OXY USA INC.

EXPLORATION AND PRODUCTION GROUP

Geological & Engineering Report
Central Corbin Queen Field
Lea County, New Mexico

Midland, Texas

July, 1990

ENGINEERING AND GEOLOGICAL REPORT

CENTRAL CORBIN QUEEN FIELD

LEA COUNTY, NEW MEXICO

MARCH, 1990

FIRST REPORT: SEPTEMBER 1987

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CONTENTS

SUMMARY

1. The Central Corbin Queen Field was discovered in March, 1985, and currently includes twenty-four producers, one temporarily abandoned well, and four plugged and abandoned wells. The most productive areas of the field have been developed.

2. The Queen reservoir is found at an average depth of 4200 feet and consists of very fine-grained sandstone deposited in a tidal channel environment. Net pay thickness averages 21 feet and porosity averages about 10%. The trap is stratigraphic; productive limits are controlled by porosity distribution. The oil-water contact exists at about -300 ft subsea and defines the southern productive limit of the field.

3. The producing rate decline has been severe. The field's cumulative oil production to May 1, 1989 is 502 MBO, and the remaining primary reserves are estimated at 70 MBO. The ultimate primary production is thus expected to reach 572 MBO, or 5.4% of the original oil-in-place.

4. Based on the performance of analogous fields, a secondary-to-primary ratio of 0.98:1 is anticipated for the Central Corbin Queen Field. Secondary reserves are estimated at 559 MBO, or 5.3% of the original oil-in-place.

5. The investment required to implement a fieldwide waterflood totals $888,000.

6. A Central Corbin Queen waterflood can be expected to generate undiscounted net cash of 3,727 M$ (2,613 M$ when discounted at 15%) for a 100% Working Interest and 87.5% Net Revenue Interest. The Discounted Cash Flow Return on Investment is 227.7% and the payback period is 1.4 years.

RECOMMENDATIONS

1. It is recommended that plans for a Central Corbin Queen waterflood be approved.

2. Unitization proceedings should be initiated. Operators with productive wells in the Central Corbin Queen Field should be contacted and informed.

3. Unitization plans should be presented to the Bureau of Land Management and the New Mexico Oil Conservation Division for approval. The field will necessarily be unitized under the rules for federal units.

4. It is recommended that a fieldwide waterflood using 80-acre, five spot patterns be implemented.

INTRODUCTION

The Central Corbin Queen Field is located in Sections 3, 4 and 9 of Township 18 south, Range 33 east, Lea County, New Mexico approximately 35 miles west of Hobbs, New Mexico (Attachment 1). The field's main producing zone is the upper member of the Guadalupian-age Queen sandstone. Primarily because of the success of other Queen waterfloods in the Delaware Basin, it has been recognized that waterflooding may be the optimal means of producing this field.

Development

The Central Corbin Queen Field was discovered in March, 1985, with the completion of the Federal "AA" No. 1 in the Queen. The wildcat was known as the Cardinal Prospect. After unsuccessful tests in the Morrow, Wolfcamp, Bone Spring and Premier, the Queen completion flowed 482 BOPD on its initial potential test.

The development began in July, 1985 as two offsets to the discovery, the Federal "AA" No. 2 and the Federal "AD" No. 1, were completed pumping 52 BOPD and flowing 589 BOPD, respectively. The drilling of eight additional wells from October through January completed the second group of wells. The Federal "AE" No. 3, the field's first unsuccessful well, was part of this group. The new wells increased OXY's field producing rate to roughly 680

BOPD.

Drilling was resumed in September, 1986. Nine wells were drilled in 1986. Portions of the western and northern boundaries of the field were established from this drilling. These wells also extended the field to the south and east. OXY has drilled twenty wells in the Central Corbin Queen Field to date. The producing rate for the OXY wells was 61 BOPD in April 1989.

The Federal "AI" Nos. 3 and 4 wells were completed in August and November 1986 respectively. The Federal "AH" No. 1 well was completed in June 1987.

Offset operators drilled a total of six Queen producers subsequent to the field's discovery. Leases containing four (4) of these six (6) wells were purchased by OXY in 1988. Current offset operators include Conoco in Section 10 and Santa Fe Exploration in Section 3.

The royalties for the federal leases are determined using a "sliding scale" formula, and vary with producing rate. Lease ownership and well locations are shown on Attachment 2. The Corbin Queen Field, located in Township 17 South, lies north of the Central Corbin Queen Field. Reservoir rock properties, fluid properties, and reserves are summarized in Table 1.

Completions

Generally, the wells in the Central Corbin Queen Field typically have 8-5/8" 24# K55 casing set below 350' and 5-1/2" 14# K55 casing set at total depth. Cement is circulated behind both strings. Most wells are pumped using 3/4" steel rods and Lufkin Mark 160D pumping units. The pumping units are somewhat oversized for current needs to allow sufficient lifting capacity for the increased fluid producing rates which will accompany the waterflood.

The overall performance of the wells drilled in October and November, 1986, was better than that of the typical well of the first eleven wells, although it is unclear whether this was due to treatments or the reservoir quality. The most recent five wells have been more disappointing, but these wells were also drilled on the margins of the field.

The Queen wells usually must be fracture stimulated before there is any show of oil and gas. These stimulations range in size from 20,000 gallons to 34,000 gallons and 41,200 pounds to 105,000 pounds of sand. Table 2 summarizes well data for Central Corbin Queen wells.

Production Characteristics

High production rates on the initial potential tests are common at the Central Corbin Queen Field. The highest test was recorded on the Federal "AE" No. 2, which flowed 611 BOPD at 100 PSI tubing pressure on a 3/4" choke. The initial potential tests on OXY wells have averaged 160 BOPD. The 80 BOPD field allowable prevented some wells from being produced daily early during their first months of production.

After eighteen months of production, some specific problems associated with production from the Central Corbin Queen Field have been recognized. The characteristics include a rapid decline in producing rate, the accumulation of paraffin in the tubulars, and the precipitation of salt both downhole and in surface vessels.

Several factors may contribute to the steep initial decline common to all Central Corbin Queen wells. First, the reservoir drive mechanism appears to be solution gas drive. In a field where GOR's are as low as they are in the Central Corbin, this energy is quickly depleted. This produces a severe pressure decline in the vicinity of the wells, reducing the pressure drop which drives the flow of hydrocarbons. The producing rates of wells in areas of low permeability will be particularly affected by this energy depletion.

A second factor which may steepen the production decline is the possible downhole precipitation of scale. Both paraffin and salt precipitation may also be accelerating the field's producing rate decline if this precipitation is occurring downhole where it is difficult to remove. The blocking of the perforations by these materials would act as skin damage in a well, reducing the flow rate into a wellbore for any particular pressure drop. Since early in 1986, Xylene treatments have been used on producing wells to remove paraffin. Surface lines and vessels can be cleaned out by the circulation of hot oil and fresh water.

RESERVOIR DESCRIPTION

The Central Corbin (Queen) Field is located on the north basin platform structural province, near the northern edge of the Delaware Basin. The Queen Formation is part of the Guadalupian age Artesia Group, which includes the Goat Seep and Capitan carbonate reef systems (Attachment 3). Central Corbin, along with several other Queen fields in the area (Corbin, E-K, and North E-K) produces from the upper part of the Queen, locally referred to as the Shattuck member, or Queen sandstone (Attachment 4). The Central Corbin Field is primarily a stratigraphic trap, with a structural influence at its southern edge.

Queen core is available on three wells in Central Corbin: the Federal "AA" No. 2 (4236-4291), Federal "AD" No. 1 (4198-4245) and the Federal "AE" No. 1 (4194-4242). Open hole logs are available on most of the wells. The gamma ray-neutron/density log has proven to be the most useful correlation tool. Regional subsurface mapping has provided valuable analogies from more mature Queen fields.

In Central Corbin, the Queen sandstone is 48-60 feet thick, with gradational contacts with the underlying and overlying anhydrite. The reservoir consists of very fine grained (62.5-125 microns) well sorted, sub-angular quartzarenite. Corrensite clay (a mixed layer chlorite-smectite clay) lines the pore throats. X-ray analysis indicates clay volumes (1,2,3,4) ranging from 4.2-

8.6% (± 2%). Authegenic potassium feldspar, dolomite and gilsonite occur in small quantities. The better reservoir rocks exhibit low-angle planar cross-bedding, and the grain size is on the coarse end of the range (88-125 microns). Oil-bearing rocks are buff-gray, whereas non-oil-bearing rocks are red. Visible oil within red sandstones are surrounded by buff-gray rings, indicating that the color change is due to reduction of iron oxides in the rock by the presence of hydrocarbons.

Porosity is interparticle, ranging up to 14%, and averaging 10.4%. Pay thickness (porosity ≥ 8%) ranges up to 34 feet, and averages 21 feet. Anhydrite is the dominant cement type in the reservoir. The degree of anhydrite plugging is a function of grain size. Sandstone on the coarse end of the range is less affected by anhydrite cementation. Permeability ranges up to 207 md, and averages 3.8 md. Porosity-permeability plots derived from core data cluster along a fairly linear trend (Figure 1). Oriented core, recovered from the Federal "AD" No. 1 indicates no preferred permeability direction. Oil staining and reduction spots on core surfaces show preferred fluid flow parallel to the low-angle cross-bedding, which probably dips to the south. Anhydrite cement distribution in the cross-bedded sandstones suggest tortuous permeability paths. Natural fractures probably influence permeability paths, however, the core does not reveal an extensive fracture system. Random distribution of anhydrite cement appears to have the greatest impact on permeability paths, therefore, near-wellbore permeability paths should be radial.

Non-reservoir rock within the Queen sandstone consists of coarse-grained (31.2-62.5 microns), sub-angular, well-sorted quartz siltstone. It is mostly red, with some red-buff wavy laminae, and wisps, or nodules of anhydrite. Porosity is completely plugged with anhydrite.

Structural strike at Central Corbin is east-west, dipping southerly 100-150 feet/mile (Attachment 5). An east-west trending monoclinal fold occurs north of Central Corbin, in the Corbin (Queen) Field. The monoclinal fold appears to have influenced pay development in Corbin. An oil-water contact occurs at -300 feet.

Calculated water saturations in the field are quite erratic, ranging from 33-82%, with no difference in water cut. The presence of corrensite clay appears to have affected resistivity measurements. In addition, porosity calculations from CNL-FDC logs sometimes bear little relationship to well performance, which in turn would distort water saturation calculations. Due to the unreliable water saturation calculations from well logs, hydrocarbon pore volume maps ($S_o\phi h$) were not constructed. A water saturation of 41% was used based on relative-permeability data and fractional flow equation.

The most significant porosity zone in the Queen occurs in the lower half of the section. Three other thin zones are correlatable throughout the field.

Core measured porosities do not consistently correlate with porosities calculated from CNL-FDC logs. Therefore the lithodensity and CNL logs were used from the Federal AE #1 and AE #5 wells to determine the two predominate minerals were annhydrite and sandstone. On this basis the matrix density was calculated on a point by point basis to arrive at the net sand and porosity-thickness values for each well with an open hole density and neutron log and porosity was then calculated from this new matrix density. These data were then used with the water-oil contact to construct the net sand, net pay and net porosity-thickness isopach maps of the Queen interval (Attachments 6, 7 and 8).

The net pay isopach of the Queen sandstone, using an 8% porosity cut-off helps define the limits of the reservoir (Attachment 7). The reservoir is bounded on the north, east and west by a pinchout of the porosity, and to the south by the oil-water contact.

The Queen sandstone is a widespread deposit of probable eolian origin. A trend of Queen sandstone production occurs along the northern edge of the underlying Goat Seep Reef lagoon (Attachment 9). The digitate lagoon-sabkha boundary is defined by lithologic logs; dolomite underlies the Queen sandstone in the lagoon, and anhydrite underlies the Queen in the sabkha. Along this boundary, the eolian transported sands were re-worked by marginal marine processes, creating the reservoir. Central Corbin Field is located within a narrow embayment in the lagoon, where tidal currents re-worked the sands. Depositional strike is north-south, perpendicular to the shoreline. The Corbin Field, to the north, is located along the shoreline, where shoreline currents re-worked the sands. Depositional strike is therefore east-west, parallel to the shoreline.

Dry holes separate the north-south trending Central Corbin (Queen) Field from the east-west trending Corbin (Queen) Field (Attachments 10 and 11). The proposed unit area includes all the active wells in the Central Corbin (Queen) Field, as well as the Oxy Federal "AI" No. 1, an old completion in the Corbin (Queen) Field (NE/4 NE/4, section 4). Current mapping indicates that this well is in communication with Central Corbin, and separate from Corbin.

Fluid Characteristics

The fluids produced at the Central Corbin Queen Field have some unique characteristics. The effect of these characteristics on waterflood performance is unknown but probably not detrimental. Queen waterfloods located near the Central Corbin Queen Field have been successful, although it is not certain whether similar fluids were originally present. Discussions of the PVT analysis, gas composition, and water properties follow.

Samples of oil and gas were collected from the Federal "AA" No. 1 on July 17, 1986 for the purpose of performing a recombination pressure-volume-temperature (PVT) analysis. The samples were collected at the heater treater. An original reservoir pressure of 1850 PSI, an initial GOR of 115 SCF/BBL, and a reservoir temperature of 96^{o} F were used to perform the analysis at approximate reservoir conditions. The bubble point pressure of the recombined fluid was found to be 895 PSIG (5). The entire PVT analysis is included as Tables 3-6 and Figures 2-8. The compositional analysis of the recombined fluids revealed the first unusual characteristic of the fluids produced from the Central Corbin Queen Field.

The compositional analysis revealed an unusually high percentage of nitrogen in the gas samples, showing that nitrogen made up almost 25 mol% of the total gas volume. The periodic gas analyses performed by Conoco Pipeline on the gas they gather from the Oxy's leases confirmed this high concentration of nitrogen in the gas. Additionally, the Conoco gas analyses show that the concentration of nitrogen appears to fluctuate with time over a wide range of values, specifically from a low of 15.7 mol% to a high of 25.4 mol%. The most recent tests indicate a nitrogen concentration of 22.0 mol%. No satisfactory explanation has been offered for this fluctuation in nitrogen concentration. Nitrogen has been encountered in this area in the past. The geologic origin of these nitrogen pockets is uncertain, but it is possible that at some time in the past, nitrogen migrated through the Queen reservoir and isolated pockets of gas were trapped. The cumulative effect of this gas on those fluid characteristics which have a bearing on waterflood performance should be reflected in the PVT data.

The second unusual characteristic of the Central Corbin Queen reservoir fluids is the behavior of the produced water. The pH tends to drop significantly with time. pH's as low as 4.1 were measured after produced water sat undisturbed and exposed to air for 24 hours. Because of the high concentration of iron ions in the water, it will be necessary to prevent the exposure of produced water to air if iron precipitation is to be avoided prior to injection. This should also help to maintain the pH of the water at its starting value of 6.0. Another unusual characteristic of the produced water at the Central Corbin Queen Field is its high salt concentration. The chlorides content of the brine averages 182,000 ppm. A typical water analysis performed on a sample soon after its collection is included as Table 7. It should be noted that the produced brine may be precipitating calcium carbonate and possibly gypsum.

Reservoir Pressure

The initial reservoir pressure of the Central Corbin Queen Field has been approximated at 1850 PSI, based on fluid levels and shut-in tubing pressures measured during completion and on flowing tubing pressures. No accurate direct pressure measurements have been made. Although a pressure of 1296 PSI was measured in the Federal "AA" No. 1 following a 144-hour shut-in period, a higher bottom hole pressure would be necessary to induce flow with the measured flowing tubing pressure. Table 8 tabulates various pressure data for several wells. An attempt was made in 1986 to determine reservoir pressure using fluid levels in producing wells. Unfortunately, this method provided contradictory estimates, and the investigation was abandoned. Direct measurements of current reservoir pressure have not been attempted, and historical data does not exist. A regular testing schedule will be needed once the waterflood is initiated to monitor its progress and maximize its efficiency.

RESERVE ANALYSIS

Original Oil-In-Place

The original-oil-in-place (OOIP) for the Central Corbin Queen Field was determined using both the volumetric and material balance methods. The volumetric OOIP estimate for the Central Corbin Queen Field is based on the porosity-thickness isopach map given as Attachment 8. A discussion of this isopach map is presented in the "Reservoir Description" section.

Log interpretation is not always indicative of the productive potential of a given well. There is good production performance from wells with poor log appearance and poor production performance from wells with good log appearance. That is, primary production is more dependent on drainage area pressure and the effect of offset production than the variation in reservoir rock character.

The pore volume of the Queen reservoir was calculated using the following method. The areas within the contour lines on the isopach maps were determined by use of a planimeter. The volume of the reservoir rock was then calculated by applying the pyramidal technique to the areas digitized. A pore volume of 18,877,541 barrels was calculated.

Most completions in the field were initially water-free, and yet conventional analysis of the dual laterologs indicated water saturation as high as 92%. Samples of core were analyzed and the clay corrensite was identified. Based on available evidence it is believed that the presence of corrensite is largely responsible for the high (log) water saturations. Therefore, relative-permeability data and the fractional flow equation were used to determine initial water saturation. A water saturation of 41% was determined at fractional flow of water equal to zero (Figure 9). The sample taken from the Federal "AE" No. 1 at 4216.4' provides relative permeability data (Table 9).

At the original reservoir pressure of 1850 PSI, all gas is in solution and B_o, the formation volume factor is 1.048 RB/STB. Using calculated pore volume, water saturation and formation volume factor, OOIP of 10,627,624 STB was calculated. This calculation is included as Table 10.

Primary Recovery

Hyperbolic decline analysis was used to determine the primary reserves for the Central Corbin Queen Field. The ultimate primary recovery was estimated at 572 MSTB, or 5.4% of OOIP and cumulative production thru April 30, 1989 totals 502 MSTB.

Hyperbolic decline analyis was applied to each well at Central Corbin Queen until it reached an abandonment rate (Q_a) of 10 BOPM. The production history and extropolated production are given for each active producing well in Appendix A. It should be noted that twenty six (26) decline curves are given. Production from the Federal "AG" No. 1 well is included but this well is not included in the current active producing well count. Also production from the Federal "AE" No. 3 well is shown but the well is temporarily abandoned and is not included in the active producing well count (24 wells). The production data used in these figures were obtained from a commercial data source (Dwight's) which receives data from the New Mexico Oil Conservation Commission. These figures (Dwight's) were compared with data submitted to the Bureau of Land Management and are in agreement.

Well-by-well cumulative production, remaining primary reserves and ultimate primary recovery are presented in Table 11.

Secondary Recovery

The ultimate secondary recovery at Central Corbin Queen is expected to reach 559 MSTB (5.3% OOIP). The estimate of ultimate secondary recovery from the Central Corbin Queen Field is based on the results of the E-K Queen Unit, which was waterflooded from 1966 until 1978. The E-K Queen Unit was flooded using eighty-acre 5-spot patterns. The E-K Queen Unit would have produced 1925 MSTB of ultimate primary recovery and 1877 MSTB were produced under secondary recovery for a secondary-to-primary ratio of 0.98:1.

The comparable depositional setting, confirmed by the log characteristics, proximity, and overall field size, also supports the analogy. These factors as well as a comparison of the producing intervals of the field are presented in Attachment 12. The 559 MSTB (5.3% OOIP) secondary recovery prediction is simply the product of 0.98 and the expected ultimate primary recovery of 572 MSTB (5.4% OOIP) for the Central Corbin Queen.

A secondary recovery schedule was obtained from a peak daily production of 925 BOPD in 1991, daily production will average 540 BOPD for over two years, then decline at 45% per year thereafter. This estimate is based on the unit being developed on 80-acre five spot patterns. Primary and secondary figures for the Central Corbin Queen Field are given in Table 12. These data are plotted on Figure 10.

Laboratory flow tests in cores from the Federal "AA" No. 2 and Federal "AE" No. 1 wells indicate an average residual oil saturation after waterflooding of about 25 percent pore volume (6). The relatively high volumetric sweep efficiency was justified by a detailed examination of the core data. Correlative intervals in the cores were identified using the gamma traces. The permeabilities in Zone 2 range from 82 md to 1.0 md. The Dykstra-Parsons permeability variation is 0.82 (Figure 11). Still, neither the high nor low permeability stringers were found to extend from well to well; any stringers with exceptional reservoir properties appear to be areally limited. Thus, no highly permeable flow channels will directly connect producer and injector. Likewise, no barriers which might restrict vertical flow across a large area are anticipated. Although the variation in the measured permeabilities is high, this variation should not significantly reduce the overall sweep efficiency.

Pattern-size Selection

A review of several Queen waterfloods in Lea and Eddy Counties has shown that an 80-acre 5-spot pattern is generally believed to adequately drain Queen reservoirs. A map illustrating the locations of these waterfloods is included as Attachment 13. Twenty-acre infill producers have been drilled as pilots in seven of these Units, and 40-acre 5-spot patterns have been developed in one Unit. Although some wells drilled in six of the eight Units could be considered economically viable, the infill projects in only two of the eight Units appear to be overall successes.

Both the Seven Rivers Queen Unit and the Langlie Jal Unit produce from several zones in addition to the Shattuck Member of the Queen. Still, these Units are examples of successful infill programs in Queen waterfloods, and should, therefore, be reviewed. First, Arco has drilled nine 20-acre producers in the Seven Rivers Queen Unit located in T-22-S, R-36-E in the South Eunice Seven Rivers Queen Field. Five of these wells appear to be recovering incremental oil, although it is not clear that their ultimate cumulative production will approach that of older offset producers. Arco is continuing this development. Second, Union Texas has had success in converting from 80-acre to 40-acre 5-spot pattern in the Langlie Jal Unit located in T-24-S and 25-S, R-37-E, in the Langlie Mattix Seven Rivers Queen Grayburg Field. Ten out of the fifteen 20-acre producers drilled appear to be economically viable and contributing incremental oil. The infill program appears to have been the product of an effort to extend the life of this Unit, as many of the old 40-acre producers had reached their economic limits.

The one 20-acre producer drilled at Yates Petroleum's Young

Queen Unit located in T-18-S, R-32-E in the Young Queen Field recovered only 3 MBO before temporarily abandoned in 1985. This field is located only 7 miles west of the Central Corbin and is in the same geologic trend. Apparently, the 80-acre 5-spot patterns have effectively recovered secondary reserves in this Unit. Accordingly it is recommended that 80-acre 5-spot patterns be utilized for waterflooding the Central Corbin Queen Field.

PLAN OF OPERATION

Fieldwide Waterflood

As indicated in the previous section it is planned to waterflood the Central Corbin Queen Field using 80-acre 5-spot patterns. Water will be from three sources: (1) Central Corbin Queen produced brine, (2) produced brine from two nearby leases and (3) fresh water from an Ogalalla supply well. Other nearby Queen waterfloods have successfully used fresh water for make-up water. Laboratory flow tests using Central Corbin Queen Field core plugs were performed using a synthetic brine mixed with increasing proportions of fresh water(7). In one case a permeability reduction was observed and in the other flow test an increase in (brine) permeability was observed. Fresh water has been injected in the E-K Queen Unit and the East E-K Queen Unit without any adverse affects. The compatibility of Corbin Queen produced brine with the nearby lease produced brine has not been determined as of this writing. However, compatibility of Central Corbin Queen produced brine with fresh water was investigated (8). An initial rate of roughly 200 BWPD per well at 1500 PSI is expected for the Central Corbin Queen.

The Bureau of Land Management must grant approval for water injection in the Central Corbin Queen before the waterflood can be initiated. Since water injection will likely push oil from one lease to another, it is recommended that the field be unitized prior to the start of water injection. A discussion of unitization is included in a later portion of this section. Permission to use fresh water as part of the make-up water will also be required.

Water Requirements and Sources

The maximum daily water requirement for the proposed flood is estimated to be 2400 BWPD for the first year (Table 13). All the produced water in the Central Corbin Queen Field will be reinjected. However, make-up water will be required throughout the life of the field to maintain pressure. Reinjected produced water is shown in Table 13. Wells on the State DW and Federal AB leases located approximately 3 miles East of the Central Corbin Queen will provide approximately 1000 BWPD during the first three years of the project. The (total) cost to purchase pipe, lay a pipeline, and purchase pumping equipment in order to deliver produced water from the State DW and Federal AB leases is estimated at $65,000. To achieve the maximum daily water injection rate, the required make-up water for the Central Corbin is shown in Table 13. This supply will be obtained by purchasing fresh water from one of the Ogalalla supply wells in the area. The cost of fresh water is $0.21/BBL.

Well Conversions

Attachment 14 shows those wells selected for conversion to water injection for the Central Corbin Queen Field. The conversion wells were selected by choosing the pattern which would position most low rate or abandoned edge wells as injectors. The 80-acre pattern size requires the conversion of eleven (11) producers and one temporarily abandoned well to injection, leaving thirteen (13) active producers in the Unit. Limited transfers of pumping units among the producers may also be needed to insure that sufficient lift capability is available as the produced water volume increases. There are already thirteen (13) M160D pumping units on OXY leases and new units will not be needed.

The cost estimate for converting an existing producer and activating a TA'd well is $30,000/well (Table 14). The total cost for converting twelve (12) wells is $360,000 (Table 14).

Facilities

The facilities investment required for implementation of a fieldwide waterflood total $528,400 and is itemized in Table 15. Attachments 15 and 16 show the gathering and injection systems respectively. The facilities plan consists of consolidating the several existing batteries to two (2) production and test facilities with a single sales facility, and one (1) injection facility. In order to conserve capital, it is intended to make use of as much of the materials on hand as possible. The production facilities will take advantage of existing production headers and well test equipment. Converting wells to injection will allow sufficient flowline materials to be reclaimed to provide flowlines for the additional wells which will need to be tied to the two production batteries. The elimination of existing batteries will provide tankage for the new waterflood plant. Transfer pumps will be standardized as much as possible for ease of maintenance and repair. Oxygen scavenging, gas blankets and filtering will be provided for the injection water to minimize corrosion and injection well plugging. Whenever practical, components will be shop rather than field fabricated to save on field labor charges.

Economic Analysis

The economic analysis of the proposed waterflood project involves three economic cases. Case 1 is the project under continued operations while case 2 is the expected value of the project if the waterflood is implemented during January 1990. Case 3 is the difference between case 1 and 2, and shows the incremental economics associated with the proposed waterflood. Table 16 is a summary of the three economic analyses.

A capital investment of 888 M$ will generate discounted net cash production of 2,613 M$ (discounted at 15%) and add lease gross incremental oil reserves of 524 MSTB. The project will generate a rate-of-return on investment of 227.7% with payout occurring in 1.4 years. A Working Interest of 100% and Net Revenue Interest of 87.5% were assumed for these economic analyses. The current oil and gas prices of $18.00/Bbl and $1.50/MCF were used, respectively. Operating expenses were based on $1,500/month/well plus the cost of make-up water at $0.21/Bbl. Constant-dollar economics were applied for all cases.

Unitization

Unit Area

The Proposed Unit is comprised of twelve (10) tracts (Tracts 1A,1B,2A,2B,3,4A,4B,5,6 and 7) with different working interest, royalties, and overriding royalties. The legal description, size, royalty owner, overriding royalty owner, and working interest ownership for each tract are given on Attachment 17. The proposed secondary recovery unit area (boundary) of Central Corbin Queen Field is shown on Attachment 18.

Equity Parameters

The following list of parameters was considered in determining equity for the proposed secondary recovery unit:

1) Surface acreage
2) Net well count
3) Cumulative production to 4/30/89
4) Remaining primary reserves
5) Ultimate primary production
6) Average production rates (As of 4/89)
7) Net pay isopach
8) Net pay porosity-thickness isopach

A summary of the values of each parameter on a tract-by-tract basis appears in Table 17. Table 18 gives the working interest participations for each operator in the field based on the parameter values in Table 17.

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2. Interoffice letter dated August 26, 1986, from Eric Eslinger to Rebecca Egg entitled "Completion Procedures in Corbin Queen Wells".

3. Study by Wade Waddell, Geology and Reservoir Description of the Queen Sand, Central Corbin Queen Field, Lea County, New Mexico, (RMG86-10). October, 1986.

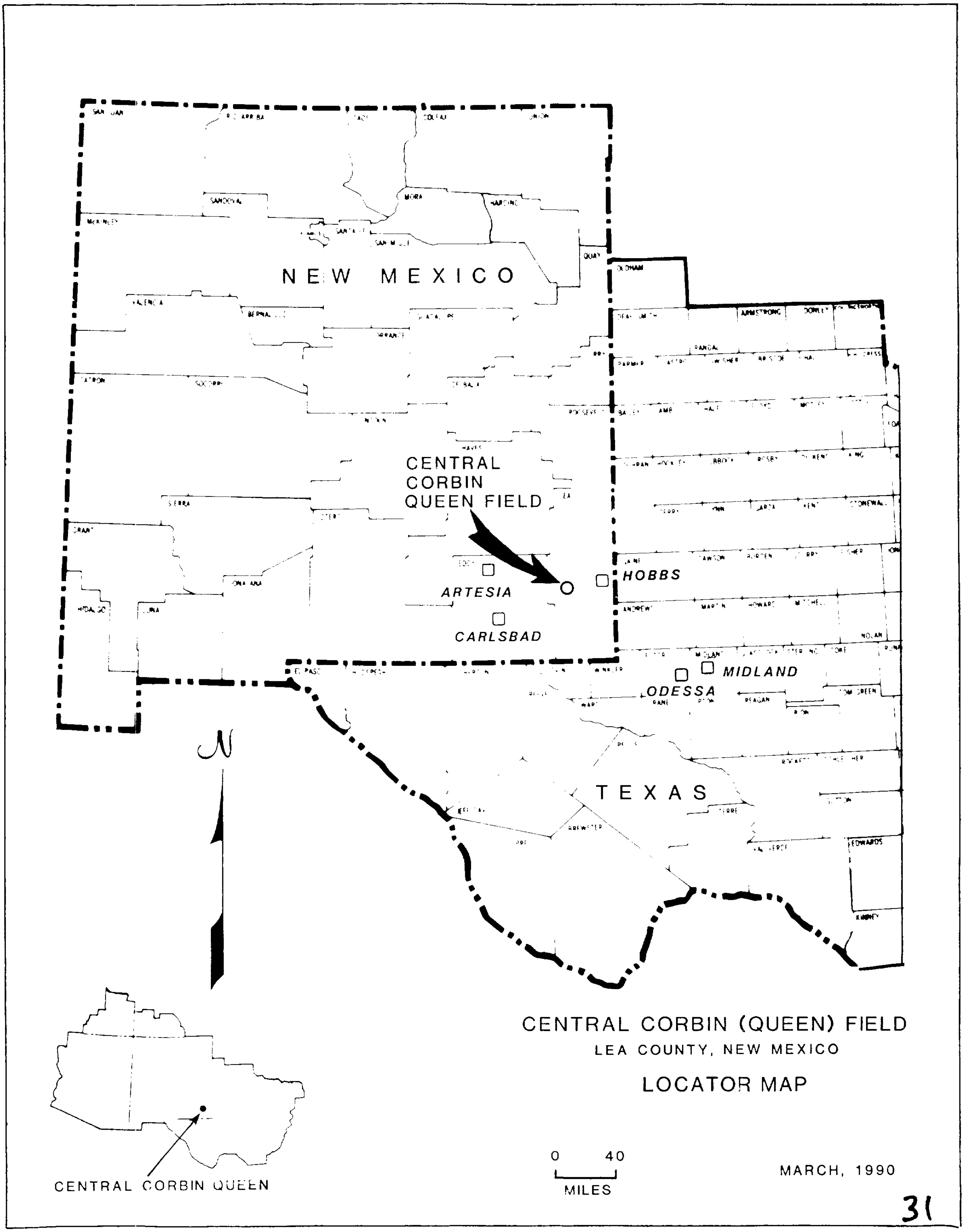
4. Interoffice letter dated September 11, 1986, from Wade Waddell to Jim McCarthy entitled, "Percent Clay in Queen Sand".

5. Interoffice letter dated November 6, 1986, from James Berryman to Jim McCarthy entitled, "Reservoir Fluid Analysis-Federal "AA-1", Corbin Queen Field, Lea County, New Mexico".

6. Interoffice letter dated June 5, 1987, from Joe Mundis to Rebecca Egg entitled, "Residual Oil Saturation Determination, Corbin Queen Field, Lea County, New Mexico".

7. Memo dated October 23, 1986, from Joe Mundis to Rebecca Egg entitled, "Water Sensitivity Test Nos. 1 and 2".

8. Interoffice letter dated September 9, 1986, from Loyd Nixon to Rebecca Egg entitled, Federal "AA", "AD", "AE" Brines Mixed with Fresh Water for Waterflood".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CORBIN
QUEEN FIELD
HOBBS
ARTESIA
CARLSBAD
MIDLAND
ODESSA
TEXAS
CENTRAL CORBIN QUEEN
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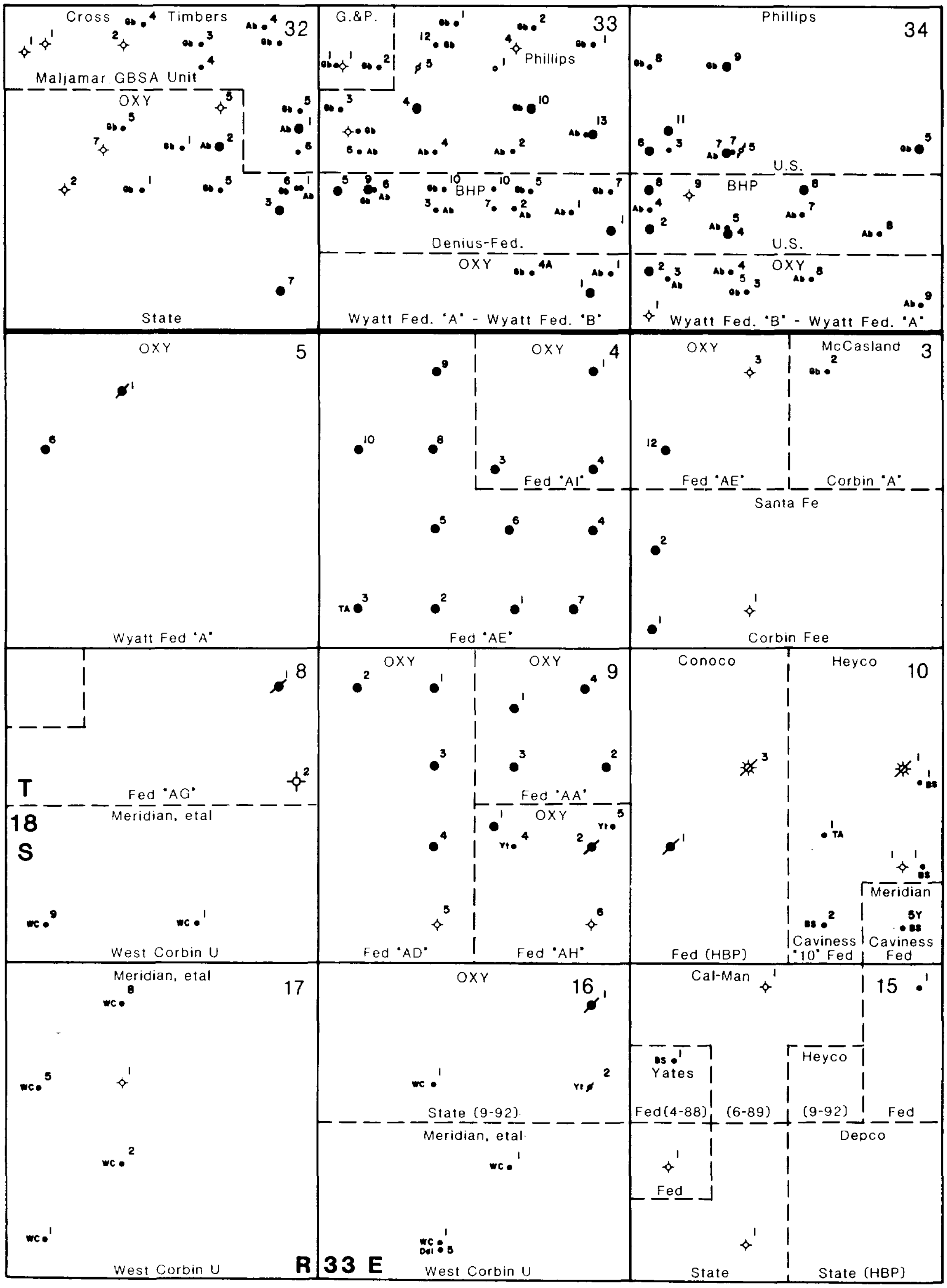
MILES
CENTRAL CORBIN (QUEEN) FIELD
LEA COUNTY, NEW MEXICO
LOCATOR MAP
MARCH, 1990

ATTACHMENT 2



● QUEEN PRODUCER

• OTHER ZONES { Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp }

CORBIN (QUEEN) AND CENTRAL CORBIN (QUEEN) FIELDS

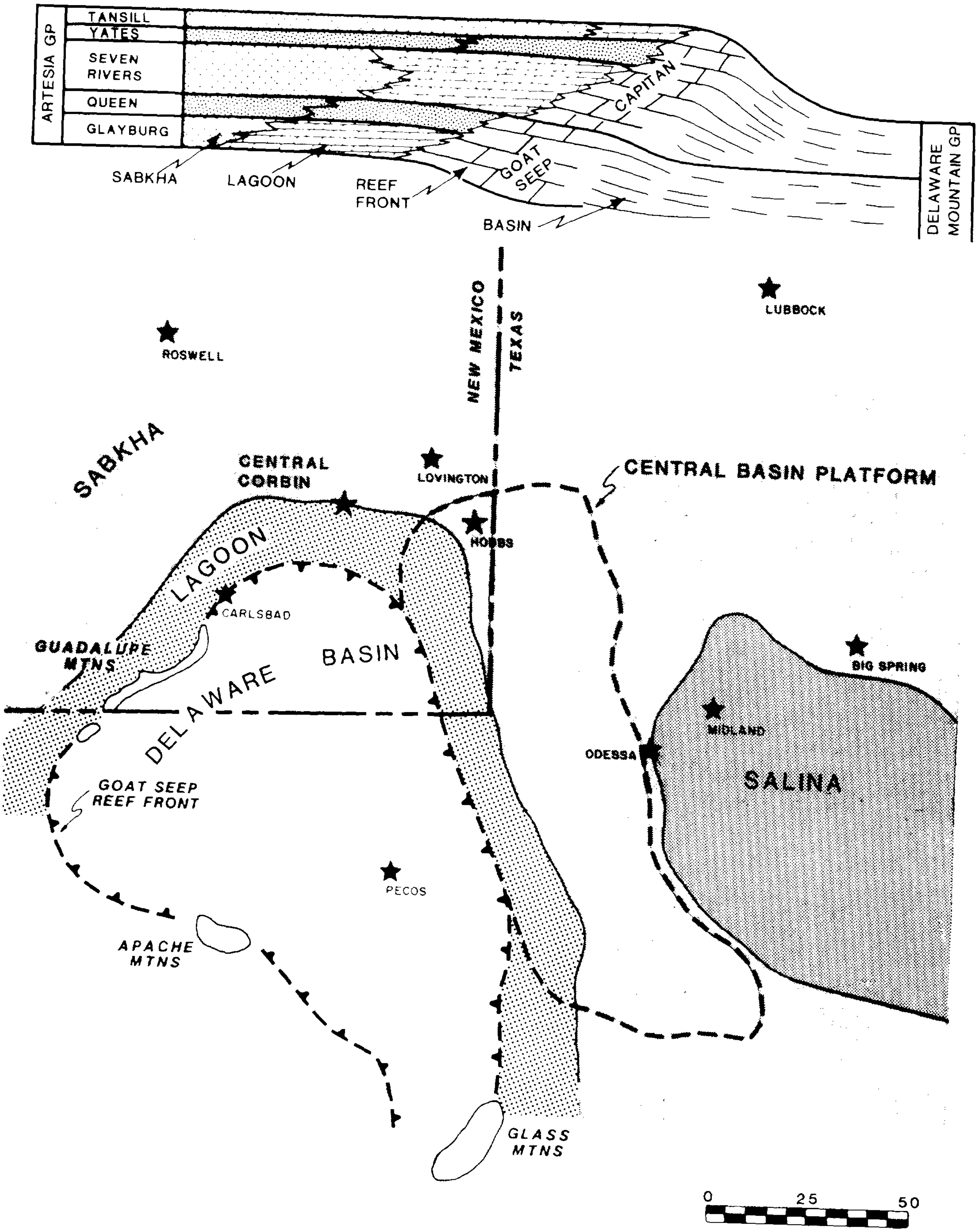
LEA COUNTY, NEW MEXICO

LEASE OWNERSHIP AND WELL LOCATIONS

0 — 1/2 MILE

MARCH, 1990

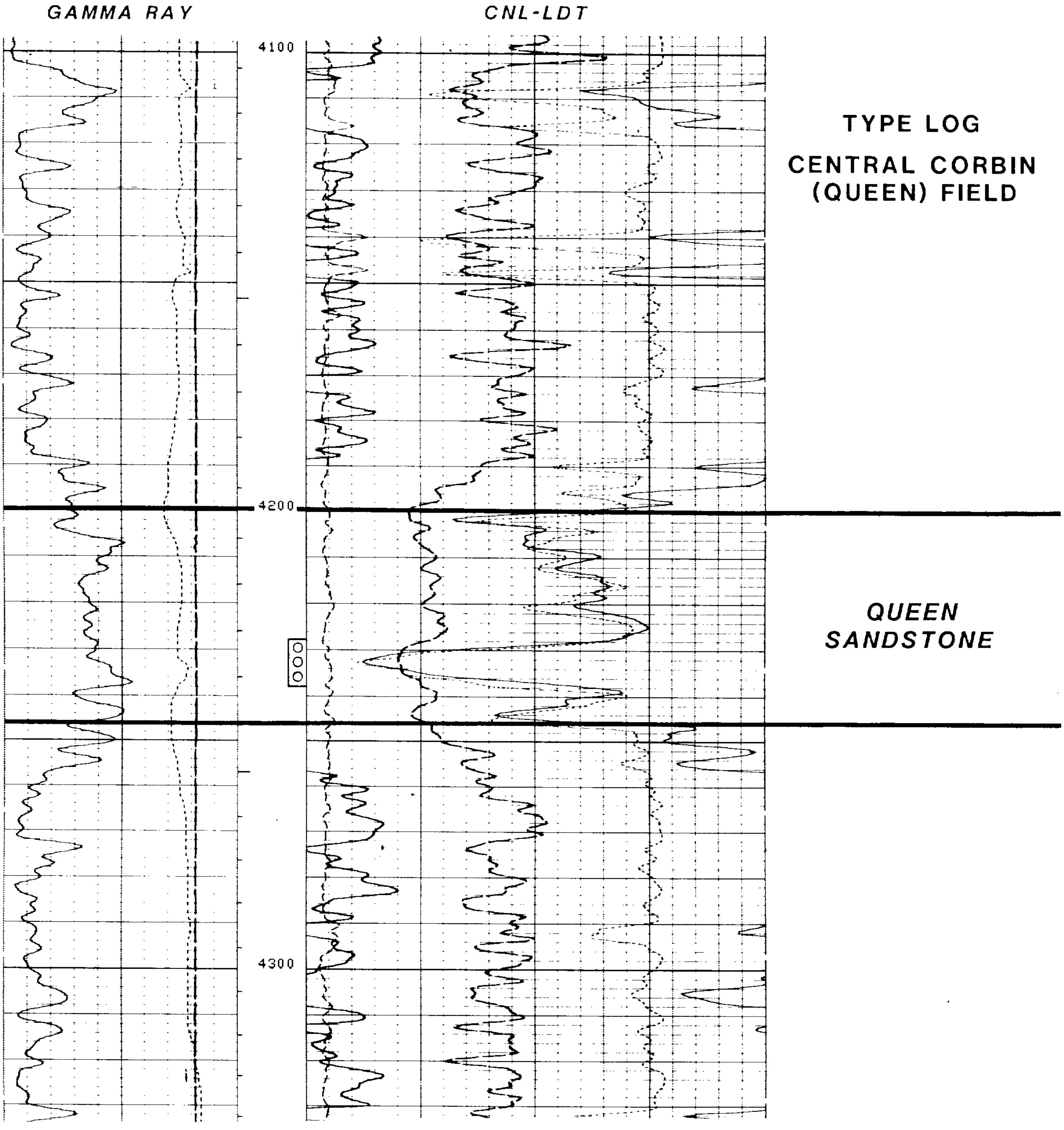
ATTACHMENT 3



GEOL: R.L. DOTY

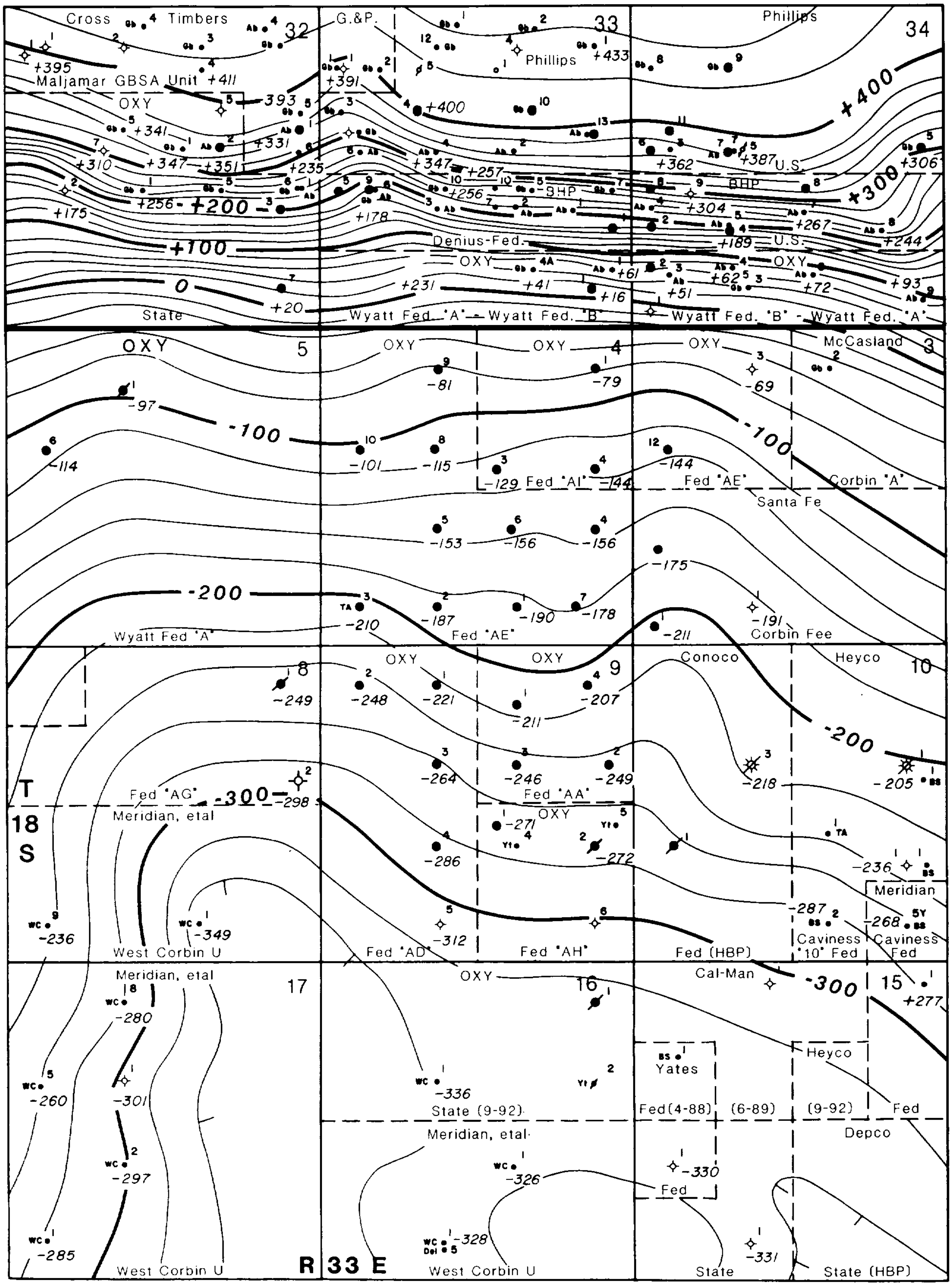
MARCH, 1990

OXY USA INC.
FEDERAL "AA"#1
990' FNL & 1980' FEL
Sec. 9, T-18-S, R-33-E
Lea County, New Mexico
KB 3985'



PF 4228-38' IPF 482 BOPD

ATTACHMENT 5



- ● QUEEN PRODUCER
- • OTHER ZONES: Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp

CENTRAL CORBIN (QUEEN) FIELD

LEA COUNTY, NEW MEXICO

QUEEN STRUCTURE

C.I.=20'

GEOL.: R. L. DOTY

0 — 1/2 MILE

MARCH, 1990

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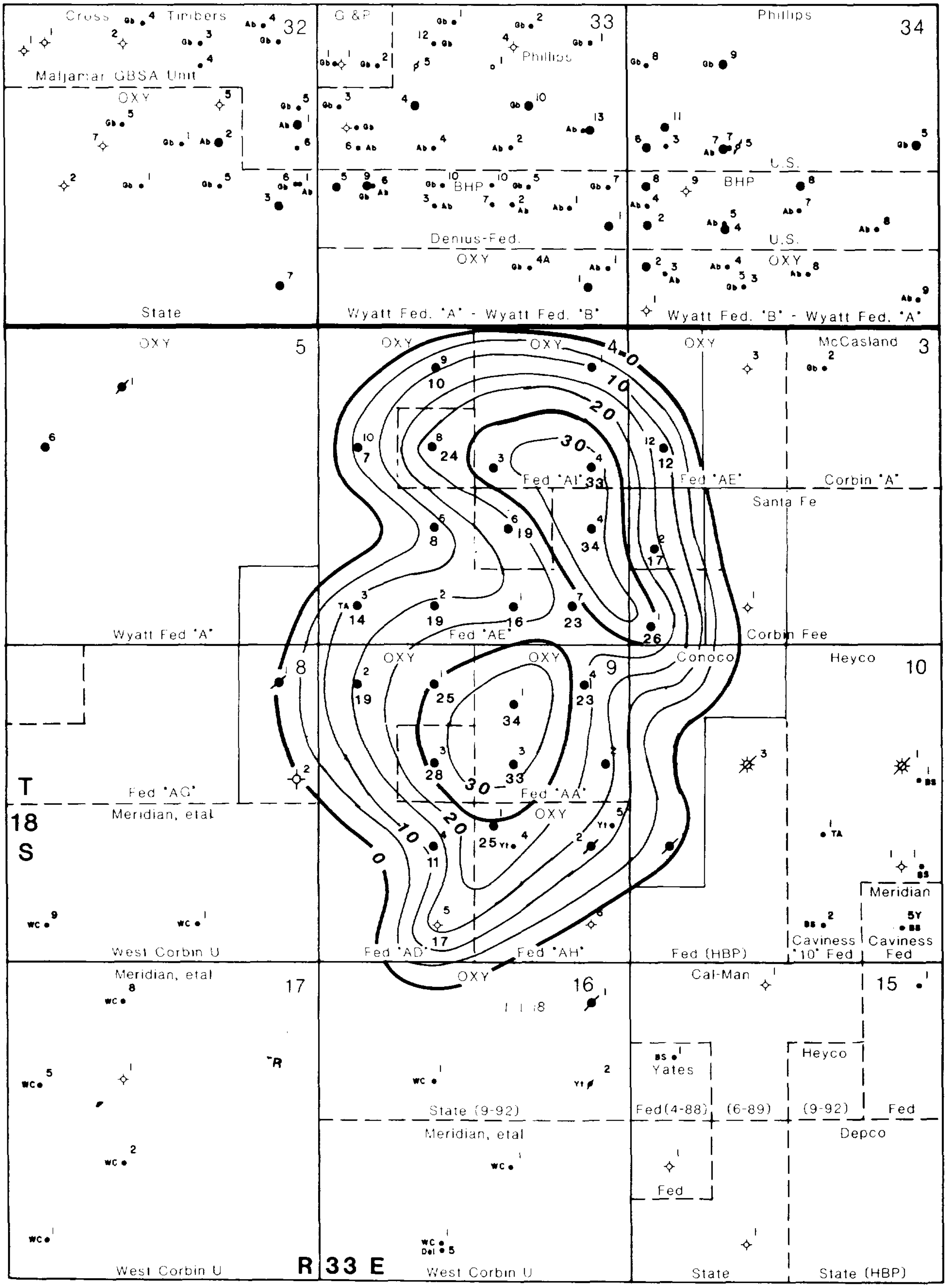
ATTACHMENT 6



● QUEEN PRODUCER

• OTHER ZONES { Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp

X WELL NUMBER
●
X NET SAND, FT

CENTRAL CORBIN (QUEEN) FIELD

LEA COUNTY, NEW MEXICO

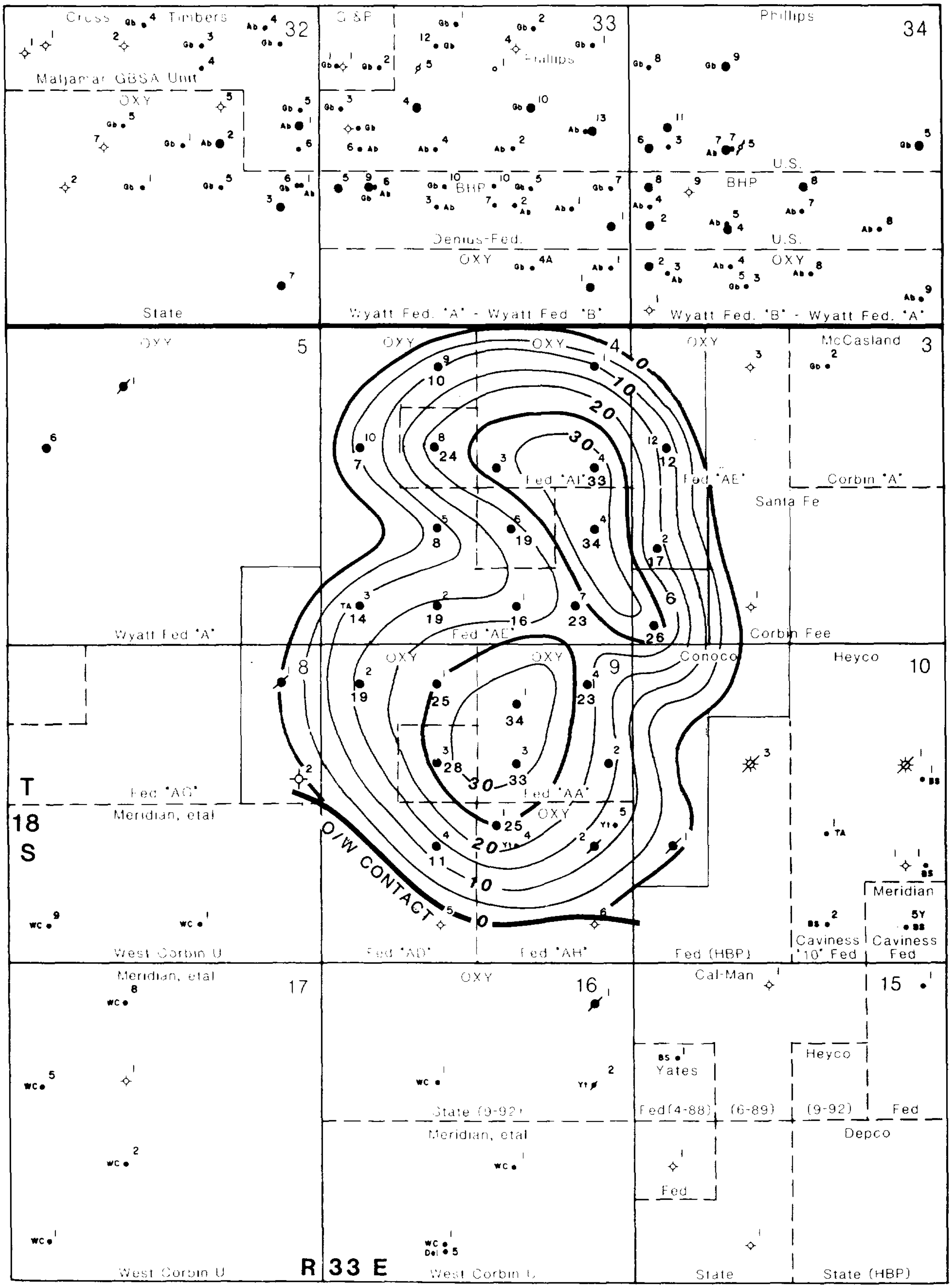
NET SAND ISOPACH (Ø ≥ 8%)

ENG.: V. PHAM

0 — 1/2 MILE

MARCH, 1990

ATTACHMENT 7



● QUEEN PRODUCER

• OTHER ZONES: Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp

●X WELL NUMBER
X NET PAY, FT

CENTRAL CORBIN (QUEEN) FIELD

LEA COUNTY, NEW MEXICO

QUEEN SANDSTONE NET PAY ISOPACH ($\phi \geq 8\%$)

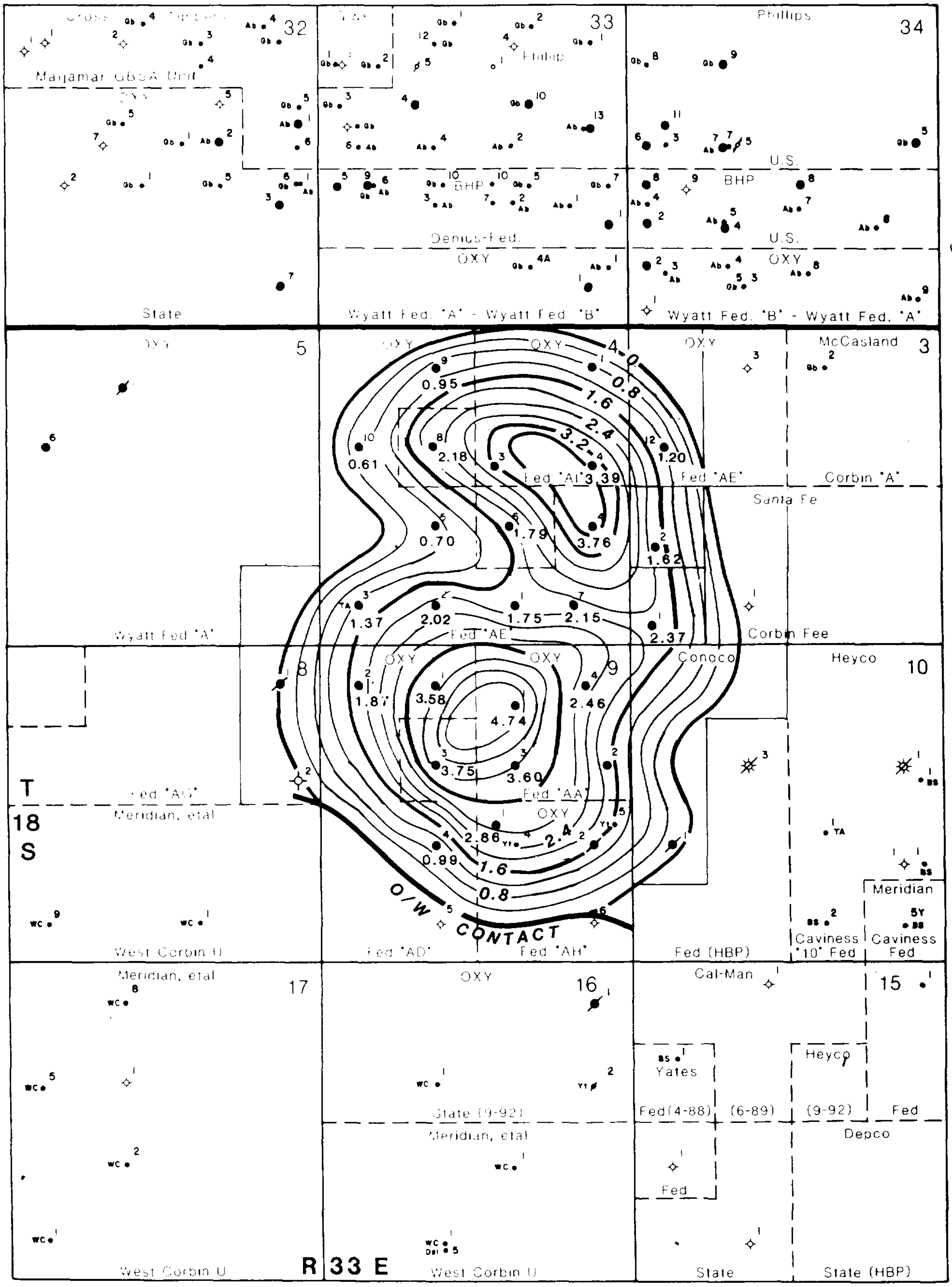
C.I. = 5'

0 — 1/2 MILE

ENG.: V. PHAM

MARCH, 1990

ATTACHMENT 8



- QUEEN PRODUCER
- OTHER ZONES (Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp)

X WELL NUMBER

X POROSITY-FEET

CENTRAL CORBIN (QUEEN) FIELD

LEA COUNTY, NEW MEXICO

QUEEN SANDSTONE POROSITY-THICKNESS ISOPACH ($\phi \geq 8\%$)

C.I. = Ø.40 h'

0 — 1/2 MILE

ENG. V. PHAM

MARCH, 1990

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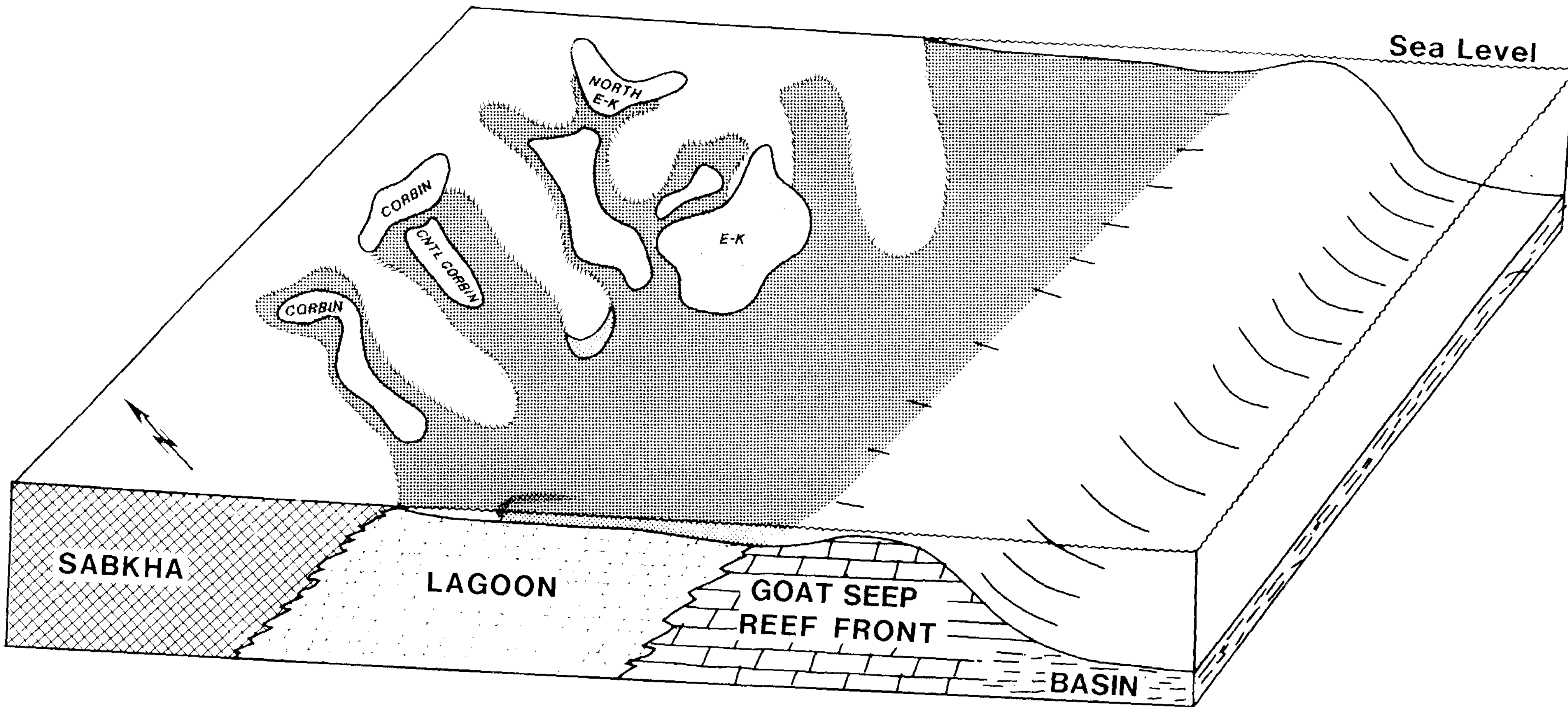
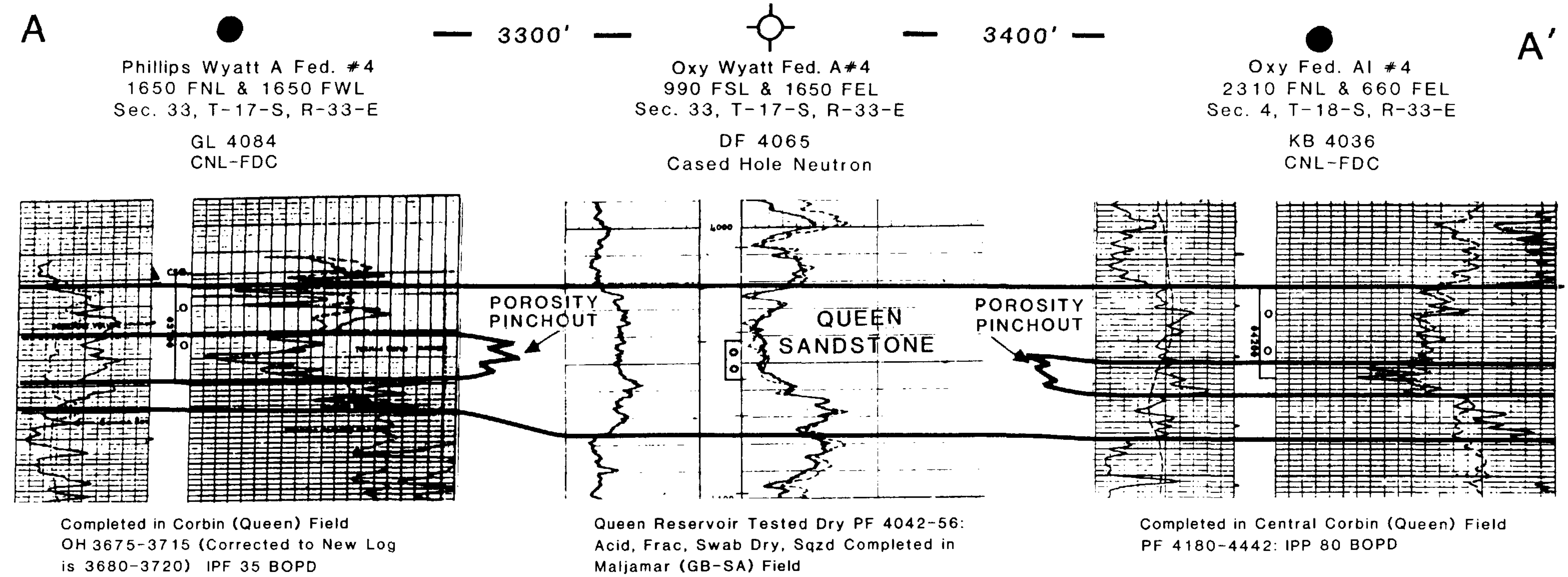
ATTACHMENT 9

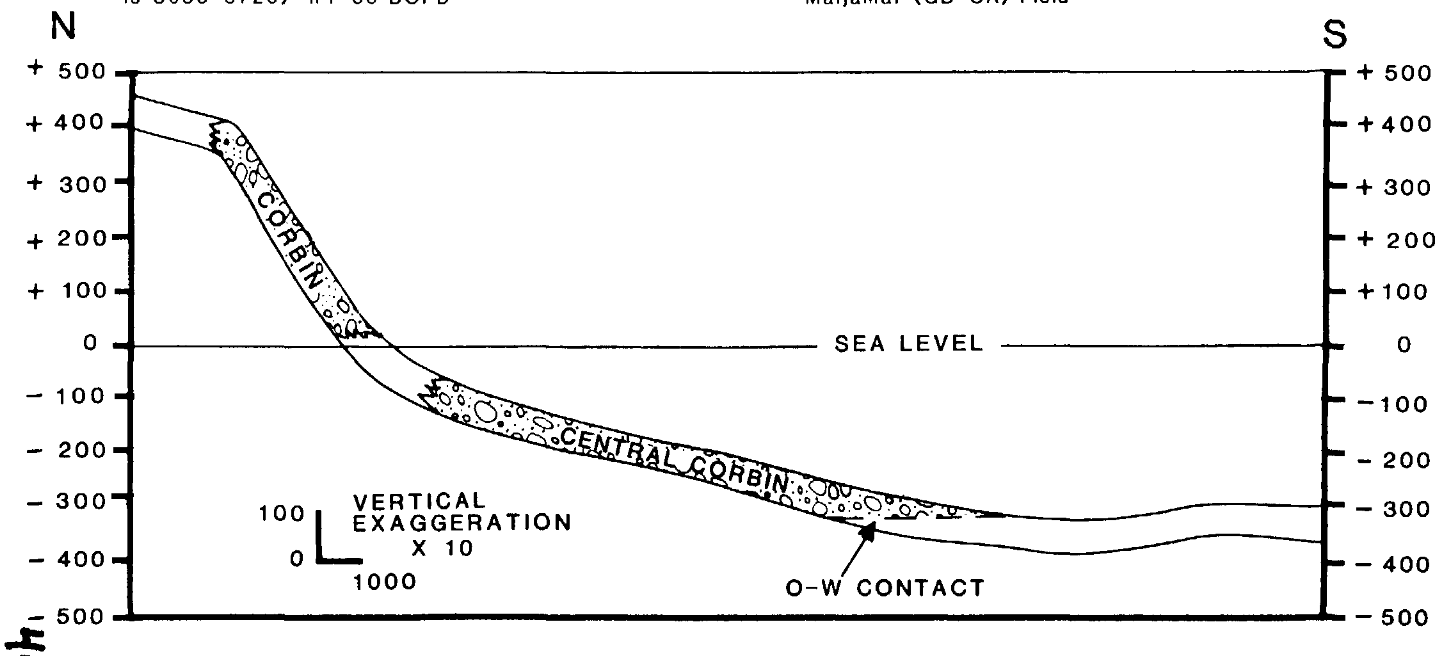


CENTRAL CORBIN (QUEEN) AREA
BLOCK DIAGRAM OF QUEEN DEPOSITION

GEOL. R.L. DOTY MARCH, 1990

ATTACHMENT 10





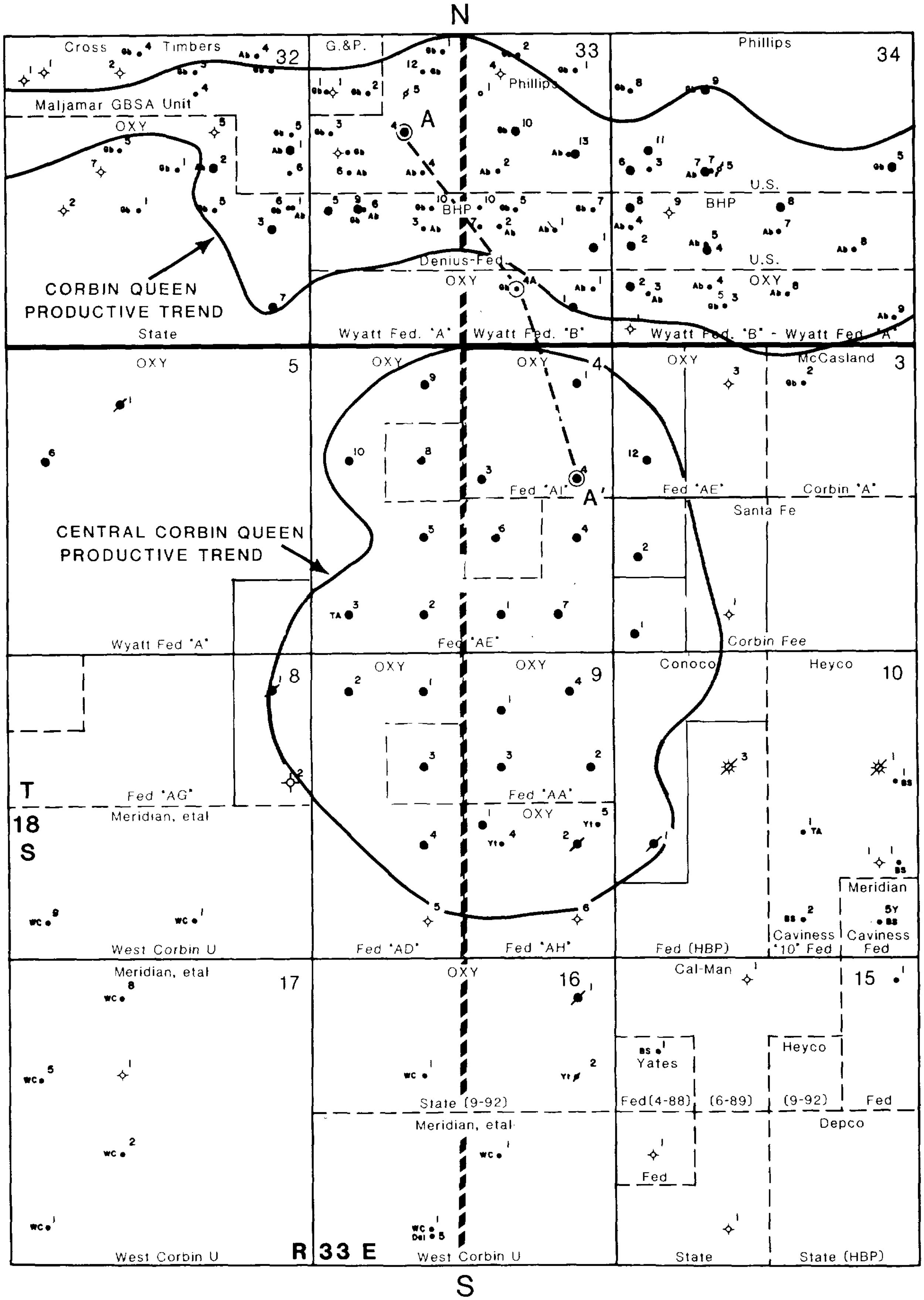
CENTRAL CORBIN
(QUEEN) FIELD
LEA COUNTY, NEW MEXICO

STRATIGRAPHIC SECTION A-A′
AND STRUCTURAL SECTION N-S

STRAT. SECTION DATUM:
TOP OF QUEEN SANDSTONE

GEOL.: R. L. DOTY MARCH, 1990

ATTACHMENT 11



● QUEEN PRODUCER

• OTHER ZONES { Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp }

CENTRAL CORBIN (QUEEN) FIELD

LEA COUNTY, NEW MEXICO

PRODUCTIVE TREND

0 — 1/2 MILE

GEOL.: R. L. DOTY

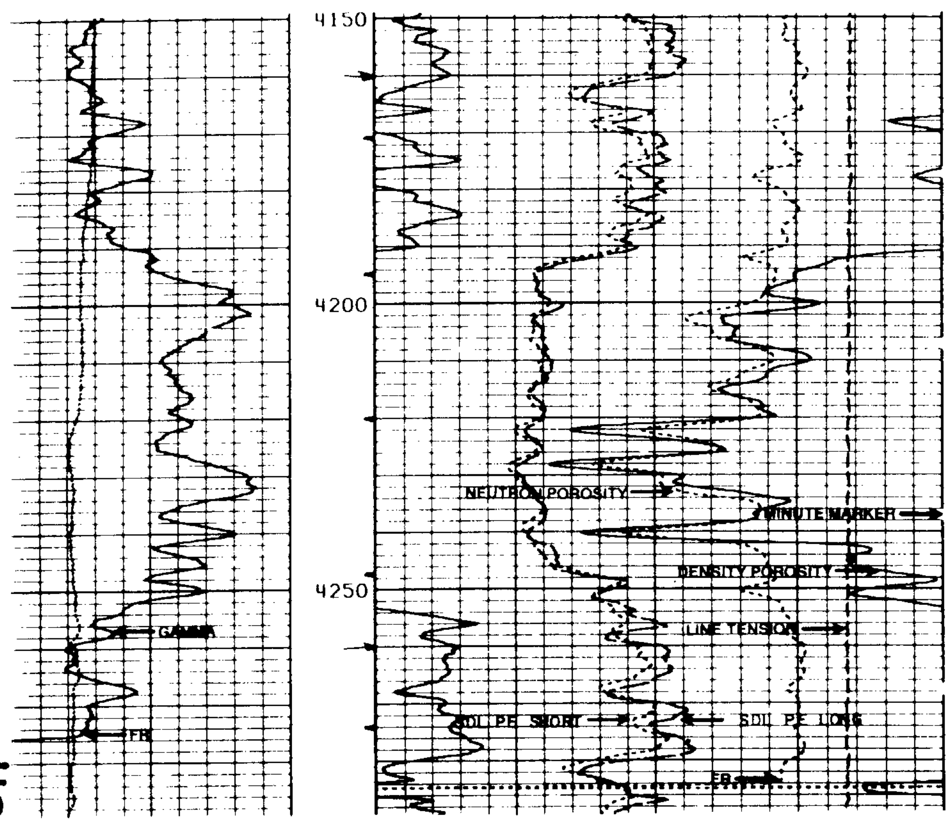
MARCH, 1990

ATTACHMENT 12

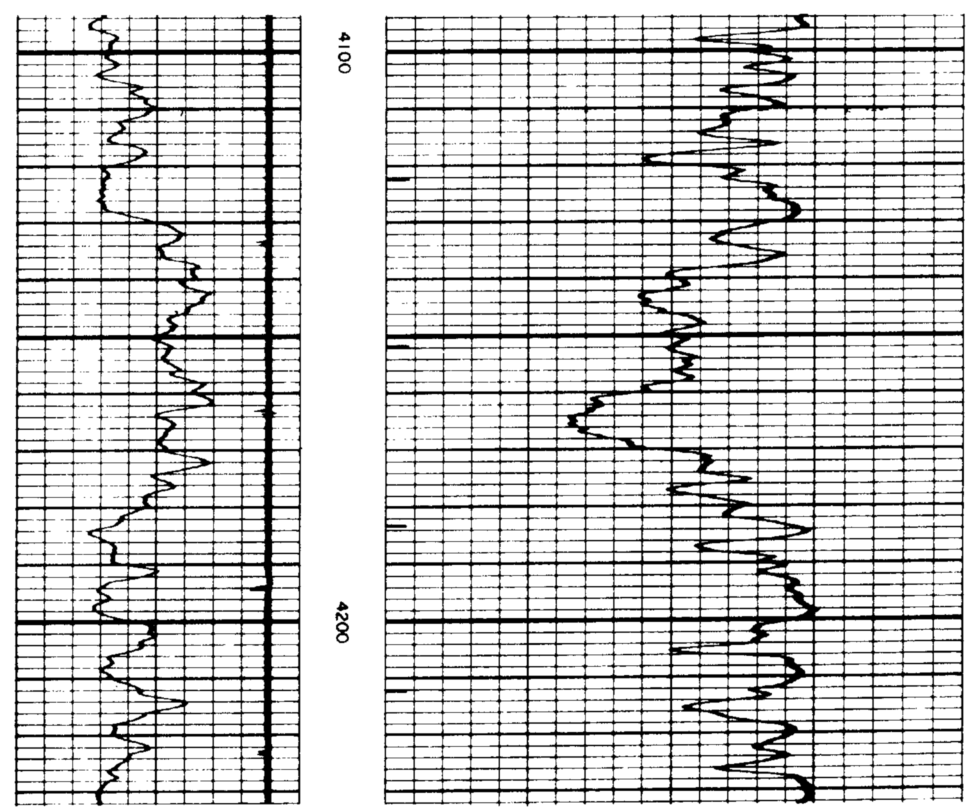
COMPARISON OF QUEEN INTERVALS

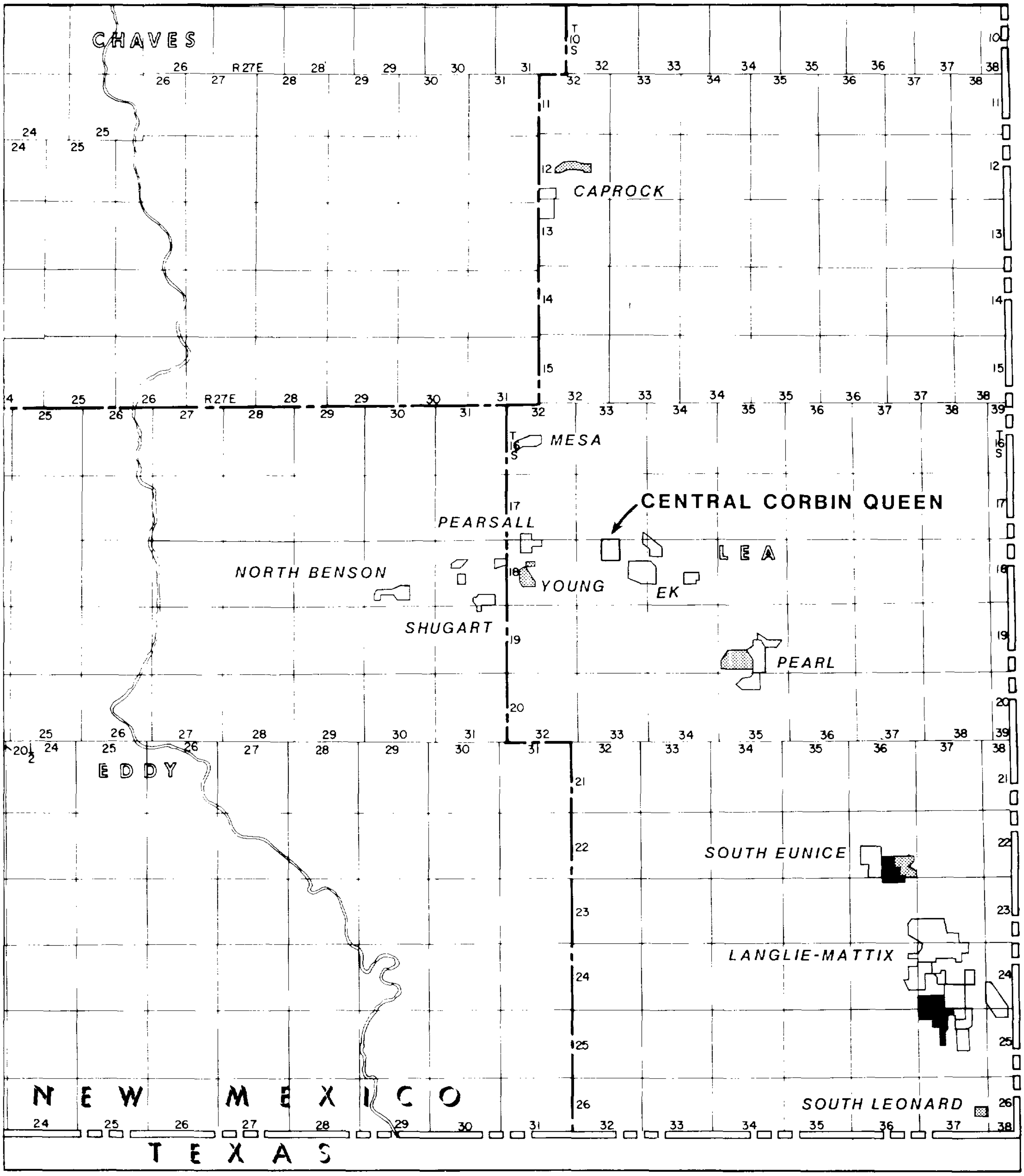
Central Corbin Queen Field	North E-K Queen Field
OXY USA Federal "AE" No. 1 Section 4, T-18-S, R-33-E Lea County, New Mexico Welex Density/Neutron Log Run 10-3-85	Murphy H. Baxter North E-K Queen Unit No. 2-5 Section 1, T-18-S, R-33-E Lea County, New Mexico Dresser Atlas Neutron Log Run 8-13-75

GAMMA RAY COMPENSATED NEUTRON



GAMMA RAY COMPENSATED NEUTRON





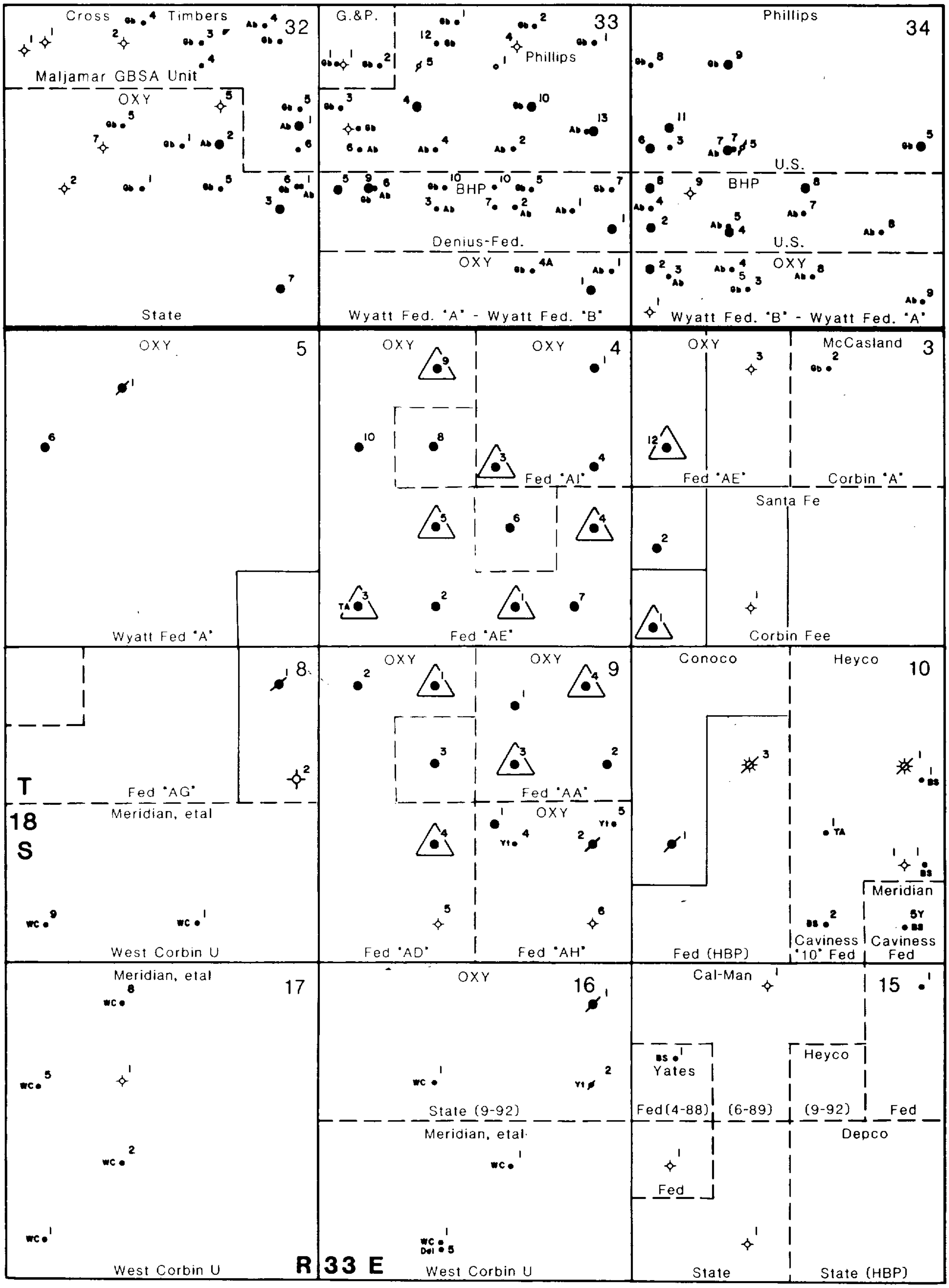
- QUEEN WATERFLOOD/80-ACRE 5-SPOT PATTERN
- QUEEN UNIT WITH 20-ACRE PRODUCERS
- QUEEN UNIT WITH SUCCESSFUL 20-ACRE PRODUCERS

QUEEN WATERFLOODS IN LEA & EDDY COUNTIES

0 6 MILES

MARCH, 1990

ATTACHMENT 14



● QUEEN PRODUCER

• OTHER ZONES: Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp

△ PROPOSED INJECTOR

CENTRAL CORBIN (QUEEN) FIELD

LEA COUNTY, NEW MEXICO

PROPOSED CONVERSION TO INJECTOR

0 — 1/2 MILE

MARCH, 1990

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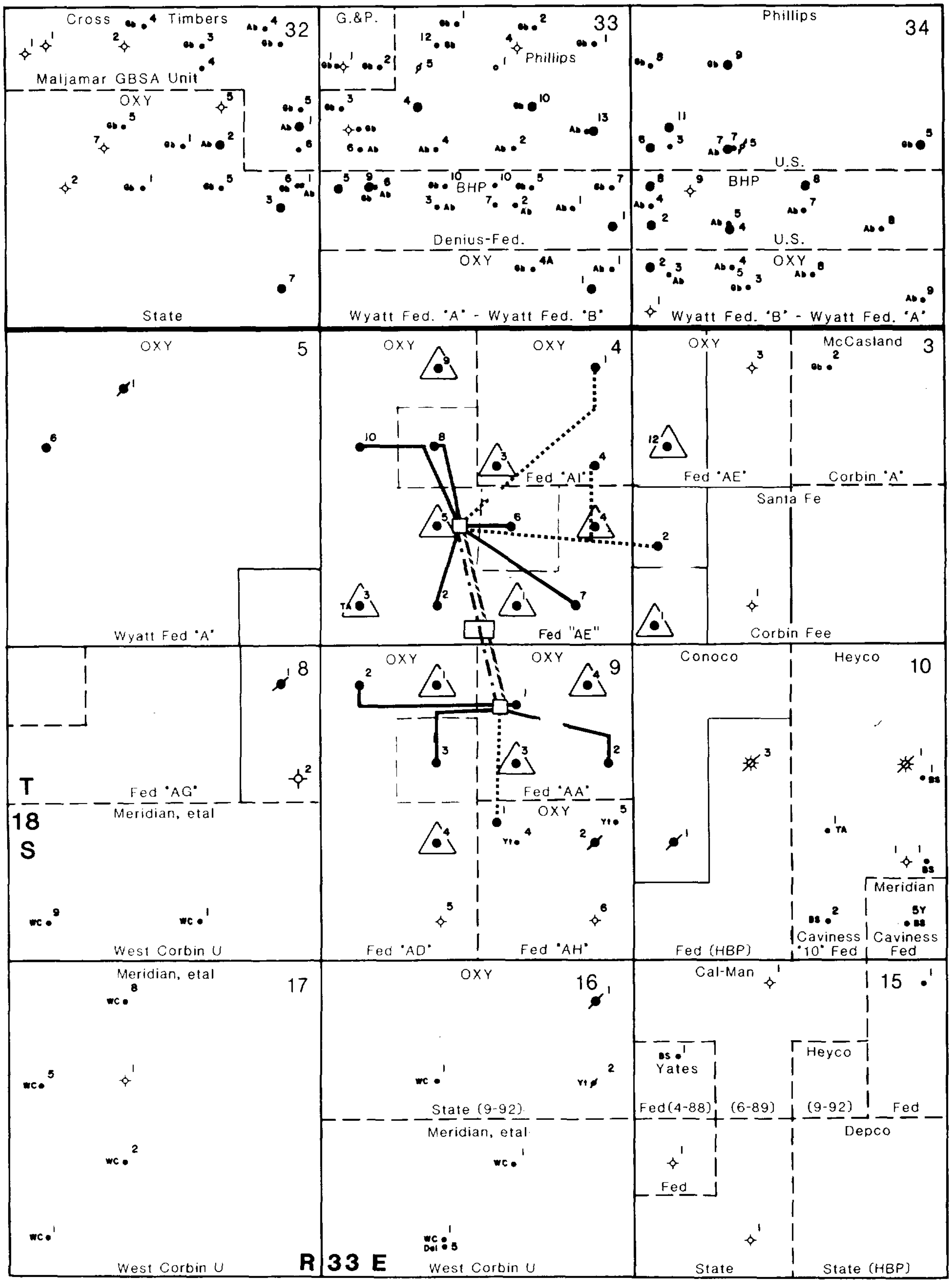
ATTACHMENT 15



● QUEEN PRODUCER

• OTHER ZONES { Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp }

EXISTING LINES

NEW LINES

OIL TRANSFER LINE

WATER TRANSFER LINES

CENTRAL CORBIN (QUEEN) FIELD

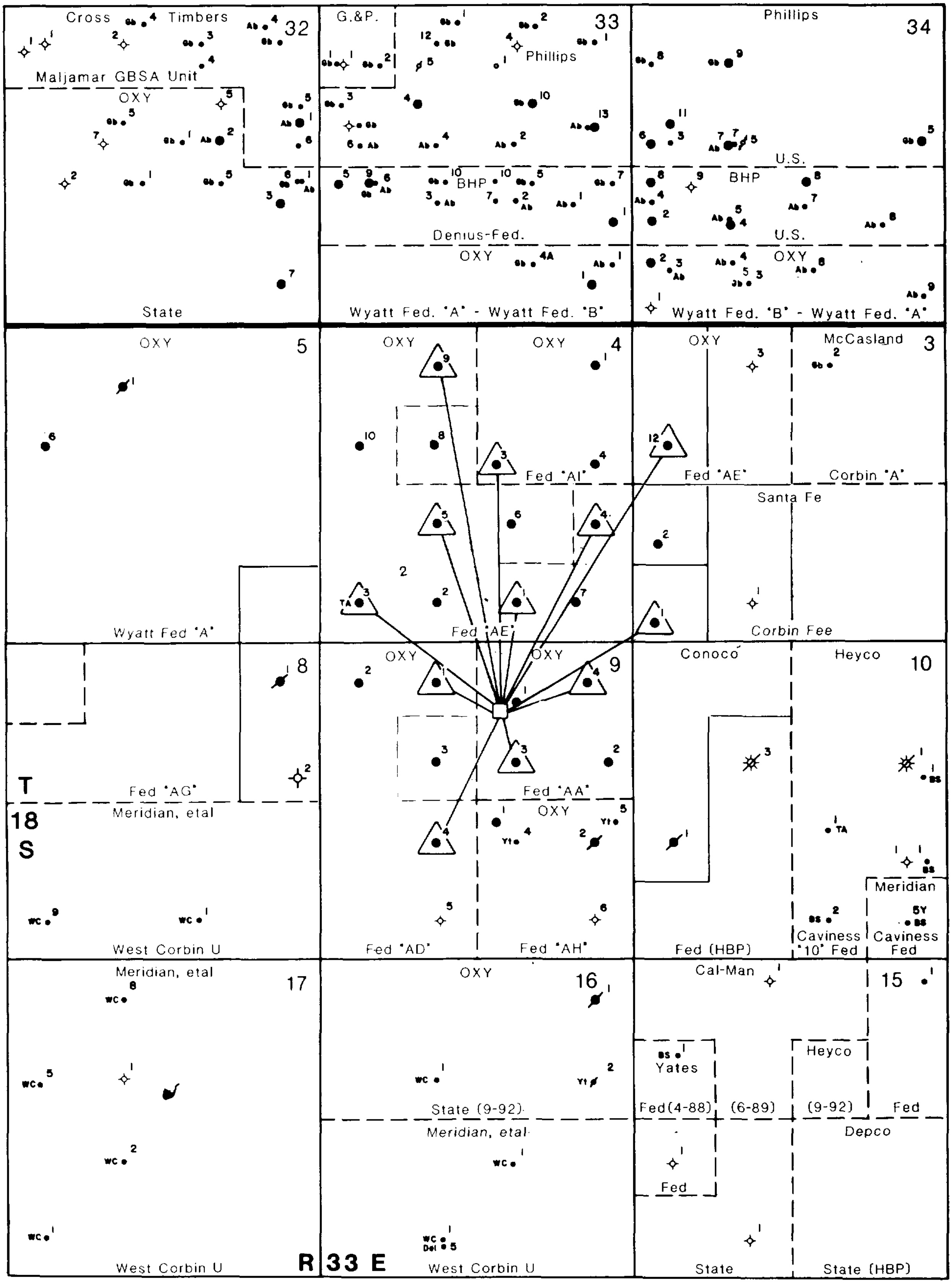
LEA COUNTY, NEW MEXICO

GATHERING SYSTEM

0 — 1/2
MILE

MARCH, 1990

ATTACHMENT 16



- ● QUEEN PRODUCER
- • OTHER ZONES { Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp

CENTRAL CORBIN (QUEEN) FIELD

LEA COUNTY, NEW MEXICO

INJECTION SYSTEM

0 — 1/2 MILE

MARCH, 1990

ATTACHMENT 17

PROPOSED SECONDARY RECOVERY UNIT
DESCRIPTION OF LANDS

<u>Tract 1a</u>

Description of Lands:	T-18S, R-33E, NMPM Sec. 9: NE/4	
No. of Acres:	160.00	
Serial Number:	LC 029 489(A)	
Basic Royalty and %:	US Bureau of Land Management	12.5%*
Current Record Title and %:	OXY USA, Inc. 100%	
Overriding Royalty and %:	Selma E. Andrews	1.07410%
	John W. Boone	.50000%
	Braille of America Inc., c/o Republic Bank of Dallas	.92590%
	Harriet Justice Cochran	.12500%
	Daisy I. Corbin	1.50000%
	Homer R. Denius, et al	2.50000%
	Higgins Trust Inc.	.50000%
	James Virgil Linam Estate	.43750%
	Allene D. Rowan	.87500%
	Sabine Royalty Trust	.50000%
	H. Dillard Schenck Estate	.06250%
	Kirby D. Schenck	.06250%
	Estate of Floyd E. Sherrell	.08333%
	Wilbur L. Sherrell	.08333%
	William M. Siegenthaler	.50000%
	Estate of Joseph Wallingford	.25000%
	Rufus Wallingford	.12500%
	J. S. Ward	.25000%
	Marideth Watkins	.08334%
	Thelma A. Webber	.43750%
	William J. Wright	.50000%
Working Interest and %:	OXY USA, Inc. 100%	

<u>Tract 1b</u>

Description of Lands:	T-18S, R-33E, NMPM, Sec. 9: SE/4	
No. of Acres:	160.0	
Serial Number:	71-029 489(A)	
Basic Royalty and %:	US Bureau of Land Management	12.5%*
Current Record Title and %:	OXY USA, Inc. 100%	
Overriding Royalty and %:	Selma E. Andrews	1.07410%
	Braille of America Inc., c/o Republic Bank of Dallas	.92590%
	Harriet Justice Cochran	.12500%
	Daisy I. Corbin	1.50000%
	Higgins Trust Inc.	.50000%
	James Virgil Linam Estate	.87500%
	Allene D. Rowan	.87500%
	Sabine Royalty Trust	.50000%

H. Dillard Schenck Estate	.06250%
Kirby D. Schenck	.06250%
Estate of Floyd E. Sherrell	.08333%
Wilbur L. Sherrell	.08333%
Leo R. Sutton, et us	.50000%
Estate of Joseph Wallingford	.25000%
Rufus Wallingford	.12500%
J. S. Ward	.25000%
Marideth Watkins	.08334%
Martha W. West	.12500%

Working Interest and %: OXY USA, Inc. 100%

Tract 2a

Description of Lands: T-18S, R-33E, Sec. 3: Lot 4 (40.18), SW/4 NW/4, Sec. 4: Lot 3 (40.40), S/2 NW/4, S/2
No. of Acres: 520.58
Serial Number: LC-029489(B)
Basic Royalty and %: US Bureau of Land Management 12.5%
Current Record Title and %: OXY USA, Inc. 100%
Overriding Royalty and %: 0%
Working Interest and %: OXY USA, Inc. 100%

Tract 2b

Description of Lands: T-18S, R-33E, Sec. 4: Lot 1 (40.27), Lot 2 (40.34), S/2 NE/4
No. of Acres: 160.61
Serial Number: LC-029489(B)
Basic Royalty and %: US Bureau of Land Management 12.5%
Current Record Title and %: OXY USA, Inc. 100%
Overriding Royalty and %: 0%
Working Interest and %: OXY USA, Inc. 100%

Tract 3

Description of Lands: T-18S, R-33E, Sec. 10: W/2 NW/4, NE/4 NW/4, NW/4 NW/4
No. of Acres: 160.00
Serial Number: LC-029489(C)
Basic Royalty and %: US Bureau of Land Management 12.5%*
Current Record Title and %: Conoco, Inc. 100%
Overriding Royalty and %: 11 Companies 7.50000%
Working Interest and %: Conoco, Inc. 100%

Tract 4

Description of Lands:	T-18S, R-33E, Sec. 9:NW/4, N/2 SW/4, SE/4 SW/4
No. of Acres:	280.00
Serial Number:	NM-55149 HBP
Basic Royalty and %:	US Bureau of Land Management 12.5%
Current Record Title and %:	OXY USA, Inc. 100%
Overriding Royalty and %:	0%
Working Interest and %:	OXY USA, Inc. 100%

Tract 5

Description of Lands:	T-18S, R-33E, Sec. 8: E/2 NE/4
No. of Acres:	80.00
Serial Number:	NM-26884(A)
Basic Royalty and %:	US Bureau of Land Management 12.5%
Current Record Title and %:	Unleased
Overriding Royalty and %:	NA
Working Interest and %:	NA

Tract 6

Description of Lands:	T-18S, R-33E, Sec. 3: SW/4 SW/4	
No. of Acres:	40.00	
Serial Number:	Fee	
Basic Royalty and %:	Three individuals 19.375%	
Current Record Title and %:	Santa Fe Exploration et. al. 100%	
Overriding Royalty and %:	Three entities 0.6503125%	
Working Interest and %:	Santa Fe Exploration Co.	25.00000%
	Dr. Dennis Alsofrom & Linda Ann Anderson	1.00000%
	Homer Bankhead	1.00000%
	Jeff Bowman	.50000%
	C. E LaRue and B. N. Muncy, Jr.	22.50000%
	Marbob Energy Corp.	15.00000%
	Dr. Roger Moore	3.75000%
	Maurice Mordka	1.00000%
	Richard Olson	.50000%
	Dale M. Sanders	1.00000%
	Sipes Properties Inc.	3.00000%
	David Spoede	.50000%
	C. W. and Frieda T. Stumhoffer	3.75000%
	James H. Bozarth	1.00000%
	Frances Buckler	3.75000%
	Pat Carlisle	1.00000%
	Binion H. Carr	3.75000%
	Bart Colwell	2.00000%
	V. Randolph Delk	3.00000%
	Dr. Fred Hadley	

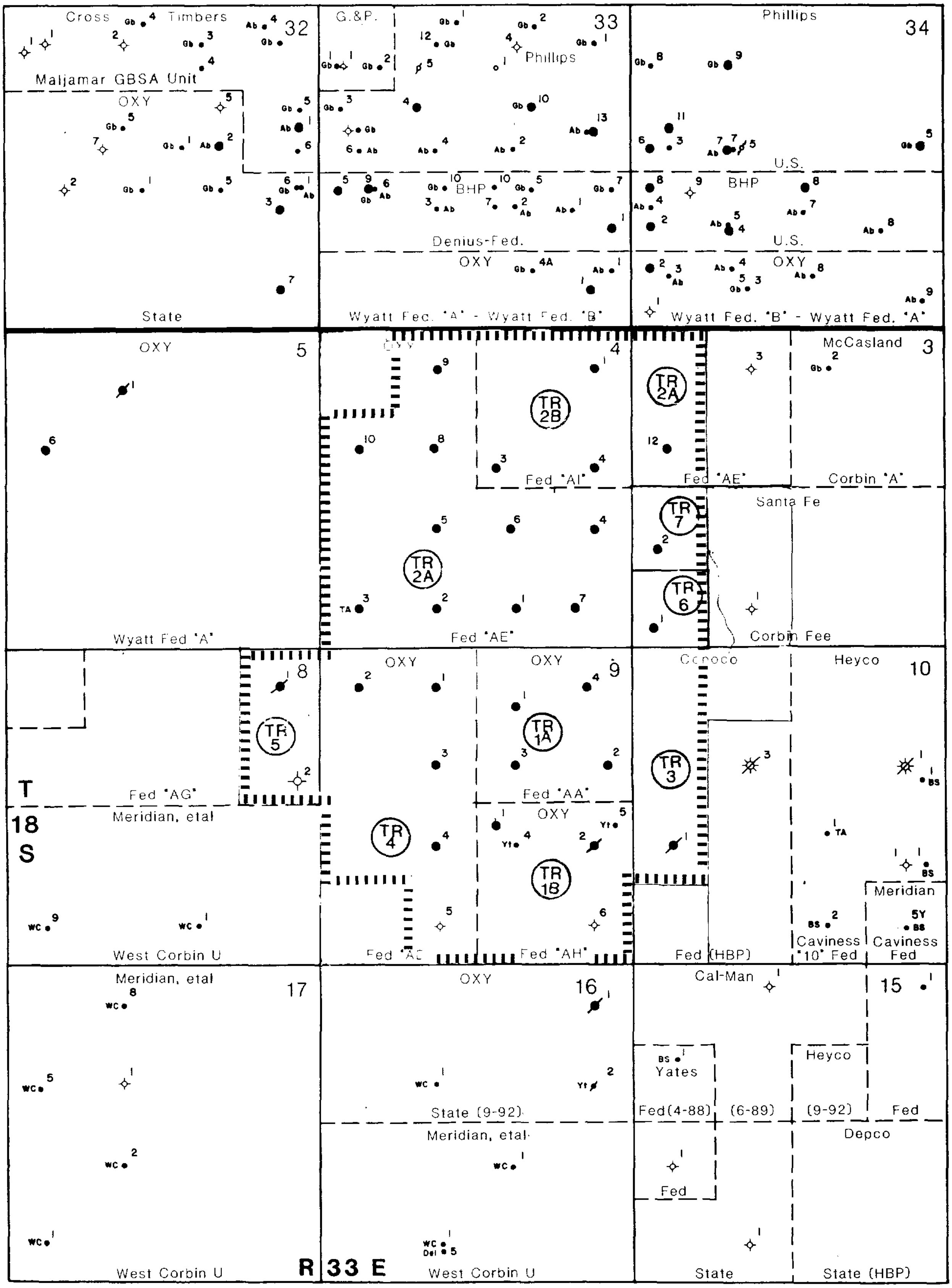
Hamilton III	1.00000%
Dr. Robert W. King	2.00000%
Jack S. Kitchen	3.00000%
Jack S. Kitchen, Jr.	1.00000%

Tract 7

Description of Lands:	T-18S, R-33E, Sec. 3: NW/4 SW/4	
No. of Acres:	40.00	
Serial Number:		
Basic Royalty and %:	Twenty entities 18.75%	
Current Record Title and %:	Santa Fe. Expl. Co. et al 100%	
Overriding Royalty and %:	Four entities 1.372462%	
Working Interest and %:	Santa Fe Expl. Co.	28.75000%
	Dr. Dennis Alsofrom & Linda Ann Anderson	1.00000%
	Homer Bankhead	1.00000%
	Phillip R. Bishop	3.75000%
	James H. Bozarth	1.00000%
	Frances Buckler	3.75000%
	Pat Carlisle	2.00000%
	Binion H. Carr	3.75000%
	Bart Colwell	2.00000%
	V. Randolph Delk	3.00000%
	Dr. Fred Hadley Hamilton III	1.00000%
	Jack S. Kitchen	3.00000%
	C. E. LaRue & B. N. Muncy, Jr.	22.50000%
	Marbob Energy Corp.	15.00000%
	Dr. Roger Moore	3.75000%
	Maurice Mordka	1.00000%
	C. W. & Frieda T. Stumhoffer	3.75000%

* Royalty is 12.5-25% on sliding scale.9+

ATTACHMENT 18



● QUEEN PRODUCER

• OTHER ZONES { Yates, Grayburg, Delaware, Abo, Bone Spring, Wolfcamp

CENTRAL CORBIN (QUEEN) FIELD

LEA COUNTY, NEW MEXICO

PROPOSED UNIT

0 — 1/2 MILE

MARCH, 1990

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TABLE 1

CENTRAL CORBIN QUEEN FIELD

FIELD AND RESERVOIR DATA

FIELD DATA

DATE OF DISCOVERY	April, 1985
TYPE OF TRAP	Stratigraphic
PRODUCING FORMATION	Queen Sand

RESERVOIR CHARACTERISTICS

AVERAGE DEPTH, FT	4200
AVERAGE GROSS THICKNESS, FT	63
AVERAGE NET THICKNESS (8% CUTOFF), FT	21
AVERAGE POROSITY (8% CUTOFF), %	10.4
AVERAGE AIR PERMEABILITY, MD	3.83
AVERAGE WATER SATURATION, %	41

FLUID CHARACTERISTICS

OIL API GRAVITY AT 60 DEG F	35.1
INITIAL PRESSURE (EST.), PSIG	1850
RESERVOIR TEMPERATURE, DEG F	96
BUBBLE POINT PRESSURE, PSIG	895
ORIGINAL SOLUTION GOR, SCF/STB	115
SOLUTION GOR AT BUBBLE POINT, SCF/BBL	103
FVF AT BUBBLE POINT, RB/STB	1.056
OIL VISCOSITY AT BUBBLE POINT, CP	2.75

RESERVES

OOIP, MSTB (VOLUMETRIC)	10628
PRIMARY RECOVERY TO 5/89, MSTB	502
ESTIMATED REMAINING PRIMARY RECOVERY FROM 5/1/89, MSTB	70
ULTIMATE PRIMARY RECOVERY, MSTB	572
ESTIMATED SECONDARY RECOVERY, MSTB	559

TABLE 2

WELL DATA SUMMARY

TRACT	OPERATOR	LEASE NAME AND WELL NUMBER	TD, FEET	PBTD, FEET	PRODUCTION CASING	PERFORATION INTERVAL, FEET	FORMATION	STATUS	INITIAL POTENTIAL
5	UNLEASED	FEDERAL AG #1	9,000	4277	5-1/2"	4218-4225	QUEEN	PA	P 5 BOPD, 146 BWPD
5	UNLEASED	FEDERAL AG #2	11,500	4310	5-1/2"	4270-4279	QUEEN	PA	NONE
4	OXY	FEDERAL AD #1	4,310	4256	5-1/2"	4206-4232	QUEEN	ACTIVE	F 589 BOPD, 83 BLW
4	OXY	FEDERAL AD #2	4,320	4276	5-1/2"	4220-4255	QUEEN	ACTIVE	P 28 BOPD, 12 BLW
4	OXY	FEDERAL AD #3	4,320	4277	5-1/2"	4245-4253	QUEEN	ACTIVE	P 98 BOPD, 12 BLW
4	OXY	FEDERAL AD #4	4,350	4288	5-1/2"	4258-4271	QUEEN	ACTIVE	P 91 BOPD, 23 BWPD
1A	OXY	FEDERAL AA #1	13,835	4850	5-1/2"	4228-4238	QUEEN	ACTIVE	F 482 BOPD, 0 BWPD
1A	OXY	FEDERAL AA #2	4,375	4339	5-1/2"	4270-4282	QUEEN	ACTIVE	P 52 BOPD, 130 BLW
1A	OXY	FEDERAL AA #3	4,350	4314	5-1/2"	4236-4262	QUEEN	ACTIVE	F 322 BOPD, 55 BLW
1A	OXY	FEDERAL AA #4	4,325	4312	5-1/2"	4213-4242	QUEEN	ACTIVE	P 81 BOPD, 408 BLW
1B	OXY	FEDERAL AH #1	4,400	4400	5-1/2"	4274-4294	QUEEN	ACTIVE	P 105 BOPD, 70 BWPD
1B	OXY	FEDERAL AH #2	4,350		5-1/2"	OH	QUEEN	PA	70 BOPD, 4 BWPD
2A	OXY	FEDERAL AE #1	4,320	4256	5-1/2"	4221-4241	QUEEN	ACTIVE	P 176 BOPD, 0 BWPD
2A	OXY	FEDERAL AE #2	4,300	4256	5-1/2"	4207-4226	QUEEN	ACTIVE	F 611 BOPD, 39 BLW
2A	OXY	FEDERAL AE #3*	4,325	4279	5-1/2"	4243-4247	QUEEN	TA	P 8 BOPD, 42 BLW
2A	OXY	FEDERAL AE #4	4,350	4314	5-1/2"	4200-4217	QUEEN	ACTIVE	P 117 BOPD, 7 BLW
2A	OXY	FEDERAL AE #5	4,280	4240	5-1/2"	4174-4180	QUEEN	ACTIVE	F 155 BOPD, 15 BLW
2A	OXY	FEDERAL AE #6	4,300	4253	5-1/2"	4184-4215	QUEEN	ACTIVE	P 49 BOPD, 18 BLW
2A	OXY	FEDERAL AE #7	4,530	4478	5-1/2"	4203-4227	QUEEN	ACTIVE	P 84 BOPD, 13 BLW
2A	OXY	FEDERAL AE #8	4,275	4225	5-1/2"	4151-4177	QUEEN	ACTIVE	P 81 BOPD, 26 BLW
2A	OXY	FEDERAL AE #9	4,452	4398	5-1/2"	4152-4166	QUEEN	ACTIVE	P 19 BOPD, 12 BLW
2A	OXY	FEDERAL AE #10	4,275	4226	5-1/2"	4134-4138	QUEEN	ACTIVE	P 4 BOPD, 0 BLW
2A	OXY	FEDERAL AE #12	4,300	4255	5-1/2"	4211-4215	QUEEN	ACTIVE	P 10 BOPD, 9 BLW
2B	OXY	FEDERAL AI #1	5,257		5-1/2"	OH	QUEEN	ACTIVE	P 50 BOPD
2B	OXY	FEDERAL AI #3	5,000	4983	5-1/2"	4163-4440	QUEEN	ACTIVE	P 80 BOPD, 26 BWPD
2B	OXY	FEDERAL AI #4	5,000	4983	5-1/2"	4180-4442	QUEEN	ACTIVE	P 80 BOPD, 20 BWPD
3	CONOCO	FEDERAL (BHP) #1	4319		7"	OH	QUEEN	PA	P 43 BOPD
6	SANTA FE	CORBIN FEE #1	5050	5050	5-1/2"	4219-4266	QUEEN	ACTIVE	P 10 BOPD, 10 BWPD
7	SANTA FE	CORBIN FEE #2	5200	5200	5-1/2"	4224-4234	QUEEN	ACTIVE	P 81 BOPD, 20 BWPD
						4898-5128	GRAYBURG	ACTIVE	NA

* YATES TESTED DRY

TABLE 3

PRESSURE - VOLUME RELATIONS AT 96 F

FEDERAL "AA" No. 1

RECOMBINED FLUIDS SAMPLE

PRESSURE, PSIG		RELATIVE VOLUME OF OIL AND GAS @ 96 F VOL./SAT. VOL.	OIL COMPRESSIBILITY 1/PSI X 10-6
5000		0.97897	4.24
4000		0.98365	4.64
3000		0.98834	5.09
2000		0.99365	5.61
1600		0.99547	5.84
1400		0.99701	5.96
1200		0.99842	6.09
1000		0.99952	6.22
895	(BUBBLE POINT PRESSURE)	1.00000	6.29
866		1.00539	
833		1.01066	
773		1.02163	
717		1.03336	
617		1.06470	
494		1.12606	
383		1.22310	
240		1.50192	
199		1.68700	
118			

RELATIVE VOLUME = A + B/(PRESSURE +C)

COMPRESSIBILITY = B/(PRESSURE + C)**2 /RELATIVE VOLUME

A = 0.88819 B = 1994.05 C = 16899

TABLE 4

DIFFERENTIAL VAPORIZATION AT 96 F

FEDERAL "AA" No. 1

RECOMBINED FLUID SAMPLE

PRESSURE, PSIG	OIL VOLUME RELATIVE TO RESIDUAL OIL @ 60 F	OIL VOLUME RELATIVE TO RESIDUAL OIL @ 96 F	SOLUTION GOR SCF GAS PER BBL RESIDUAL OIL @ 60 F	SOLUTION GOR SCF GAS PER BBL RESIDUAL OIL @ 96 F	GAS GRAVITY @ 96 F (AIR=1)
5000	1.03079	1.01458			
4000	1.03608	1.01979			
3000	1.04105	1.02468			
2000	1.04734	1.03087			
1600	1.05024	1.03373			
1400	1.05163	1.03510			
1200	1.05340	1.03684			
1000	1.05532	1.03873			
895	1.05643	1.03982	104.3	102.6	
610	1.05141	1.03488	77.9	76.7	0.844
370	1.03754	1.02122	55.8	54.9	0.780
175	1.02846	1.01229	29.3	28.8	0.757
82	1.02230	1.00623	14.9	14.7	0.769
0	1.01597	1.00000	0.0	0.0	0.863

API GRAVITY OF RESIDUAL OIL @ 60 F = 35.8

TABLE 5

DIFFERENTIAL VAPORIZATION AT 96 F

FEDERAL "AA" No. 1

RECOMBINED FLUIDS SAMPLE

PRESSURE PSIG	OIL DENSITY @ 96 F G/CC	OIL VISCOSITY @ 96 F CENTIPOISE	GAS VISCOSITY @ 96 F CENTIPOISE	OIL/GAS VISCOSITY RATIO
5000	0.8384	3.86		
4000	0.8341	3.57		
3000	0.8301	3.28		
2000	0.8251	3.01		
1600	0.8228	2.91		
1400	0.8218	2.86		
1200	0.8304	2.82		
1000	0.8189	2.76		
895	0.8180	2.74		
610	0.8173	2.92	0.0116	252
370	0.8246	3.06	0.0113	271
175	0.8276	3.25	0.0111	293
92	0.8303	3.40	0.0109	312
0	0.8327	3.58	0.0105	341

TABLE 6

FEDERAL "AA" No. 1

FLUID COMPOSITIONS

COMPONENTS	SEP. GAS MOL %	SEP. OIL MOL %	RECOMBINED SAMPLE, MOL % EXPERIMENTAL	THEORETICAL
OXYGEN	0.02	0.00	0.00	0.00
NITROGEN	24.72	0.13	4.16	4.02
METHANE	54.63	0.99	9.70	9.48
CARBON DIOXIDE	0.01	0.01	0.01	0.01
ETHANE	8.77	0.81	2.10	2.07
PROPANE	6.34	1.62	2.43	2.37
ISOBUTANE	0.96	0.56	0.64	0.62
N-BUTANE	2.25	2.13	2.23	2.15
ISOPENTANE	0.65	1.68	1.60	1.52
N-PENTANE	0.58	2.18	2.01	1.92
HEXANES	0.64	6.43	6.02	5.51
HEPTANES PLUS	0.43	83.46	69.10	70.33

C7+ MOL WT.	205
C7+ DENSITY, G/CC @ 60 F	0.8896
SPECIFIC GRAVITY OF GAS (AIR = 1.0)	0.8609
BTU CONTENT OF GAS, DRY GROSS	1078
SEPARATOR PRESSURE, PSIG	33
SEPARATOR TEMPERATURE, F	108
SEPARATOR OIL SHRINKAGE FACTOR	1.012
API GRAVITY OF STOCK TANK OIL @ 60 F	35.1

TABLE 7

WATER ANALYSIS BY
CHAMPION CHEMICALS, INC.
6/26/86

CHEMICAL COMPONENTS	PARTS PER MILLION LEASE		
	FEDERAL AE	FEDERAL AD	FEDERAL AA
CHLORIDE	180,000	199,000	208,000
IRON	105	102	48
TOTAL HARDNESS	60,200	72,400	79,400
CALCIUM	7,378	8,541	6,295
MAGNESIUM	10,157	12,417	15,479
BICARBONATE	244	170	305
CARBONATE	0	0	0
SULFATE	1,100	737	1,200
HYDROGEN SULFIDE	18	30	18
SPECIFIC GRAVITY	1.190	1.200	1.210
DENSITY LB/GAL	9.917	10.000	10.084
pH	6.20	5.80	5.80
SODIUM (CALC)	90,179	96,797	99,832
TDS	289,058	317,664	331,112
$CaSO_4$ PRESENT	1,558	1,045	1,700
$CaCO_3$ SI @ 86 F	+1.37	+1.31	+1.69
104 F	+1.60	+1.54	+1.92
122 F	+1.86	+1.80	+2.18
140 F	+2.15	+2.09	+2.47
158 F	+2.47	+2.41	+2.79

TABLE 8

PRESSURE DATA

LEASE/WELL		MID-PERFS, FEET	SITP, PSI	FLUID LEVEL, FEET	BHP 1, PSI	FTP, PSI	BHP 2, PSI
FEDERAL AA	#1	4228	-	-	-	40	1625
	#2	4270	175	2300	1106	-	-
	#3	4249	50	2100	896	20	1693
	#4	4228	525	3300	902	-	-
FEDERAL AD	#1	4206	150	500	1504	25	1602
	#2	4220	100	1900	1188	-	-
	#3	4245	175	1300	1511	-	-
	#4	4264	700	3000	1224	-	1770
FEDERAL AE	#1	4221	275	900	1632	-	-
	#2	4207	200	1100	1388	100	1709
	#4	4208	400	1800	1303	-	-
	#5	4174	450	800	1778	70	1714
	#6	4184	1200	-	1200	40	1803
	#7	4215	475	1800	1637	-	-
	#8	4151	35	1440	1136	40	1726
	#9	4159	700	3000	597	-	-
	#10	4136	0	3100	502	-	-
	#12	4213	0	2400	902	-	-

BHP 1 - Pressure estimate based on SITP and fluid level measured during completion.

BHP 2 - Pressure estimate based on FTP.

TABLE 9

WATER-OIL RELATIVE PERMEABILITY DATA
UNSTEADY STATE

4216.4 FT   FEDERAL "AE" No. 1

VISCOSITY OF SYN FORMATION WATER, CP	1.58
VISCOSITY OF TEST OIL, CP	3.65
DENSITY OF SYN FORMATION WATER, G/CC	1.160
DENSITY OF TEST OIL, G/CC	0.788
PORE VOLUME, CC	6.49
POROSITY, %	12.9
AIR PERMEABILITY, MD	39.970
IRREDUCIBLE WATER SATURATION, %PV	41.0
OIL PERMEABILITY @ IRREDUCIBLE WATER, MD	32.180
RESIDUAL OIL SATURATION, %PV	21.3
WATER PERMEABILITY @ RESIDUAL OIL. MD	11.370

WTRSAT,%	KWATER (MD)	KOIL (MD)	KW/KO	KRW	KRO
63.8	---	---	3.117	---	---
64.2	3.9873	1.1337	3.517	0.12391	0.03523
66.8	4.2246	0.5362	7.878	0.13128	0.01666
68.3	4.5369	0.3547	12.790	0.14098	0.01102
70.0	4.8468	0.2195	22.077	0.15062	0.00682
72.3	5.5329	0.1072	51.630	0.17194	0.00333
74.2	6.0649	0.0543	111.722	0.18847	0.00169
77.0	6.9996	0.0098	712.087	0.21751	0.00031
77.5	7.2695	0.0050	1463.674	0.22590	0.00015
78.2	9.1755	0.0018	5180.316	0.28513	0.00006
71.5	0.2621	0.0000	8300.941	0.43330	0.00005

TABLE 10

ORIGINAL OIL-IN-PLACE

POROSITY-THICKNESS ISOPACH

PROPERTY	PYRAMID METHOD (AC-FT)
TRACT 5	13.46
TRACT 4	573.45
TRACT 1A	472.62
TRACT 1B	183.36
TRACT 2A	679.61
TRACT 2B	307.13
TRACT 3	78.50
TRACT 6	59.92
TRACT 7	57.98
TOTAL (UNIT AREA)	2426.03

TOTAL PORE VOLUME FROM PHI-H MAP - 2433.30

VOLUMETRIC EQUATION

$$OOIP = 7758*A*h*\phi*(1-s_w)/B_o$$

$$= 7758*2433.30*(1-0.41)/1.048$$

$$= 10,627,624 \text{ STB}$$

WHERE:

$A*h*\phi$ is average of porosity-thickness isopach = 2433.30 ac-ft

S_w is initial water saturation = 0.41

B_o is initial oil formation volume factor = 1.048 RB/STB

TABLE 11

SUMMARY OF PRIMARY PRODUCTION
AS OF 4/30/89

TRACT NUMBER	LEASE	WELL NUMBER	CUMMULATIVE PRODUCTION, BBLS	REMAINING RESERVES, BBLS	ULTIMATE PRIMARY RECOVERY, BBLS
1A	FEDERAL "AA"	1	69751	2599	72350
1A	FEDERAL "AA"	2	21288	463	21751
1A	FEDERAL "AA"	3	15384	251	15635
1A	FEDERAL "AA"	4	18020	1173	19193
1B	FEDERAL "AH"	1	9509	4775	14284
1B	FEDERAL "AH"	2	41087	0	41087
2A	FEDERAL "AE"	1	30724	1890	32614
2A	FEDERAL "AE"	2	25719	3374	29093
2A	FEDERAL "AE"	3	2641	0	2641
2A	FEDERAL "AE"	4	10980	4056	15036
2A	FEDERAL "AE"	5	25069	2460	27529
2A	FEDERAL "AE"	6	8339	363	8702
2A	FEDERAL "AE"	7	11539	9501	21040
2A	FEDERAL "AE"	8	20221	7649	27870
2A	FEDERAL "AE"	9	2633	2677	5310
2A	FEDERAL "AE"	10	586	999	1585
2A	FEDERAL "AE"	12	5588	6425	12013
2B	FEDERAL "AI"	1	37833	1058	38891
2B	FEDERAL "AI"	3	9429	3305	12734
2B	FEDERAL "AI"	4	8377	1169	9546
3	FEDERAL (BHP)	1	23590	0	23590
4A	FEDERAL "AD"	1	42275	4965	47240
4A	FEDERAL "AD"	2	10854	2029	12883
4A	FEDERAL "AD"	3	10733	568	11301
4A	FEDERAL "AD"	4	13322	251	13573
5	FEDERAL "AG"	1	19	0	19
5	FEDERAL "AG"	2	0	0	0
6	CORBIN FEE	1	3070	208	3278
7	CORBIN FEE	2	23114	8412	31526
	TOTALS	29	501694	70620	572314

TABLE 12

Primary and Secondary Recovery Production Schedules

Actuals Thru 4/30/89
(BBL)

	Tract 1A	Tract 1B	Tract 2A	Tract 2B	Tract 3	Tract 4	Tract 5	Tract 6	Tract 7	Totals
1938-1978		41087		30865	23590					95542
1979				1019						1019
1980				965						965
1981				843						843
1982				792						792
1983				805						805
1984				677						677
1985	37218		15853	715		17461		649	4502	76398
1986	47388		70111	6710		35491		1229	12464	173393
1987	29138	4824	37463	7808		16553		700	3300	99786
Jan 88	1263	555	2063	404		769	8	55	231	5348
Feb 88	972	848	1933	362		556	5	43	190	4909
Mar 88	982	405	1663	389		607	1	35	218	4300
Apr 88	774	310	1610	285		593	0	30	182	3784
May 88	846	313	1341	303		651	0	48	206	3708
Jun 88	1313	381	1172	299		294	5	33	181	3678
Jul 88	1098	300	1374	43		679	0	35	183	3712
Aug 88	1005	212	1231	310		421	0	19	189	3387
Sep 88	837	238	1282	312		427	0	41	171	3308
Oct 88	824	142	1253	324		422	0	20	164	3149
Nov 88	603	187	823	268		361	0	26	160	2428
Dec 88	526	219	1290	321		386	0	24	169	2935
Jan 89	486	154	945	286		484	0	28	165	2548
Feb 89	182	47	860	169		371	0	18	139	1786
Mar 89	323	199	694	201		411	0	20	154	2002
Apr 89	161	175	1078	164		247	0	17	146	1988
May 89										
Jun 89										
Jul 89										
Aug 89										
Sep 89										
Oct 89										
Nov 89										
Dec 89	1130	1144	7646	1235	0	1701	0	118	1059	14033
1990	4452	1912	6334	2112	815	2935	0	113	1089	19760
1991	55801	23965	79391	26475	10210	36787	0	1419	13645	247692
1992	34049	14623	48443	16155	6230	22447	0	866	8326	151138
1993	16699	7172	23759	7923	3055	11009	0	425	4083	74125
1994	10450	4488	14867	4958	1912	6889	0	266	2555	46384
1995	6870	2951	9775	3260	1257	4529	0	175	1680	30497
1996	4377	1880	6228	2077	801	2886	0	111	1070	19429
1997	3325	1428	4731	1578	608	2192	0	85	813	14760
1998	2418	1038	3440	1147	442	1594	0	61	591	10732
Tot. Pri.+Sec.	265510	111196	348651	122558	48921	170153	19	6708	58025	1131740

CCQ primary prediction was based on hyperbolic decline
CCQ total secondary recovery was based on secondary/primary ratio of 0.98 from the E.K. Queen Unit
Annual secondary production by tract was calculated using the ratio of ultimate primary tract / ultimate primary total

TABLE 13

INJECTION AND SUPPLY WATER SCHEDULES

YEAR	INJECTED* WATER, BBL	PRODUCED WATER, BBL	WATER FROM STATE DW & FEDERAL AB, BBL	FRESH WATER MAKE-UP, BBL
1990	876000	11000	365000	500000
1991	810300	142000	365000	303300
1992	700800	283000	365000	52800
1993	591300	348000	243300	0
1994	481800	436000	45800	0
1995	394200	355000	39200	0
1996	350400	315000	35400	0
1997	306600	275000	31600	0
1998	262800	240000	22800	0

* CONSTANT PRESSURE AT 1500 PSI

TABLE 14

TYPICAL CONVERSION COST*

(DOLLARS)

ITEM	TANGIBLE	INTANGIBLE	TOTAL
4300' 2-3/8" 4.7# J55 PC TUBING	15,050		15,050
INJECTION PACKER	3,000		3,000
INJECTION WELLHEAD	3,000		3,000
3 DAYS PULLING UNIT		2,700	2,700
ACID TREATMENT		5,000	5,000
MISCELLANEOUS		1,250	1,250
TOTAL	21,050	8,950	30,000

TOTAL CONVERSION COST (12 WELLS)	360,000

* ESTIMATE PROVIDED BY THE HOBBS PRODUCTION GROUP

TABLE 15

FACILITIES INVESTMENT FOR FIELDWIDE WATERFLOOD*

ITEM	COST, $
BATTERY	
BATTERY PAD (INCLUDES DAMAGES AND ROAD)	7,300
INJECTION PUMP SKID AND FILTER	77,000
CHEMICAL PUMPS	1,600
REFURBISH, MOVE, SET AND COAT TANKS	16,000
CEMENT FOUNDATION WORK	500
TRANSFORMERS	2,500
LEVEL CONTROLS	1,600
ELECTRICAL MATERIALS AND LABOR	8,000
INJECTION HEADER, CHOKES AND METERS	25,000
ALARM SYSTEM REPLACEMENT	10,000
WELL TEST EQUIPMENT	2,500
PLANT PIPING AND VALVING	15,000
WATER SUPPLY WELL (OPTIONAL, MAY PURCHASE @ 5¢/BBL)	7,000
LABOR	15,000
PLANT TOTAL	189,000
INJECTION AND TRANSFER LINES	
PRODUCED WATER LINE FROM STATE DW	65,000
INJECTION LINES AND INSTALLATION	230,000
FLOWLINES FOR OFFSET PRODUCERS	13,000
OIL TRANSFER LINE	9,500
WATER TRANSFER LINES	17,500
GAS LINE	4,400
LINE TOTAL	339,400
TOTAL FACILITY INVESTMENT	528,400

* BASED ON WORK BY ROB MC ALPINE

Table 16

Economic Summary

	Primary Depletion	Primary + Waterflood Project	Incremental Waterflood Project
Total Invesment (M$)	0	888	888
Operating Expenses (M$)	191	2430	2239
Lease Gross Reserves			
Oil (MSTB)	15	539	524
Gas (MMCF)	44	81	37
Profitability Indicators			
Disc. Net Cash Prod.			
@ 10% (M$)	55	2982	2927
@ 15% (M$)	54	2667	2613
DCF Return On Inv. (%)	NMV	246.5	227.7
Payout (Years)	0	1.4	1.4
Project Life (Years)	1	5	5

TABLE 17
EQUITY PARAMETERS

PARAMETER(UNIT)	TRACT 1A VALUE	TRACT 1B VALUE	TRACT 2A VALUE	TRACT 2B VALUE	TRACT 3 VALUE	TRACT 4 VALUE	TRACT 5 VALUE	TRACT 6 VALUE	TRACT 7 VALUE	TOTAL
SURFACE ACRES(ACRES)	160.00	160.00	520.58	160.61	120.00	280	80.00	40.00	40.00	1561.19
NET WELL COUNT										
PRODUCIBLE	4	1	10	3	0	4	0	1	1	24
USABLE*	0	0	1	0	1 ##	0	0	0	0	2
CUMULATIVE PRODUCTION THRU 4/30/89 (BBL)	124443	50596	144039	55639	23590	77184	19	3070	23114	501694
REMAINING PRIMARY RESERVES FROM 5/1/89 (BBL)	4485	4775	39394	5533	0	7813	0	208	8412	70620
ULTIMATE PRIMARY RECOVERY (BBL)	128928	55371	183433	61172	23590	84997	19	3278	31526	572314
AVERAGE CURRENT PRODUCING RATES AS OF APRIL, 1989 (BBL/MON)	161	175	1078	164	0	247	0	17	146	1988
NET PAY ISOPACH-PYRAMID METHOD (ACRE-FT)**	3853.28	1494.24	6369.2075	3087.51	657.51	3883.07	121.18	675.94	473.67	20615.606
NET PHI*H - PYRAMID METHOD (ACRE-0-FT)***	472.62	183.36	675.34205	307.13	75.40	573.45	13.46	59.92	57.98	2418.66305

PORTION OF TOTAL, DECIMAL********************************

PARAMETER(UNIT)	TRACT 1A VALUE	TRACT 1B VALUE	TRACT 2A VALUE	TRACT 2B VALUE	TRACT 3 VALUE	TRACT 4 VALUE	TRACT 5 VALUE	TRACT 6 VALUE	TRACT 7 VALUE	TOTAL
SURFACE ACRES(ACRES)	0.10248592	0.10248592	0.33345077	0.10287665	0.07686444	0.17935037	0.05124296	0.02562148	0.02562148	1.000000
NET WELL COUNT										
PRODUCIBLE	0.16666667	0.04166667	0.41666667	0.12500000	0.00000000	0.16666667	0.00000000	0.04166667	0.04166667	1.000000
USABLE*	0.00000000	0.00000000	0.50000000	0.00000000	0.50000000	0.00000000	0.00000000	0.00000000	0.00000000	1.000000
CUMULATIVE PRODUCTION THRU 4/30/89 (BBL)	0.24804562	0.10085032	0.28710529	0.11090226	0.04702069	0.15384677	0.00003787	0.00611927	0.04607191	1.000000
REMAINING PRIMARY RESERVES FROM 5/1/89 (BBL)	0.06350892	0.06761541	0.55783064	0.07834891	0.00000000	0.11063438	0.00000000	0.00294534	0.11911640	1.000000
ULTIMATE PRIMARY RECOVERY (BBL)	0.22527494	0.09674934	0.32051112	0.10688538	0.04121863	0.14851463	0.00003320	0.00572763	0.05508515	1.000000
AVERAGE CURRENT PRODUCING RATES AS OF APRIL, 1989 (BBL/MON)	0.08098592	0.08802817	0.54225352	0.08249497	0.00000000	0.12424547	0.00000000	0.00855131	0.07344064	1.000000
NET PAY ISOPACH-PYRAMID METHOD (ACRE-FT)**	0.18691083	0.07248101	0.30895078	0.14976567	0.03189373	0.18835585	0.00587807	0.03278778	0.02297628	1.000000
NET PHI*H - PYRAMID METHOD (ACRE-0-FT)***	0.19540547	0.07581048	0.27922122	0.12698338	0.03117466	0.23709379	0.00556506	0.02477402	0.02397192	1.000000

* INCLUDES TA'D AND P&A'D WELLS.
** POROSITY CUTOFF OF 8% WAS USED--SEE ATTACHMENT 6.
*** POROSITY CUTOFF OF 8% WAS USED--SEE ATTACHMENT 9.
ASSUME THIS WELL IS USABLE

TABLE 18

EQUITY PARAMETERS AND WORKING INTEREST PARTICIPATION
DERIVED FROM TABLE 17 FIGURES

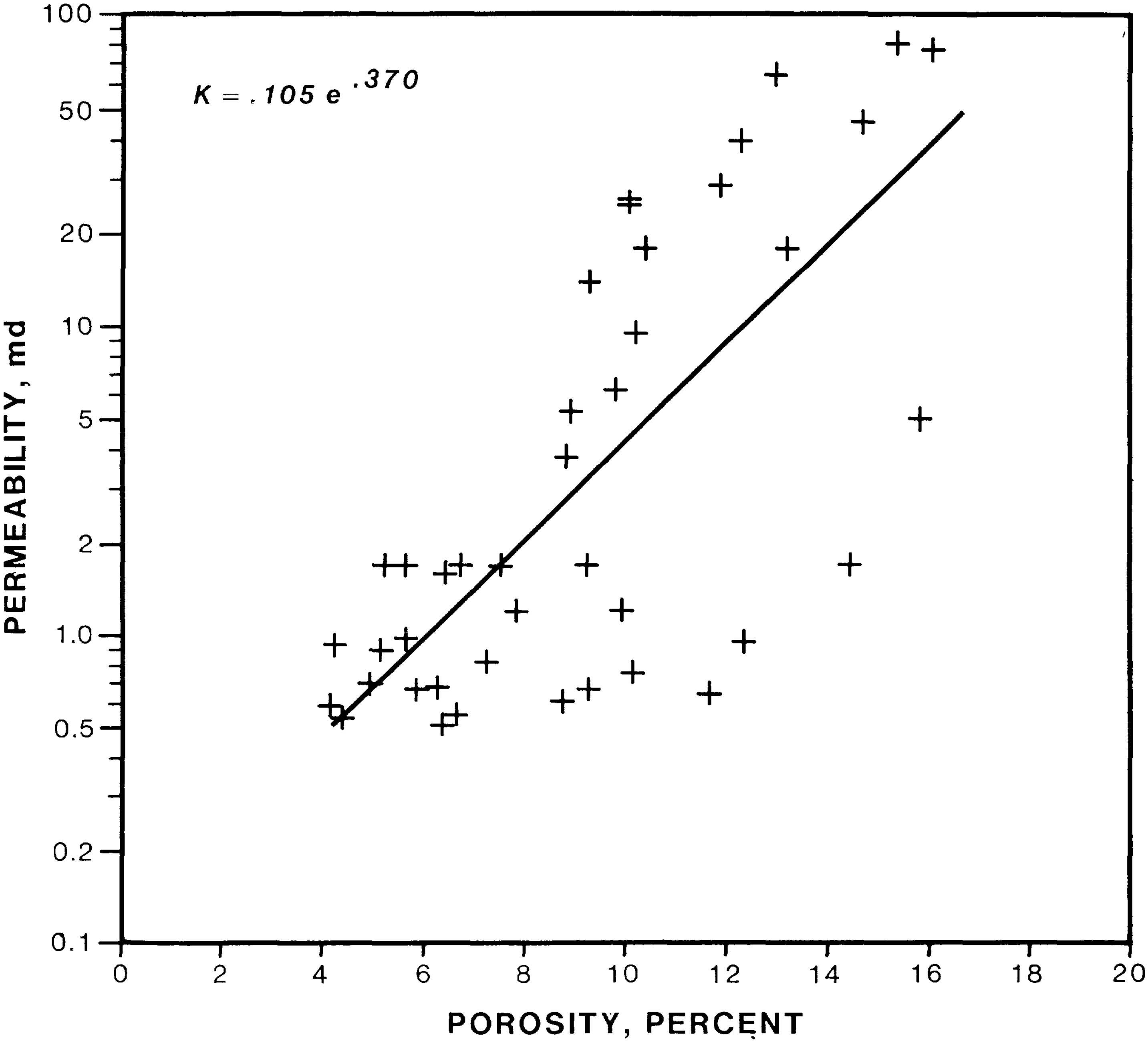
PARAMETER	OXY %	CONOCO %	SANTA FE* %	SANTA FE ENERGY %	TOTAL
SURFACE ACRES	82.0650	7.6864	5.1243	5.1243	100
NET WELL COUNT					
PRODUCIBLE	91.6667	0.0000	8.3333	0.0000	100
USABLE	50.0000	50.0000	0.0000	0.0000	100
CUMULATIVE PRODUCTION TO 5/1/89	90.0750	4.7021	5.2191	0.0038	100
REMAINING PRIMARY RESERVES FROM 5/1/89	87.7938	0.0000	12.2062	0.0000	100
ULTIMATE PRIMARY RESERVES	89.7935	4.1219	6.0813	0.0033	100
AVERAGE CURRENT PRODUCING RATES AS OF 4/89	91.8008	0.0000	8.1992	0.0000	100
NET PAY ISOPACH PYRAMID METHOD	90.6464	3.1894	5.5764	0.5878	100
NET POROSITY-THICKNESS PYRAMID METHOD	91.4514	3.1175	4.8746	0.5565	100

OXY USA: TRACTS 1A,1B,2A,2B,4A AND 4B
CONOCO: TRACT 3
*SANTA FE AND APPROXIMATELY 26 OTHERS: TRACTS 6 AND 7
SANTA FE ENERGY: TRACT 5

COMPLETE TRACT DESCRIPTIONS ARE GIVEN IN ATTACHMENT 17.

FIGURE 1

POROSITY-PERMEABILITY CROSSPLOT FROM CORE DATA



USING CORE ANALYSIS FROM: FEDERAL "AA" No.2
FEDERAL "AD" No.1
FEDERAL "AE" No.1

FIGURE 2
Pressure and Volume Relations

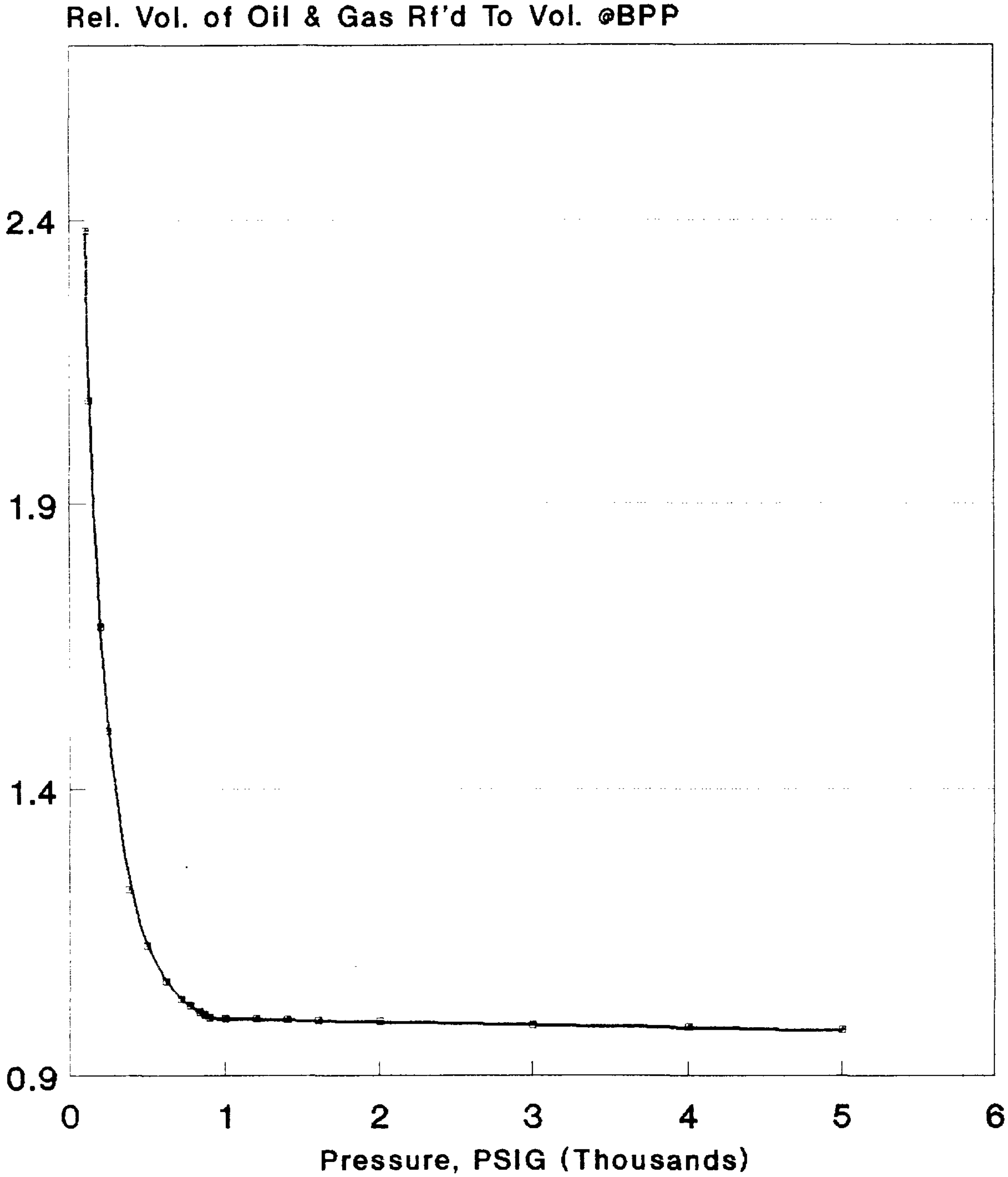


FIGURE 3

Liquid Compressibility vs. Pressure

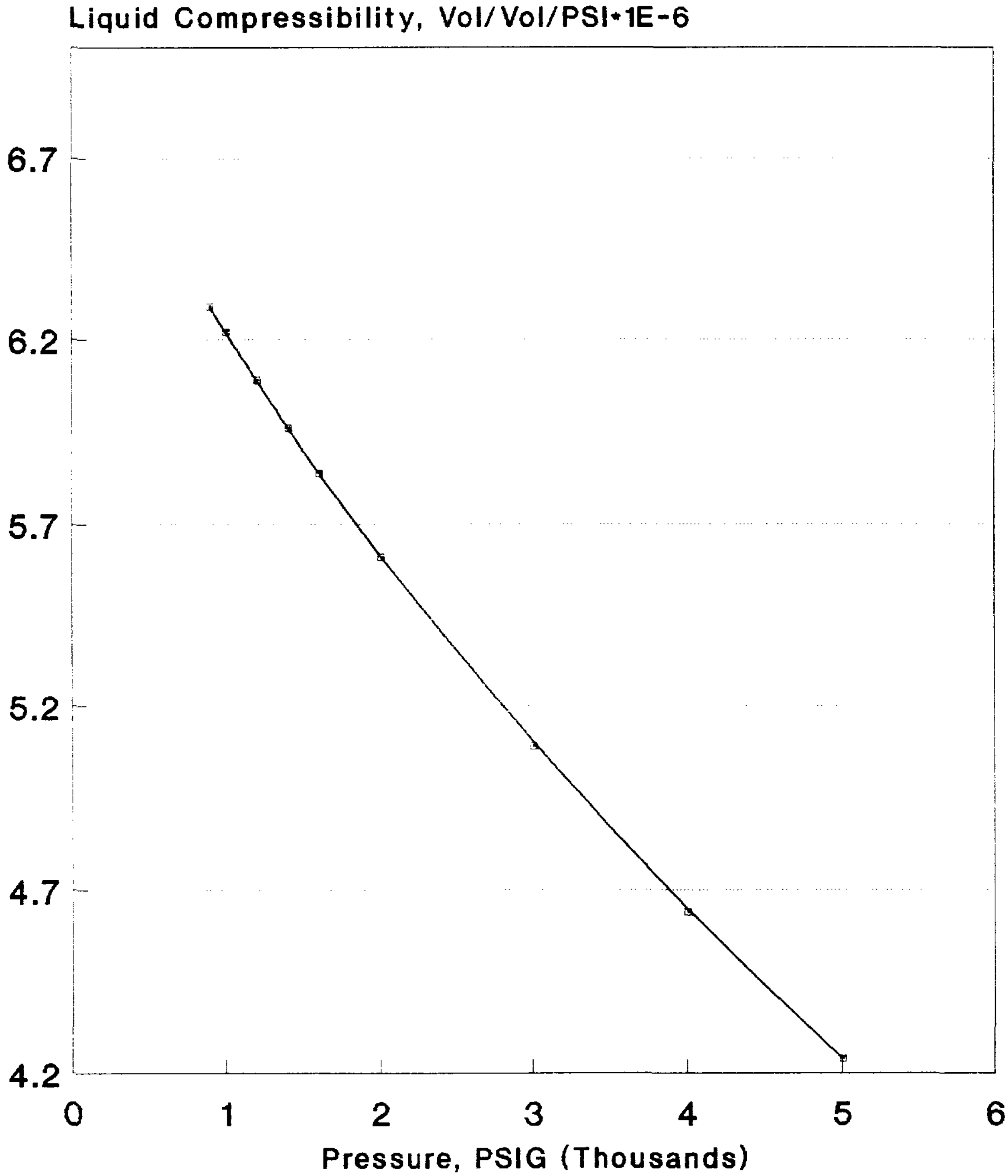


FIGURE 4

Reservoir Volume Factor vs. Pressure

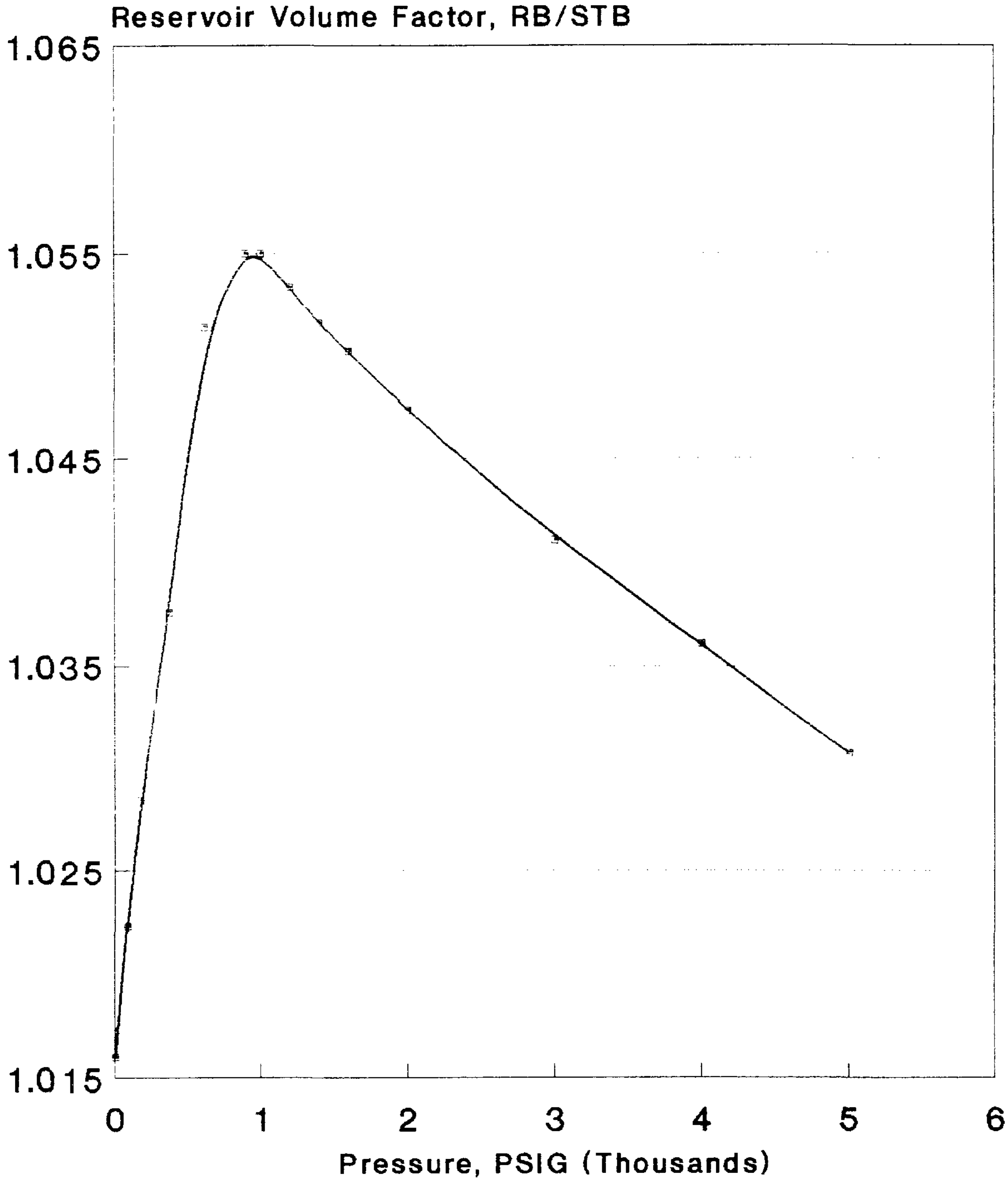


FIGURE 5

Solution Gas-Oil-Ratio vs. Pressure

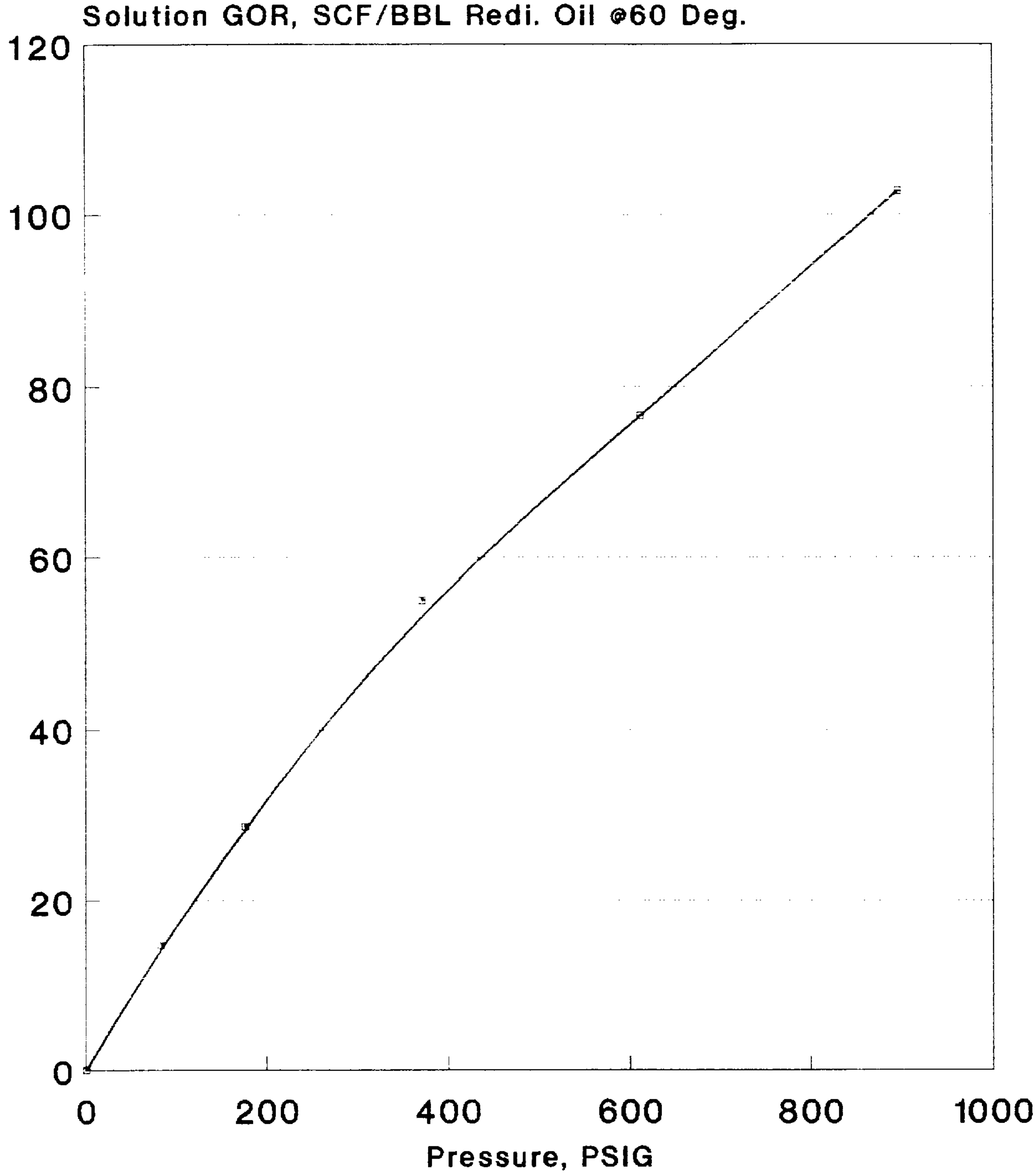


FIGURE 6

Liquid Density vs. Pressure

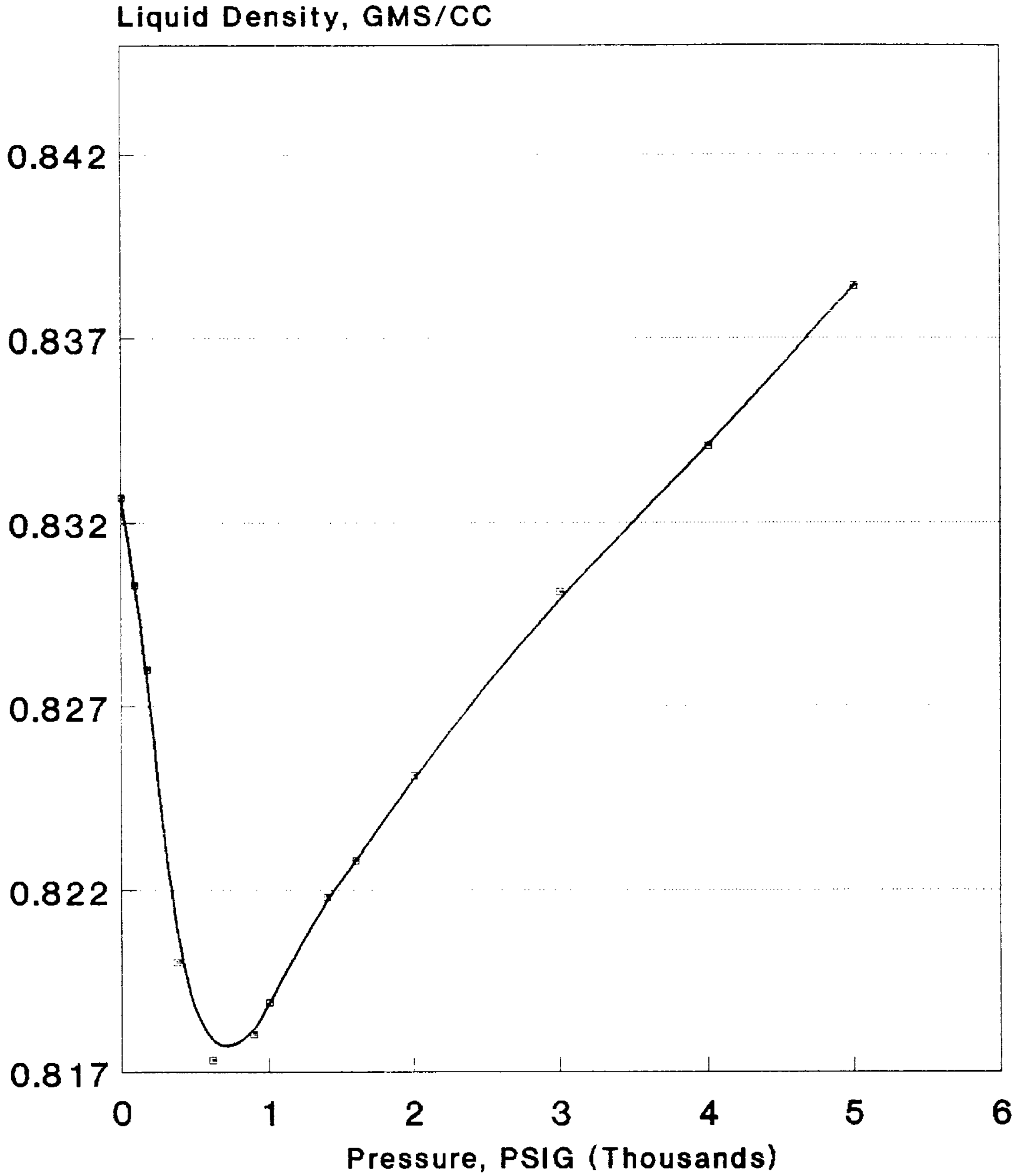


FIGURE 7

Viscosity vs. Pressure @ Reservoir Temp.

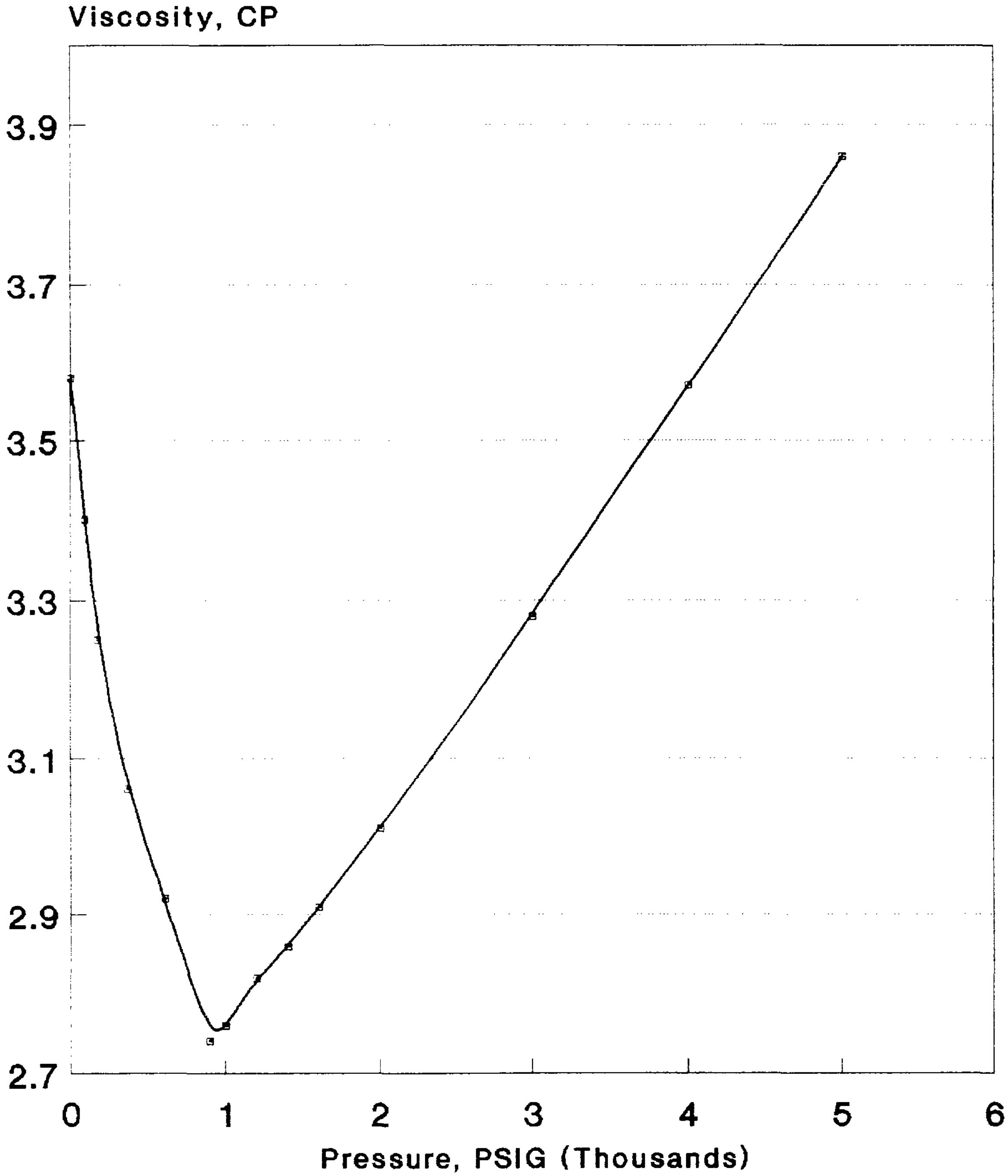


FIGURE 8

Specific Gravity of Liberated Gas

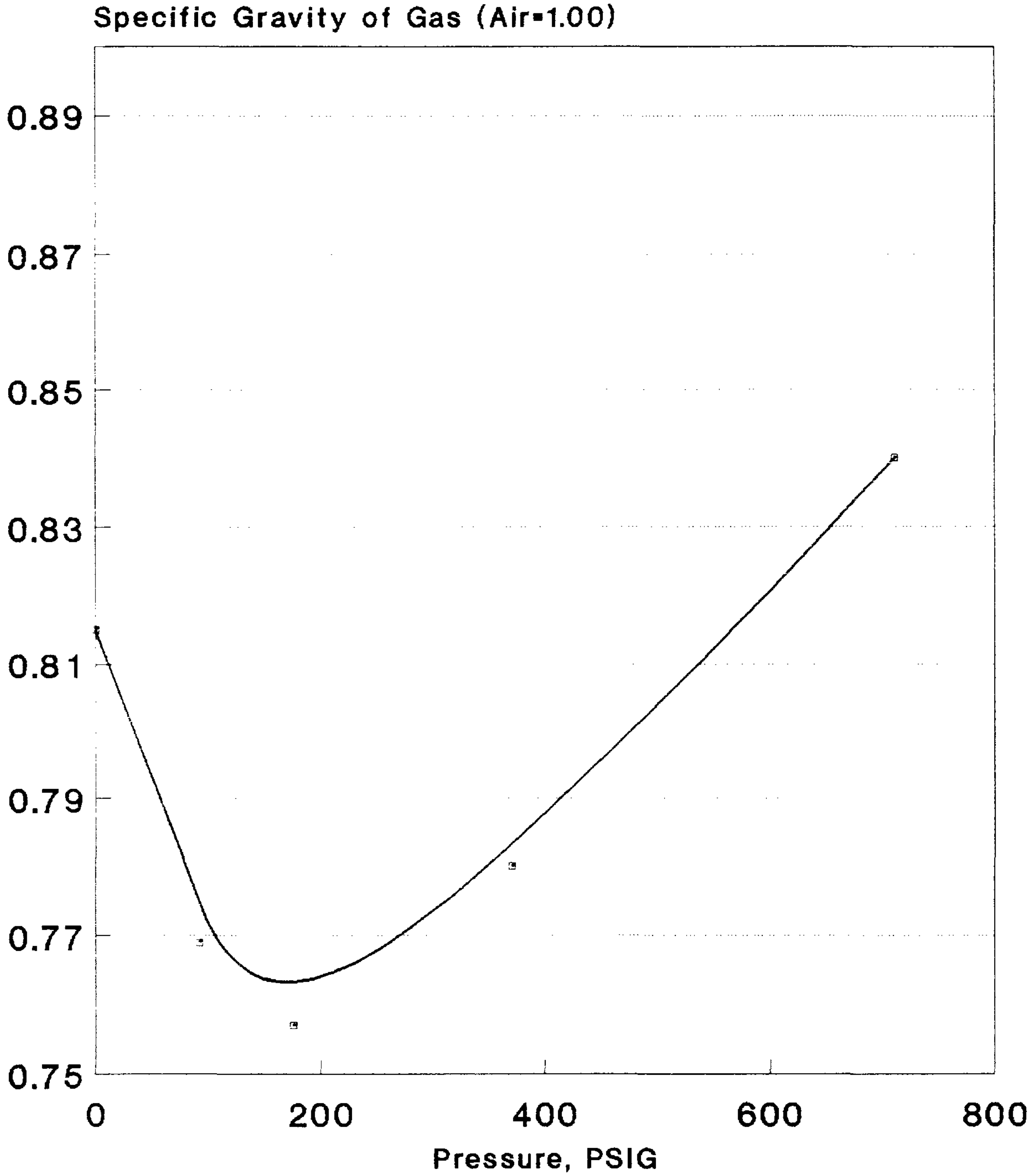


FIGURE 9

Fractional Flow Curve

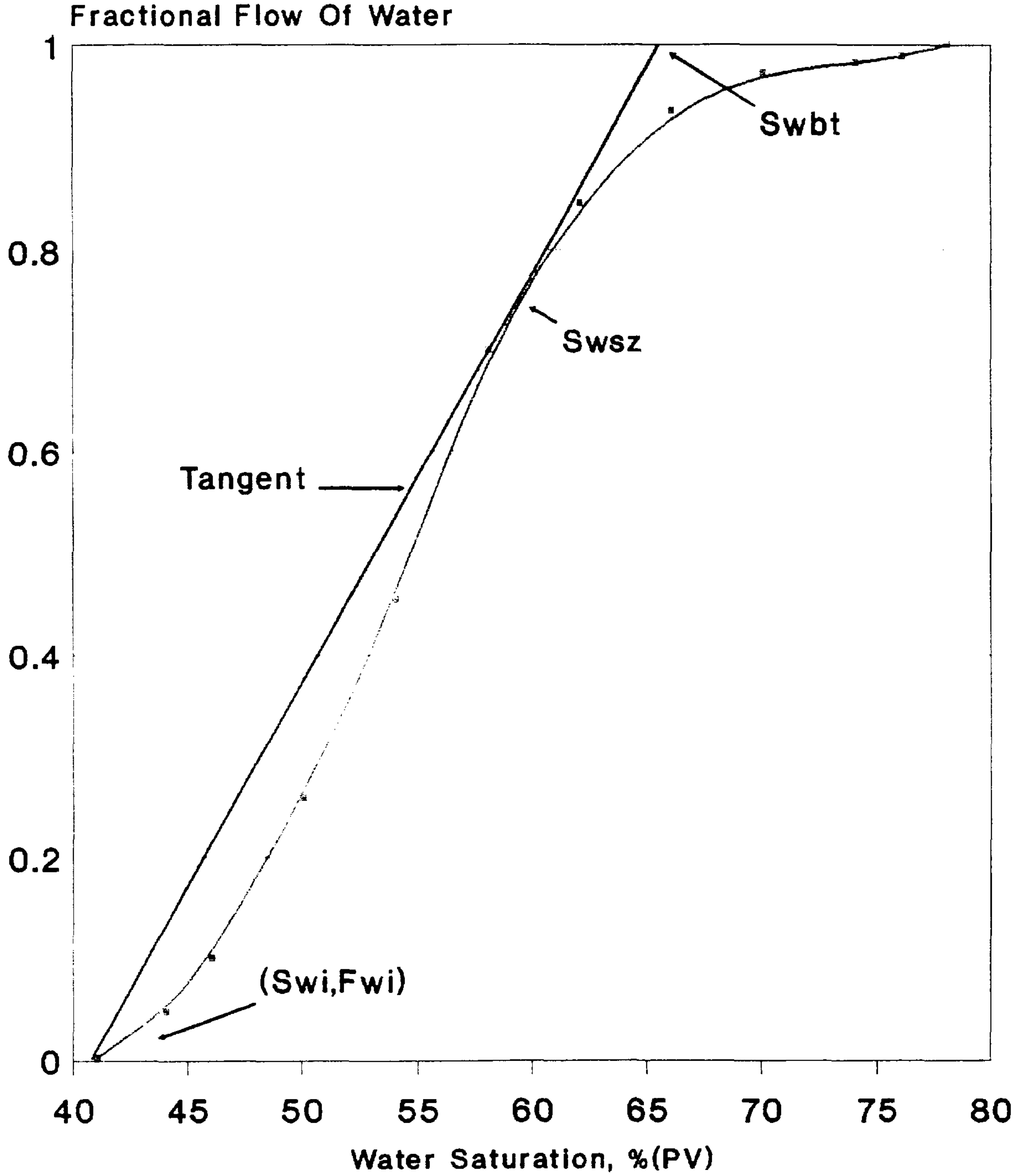


FIGURE 10

Central Corbin Queen

Waterflood Start 1/1990

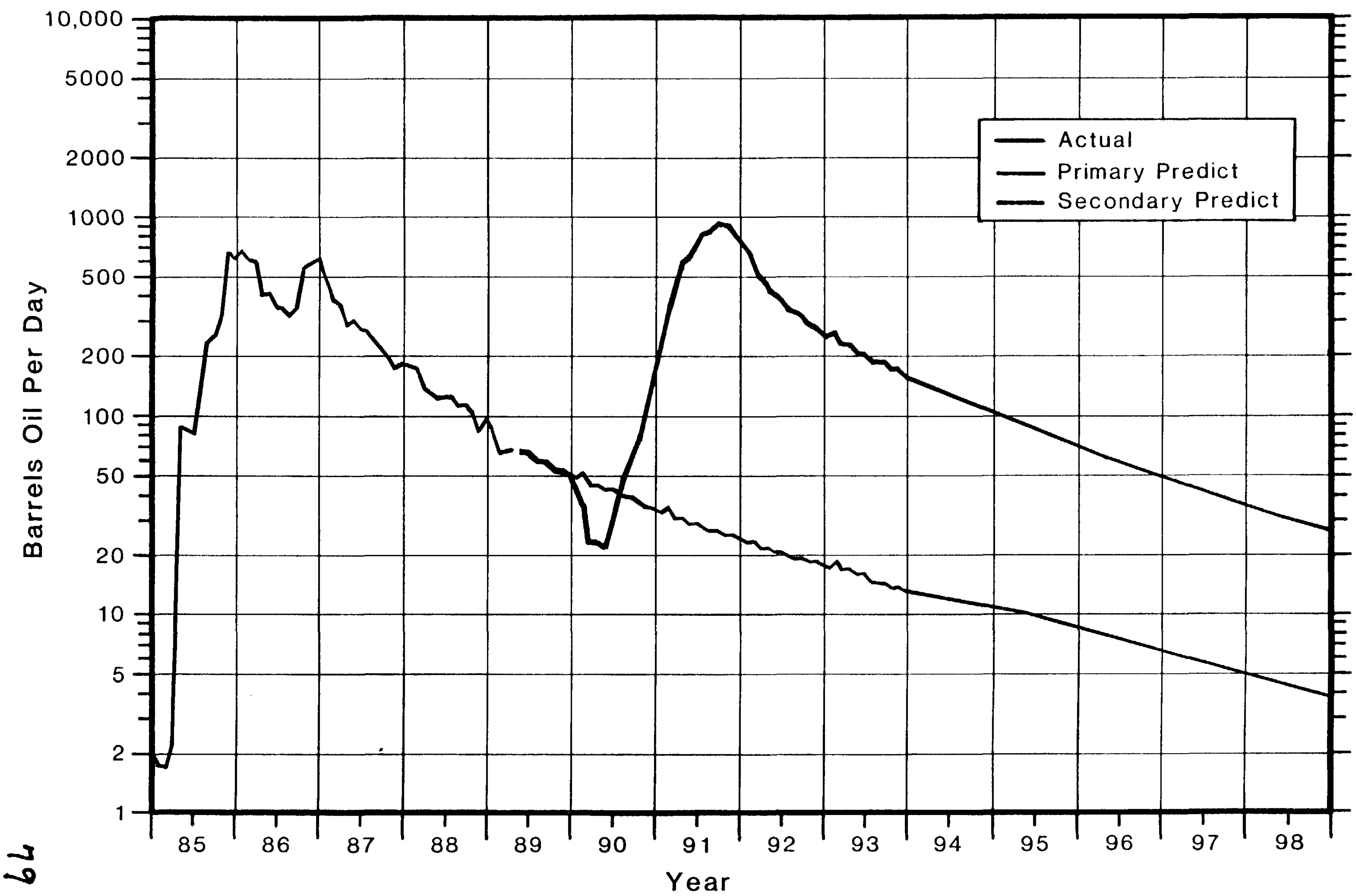
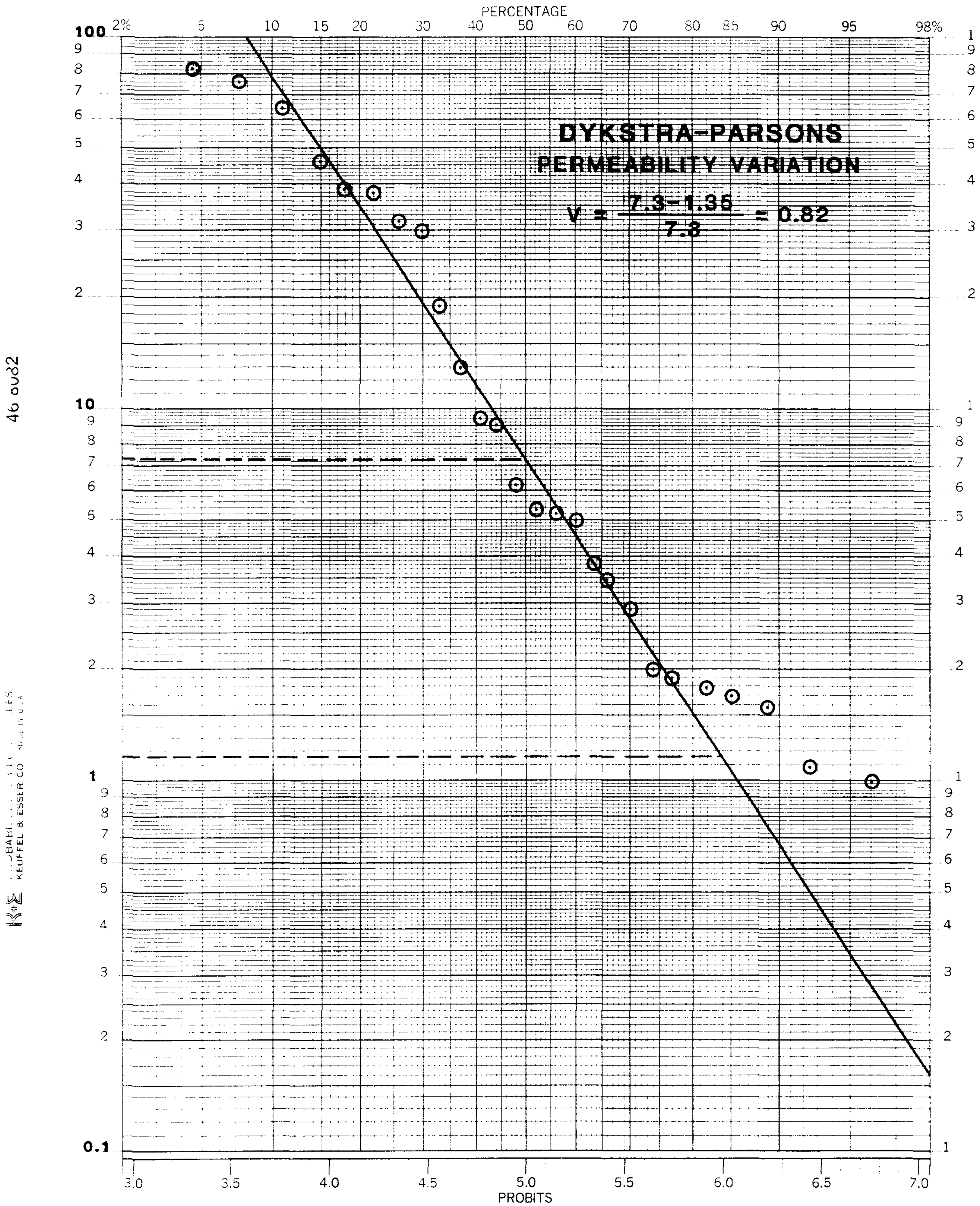
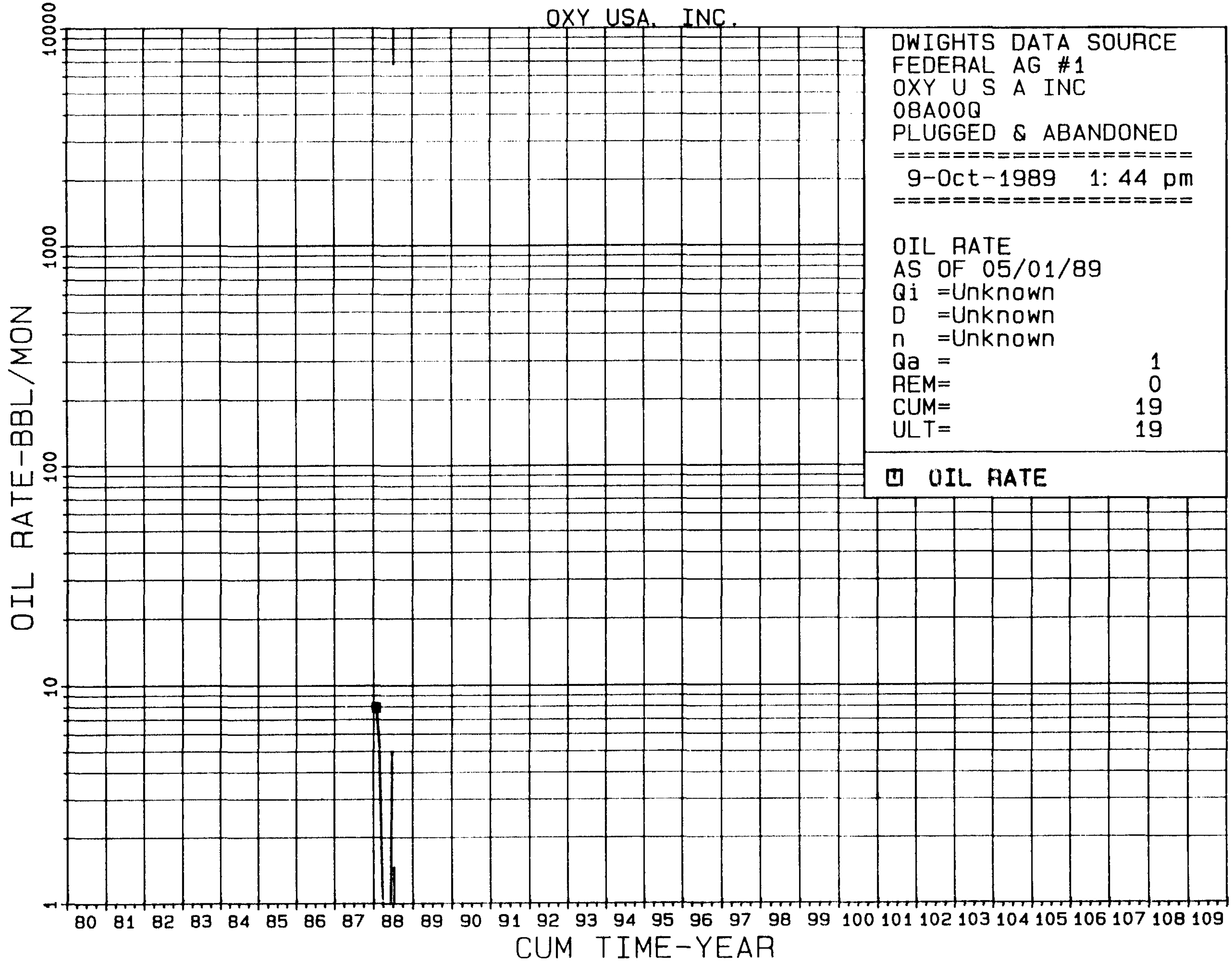
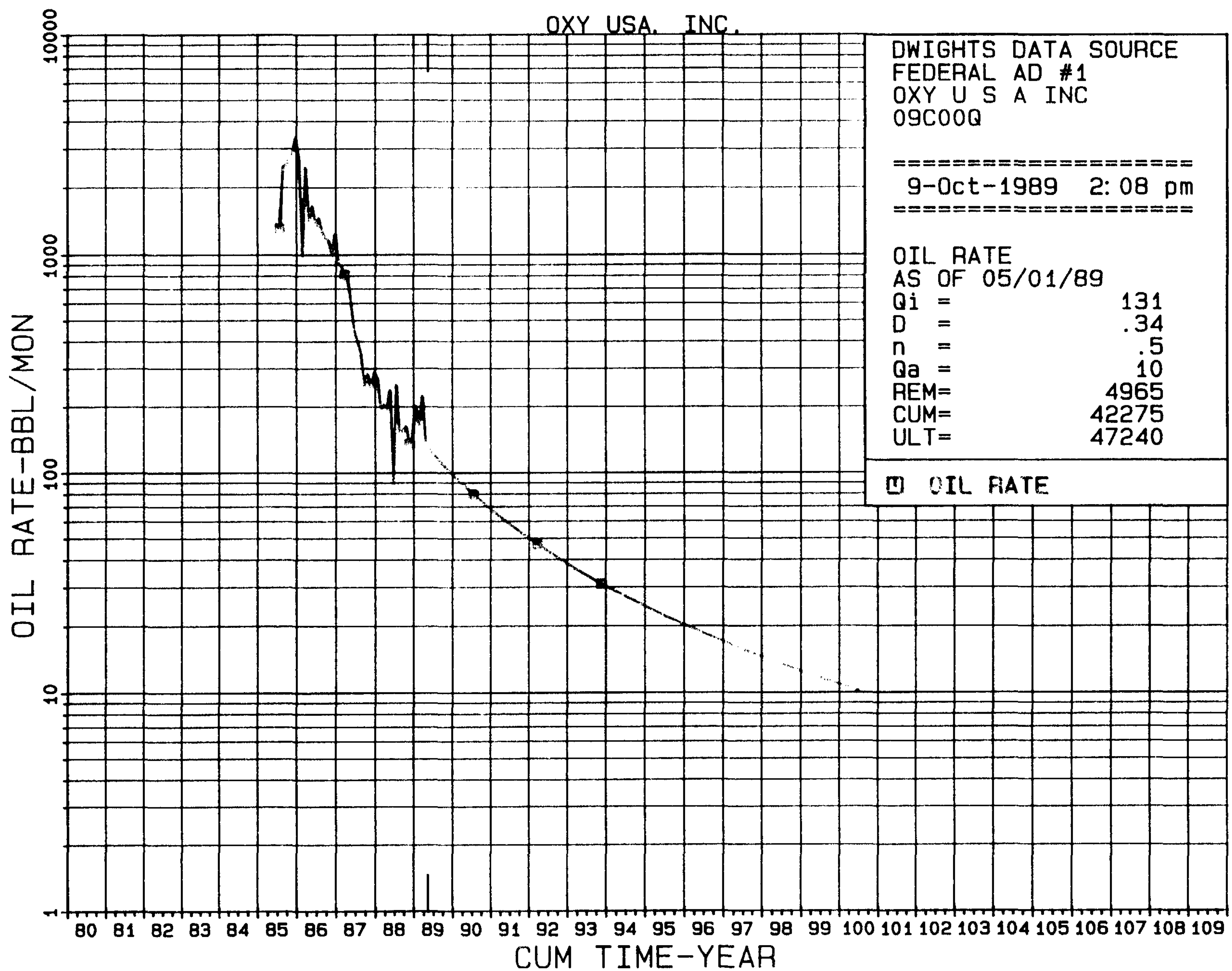
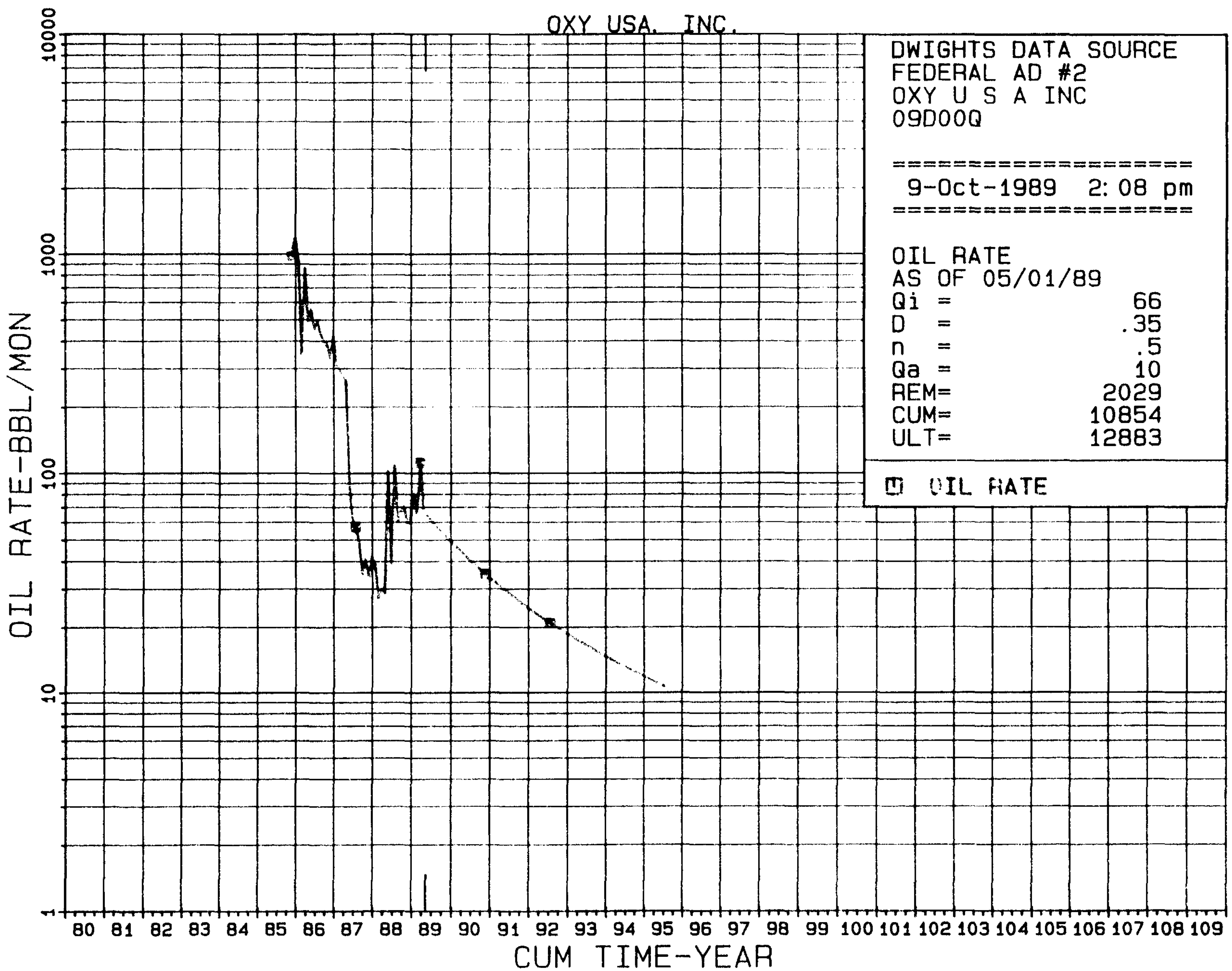


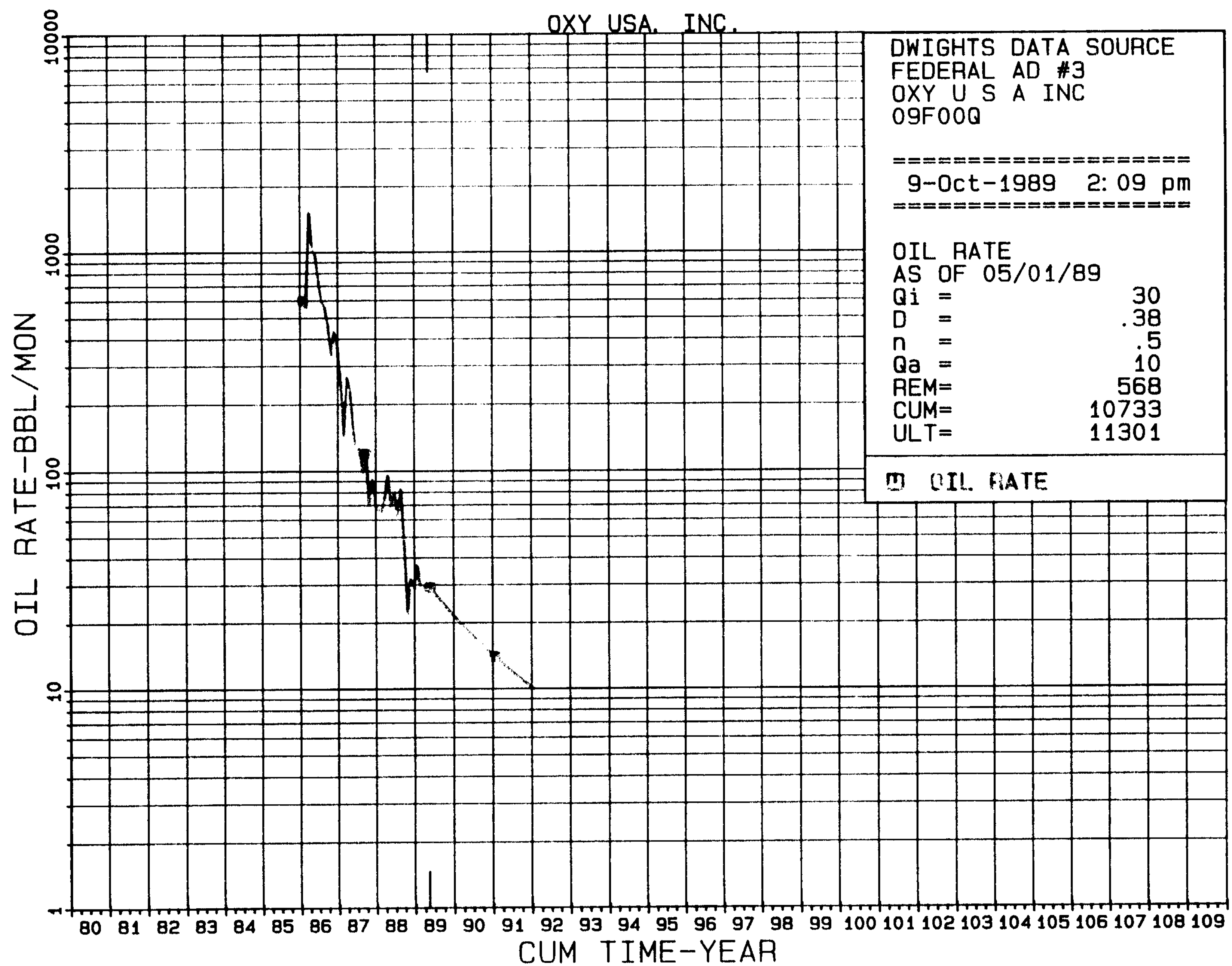
FIGURE 11

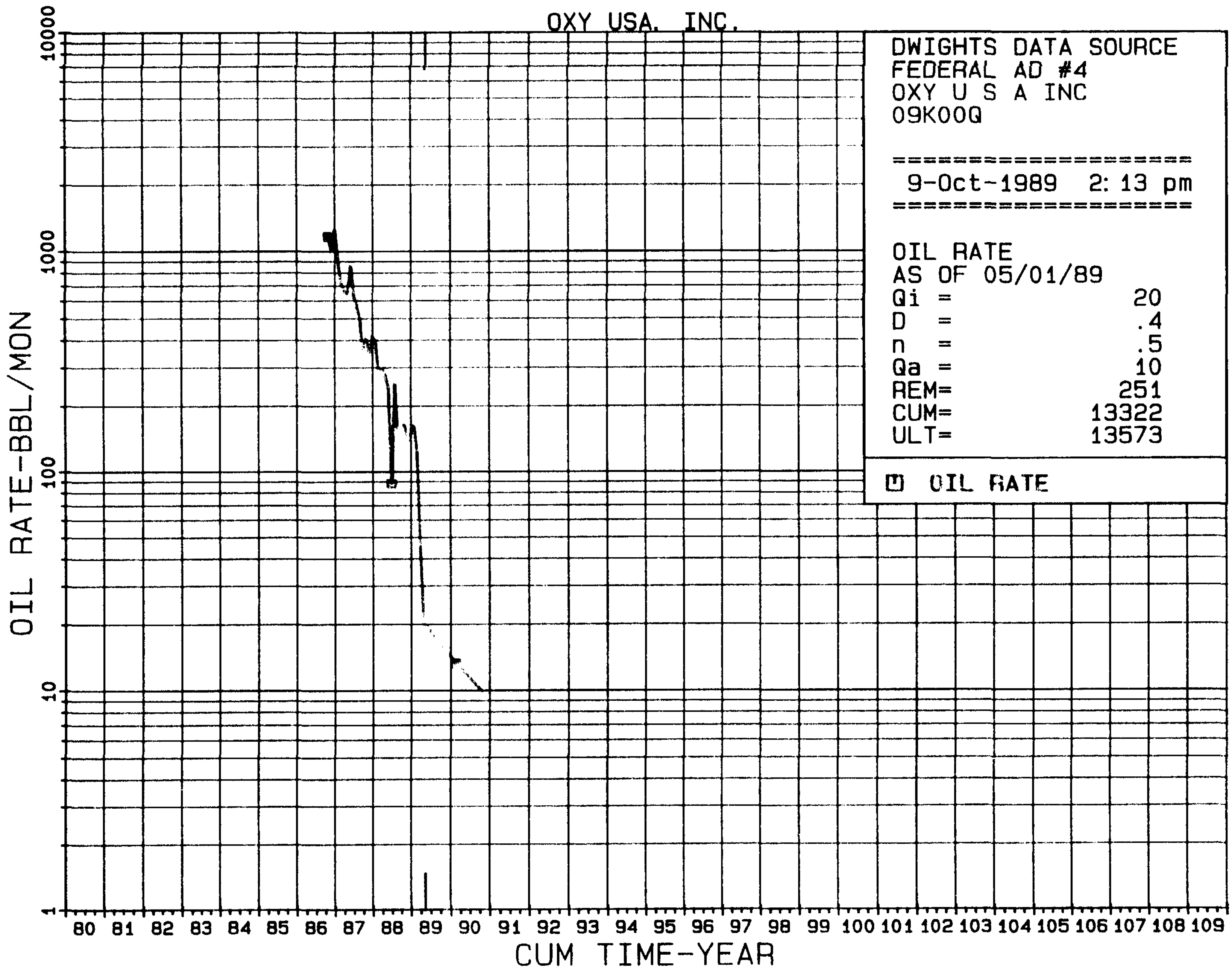

PERCENTAGE
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
DYKSTRA-PARSONS
PERMEABILITY VARIATION
V = (7.3-1.35)/7.3 = 0.82
100
10
1
0.1
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
PROBITS
46 8082
KEUFFEL & ESSER CO.


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AG #1
OXY U S A INC
08A00Q
PLUGGED & ABANDONED
9-Oct-1989 1:44 pm
OIL RATE
AS OF 05/01/89
Qi =Unknown
D =Unknown
n =Unknown
Qa = 1
REM= 0
CUM= 19
ULT= 19
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

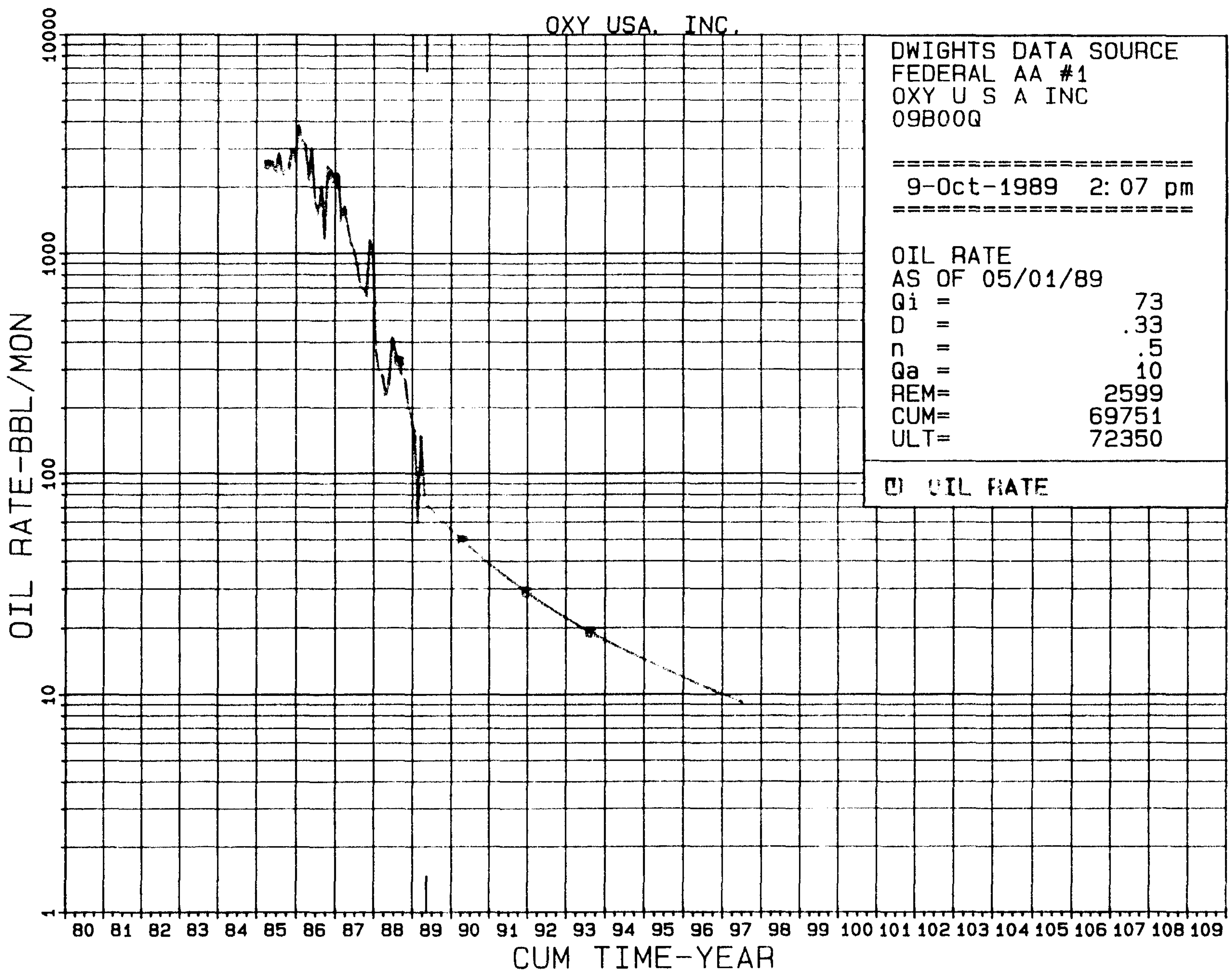

OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AD #1
OXY U S A INC
09C00Q
9-Oct-1989 2:08 pm
OIL RATE
AS OF 05/01/89
Qi = 131
D = .34
n = .5
Qa = 10
REM= 4965
CUM= 42275
ULT= 47240
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
CUM TIME-YEAR
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AD #2
OXY U S A INC
09D00Q
9-Oct-1989 2:08 pm
OIL RATE
AS OF 05/01/89
Qi = 66
D = .35
n = .5
Qa = 10
REM= 2029
CUM= 10854
ULT= 12883
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AD #3
OXY U S A INC
09F00Q
9-Oct-1989 2: 09 pm
OIL RATE
AS OF 05/01/89
Qi = 30
D = .38
n = .5
Qa = 10
REM= 568
CUM= 10733
ULT= 11301
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
CUM TIME-YEAR
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AD #4
OXY U S A INC
09K00Q
====================
9-Oct-1989 2: 13 pm
====================
OIL RATE
AS OF 05/01/89
Qi = 20
D = .4
n = .5
Qa = 10
REM= 251
CUM= 13322
ULT= 13573
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

85



OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AA #1
OXY U S A INC
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9-Oct-1989 2:07 pm
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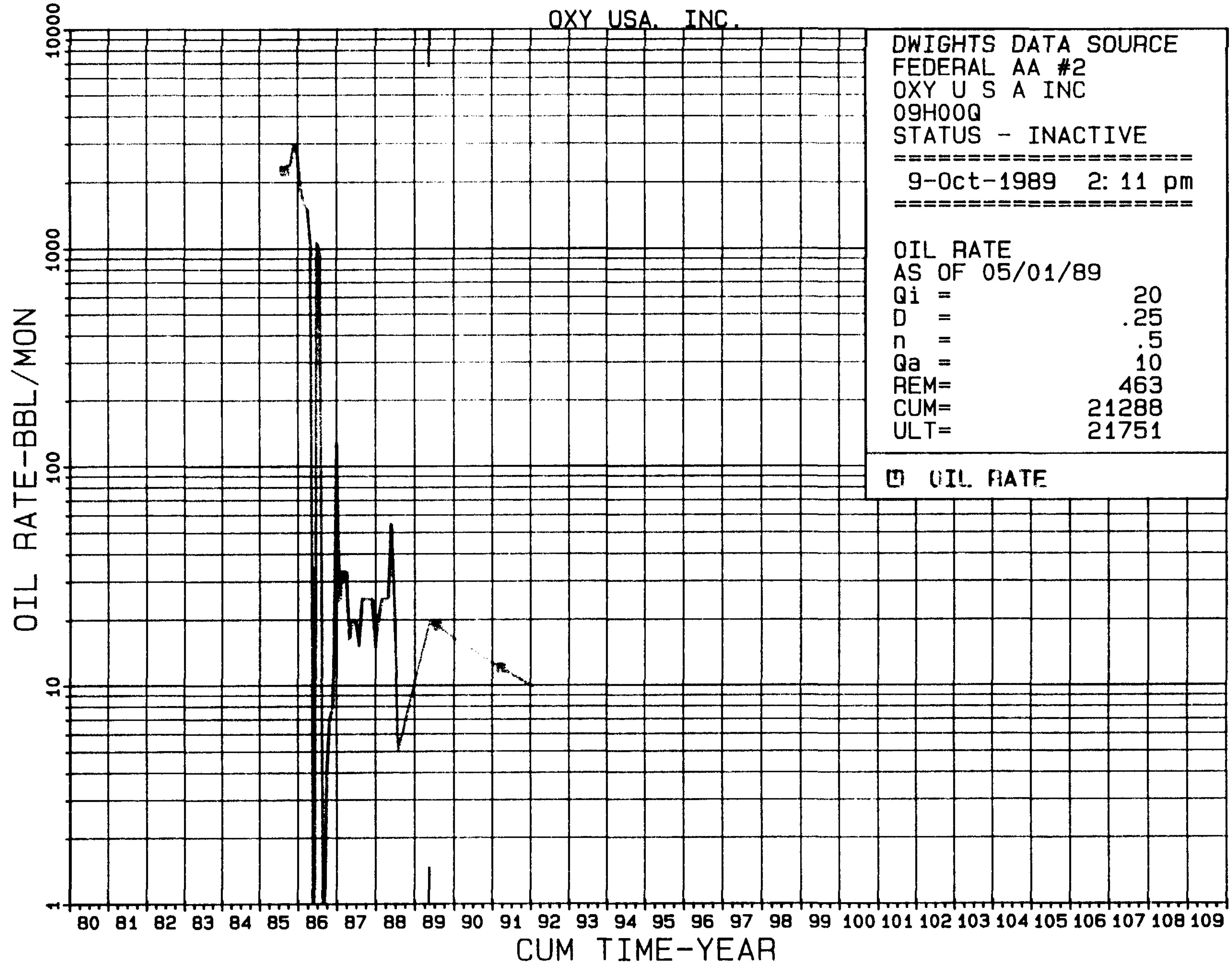
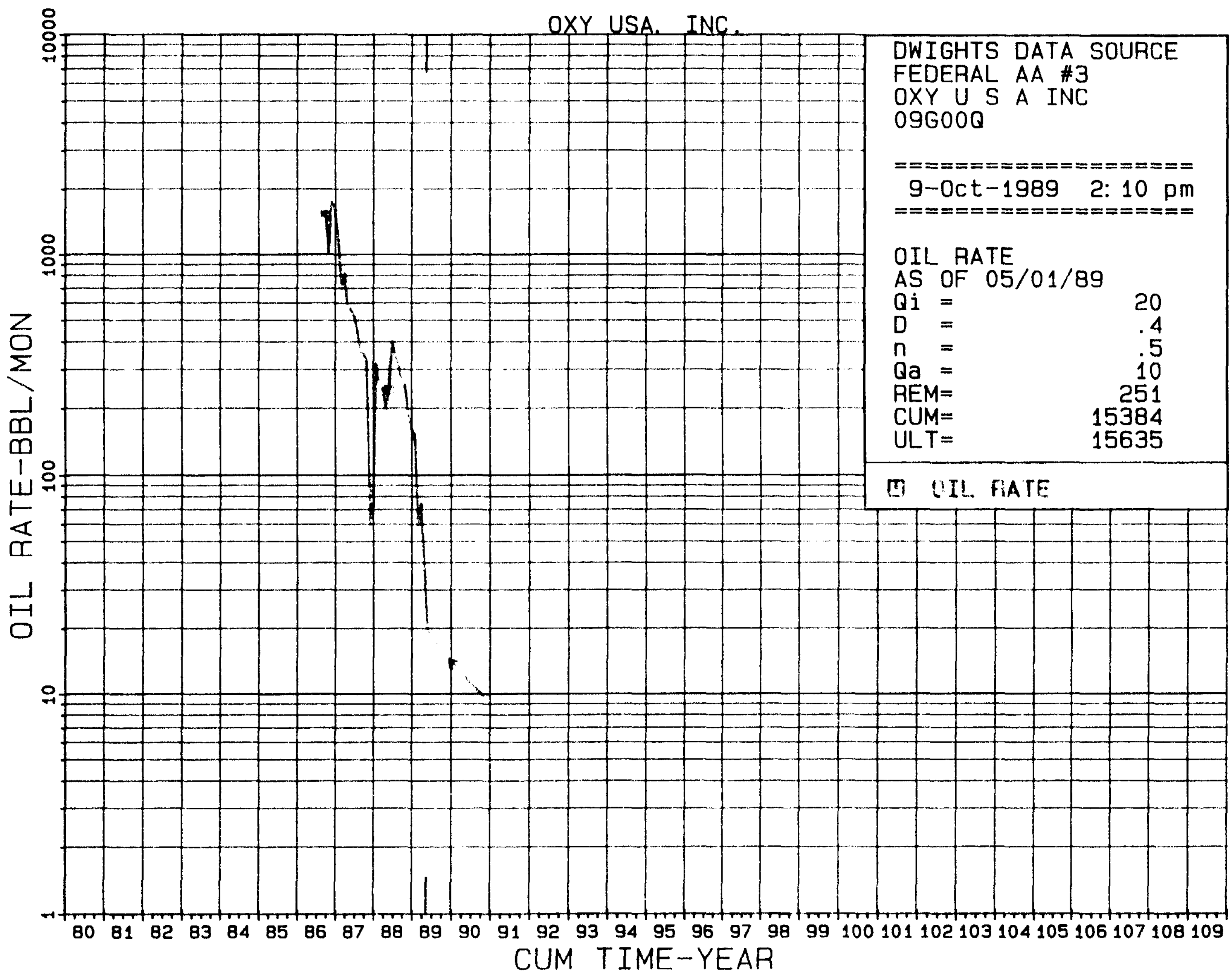
OIL RATE
AS OF 05/01/89
Qi = 73
D = .33
n = .5
Qa = 10
REM= 2599
CUM= 69751
ULT= 72350
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

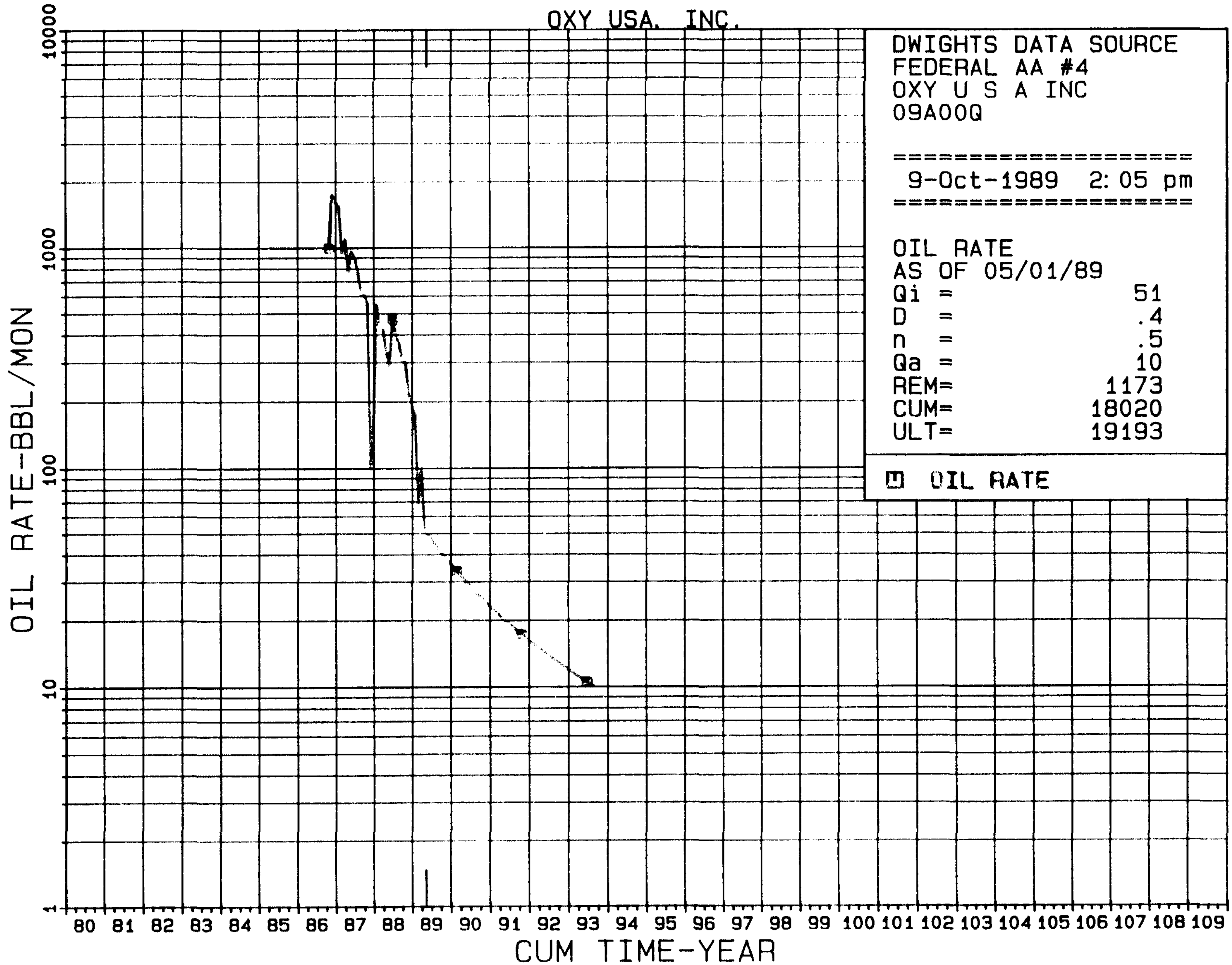

OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AA #2
OXY U S A INC
09H00Q
STATUS - INACTIVE
9-Oct-1989 2: 11 pm
OIL RATE
AS OF 05/01/89
Qi = 20
D = .25
n = .5
Qa = 10
REM= 463
CUM= 21288
ULT= 21751
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

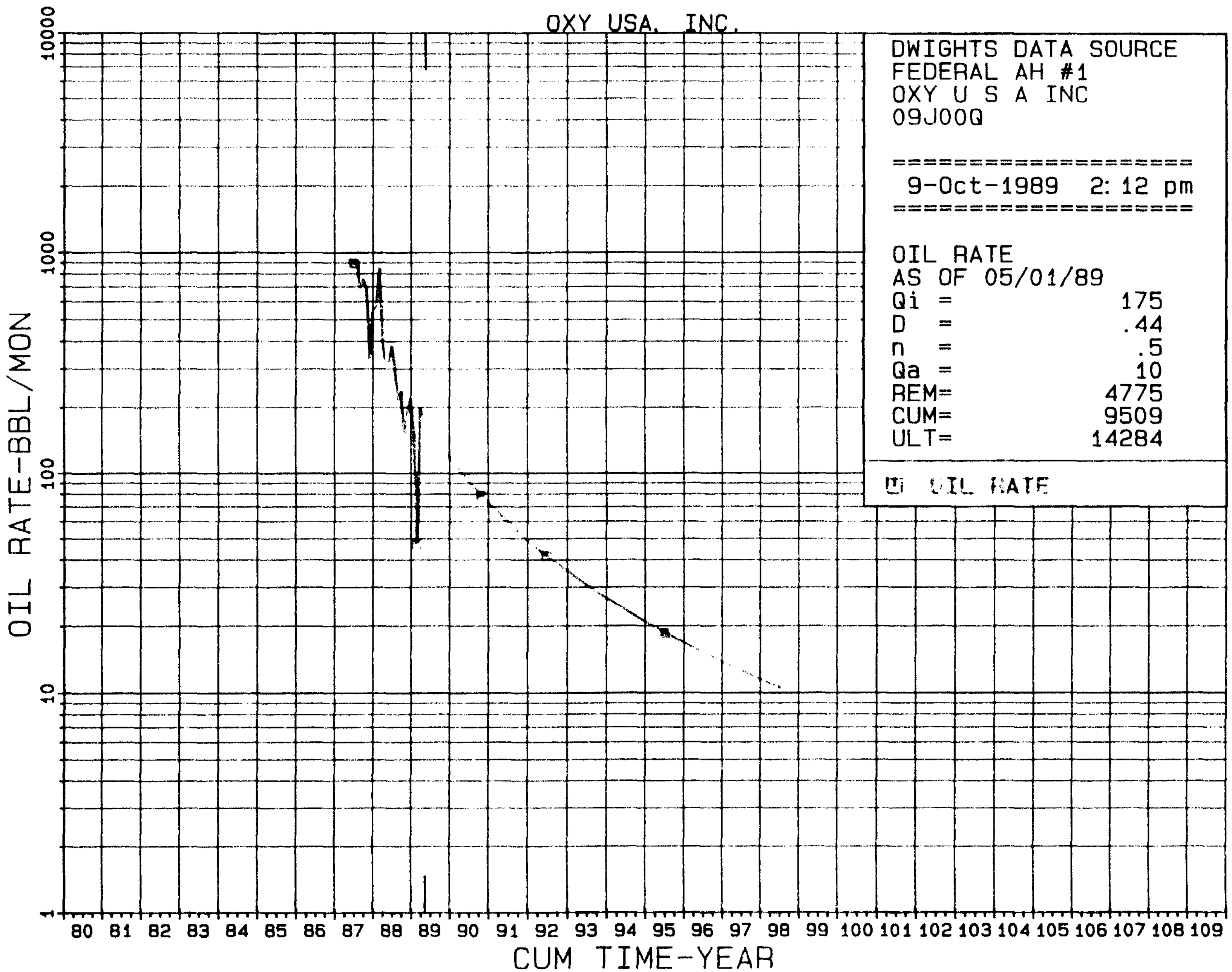
87

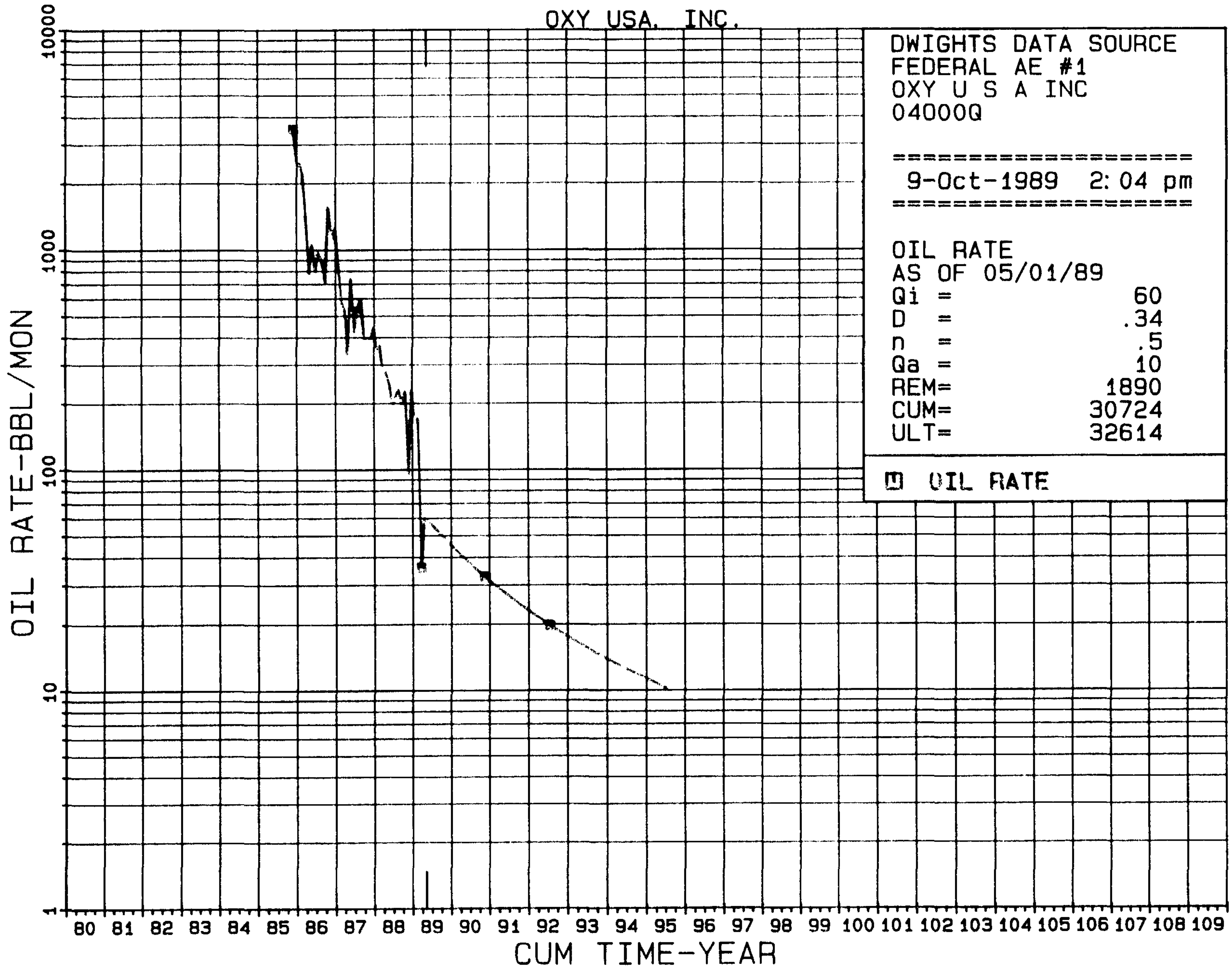

OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AA #3
OXY U S A INC
09G00Q
====================
9-Oct-1989 2:10 pm
====================
OIL RATE
AS OF 05/01/89
Qi = 20
D = .4
n = .5
Qa = 10
REM= 251
CUM= 15384
ULT= 15635
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

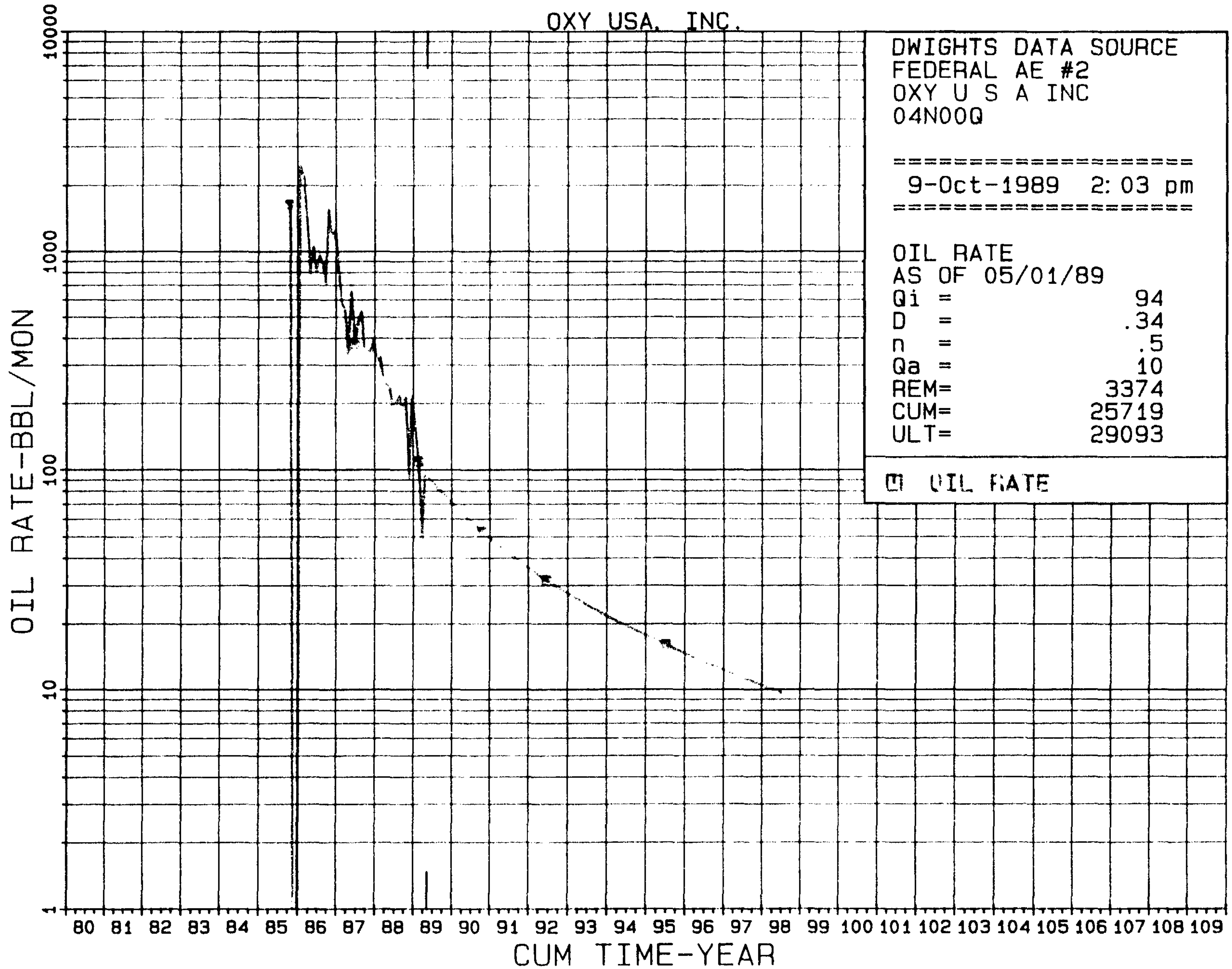
88

OXY USA, INC.


OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR
DWIGHTS DATA SOURCE
FEDERAL AA #4
OXY U S A INC
09A00Q
====================
9-Oct-1989 2:05 pm
====================
OIL RATE
AS OF 05/01/89
Qi = 51
D = .4
n = .5
Qa = 10
REM= 1173
CUM= 18020
ULT= 19193
OIL RATE

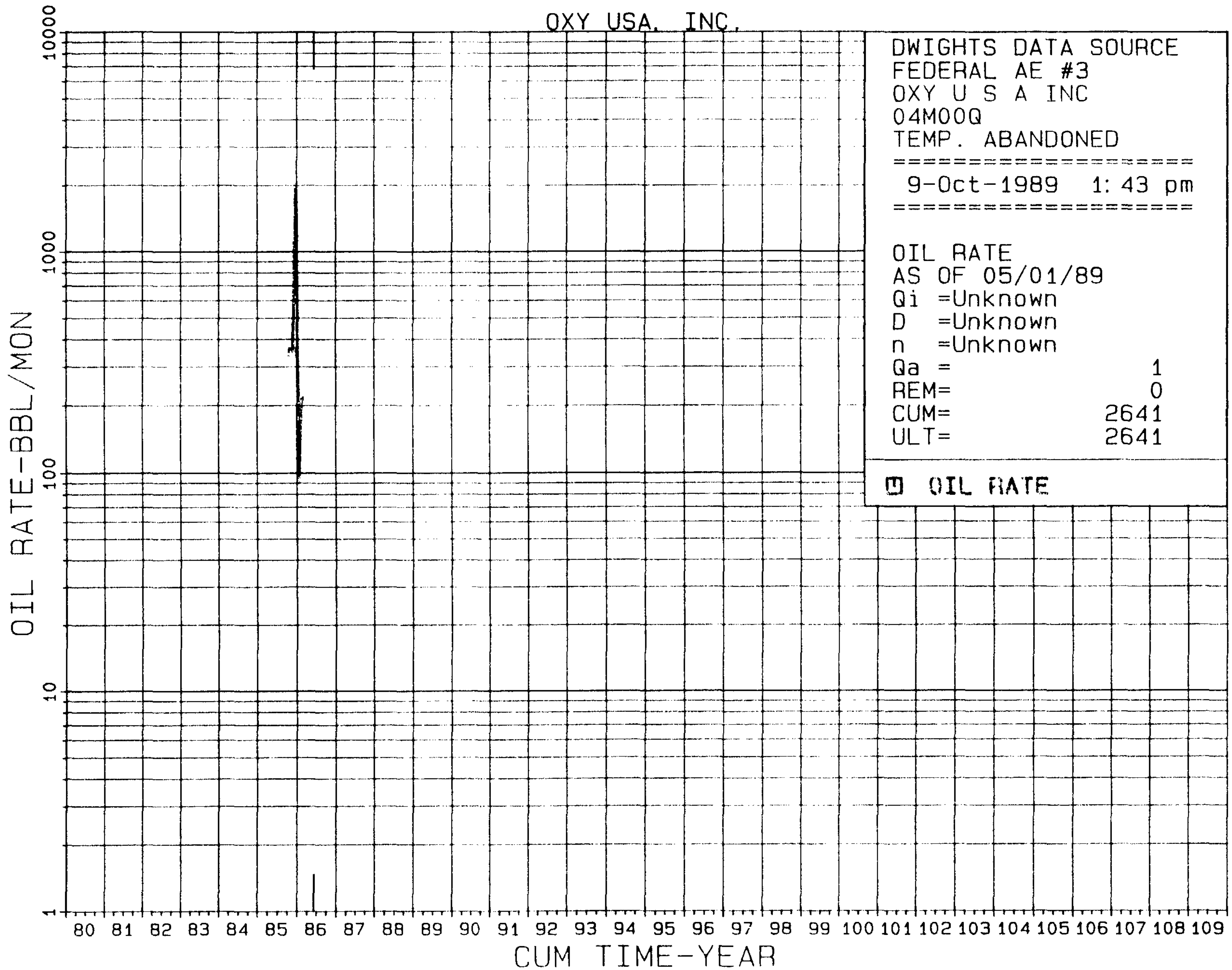

OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AH #1
OXY U S A INC
09J00Q
9-Oct-1989 2:12 pm
OIL RATE
AS OF 05/01/89
Qi = 175
D = .44
n = .5
Qa = 10
REM= 4775
CUM= 9509
ULT= 14284
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
CUM TIME-YEAR
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #1
OXY U S A INC
04000Q
9-Oct-1989 2:04 pm
OIL RATE
AS OF 05/01/89
Qi = 60
D = .34
n = .5
Qa = 10
REM= 1890
CUM= 30724
ULT= 32614
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

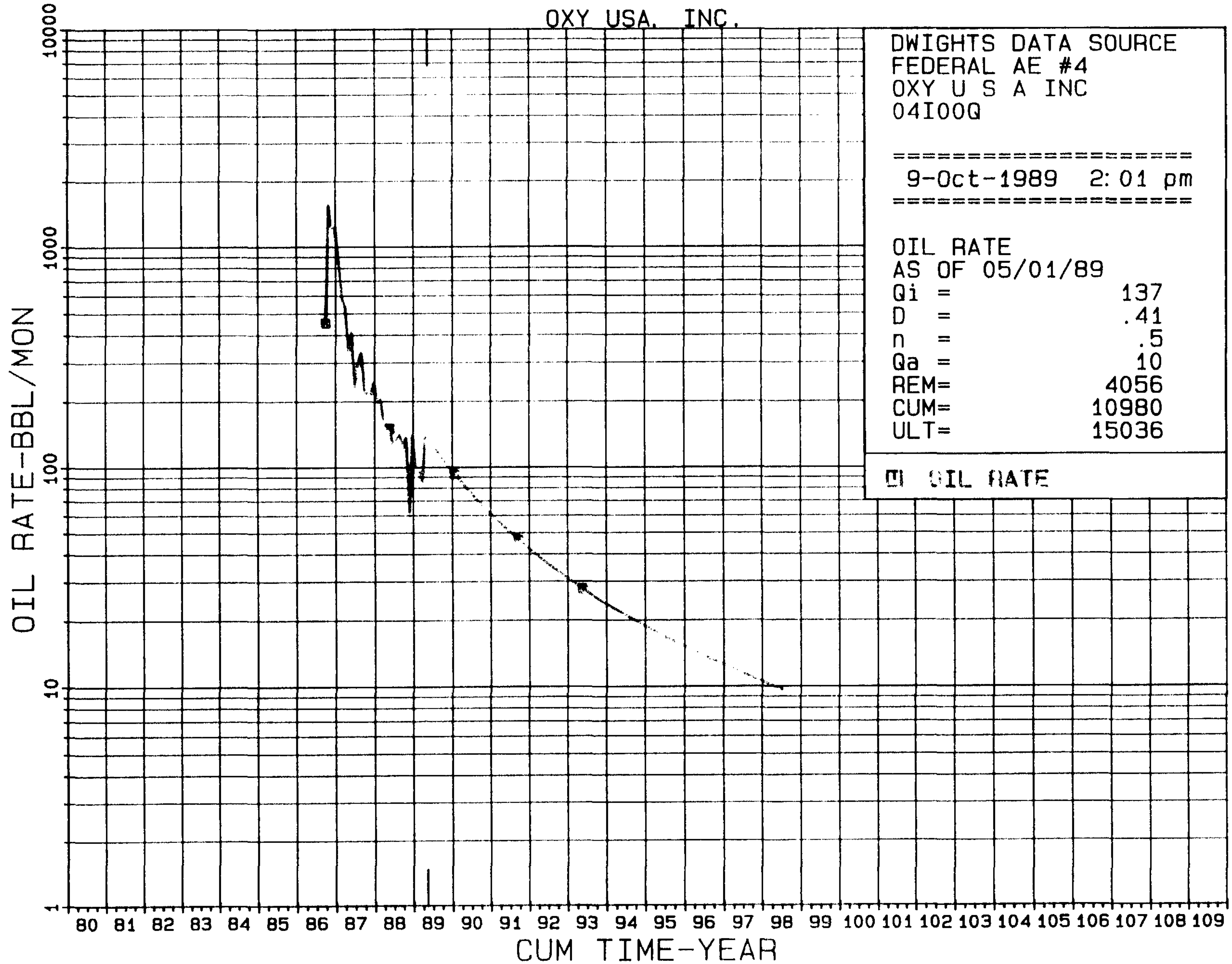


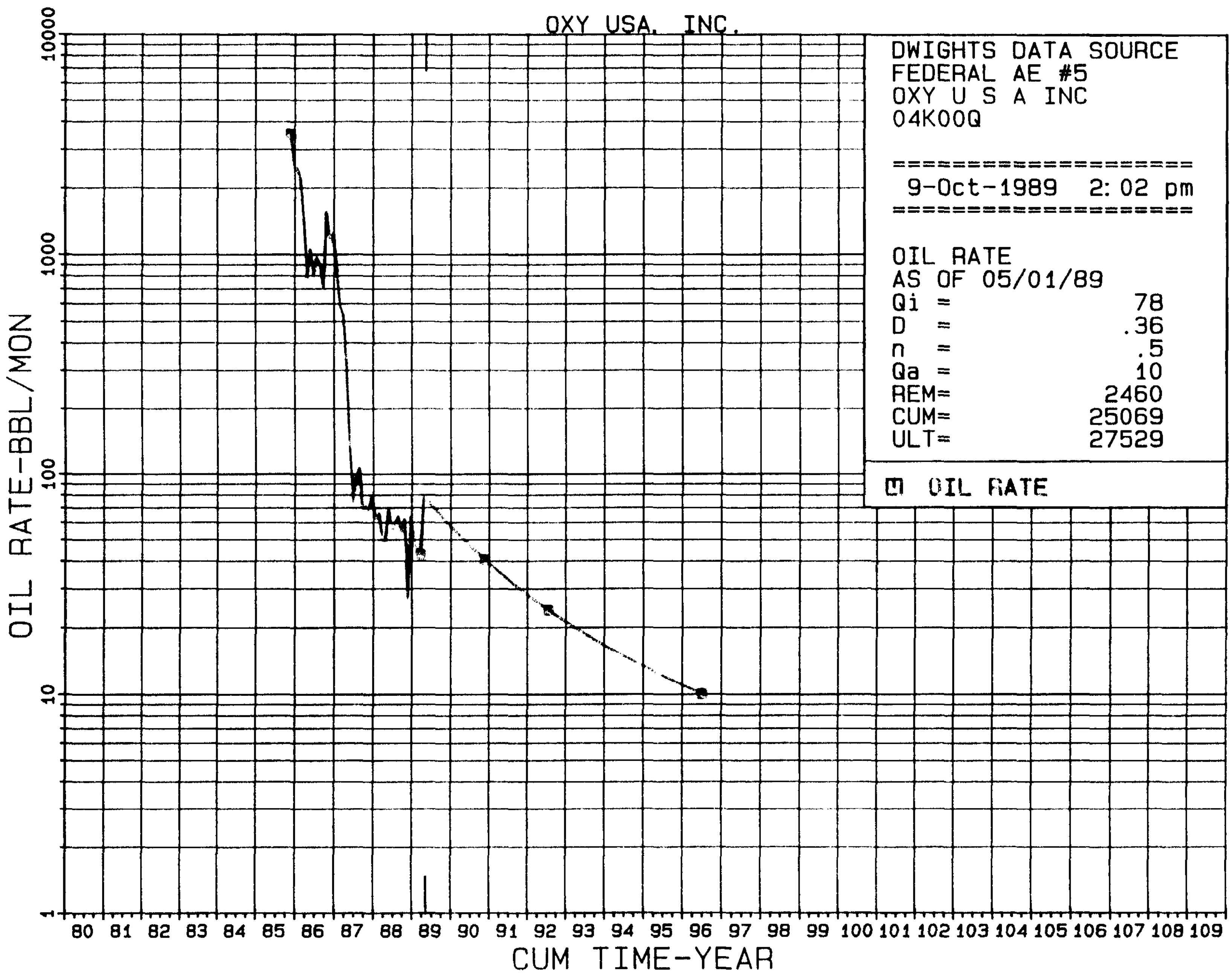
OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #2
OXY U S A INC
04N00Q
9-Oct-1989 2:03 pm
OIL RATE
AS OF 05/01/89
Qi = 94
D = .34
n = .5
Qa = 10
REM= 3374
CUM= 25719
ULT= 29093
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

92

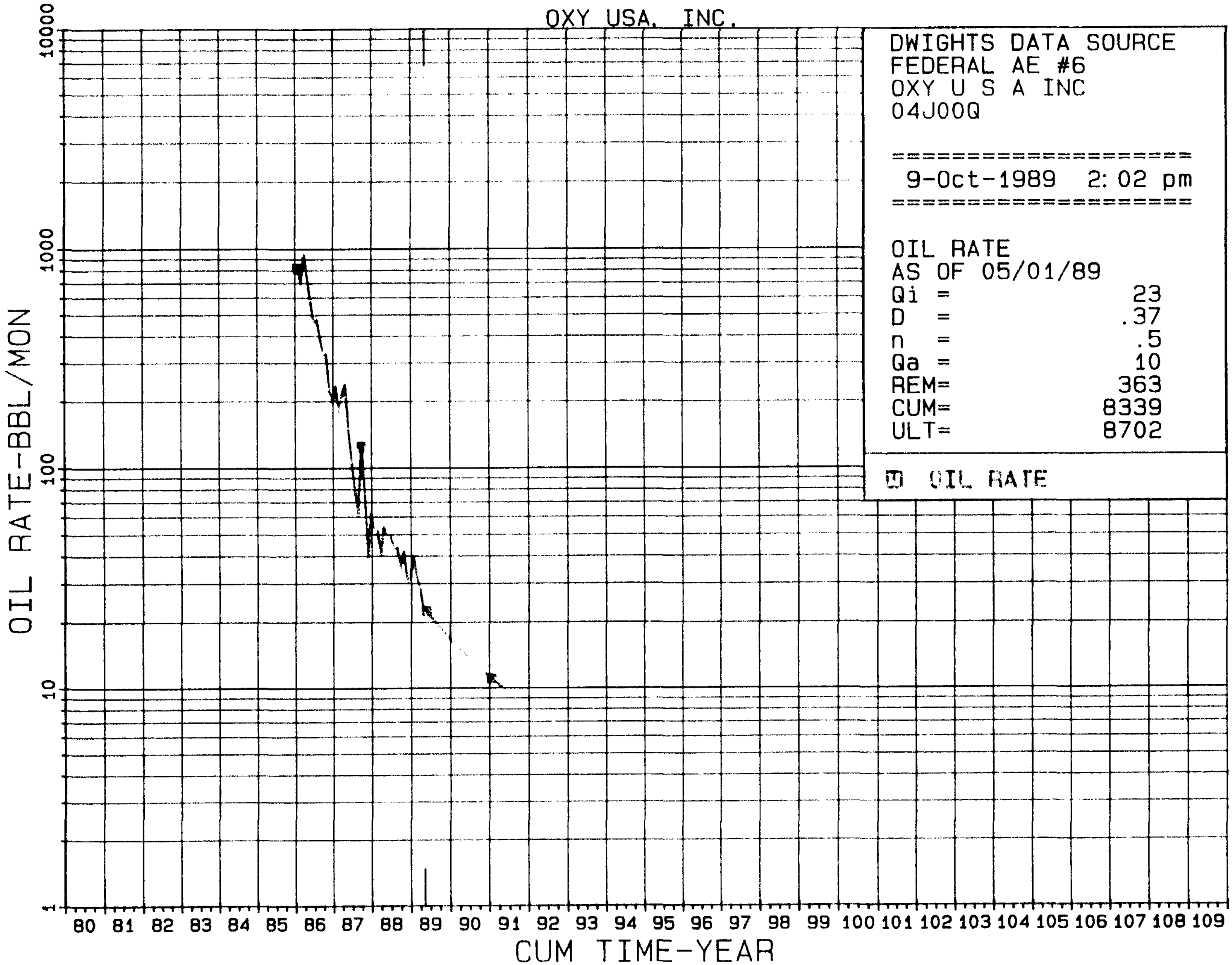


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #3
OXY U S A INC
04M00Q
TEMP. ABANDONED
9-Oct-1989 1:43 pm
OIL RATE
AS OF 05/01/89
Qi =Unknown
D =Unknown
n =Unknown
Qa = 1
REM= 0
CUM= 2641
ULT= 2641
OIL RATE
OIL RATE-BBL/MON
CUM TIME-YEAR


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #4
OXY U S A INC
04I00Q
9-Oct-1989 2:01 pm
OIL RATE
AS OF 05/01/89
Qi = 137
D = .41
n = .5
Qa = 10
REM= 4056
CUM= 10980
ULT= 15036
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

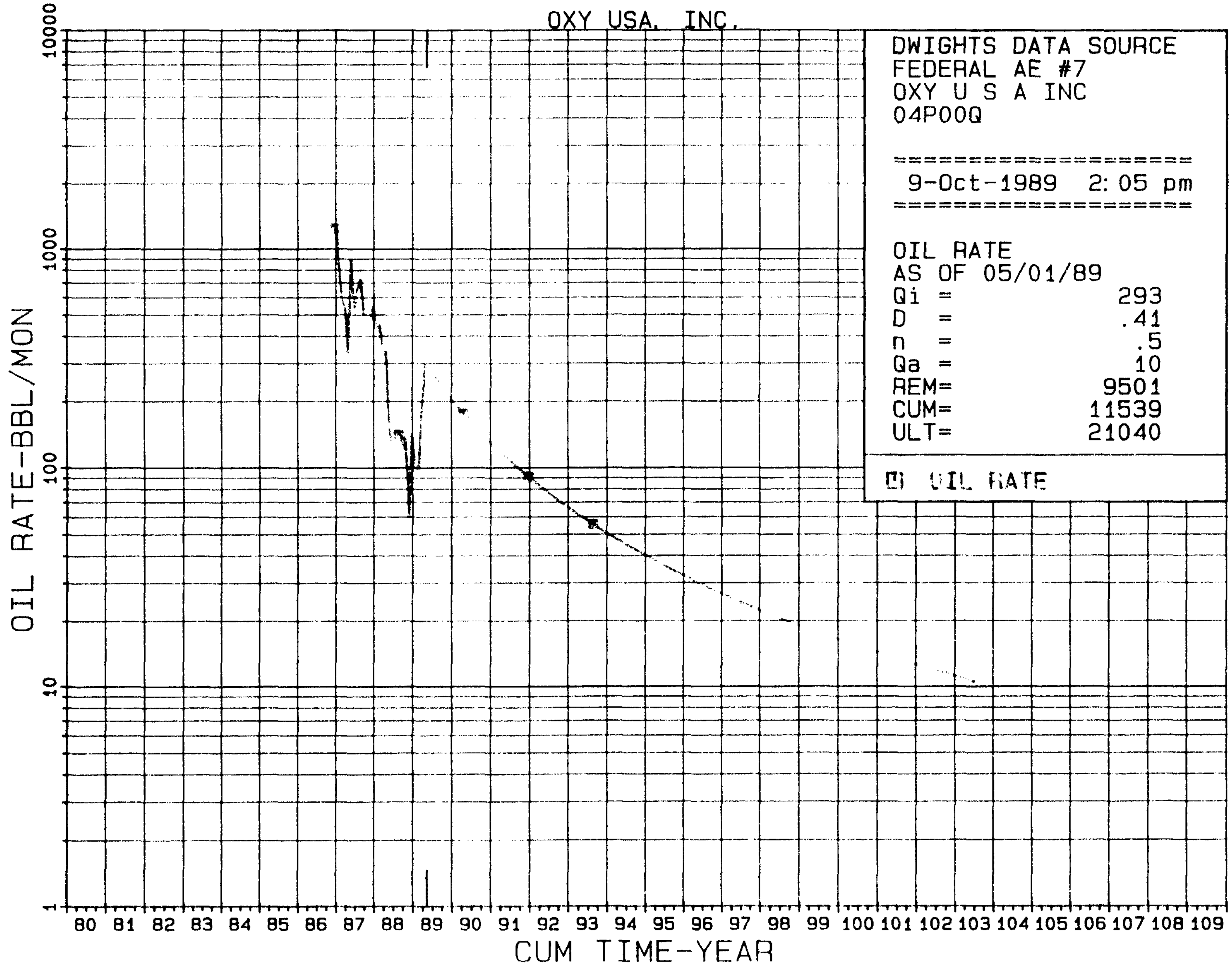

OXY USA. INC.
DWIGHTS DATA SOURCE
FEDERAL AE #5
OXY U S A INC
04K00Q
====================
9-Oct-1989 2:02 pm
====================
OIL RATE
AS OF 05/01/89
Qi = 78
D = .36
n = .5
Qa = 10
REM= 2460
CUM= 25069
ULT= 27529
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

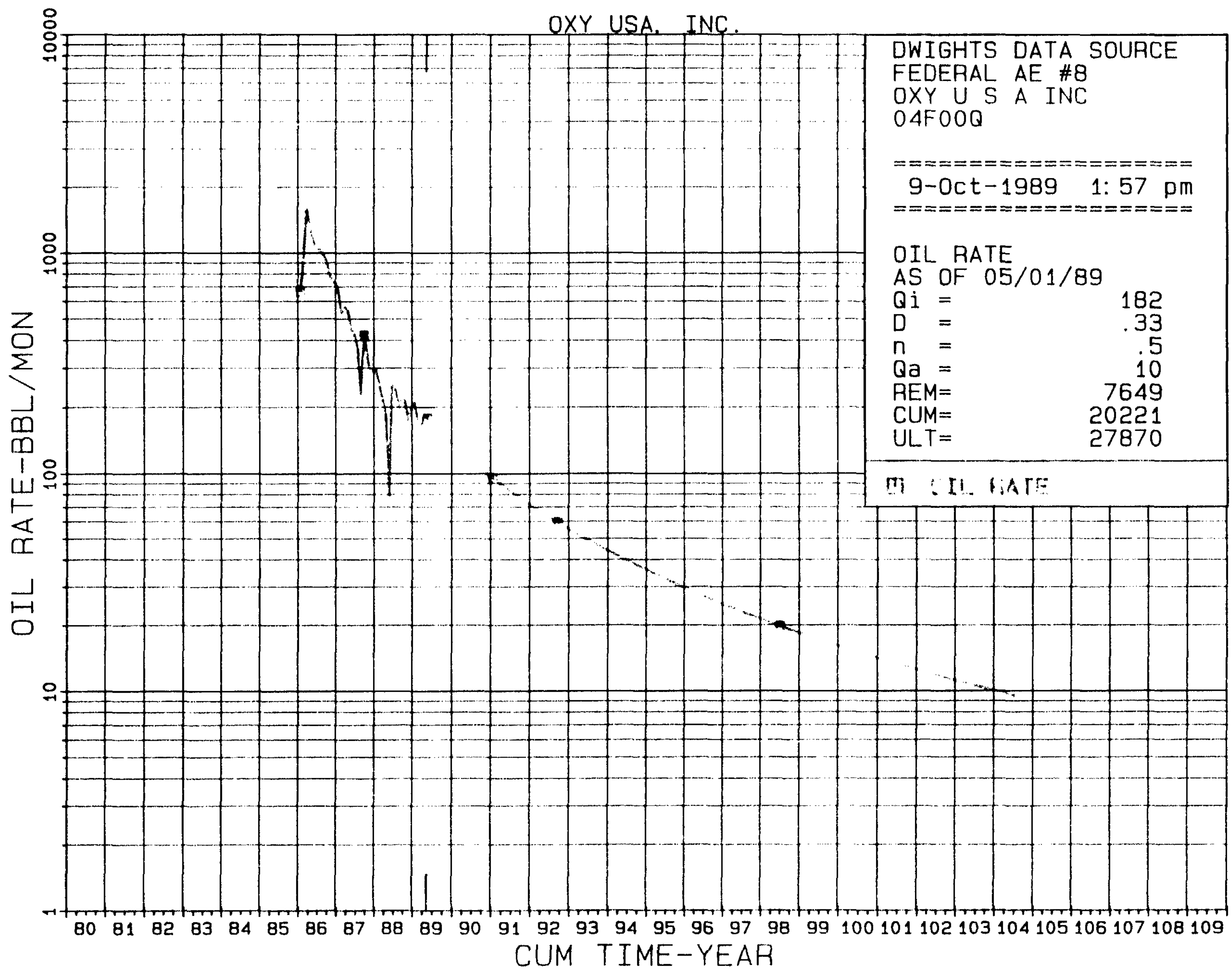
95

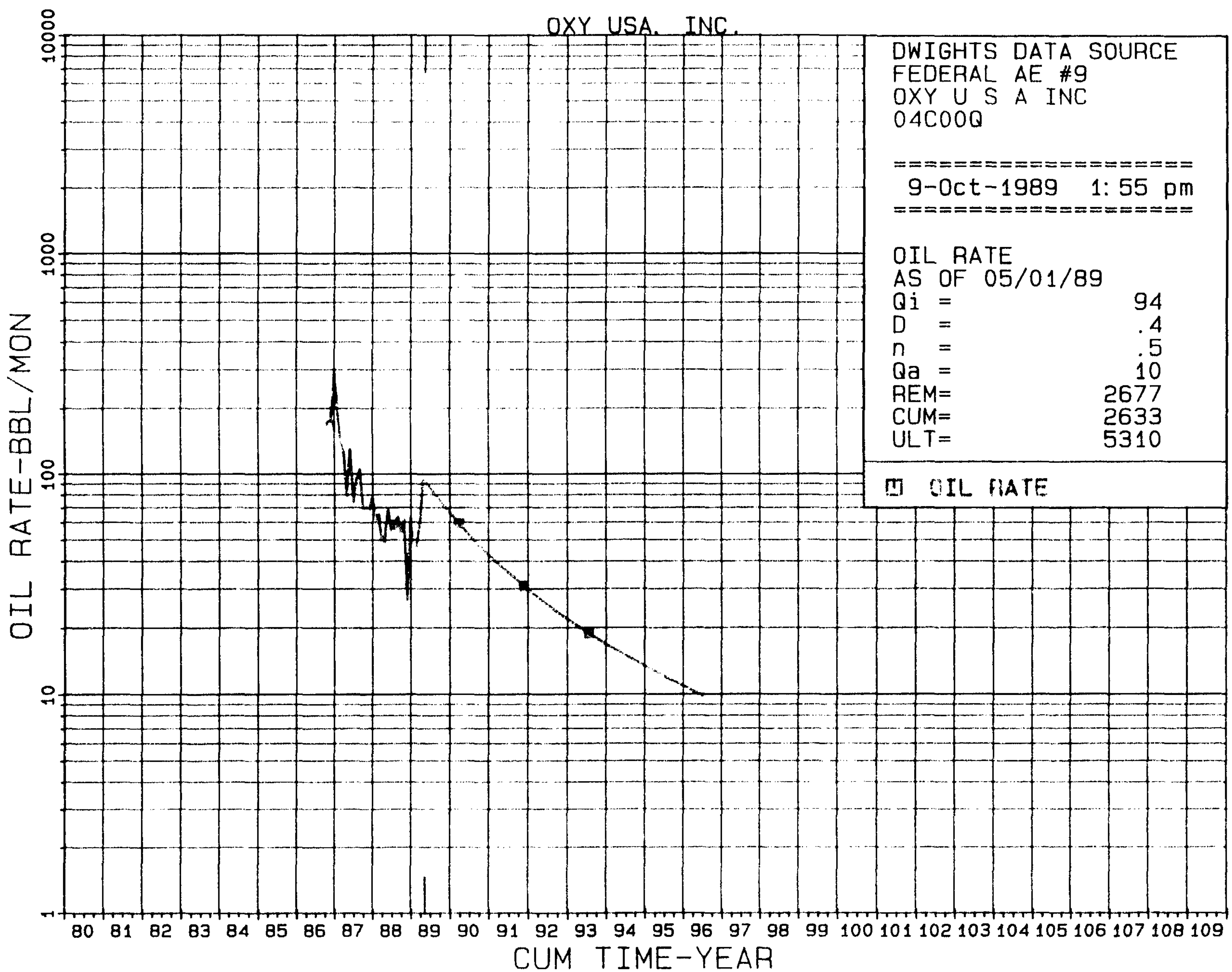


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #6
OXY U S A INC
04J00Q
====================
9-Oct-1989 2:02 pm
====================
OIL RATE
AS OF 05/01/89
Qi = 23
D = .37
n = .5
Qa = 10
REM= 363
CUM= 8339
ULT= 8702
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
CUM TIME-YEAR
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109

96

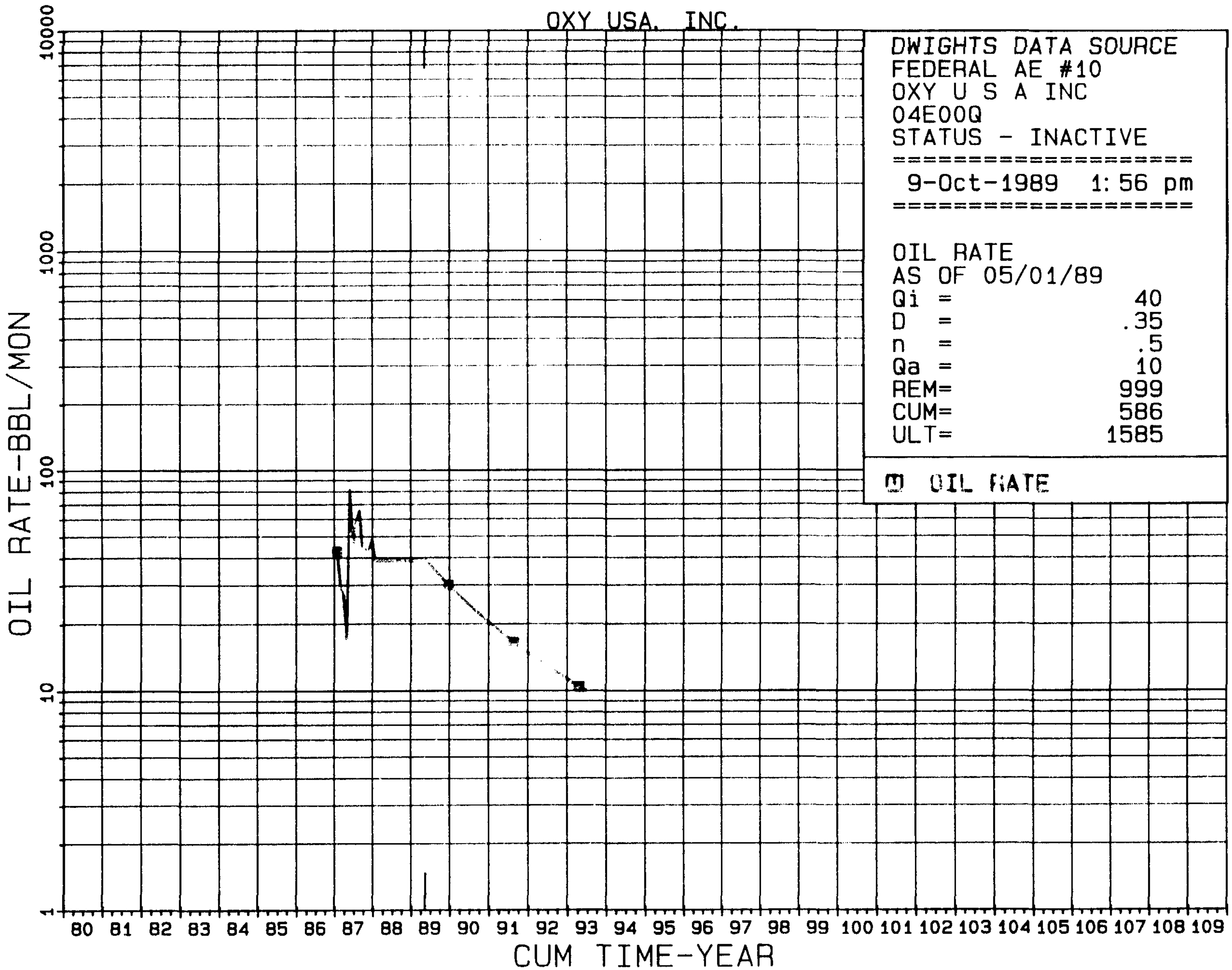

OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #7
OXY U S A INC
04P00Q
9-Oct-1989 2:05 pm
OIL RATE
AS OF 05/01/89
Qi = 293
D = .41
n = .5
Qa = 10
REM= 9501
CUM= 11539
ULT= 21040
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #8
OXY U S A INC
04F00Q
9-Oct-1989 1:57 pm
OIL RATE
AS OF 05/01/89
Qi = 182
D = .33
n = .5
Qa = 10
REM= 7649
CUM= 20221
ULT= 27870
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

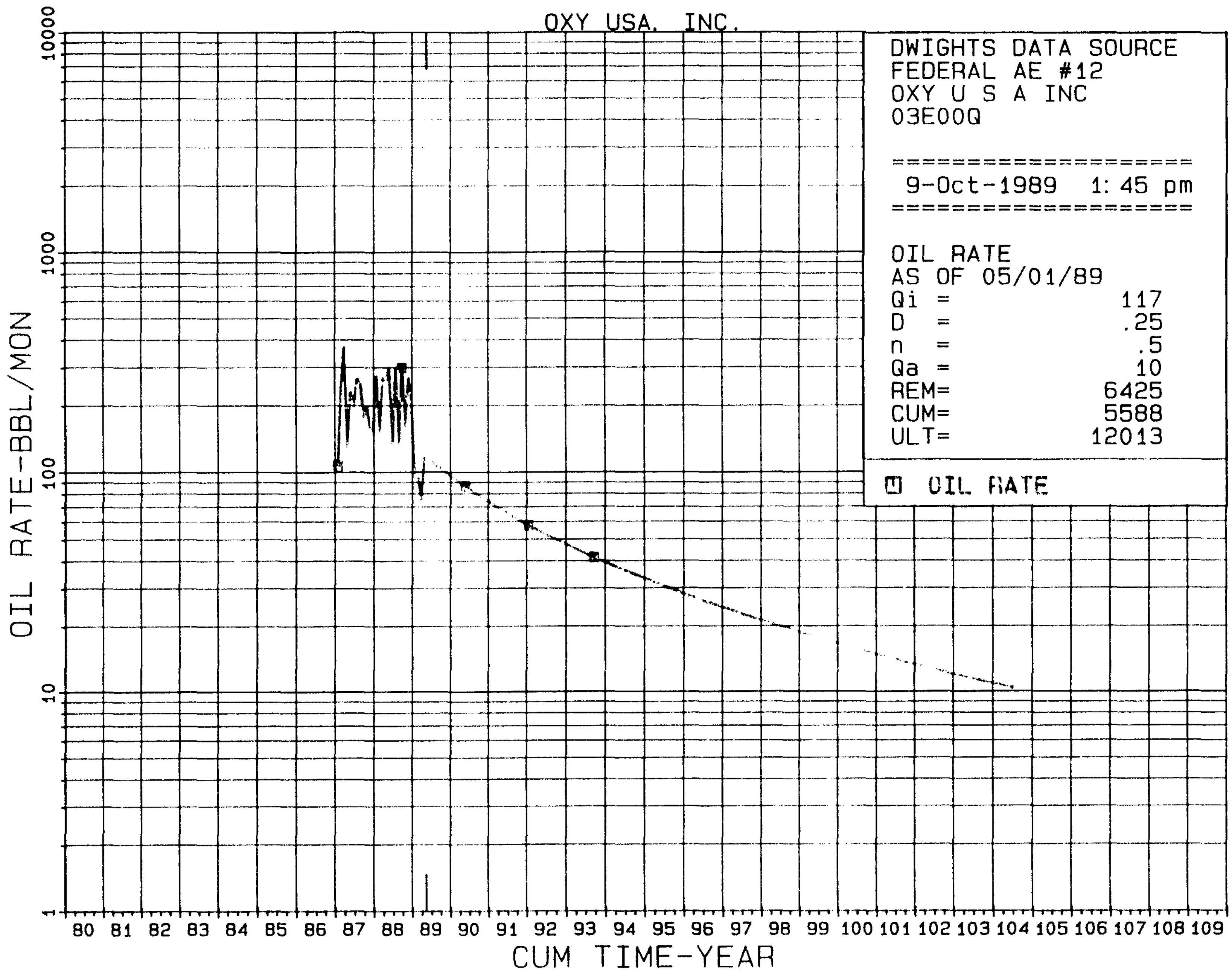


OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #9
OXY U S A INC
04C00Q
9-Oct-1989 1:55 pm
OIL RATE
AS OF 05/01/89
Qi = 94
D = .4
n = .5
Qa = 10
REM= 2677
CUM= 2633
ULT= 5310
OIL RATE
OIL RATE-BBL/MON
1
10
100
1000
10000
CUM TIME-YEAR
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109

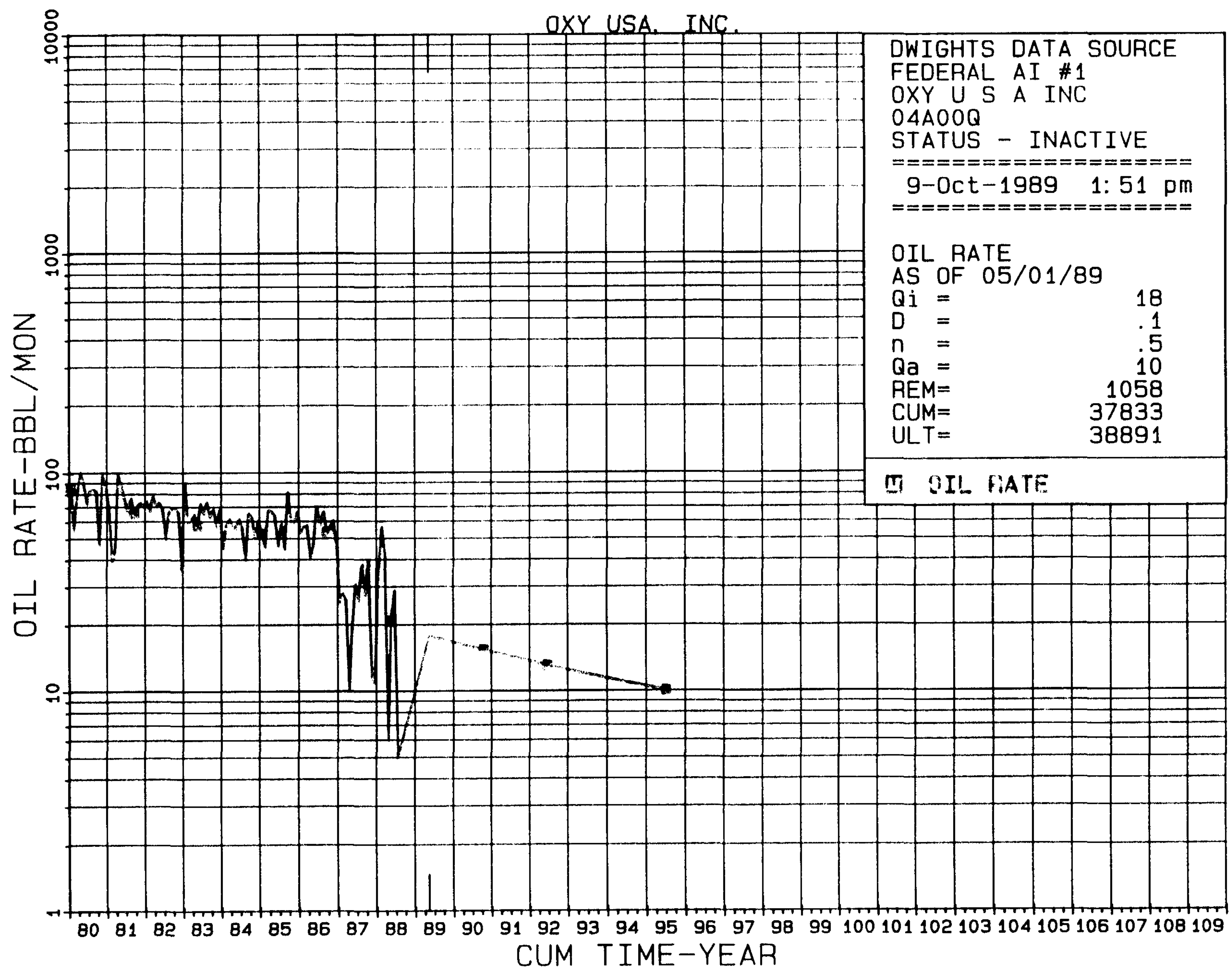
99

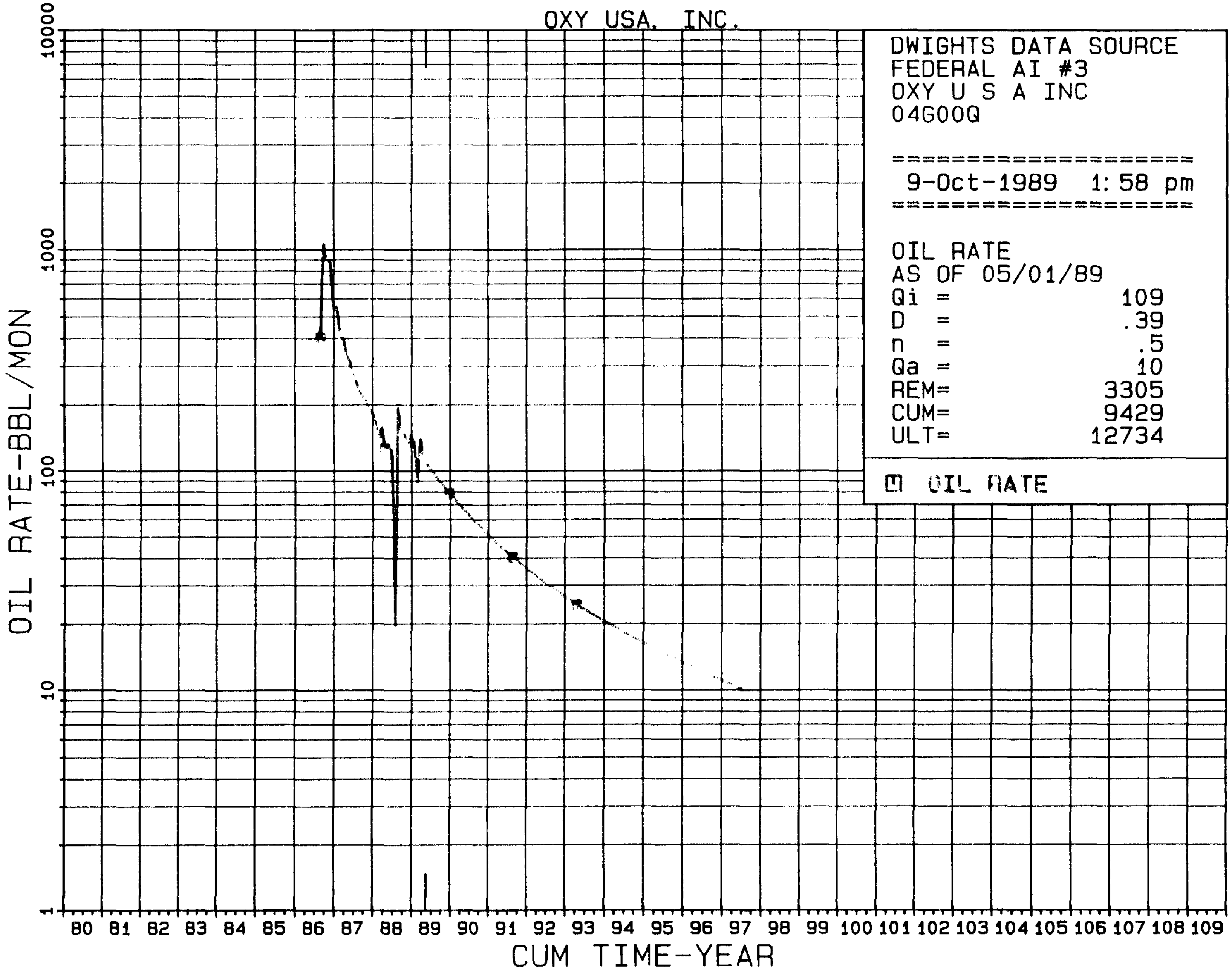

OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #10
OXY U S A INC
04E00Q
STATUS - INACTIVE
9-Oct-1989 1:56 pm
OIL RATE
AS OF 05/01/89
Qi = 40
D = .35
n = .5
Qa = 10
REM= 999
CUM= 586
ULT= 1585
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

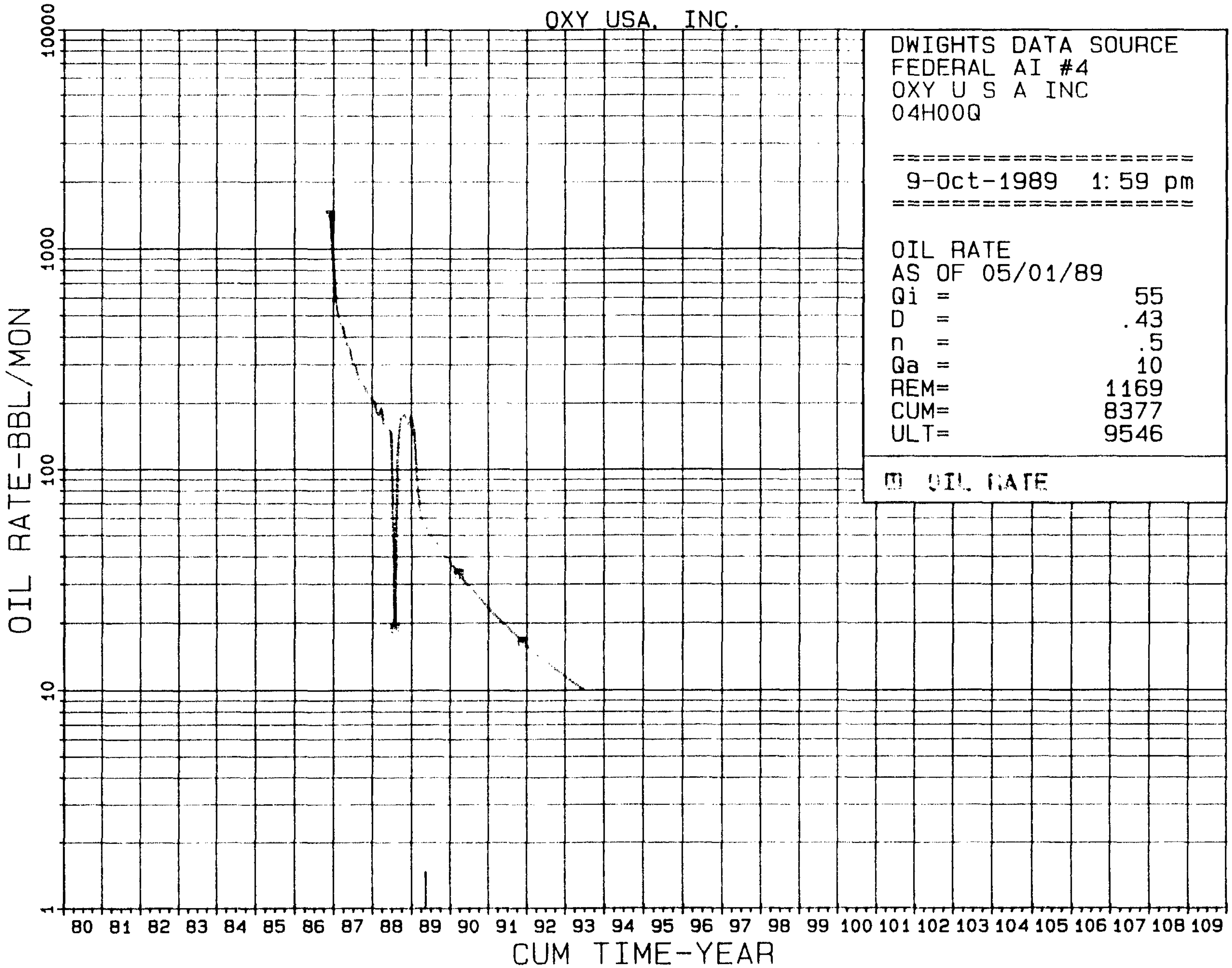
100



OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AE #12
OXY U S A INC
03E00Q
====================
9-Oct-1989 1:45 pm
====================
OIL RATE
AS OF 05/01/89
Qi = 117
D = .25
n = .5
Qa = 10
REM= 6425
CUM= 5588
ULT= 12013
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

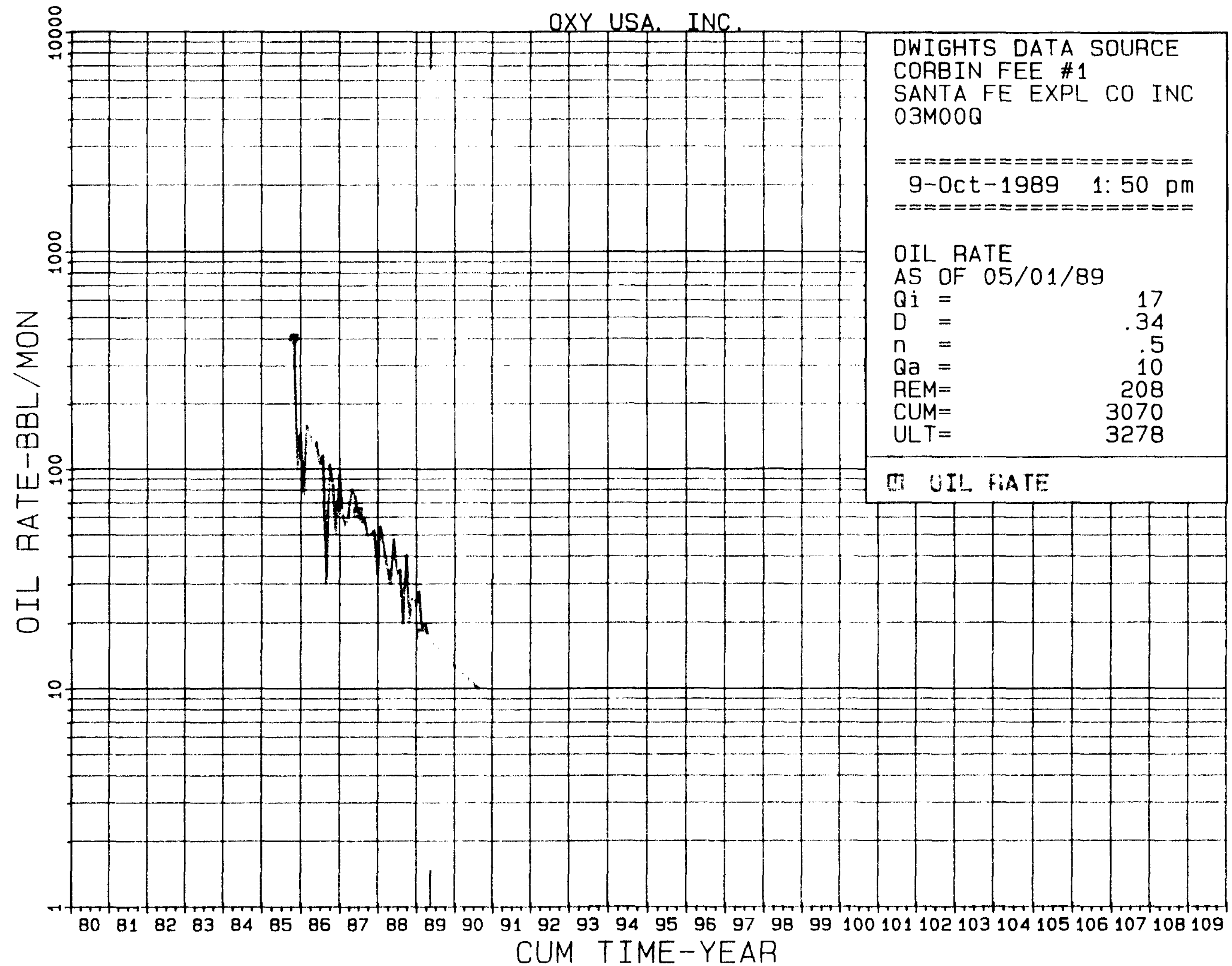

OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AI #1
OXY U S A INC
04A00Q
STATUS - INACTIVE
9-Oct-1989 1:51 pm
OIL RATE
AS OF 05/01/89
Qi = 18
D = .1
n = .5
Qa = 10
REM= 1058
CUM= 37833
ULT= 38891
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

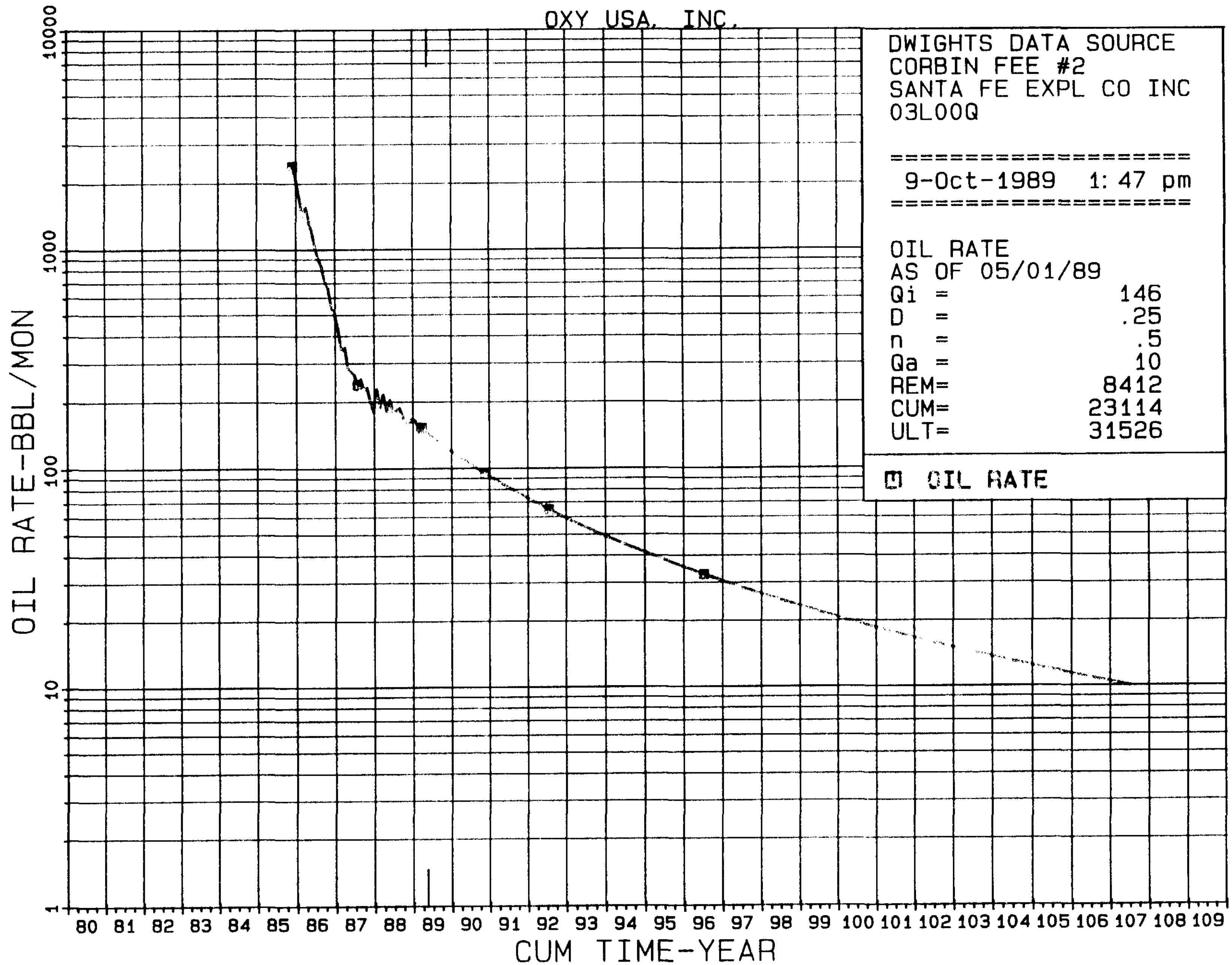

OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AI #3
OXY U S A INC
04G00Q
9-Oct-1989 1:58 pm
OIL RATE
AS OF 05/01/89
Qi = 109
D = .39
n = .5
Qa = 10
REM= 3305
CUM= 9429
ULT= 12734
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR



OXY USA, INC.
DWIGHTS DATA SOURCE
FEDERAL AI #4
OXY U S A INC
04H00Q
====================
9-Oct-1989 1:59 pm
====================
OIL RATE
AS OF 05/01/89
Qi = 55
D = .43
n = .5
Qa = 10
REM= 1169
CUM= 8377
ULT= 9546
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR

104


OXY USA, INC.
DWIGHTS DATA SOURCE
CORBIN FEE #1
SANTA FE EXPL CO INC
03M00Q
9-Oct-1989 1:50 pm
OIL RATE
AS OF 05/01/89
Qi = 17
D = .34
n = .5
Qa = 10
REM= 208
CUM= 3070
ULT= 3278
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR


OXY USA, INC.
DWIGHTS DATA SOURCE
CORBIN FEE #2
SANTA FE EXPL CO INC
03L00Q
====================
9-Oct-1989 1:47 pm
====================
OIL RATE
AS OF 05/01/89
Qi = 146
D = .25
n = .5
Qa = 10
REM= 8412
CUM= 23114
ULT= 31526
OIL RATE
OIL RATE-BBL/MON
10000
1000
100
10
1
80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109
CUM TIME-YEAR