUAN COUNTY,  
NEW MEXICO, AND FOR THE PROMULGATION OF  
SPECIAL RULES GOVERNING THE OPERATION OF SAID  
PROJECT.

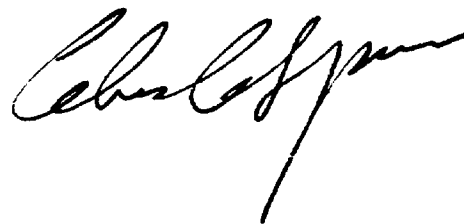
Dear Mr. Porter:

I enclose herewith the original and two copies of Application  
for De Novo Hearing which we are filing in behalf of El Paso Natural  
Gas Products Company in the above entitled and numbered cause.

Very truly yours,

GRANTHAM, SPANN AND SANCHEZ

By



ccs:mi

encls 3

*Handwritten notes:*  
Mailed  
Aug 4, 1960  
MB

21  
BEFORE THE OIL CONSERVATION COMMISSION OF  
THE STATE OF NEW MEXICO

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

CASE NO. 1979  
Order No. R-1699

APPLICATION OF THE ATLANTIC REFINING  
COMPANY FOR A PRESSURE MAINTENANCE  
PROJECT IN THE HORSESHOE-GALLUP OIL  
POOL, SAN JUAN COUNTY, NEW MEXICO,  
AND FOR THE PROMULGATION OF SPECIAL  
RULES GOVERNING THE OPERATION OF  
SAID PROJECT.


APPLICATION FOR DE NOVO HEARING

Comes now El Paso Natural Gas Products Company, a corpor-  
a party  
ation, adversely affected by Order R-1699 entered in Case No. 1979 on  
June 10, 1960, and pursuant to Rule No. 1220 of the Commission, here-  
by requests that the above matter be heard de novo before the full Com-  
mission.

A copy of this application is being mailed, postage prepaid, to  
Clarence Hinkle, attorney for Atlantic Refining Company, Roswell,  
New Mexico, on this the 7th day of July, 1960.

EL PASO NATURAL GAS PRODUCTS COMPANY

GRANTHAM, SPANN AND SANCHEZ

By   
904 Simms Building  
Albuquerque, New Mexico  
Attorneys for El Paso Natural Gas  
Products Company