1242-A

HALLIBURTON DIVISION LABORATORY

HALLIBURTON SERVICES
MIDLAND DIVISION
ARTESIA, NEW MEXICO 88210

LABORATORY WATER ANALYSIS No. W163-86

To Mr. Craig Huber

Challenger Energy

P. O. Box 1262

Artesia, NM 88210

Date March 16, 1986

Submitted by _____ Date Rec. March 16, 1986

Well No. Mobil Fed. #1 Depth _____ Formation Delaware

County Eddy Field _____ Source Wellhead

Resistivity	.051 @ 72°			
Specific Gravity	1.198			
pH	6.6			
Calcium (Ca)	37,740			*MPL
Magnesium (Mg)	2,696			
Chlorides (Cl)	182,000			
Sulfates (SO_4)	Small			
Bicarbonates (HCO_3)	76			
Soluble Iron (Fe)	Heavy			
KCL	1%			
API GRAVITY @ 60°	27°			

BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SUN EXHIBIT NO. 5
CASE NO: 9646

Remarks:

*Milligrams per liter

Rocky Chambers
Respectfully submitted,

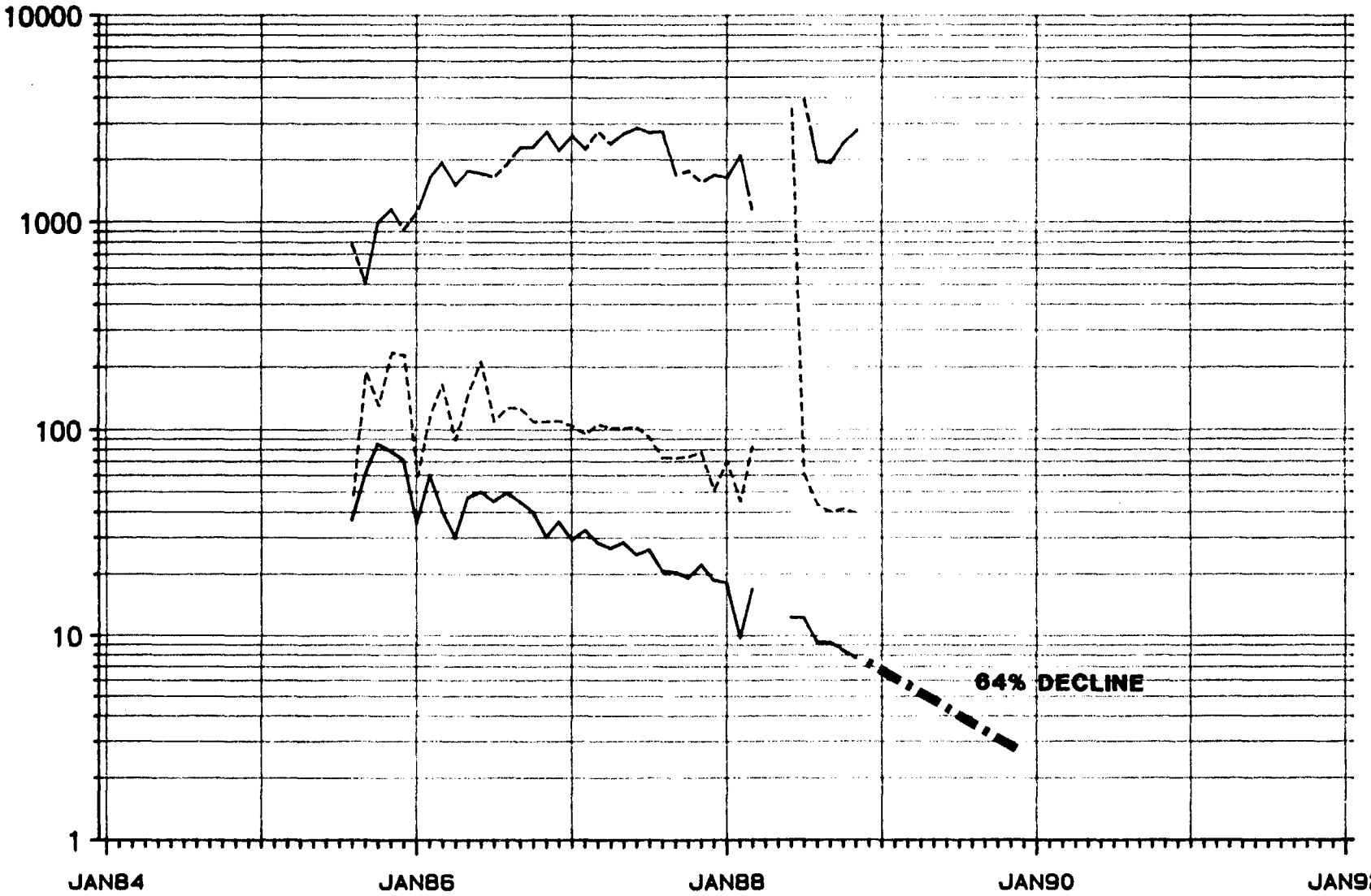
Analyst: Rocky Chambers - Field Engineer

HALLIBURTON COMPANY

cc:

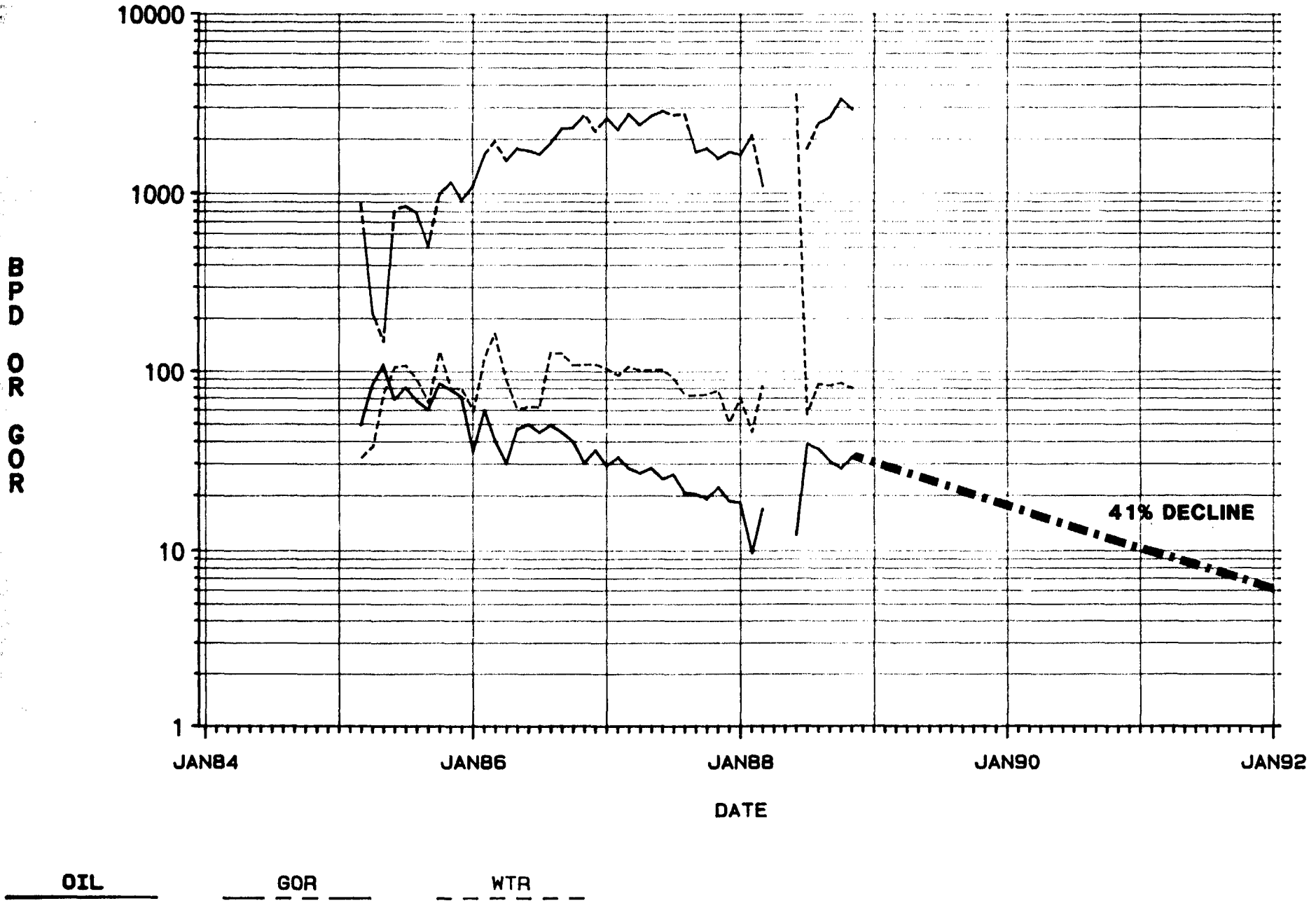
NOTICE

LEASE=MOBIL 22 FEDERAL WELL_ID=000005



OIL GOR WTR

BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SUN EXHIBIT NO. 6
CASE NO. 9646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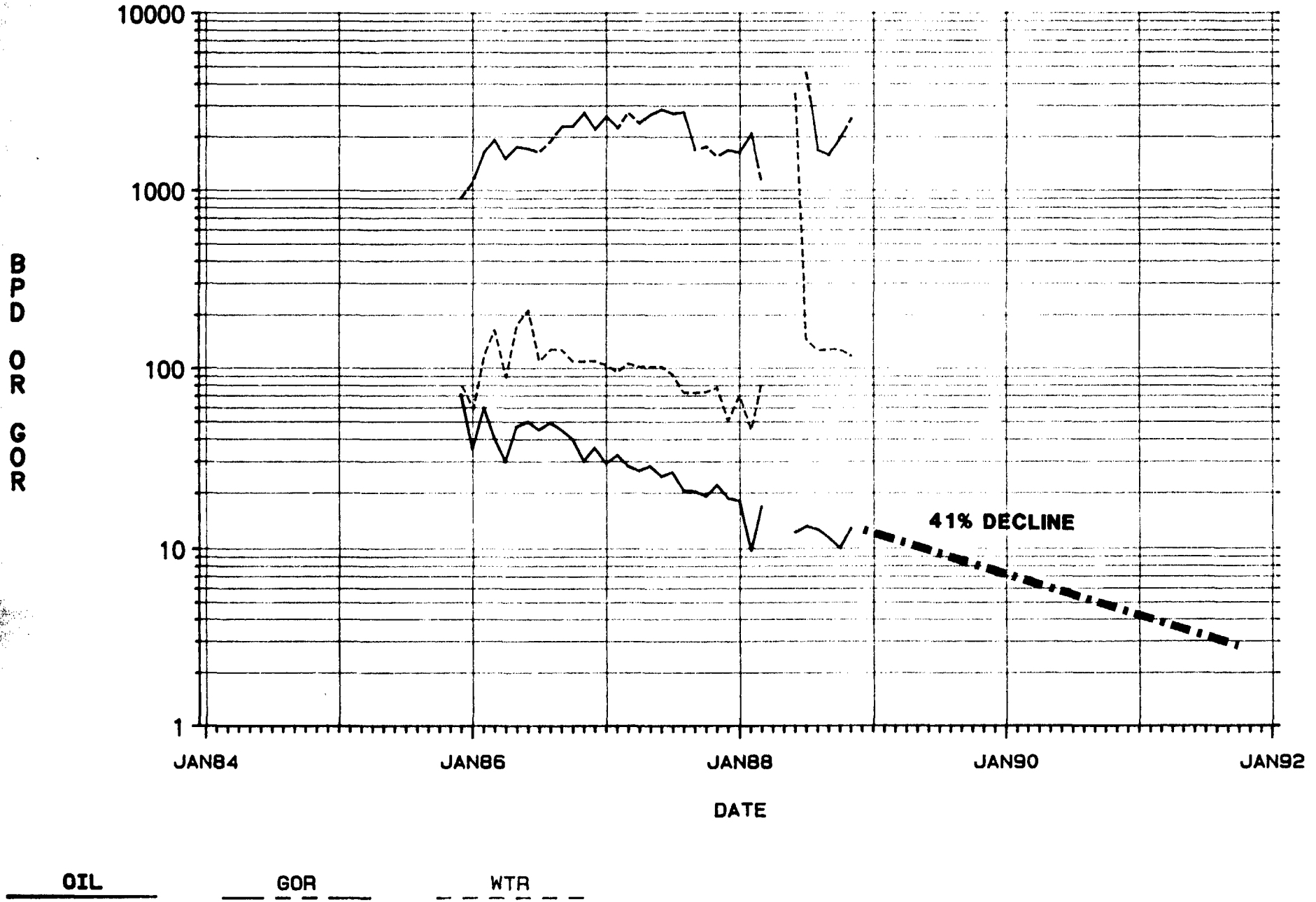
DATE
41% DECLINE
OIL
GOR
WTR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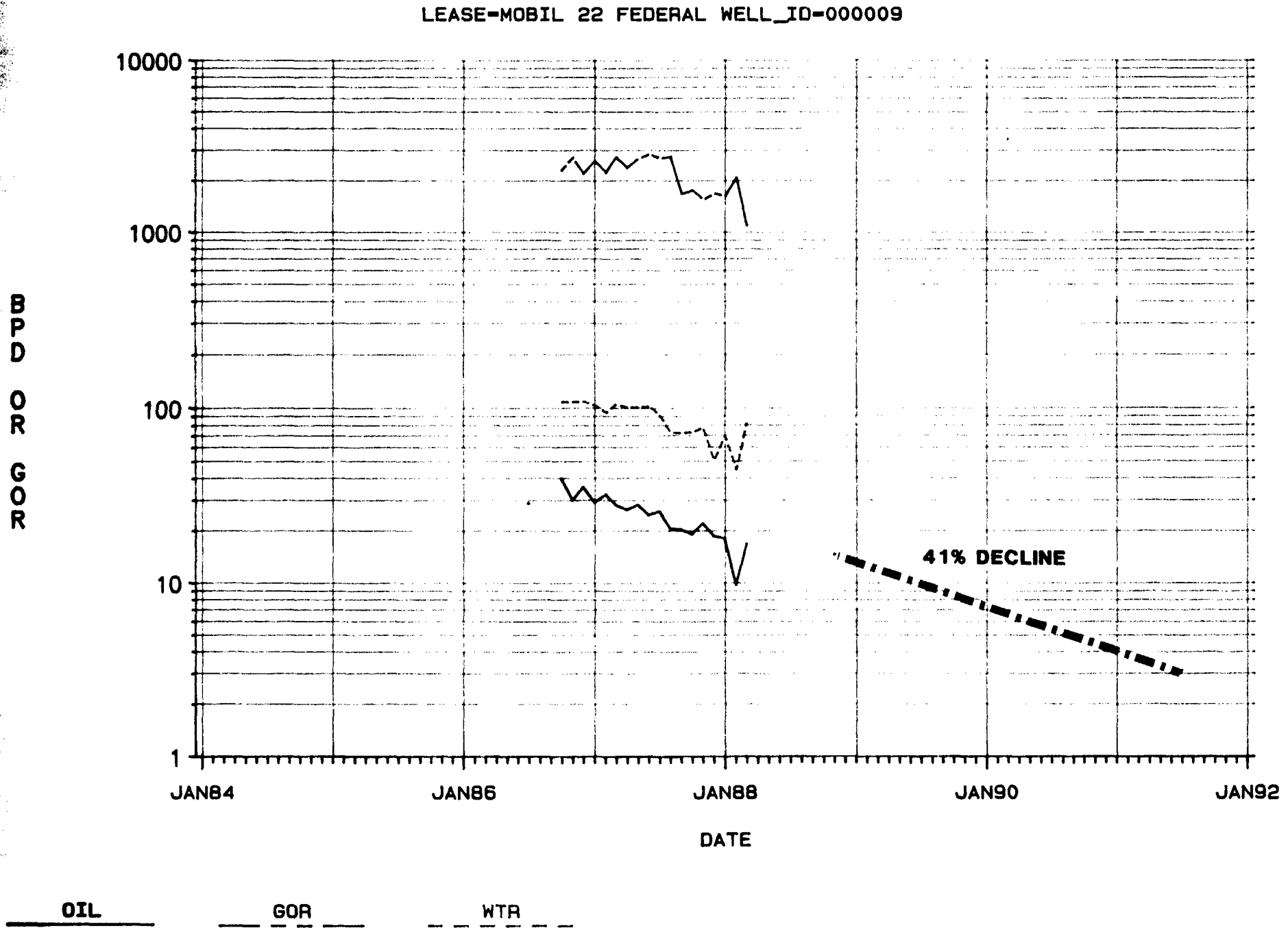
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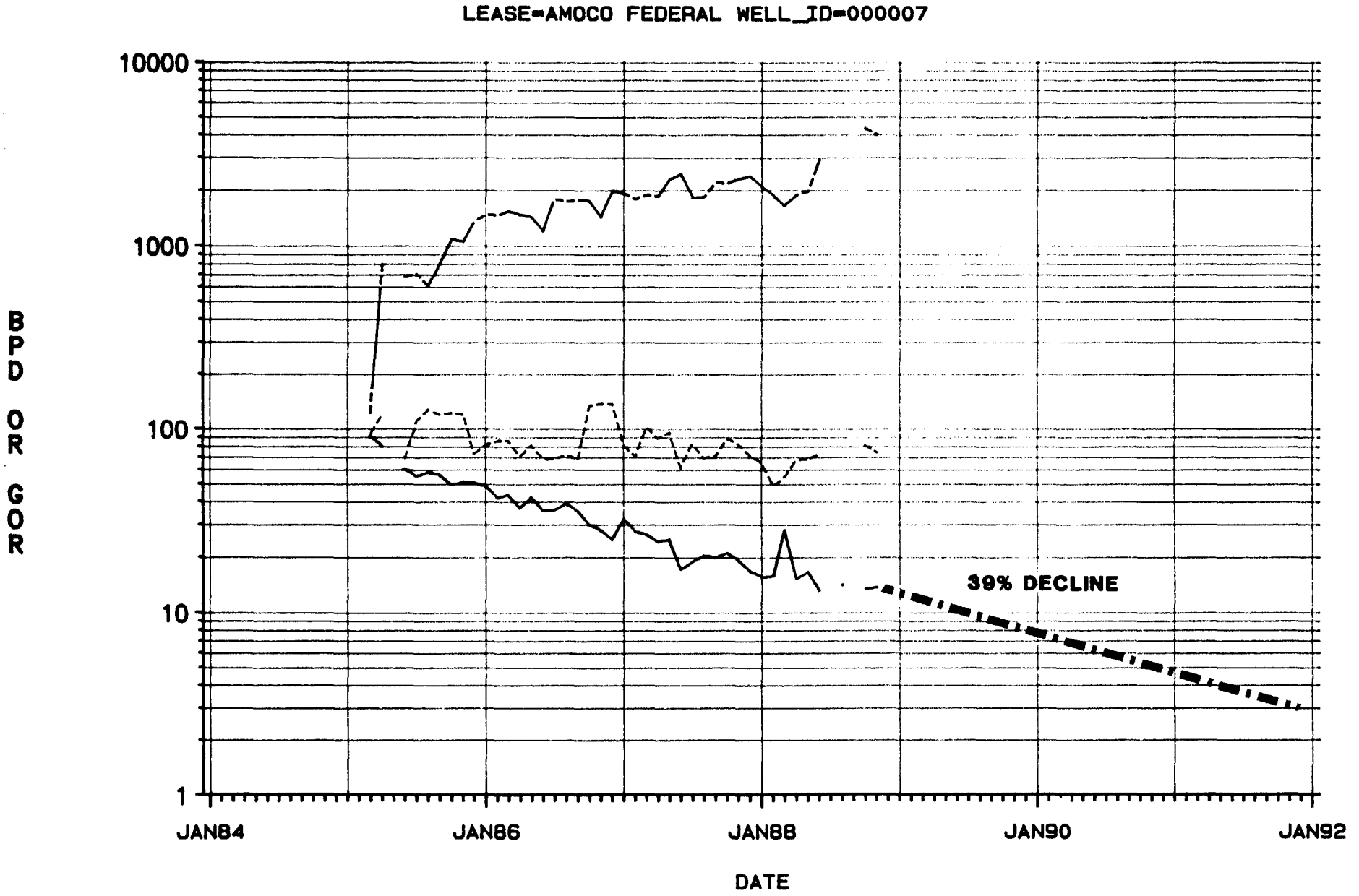
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BPD OR GOR
39% DECLINE
JAN84
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DATE
OIL
GOR
WTR

MOBIL 22 FEDERAL WATERFLOOD PILOT

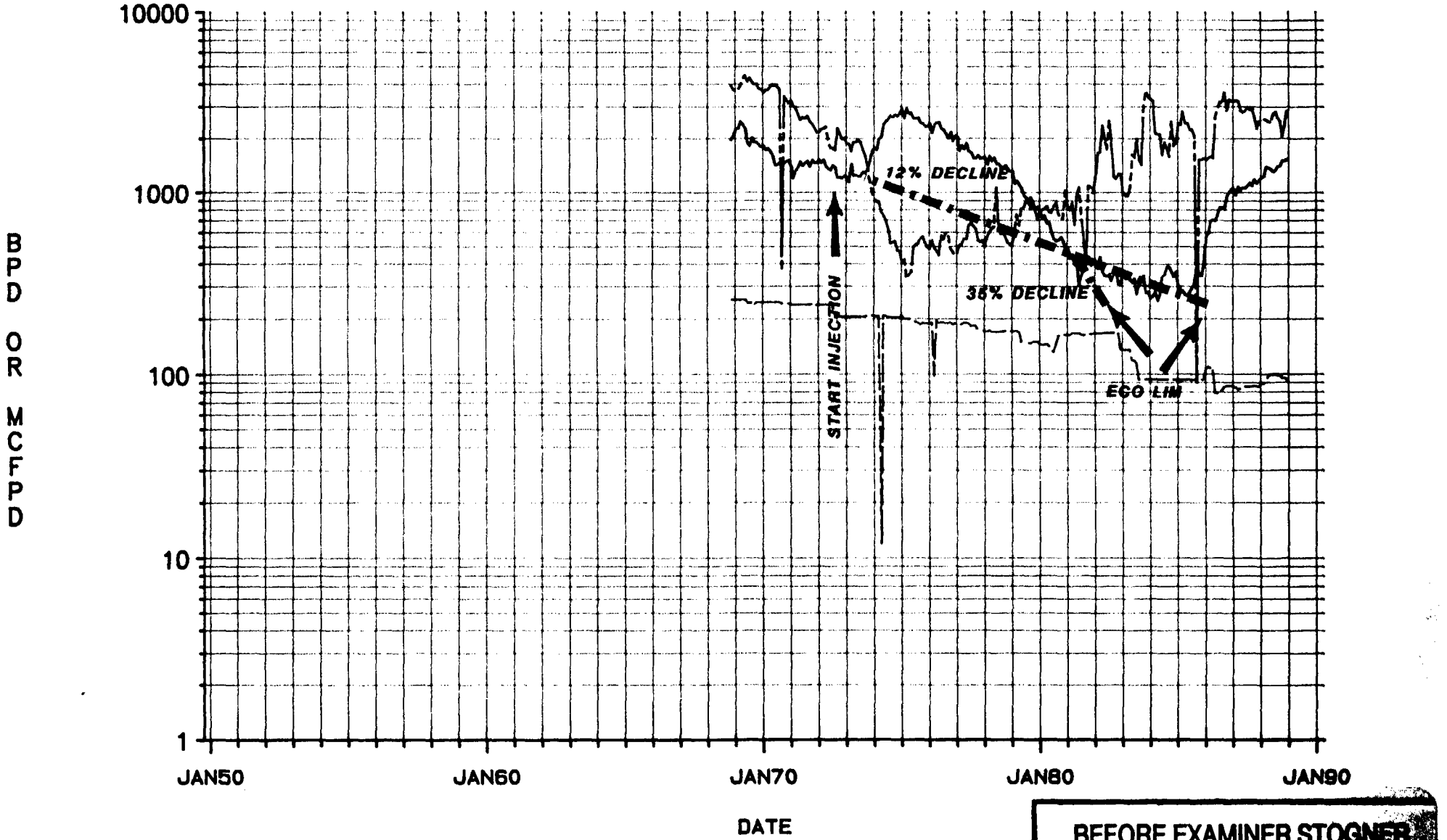
BRUSHY DRAW FIELD
EDDY COUNTY, NEW MEXICO

PRIMARY RECOVERY PREDICTION

Well	Cumulative Oil Production	Cumulative Gas Production	Decline Rate	Remaining Oil Reserves	Ultimate Recovery
Mobil Federal #3	54,080 STBO	81,768 MCF	41%	20,061 STBO	74,141 STBO
Mobil Federal #5	37,652 STBO	65,632 MCF	64%	1,429 STBO	39,081 STBO
Mobil Federal #6	30,152 STBO	59,314 MCF	41%	6,918 STBO	37,070 STBO
Mobil Federal #9	14,911 STBO	35,579 MCF	41%	7,609 STBO	22,520 STBO
Amoco Federal #7	42,859 STBO	62,077 MCF	39%	7,384 STBO	50,243 STBO
TOTAL	179,654	301,370		43,401	223,055
AVERAGE	35,931	60,274		8,680	44,611

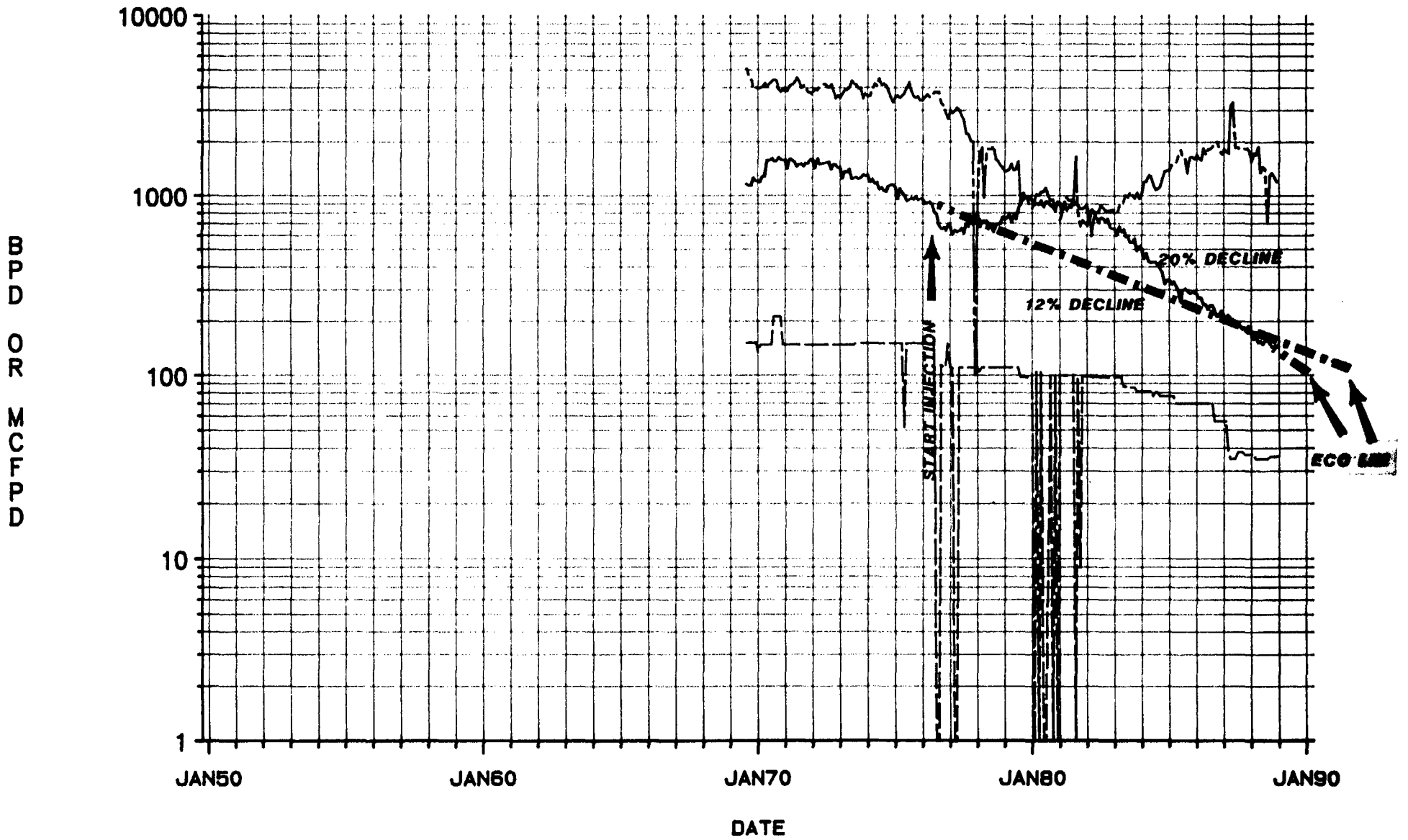
BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SUN EXHIBIT NO. 7
CASE NO. 9646

FORD-GERALDINE UNIT

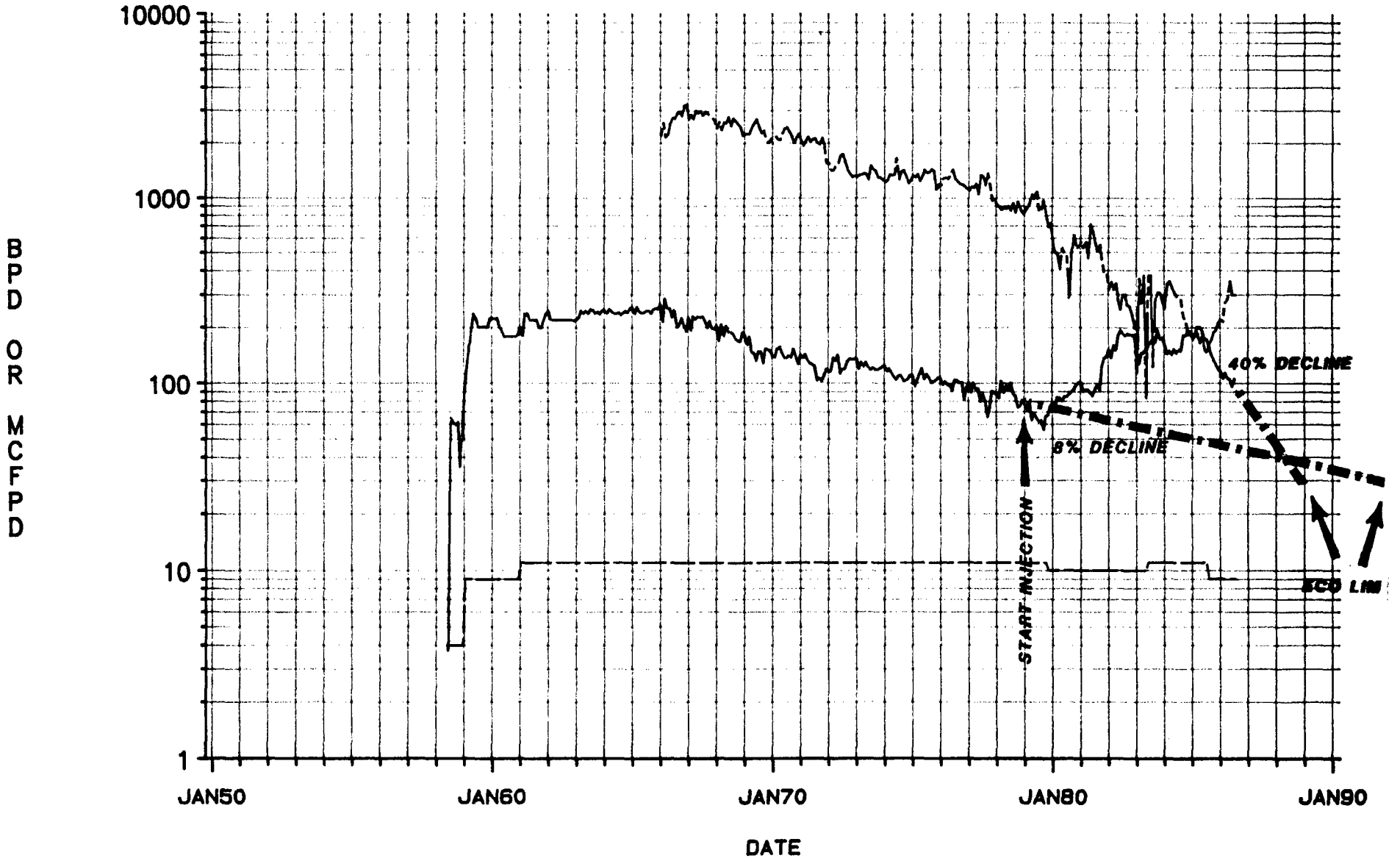


BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SUN EXHIBIT NO. 8
CASE NO. 9646

EL MAR DELAWARE UNIT



AGNES BECKHAM



MOBIL 22 FEDERAL WATERFLOOD PILOT

ANALOGY WATERFLOODS

Property	Ford Geraldine Unit	El Mar Unit	Agnes Belkham
County	Reeves, TX	Loving, TX	Reeves, TX
Operator	Conoco	Texaco	ARCO
CUMULATIVE PRODUCTION AT START OF WATERFLOOD	1879.1 MSTBO	3175.8	1220.9
ESTIMATED REMAINING PRIMARY RECOVERY	3431.9 MSTBO	2270.0	218.9
ESTIMATED ULTIMATE PRIMARY RECOVERY	5311.0 MSTBO	5445.8	1439.8
ESTIMATED TOTAL RECOVERY AFTER START OF WATERFLOOD	5773.7 MSTBO	3693.3	405.4
INCREMENTAL SECONDARY RESERVES	2341.8 MSTBO	1423.3	186.5

EDDY COUNTY

POGO PROD. | EXXON | CHEVRON | CHEVRON

16 | 15 | 14 | 13

STATE T 26 S

EXXON R 29 E

SUN | SUN | SUN | SUN | SUN

EXXON FED. US | US | GULF-FED.

CHEVRON

21 | 22 | 23 | 24

RED BLUFF RESERVOIR

WORTH FED.

MORE '22' FED. US | 'BOOTH-FED.' | 'GULF-FED.'

US

MALLON | MALLON | J.C. WILLIAMSON | TEXACO | WILLIAMSON | TEXACO

MERIDIAN | HOLLEY 'A' FED | HOLLEY FED.

'AMOCO-FED.' | J.C. WILLIAMSON

28 | 27 | 26 | 25

'AMOCO-FED.' US | MERIDIAN | 'PECOS-FED.' | 'EP-USA' | 'UCBHWW-FED.' | 'SALT MTN FED.'

R. WILLIAMSON | J.C. WILLIAMSON | TEXACO

33 | 34 G.H. MITCHELL | 35 | 36

NEW MEXICO | 'LITTLEFIELD-FED' | STATELINE FED. | 'MWJ FED.' | SALT MTN '36' ST.

TEXAS W.&N.W.R.R.CO. REEVES COUNTY / LOVING COUNTY | 5 EXXON | W. JOHNSON J.C. WILLIAMSON 4 | EXXON-JOHNSON | TEXACO T.& P.R.R.CO. BLK. 57 | 'LOVING-FEE AY' | 3 W. JOHNSON

BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SUN EXHIBIT NO. 10
CASE NO. 9646

SUN Sun Exploration and Production Company

BRUSHY DRAW FIELD
CHERRY CANYON & BRUSHY CANYON WELLS

Horizon Contoured	MODEL AREA		
Interpretation By	D. ROJAS	Date	4/7/89
Contour Interval			
Scale	1"=2000'	Datum	
Drafting by	D. ROJAS		
District	SOUTHWESTERN REGION	File	BRUSHY.DWG
Comments:			

MOBIL 22 FEDERAL WATERFLOOD PILOT

RESERVOIR SIMULATION STUDY

MODEL PROGRAM SOFTWARE

VIP (VECTORIZED IMPLICIT PROGRAM) CORE AND EXEC MODULES

- DEVELOPED BY J. S. NOLEN AND ASSOCIATES
  HOUSTON, TEXAS

- THREE DIMENSIONAL, THREE-PHASE (OIL, GAS, WATER)

- BLACK OIL; OIL AND GAS PROPERTIES DESCRIBED BY INPUT
  FVF, VISCOSITY, AND SOLUTION GAS-OIL RATIO

- ACCOUNTS FOR GRAVITY, VISCOUS, AND CAPILLARY FORCES
  USES MATHMATICAL EQUATIONS FOR FLUID FLOW COMMON
  TO ALL MODERN RESERVOIR SIMULATION PROGRAMS

- RESULTS COMPARED AGAINST OTHER INDUSTRY PRODUCTS IN
  SOCIETY OF PETROLEUM ENGINEERS COMPARITIVE TEST,
  (JOURNAL OF PETROLEUM TECHNOLOGY, MARCH 1986)

- USED BY OTHER MAJOR OIL COMPANIES INCLUDING CONOCO,
  PHILLIPS, STANDARD OIL, AND UNOCAL

SUN EXPLORATION AND PRODUCTION COMPANY'S EXPERIENCE

- EXTENSIVELY TESTED AND BENCHMARKED PROGRAM AGAINST
  OTHER PUBLICLY AVAILABLE SOFTWARE

- HAS BEEN USED TO MODEL NUMEROUS RESERVOIRS OF VARIOUS
  TYPES SINCE ACQUISITION IN 1983

BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SUN EXHIBIT NO. 11
CASE NO. 9646

MOBIL 22 FEDERAL WATERFLOOD PILOT

RESERVOIR SIMULATION STUDY

ASSUMPTIONS

RESERVOIR CONDITIONS AND PROPERTIES

Initial Pressure	1800 PSIA
Initial Saturation Pressure	1800 PSIA
Temperature	105° F
Porosity (Average)	17.5%
Net Pay (Average)	48 Ft.
Irreducible Water Saturation	17%
Residual Oil Saturation	24%
Critical Gas Saturation	5.0%
OOIP	746 MSTBO (40 Acres)
Rock Compressibility	10×10^{-6} 1/PSI
Permeability (Log Average)	5.1 MD

FLUID PROPERTIES

OIL

Initial Saturation Pressure	1800 PSIA
Initial FVF	1.31 RB/STB
Initial Solution Gas-Oil Ratio	800 SCF/STB

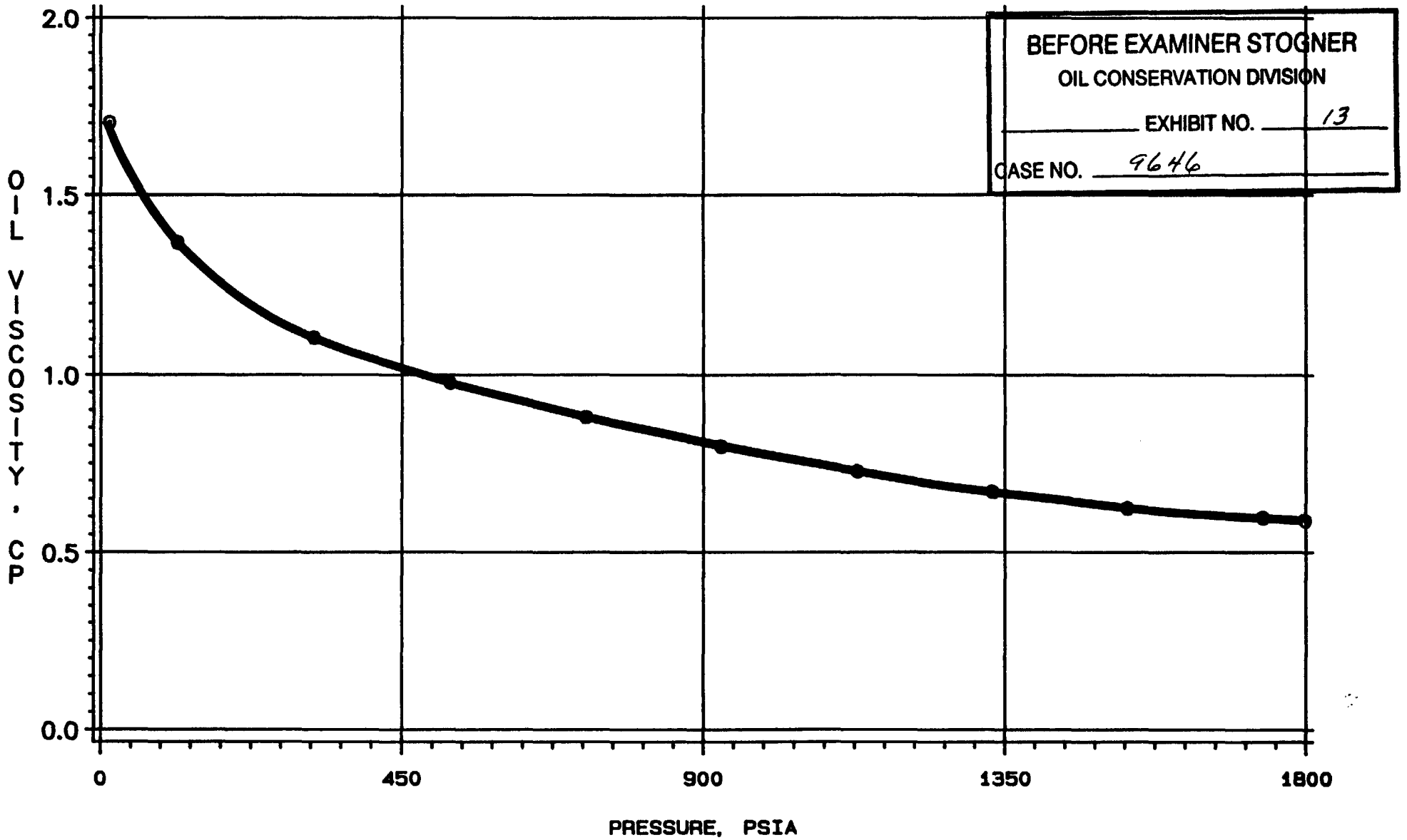
WATER

Density	1.198 GM/CC
FVF	1.005
Viscosity	1.07 CP
Compressibility	3.1×10^{-6} 1/PSI

BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SUN EXHIBIT NO. 12
CASE NO. 9646

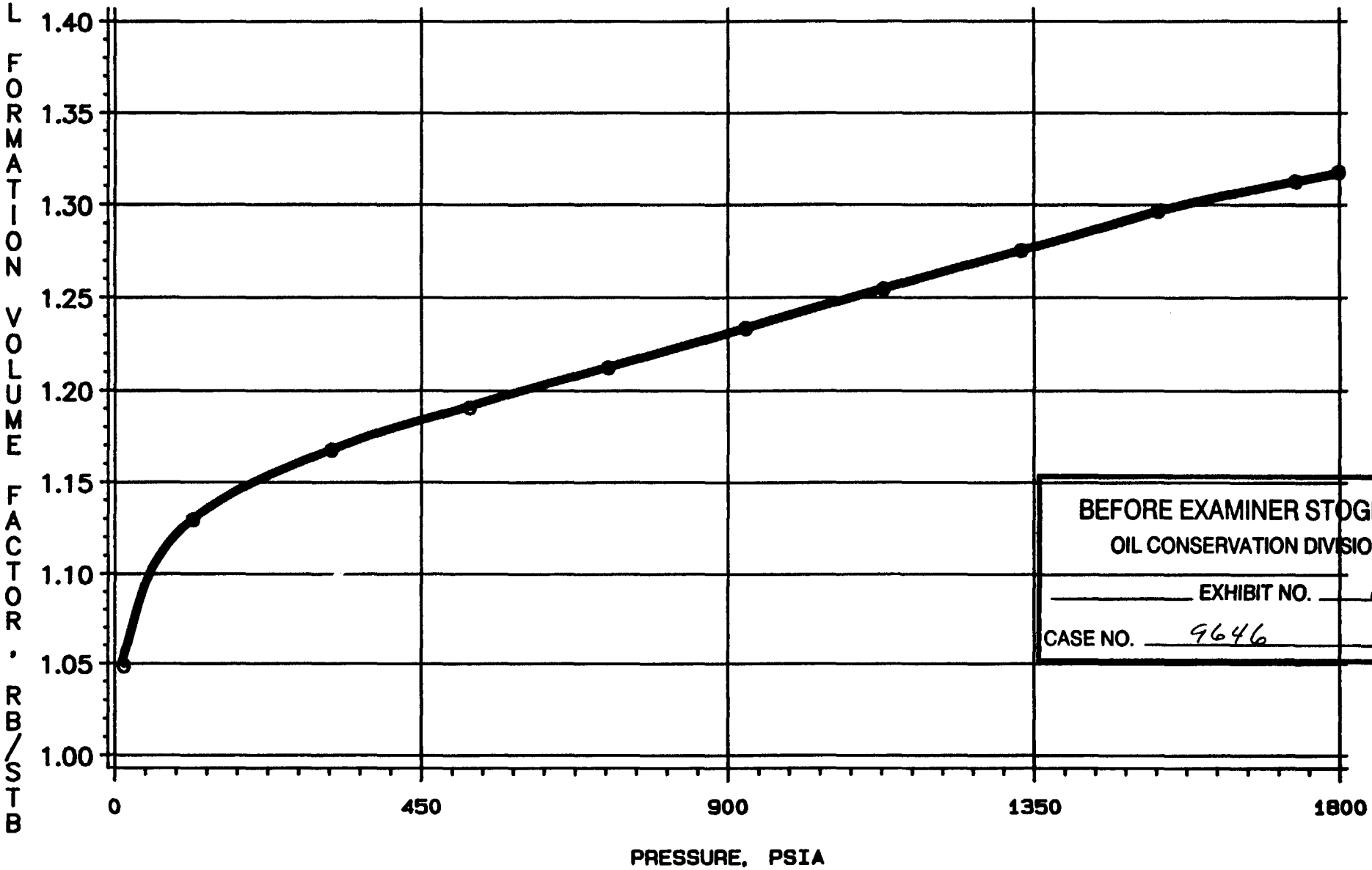
MOBIL 22 FEDERAL WATERFLOOD PILOT

OIL VISCOSITY VS. PRESSURE



MOBIL 22 FEDERAL WATERFLOOD PILOT

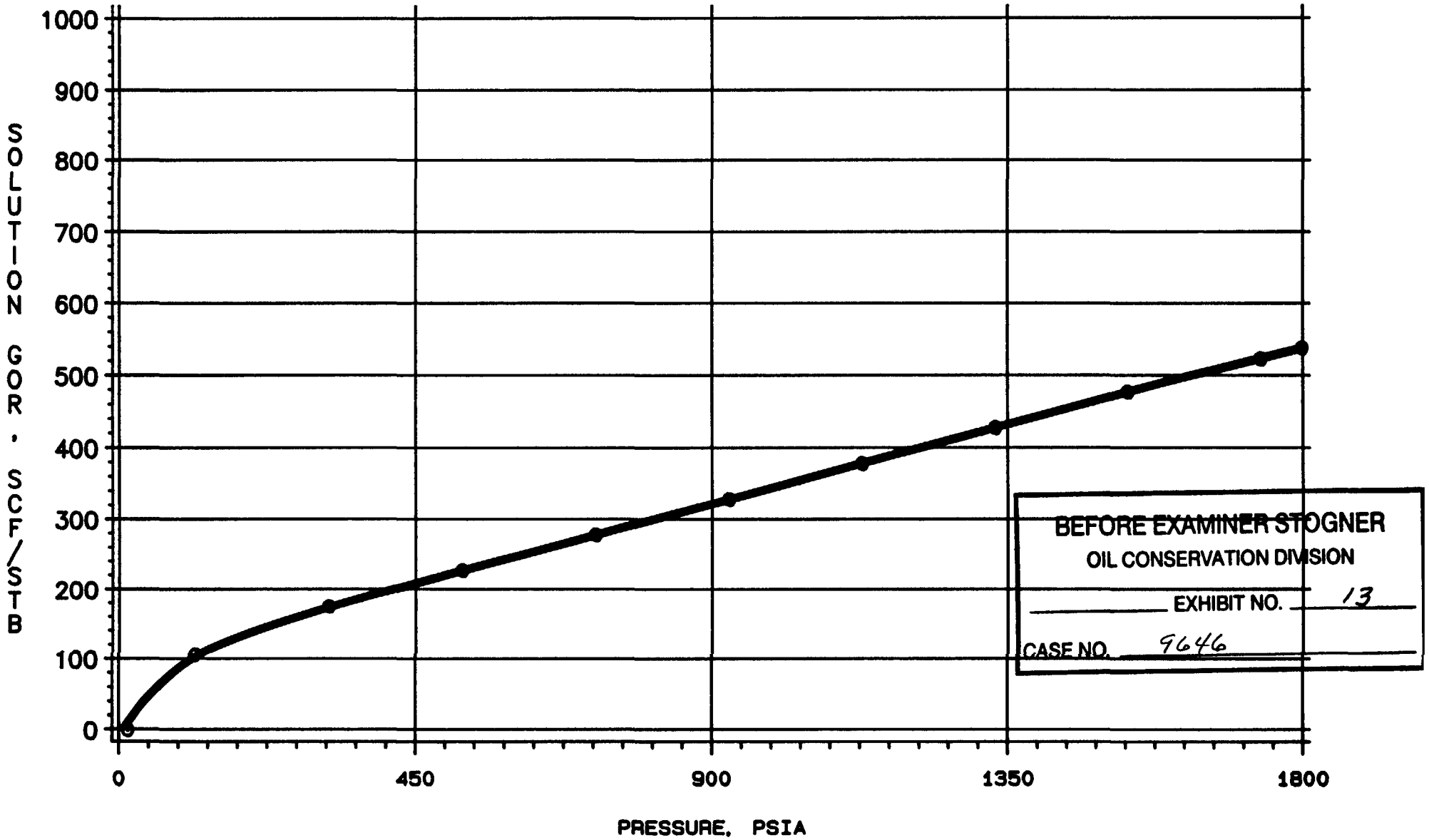
OIL FORMATION VOLUME FACTOR VS. PRESSURE



BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
EXHIBIT NO. 13
CASE NO. 9646

MOBIL 22 FEDERAL WATERFLOOD PILOT

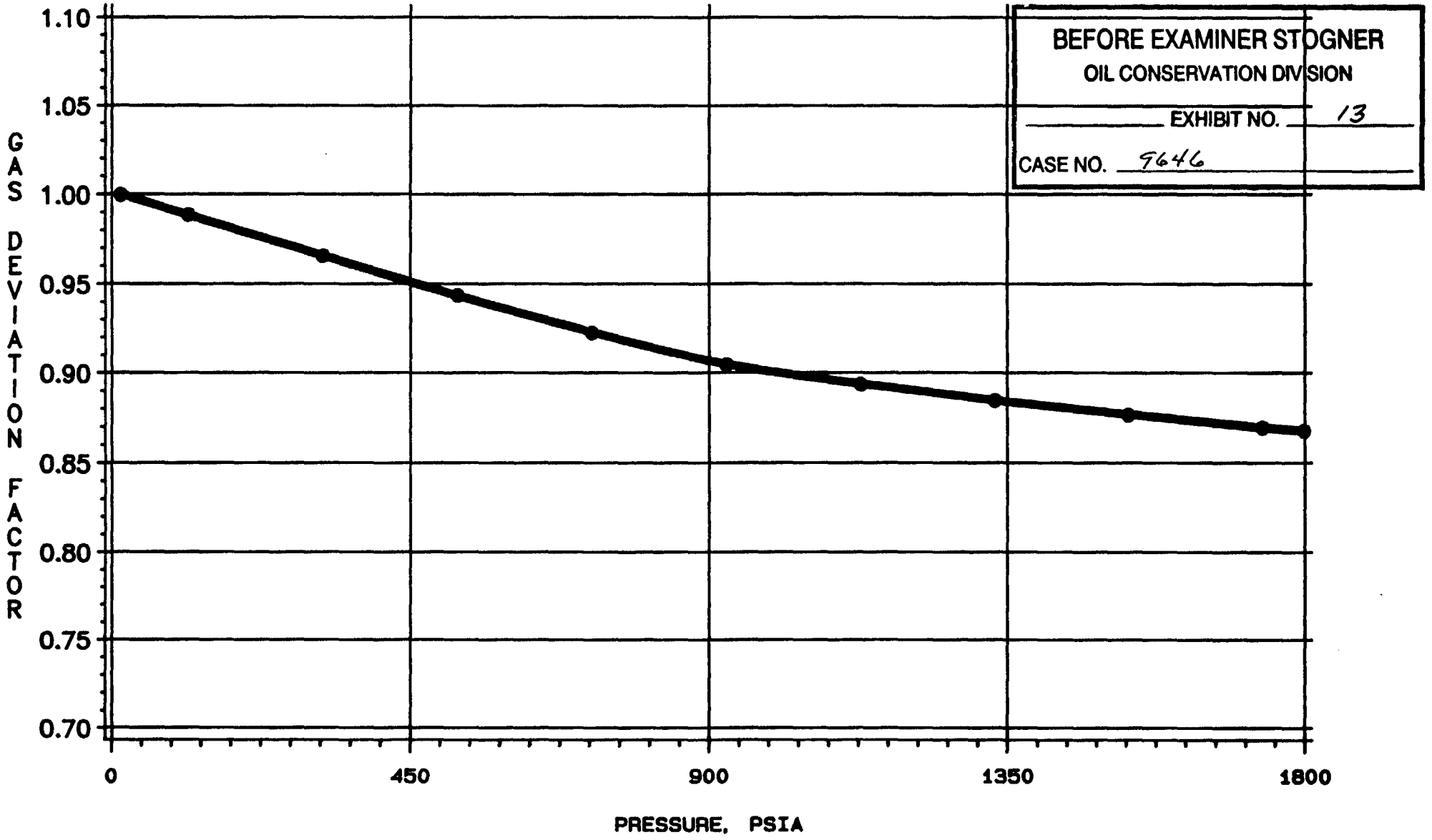
SOLUTION GOR VS. PRESSURE



BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
EXHIBIT NO. 13
CASE NO. 9646

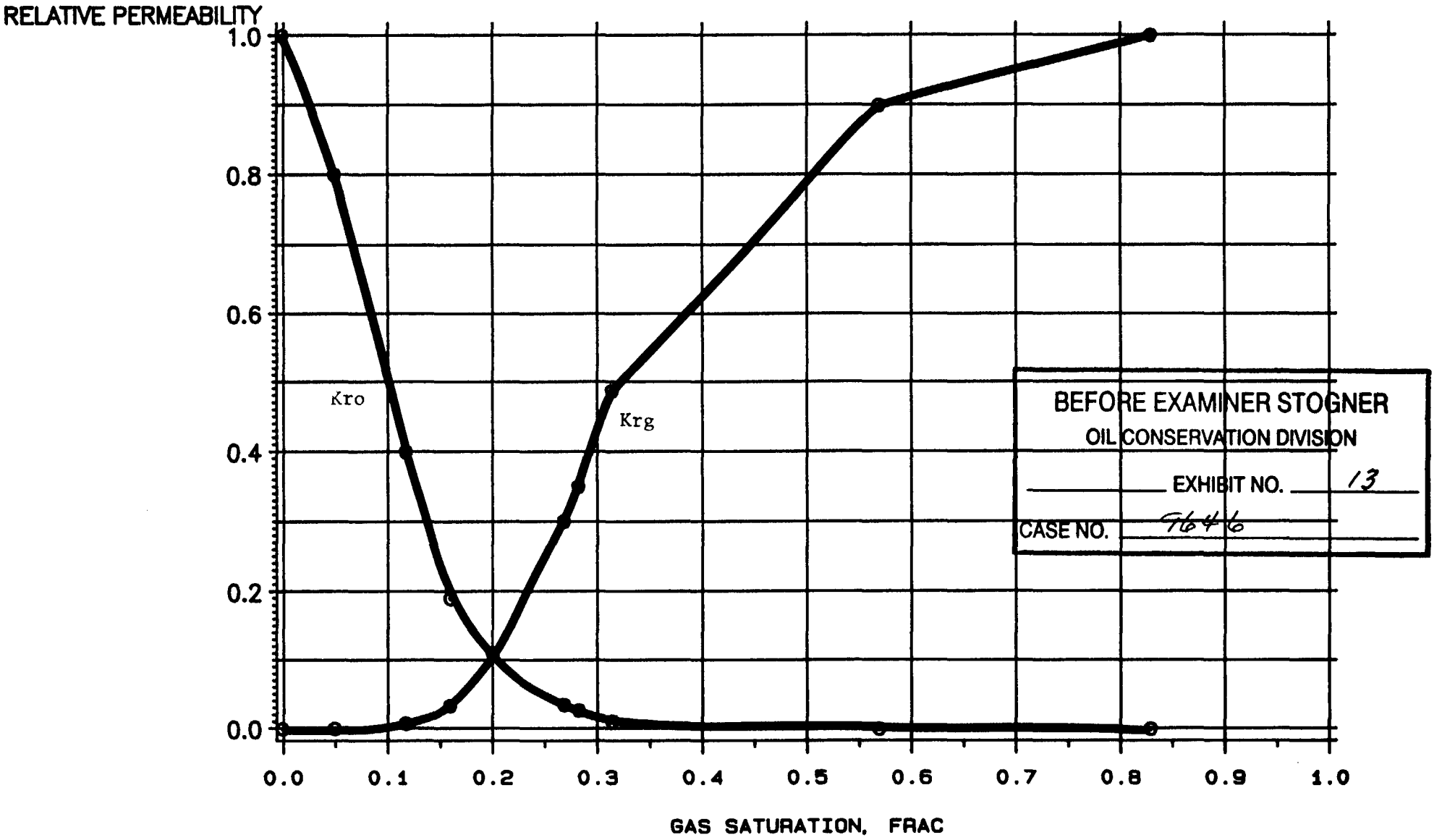
MOBIL 22 FEDERAL WATERFLOOD PILOT

GAS DEVIATION FACTOR VS. PRESSURE



MOBIL 22 FEDERAL WATERFLOOD PILOT

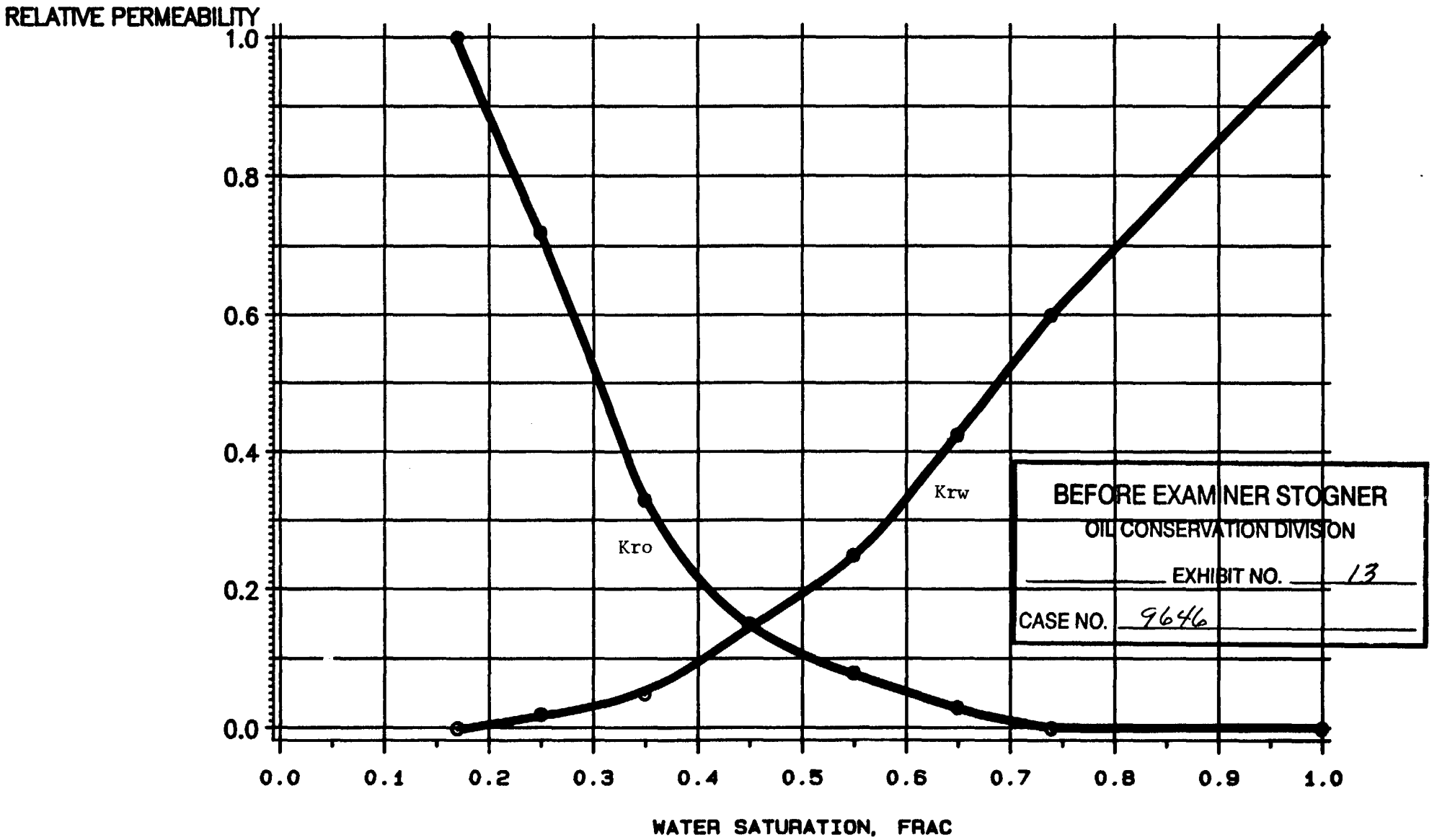
GAS-OIL RELATIVE PERMEABILITY



BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
EXHIBIT NO. 13
CASE NO. 7646

MOBIL 22 FEDERAL WATERFLOOD PILOT

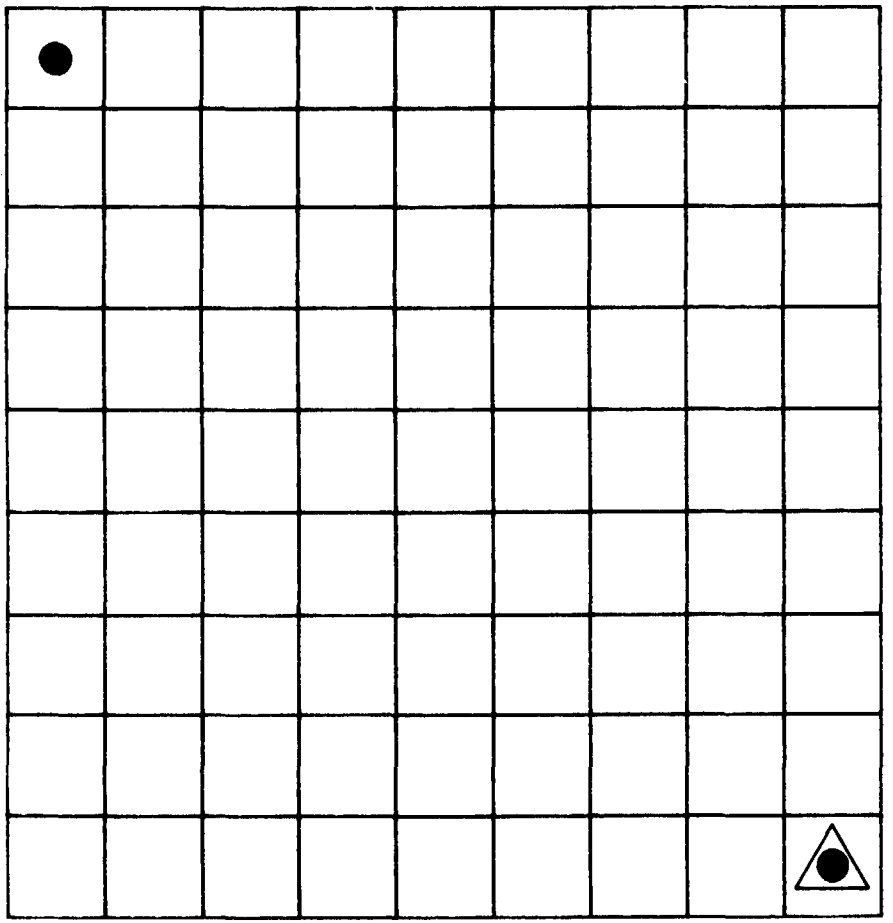
WATER-OIL RELATIVE PERMEABILITY



BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
EXHIBIT NO. 13
CASE NO. 9646

MOBIL 22 FEDERAL WATERFLOOD PILOT

RESERVOIR SIMULATION MODEL GRID

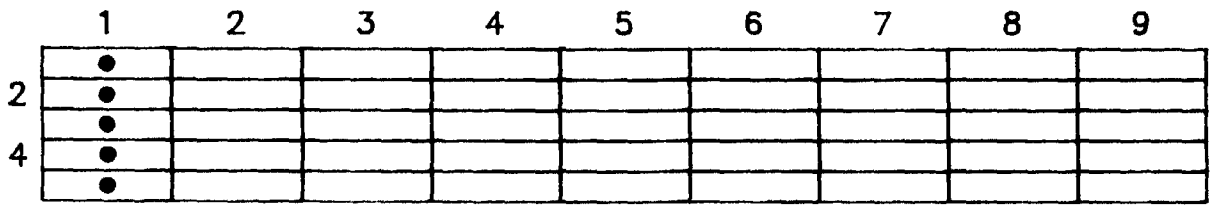


AREAL VIEW

BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SUN EXHIBIT NO. 14
CASE NO. 9646

MOBIL 22 FEDERAL WATERFLOOD PILOT

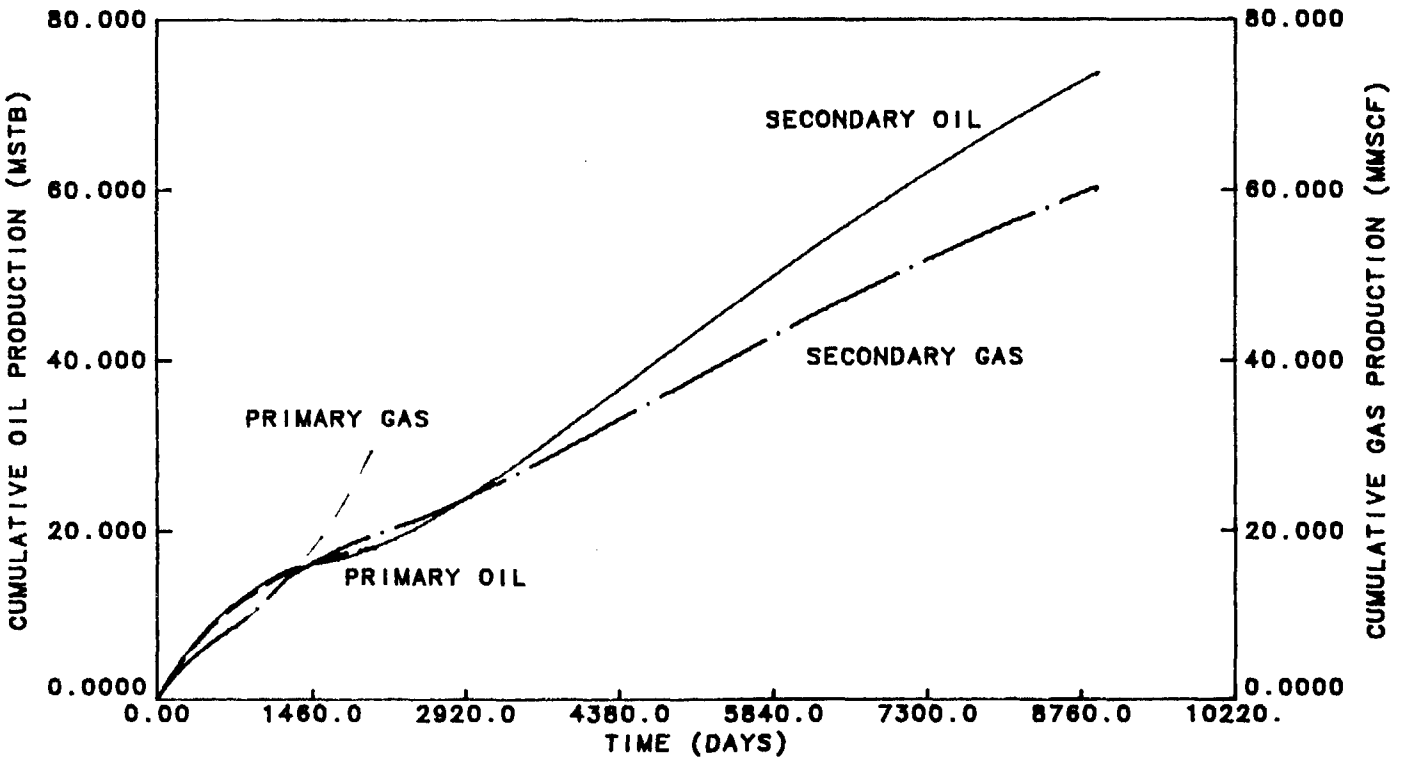
RESERVOIR SIMULATION MODEL GRID



CROSS-SECTIONAL VIEW

MOBIL 22 FEDERAL WATERFLOOD PILOT

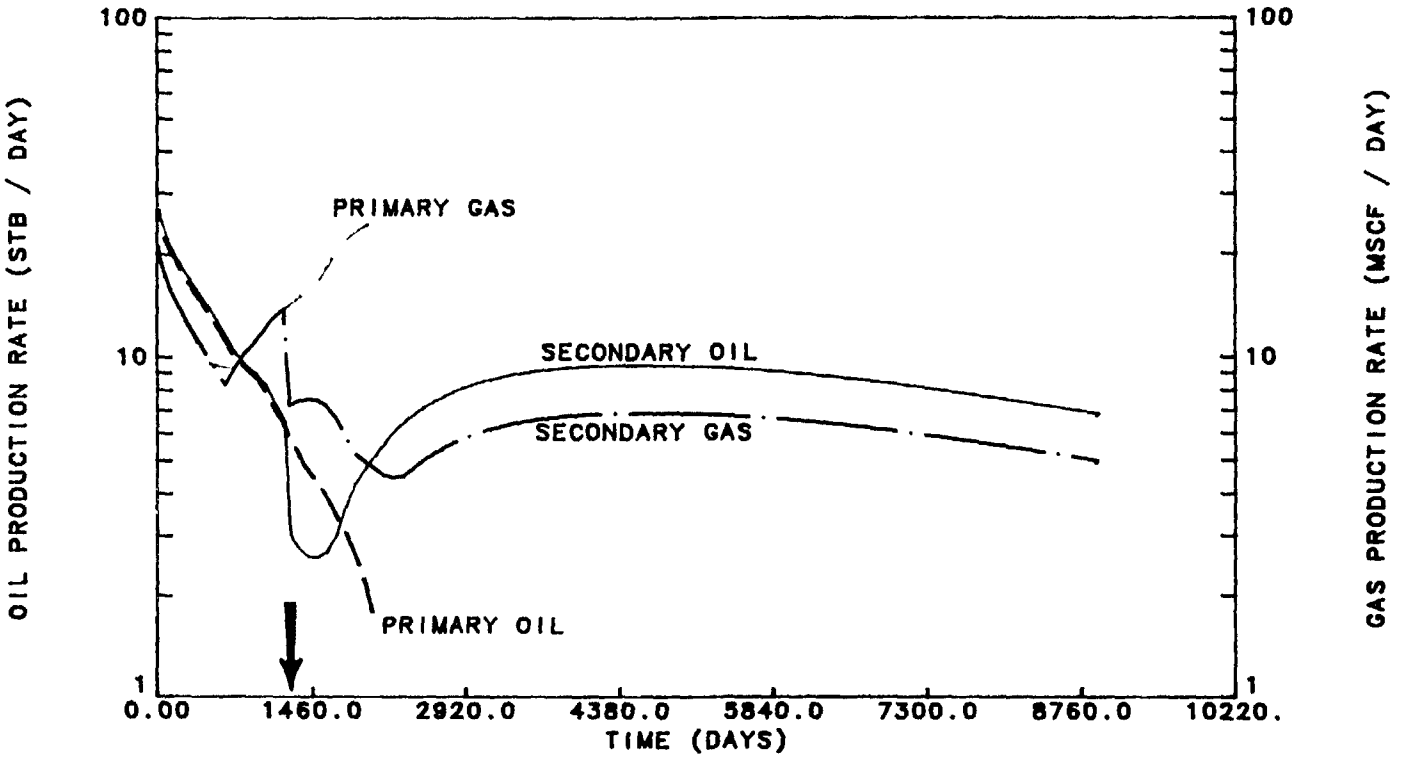
CUMULATIVE PRODUCTION FORECAST



BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SW EXHIBIT NO. 15
CASE NO. 9646

MOBIL 22 FEDERAL WATERFLOOD PILOT

PRODUCTION FORECAST



MOBIL 22 FEDERAL WATERFLOOD PILOT

RESERVOIR SIMULATION
RESULTS

	Quarter Scale	Full Scale
Primary Forecast		
Remaining Primary Production	3.2 MSTBO	12.8 MSTBO
Ultimate Primary Recovery	18.0 MSTBO	72.0 MSTBO
Secondary Forecast		
First Year Injection Rate	47.9 BWPD	191.6 BWPD
Maximum Bottom Hole Injection Pressure	1900 PSIA	1900 PSIA
Cumulative Injection After 20 Years	236.3 MBW	945.2 MBW
Oil Production After Start of Waterflood	58.4 MSTBO	233.6 MSTBO
Ultimate Recovery with Waterflooding	73.2 MSTBO	292.8 MSTBO
Incremental Secondary Recovery	55.2 MSTBO	220.8 MSTBO

BEFORE EXAMINER STOGNER
OIL CONSERVATION DIVISION
SUN EXHIBIT NO. 16
CASE NO. 9646

MALLON OIL COMPANY

1099 18th Street, Suite 2750, Denver, Colorado 80202
(303) 293-2333

April 10, 1989

Mr. David Rojas, Developement Geologist
Sun Exploration and Production Co.
P.O. Box 1861
Midland, TX 79702-1861

Dear Mr. Rojas:

This letter is in response to our discussions regarding Sun's proposed pilot waterflooding in the Williamson Sd. member of the Cherry Canyon formation in the Brushy Draw-Delaware pool.

My review of Sun's Application for Authorization to Inject, which was received at Mallon's office January 25, 1989, has left me satisfied that the proposal poses minimal risk of damage to Mallon's lease located 990' south of the proposed injection well. My conclusion is based on the facts that the proposed 300-400 BWPD injection rate falls within the present combined withdrawal rate of the four nearest offsetting wells, that the Williamson was completed across the entire gross sand interval and that the hydraulic fracture treatment was reportedly contained within the interval boundaries in the subject well.

Pressure depletion effects have been observable across the entire field in the declining total fluid production rates and climbing gas-oil ratios of individual wells as well as a lower measured pressure from the drill stem test of our early 1987 Amoco-Federal #10 well. It has been our opinion at Mallon that some effort toward evaluating the potential for waterflooding this complex but apparently well communicated reservoir is a necessary step that should be taken as soon as possible.

We are pleased to see Sun with it's strong background in waterflooding taking the intitiative and financial risk for such a test. We feel that the proposed site offers a good location within the reservoir to conduct such a test, being adjacent to some of the better field production to the east and some of the poorer production to the west which generally represents the field frontiers.

We would like to be kept informed of your injection activity and would be willing to exchange current production information on wells which may be affected by the injection on our respective leases so that the process can be evaluated on a timely basis.

Please feel free to call on anything that I might be able to help you with regarding your test.

Sincerely,

MALLON OIL COMPANY

Joe H. Cox, Jr.
Manager Production and Engineering

JHC:er

Williamson Exhibit 2
Complete Set

WELL PRODUCTION

OPERATOR SUN EXPLORATION & PRODUCTION
FIELD BRUSHY DRAW DELAWARE LEASE MOBIL 22 FED WELL# 5

MONTH/YEAR	OIL PRODUCTION	OIL RUNS	GAS PRODUCTION	WATER PRODUCTION	COMMENTS
JANUARY 85					
FEBRUARY 85					
MARCH 85					
APRIL 85					
MAY 85					
JUNE 85					
JULY 85					
AUGUST 85	1,116		873	1,483	
SEPTEMBER 85	1,824		925	5,837	
OCTOBER 85	2,585		2,591	3,993	
NOVEMBER 85	2,379		2,770	7,200	
DECEMBER 85	2,160		1,989	6,955	
CUM FOR YEAR	10,064	0	9,148	25,468	
CUM FOR WELL	10,064	0	9,148	25,468	
JANUARY 86	1,063		1,188	1,804	
FEBRUARY 86	1,823		2,998	3,646	
MARCH 86	1,250		2,432	5,056	
APRIL 86	907		1,376	2,721	
MAY 86	1,423		2,525	4,554	
JUNE 86	1,485		2,622	6,534	
JULY 86	1,363		2,171	3,338	
AUGUST 86	1,498		2,860	3,908	
SEPTEMBER 86	1,365		3,159	3,883	
OCTOBER 86	1,215		2,822	3,340	
NOVEMBER 86	1,123		2,523	3,340	
DECEMBER 86	1,091		2,422	3,366	
CUM FOR YEAR	15,606	0	29,098	45,490	
CUM FOR WELL	25,670	0	38,246	70,958	
JANUARY 87	886		2,337	3,182	
FEBRUARY 87	992		2,240	2,904	
MARCH 87	860		2,391	3,260	
APRIL 87	805		1,935	3,115	
MAY 87	862		2,327	3,115	
JUNE 87	750		2,161	3,147	
JULY 87	795		2,175	2,826	
AUGUST 87	627		1,744	2,240	
SEPTEMBER 87	619		1,048	2,227	
OCTOBER 87	579		1,155	2,250	
NOVEMBER 87	675		1,053	2,381	
DECEMBER 87	566		961	1,552	
CUM FOR YEAR	9,016	0	21,527	32,199	
CUM FOR WELL	34,686	0	59,773	103,157	
JANUARY 88	548		898	2,159	
FEBRUARY 88	294		619	1,373	
MARCH 88	510		565	2,520	
APRIL 88					NO REPORT
MAY 88					NO REPORT
JUNE 88	280		0		
JULY 88	370		1,454	1,860	
AUGUST 88	280		549	1,326	
SEPTEMBER 88	281		544	1,230	
OCTOBER 88	256		622	1,271	
NOVEMBER 88	234		657	1,200	
DECEMBER 88	372		743	1,240	
CUM FOR YEAR	3,425	0	6,651	14,179	
CUM FOR WELL	38,111	0	66,424	117,336	

SUN EXPLORATION & PRODUCTION
(Williamson)
Case No. 9646
4/12/89 Examiner Hearing
Exhibit No. 2

WELL PRODUCTION

OPERATOR SUN EXPLORATION & PRODUCTION
FIELD BRUSHY DRAW DELAWARE LEASE MOBIL 22 FED WELL# 5

MONTH/YEAR	OIL PRODUCTION	OIL RUNS	GAS PRODUCTION	WATER PRODUCTION	COMMENTS
JANUARY 89	189		632	1,120	
FEBRUARY 89	336		483	924	
MARCH 89					
APRIL 89					
MAY 89					
JUNE 89					
JULY 89					
AUGUST 89					
SEPTEMBER 89					
OCTOBER 89					
NOVEMBER 89					
DECEMBER 89					
CUM FOR YEAR	525	0	1,115	2,044	
CUM FOR WELL	38,636	0	67,539	119,380	

SUN EXPLORATION & PRODUCTION
(Williamson)
Case No. 9646
4/12/89 Examiner Hearing
Exhibit No. 2

Williamson Exhibit 2

WELL PRODUCTION

OPERATOR SUN EXPLORATION & PRODUCTION
FIELD BRUSHY DRAW DELAWARE LEASE MOBIL 22 FED WELL# 5

MONTH/YEAR	OIL PRODUCTION	OIL RUNS	GAS PRODUCTION	WATER PRODUCTION	COMMENTS
JANUARY 85					
FEBRUARY 85					
MARCH 85					
APRIL 85					
MAY 85					
JUNE 85					
JULY 85					
AUGUST 85	1,116		873	1,483	
SEPTEMBER 85	1,824		925	5,837	
OCTOBER 85	2,585		2,591	3,993	
NOVEMBER 85	2,379		2,770	7,200	
DECEMBER 85	2,160		1,989	6,955	
CUM FOR YEAR	10,064	0	9,148	25,468	
CUM FOR WELL	10,064	0	9,148	25,468	
JANUARY 86	1,063		1,188	1,804	
FEBRUARY 86	1,823		2,998	3,646	
MARCH 86	1,250		2,432	5,056	
APRIL 86	907		1,376	2,721	
MAY 86	1,423		2,525	4,554	
JUNE 86	1,485		2,622	6,534	
JULY 86	1,363		2,171	3,338	
AUGUST 86	1,498		2,860	3,908	
SEPTEMBER 86	1,365		3,159	3,883	
OCTOBER 86	1,215		2,822	3,340	
NOVEMBER 86	1,123		2,523	3,340	
DECEMBER 86	1,091		2,422	3,366	
CUM FOR YEAR	15,606	0	29,098	45,490	
CUM FOR WELL	25,670	0	38,246	70,958	
JANUARY 87	886		2,337	3,182	
FEBRUARY 87	992		2,240	2,904	
MARCH 87	860		2,391	3,260	
APRIL 87	805		1,935	3,115	
MAY 87	862		2,327	3,115	
JUNE 87	750		2,161	3,147	
JULY 87	795		2,175	2,826	
AUGUST 87	627		1,744	2,240	
SEPTEMBER 87	619		1,048	2,227	
OCTOBER 87	579		1,155	2,250	
NOVEMBER 87	675		1,053	2,381	
DECEMBER 87	566		961	1,552	
CUM FOR YEAR	9,016	0	21,527	32,199	
CUM FOR WELL	34,686	0	59,773	103,157	
JANUARY 88	548		898	2,159	
FEBRUARY 88	294		619	1,373	
MARCH 88	510		565	2,520	
APRIL 88					NO REPORT
MAY 88					NO REPORT
JUNE 88	280		0		
JULY 88	370		1,454	1,860	
AUGUST 88	280		549	1,326	
SEPTEMBER 88	281		544	1,230	
OCTOBER 88	256		622	1,271	
NOVEMBER 88	234		657	1,200	
DECEMBER 88	372		743	1,240	
CUM FOR YEAR	3,425	0	6,651	14,179	
CUM FOR WELL	38,111	0	66,424	117,336	

SUN EXPLORATION & PRODUCTION
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WELL PRODUCTION

OPERATOR SUN EXPLORATION & PRODUCTION
FIELD BRUSHY DRAW DELAWARE LEASE MOBIL 22 FED WELL# 5

MONTH/YEAR	OIL PRODUCTION	OIL RUNS	GAS PRODUCTION	WATER PRODUCTION	COMMENTS
JANUARY 89	189		632	1,120	
FEBRUARY 89	336		483	924	
MARCH 89					
APRIL 89					
MAY 89					
JUNE 89					
JULY 89					
AUGUST 89					
SEPTEMBER 89					
OCTOBER 89					
NOVEMBER 89					
DECEMBER 89					
CUM FOR YEAR	525	0	1,115	2,044	
CUM FOR WELL	38,636	0	67,539	119,380	

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