

POST WATERFLOOD CO₂ MISCIBLE FLOOD IN LIGHT OIL
FLUVIAL DOMINATED DELTAIC RESERVOIRS"

"DE-FC22-93BC14960"
TECHNICAL PROGRESS REPORT

2nd QUARTER, 1995.

EXECUTIVE SUMMARY.

Production from the Marg Area 1 at Port Neches is averaging 392 BOPD for this quarter. The production drop is due to fluctuation in both GOR and BS&W on various producing wells, coupled with low water injectivity in the reservoir. We were unable to inject any tangible amount of water in the reservoir since late January. Both production and injection problems are currently being evaluated to improve reservoir performance. Well Kuhn #6 was stimulated with 120 MMCF of CO₂, and was placed on production in February 1, 1995. The well was shut in for an additional month after producing dry CO₂ initially. The well was opened again in early April and is currently producing about 40 BOPD. CO₂ injection averaged 11.3 MMCFD including 4100 MMCFD purchased from Cardox, while water injection averaged 1000 BOPD with most of the injection occurring in the month of January.

1st QUARTER (1995) OBJECTIVES.

* Monitor and optimize reservoir production.

Recent decline in reservoir production from 450 to 392 BOPD is mainly due to fluctuation in the GOR and BS&W of several producing wells. We are currently evaluating if the decline is due to possible wellbore mechanical problems. We observed a decline in the reservoir yield associated with the production drop, suggesting the need to resume a second WAG cycle in order to reduce CO₂ production and increase the sweep efficiency. Evaluation is currently underway to improve water injectivity in the reservoir in order to maintain pressure and improve sweep efficiencies. Performance plots (Production & Yield vs. Time) for the reservoir and individual wells are included in this report on pages 8 through 12. Most of the production decline is attributed to wells Kuhn #15R and Kuhn #38.

DISCLAIMER

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- * Evaluate performing a huff-puff cycle on well Polk B#5.

A workover was planned on the subject well for the first quarter of 1995, along with the drilling of well Polk B#39. However, the well workover was performed earlier on an emergency basis to install a tree and a packer due to increasing pressure in the wellbore. This work was necessary to prevent any potential oil spill in case the well started to flow.

Based on the well readiness and the performance of the first huff-puff cycle in well Kuhn #6, which is currently flowing about 35 BOPD, it is recommended to lay an injection line to Polk B#5 and inject a similar volume of CO₂ (120 MMCF). It is anticipated that this work will be performed by mid May. Kuhn #6 performance is also indicative of a water drive reservoir where we have an initial yield of 40 BO/MMCF.

- * Evaluate the need to drill well Polk B#39 in project Area 2, using BHP data and 3-D mapping.

Current reservoir evaluation based on recent 3D interpretation and BHP taken in wells Kuhn #6 and Polk B#5 confirmed the suspected separation between area 1 and area 2. Also it confirmed that area 2 is a water drive reservoir open to an aquifer in the south. The newly developed map reduced the reservoir drainage area which in turn reduced the remaining oil target. Based on the above and on Texaco's prior experience of CO₂ flooding strong water drive reservoirs, the anticipated recovery from this portion of the reservoir does not justify drilling a new injection well. Therefore we recommend cancelling the drilling of well Polk B#39 in the Marg Area 2. Instead we recommend to proceed with the Huff-Puff of well Polk B#5, in order to maximize recovery of hydrocarbon from this area of the reservoir.

- * Resume working on the reservoir compositional model. Set a target date to complete the model by June 30, 1995.

The stratamodel was completed early this quarter and it is available to input in the compositional model. however the compositional modeling of the reservoir will be delayed for sometime due to personnel availability. This delay will not hinder our ability to operate the project.

* Evaluate a workover on either Kuhn # 16 or Kuhn #42, to improve reservoir sweep efficiency, and to increase the production rate.

Texaco is planning to perform a workover to plugdown well Kuhn #42 to the Marg Area 1. This well will allow us to sweep a new area and recover additional oil from the reservoir that will not be recovered otherwise. This well performance should be comparable to well Kuhn #15R. A performance plot for Kuhn #15R is shown on page 8. The workover is scheduled for early July 1995. The well is anticipated to produce at a rate of 150 BOPD initially.

DISCUSSION OF RESULTS - FIELD OPERATIONS.

Repeated measurement of BHP in wells Kuhn #6 and Polk B#5 confirmed the presence of a fault separating the two wells. Also the increased BHP due to CO₂ injection in well Kuhn #6 (3300 psi), above the normal reservoir pressure (2700 psi) suggests the possible presence of a permeability barrier between Kuhn #6 and the main part of the reservoir. The same idea was also suggested by the Stratamodel. Reservoir performance has been declining recently due to decreased water injectivity, as well as possible mechanical problems in the producing wells. Texaco is planning to check the integrity of sand control systems in the producing wells in order to restore higher production rates. Expense workovers may be required to change the gravel pack settings in the affected wells. Similar evaluation will be conducted on the injection wells to restore high water injection rates.

The following is a list of the most recent well tests taken on March 31, 1995 for all the producing and injection wells:

Kuhn #15R	120	BOPD,	480	BWPD,	2550	MMCFD,	17	CHOKE.
Kuhn #38	132	BOPD,	1335	BWPD,	2460	MMCFD,	22	CHOKE.
KUHN #33	63	BOPD,	170	BWPD,	2650	MMCFD,	18	CHOKE.
STARK #8	54	BOPD,	332	BWPD,	2646	MMCFD,	28	CHOKE.
KUHN #6	0	BOPD,	0	BWPD,	0	MMCFD,	OL	CHOKE.
KUHN #14	--	BOPD,	--	BWPD,	--	MMCFD,	--	CHOKE.
POLK #B5	--	BOPD,	--	BWPD,	--	MMCFD,	--	CHOKE.

MARG AREA #1H	4312 MMCFD,	1220 PSI.
STARK #7	1058 MMCFD,	1390 PSI.
STARK #10	2743 MMCFD,	1400 PSI.
Kuhn #17	2763 MMCFD,	1390 PSI.

The average injection and production volumes for this quarter are as follow:

Oil Production:	392	BOPD.
Water Production:	2208	BWPD.
Gas Production:	7760	MMCFD.
Water Injection:	1007	BWPD.
Gas Injection:	11300	MMCFD.
Reservoir Voidage:	509	BPD.

DISCUSSION OF RESULTS - TECHNOLOGY TRANSFER.

Enclosed as appendix "A" is a report summarizing LSU's completed work covering the following topics:

- * History of CO₂ use in EOR efforts in Louisiana.
- * Jackson Dome (Shell) Pipeline.
- * CO₂ Sources/Providers in Louisiana.
- * Preliminary Ranking of Reservoirs Suitable for Post Waterflood CO₂ Miscible Flooding.
- * Tertiary CO₂ Enhanced Oil Recovery Map.

LSU is planning on transferring this information to the industry via SPE papers and/or industry forums.

3rd Quarter (1995) Objectives.

- * Continue monitoring and optimizing reservoir performance.
- * Evaluate the need to run production surveys in the producing and injection wells, and determine the any workover requirements.
- * Workover well Kuhn #42 to the Marg Area 1 reservoir to increase production.
- * Discuss with the DOE the addition of the Marg Area 3 to the project. This segment is a natural extension to the reservoir covering the Marg area 1&2. The success of this process will have a significant economic impact on the project and the program in general.

PORT NECHES FIELD

RESVR YIELD & PROD. VS. TIME

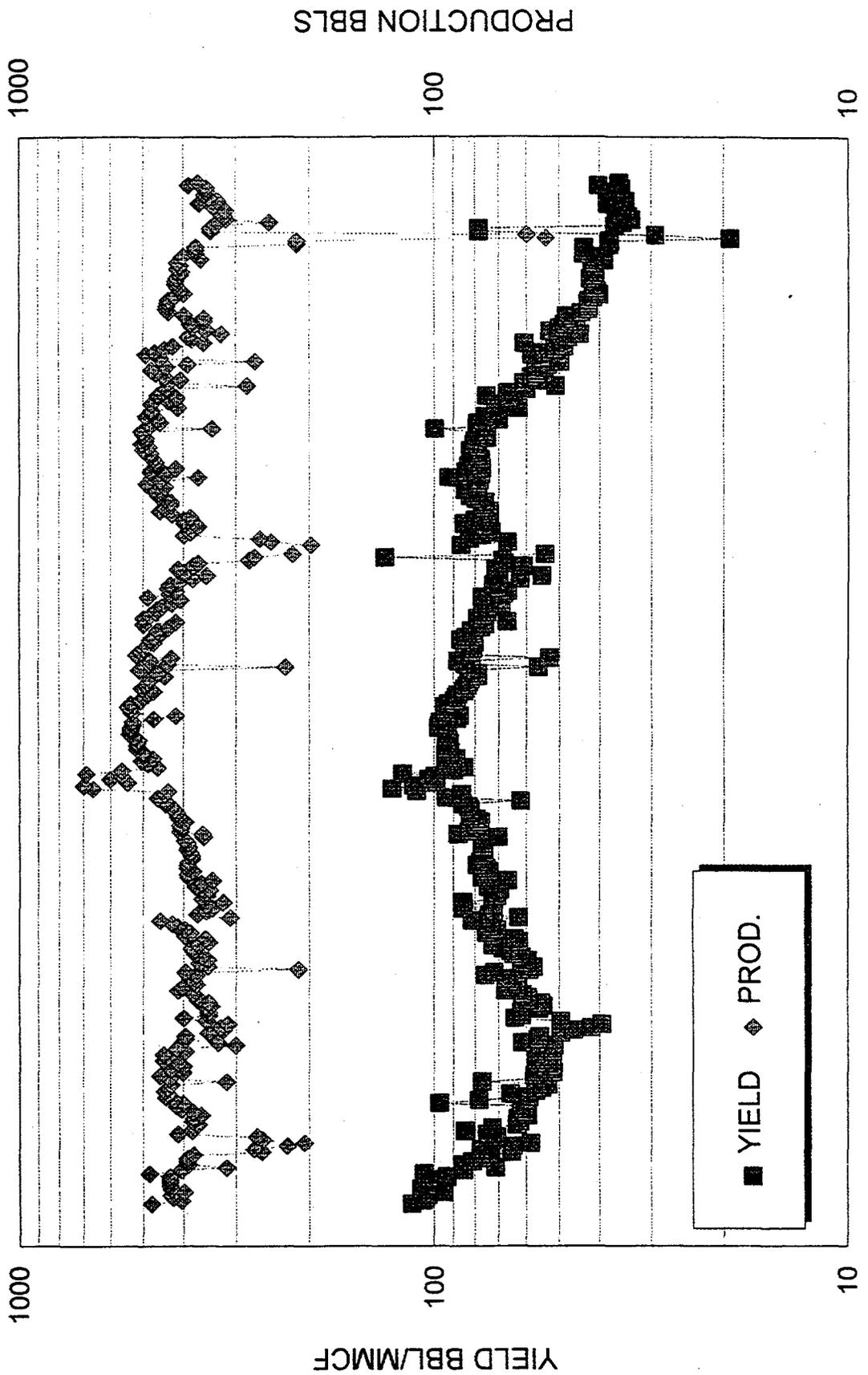


Fig 3
7

Port Neches CO2 Project Allocated Production

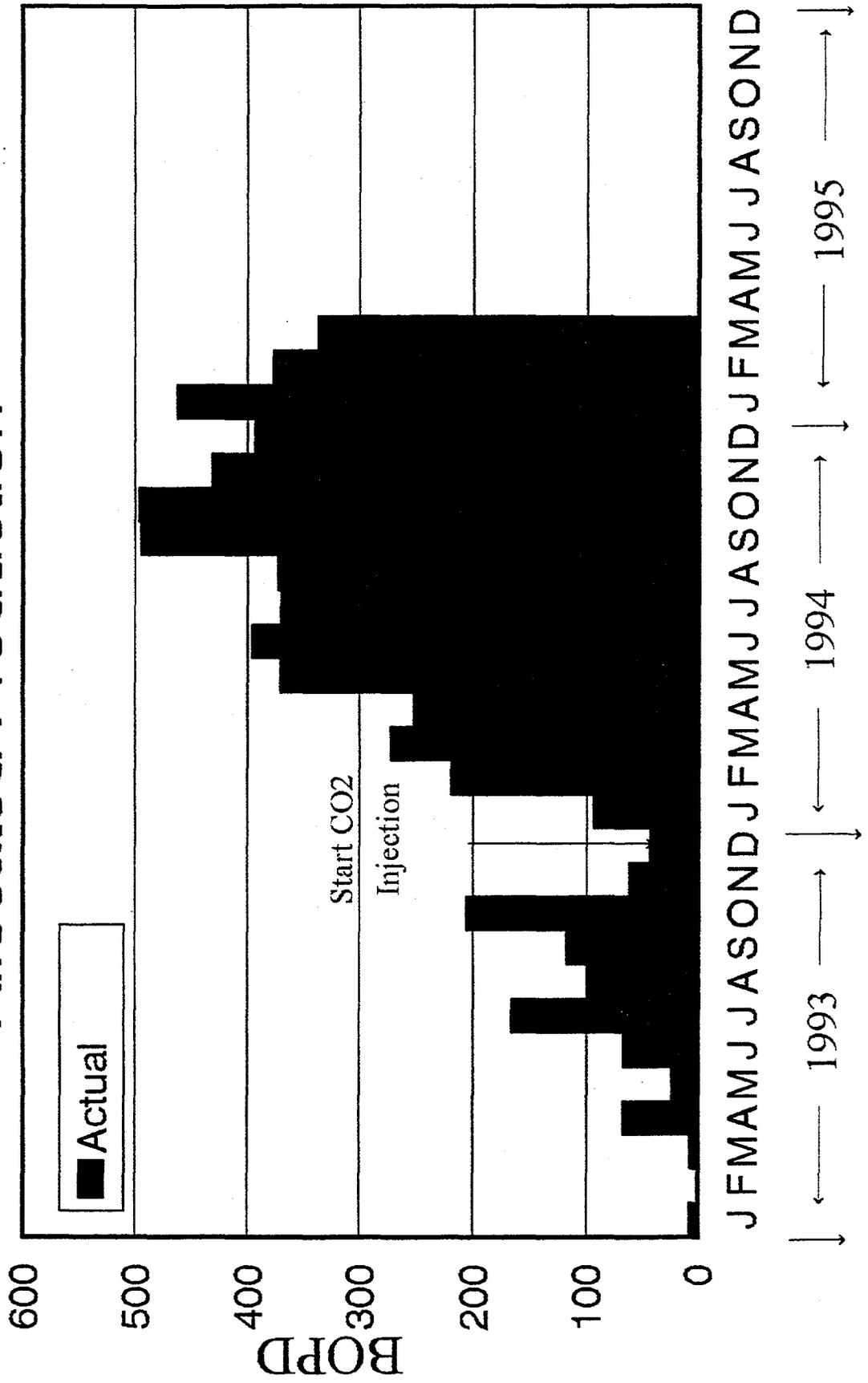


Fig 1
5

PORT NECHES FIELD

WELL #8 YIELD & PROD. VS. TIME

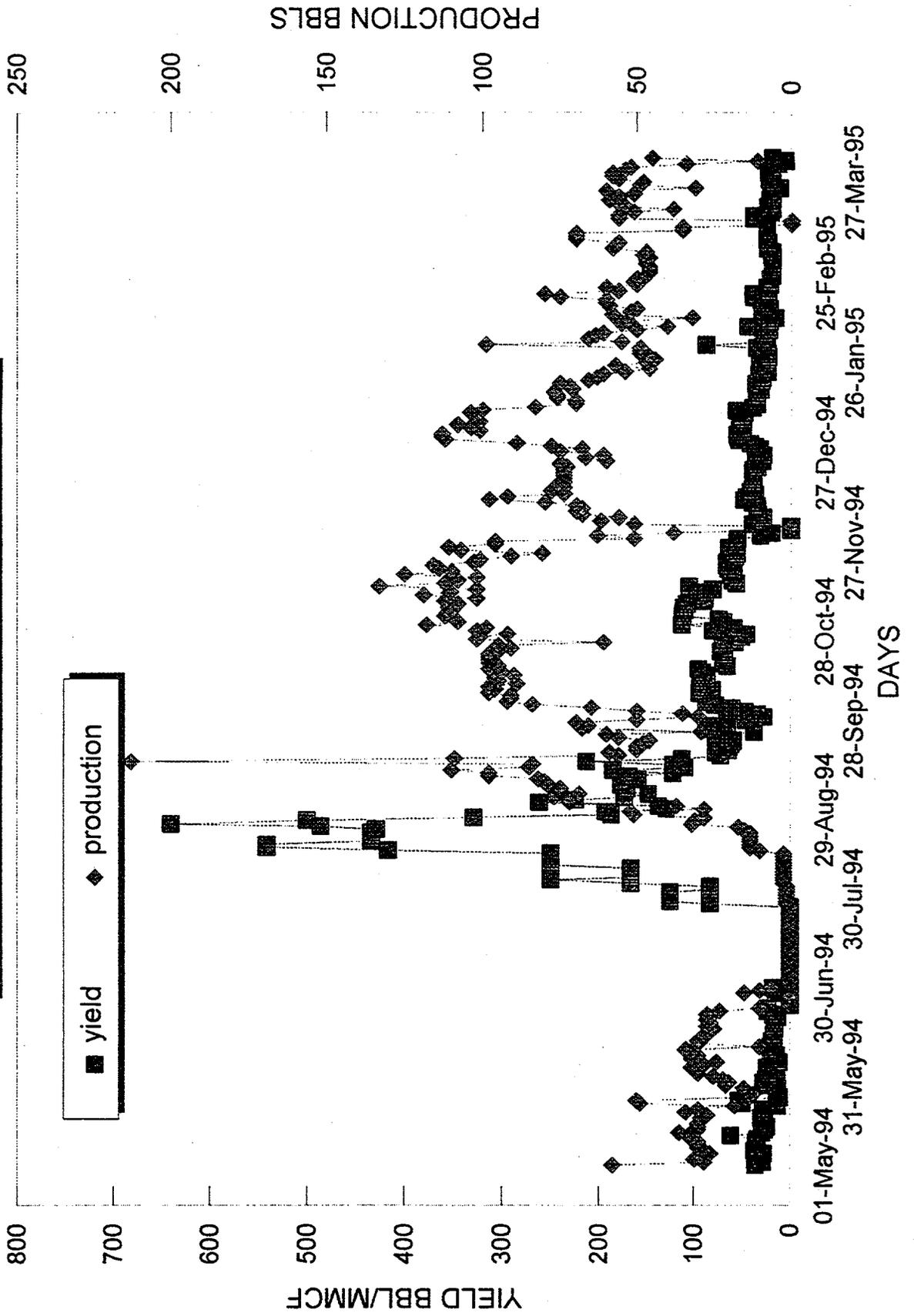


Fig 4
8

**PORT NECHES - CO2 DELIVERY
ACTUAL VS. CONTRACT**

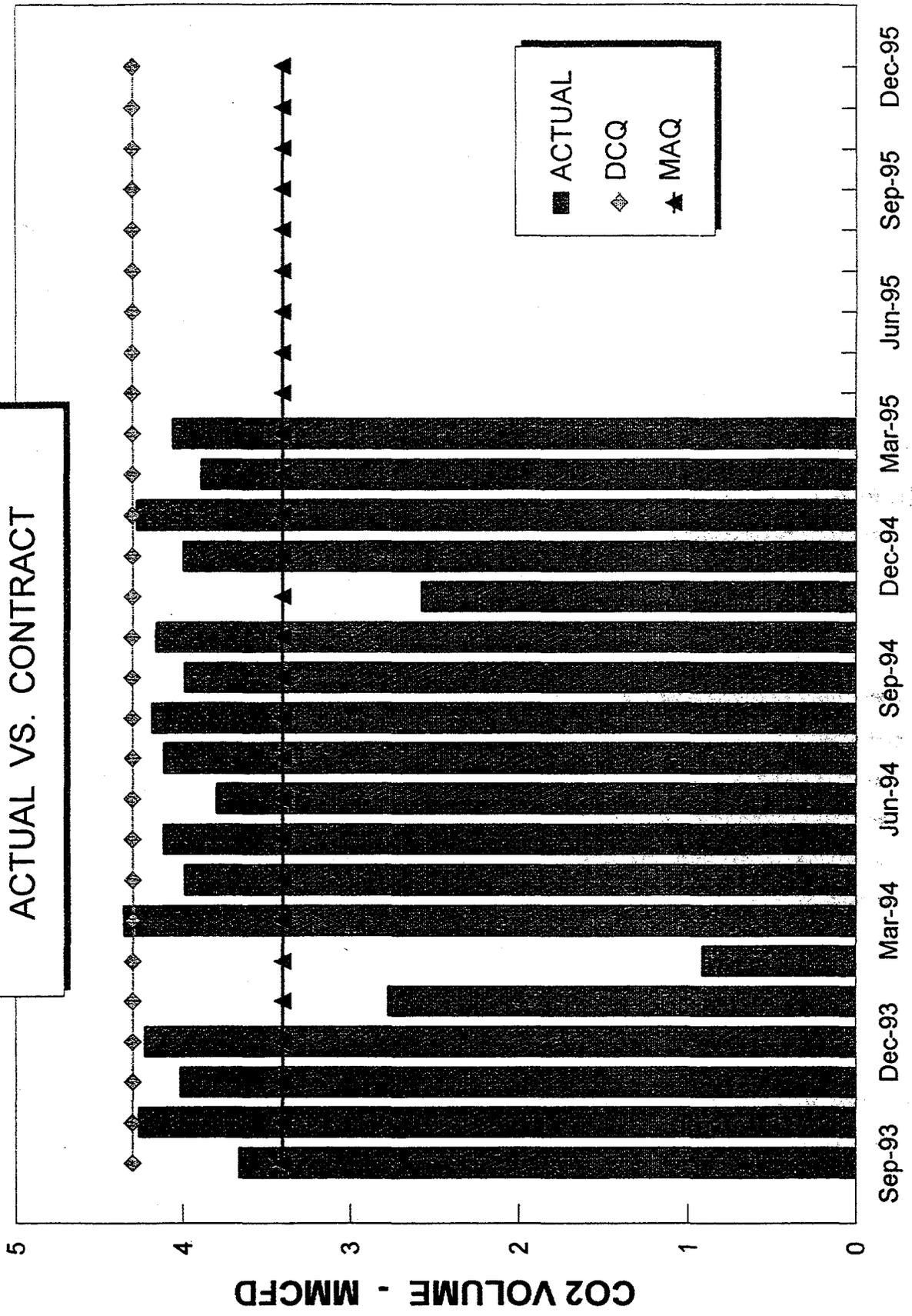


Fig 2
6

PORT NECHES FIELD

WELL #14 YIELD & PROD. VS. TIME

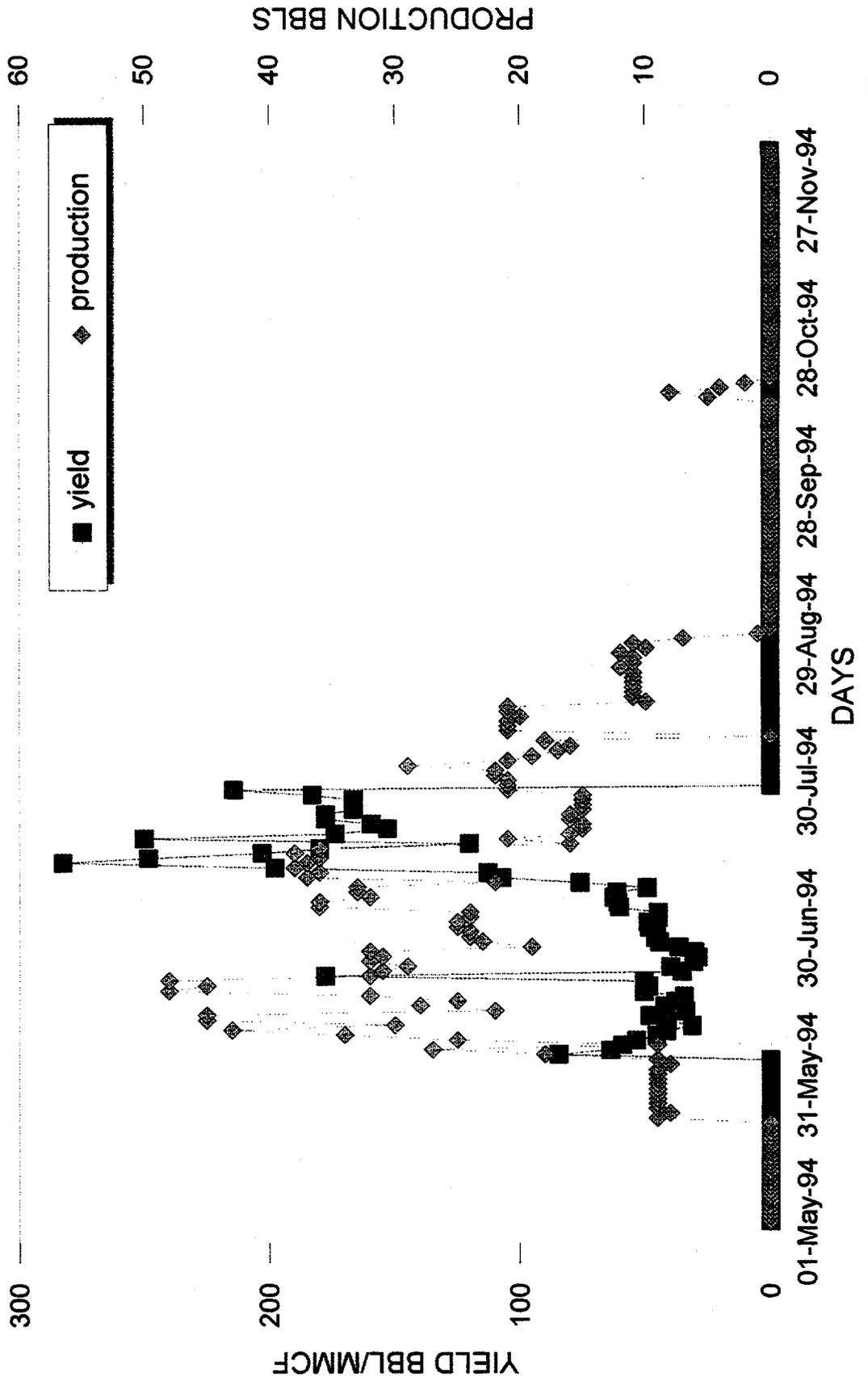


Fig 5
9

PORT NECHES FIELD
WELL #15R YIELD, PROD. VS. TIME

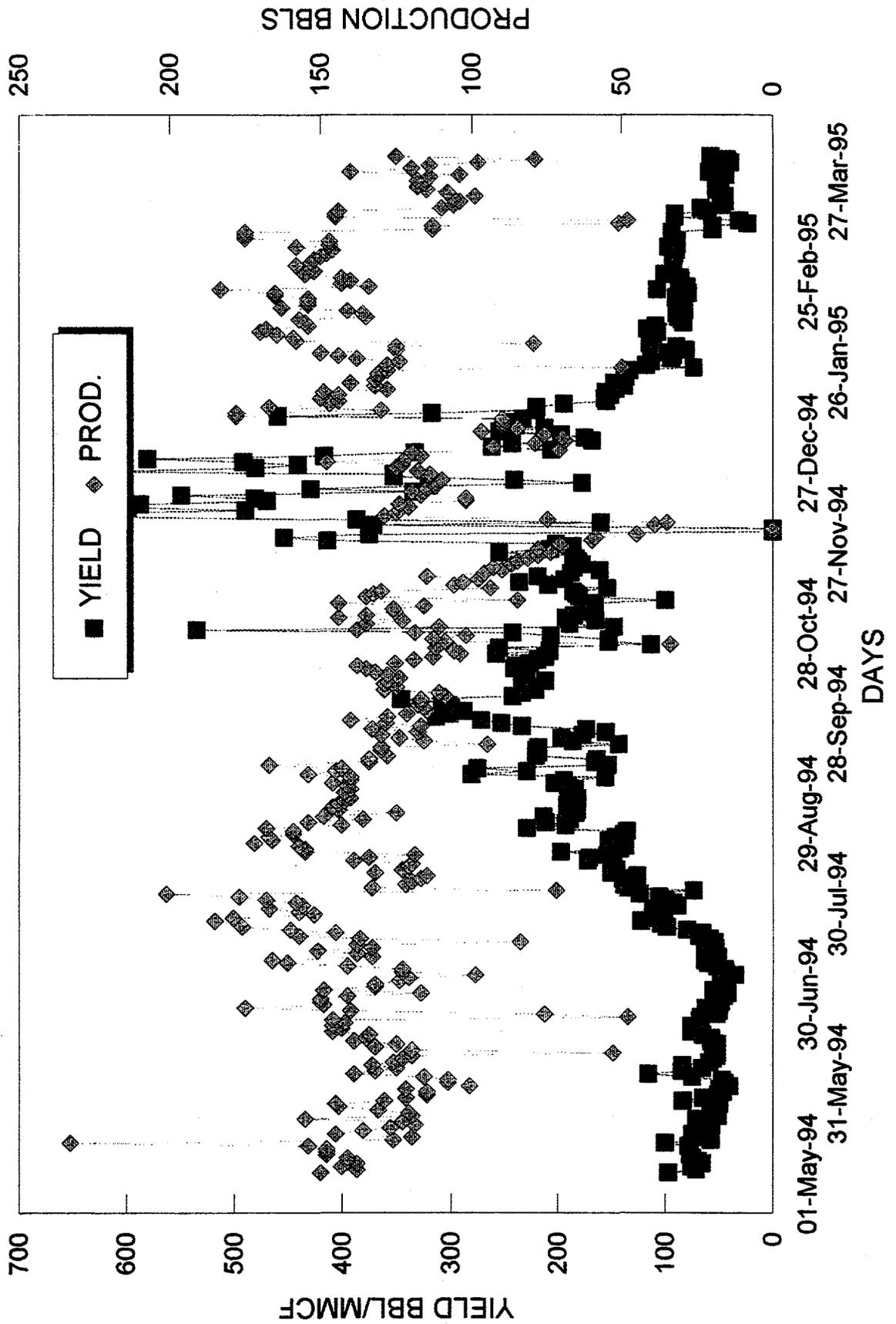


Fig 6
 10

PORT NECHES FIELD

WELL #33 YIELD & PROD. VS.TIME

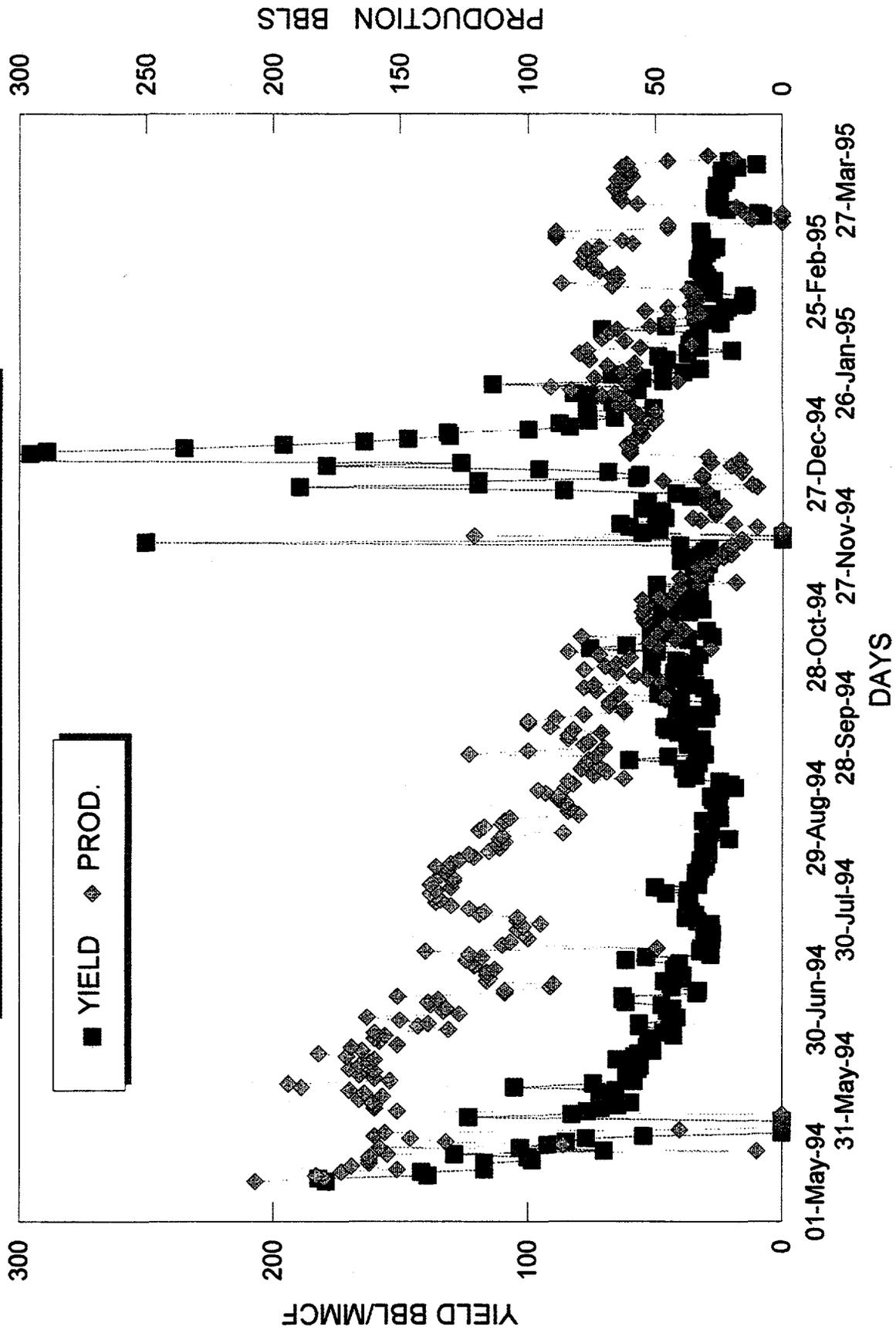


Fig 7
11

PORT NECHES FIELD

WELL #38 YIELD & PROD. VS. TIME

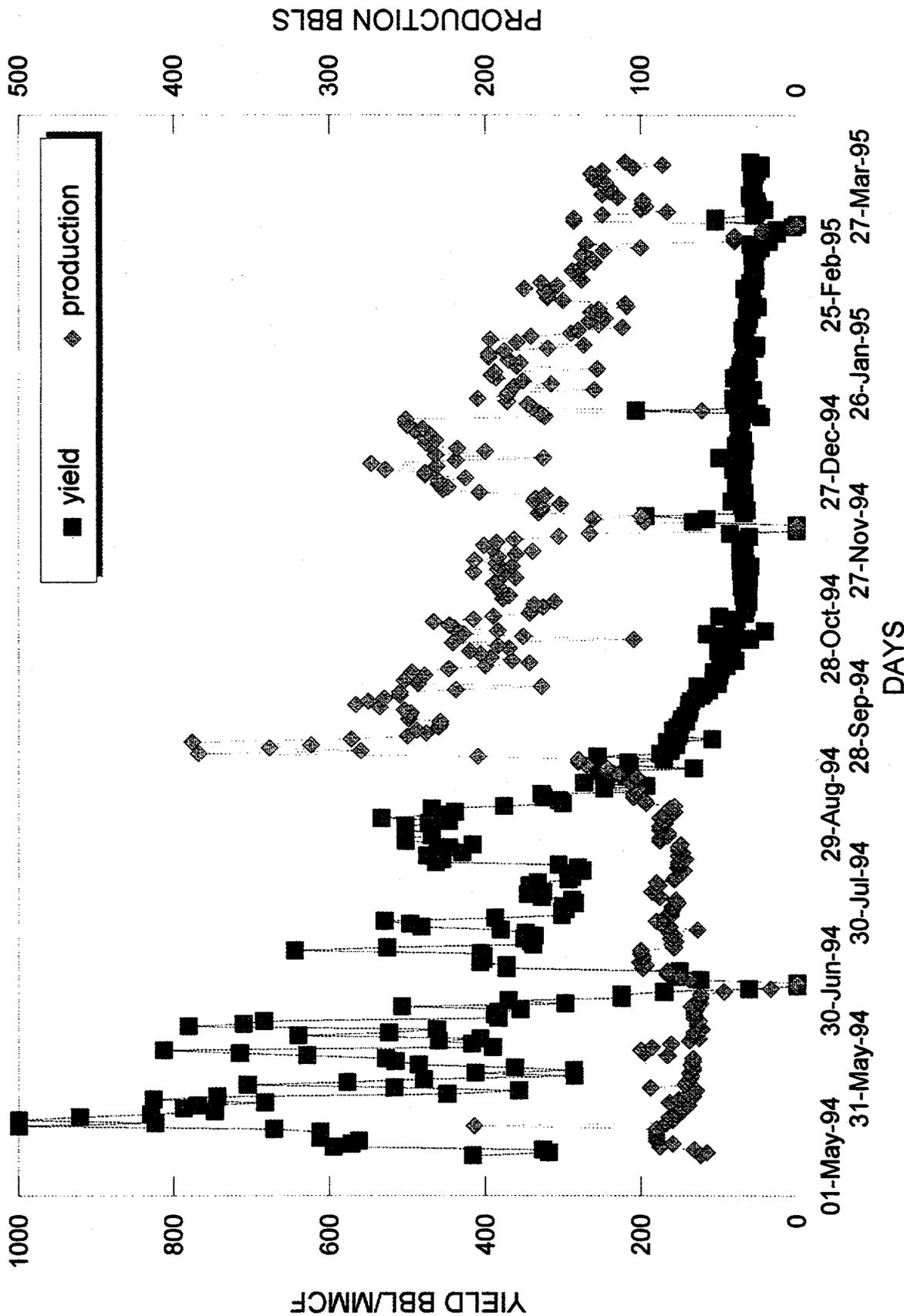


Fig 8

PORT NECHES RESERVOIR PRESSURE

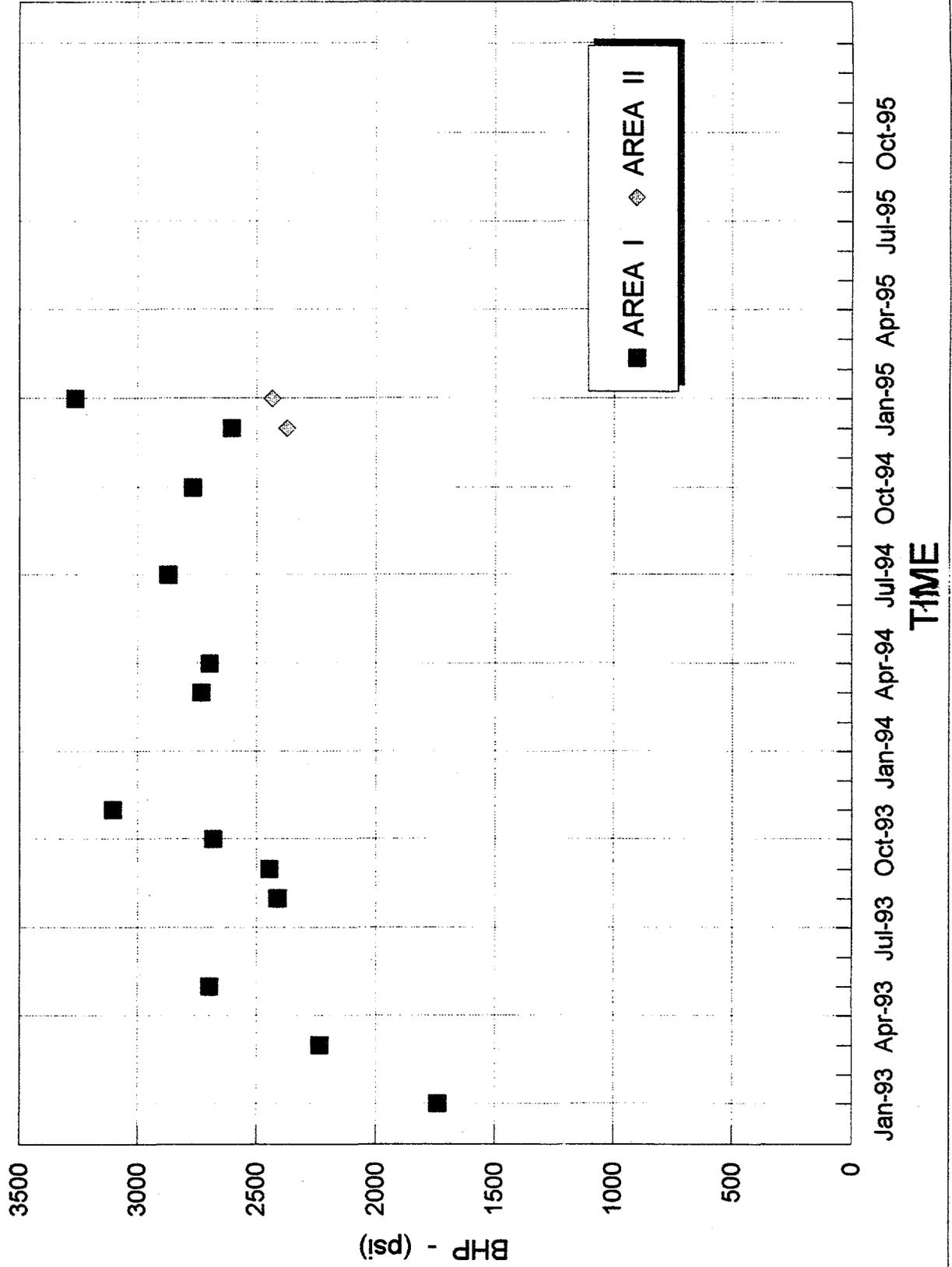


Fig 9
13

RESERVOIR VOIDAGE

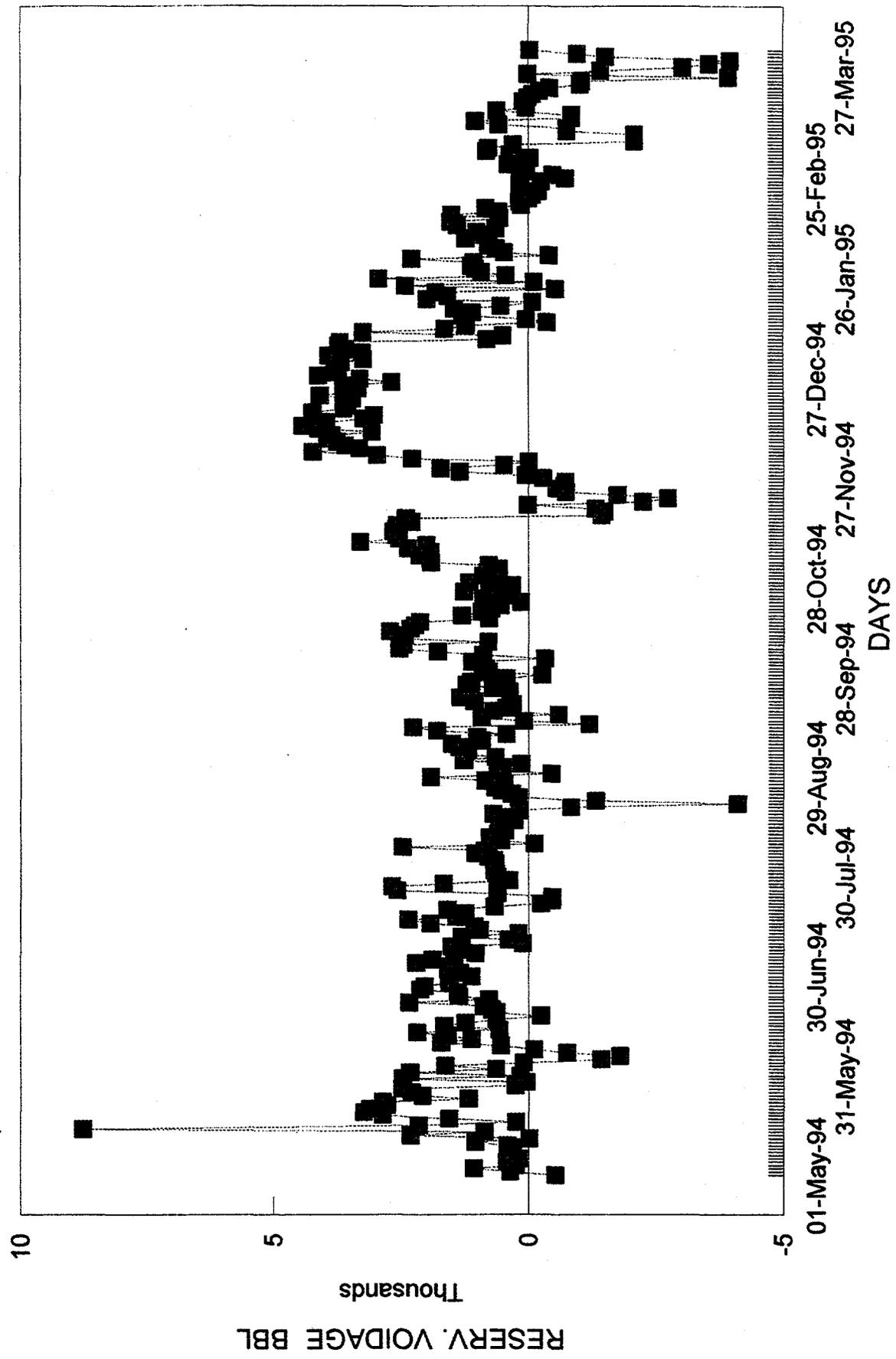


Fig 10
14

PORT NECHES WATER & CO2 INJECTION

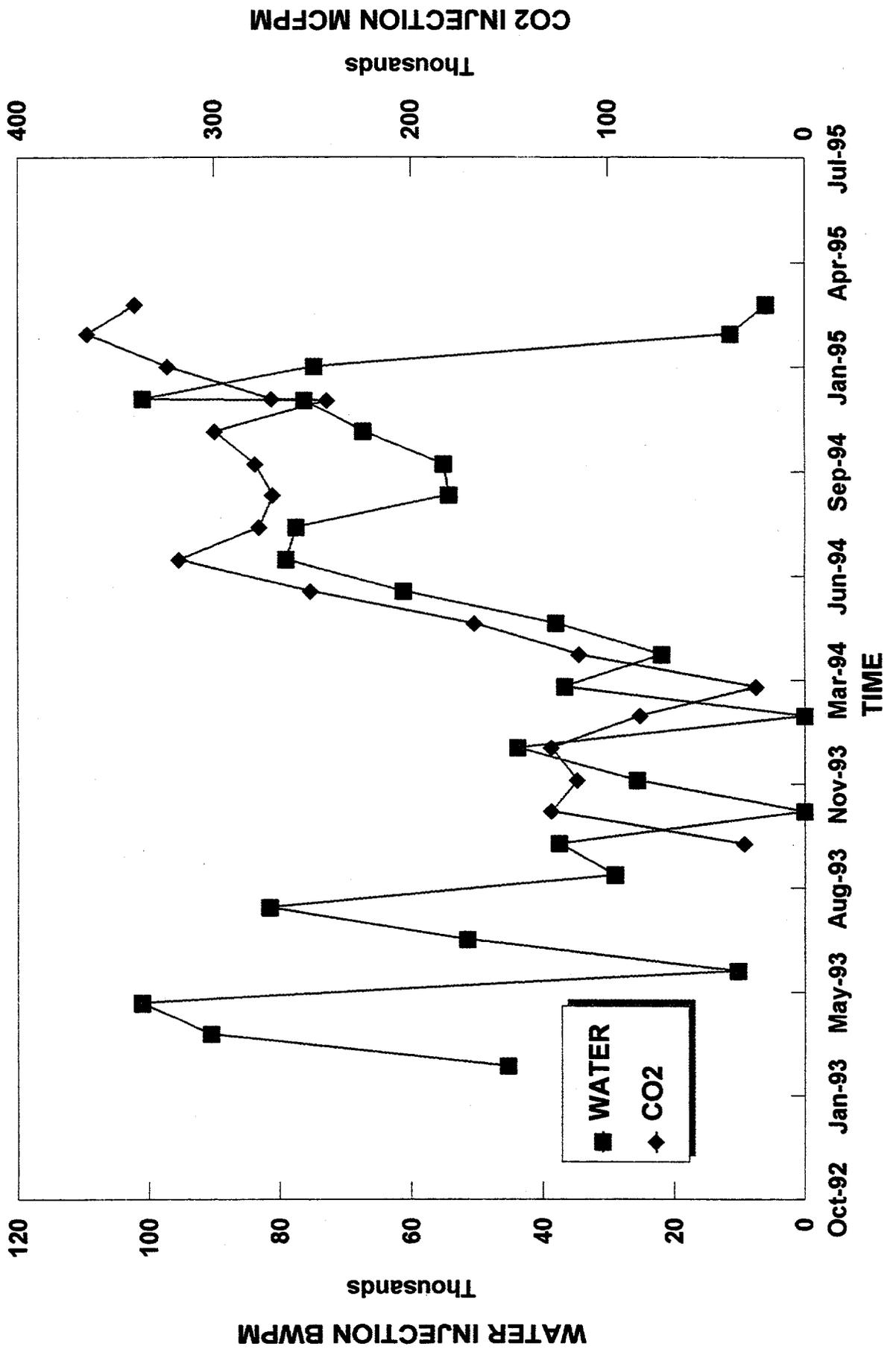
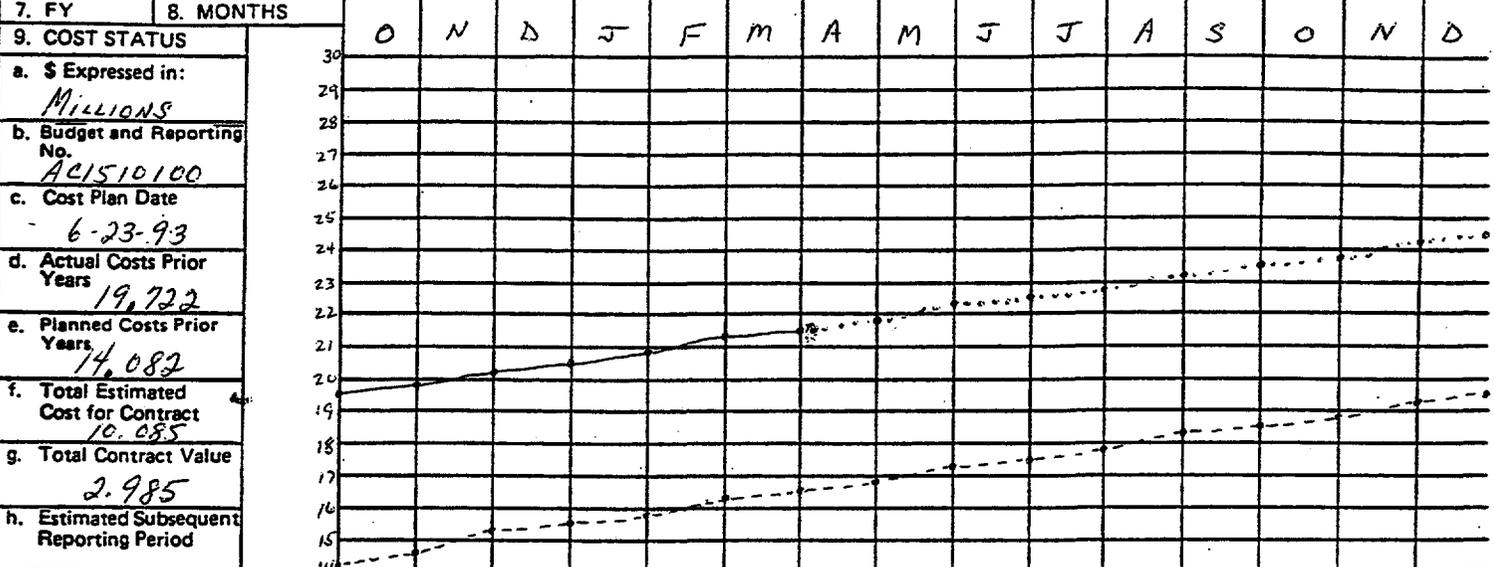


Fig 11
15

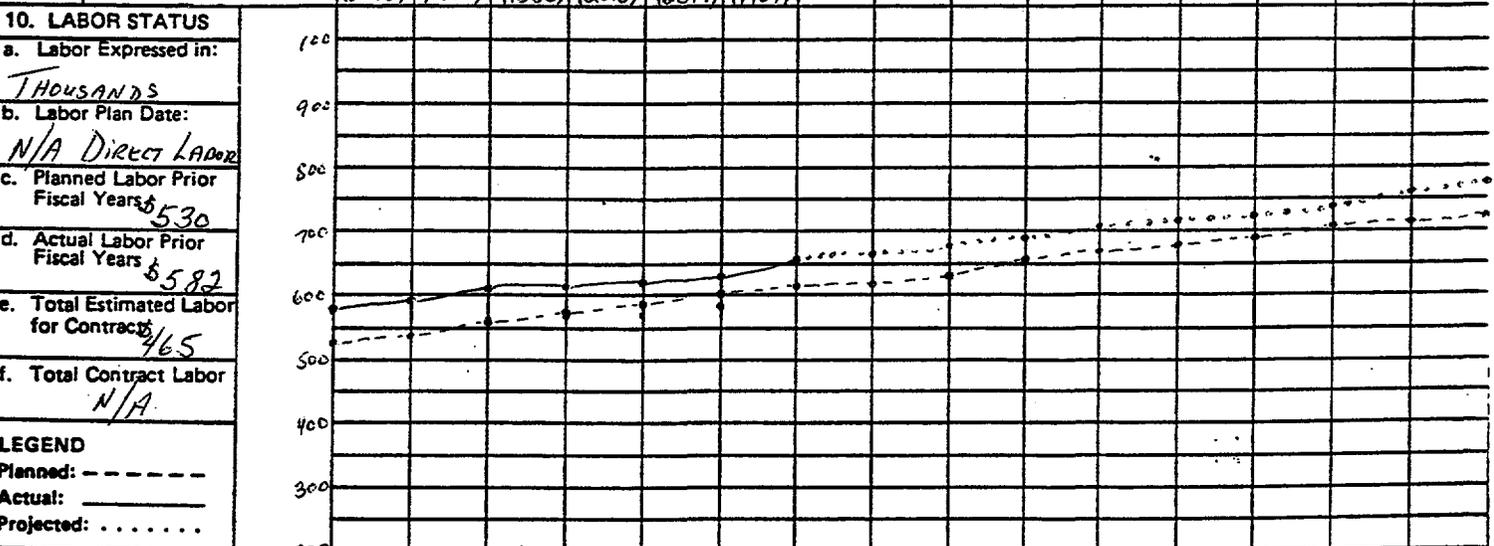
U.S. DEPARTMENT OF ENERGY
SUMMARY REPORT

1. IDENTIFICATION NUMBER DE-FC22-93BC14960	2. PROGRAM/PROJECT TITLE CLASS I	3. REPORTING PERIOD 1/1/95 to 3/31/95
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4. PARTICIPANT NAME AND ADDRESS TEXACO EXPLORATION AND PRODUCTION 400 Poydras St. NEW ORLEANS, LA 70130	5. START DATE: 6/1/93
	6. COMPLETION DATE 12/31/97



Accrued Costs	g. Planned	630	630	214	330	330	330	330	330	330	330	330	330	330	330	330
	h. Actual	214	239	319	490	331	222									
	i. Variance	416	391	<105>	<160>	<1>	108									
	j. Cumulative Variance	<2142>	<1751>	<1856>	<2016>	<2017>	<1909>									



Labor	g. Planned	15	15	15	13	13	13	13	13	13	13	13	13	13	13	13
	h. Actual	13	11	9	5	15	18									
	i. Variance	2	4	6	8	<0>	<5>									
	j. Cumulative Variance	<43>	<39>	<33>	<25>	<27>	<32>									

11. MILESTONES	STATUS	COMMENTS
a.		
b.		
c.		
d.		
e.		
f.		
g.		

U.S. DEPARTMENT OF ENERGY
MILESTONE SCHEDULE [] PLAN [X] STATUS REPORT

DOE F1332.3
(11-84)

FORM APPROVED
OMB NO. 1901-1400

7. ELEMENT CODE	8. REPORTING ELEMENT	9. DURATION												CURRENT FISCAL YEAR 1983				FY 1984				FY 1985				FY 1996	FY 1997	10. PERCENT COMPLETE		
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	a. Plan	b. Actual							
		1. TITLE												2. REPORTING PERIOD				3. IDENTIFICATION NUMBER				5. START DATE		6. COMPLETION DATE						
1.1	Geologic & Engineering																												100%	100%
1.2	Extraction Technology																												100%	100%
2.1	Recording Daily Production																												40%	40%
2.2	Reservoir Characterization																												90%	90%
2.3	Site Operation & Field Work																												90%	90%
2.4	CO2																												35%	35%
2.5	EH&S Monitoring & Compliance																												40%	40%
3.1	CO2 Screening Model																												100%	100%
3.2	Environmental Analysis																												100%	100%
3.3	FDD Database & Model																												75%	75%
3.4	Technical Publications																												40%	40%
11. SIGNATURE OF PARTICIPANT'S PROJECT MANAGER AND DATE																														

U.S. DEPARTMENT OF ENERGY
MILESTONE SCHEDULE [] PLAN [X] SCHEDULE
(ATTACHMENT)

DOE F1332.3 ATTACHMENT
(11-84)

1. TITLE Post Waterflood CO2 Miscible Flood in a Light Oil Fluvial Dominated Deltaic Reservoir		2. REPORTING PERIOD Jan. 1, 1995 - Mar. 31, 1995	3. IDENTIFICATION NUMBER DE-FC22-93BC14960
4. PARTICIPANT NAME AND ADDRESS Texaco Exploration and Production Inc. 400 Poydras St. New Orleans, LA 70130		5. START DATE June 1, 1993	6. COMPLETION DATE December 31, 1997

MAJOR EVENTS	DATE	DESCRIPTION	STATUS
1	10/15/92	TASK 1.1 - GEOLOGICAL RESERVOIR DESCRIPTION AND LAB TESTS	COMPLETED
2	10/15/92	TASK 1.2 - PHASE 1 RESERVOIR SIMULATION	COMPLETED
3	08/01/93	TASK 2.1 - RECEIVE DOE APPROVAL TO INJECT CO2	COMPLETED
4	08/01/93	TASK 2.2 - RESERVOIR PRESSURE IS RAISED TO 2700 PSI BY WATER INJECTION	COMPLETED
5	08/15/93	TASK 2.3 - CO2 INJECTION AND PRODUCTION FACILITY IS COMPLETED	COMPLETED
6	08/15/93	TASK 2.4 - CO2 PIPELINE IS INSTALLED	COMPLETED
7	08/15/93	TASK 2.5 - NEPA CATEGORICAL EXCLUSION IS RECEIVED	COMPLETED
8	12/31/95	TASK 3.1 - SPE PAPER AND RELEASE OF CO2 SCREENING MODEL	COMPLETED
9	12/31/94	TASK 3.2 - TOPICAL REPORT ON ENVIRONMENTAL CONSTRAINTS	COMPLETED
10	12/31/95	TASK 3.3 - TOPICAL REPORT ON FDD DATABASE	PROJECT 75% COMPLETE
11	12/31/97	TASK 3.4 - SPE PAPER ON RESERVOIR CHARACTERIZATION	TO BE PRESENTED 1997

INTERMEDIATE
EVENTS

DATE	DESCRIPTION	STATUS	
A	12/31/97	TASK 2.1 - FINAL PROJECT REPORT	TO BE COMPLETED DURING 1997
B	12/31/93	TASK 2.2 - UPDATED RESERVOIR MODEL COMPLETED	COMPLETED
C	12/01/94	TASK 2.2 - CONVENTIONAL CORE ANALYZED IN POLK "B" #39 WELL	DEFERRED
D	04/30/93	TASK 2.3 - 10 WELL WORKOVER PROGRAM COMPLETED	COMPLETED
E	10/01/93	TASK 2.3 - HORIZONTAL CO2 INJECTION WELL DRILLED, POLK "B" #2 W/O PERFORMED	HORIZ. WELL COMPLETE, POLK "B" W/O CANCELLED
F	12/01/94	TASK 2.3 - VERTICAL CO2 INJECTION WELL DRILLED (POLK "B" #39)	DEFERRED
G	06/10/93	TASK 2.5 - PERMIT FOR CO2 PIPELINE RECEIVED FROM ARMY CORPS OF ENGINEERS	COMPLETED
H	06/30/93	TASK 2.5 - HAZARDOUS SUBSTANCE PLAN SUBMITTED TO DOE	COMPLETED
I	12/31/97	TASK 2.5 - FINAL HAZARDOUS SUBSTANCE PLAN SUBMITTED TO DOE	TO BE COMPLETED DURING 1997
J	12/31/94	TASK 3.1 - CO2 SCREENING MODEL FINAL REPORT SUBMITTED TO DOE	COMPLETED
K	12/31/94	TASK 3.3 - FDD DATABASE STUDY IS COMPLETED BY LSU	LSU WORK WILL BE COMPLETED IN SPRING, 1996
L	04/18/94	TASK 3.5-1ST SPE PAPER PRESENTED-PROJECT IMPLEMENTATION	TO BE SUBMITTED @SPE/DOE SYMPOSIUM 1996

11. SIGNATURE OF PARTICIPANT'S PROJECT MANAGER AND DATE

FINANCIAL STATUS REPORT
(Short Form)

1. Federal Agency and Organizational Element to Which Report is submitted U. S. Department of Energy		2. Federal Grant or Other Identifying Number Assigned By Federal Agency DE-FC22-93BC14960		OMB Approval No. 0348-0039	Page 1	of 1 pages		
3. Recipient Organization (Name and complete address, including ZIP code) Texaco Exploration and Production Inc. 400 Poydras St. New Orleans, LA 70130								
4. Employer Identification Number 51-0265713		5. Recipient Account Number or Identifying Number 323037151		6. Final Report <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		7. Basis <input checked="" type="checkbox"/> Cash <input type="checkbox"/> Accrual		
8. Funding/Grant Period (See Instructions) From: (Month, Day, Year) January 1, 1995		To: (Month, Day, Year) December 31, 1997		9. Period Covered by this Report From: (Month, Day, Year) 01-01-95		To: (Month, Day, Year) 03-31-95		
10 Transactions				I Previously Reported	II This Period	III Cumulative		
a. Total outlays				\$0.00	\$1,042,421.35	\$ 1,042,421.35		
b. Recipient share of outlays (64.39%)				\$0.00	\$671,215.11	\$ 671,215.11		
c. Federal share of outlays (35.61%)				\$0.00	\$371,206.24	\$ 371,206.24		
d. Total unliquidated obligations				0.00	0.00	0.00		
e. Recipient share of unliquidated obligations				0.00	0.00	0.00		
f. Federal share of unliquidated obligations				0.00	0.00	0.00		
g. Total Federal share (Sum of lines c and f)				\$0.00	\$371,206.24	\$ 371,206.24		
h. Total Federal funds authorized for this funding period				\$2,984,599.00	\$0.00	\$ 2,984,599.00		
i. Unobligated balance of Federal funds (Line h minus line g)				\$2,984,599.00	(\$371,206.24)	\$ 2,613,392.76		
11. Indirect Expense (Labor)		a. Type of Rate (Place "X" in appropriate box) <input checked="" type="checkbox"/> Provisional <input type="checkbox"/> Predetermined <input type="checkbox"/> Final <input type="checkbox"/> Fixed			b. Rate 89.34%	c. Base \$ 38,226.42	d. Total Amount \$ 34,151.48	e. Federal Share \$ 12,161.34
12. Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation								
13. Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.								
Typed or Printed Name and Title Sami Bou-Mikael - Project Manager					Telephone (Area code, number and extension) (504) 593-4565			
Signature of Authorized Certifying Official					Date Report Submitted April 15, 1995			

FEDERAL CASH TRANSACTIONS REPORT

(See instructions on the back. If report is for more than one grant or assistance agreement, attach completed Standard Form 272-A.)

Approved by Office of Management and Budget No 80-80182

1. Federal sponsoring agency and organizational element to which this report is submitted **U. S. Department of Energy**

2. RECIPIENT ORGANIZATION

Name **Texaco Exploration and Production Inc.**

Number **400 Poydras St.**

and Street **New Orleans, Louisiana 70130**

City, State

and Zip Code:

4. Federal grant or other identification number
DE-FC22-93BC14960

5. Recipient's account number or identifying number
323037151

6. Letter of credit number
NA

7. Last payment voucher number
-

Give total number for this period

8. Payment Vouchers credited to your account **-**

9. Treasury checks received (whether or not deposited) **0**

10. PERIOD COVERED BY THIS REPORT

3. FEDERAL EMPLOYER

IDENTIFICATION NO> **51-0265713**

FROM (month,day,year)
01/01/95

TO (month,day,year)
03/31/95

11. STATUS OF FEDERAL CASH

a. Cash on hand beginning of reporting period	\$	0.00
b. Letter of credit withdrawals		0.00
c. Treasury check payments		0.00
d. Total receipts (Sum of lines b and c)		0.00
e. Total cash available (Sum of lines a and d)		0.00
f. Gross disbursements		0.00
g. Federal share of program income		0.00
h. Net disbursements (Line f minus line g)		0.00
i. Adjustments of prior periods		0.00
j. Cash on hand end of period	\$	0.00

12. THE AMOUNT ON LINE j. REPRESENTING

13. OTHER INFORMATION		
k. Interest income	\$	0.00
l. Advances to subgrantees or subcontractors	\$	0.00

14. REMARKS

15. CERTIFICATION

AUTHORIZED CERTIFYING OFFICIAL	SIGNATURE	DATE REPORT SUBMITTED
	TYPED OR PRINTED NAME AND TITLE	TELEPHONE (Area Code, Number, Extension)
	Sami Bou-Mikael - Project Manager	04/15/95 (504) 593-4565

THIS SPACE FOR PRIVATE USE

Date: 7 April 1995

From: Zaki Bassiouni, Department Chair
Louisiana State University
Department of Petroleum Engineering

To: Sami Bou-Mikael
Texaco
PO Box 60252
New Orleans, Louisiana 70160

Re: The Port Neches Project Progress Report

Project Goal

Under the TEPI-LSU Agreement #NOS-01-93, the Louisiana State University Department of Petroleum Engineering is providing technical support for the project entitled, "Post Waterflood CO₂ Miscible Flood in Light Oil Fluvial Dominated Deltaic Reservoirs."

One of the tasks of the agreement requires LSU to identify locations of CO₂ sources throughout the Gulf Coast region. Identifying locations is necessary because the distance to a CO₂ source is an important criterion when considering miscible flooding for a specific reservoir.

The other tasks consist mainly of screening and ranking reservoirs for their suitability to this process of enhanced oil recovery.

Work Completed

History of CO₂ Use in Enhanced Oil Recovery Efforts in Louisiana

The Department of Natural Resources (DNR) provided information on 23 CO₂ recovery projects within Louisiana. Of these 23, Texaco has 11 in five fields, Shell has three in two fields, ARCO has two (both sold to TXO) in one field, Chevron has six (two sold to Greenhill Petroleum) in three fields, and Hunt has one. All but one are in south Louisiana (Hunt's is in Olla field in LaSalle Parish). Not all of these projects are presently active. A list of the projects along with company ownerships and permit application dates is given in Table 1.

C.F. Industries (now operating as Cherokee Associates) of Baton Rouge, Louisiana, has provided and transported CO₂ in liquid form to eight of the 23 projects. C.F. Industries has two CO₂ plants in Louisiana. These two facilities recover CO₂ from flue gas and from other operations, such as ammonia. Cherokee Associates has operations close to Jackson Dome (near Jackson, Mississippi) and owns part of the Choctaw pipeline. Liquid Carbonics company was listed as a commercial source of CO₂ for one of Chevron's projects in Timbalier Bay. For its project in Olla field, Hunt obtained CO₂ by unknown means from Black Lake field. Shell, for its project in Week's Island field, used CO₂ via pipeline from Jackson Dome.

Jackson Dome (Shell) Pipeline

Jackson Dome is the only major naturally occurring source of CO₂ in the south. Shell operates a pipeline that runs from Jackson Dome to Week's Island field. The pipeline has two sections: a 20 inch and a 10 inch. The 20-inch pipeline crosses from Mississippi into Louisiana in

St. Helena Parish and continues across St. Helena, Livingston, East Baton Rouge, Ascension, and Iberville parishes. A site just northeast of Pierre Part serves as a pumping station where the 20-inch and 10-inch pipelines connect. The 10-inch pipeline, then, starts from Pierre Part, crosses Assumption, St. Martin, St. Mary, and Iberia parishes, and terminates at Week's Island field. The last 16 miles of this pipeline were leased and are temporarily being used for hydrocarbon transportation. The remaining northern portion is still in use for transport of a small amount of CO₂ to Shell projects.

Mr. Don Hebert of the Pipeline Division of the Office of Conservation supplied the name of the Shell contact, Mr. Bruce Blome (713-241-2702). Mr. Blome said that the line is available for tap-ins and has a large transportation capacity. He suggested that Mr. Jim Gross (713-241-3888), the builder of the line for Shell, be contacted for specifics.

CO₂ Sources/Providers in Louisiana

A complete list of CO₂ sources and providers was compiled through personal interviews and by reviewing a brochure entitled, "A Visitor's Guide to the Louisiana Chemical Industry," published by the Louisiana Chemical Association in January 1993. Additional providers/sources include those identified by Texaco. Some potential commercial sources/providers of CO₂ were also found from a Sara Title-3 database provided by Dr. John Pine of Louisiana State University. A list of identified CO₂ providers is given in Table 2.

Preliminary Ranking of Reservoirs Suitable for Post Waterflood CO₂ Miscible Flooding

The major task of the project is to identify Louisiana reservoirs that are suitable for the application of the post waterflood CO₂ miscible flood process. The Department of Natural Resources also provided information on 501 reservoirs that have been either waterflooded or studied to be waterflooded within Louisiana. An abundant source of information on these reservoirs was found in DNR's "Waterflood Application Questionnaire Sheets" and the "Secondary Recovery and Pressure Maintenance Annual Data Sheets." Additional information was obtained through the Department of Natural Resources PARS computer database. A list of fields with at least one waterflooded reservoir is given in Table 3.

A spreadsheet of the information collected for the waterflood reservoirs was developed, in the form of Lotus 1-2-3, for screening and ranking the reservoirs for tertiary CO₂ flooding. The data contained within the spreadsheet is listed in Table 4. Using the spreadsheet, we found inconsistencies in the data. These inconsistencies are believed to have been caused by a change of field operators and a change in personnel filing reports and undocumented updates to the reservoirs' characterizations by operators. Primary missing and erroneous data included information on pressure, reservoir area, production, temperature, and other miscellaneous items, such as present total wells, depth, thickness, porosity, and API gravity.

Very little pressure information is available at the Louisiana Department of Conservation. Missing temperature data was estimated from depth whenever possible. Any other missing information that could not be obtained from DNR was also estimated whenever possible.

Using the available data, we performed a preliminary ranking of reservoirs based on the technical feasibility of the process. Fields that contain the top 100 technically ranked reservoirs, at this stage in the study, are listed in Table 5.

Tertiary CO₂ Enhanced Oil Recovery Prospect Map

To illustrate the proximity of the waterflooded reservoirs to CO₂ sources, we modified, with their permission, Pennwell Publishing Company's map, "Pipelines of Louisiana," copyright 1986. To the map, we added the following information:

- fields with at least one waterflooded reservoir;
- plant sources of CO₂;
- fields with at least one reservoir in the initial top 100 technical ranking; and
- the location of the Shell CO₂ pipeline.

Two copies of the modified map are attached.

Work Planned

Work planned for the next reporting period includes contacting Hunt to determine if Black Lake field has a sufficient quantity of CO₂ for use. Also planned for the next reporting period is to use information from the CO₂ spreadsheet to complete the screening and ranking of all waterflooded reservoirs for their suitability for tertiary CO₂ flooding. Reservoirs for which we do not have sufficient information to make estimations will be eliminated from the list as we screen them.

TABLE 1
CO₂ PROJECTS IDENTIFIED FROM OFFICE OF CONSERVATION*

Texaco: Lake Barre (LB UP MS RD SU) - 3/84
West Cote Blanche Bay (W CBB 14 RBX SU) - 3/84
Bayou Sale (BS St. Mary RDS SU) - 3/84
Paradis (PAR Paradis RTSU) - 3/84
Lafitte (LFT 8900 RMKA SU) - 5/84
Paradis (PAR LWR 9000 RM SU) - 1/80
Paradis (PAR 8 RA SU) - 1/80
Paradis (PAR 9500 RC7 SU) - 4/89
Paradis (16 SD RAB-1) - 2/89
Paradis (PAR PZ RU SU) - 5/90
Paradis (PAR 10000 RU SU) - 5/90

ARCO: Jeanerette (JEN Q RA VU) - 7/84, [currently owned by TXO]
Jeanerette (JEN UR RA VU) - 7/84, [currently owned by TXO]

Shell: White Castle (WC MW RA SU) - 3/86
Weeks Island (R RA SU) - 9/86
Weeks Island (S RA SU) - 9/86

Chevron: Timbalier Bay (TB 4900 RBASU) - 1/87, [currently owned by Greenhill Petroleum]
Quarantine Bay (QB 4 RC SU) - 8/81
Timbalier Bay (TB S-2B RA SU) - 9/83, [currently owned by Greenhill Petroleum]
Baymarchand (BLK 2 2500' A) - 7/90
Baymarchand (BLK 2 3150'-3200' A) - 7/90
Baymarchand (BLK 2 3400' RB) - 3/91

Hunt: Olla (OL 2800 Wilcox RA SU) - 10/82

* DNR EOR contact: Mr. Todd Keating, 504-342-5540

TABLE 2
CO₂ PROVIDERS IN LOUISIANA

AGRICO CHEMICAL COMPANY/FREEPORT-MCMORAN

9959 La. 18
St. James, La. 70086
(504) 473-4271
Scott Shean

Chemicals manufactured: sulfuric acid, phosphoric acid, diammonium and monoammonium phosphates, urea.

Consumer uses: fertilizer.

AIR PRODUCTS AND CHEMICALS, INC.

14700 Intracoastal Drive
New Orleans, La. 70129
(504) 254-1590
William Greer

Chemicals manufactured: Ammonia, carbon dioxide, hydrogen.

Consumer uses: fertilizer (urea products), dry ice, fuel for space shuttle program.

AMERICAN CYANAMID

10800 River Road
Westwego, La. 70094-2040
(504) 431-6436
Jim Dutcher

Chemicals manufactured: acrylonitrile, aminonitrile, acrlamae, methylmethancralate, acetonitrile, melamine, sulfuric acid, ammonia.

Consumer uses: acrylite, synthetic fibers, ABS plastics.

AMPRO FERTILIZER INC.

P.O. Box 392
Donaldsonville, La. 70346
(504) 473-3976
Bobby K. Shackelford

Chemicals manufactured: anhydrous ammonia

Consumer uses: fertilizer

CF INDUSTRIES

P.O. Box 468
Donaldsonville, La. 70346
(504) 473-8291
Gene T. Lewis

Chemicals manufactured: ammonia, urea ammonia nitrate, urea.
Consumer uses: fertilizer.

DOW CHEMICAL USA

P.O. Box 150
Plaquemine, La. 70765-0150
(504) 389-8236

Chemicals manufactured: caustic, chlorine, chlor-alkali, cellulose, chlorinated methanes, chlorinated polyethylene/glycol ethers, glycol I and II, light hydrocarbon II and III, poly A & B, C, solvents/EDC, vinyl II (over 50 basic chemicals).

Consumer uses: soaps, bleaches, food additives, cosmetics, shampoos, pharmaceuticals, automotive hoses, roofing, brake fluid, antifreeze, adhesives, film, trash bags, Tupperware, pipe, diaper liners, wall paper, herbicides, aerosols, Teflon, solvents, silicones, detergents, milk carton coatings, Handi-wrap, Saran-wrap, ice bags, housewares, margarine tubs.

FARMLAND INDUSTRIES, INC.

P.O. Box 438
Pollock, La. 71467
(318) 765-3574
William White

Chemicals manufactured: anhydrous ammonia
Consumer uses: fertilizer

MONSANTO COMPANY

P.O. Box 174
Luling, La.-70070
(504) 785-3259
Tim Gustafson

Chemicals manufactured: ammonia, activated chlorine/cynauric (ACL/CYA), phosphorous trichloride (PCL3), disodiumiminodisidicacid (DSIDA), APAP (Acetaminophen), Glyphosate, herbicide.

Consumer uses: nylon, chlorine for swimming pools, bleaches, aspirin substitute, herbicides.

OCCIDENTAL CHEMICAL CORPORATION

7377 Hwy. 3214
Convent, La. 70723
(504) 562-9201

Chemicals manufactured: chlorine, caustic soda, ethylene dichlorides (EDC), hydrogen.
Consumer uses: PVC plastics - EDC, water purification, chlorine.

OLIN CORPORATION

P.O. Box 52137
Shreveport, La. 71135
(318) 797-2595
E.E. Warren

Chemicals manufactured: sulfuric acid.
Consumer uses: gasoline, paper, batteries, fertilizer, water purification.

PIONEER CHLOR ALKALI COMPANY INC.

P.O. Box 23
St. Gabriel, La. 70776
(504) 642-1882
Benny L. Bennett

Chemicals manufactured: chlorine, caustic, hydrogen.
Consumer uses: polyvinyl chloride, soap, bleach, pesticides, water treatment chemicals.

TRIAD CHEMICAL

P.O. Box 310
Donaldsonville, La. 70346
(504) 473-9231
Tomm Torr

Chemicals manufactured: ammonia, urea.
Consumer uses: fertilizers.

VULCAN CHEMICAL COMPANY

P.O. Box 227
Geismar, La. 70734
(504) 473-5003
John Waupsh

Chemicals manufactured: chlorine, caustic soda, methyl chloride, chloroform, carbon tetrachloride, perchloroethylene, EDC, methyl chloroform, muriatic acid, hydrogen.

Consumer uses: refrigerants, silicones, dry cleaning, equipment cleaning solvents, food industry (soda pop), pulp and paper.

CONVENT PLANT

Convent, La.

UNION CARBIDE CORP.

P.O. Box 50
Hahnville, La. 70057

INTERNATIONAL MINERALS & CHEMICAL CORP.

Sterlington, La. 71280

FORMOSA PLASTICS CORPORATION

P.O. Box 271
Baton Rouge, La. 70821
(504) 356-3341
Alden L. Andre

Chemicals manufactured: chlorine, caustic soda, ethylene dichlorides (EDC), vinyl chlorides monomer (VCM), polyvinyl chloride (PVC).

Consumer uses: PVC pipe, pool liners, pondliners, shower curtains, tablecloths, raincoats, book binders, air mattresses, waterbeds, etc.

PPG INDUSTRIES INC.

P.O. Box 15
Lake Charles, La. 70602
(318) 491-4500
Tom G. Brown

Chemicals manufactured: chlorine, caustic soda, vinyl chloride monomer, silicas products, chlorinated solvents.

Consumer uses: vinyl plastic, water treatment, paper, aluminum.

TABLE 3
FIELDS WITH AT LEAST ONE WATERFLOODED RESERVOIR

Avery Island	Good Hope	Northeast Lisbon
Bancroft	Grand Bay	Olla
Bay Marchand	Grand Ilse Block 18	Opelousas
Bay St. Elaine	Grand Lake	Opelousas
Bayou Choctaw	Greenwood-Waskom	Ora
Bayou des Glaise	Grogan	Panther Creek
Bayou Fordoche	Haynesville	Paradis
Bayou Middle Fork	Hester	Patterson
Bayou Sale	Holly	Perry Point
Belle Isle	Hurricane Creek	Pine Island
Bellevue	Iota	Pleasant Hill
Big Creek	Iowa	Plumb Bob
Black Bayou	Jefferson Davis	Port Barre
Bossier	Jennings	Potash
Buckhorn	Killens Ferry	Quarantine Bay
Bull Bayou	Klondike	Red River-Bull Bayou
Bully Camp	Lafitte	Redland
Burrwood	Lake Barre	Rodessa
Caddo (Jeems Bayou)	Lake Enfermer	S.E. Manila Village
Caddo-Pine Island	Lake Hatch	Saline Lake
Caillou Island	Lake Hermitage	Section 28
Carterville	Lake Mongulouis	Sentell Field
Catahoula Lake	Lake Pelto	Shongaloo
Cecelis	Lake Salvador	Shongaloo-Pettet, W Seg
Chemard Lake	Lake Washington	Siegen
Clovelly	Larose	Simpson Lake
Cotton Valley	Larto Lake	South Bayou Mallet
Cut Off	Leeville	South Black Bayou
Dave Haas	Lisbon	South Pass Block 24
Delhi	Little Lake	South Pass Block 27
Delta Farms	Little Temple	Southeast Pass
Delta Duck Club	Livingston	Southeast Pass & S. Pass Blk. 6
Deltabridge	Livonia	Southwest Lisbon
DeSoto - Red River	Lockhart Crossing	Starks
DeSoto - Red River (Bull Bayou)	Locust Ridge	Sulphur Mines
Dog Lake	Longville	Ten Mile Bayou
Duck Lake	Main Pass Block 35	Tepetate
Dykesville	Main Pass Block 41	Timbalier Bay
East Hackberry	Main Pass Block 69	Valentine
East Larto Lake	Mamou	Vatican
East Longville	Manila Village	Venice
Erath	Mira	Ville Platte
Eugene Island Block 18	Naberton (Bull Bayou)	West Bay
Eugene Island Block 19	Napoleonville	West Cote Blanche Bay
Frisco	Nebo-Hemphill	West Delta Block 83
Garden City	Newlight	West Delta Block 84
Garden Island Bay	North Burtville	West Hackberry
	North Cankton	West Lake Verret
	North Missionary Lake	West Lisbon
	North Shongaloo-Red Rock	West Tepetate
		West White Lake
		White Castle

TABLE 4
DATA CONTAINED WITHIN CO₂ SPREADSHEET

operator	Swc
field	Sor
b-codes	orig. So
LUW	RP
parish	Pentanes+
reservoir	date pre-app
Distance to source (mi.)	Np pre-app
Nearest Source	Gp pre-app
Pipeline Distance (mi)	Wp pre-app
1st .comp	Np prior to inj.
wellupd	Gp prior inj.
dateupd	Wp prior inj.
total active&siwells	Np since inj.
total gas wells	Gp since inj.
total inj. wells	Wp since inj.
P&A	Cum Np
total wells	Cum Gp
orig area	Cum Wp
type struct	Cum Wi
orig res psi	EOOIP
date orp	M
pres res psi	GOR trend
date prp	WOR trend
orig drive	Pres dec
pres drive	Well Density
avg depth	pres est So
avg H O&G	BOPD
avg H oil	MCFD
area oil	BWPD
avg H gas	Type Inj. H2O
area gas	API
avg por	C5+ MW
avg Kh	Temp (f)
avg Kv	Date of MRP
cp	MMP
sat psi	sat gor

TABLE 5
FIELDS WITH RESERVOIRS IN TOP 100 TECHNICAL RANK

Bay Marchand Block 2	
Black Bayou	
Bully Camp	
Burrwood	
Caillou Island	
Clovelly	
Dave Haas	
Delta Duck Club	
Dog Lake	
Eugene Island Block 18	
Frisco	
Garden City	
Garden Island Bay	
Grand Bay	
Hurricane Creek	
Lake Barre	
Lake Hatch	
Leeville	
Little Lake	
Livingston	
	Livonia
	Lockhart Crossing
	Main Pass Block 69
	Manila Village
	Plumb Bob
	Port Barre
	Quarantine Bay
	South Pass Block 24
	South Pass Block 27
	Southeast Pass
	Tepetate
	Timbalier Bay
	Valentine
	Vatican
	Ville Platte
	West Bay
	West Cote Blanche
	West Delta Block 83
	West White Lake