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Petroleum Reservoir Data for Testing Simulation Models

J. M. Lloyd and W. Harrison

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PETROLEUM RESERVOIR DATA FOR TESTING SIMULATION MODELS

by

Jacqueline M. Lloyd and Wyman Harrison

Energy and Environmental Systems Division

September 1980

Prepared for the

Conservation Division
U. S. Geological Survey
U. S. Department of the Interior
Denver, Colorado 80225

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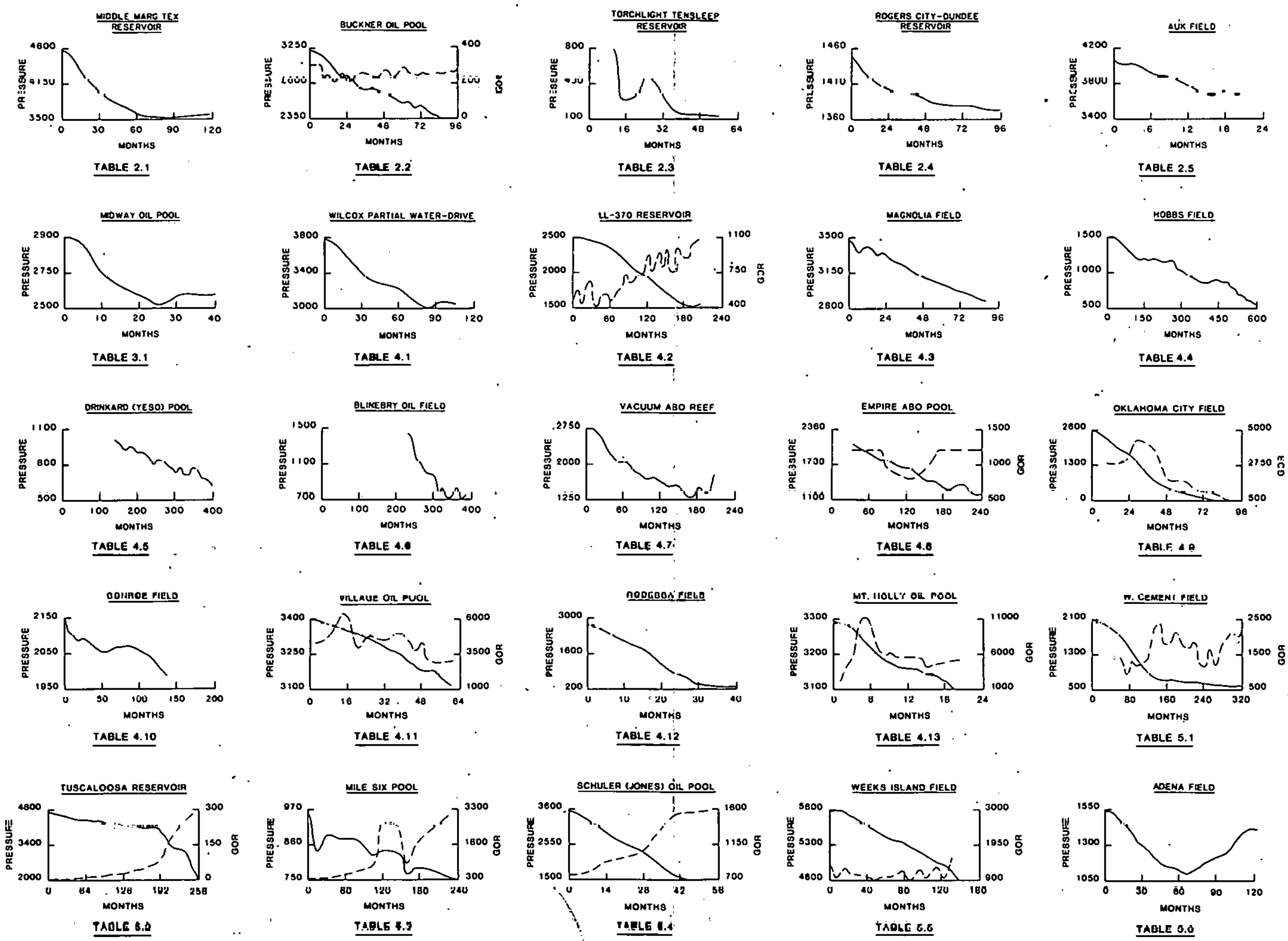
SI METRIC CONVERSION FACTORS

acre	×	4.046 856	E + 03	= m^2
acre-ft	×	1.233 482	E + 03	= m^3
bbl	×	1.589 873	E − 01	= m^3
bbl/acre-ft	×	1.288 931	E − 04	= m^3/m^3
bbl/day	×	1.589 873	E − 01	= m^3/d
cP	×	1.0*	E − 03	= Pa•s
d	×	9.869 233	E − 01	= μm^2
°F		(°F − 32) 5/9		= °C
ft	×	3.048*	E − 01	= m
ft^3	×	2.831 685	E − 02	= m^3
ft^3/bbl	×	7.518 21	E − 03	= kmol/m^3
md	×	9.869 233	E − 04	= μm^2
psi	×	6.894 757	E + 00	= kPa

*Conversion factor is exact

NOMENCLATURE

SCHEMATIC PLOTS OF RESERVOIR PRESSURE AND GAS-OIL RATIO (GOR) AS A FUNCTION OF TIME FOR THE DATA OF REPORT TABLES (NUMBERED BELOW)



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ABSTRACT

This report consists of reservoir pressure and production data for 25 petroleum reservoirs. Included are 5 data sets for single-phase (liquid) reservoirs, 1 data set for a single-phase (liquid) reservoir with pressure maintenance, 13 data sets for two-phase (liquid/gas) reservoirs and 6 for two-phase reservoirs with pressure maintenance. Also given are ancillary data for each reservoir that could be of value in the development and validation of simulation models. A bibliography is included that lists the publications from which the data were obtained.

1 INTRODUCTION

1.1 PURPOSE

These data were collected in support of a related effort (Sanathanan and Harrison, 1980) involving validation of a simple reservoir model (Lohrenz and Monash, 1979). Although the presentation format is oriented specifically toward this particular model, the tables and the reference list may prove useful to other modelers since the validation of mathematical simulation models for petroleum reservoirs requires a ready source of tabled pressure and production data from single-phase, two-phase, and pressure-maintained reservoirs. Such data are scattered throughout the literature and are often presented in graphical form. Extracting the data is time consuming and small discrepancies will occur when different workers extract values from graphs. These discrepancies may present problems; for example, unexplained differences may occur in the results of different workers as they attempt to simulate production histories of identical petroleum reservoirs. This report is not exhaustive, but does give tabled pressure and production data and a reference list for each of the three types of petroleum reservoirs.

1.2 DATA SOURCES

Most of the data presented here are extracted from the literature. Monograph 13 of the Bureau of Mines (Weaver and Anderson, 1966) is particularly useful and includes histories for the "J" Sand Unit of the Adena Field, Colorado; the Medrano Sand Reservoir of the West Cement Field, Oklahoma; and the Tuscaloosa Reservoir of the Cranfield Field, Mississippi. An extensive study of the Smackover Limestone Formation, Southern Arkansas (Bruce, 1944), includes reservoir information for the Magnolia, Buckner, Midway, Mt. Holly, Schuler (Reynolds), and Village oil pools. The Schuler

(Jones), Buckner, and Midway oil pools of the Smackover are summarized in Muskat (1949). Excellent data for the Magnolia Field are also available (Pirson, 1950; Carpenter, et al., 1943; Bruce, 1944; Muskat, 1949; Craft and Hawkins, 1959; and Weaver and Anderson, 1966).

Most of the production and reservoir data for the Empire Abo, Hobbs, Drinkard, Blinebry and Vacuum Abo Reef Fields were obtained from the New Mexico Petroleum Research Center, Socorro, N.M. Pressure data for these fields were extracted from the Annual Reports of the New Mexico Oil and Gas Engineering Committee, Hobbs, N.M.

Several state regulatory commissions were contacted. Reservoir production data are readily available because most regulatory commissions require operators to file monthly production reports. Reports of reservoir pressure, however, are not required and will be found only in those cases in which pressure data are pertinent to a particular regulatory-agency hearing.

1.3 PRESENTATION FORMAT

Reservoirs may be classified into one of the six types shown in Table 1.1. This report is not concerned with single phase gas reservoirs. Thus, the reservoir data are presented in four categories: single phase (liquid) reservoirs (Section 2), single phase (liquid) reservoirs with pressure maintenance (Section 3), two phase (liquid/gas) reservoirs (Section 4), and two phase (liquid/gas) reservoirs with pressure maintenance (Section 5).

All tables include time, reservoir pressure, and cumulative oil production. Pressure data are tabulated with the same headings and units as found in their respective sources. Pressure data are reported in the literature under various headings such as "bottom hole pressure," "average reservoir pressure," "arithmetic average well pressure," and "reservoir pressure." Units are given in psig, psia, or simply psi; a pressure datum may or may not be given. When a pressure datum is given it is not clear that it should be interpreted as the exact place at which measurements were taken. It was felt that standardizing the pressure data would be misleading and inaccurate because the techniques with which pressure data were collected and subsequently reported are open to interpretation. [This did not present problems in the model-validation work of the related study (Sanathanan and Harrison, 1980).]

Time is given in number of months, as well as by actual dates, to facilitate use of the data in modeling; the tables also include number of wells, gas and water production, gas and (or) water injection, and gas-oil ratio (GOR). In some cases, calculated data were available in the literature and were tabulated as possible checks for models. These include specific volumes, formation volume factors, and water influx data.

Additional reservoir data immediately follow the tabled data. The availability of such information varies greatly, but, when available, includes the assessment of trap type and estimates of various reservoir characteristics given in the cited literature.

Table 1.1. Classification of Reservoirs and Section of Report Where Reservoir Data Can Be Found

SINGLE PHASE (GAS)	SINGLE PHASE (LIQUID)	TWO PHASE (LIQUID/GAS)	
--	Section 2	Section 4	WITHOUT PRESSURE MAINTENANCE
--	Section 3	Section 5	WITH PRESSURE MAINTENANCE

The tables in Sections 2-5 are ordered according to greatest length of record, frequency and regularity of pressure and oil-production data, and the quantity of other data available (number of wells, gas and water production GOR, % water, water influx, gas and (or) water injection, and reservoir characteristics data).

Schematic plots of reservoir pressure as a function of time for each data set (and of instantaneous GOR as a function of time, when available) are presented on the foldout (page *viii*). The foldout may be consulted by researchers as a quick reference when seeking data sets appropriate for their models.

2 DATA FOR SINGLE PHASE (LIQUID) RESERVOIRS

This section provides data for the following single phase (liquid) reservoirs: The Middle Marg Tex, Sunshine Field (Table 2.1); the Buckner Oil Pool, Smackover Limestone Formation (Table 2.2); the Torchlight Tensleep Reservoir (Table 2.3); the Rogers City-Dundee Reservoir, Coldwater Field (Table 2.4); and the Lower Zechstein Reservoir, Auk Field (Table 2.5).

Table 2.1. Pressure, Production, and Reservoir Data for the Middle Marg Tex Oil Reservoir, Sunshine Field, Iberville Parish, Louisiana

Time (Mos)	Date	Bottom Hole Pressure (psig)	Cumulative Production (bbl) Oil	Water	B_o^a (bbl/STB)
0	April, 1949	4,750			1.1707
9	Jan 1, 1950	4,550	133,504	5,938	1.1731
21	Jan 1, 1951	4,182	690,076	81,848	1.1774
33	Jan 1, 1952	3,909	1,511,441	273,753	1.1806
45	" 1953	3,765	2,076,601	706,074	1.1823
57	" 1954	3,623	2,526,791	1,597,205	1.1839
69	" 1955	3,538	2,904,769	2,797,837	1.1849
81	" 1956	3,516	3,196,201	3,940,569	1.1851
93	" 1957	3,525	3,474,252	5,032,759	1.1850
105	" 1958	3,560	3,711,708	6,151,193	1.1846
117	" 1959	3,590	3,872,370	7,086,105	1.1843
129	" 1960	3,620	4,013,462	7,960,843	1.1839
141	" 1961	3,645	4,157,168	8,723,914	1.1836
153	" 1962		4,282,367	9,444,288	
165	" 1963		4,408,503	10,148,381	
177	" 1964		4,510,617	11,081,532	
189	" 1965		4,582,248	12,062,091	

Source: Lowe, 1967, Table 1

[a]Values for B_o are interpolated from Lowe's calculations

RESERVOIR DATA:

Producing mechanism:	Water drive
Producing zone:	Marginulina Texana zone of the Upper Frio formation
Net thickness of productive sandstone:	50-60 ft
Original reservoir pressure:	4750 psig
Average porosity:	29%
Average permeability:	≈ 1d
Connate water saturation:	23%
Oil gravity:	27.5 °API
FVF at original reservoir pressure:	1.1707
Gas in solution:	400 ft^3/bbl
Saturation pressure:	2465 psig
Crude viscosity at reservoir temperature of 199°F:	3.23 cP

Table 2.1. (Contd.)

RESERVOIR DATA: (Contd.)

Formation (rock) compressibility:	3.10×10^{-6} vol/vol/psi
Water compressibility:	3.44×10^{-6} vol/vol/psi
Estimated original oil in place:	9-10 MMbbl
Reservoir Temperature:	199°F

Source: Lowe, 1967

Table 2.2. Pressure, Production, and Reservoir Data for Buckner Oil Pool, Smackover Limestone Formation, Lafayette and Colombia Counties, Arkansas

Time (Mos)	Date	Average Reservoir Pressure (psig)	Cumulative Production Oil (MMbbl)	Cumulative Production Water (MMbbl)	GOR (ft^3/bbl)	Cumulative Water Influx[a] (MMbbl)
0	Sep 1937	3220			300	
3	Dec	3198	0.024		300	0.02
6	Mar 1938	3165	0.050		300	0.04
9	Jun	3135	0.11		234	0.11
12	Sep	3085	0.23		240	0.22
15	Dec	3010	0.35		212	0.35
18	Mar 1939	2940	0.48		204	0.53
21	Jun	2885	0.64	0.004	252	0.71
24	Sep	2905	0.80	0.008	210	0.93
27	Dec	2835	1.01	0.012	207	1.17
30	Mar 1940	2794	1.22	0.121	252	1.41
33	Jun	2729	1.42	0.039	258	1.67
36	Sep	2725	1.63	0.057	253	1.95
39	Dec	2732	1.82	0.072	239	2.24
42	Mar 1941	2719	2.06	0.094	231	2.51
45	Jun	2703	2.26	0.12	235	2.80
48	Sep	2679	2.47	0.15	274	3.08
51	Dec	2637	2.68	0.17	268	3.38
54	Mar 1942	2604	2.88	0.20	233	3.64
57	Jun	2575	3.07	0.23	260	3.89
60	Sep	2547	3.25	0.26	296	4.13
63	Dec	2532	3.42	0.29	271	4.39
66	Mar 1943	2554	3.61	0.33	251	4.61
69	Jun	2474	3.76	0.37	242	4.83
72	Sep	2520	3.87	0.41	254	
75	Dec	2464	4.04	0.47	248	
78	Mar 1944		4.21	0.54	255	
79	Apr	2400				
81	Jun		4.37	0.61	257	
82	Jul	2366				
84	Sep		4.54	0.68	267	
87	Dec		4.70	0.76	263	
90	Mar 1945		4.86	0.84	283	
93	Jun		5.02	0.93	263	
96	Sep		5.17	1.02	256	
99	Dec		5.33	0.12	228	

Source: Bruce, 1944, Fig. 12; Muskat, 1949, Fig. 11.26; Miller, 1942, Table 7.

[a]Calculated by Bruce, 1944.

Table 2.2. (Contd.)

RESERVOIR DATA:

Producing mechanism:	Complete water drive
Producing zone:	Reynolds lime
Trap type:	Asymmetrical anticlinal fold
Estimated area:	1610 acres
Original reservoir volume:	43.3 MMbbl
Average permeability:	50 md
Average porosity:	20.0%
Original pressure at 7010 ft ss:	3250 psia
Number of producing wells:	28
Reservoir liquid compressibility	1.8×10^{-5} bbl/bbl/psi
Tank oil gravity:[1] (Thigpen et al., 1943, Tables 3 & 4)	32° API
Approximate initial GOR:[2] (Miller, 1942)	300 ft^3/bbl
Encroachment factor calculation by Elliott, 1946:	
K, bbs of encroached water/month/lb. differential between reservoir pressure at a given time and the original reservoir pressure:	126 bbl/lb-month
Area:	35,000 acre-ft
K_a, encroachment factor; "degree" of water driven when comparing one reservoir to another; K divided by acre-ft of oil reservoir:	0.0036 bbl/lb-month/acre-ft

Source: Bruce, 1944; Muskat, 1949

[1]Thigpen, et al., 1943, Table 4.

[2]Miller, 1942.

Table 2.3. Pressure, Production, and Reservoir Data for the Torchlight Tensleep Reservoir, Big Horn Basin, Big Horn County, Wyoming

Time (Mos)	Date	Reservoir Pressure (psi)[a]	Cumulative Oil Production (Mbbl)[b]
0	Sep 1947	1618	
1	Oct	1620	
2	Nov		5.9
3	Dec		14.5
4	Jan 1948	1500	21.7
5	Feb	1420	28.9
6	Mar		41.0
7	Apr		50.2
8	May		60.2
9	Jun		80.6
10	Jul	800	109
11	Aug	700	143
12	Sep		177
13	Oct	300	204
14	Nov		224
15	Dec		247
16	Jan 1949		263
17	Feb		272
18	Mar	300	283
19	Apr		294
20	May	330	306
21	Jun		313
22	Jul		322
23	Aug		332
24	Sep		340
25	Oct	500	348
26	Nov		357
27	Dec		366
28	Jan 1950		376
29	Feb		391
30	Mar		408
31	Apr	340	422
32	May		439
33	Jun		454
34	Jul		469
35	Aug		484
36	Sep		499
37	Oct	170	512
38	Nov		525
39	Dec		538
40	Jan 1951		552
41	Feb		564
42	Mar		577
43	Apr		591
44	May	150	605

Table 2.3. (Contd.)

Time (Mos)	Date	Reservoir Pressure (psi)[a]	Cumulative Oil Production (Mbbl)[b]
45	Jun		618
46	Jul		632
47	Aug		645
48	Sep		657
49	Oct		669
50	Nov		681
51	Dec		693
52	Jan 1952		696
53	Feb		707
54	Mar		720
55	Apr		731
56	May	140	743
57	Jun		755
58	Jul		768
59	Aug		780
60	Sep		792
61	Oct		804
62	Nov		815
63	Dec		826
64	Jan 1953		838
65	Feb		849
66	Mar		660
67	Apr		871
68	May		882

Source: Stewart, et al., 1954, Figs. 3, 4, 5, and 6.

[a]Datum -- 1000 ft above sea level. Oil production increased rapidly to a peak by the middle of 1948 followed by a period of rapidly decreasing rate as reservoir pressure and well capacity declined. Production rate was then reduced below capacity during 1949 and reservoir pressure responded by increasing rapidly. Production was increased in February 1950, and since mid-1950 has been at well capacity.

[b]Calculated from production rates given in Source Figs. 3, 4, 5, and 6.

Table 2.3. (Contd.)

RESERVOIR DATA:	
Producing mechanism:	Water drive
Trap type:	Anticline
Productive area:	220 acres
Net thickness of pay:	31 ft
Porosity:	17%
Connate water saturation:	10%
Permeability from cores:	204 md
Permeability from PIs:	87 md
Original pressure at +1,000 ft datum:	1,618 psi
Reservoir temperature:	100°F
Bubble point:	55 psi
Gas in solution:	2 ft^3/bbl
Reservoir Volume Factor at bubble point:	1.0225
Oil gravity:	35°API
Viscosity of oil:	3.5 cP
Viscosity of water:	0.60 cP
Compressibility:	
Reservoir oil:	7.7×10^{-6} vol/vol/psi
Reservoir water:	3.1×10^{-6} vol/vol/psi
Compressibility of reservoir rock:	6.6×10^{-7} pore vol/bulk vol/psi
Estimated formation volume:	6820 acre-ft
Estimated original oil in place:	
By Volumetric Method	6.1 MMbbl
By Modified Schilthuis Method:	8.1 MMbbl
By Simplified Hurst Method:	7.6 MMbbl
By VanEverdingen, et al., (1952) Method:	6.1 MMbbl

Source: Stewart, et al., 1954

Table 2.4. Pressure, Production, and Reservoir Data, for the Rogers City-Dundee Reservoir, Coldwater Field, Isabella County, Michigan

Time (Mos)	Date	Bottom Hole pressure (psig)[a]	Cumulative Production Oil (MMbbl)	Cumulative Production Water (MMbbl)
0	8/44	1453		
4	12/44	1438	0.1	
10	6/45	1424	0.4	
16	12/45	1413	1.0	
22	6/46	1407	1.8	0.01
28	12/46	1400	2.6	0.1
34	6/47	1398	3.5	0.3
40	12/47	1395	4.4	0.7
46	6/48	1390	5.4	1
52	12/48	1384	6.6	2
58	6/49	1380	7.5	3
64	12/49	1380	8.3	5
70	6/50	1380	9.0	7
76	12/50	1379	9.9	9
82	6/51	1378	10.8	11
88	12/51	1375	11.5	14
94	6/52	1375	12.2	17
100	12/52	1375	12.8	20

Source: Criss and McCormick, 1954, Fig. 2.

[a]Arith. field avg. BHP - psig (Datum - 2770')

RESERVOIR DATA:

Producing mechanism:	Water Drive	
Producing zones:	Rogers City	Dundee
Depth of producing zones:	3,700 ft	3,735 ft
Matrix porosity:	4.2%	2.5%
Gross pay volume:	76,800 acre-ft	13,200 acre-ft
Horizontal permeability:	0-1,368 md	
Vertical permeability:	0-62 md	
Original bottom hole pressure at 2,770 ft ss:	1,453 psig	
Solution GOR:	512 ft^3/bbl	
Saturation pressure:	1,190 psig	
FVF at saturation pressure:	1.306	
Compressibility factor of the oil at 1,400 psi:	12.5×10^{-6}	
Reservoir temperature:	120°F	
Oil gravity:	48.6°API	
Oil viscosity at 100°F:	34 SSU	

Table 2.4. (Contd.)

Average separator gas sample analyses (20 psig):

Component	Mol %
N_2	3.7
CO_2	0.1
C_1	52.8
C_2	24.0
C_3	13.4
nC_4	2.8
iC_4	1.7
nC_5	0.5
iC_5	0.5
C_6+	0.5
	100.0

Source: Criss and McCormick, 1954

Table 2.5. Pressure, Production, and Reservoir Data for the Lower Zechstein Reservoir, Auk Field, U.K. North Sea

Time (Mos)	Date	Reservoir Pressure (psia)[a]	Cumulative Production Oil (MMbbl)	Cumulative Production Water (MMbbl)
1	3/76	4067	0.7	
2	4/76	4020	1.4	
3	5/76		1.8	
4	6/76		2.8	0.06
5	7/76	4008	3.5	0.11
6	8/76	3955	4.0	0.11
7	9/76		5.3	0.26
8	10/76	3900	6.9	0.57
9	11/76		8.2	1.0
10	12/76	3884	9.2	1.2
11	1/77		10.7	1.5
12	2/77	3810	12.2	2.1
13	3/77		13.9	2.8
14	4/77		15.6	3.4
15	5/77		17.9	4.1
16	6/77[b]		19.8	5.2
17	7/77	3667	21.1	6.1
18	8/77		22.9	7.5
19	9/77	3725	24.1	8.4
20	10/77	3690	25.2	10.2
21	11/77		26.0	10.9
22	12/77		27.0	11.8
23	1/78	3720	27.5	12.6
24	2/78		28.0	13.1
25	3/78		29.0	14.7
26	4/78		30.4	16.3

Source: Buchanan and Hoogteyling, 1979, Fig. 9.

[a]Arithmetic well average.

[b]There was a planned engineering shut down in mid-77.

Table 2.5. (Contd.)

RESERVOIR DATA:	
Producing Mechanism:	Water drive
Producing formation:	Thin, highly permeable, Zechstein dolomite
Reservoir thickness:	30 ft
Porosity:	12-16%
Oil saturation:	50-80%
Permeability:	5-20 darcies
Oil/water contact:	7750 ft
Initial subsea reservoir pressure at datum (7600 ft):	4067 psia
GOR:	155 scf/bbl
Oil gravity:	38°API
Saturation pressure:	800 psia
Viscosity:	1.2 cP

Source: Buchanan and Hoogteyling, 1979.

3 DATA FOR SINGLE PHASE (LIQUID) RESERVOIRS WITH PRESSURE MAINTENANCE

Table 3.1 lists data for Midway Oil Pool, Smackover Limestone Formation, an undersaturated reservoir which underwent water injection. Water injection was undertaken at Midway to assist a natural water drive and thus maintain pressures (Bruce, 1944).

Table 3.1. Pressure, Production, and Reservoir Data for Midway Oil Pool, Smackover Limestone Formation, Lafayette County, Arkansas

Time (Mos)	Date	Average Pool Pressure[a] (psig)	Cumulative Production Oil (MMbbl)	Cumulative Production Water (Mbbl)	Cumulative Water Injected (MMbbl)	Cumulative Water Influx[b] (MMbbl)
1	Jan 1942	2906	0.01			
2	Feb		0.03			
3	Mar	2882	0.09	0.002		
4	Apr	2880	0.15	0.004		0.05
5	May	2862	0.24	0.007		0.12
6	Jun	2849	0.29	0.010		0.19
7	Jul		0.42	0.012		0.27
8	Aug	2807	0.58	0.016		0.35
9	Sep	2786	0.74	0.020		0.43
10	Oct	2750	0.91	0.022		0.53
11	Nov	2726	1.0	0.026		0.65
12	Dec	2713	1.2	0.030		0.78
13	Jan 1943		1.4	0.036		0.93
14	Feb	2689	1.5	0.040		1.1
15	Mar		1.7	0.045		1.3
16	Apr		1.8	0.050	0.02	1.4
17	May	2660	2.0	0.054	0.09	1.6
18	Jun	2671	2.2	0.061	0.15	1.8
19	Jul	2664	2.4	0.068	0.24	
20	Aug	2660	2.7	0.077	0.35	
21	Sep	2651	2.9	0.085	0.46	
22	Oct	2645	3.1	0.094	0.60	
23	Nov	2640	3.3	0.10	0.73	
24	Dec	2620	3.6	0.12	0.82	
25	Jan 1944	2613	3.8	0.13	0.94	
26	Feb	2620	4.0	0.14	1.1	
27	Mar	2625	4.3	0.15	1.3	
28	Apr	2631	4.5	0.17	1.4	
29	May	2646	4.8	0.18	1.6	
30	Jun	2651	5.0	0.19	1.8	
31	Jul	2655	5.2	0.21	2.0	
32	Aug	2650	5.5	0.22	2.2	
33	Sep	2647	5.7	0.24	2.4	
34	Oct	2658	6.0	0.25	2.6	
35	Nov	2664	6.2	0.27	2.8	
36	Dec	2660	6.5	0.29	3.0	
37	Jan 1945	2655	6.7	0.31	3.2	
38	Feb	2656	7.0	0.33	3.5	
39	Mar	2663	7.3	0.35	3.8	
40	Apr	2668	7.5	0.38	4.0	
41	May	2676	7.8	0.40	4.3	
42	Jun	2674	8.1	0.43	4.8	
43	Jul	2677	8.4	0.46	4.9	

Table 3.1. (Contd.)

Time (Mos)	Date	Pressure[a] (psig)	Cumulative Production Oil (MMbbl)	Cumulative Production Water (Mbbl)	Cumulative Water Injected (MMbbl)	Cumulative Water Influx[b] (MMbbl)
44	Aug 1945	2678	8.7	0.49	5.1	
45	Sep	2680	8.9	0.53	5.4	

Source: Bruce, 1944, Fig. 14; Muskat, 1949, Fig. 11.30. Cumulative oil production, cumulative water influx, water injection rate and average pool pressure through June 1943 given in Bruce, 1944. Water production and input rates, oil production rate, and average pool pressure given in Muskat, 1949.

[a]Datum: 6050 ft ss.

[b]Calculated by Bruce, 1944.

RESERVOIR DATA:

Producing mechanisms:	Water drive/water injection
Producing zone:	Reynolds lime
Trap type:	Elongated anticline
Estimated area:	2400 acres
Structural closure:	>200 ft
Original reservoir volume:	180 MMbbl
Average permeability:	145 md
Average porosity:	21.3%
Original:	
reservoir pressure at 6050 ft ss:	2920 psig
saturation pressure:	2528 psig
formation volume factor:	1.24
oil compressibility (per psi):	15×10^{-6}
reservoir temperature:	182°F
Number of producing wells:	37
Number of injection wells:	4
Tank oil gravity:	31° API
Water influx	0.008 bbl/day/psi/acre

Source: Bruce, 1944; Muskat, 1949.

4 DATA FOR TWO PHASE (LIQUID/GAS) RESERVOIRS

This section provides data for the following two phase (liquid/gas) reservoirs: the Wilcox Partial Water-Drive Field (Table 4.1); the LL-370 Reservoir, Bolivar Coastal Field (Table 4.2); the Reynolds Oölitic Zone, Magnolia Field, Smackover Limestone Formation (Table 4.3); the Hobbs (Grayburg-San Andres) Field (Table 4.4); the Drinkard (Yeso) Field (Table 4.5); the Blinebury (Oil) Field (Table 4.6); the Vacuum Abo Reef Field (Table 4.7); the Empire Abo Pool (Table 4.8); the Wilcox Sand Reservoir, Oklahoma City Field (Table 4.9); the Main Conroe Sand, Conroe Field (Table 4.10); the Village Oil Pool, Smackover Limestone Formation (Table 4.11); the Gloyd Mitchell Zone, Rodessa Field (Table 4.12); and the Mt. Holly Oil Pool, Smackover Limestone Formation (Table 4.13).

Table 4.1. Pressure, Production and Reservoir Data for a Wilcox Partial Water-Drive Field

Time (Mos)	Date	Average Reservoir Pressure (psia)[a]	Drainage Boundary Pressure (psia)[a]	Cumulative Production Oil (STB)	Cumulative Production Water (bbl)	Cumulative GOR (ft^3/bbl)
3	Mar 1942	3786	3788	13,549	0	900
6	Jun 1942	3768	3774	49,005	370	900
9	Sep 1942	3739	3748	99,774	1,030	900
12	Dec 1942	3699	3709	171,884	1,750	900
15	Mar 1943	3657	3680	324,843	2,834	900
18	Jun 1943	3613	3643	528,068	4,840	919
21	Sep 1943	3558	3595	788,009	7,749	914
24	Dec 1943	3511	3547	1,066,911	13,895	910
27	Mar 1944	3476	3518	1,339,902	24,808	911
30	Jun 1944	3444	3485	1,615,461	37,653	917
33	Sep 1944	3408	3437	1,890,560	58,449	937
36	Dec 1944	3375	3416	2,171,963	111,863	952
39	Mar 1945	3333	3379	2,441,226	163,250	970
42	Jun 1945	3309	3358	2,713,986	219,848	987
45	Sep 1945	3292	3338	2,970,088	301,256	1,006
48	Dec 1945	3277	3329	3,175,948	381,548	1,016
51	Mar 1946	3269	3324	3,399,591	465,877	1,022
54	Jun 1946	3263	3319	3,630,154	561,526	1,020
57	Sep 1946	3242	3302	3,883,548	692,213	1,017
60	Dec 1946	3230	3292	4,118,506	825,223	1,017
63	Mar 1947	3214	3276	4,335,352	983,237	1,017
66	Jun 1947	3174	3243	4,582,853	1,189,160	1,018
69	Sep 1947	3178	3206	4,819,389	1,401,565	1,022
72	Dec 1947	3116	3184	5,050,931	1,645,146	1,023
75	Mar 1948	3090	3165	5,274,725	1,909,325	1,028
78	Jun 1948	3057	3135	5,489,387	2,197,393	1,032
81	Sep 1948	3029	3108	5,709,618	2,514,476	1,037
84	Dec 1948	3015	3095	5,921,511	2,828,446	1,039
87	Mar 1949	3002	3086	6,093,544	3,127,439	1,039
90	Jun 1949	3040	3103	6,224,712	3,397,011	1,040
93	Sep 1949	3063	3125	6,343,352	3,658,912	1,037
96	Dec 1949	3062	3120	6,476,584	3,999,237	1,032
99	Mar 1950	3061	3115	6,594,582	4,326,586	1,028
102	Jun 1950	3060	3114	6,711,898	4,682,633	1,024
105	Sep 1950	3060	3115	6,839,926	5,010,051	1,022
108	Dec 1950	3060	3116	6,965,325	5,291,120	1,020

Source: VanEverdingen, et al., 1953, Table 1.

[a]Datum 8,075 ft.

Table 4.1. (Contd.)

RESERVOIR DATA:	
Producing Zone:	Top of the Wilcox formation; Eocene age
Depth:	≈ 8,100 ft ss
Original producing area:	1,830 acres
Original oil column thickness:	37 ft
Maximum net sand thickness:	26 ft
Original producing volume:	27,500 acre-ft
Average permeability:	236 md
Average porosity:	19.9%
Interstitial water:	15%
Initial GOR:	900 ft^3/bbl
Initial shrinkage factor:	0.65
Estimated original oil-in-place	
By volumetric method:	24-25 MMbbl
By material balance:	25.6 MMbbl
Original reservoir pressure	3793 psia

Source: VanEverdingen, et al., 1953.

Table 4.2. Pressure, Production, and Reservoir Data for LL-370 Reservoir, Bolivar Coastal Field, Lake Maracaibo, Venezuela

Months After Start of Production	Date	Number of Producing Wells	Average Reservoir Pressure[a] (psia)	Cumulative Oil Production (MMbbl)	GOR (ft^3/bbl)
0	Oct 1939	1	2490	neg.	400
2	Dec 1939	1	2485	0.2	490
8	Jun 1940	1	2480	0.7	565
14	Dec 1940	1	2475	1	450
20	Jun 1941	6	2470	2	590
26	Dec 1941	6	2460	4	660
32	Jun 1942	6	2450	6	440
38	Dec 1942	6	2435	8	420
44	Jun 1943	6	2415	10	510
50	Dec 1943	6	2400	15	520
56	Jun 1944	8	2380	20	530
62	Dec 1944	17	2350	25	470
68	Jun 1945	20	2310	31	520
74	Dec 1945	23	2250	39	580
80	Jun 1946	25	2190	50	610
86	Dec 1946	28	2145	60	720
92	Jun 1947	28	2090	74	650
98	Dec 1947	29	2050	90	660
104	Jun 1948	29	2010	95	700
110	Dec 1948	30	1985	100	720
116	Jun 1949	32	1950	114	750
122	Dec 1949	32	1925	125	910
128	Jun 1950	37	1875	135	760
134	Dec 1950	37	1840	143	830
140	Jun 1951	40	1790	150	940
146	Dec 1951	40	1750	163	800
152	Jun 1952	41	1700	175	970
158	Dec 1952	41	1660	185	755
164	Jun 1953		1620	192	750
170	Dec 1953		1585	200	980
176	Jun 1954		1550	215	950
180	Oct 1954[b]		1545	225	900
182	Dec 1954		1535	230	890
188	Jun 1955		1530	244	1020
204	Dec 1955		1545	255	1040
210	Jun 1956		1555	270	1060

Source: McCord, 1953, Fig. 1; Edison, 1957, Fig. 1.

[a]Arithmetic average reservoir pressure at 5235 feet subsea datum.

[b]Start of gas injection - October 3, 1954.

Table 4.2. (Contd.)

RESERVOIR DATA:	
Producing mechanism:[1]	Gravity drainage
Oil-bearing formation:	Truncated monocline of Eocene ss called the B-6
Surface area:	9800 acres
Average section thickness:	210 ft
Average net sand thickness:	170 ft
Volume:	1.66 MMacre feet
Original pressure, at 5250 feet subsea:	2490 psia
Reservoir void space:	2.31×10^9 bbl
Average permeability (dry air):	1000 md
Average porosity:	20.5%
Average connate water:	13.5% pore space
Average gravity:	25.4°API
Formation volume factor, bbl of oil at original reservoir conditions per stock tank barrel:	1.264 bbl/STB
Average solution gas:	478 ft^3/STB
Average viscosity:	2.04 cP
Average formation dip:	3°
Gas gravity:	0.788
Reservoir temperature:	178°F

Source: McCord, 1953; Edison, 1957; Joslin, 1964.

[1]The reservoir was originally saturated at the top of the structure but undersaturated downdip. There was no original gas cap and no water influx throughout the given production history.

Table 4.3. Pressure, Production, and Reservoir Data for the Reynolds Oölitic Zone, Magnolia Field, Smackover Limestone Formation, Colombia County, Arkansas

Months of Prod.	Date	Number of Wells	Average Reservoir Pressure[a] (psig)	Cumulative Production Oil (MMbbl)	Cumulative Production Gas (MMcf)	Cumulative Production Water (Mbbl)	Cumulative GOR (ft^3/bbl)
0	Mar 1938	1	3465	0.0007	0.294	0.216	700
1	Apr "	1	3445	0.0093	3.91	0.456	420
2	May "	1	3440	0.016	7.10	0.704	420
3	Jun "	1	3426	0.022	10.8	0.944	481
4	Jul "	1	3400	0.031	16.2	1.19	529
5	Aug "	1	3380	0.040	20.3	1.44	510
6	Sep "	1	3350	0.048	22.9	1.68	481
7	Oct "	2	3280	0.065	39.1	1.93	600
8	Nov "	4	3320	0.091	64.5	2.17	705
9	Dec "	6	3390	0.128	100	2.42	781
10	Jan 1939	8	3430	0.189	163	2.66	530
11	Feb "	10	3385	0.275	252	2.89	916
12	Mar "	15	3403	0.391	367	3.14	973
13	Apr "	21	3410	0.495	464	3.38	938
14	May "	27	3400	0.698	641	3.62	918
15	Jun "	34	3370	1.001	899	3.86	897
16	Jul "	46	3358	1.406	1317	4.11	937
17	Aug " [b]	53	3437	1.652	1540	4.36	926
18	Sep "	67	3325	2.133	1952	4.60	915
19	Oct "	71	3380	2.614	2366	4.85	905
20	Nov "	79	3370	3.219	2888	5.09	897
21	Dec "	82	3355	3.849	3421	5.35	889
22	Jan 1940	87	3338	4.471	3952	5.58	884
23	Feb "	93	3315	5.050	4455	6.60	882
24	Mar "	97	3308	5.652	4985	8.46	882
25	Apr "	102	3301	6.257	5523	11.1	883
26	May "	105	3295	6.879	6093	14.2	886
27	Jun "	105	3288	7.483	6650	18.2	889
28	Jul "	109	3282	8.137	7254	23.5	891
29	Aug "	111	3280	8.793	7852	30.5	893
30	Sep "	112	3268	9.430	8430	38.3	894
31	Oct "	113	3249	10.027	8978	49.1	895
32	Nov "	114	3237	10.612	9498	62.2	895
33	Dec "	115	3236	11.226	10033	78.3	893
34	Jan 1941	116	3235	11.838	10547	97.2	891
35	Feb "	116	3231	12.389	11005	117.2	888
36	Mar "	116	3215	13.000	11516	141.7	886
37	Apr "	116	3200	13.598	12039	168.1	885
38	May "	116	3184	14.214	12578	198.3	885
39	Jun "	116	3175	14.810	13109	230.1	885
40	Jul "	116	3165	15.423	13652	265.7	885
41	Aug "	116	3155	16.033	14197	307.9	885
42	Sep "	115	3147	16.625	14736	355.2	886
43	Oct "	115	3141	17.208	15251	412	886

Table 4.3. (Contd.)

Months of Prod.	Date	Number of Wells	Average Reservoir Pressure[a] (psig)	Cumulative Production			Cumulative GOR (ft^3/bbl)
				Oil (MMbbl)	Gas (MMcf)	Water (Mbbl)	
44	Nov 1941	115	3135	17.770	15,725	474.7	885
45	Dec "	115	3124	18.349	16,197	547.6	884
46	Jan 1942	115	3114	18.931	16,663	623.7	880
47	Feb "	115	3104	19.456	17,116	695.4	880
48	Mar "	115	3097	20.037	17,624	777.9	880
49	Apr "	115	3091	20.564	18,102	859.6	880
50	May "	115	3086	21.090	18,595	945.8	882
51	Jun "	115	3078	21.592	19,086	1031	884
52	Jul "	115	3070	22.123	19.596	1121	886
53	Aug "	115	3063	22.646	20,108	1213	888
54	Sep "	115	3058	23.158	20,609	1303	890
55	Oct "	115	3055	23.670	21,110	1399	892
56	Nov "	115	3051	24.182	21,614	1493	893
57	Dec "	115	3045	24.715	22,132	1593	896
58	Jan 1943		3038	25.253	22,661	1680	897
59	Feb "		3032	25.737	23,148	1756	899
60	Mar "		3027	26.268	23,684	1836	902
61	Apr "		3023	26.773	24,223	1900	905
60	May "		3018	27.298	24,799	2002	908
63	Jun "		3015	27.802	25,360	2132	912
64	Jul "		3013	28.320	25,926	2267	915
65	Aug		3011	28.813	26,467	2336	919
66	Sep "		3009	29.288	26,974	2410	921
67	Oct "		2995	29.755	27,470	2491	923
68	Nov "		2981	30.238	27,917	2545	923
69	Dec "		2972	30.714	28,366	2603	924
70	Jan 1944		2970	31.191	28,813	2659	924
71	Feb "		2969	31.638	29,243	2711	924
72	Mar "		2967	32.116	29,732	2771	926
73	Apr "		2966	32.576	30,209	2831	927
74	May "		2965	33.050	30,711	2894	929
75	Jun "		2960	33.510	31,214	2957	931
76	Jul "		2952	33.983	31,715	3026	933
77	Aug "		2943	34.452	32,210	3095	935
78	Sep "		2935	34.906	32,685	3159	936
79	Oct "		2928	35.376	33,166	3226	938
80	Nov "		2923	35.820	33,597	3293	938
81	Dec "		2917	36.280	34,042	3359	938
82	Jan 1945[c]		2911	36.738	34,503	3424	939
83	Feb "		2906	37.126	34,902	3486	940
84	Mar "		2900	37.558	35,365	3555	942
85	Apr "		2895	37.978	35,827	3624	943
86	May "		2889	38.402	36,303	3695	945
87	Jun "		2884	38.810	36,768	3766	947

Table 4.3. (Contd.)

Source: Carpenter, et al., 1943, Tables 8 and 13; Pirson, 1950, Table 7-8a (Data for March 1938 through December 1942 available in Carpenter, et al., 1943, U.S. Bur Mines RI 3720. For March 1938 through December 1948 available in Pirson, S.J., 1950, *Elements of Oil Reservoir Engineering,* McGraw-Hill, N.Y.)

[a]Datum, 7100 ft ss.

[b]Field shut down from 7:00 AM August 7 to 7:00 AM September 1, 1939 -- 15 days. During the first seven days of this shut down pressure increased by 79 psig indicating an effective water drive.

[c]Water injection commenced on January 31, 1945.

RESERVOIR DATA:

Producing mechanisms:	Gas cap expansion/water drive
Main producing zone:	Reynolds lime
Estimated area:	5600 acres
Thickness of producing formation:	0-300 ft
Trap type:	Anticlinal
Average formation dip:	5°
Crest of Magnolia structure on top of Smackover Limestone:	7,000 ft ss
Maximum closure on top of Smackover Limestone:	321 ft
Original oil-water contact:	7,321 ft ss
Original gas-oil contact:	7,138 ft ss
Average net thickness of:	
oil-saturated reservoir:	74 ft
gas-cap:	53.6 ft
Original volume of:	
oil-saturated reservoir:	345,550 acre-ft
gas-cap:	74,000 acre-ft
Average porosity, Ø:	16.82%
Average permeability, K:	1,500 md
Connate water saturation (selected arbitrarily):	20%
Formation volume factor of the reservoir water:	1.025 bbl/STB
Original reservoir pressure at 7100 ft ss:	3465 psig
Reservoir temperature at 7294 ft ss, January, 1940:	207°F
Approximate initial gas-oil ratio:	825 ft^3/bbl
Tank Oil gravity:	38.8°API
Original reservoir volume factor:	1.476
Saturation pressure of oil sample at 7,264 ft ss:	
Bur of Mines:	3,106 psia
Carter Oil Co:	3,070 psia

Table 4.3. (Contd.)

Encroachment factor calculation by Elliott, 1946:	
K, bbls of encroached water/month/lb. differential between reservoir pressure at a given time and the original reservoir pressure:	1,130 bbl/16-month
Area:	523,000 acre-ft
K_a, encroachment factor; "degree" of water driven when comparing one reservoir to another; K divided by acre-ft of oil reservoir:	0.0021 bbl/lb-month/acre-ft
Water Influx:	0.007 bbl/day/psi/acre

No wells were completed in gas cap; all gas produced was associated with oil.

Source: Carpenter, et al., 1943; Pirson, 1950.

Table 4.4. Pressure, Production, and Reservoir Data for the Hobbs (Grayburg-San Andres) Field, Lea County, New Mexico

Time (mos)	Date	Number of Wells: Prod.	Number of Wells: Inj.	Number of Wells: Pressure Measure-ments	Average Bottom Hole Pressure[a] (psi)	Cumulative Oil Prod.[b] (MMbbl)	Annual Production: Gas[c] (MMCF)	Annual Production: Water[c] (Mbbl)
28	Oct 1930			5	1497.4			
31	Jan 1931			9	1475.2			
34	Apr 1931			9	1468.2			
37	Jul 1931			10	1437.2			
41	Nov 1931			64	1430.5			
42	Dec 1931			36	1435.6			
43	Jan 1932			23	1436.7			
44	Feb 1932			28	1401.2			
48	Jun 1932			34	1394.5			
49	Jul 1932			30	1390.9			
52	Oct 1932			78	1375.4			
55	Jan 1933			43	1373.6			
57	Mar 1933			103	1373.1			
61	Jul 1933			27	1362.7			
62	Aug 1933			92	1355.2			
64	Oct 1933			149	1351.6			
68	Feb 1934			147	1342.9			
72	Jun 1934			34	1310.1			
74	Aug 1934			110	1325.0			
77	Nov 1934			169	1328.4			
78	Dec 1934	209				53.1		
80	Feb 1935			94	1320.6			
83	May 1935			150	1257.1			
86	Aug 1935			127	1272.8			
90	Dec 1935	267				73.2		
93	Mar 1936			158	1268.8			
99	Sep 1936			154	1242.5			
102	Dec 1936	242				74.1		
104	Feb 1937			151	1229.4			
110	Aug 1937			134	1201.9			
114	Dec 1937	246				88.4		
116	Feb 1938			121	1198.8			
122	Aug 1938			129	1186.4			
126	Dec 1938	254				86.0		
128	Feb 1939			136	1185.1			
135	Sep 1939			173	1181.8			
138	Dec 1939	251				90.4		
141	Mar 1940			137	1168.8			
147	Sep 1940			151	1188.5			
150	Dec 1940	263				94.1		
152	Feb 1941			186	1190.7			
158	Aug 1941			182	1181.9			

Table 4.4. (Contd.)

Time (mos)	Date	Number of Wells: Prod.	Number of Wells: Inj.	Number of Wells: Pressure Measure-ments	Average Bottom Hole Pressure[a]	Cumulative Oil Prod.[b] (MMbbl)	Annual Production: Gas[c] (MMCF)	Annual Production: Water[c] (Mbbl)
162	Dec 1941	265				97.9		
164	Feb 1942			180	1151.5			
170	Aug 1942			172	1180.3			
174	Dec 1942	262				100.9		
176	Feb 1943			161	1178.8			
182	Sep 1943			140	1165.8			
186	Dec 1943	262				104.7		
188	Feb 1944			159	1155.6			
194	Aug 1944			160	1157.3			
198	Dec 1944	262				108.8	6605	3542
200	Feb 1945			155	1161.5			
206	Aug 1945			156	1154.1			
210	Dec 1945	256				112.6	6042	3208
212	Feb 1946			156	1158.1			
218	Aug 1946			164	1143.2			
222	Dec 1946	258				116.2	4919	2724
224	Feb 1947			170	1141.2			
234	Dec 1949	254				119.8	4772	3264
236	Feb 1948			171	1141.9			
246	Dec 1948	257				123.6	5462	3317
248	Feb 1949			164	1139.4			
258	Dec 1949	256				127.3	5548	3916
260	Feb 1950			163	1167.7			
270	Dec 1950	255				131.3	6431	5601
274/275	Apr/May 1951			147	1087.3			
282	Dec 1951	262				135.6	8512	5611
284	Feb 1952			116	1058.8			
294	Dec 1952	263				139.5	9352	3828
296	Feb 1953			29	1004.6			
303	Sep 1953			181	1009.7			
306	Dec 1953	275				143.1	9730	2944
308	Feb 1954			29	986.4			
318	Dec 1954	284				146.5	8192	2895
320	Feb 1955			30	985.6			
330	Dec 1955	289				149.9	7857	2386
332	Feb 1956			28	941.4			
342	Dec 1956	293				153.3	8259	2512
343	Jan 1957			23	947.0			
354	Dec 1957	307				156.8	8641	2973
356	Feb 1958			27	901.7			
366	Dec 1958[d]	313				160.0	8049	3331
368	Feb 1959			46	877.9			
378	Dec 1959	327				163.1	7938	3450
380	Feb 1960			49	882.5			

Table 4.4. (Contd.)

Time (mos)	Date	Number of Wells: Prod.	Inj.	Pressure Measure-ments	Average Bottom Hole Pressure[a]	Cumulative Oil Prod. (MMbbl)	Annual Production: Gas (MMCF)	Water (Mbbl)
390	Dec 1960	328				166.5	7909	3602
392	Feb 1961			40	845.1			
402	Dec 1961	336				169.8	7573	3545
404	Feb 1962			30	876.0			
414	Dec 1962	338				173.0	7275	3252
416	Feb 1963			44	874.2			
426	Dec 1963	341				176.4	7040	3046
428	Feb 1964			36	892.5			
438	Dec 1964	341				179.8	6962	3380
440	Feb 1965			30	921.4			
450	Dec 1965	338				183.2	6761	3662
452	Feb 1966			43	890.6			
462	Dec 1966	339				186.9	7027	4073
464	Feb 1967			31	877.6			
474	Dec 1967	334				191.0	7967	4009
476	Feb 1968			33	868.4			
486	Dec 1968	336				195.1	9750	4130
488	Feb 1969			33	879.6			
498	Dec 1969	337				199.8	11483	4960
500	Feb 1970			30	805.5			
510	Dec 1970	343				204.7	14071	5399
512	Feb 1971			34	773.5			
522	Dec 1971	333				209.5	15353	6041
524	Feb 1972			26	702.4			
534	Dec 1972	328	1			214.0	15627	5838
538	Apr 1973			20	711.6			
546	Dec 1973	332	1			218.3	15447	6017
550	Apr 1974			19	683.5			
558	Dec 1974	330	3			222.4	14515	6451
562	Apr 1975			15	590.2			
570	Dec 1975	326	14			226.3	13883	7123
574	Apr 1976			19	636.7			
582	Dec 1976	315	31			229.7	11170	6943
586	Apr 1977			20	609.5			
594	Dec 1977	316	33			233.4	10561	9118
598	Apr 1978			14	584.6			
606	Dec 1978	310	36			237.4	10854	10885

Source: Stipp, et al., 1956, pp. 206-207; NM Oil and Gas Eng. Comm., Annual Reports, 1934-1978; Foster, pers. and written comm., 1980.

[a]Arithmetic well average pressure; pool datum 400 ft ss.

[b]Oil production data unavailable prior to 1934.

[c]Gas and water production data unavailable prior to 1944.

Table 4.4. (Contd.)

[d]Production data is questionable for 1958 and 1968 because of computerization. This normally involves accumulative production data given in the annual reports of the NM Oil and Gas Eng. Comm. Some fields have errors in annual production figures, but these are normally minor. (Foster, written communication, March 14, 1980). The values given here were calculated from annual data and should be fairly good.

RESERVOIR DATA:

Producing Mechanism:	Water drive	
Producing Zones:	Grayburg (dolomitic sands at approx. 3700	
	San Andres (porous white limestone) at approx. 3930 ft	
Trap Type:	Anticline	
Horizontal permeability:	50 md	
Porosity:	15%	
Water saturation (% of pore space):	15%	
Oil gravity at 60°F:	34° API	
Gravity of gases produced with the oil:[1]	Analysis I	Analysis II
Observed gravity:	1.050	0.933
Calculated gravity:	1.044	0.938
Initial Field pressure at 400 ft ss:	1525 psi	
Average GOR during March 1931:	900 ft^3/bbl	

Source: Stipp, et al., 1956, pp. 206-207; NM Oil and Gas Eng. Comm., Annual Reports, 1934-1978; Foster, pers. and written comm., 1980.

[1]DeFord and Wahlstrom, 1932, pg. 89.

Table 4.5. Pressure, Production, and Reservoir Data for the Drinkard (Yeso) Field Lea County, New Mexico

Time (Mos)	Date	Prod.	Inj.	No. Pressure Measurements: Andrews Zone	No. Pressure Measurements: Vivian Zone	Bottom Hole: Andrews Zone	Pressure, psig[a]: Vivian Zone	Cumulative Production: Oil (bbl)	Cumulative Production: Gas (MCF)	Cumulative Production: Water (bbl)
2	Dec 1944	1						2,898	3,996	
14	Dec 1945	13						99,351	271,069	3,165
26	Dec 1946	76						784,590	1,912,412	15,263
38	Dec 1947	221						4,124,749	6,975,303	48,766
50	Dec 1948	315						10,379,087	19,514,920	139,385
62	Dec 1949	362						17,133,735	41,440,508	259,745
74	Dec 1950	415						23,021,079	69,546,993	366,001
86	Dec 1951	429						28,045,581	99,085,173	480,973
98	Dec 1952	423						32,055,022	128,872,505	610,448
110	Dec 1953	473						35,481,046	157,391,917	730,789
122	Dec 1954	468						38,312,016	182,594,735	844,955
134	Dec 1955	468						40,782,392	207,374,267	968,409
139	May 1956			3	91	1270.3	1005.8			
146	Dec 1956	467						42,835,301	230,971,759	1,096,011
151	May 1957			2	86	1499.0	973.5			
158	Dec 1957	460						44,697,129	252,889,294	1,234,331
163	May 1958			1	73	1773.0	928.2			
170	Dec 1958	461						46,431,580	274,135,834	1,379,963
181	Nov 1959				71		951.4			
182	Dec 1959	457						48,020,552	295,093,389	1,503,865
193	Nov 1960				93		913.7			
194	Dec 1960	457						49,493,945	315,014,189	1,626,918
205	Nov 1961				76		905.7			
206	Dec 1961	447						50,880,812	334,241,978	1,770,739
217	Nov 1962				81		895.2			
218	Dec 1962	462						52,417,147	354,076,266	1,905,804
229	Nov 1963				84		855.0			
230	Dec 1963	473						54,015,379	373,601,580	2,086,546
241	Nov 1964				64		801.4			
242	Dec 1964	480						55,773,583	393,623,967	2,232,343
253	Nov 1965				56		836.6			
254	Dec 1965	484						57,637,502	415,298,801	2,385,477

Table 4.5. (Contd.)

Time (Mos)	Date	Prod.	Inj.	No. Pressure Measurements Andrews Zone	No. Pressure Measurements Vivian Zone	Bottom Hole Andrews Zone	Pressure, psig[a] Vivian Zone	Cumulative Production Oil (bbl)	Cumulative Production Gas (MCF)	Cumulative Production Water (bbl)
265	Nov 1966				54		828.3			
266	Dec 1966	495						59,368,740	438,260,514	2,553,864
277	Nov 1967				55		799.0			
278	Dec 1967	486						60,823,309	461,657,987	2,679,367
289	Nov 1968				45		770.5			
290	Dec 1968[b]	476						62,086,284	484,541,075	2,814,749
301	Nov 1969				49		731.0			
302	Dec 1969	493						63,239,882	506,991,765	3,108,479
313	Nov 1970				49		772.5			
314	Dec 1970	501						64,307,904	530,537,019	3,344,050
325	Nov 1971				48		714.7			
326	Dec 1971	478						65,241,727	553,970,044	3,600,685
337	Nov 1972				45		717.7			
338	Dec 1972	481						66,128,302	578,603,123	3,855,322
349	Nov 1973				43		780.2			
350	Dec 1973	498						67,051,438	610,775,421	4,187,366
361	Nov 1974				41		747.7			
362	Dec 1974	533						68,211,512	657,108,674	4,610,722
373	Nov 1975				39		691.7			
374	Dec 1975	609						69,783,997	712,738,348	5,345,392
377	Mar 1976				5		1113.0			
385	Nov 1976				40		687.8			
386	Dec 1976	666	26		2		526.0	71,601,481	772,590,359	6,450,479
396	Oct 1977				2		374.0			
397	Nov 1977				37		636.0			
398	Dec 1977	705	26/4		6		532.0	73,201,477	826,846,081	7,664,565
399	Jan 1978				11		443.9			
409	Nov 1978				35		503.4	74,781,434	873,632,486	8,868,964
410	Dec 1978	725	26/4		13		736.4			

Source: Ray Foster, personal and written communication; Stipp, et al., 1956; NM Oil and Gas Eng. Comm., Annual Reports, 1959-1978.

[a]Arithmetic well average; Andrews Zone datum - 3225 ft ss and Vivian Zone datum - 3050 ft ss.

Table 4.5. (Contd.)

[b]Production data is questionable for 1958 and 1968 because of computerization. This normally involves accumulative production data given in the annual reports of the NM Oil and Gas Engineering Committee. Some fields have errors in annual production figures, but these are normally minor. (Foster, written communication, March 14, 1980). The values given here were calculated from annual data and should be fairly good.

RESERVOIR DATA:

Producing Mechanism:	Solution Gas Drive and Gas-Cap Drive	
Trap Type:	Anticline	
Producing Zones:	Vivian Zone	Andrews Zone
Depth of Producing Zones:	3050 ft ss	3525 ft ss
Initial Field Pressure at Datum:	2660 psi	2812 psi
Oil Gravity:	40°API	
Specific Gravity of Gas:	765	
Average Horizontal Permeability:	5.6 md	
Average Porosity:	11.6%	
Water Saturation (% of pore space):	16.20%	
Oil Saturation (% of pore space):	13.7%	

Source: Ray Foster, personal and written communication; Stipp, et al., 1956; NM Oil and Gas Eng. Comm., Annual Reports, 1959-1978.

Table 4.6. Pressure, Production, and Reservoir Data for the Blinebury (Oil) Field, Lea County, New Mexico

Time (Mos)	Date	No. of Wells: Prod.	No. of Wells: Inj/Gas lift	No. of Well Pressure Measurements	Average Bottom Hole Pressure (psi)[a]	Cumulative Production: Oil (bbl)	Cumulative Production: Gas (Mcf)	Cumulative Production: Water (bbl)
0	Dec 1945	1				5,028	1,001	25
12	Dec 1946	4				29,187	24,085	2,506
24	Dec 1947	5				53,570	165,986	2,658
36	Dec 1948	8				87,289	269,985	2,883
48	Dec 1949	12				133,171	355,218	4,366
60	Dec 1950	12				178,185	543,706	6,297
72	Dec 1951	13				218,575	887,858	9,823
84	Dec 1952	23				338,950	1,284,189	12,240
96	Dec 1953	22				524,121	1,795,760	18,196
108	Dec 1954	43				861,829	2,621,169	23,434
120	Dec 1955	73				1,656,872	2,839,473	57,787
132	Dec 1956	104				2,823,922	7,942,980	120,426
144	Dec 1957	120				4,118,527	16,068,359	176,845
156	Dec 1958[b]	130				5,242,969	25,186,274	242,600
168	Dec 1959	131				6,242,346	35,247,397	312,403
180	Dec 1960	150				7,213,358	45,447,047	366,378
192	Dec 1961	179				8,303,145	56,647,949	447,616
204	Dec 1962	216				9,622,674	71,085,891	571,352
216	Dec 1963	264				11,413,463	90,761,740	679,550
228	Dec 1964	334				13,753,078	113,927,591	830,789
229	Jan 1965			59	1436.3			
240	Dec 1965	363				16,367,762	142,902,402	1,019,302
241	Jan 1966			51	1297.6			
252	Dec 1966	367				18,644,280	172,838,002	1,214,747
253	Jan 1967			42	1153.4			
264	Dec 1967	363				20,433,491	200,137,947	1,384,310
265	Jan 1968			45	1101.7			
276	Dec 1968[b]	365				21,961,879	226,657,673	1,536,807
277	Jan 1969			47	1031.2			

Table 4.6. (Contd.)

Time (Mos)	Date	No. of Wells: Prod.	No. of Wells: Inj/Gas lift	No. of Well Pressure Measurements	Average Bottom Hole Pressure (psi)[a]	Cumulative Production: Oil (bbl)	Cumulative Production: Gas (Mcf)	Cumulative Production: Water (bbl)
288	Dec 1969	369				23,269,187	251,504,190	1,751,602
289	Jan 1970			40	976.4			
293	May 1970			32	686.0			
298	Oct 1970			33	719.1			
300	Dec 1970	372				24,453,829	274,181,611	1,919,775
301	Jan 1971			31	960.5			
305	May 1971			30	664.1			
310	Oct 1971			30	607.2			
312	Dec 1971	344				25,512,483	294,528,303	2,084,768
313	Jan 1972			23	793.4			
317	May 1972			26	548.8			
322	Oct 1972			23	557.5			
324	Dec 1972	322				26,536,656	308,843,836	2,657,683
325	Jan 1973			21	816.9			
329	May 1973			23	684.7			
336	Dec 1973	307				27,441,060	321,165,661	6,477,161
337	Jan 1974			27	720.3			
339	Mar 1974			3	1055.0			
342	Jun 1974			5	880.8			
348	Dec 1974	458				28,429,671	369,909,262	7,297,594
349	Jan 1975			15	666.7			
351	Mar 1975			4	953.8			
360	Dec 1975	482				29,443,471	417,970,788	8,086,833
361	Jan 1976			19	824.6			
362	Feb 1976			5	902.4			
364	Apr 1976			2	1053.0			
372	Dec 1976	487	1			30,436,285	461,443,485	8,773,762
373	Jan 1977			22	719.3			
384	Dec 1977	501	1/9			31,382,665	504,963,751	9,541,642
385	Jan 1978			24	758.5			

Table 4.6. (Contd.)

Time (Mos)	Date	No. of Wells Prod.	No. of Wells Inj/Gas lift	No. of Wells Pressure Measurements	Average Bottom Hole Pressure (psi)[a]	Cumulative Production Oil (bbl)	Cumulative Production Gas (Mcf)	Cumulative Production Water (bbl)
386	Feb 1978			2	806.0			
396	Dec 1978	508	1/9			32,281,831	544,580,659	10,288,115

Source: Foster, pers. and written comm., 1980; NM Oil & Gas Eng. Comm., annual reports 1965-1978; Stipp, et al., 1956; Frick, 1962.

[a]Arithmetic well average pressure; pool datum 2400 ft ss.

[b]Production data is questionable for 1958 and 1968 because of computerization. This normally involves accumulative production data given in the annual reports of the NM Oil and Gas Engineering Committee. Some fields have errors in annual production figures, but these are normally minor. (Foster, written communication, March 14, 1980). The values given here were calculated from annual data and should be fairly good.

RESERVOIR DATA:

Producing mechanism:	Solution gas drive
Trap type:	Anticline
Average producing depth:	5610 ft
Average producing thickness:	43 ft
Average permeability:	1.8 md
Average porosity:	12.7%
Average oil saturation:	4.9%
Average calculated connate water saturation:	33%
Average total water saturation:	36%
Initial field pressure at 2200 ft ss:	882 psi
Oil gravity:	41°API

Source: Foster, pers. and written comm., 1980; NM Oil & Gas Eng. Comm., annual reports, 1965-1978; Stipp, et al., 1956; Frick, 1962.

Table 4.7. Pressure, Production, and Reservoir Data for the Vacuum Abo Reef Field, Lea County, New Mexico

Time (Mos)	Date	No. of Wells: Prod.	No. of Wells: Inj./Gas Lift	No. of Wells: Press. Msmnts.	Average Bottom Hole Pressure[a] (psi)	Cumulative Production: Oil (Mbbl)	Cumulative Production: Gas (MMcf)	Cumulative Production: Water (Mbbl)
2	Dec 1960					8	10	
14	Dec 1961	43				743	612	38
23	Sep 1962			30	2684.8			
26	Dec 1962	93				3,286	2,724	95
35	Sep 1963			46	2433.8			
38	Dec 1963	129				7,522	6,478	196
41	Mar 1964			100	2291.4			
47	Sep 1964			93	2215.8			
50	Dec 1964	143				12,638	11,079	369
53	Mar 1965			78	2119.9			
59	Sep 1964			82	2021.9			
62	Dec 1965	143				17,551	17,328	617
65	Mar 1966			64	2039.9			
71	Sep 1966			59	2041.3			
74	Dec 1966	143				23,024	23,578	1,049
77	Mar 1967			37	1950.6			
83	Sep 1967			30	1864.7			
86	Dec 1967	141				28,806	30,100	1,473
89	Mar 1968			33	1780.6			
95	Sep 1968			29	1776.8			
98	Dec 1968	141				34,838	36,775	1,960
101	Mar 1969			25	1719.4			
107	Sep 1969			23	1663.3			
110	Dec 1969	139				40,784	43,245	2,748
113	Mar 1970			17	1729.6			
119	Sep 1970			16	1701.3			
122	Dec 1970	137				46,493	49,740	3,672
125	Mar 1971			15	1683.8			
131	Sep 1971			21	1630.4			
134	Dec 1971	136				51,863	57,461	4,601

Table 4.7. (Contd.)

Time (Mos)	Date	No. of Wells Prod.	Inj./Gas Lift	Press. Msmnts.	Average Bottom Hole Pressure[a] (psi)	Cumulative Production Oil (Mbbl)	Gas (MMcf)	Water (Mbbl)
137	Mar 1972			23	1535.0			
143	Sep 1972			20	1530.8			
146	Dec 1972	137				55,944	65,656	5,738
149	Mar 1973			22	1553.1			
155	Sep 1973			21	1548.1			
158	Dec 1973	132				60,025	73,682	6,534
161	Mar 1974			14	1497.7			
167	Sep 1974			18	1423.8			
170	Dec 1974	127				63,440	81,203	7,493
173	Mar 1975			7	1362.8			
180	Oct 1975			14	1285.1			
182	Dec 1975	128	1			66,537	87,801	8,456
185	Mar 1976			7	1794.7			
186	Apr 1976			9	1224.3			
191	Sep 1976			9	1501.1			
194	Dec 1976	119	1			69,350	93,367	9,626
197	Mar 1977			9	1514.8			
203	Sep 1977			8	1386.0			
206	Dec 1977	113	1/5			71,516	97,993	11,111
209	Mar 1978			9	1433.9			
216	Oct 1978			6	1783.3			
218	Dec 1978	110	3/5			73,301	102,406	12,605

Source: Roswell Geological Society, 1966; NM Oil & Gas Eng. Comm., Annual Reports, 1962-1978; Foster, 1980, pers. & written comm.

[a]Arithmetic well average pressure; pool datum 4650 ft ss.

[b]Production data is questionable for 1968 because of computerization. This normally involves accumulative production data given in the annual reports of the NM Oil and Gas Eng. Comm. Some fields have errors in annual production figures, but these are normally minor (Foster, written communication, March 14, 1980). The values given here were calculated from annual data, and should be fairly good.

Table 4.7. (Contd.)

RESERVOIR DATA:

Producing mechanism:	Solution-gas drive and partial water drive
Producing zone:	The Abo formation
Lithology:	Coarsely crystalline to vuggy dolomite, fractured, with streaks of gray shale and anhydritic dolomite.
Trap type:	Stratigraphic (Reef), updip pinchout of porosity, downdip limit of field controlled by water-partially structurally controlled.
Approximate average pay thickness (gross):	560 ft
Productive area:	11,760 acres
Estimated formation volume:	6,585,600 acre-ft
Average porosity:	4.7%
Average permeability:	13.9 md
Water saturation:	26%
Oil saturation:	74%
Oil gravity:	40°API
GOR at 0 psi and 76°F:	900 ft^3/bbl
Gas gravity at 0 psi and 76°F:	1.064
Initial field pressure at 4,800 ft ss:	3,230 psi
Reservoir temperature at 4,725 ft ss:	136°F
Bubble-point (calc. by Standings Correlation):[1]	2,036 psi

Source: Roswell Geological Society, 1966; NM Oil & Gas Eng. Comm., Annual Reports, 1962-1978; Foster, 1980, pers. & written comm.

[1] Frick, 1962, pg. 19-4.

Table 4.8. Pressure, Production, and Reservoir Data for the Empire Abo Pool, Eddy County, New Mexico

Time (Mos)	Date	No. of Wells Prod.	No. of Wells Inj.	No. of Wells Press. Msmnts. Taken	Reservoir Pressure (psig)[a]	Cumulative Production Oil (bbl)	Cumulative Production Gas (Mcf)	Cumulative Production Water (bbl)	Cumulative Gas Injection (MMcf)	GOR (ft^3/bbl)
0	Nov 1957				2396[b]					
2	Dec 1957	1				3,793				
14	Dec 1958[c]	6				84,216	75,662	11,862		
26	Dec 1959	65				917,333	926,428	19,675		
36	Oct 1960			23	2096.8					
38	Dec 1960	194				4,250,307	4,588,316	73,537		1200
45	Jul 1961			69	1996.6					
50	Dec 1961	233				9,099,402	10,181,524	199,674		1200
57	Jul 1962			65	1915.5					
62	Dec 1962	246				14,479,606	16,577,408	385,403		1200
69	Jul 1963			70	1861.1					
74	Dec 1963	245				20,191,892	23,741,555	786,636		1200
81	Jul 1964			84	1799.0					
86	Dec 1964	245				25,963,729	31,209,100	1,211,568		1000
93	Jul 1965			71	1785.6					
98	Dec 1965	244				31,621,725	38,683,806	1,684,723		900
105	Jul 1966			86	1708.7					
110	Dec 1966	244				38,108,094	47,264,525	2,316,118		800
117	Jul 1967			84	1662.6					
122	Dec 1967	242				45,283,603	56,785,250	2,831,025		800
129	Jul 1968			73	1638.9					
134	Dec 1968[c]	242				53,155,171	67,603,352	3,322,150		800
141	Jul 1969			65	1518.7					
146	Dec 1969	242				61,555,075	79,620,548	3,870,784		900
153	Jul 1970			56	1433.6					
158	Dec 1970	243				70,691,925	92,676,037	4,531,040		1000
165	Jul 1971			54	1453.1					
170	Dec 1971	241				79,971,397	105,896,737	5,275,936		1180
177	Jul 1972			51	1372.3					
182	Dec 1972	236				89,346,219	118,961,498	6,059,749		1200

Table 4.8. (Contd.)

Time (Mos)	Date	No. of Wells: Prod.	No. of Wells: Inj.	Press. Msmnts. Taken	Reservoir Pressure (psig)[a]	Cumulative Production: Oil (bbl)	Cumulative Production: Gas (Mcf)	Cumulative Production: Water (bbl)	Cumulative Gas Injection (MMcf)	(ft^3/bbl)
189	Jul 1973			49	1284.2					
194	Dec 1973	230				99,089,847	131,978,355	6,843,094		1200
201	Jul 1974			56	1367.2					
206	Dec 1974	174	7			112,470,217	146,950,217	7,368,311	6.0	1200
213/214	Jul/Aug 1975			49	1365.0					
218	Dec 1975	190	7			127,690,017	167,986,538	7,946,452	19.2	1200
225	Jul 1976			6	1217.5					
228	Oct 1976			48	1259.7					
230	Dec 1976	169	13			142,986,459	175,896,458	8,640,069	32.2	1200
237	Jul 1977			2	1212.5					
238	Aug 1977			1	1214.0					
239	Sep 1977			2	1201.5					
240	Oct 1977			32	1204.1					
242	Dec 1977	185	14			158,155,323	185,977,627	9,085,524	45.2	1200
252/253	Oct/Nov 1978			43	1192					
254	Dec 1978	217	17			172,523,426	194,949,058	9,712,723		1400

Source: Roy Foster, pers. and written communication, Roswell Geological Society, 1960, Killough and Foster, H.P., 1979, Figures 3, 9, and 17, New Mexico Oil and Gas Engineering Committee, Annual Reports, 1960-1978.

[a]Original reservoir pressure, psia, at 109°F and 6022 ft.

[b]Arithmetic well average; pool datum 2400 ft.ss.

[c]Production data is questionable for 1958 and 1968 because of computerization. This normally involves accumulative production data given in the annual reports of the NM Oil & Gas Eng. Comm. Some fields have errors in annual production figures, but these are normally minor (Foster, written comm., March 14, 1980). The values given here were calculated from annual data and should be fairly good.

Table 4.8. (Contd.)

RESERVOIR DATA:	
Producing mechanism:	Water drive
Trap type:	Combination structure and stratigraphic
Producing zone:	Biohermal (reef) mass within Abo formation of Leonard series (Permian system). Micro to coarse crystalline, slight to very anhydritic, dolomite. Primary porosity is intercrystalline, with pinpoint-corase vuggy and slight to heavily fractured secondary porosity.
Formation dip:	1° SW to NE 10-20° N to S (crest to forereef)
Average depth:	5,800 ft
Productive area:	11,339 acres
Average thickness:	300 ft
Estimated formation volume:	3,401,700 acre-ft
Porosity:	1.5-18.3%
Water saturation (% pore space):	25-60%
Oil saturation (% pore space):	40-80%
Horizontal permeability:	0.1-1970 md
Original pressure (109°F and 6,022 ft):	2,396 psia
Reservoir temperature:	109°F
Approximate initial GOR:	1,250 ft^3/bbl
Approximate initial FVF:	1.60 reservoir bbl/STB
Saturation pressure:	2,220 psia
FVF at saturation pressure:	1.61 reservoir bbl/STB
Gas gravity:	0.889
Tank oil gravity:	43°API

Source: Roy Foster, pers. and written communication, Roswell Geological Society, 1960, Killough and Foster, H.P., 1979, Figures 3, 9, and 17, New Mexico Oil and Gas Engineering Committee, Annual Reports, 1960-1978.

Table 4.9. Pressure, Production, and Reservoir Data for the Wilcox Sand Reservoir of the Oklahoma City Field, Oklahoma

Time (Mos)	Date	Reservoir Pressure (psi)	Cumulative Oil Production (MMbbl)	Cumulative Gas Production (MMcf)	GOR (ft^3/bbl)
0	Jan 1931	2600	5.9	280.4	1040
12	Jan 1932	2090	37.8	9,799.5	2830
24	Jan 1933	1700	59.8	25,673	2840
36	Jan 1934	975	106.8	70,768	4290
48	Jan 1935	500	156.2	99,295	3860
60	Jan 1936	250	200.5	122,639	1840
72	Jan 1937	130	243		1725
84	Jan 1938	60	290		1135
96	Jan 1939	30	320		980
108	Jan 1940		349		580
120	Jan 1941		379		490
126	Jul 1941		393		520

Source: Muskat, 1949, Fig. 10.44; Hill, et al., 1936, Tables 23 and 54.

RESERVOIR DATA:

Producing mechanism:	Gravity drainage
Productive area:	6900 acres
Original gas-oil contact:	
northern end of field:	5052 ft
southern end of field:	5116-5164 ft
Initial stock-tank oil in place:	1070 MMbbl
Average formation thickness:	103 ft
Average porosity:	18-19%
Permeability:	>1000 md for many samples
Oil gravity:	39.0° API
Connate water content:	1-2%
Reservoir temperature:	130°F
Estimated formation volume:	710,700 acre-ft
Initial reservoir pressure (at 5,100 ss)	2,600 psi
GOR:	795 ft^3/bbl
Specific gravity of oil:	0.830
Formation volume factor:	1.35

Table 4.9. (Contd.)

Gas analyses from two Wilcox zone wells, Oklahoma City Field:

Date:	8/18/31	1/1/36
Sample Depth:	6476 ft	6390 ft
Seperator Pressure:	17.4 psia	86.5 psia
Seperator Temperature:	65°F	46°F
GOR	374 ft^3/bbl	1304 ft^3/bbl
Constituents:		
Carbon dioxide	0.66	0.00
Nitrogen	1.56	2.38
Methane	44.24	73.71
Ethane	19.23	13.27
Propane	18.89	6.28
Isobutane	3.22	0.98
Normal butane	6.95	1.70
Isopentane	1.25	0.38
Normal pentane	1.81	0.34
Hexane	1.25	0.56
Heptane Plus	0.94	0.40
Total	100.00	100.00

Source: Muskat, 1949; Deegan, 1944; Knowlton, et al., 1932; Hill, et al., 1936.

Table 4.10. Pressure, Production, and Reservoir Data for the Main Conroe Sand, Conroe Field, Montgomery County, Texas

Time (days)	Date	Average Reservoir Pressure (psig)	Cumulative Oil Production (MMbbl)	Produced GOR (ft^3/bbl)	Specific Volume[a] of Free Gas (ft^3/ft^3)	Specific Volume[a] of Oil and Its Dissolved Gas (ft^3/bbl)
0	6-1-33	2143	9.070	1630	0.00676	7.46
391	7-26-33	2123	10.84	1760	0.00682	7.49
454	9-27-33	2118	18.24	1280	0.00684	7.50
514	11-26-33	2108	22-34	1180	0.00687	7.51
585	2-5-34	2113	26.08	1130	0.00686	7.50
641	4-2-34	2095	28.65	1110	0.00691	7.52
706	6-6-34	2098	32.03	1070	0.00690	7.51
762	8-1-34	2093	34.83	1050	0.00692	7.52
823	10-1-34	2092	37.71	1030	0.00693	7.52
887	12-4-34	2087	40.18	1025	0.00694	7.53
946	2-1-35	2090	42.90	1015	0.00693	7.52
1005	4-1-35	2090	45.65	1005	0.00693	7.52
1066	6-1-35	2091	48.24	995	0.00693	7.52
1431	6-1-36	2074	60.08			
1919	10-1-37	2053	77.63			
2284	10-1-38	2066	87.89			
2861	5-1-40	2073	100.59			
3227	5-1-41	2070	109.54			
3592	5-1-42	2053	120.38			
3837	1-1 43	2043	129.25			
4018	7-1-43	2033	137.25			
4202	1-1-44	2014	148.18			
4567	1-1-45	1988	170.48			

Source: Schilthuis, 1936, Table 1; Deegan, 1945, Table 1

[a]Calculated by Schilthuis, 1936.

RESERVOIR DATA:

Main producing mechanism:	Water drive
Trap type:	Symmetrical dome
Oil and gas closure:	300 ft
Producing formation:	Cockfield
Producing zones:	Upper Cockfield Sand, Main Conroe Sand
Original oil-water contact:	4,900 ft ss
Original gas-oil contact:	Between 4,850 and 4,860 ft ss
Thickness of gas cap:	170 ft
Thickness of oil zone:	130 ft
Estimated original formation volume:	
gas sand:	181,225 acre-ft
oil sand:	810,000 acre-ft
Crude oil gravity:	38°API

Table 4.10. (Contd.)

Formation volume factor:	
oil and dissolved gas:	1.282
free gas:	153.5
Reservoir temperature:	170°F
Rate of water encroachment:	401,000 ft^3/day
Rate of water encroachment/ pressure gradient:	2,170 ft^3/day/psi
Specific gravity of gas (air = 1):	0.646
Saturation pressure of gas in Conroe crude at 170°F:	2,300 psi
GOR:	600 ft^3/bl
Estimated initial gas cap gas content (at atmospheric T and p):	
Conroe sand:	350,321,670,035 SCF
Upper Cockfield sand:	228,292,223,200 SCF
Total:	578,613,893,235 SCF
Original recoverable reserves:	606,980,000 bbl

Source: Schilthuis, 1936; Michaux and Buck, 1936; and Muskat, 1949

ADDITIONAL RESERVOIR DATA (1974):

	Main Conroe Sand	Upper Cockfield Sand
Original reservoir pressure	2275 psig	2190 psig
Interstitial water saturation:		
gas sand:	30%	28%
oil sand:	30%	38%
Average porosity:		
gas sand:	27%	30%
oil sand:	32%	28%
Permeability of oil sand:	1400 md	775 md
Area:		
gas sand:	Segment I-559 acres[1] Segment II-1840 acres Segment III-842 acres Segment IV-2004 acres	14,700 acres
oil sand:	14,500 acres	2,700 acres
Thickness:		
gas sand:	Segment I-25 ft[1] Segment II-36 ft Segment III-29 ft Segment IV-33 ft	9 ft
oil sand:	67 ft	18 ft
Formation volume:		
gas sand:	170,765 acre-ft	132,300 acre-ft
oil sand:	971,500 acre-ft	48,600 acre-ft

Table 4.10. (Contd.)

	Main Conroe Sand	Upper Cockfield Sand
Initial oil in place:	1,316,899,320 STB	51,056,112 STB
Recovery factor:	0.57	0.525
Initial reserves:	750,632,612 STB	26,804,459 STB
Total initial oil in place:	1,367,955,432 STB	Included with Main Conroe
Total initial reserves:	777,437,071 STB	Included with Main Conroe

Conroe Field Gas Volume Calculations, 1975:

Gas cap gas sands of the Upper Cockfield and Conroe field:	
net acre-ft:	360,000
porosity:	32%
interstitial water saturation:	16%
recovery factor:	70%
Initial gas in place:	
Upper Cockfield and Conroe gas cap gas:	647,000 MMscf
Upper Cockfield solution gas:	27,315
Conroe sand solution gas:	704,541
Total initial gas in place:	1,378,856 MMscf
Total original gas reserves:	970,663 MMscf

[1]The Conroe pay section is made up of six individual sand members and originally had uniform gas-oil contacts and water-oil contacts. Within the Conroe sand are four segments that have limited gas caps.

Table 4.11. Pressure, Production, and Reservoir Data for the Village Oil Pool, Smackover Limestone Formation, Colombia County, Arkansas

Time (Mos)	Date	Average Pool Pressure (psig)	Cumulative Oil Production (MMbbl)	GOR (ft^3/bbl)	Cumulative Water Influx[a] (MMbbl)
0	Jun 1938	3405		1845	
3	Sep "	3395	0.03	4273	0.09
6	Dec "	3385	0.07	9569	0.31
9	Mar 1939	3377	0.12	7428	0.64
12	Jun "	3367	0.18	6817	1.08
15	Sep "	3354	0.27	6261	1.58
18	Dec "	3347	0.38	5113	2.06
21	Mar 1940	3334	0.50	4097	2.56
24	Jun "	3321	0.61	4517	3.05
27	Sep "	3309	0.72	4678	3.56
30	Dec "	3296	0.77	4488	4.06
33	Mar 1941	3279	0.87	4460	4.52
36	Jun "	3268	0.97	4799	4.98
39	Sep "	3253	1.06	4939	5.40
42	Dec "	3238	1.15	4506	5.82
45	Mar 1942	3220	1.25	3748	6.24
48	Jun "	3205	1.35	4276	6.64
51	Sep "	3180	1.45	3057	7.01
54	Dec "	3180	1.55	2941	7.38
57	Mar 1943	3140	1.64	2955	7.76
60	Jun "	3120	1.73	3025	8.10

Source: Bruce, 1944, Fig. 7.

[a]Calculated by Bruce, 1944.

RESERVOIR DATA:

Producing mechanism:	Water drive
Producing zone:	Reynolds lime
Trap type:	Round anticline
Number of producing wells:	12
Original reservoir volume:	
gas cap:	11.3 MMbbl
oil zone:	18.8 MMbbl
Reservoir thickness:	
gas cap:	35 ft
oil zone:	22 ft
Water influx:	4000 bbl/day
Average permeability:	2000 md
Average porosity:	20.0%
Estimated area:	640 acres
Estimated formation volume:	
gas cap	22,400 acre-ft
oil zone:	14,080 acre-ft

Table 4.11. (Contd.)

Original reservoir pressure at 7130 ft ss:	3405 psia
Tank oil gravity:[1]	43° API

Source: Bruce, 1944.

[1] Thigpen et al., 1943, Tables 3 and 4.

Table 4.12. Pressure, Production, and Reservoir Data for the Gloyd Mitchell Zone, Rodessa Field, Louisiana

Months After Start of Production	No. Wells	Average Pressure (psig)	Cumulative Production (bbl) Oil	Gas	Cumulative GOR (SCF/STB)
1	2	2700[a]	12,160	7,600	625
4	4	2490	88,160	77,140	875
7	12	2280	291,840	300,884	1031
10	28	2070	854,240	1,127M	1319
13	59	1860	1,808,800	2,971M	1643
16	79	1650[b]	2,769,440	5,662M	2045
19	93	1250	3,651,040	9,801M	2684
20	96	1115	3,903,360	11,290M	2892
21	93	1000	4,122,240	12,778M	3100
22	93	900	4,316,800	14,237M	3298
23	95	825	4,493,120	15,577M	3467
24	94	740	4,657,820	16,841M	3616
25	95	725	4,809,280	18,027M	3748
26	92	565	4,943,040	19,030M	3850
27	94	530	5,070,720	19,962M	3937
28	94	500	5,192,320	20,850M	4016
29	93	450	5,295,680	21,553M	4070
30	95	405	5,392,960	22,165M	4110
31	91	350	5,487,200	22,740M	4144
32	93	310	5,575,360	23,243M	4169
33	92	390	5,666,560	23,726M	4187
34	88	300	5,754,720	24,176M	4201
35	87	280	5,815,520	24,474M	4208
36	90	310	5,888,480	24,824M	4216
37	88	300	5,952,320	25,111M	4219
38	88	325	6,019,200	25,412M	4222
39	87	300	6,083,040	25,687M	4223
40	82	275	6,143,840	25,930M	4220
41	85	225	6,207,680	26,160M	4214

Source: Craft and Hawkins, 1959, Table 3.5.

[a]Linear decline assumed from original to first measured BHP (bottom hole pressure).

[b]First measured reservoir pressure. All subsequent pressures are measured.

RESERVOIR DATA:

Producing mechanism:	Solution gas drive
up to 200 Mbbl of production:	Liquid expansion
followed by:	gas expansion
Main producing zone:	Mitchell sandstone within the Gloyd zone
Depth of Gloyd zone:	5,600 ft ss
Depth of Mitchell sandstone:	5,630 ft ss

Table 4.12. (Contd.)

Maximum thickness of Gloyd zone:	135 ft
Maximum thickness of Mitchell sandstone:	25 ft
Maximum producing closure:	500 ft
Productive area:	5,650 acres
Estimated formation volume:	84,750 acre-ft
Approximate bubble-point pressure:	2200 psig
Original bottom hole pressure:	2700 psig
Original solution gas-oil ratio:	627 SCF/STB
Tank Oil gravity:	42.8 API
Oil gravity at reservoir conditions:	76° API
Oil compressibility:	1.35×10^{-5} vol/vol/psi
FVF:	1.351
Reservoir temperature:	192.5° F
Average porosity:	16.5%
Maximum permeability	38 md
Average calculated connate water saturation:	31%

Gas Cap Gas Analysis:		
Methane	93.40%	
Ethane	3.85	
Propane	1.33	
Isobutane	0.46	0.150 g.p.n.
Normal butane	0.38	0.120
Pentane	0.58	0.233
Total	100.00%	0.503 g.p.n.

Source: Craft and Hawkins, 1959; Hill, et al., 1943.

Table 4.13. Pressure, Production, and Reservoir Data for Mt. Holly Oil Pool, Smackover Limestone Formation, Union County, Arkansas

Time (Mos)	Date	Reservoir Pressure (psig)	Cumulative Stock Tank Oil (Mbbl)	GOR (ft^3/bbl)	Cumulative Water Influx[a] (Mbbl)
0	Oct 1941	3290		1660	
1	Nov "	3285	4	2130	
2	Dec "	3280	8	3890	10
3	Jan 1942	3275	14	5430	25
4	Feb "	3255	27	10545	47
5	Mar "	3235	41	10920	78
6	Apr "	3215	52	9670	111
7	May "	3195	63	6975	150
8	June "	3180	73	6105	186
9	Jul "	3175	81	6075	228
10	Aug "	3165	93	5650	269
11	Sep "	3160	103	5565	314
12	Oct "	3157	113	5520	361
13	Nov "	3155	126	5410	405
14	Dec "	3150	136	5410	451
15	Jan 1943	3142	150	4150	495
16	Feb "	3140	161	4340	536
17	Mar "	3132	174	4635	579
18	Apr "	3125	187	4830	617
19	May "	3110	200	4995	653
20	Jun "		213	5040	687

Source: Bruce, 1944, Fig. 9.

[a]Calculated by Bruce, 1944.

RESERVOIR DATA:

Producing mechanism:	Water drive
Producing zone:	Reynolds lime
Trap type:	Oval anticline
Estimated area:	360 acres
gas cap:	11.3 MMbbl
oil zone:	10.5 MMbbl
Average permeability:	1130 md
Average porosity:	20.0%
Reservoir pressure, November 1941:	3290 psig
No. of producing wells:	5
Tank oil gravity:[1]	42° API
GOR[2]	2000 ft^3/bbl

Source: Bruce, 1944.

[1]Thigpen et al., 1943, Tables 3 and 4.

[2]Blanpied and Hazzard, 1942.

5 *DATA FOR TWO PHASE (LIQUID/GAS) RESERVOIRS WITH PRESSURE MAINTENANCE*

Tables 5.1 through 5.4 list data for the following reservoirs undergoing gas injection: the Medrano Sand Reservoir, Medrano Unit, W. Cement Field (Table 5.1); the Tuscaloosa Reservoir, Cranfield Unit, Cranfield Field (Table 5.2); the Mile Six Pool (Table 5.3); and the Schuler (Jones) Oil Pool, Smackover Limestone Formation (Table 5.4). Table 5.5 lists data for the "S" Sand Reservoir B, Weeks Island Field, which is undergoing a combination of water injection and enhanced recovery through CO_2 injection. Table 5.6 lists data for the Adena reservoir, undergoing water injection.

Table 5.1. Pressure, Production, and Reservoir Data for the Medrano Sand Reservoir, Medrano Unit, W. Cement Field, Caddo County, Oklahoma

Time (Mos)	Date	Average Oil Zone Reservoir Pressure (psig)	Cumulative Production			Cumulative Gas Injection[a] (BSCF)	Average Produced GOR (MSCF/bbl)
			Oil (MMbbl)	Water[a] (MMbbl)	Gas Cap[a] (BSCF)		
0	6/1938	2090			0.9		
12	6/1939	2010			1.5		
24	6/1940	1950			2.6		
36	6/1941	1880			4.8		
48	6/1942	1800			14		
60	6/1943	1695	0.5		32		1.42
72	6/1944	1535	1.5	0.002	49		0.94
84	6/1945	1340	3.8	0.008	58		1.30
96	6/1946	1185	6.2	0.02	66		1.21
108	6/1947	1010	8.0	0.05	73[b]		1.24
120	6/1948	850	9.8	0.13			1.39
132	6/1949	750	11.6	0.23		0.14	2.24
144	6/1950	740	128	0.33		2.2	2.34
156	6/1957	750	14.2	0.43		5.1	1.81
168	6/1952	740	16.0	0.53		7.8	1.85
180	6/1953	700	17.6	0.62		10.7	2.10
192	6/1954	685	18.8	0.74		12.7	1.73
204	6/1955	680	19.9	0.86		14.2	1.68
216	6/1956	675	21.2	1.01		15.8	1.83
228	6/1957	670	22.2	1.16		17.1	1.20
240	6/1958	650	23.3	1.29		17.8	1.14
252	6/1959	640	24.3	1.38		18.8	1.60
264	6/1960	620	25.2	1.56		19.6	1.20
276	6/1961	615	26.2	1.71		20.3	1.72
288	6/1962	610	27.2	1.88		21.8	1.97
300	6/1963	605	28.3	2.07		23.7	2.08
312	6/1964	600	29.3	2.25		25.4	2.00
324	6/1965	595	30.2	2.41		27.2	2.68

Source: Weaver and Anderson, 1966, Figs. 24, 25, and 26.

[a]Calculated from average monthly production and injection values.

[b]All gas-cap wells were shut-in as of December 1947. Cumulative gas-cap production through December 1947 ≈ 76BSCF.

RESERVOIR DATA:

Producing mechanisms:	Gas-cap expansion and gravity drainage
Original productive area of reservoir:	
gas zone:	1980 acres
oil zone:	1300 acres
Initial reservoir temperature:	119°F

Table 5.1. (Contd.)

Oil zone pressure in March 1943:	1,750 psia
Compressibility factor (z) of reservoir gas:	
at 2000 psia:	0.8375
1700 psia:	0.8502
900 psia:	0.9070
Initial solution gas-oil ratio:	
flash gas liberation at 119°F:	417 scf/bbl
differential gas liberation at 119°F:	404 scf/bbl
Average interstitial water saturation, pct of pore space:	20
Specific gravity of Medrano water at 60°F:	1.0776
Average porosity:	16.5%
Average permeability:	300 md
Total reservoir rock volume:	260,000 acre ft
Ratio of original gas-cap volume to oil volume:	1.1 to 1
Angle of dip of oil zone:	16-23°
Average gravity of stock-tank oil:	36° API
Average gravity of gas-cap gas (air = 1):	0.6
Density of reservoir oil:	
At 1,766 psia and 119°F	0.765 g/cu cm
At 408 psia and 119°F:	0.797 g/cu cm
Density of reservoir gas:	
At 1,766 psia and 119°F:	0.00072 g/cu cm
At 408 psia and 119°F:	0.00074 g/cu cm
Viscosity of reservoir oil:	
At 1,766 psia:	1.74 cP
At 408 psia:	2.82 cP
Viscosity of reservoir gas:	
At 1,766 psia:	0.017 cP
At 408 psia:	0.013 cP
Initial oil in place:	85 MMSTBbl
Initial gas:	
In solution:	36 BSCF
In the gas-cap:	90 BSCF

Source: Weaver and Anderson, 1966, Table 5.

Table 5.2. Pressure, Production, and Reservoir Data for the Tuscaloosa Reservoir, Cranfield Unit, Cranfield Field, Adams and Franklin Counties, Mississippi

			Cumulative Production		Cumulative Injection			
Time (Mos)	Date	Average Reservoir Pressure (psig)	Blended Crude Oil (MMbbl)	Gas[a] (Bscf)	Water[a] (MMbbl)	Gas[a] (Bscf)	Average Produced GOR (Mscf/bbl)	Water in Total Produced Liquid (%)
6	6/1944	4640	0.1	0.11			1.2	
18	6/1945	4560	1.4	1.94			2	2
30	6/1946	4500	4.0	7.93		0.5	2	3
42	6/1947	4410	8.7	17.0		3.8	3	21
54	6/1948	4360	14.0	41.9		26	5	18
66	6/1949	4360	18.6	74.6		56	7	24
78	6/1950	4300	22.8	109		88	10	50
90	6/1951	4310	25.9	143		121	13	63
102	6/1952	4220	28.2	180		154	22	70
114	6/1953	4200	30.2	219		189	19	74
126	6/1954	4150	32.0	258		226	28	78
138	6/1955	4100	33.2	299		264	37	85
150	6/1956	4070	34.2	339		301	45	84
162	6/1957	4060	35.0	379		338	50	82
174	6/1958	4050	35.8	420	0.38	375	64	81
186	6/1959	4030	36.3	460	1.05[b]	412	74	87
198	6/1960	3710	36.7	512		441	123	90
210	6/1961	3350	37.1	565		462	173	93
222	6/1962	3210	37.3	606		474	210	94
234	6/1963	3170	37.4	641		480	252	94
246	6/1964	2600	37.5	662		481	277	91
258	6/1965	2000	37.6	668				80

Source: Weaver and Anderson, 1966, Figs. 36 and 38.

[a]Calculated from average monthly production and injection values.

[b]Water injection was begun in 1958 and abandoned in 1959. A total of 1,456,007 bbl of water was injected during this time.

Table 5.2. (Contd.)

RESERVOIR DATA:	
Trap type:	Anticline
Original productive area of reservoir:	7,754 acres
oil zone:	5,709 acres
gas zone:	3,867 acres
Range of producing depths:	10,042-10,476 ft
Average gravity of stock-tank oil:	39°API
Average gravity of stock-tank condensate:	55°API
Average gravity of gas (air = 1.00):	0.785
Compressibility factor, z, at 4,701 psia and 257°F:	0.960
Specific gravity of formation water:	1.109
Viscosity at 4,500 psia and 265°F:	
of reservoir oil:	0.44 cP
of reservoir gas:	0.028 cP
Initial reservoir temperature:	257°F
Initial reservoir pressure at 9,976 subsea datum:	4,701 psia
Saturation pressure at 262°F:	4,684 psia
Initial FVF for oil:	
differential gas liberation at 262°F:	1.6116
Initial solution GOR:	
differential gas liberation:	1,074 scf/bbl
Average porosity:	25.5%
Average interstitial water saturation:	47.3%
Arithmetic average horizontal permeability:	280 md
Reservoir rock volume:	
oil zone:	176,600 acre ft
gas zone:	242,982 acre ft
Ratio of orginal gas cap volume to oil volume:	1.38-1

Source: Weaver and Anderson, 1966, Table 7.

Table 5.3. Pressure and Production Data for Various Dates and Reservoir Data for Mile Six Pool, La Brea-Pariñas Concession of International Petroleum Co., Ltd., Northwestern Peru

Time (Mos)	Date	Press. at -2200 ft ss (psia)	Gas-Oil Contact (ft ss)	Press. at G-O Contact (psia)	Cumulative Prod. Oil (Mbbl)	Cumulative Prod. Gas (Mcf)	Cum. Gas Injected (Mcf)	Prod. GOR (cf/bbl)
	Discovery	965	1875	856	0	0	0	
1	9/30/33	952	1875	843	385	175	0	366
13	9/30/34	838	1975	763	2,777	1,163	663	363
31	3/31/36	886	2110	854	8,645	3,491	3,491	341
53	1/31/38	876	2250	876	17,629	6,454	8,634	468
74	10/31/39	874	2310	874	22,195	9,095	11,518	616
104	4/30/42	826	2340	826	25,142	10,902	13,843	900
128	4/30/44	839	2360	839	26,839	13,783	16,437	2594
145	9/30/45	831	2370	831	27,618	15,710	18,355	2512
156	8/31/46	765	2380	765	28,176[a]	18,034[a]	19,228	1039
181	9/30/48	786	2390	786	29,457[a]	19,673[a]	21,529	1718
197	1/31/50	770	2395	770	30,040[a]	21,095[a]	23,301	3250
225	5/31/52	762	2400	762	30,476[a]	22,320[a]	24,983	2931

Source: Anders, 1953, Table 3.

[a]These figures include 7000 bbl of oil and 1600 MMcf of gas lost in blowout of well 2281 (January 1946).

RESERVOIR DATA:

Main producing mechanism:	Gravity drainage
Producing formation:	Pariñas sandstone
Average depth of producing formation:	2,200 ft
Formation thickness:	635 ft
Thickness of original oil zone:	565 ft
Main producing mechanism:	gravity drainage
Estimated area:	350 acres
Original volume:	
oil zone:	54,580 acre ft
gas cap:	7,120 acre ft

Table 5.3. (Contd.)

Average porosity:	22.6%
Average permeability to dry air:	780 md
Average formation dip:	17.5°
Reservoir rock assumed to be water wet	
Estimated original gas-oil contact:	1,875 ft ss
Original oil in place:	51,800,000 STB
Original oil in place:	61,900,000 reservoir bbl
Original pressure:	
at gas-oil contact:	856 psia
at water-oil contact:	1045 psia
at oil zone midpoint (2158 ft ss):	951 psia
at datum plane (2200 ft ss):	965 psia
Temperature at 2200 ft ss:	114°F
Original gas-oil ratio (flash):	325 SCF/STB
Original reservoir volume factor (flash):	1.1960 res. bbl/STB
Original viscosity:	
oil:	1.02 cP
gas:	0.013 cP
Original compressibility factor, z:	
gas liberated by differential vaporization:	0.570
gas-cap gas	0.880
Oil gravity:	40.02° API
Specific gravity of gas:	1.174
Bubble point pressure:	890 psia

Source: Anders, 1953.

Table 5.4. Pressure, Production, and Reservoir Data for the Schuler (Jones) Oil Pool, Smackover Limestone Formation, Union County, Arkansas

Time (Mos)	Date	Reservoir Pressure (psig)	Cumulative Oil Production (MMbbl)	Water Production Rate (MMbbl/day)	Cumulative Gas Injection (BCF)	Average GOR (ft^3/bbl)	Cumulative GOR (ft^3/bbl)
0	Sep 17, 1937	3520	0		0		760
10	Jul 1938	3125	2.818		0	1022	853
13	Oct	2910	4.653		0	990	906
16	Jan 1939	2785	6.030		0	1019	939
19	Apr	2650	7.360		0	1255	960
22	Jul	2505	8.751		0	1465	990
23	Aug	2501	9.011		0	1465	997
25	Oct	2425	9.873		0	1545	1018
28	Jan 1940	2290	11.259		0	1734	1070
31	Apr	2125	12.619		0	2074	1200
34	Jul	1950	13.998		0	2304	1310
35	Aug	1878	14.462		0	2304	1350
37	Oct	1785	15.321		0	2510	1440
39	Dec	1670	16.132		0	2510	1500
40	Jan 1941	1630	16.552		0	2079	1520
	Feb 14	1609	16.739		0	2079	1520
41	Feb 28	1608	16.929		0	2079	1519
42	Mar	1601	17.348		0	2079	1516
43	Apr	1575	17.757		0	1579	1515
44	May	1555	17.757		0	1579	1516
45	Jun	1537	18.583		0	1579	1520
46	Jul	1514	19.006		0.3724	1744	1527
47	Aug	1505	19.426		0.9543	1744	1532
48	Sep	1502	19.830		1.529	1744	1534
49	Oct	1506	20.249		2.136	1724	1537
50	Nov	1506	20.652		2.762	1724	1541

Table 5.4. (Contd.)

Time (Mos)	Date		Reservoir Pressure (psig)	Cumulative Oil Production (MMbbl)	Water Production Rate (Mbbl/day)	Cumulative Gas Injection (BCF)	Average GOR (ft^3/bbl)	Cumulative GOR (ft^3/bbl)
51	Dec	1941	1500	21.068		3.402	1724	1545
52	Jan	1942	1498	21.474	0.2	4.006	1934	1549
53	Feb		1492	21.850	0.2	4.649	1934	1556
54	Mar		1493	22.261	0.2	5.392	1934	1565
55	Apr		1493	22.619	0.2	5.883	1557	1566

Source: Muskat, 1949, Table 1, pg. 388; Fig. 10.34, pg. 474

RESERVOIR DATA:

Producing mechanisms:	Water drive/gas injection
Producing zone:	Jones sandstone
Trap type:	Anticline
Closure:	90-135 ft
Depth of reservoir:	7553-7601 ft
No. of producing wells:	146
Original oil-in-place:	99 MMbbl
Gas/oil contact:	7270 ft ss
Water/oil contact:	7370-7380 ft ss
Average permeability:	355 md
Average porosity:	17.6%
Connate-water saturation:	15%
Initial formation volume factor:	1.52
Gravity of stock tank oil:	34°API
Original reservoir pressure at 7300 ft ss:	3520 psig
Pressure maintenance:	Return of approximately 90% of produced gas

Table 5.4. (Contd.)

GOR:	
Estimated original GOR:	762 ft^3/bbl
Average for 1st two yrs. of prod.:	972 ft^3/bbl
Reservoir temperature:	198°F
Maximum net thickness of:	
Gas-bearing sand:	17 ft
Oil-bearing sand:	85 ft
Saturation pressure:	3230 psi

Source: Muskat, 1949; Weeks and Alexander, 1942.

Table 5.5. Pressure, Production, and Reservoir Data for the "S" Sand Reservoir B, Weeks Island Field, Iberia Parish, Louisiana

Time (Mos)	Date	Reservoir Pressure (psi)	Cumulative Oil Production[a] (Mbbl)	Cumulative Injection[b] Water (Mbbl)	Cumulative Injection[b] CO_2 (M Reservoir bbl)	GOR (ft^3/bbl)
0	Feb 1968	5775	3.7			1350
5	Jun 1968	5775	29.1			1000
11	Dec 1968	5775	66.4			1150
17	Jun 1969	5735	104			1250
23	Dec 1969	5700	143			1100
29	Jun 1970	5650	186			900
35	Dec 1970	5600	242			1050
41	Jun 1971	5550	309			1000
47	Dec 1971	5510	393			940
53	Jun 1972	5460	482			1000
59	Dec 1972	5425	572			1000
65	Jun 1973	5375	730			1000
68	Sep 1973	5350	827	42.8		1050
71	Dec 1973	5340	982	199		1180
77	Jun 1974	5290	1240	702		925
83	Dec 1974	5250	1529	1159		1000
89	Jun 1975	5200	1853	1591		1225
95	Dec 1975	5150	1996	1951		1000
101	Jun 1976	5110	2154	2315		1100
107	Dec 1976	5065	2314	2522		1300
113	Jun 1977	5025	2422	2762		1000
119	Dec 1977	5000	2477	3065		3000
125	Jun 1978	4915	2501	3191		1550
129	Oct 1978	4850			13.9	
131	Dec 1978	4820			66.0	
135	Apr 1979	4800			176.0	

[a] Calculated from production rates.

[b] Calculated from injection rates.

RESERVOIR DATA:

Initial production mechanism:	Natural water drive
Pressure maintenance by:	Water injection and CO_2 injection
Original oil-in-place:	4.1 MMbbl
Original gas-in-place:	24 bcf
Prior to CO_2 injection, Jan 1, 1978:	
water/oil contact:	12,786 ft
gas/oil contact:	12,760 ft
1979 revised "S" Sand Reservoir B parameters:	
Porosity:	0.26
Water drive residual oil saturation:	0.22%
Absolute permeability:	1800 md

Table 5.5. (Contd.)

Reservoir temperature =	225°F
Oil gravity at 60°F	32.2° API
Spec. gravity of gas at 60/60°F =	0.8644
Saturation pressure at 225°F =	5100
Specific volume at saturation pressure and 225°F =	0.02375 ft^3/lb
Thermal expansion of saturated oil at 6000 psi =	$\frac{V\ @\ 225°F}{V\ @\ 76°F} = 1.08755$
Compressibility of saturated oil at reservoir temperature:	
from 6000 to 5500 psi =	13.16×10^6 vol/vol/psi
from 5500 psi to 5100 psi =	14.00×10^6 vol/vol/psi

Source: Shell Oil Company and Shell Development Co., 1979.

Table 5.6. Pressure, Production, and Reservoir Data for the "J" Sand Unit, Adena Field, Morgan County, Colorado

Time (Mos)	Date	Average Reservoir Pressure (psig)	Cumulative Production Oil (MMbbl)	Cumulative Production Water[a] (MMbbl)	Cumulative Water Injection[a] (MMbbl)	Water in Total Produced Liquid (%)
2	12/1953	1531	0.1			0.5
8	6/1954	1490	1.5	0.006		1.5
14	12/1954	1445	4.0	0.053		4.0
20	6/1955	1390	6.8	0.178		6.0
26	12/1955	1315	9.5	0.344		6.0
32	6/1956	1275	12.0	0.600		9.5
38	12/1956	1220	14.5	0.780		5.5
44	6/1957	1165	17.5	0.931	0.21	6.5
50	12/1957	1140	20.0	1.12	9.87	6.5
56	6/1958	1135	22.0	1.29	23.5	9.0
62	12/1958	1110	24.5	1.59	37.2	8.0
68	6/1959	1105	27.5	1.77	50.7	4.5
74	12/1959	1135	31.0	1.94	64.5	11.0
80	6/1960	1180	34.5	2.56	77.8	18.0
86	12/1960	1200	38.0	3.64	87.8	24.0
92	6/1961	1225	42.5	5.16	95.7	32.0
98	12/1961	1245	45.5	7.41	101.8	48.5
104	6/1962	1330	48.5	10.13	107.9	52.0
110	12/1962	1385	50.0	12.69	111.8	65.5
116	6/1963	1410	51.5	16.04	115.9	76.0
122	12/1963	1410	52.0	19.44	119.5	80.5

Source: Weaver and Anderson, 1966, Figs. 9, 12, and 13.

[a]Calculated from average monthly production and injection values.

RESERVOIR DATA:

Original productive area of reservoir:	
oil zone:	8,425 acres
gas zone:	4,650 acres
Initial reservoir temperature:	178°F
Initial reservoir pressure at datum 1,050 ft, subsea:	1,541 psig
Saturation pressure:	1,542 psig
Compressibility factor, z, of gas-cap gas at 1,541 psig:	0.860
Initial FVF for oil:	
flash gas liberation at 10 psig and 105°F:	1.361
differential gas liberation at 180°F:	1.396

Table 5.6. (Contd.)

Average gravity of stock-tank oil:	43.4° API
Average gravity of gas-cap gas (air = 1.0):	0.735
Density of reservoir oil:	
At 1,502 psia and 180°F:	0.689 g/cu cm
At 827 psia and 180°F:	0.708 g/cu cm
Average depth to producing formation:	5,650 ft
Specific gravity of "J" sand water:	1.01
Viscosity of reservoir oil:	
At 1,541 psig and 180°F:	0.359 cP
At 900 psig and 180°F	0.500 cP
Viscosity of reservoir gas:	
At 1,541 psig and 180°F	0.0177 cP
Viscosity of reservoir water:	
"J" sand at 178°F	0.36 cP
Average thickness:	
Of the gas zone:	18 ft
Of the oil sand:	30 ft
Initial solution GOR:	
flash gas liberation at 10 psig and 105°F:	526 SCF/bbl
differential gas liberation at 180°F:	583 SCF/bbl
Average porosity:	
oil zone (% of pore space):	19.7
gas zone (% of pore space):	19.7
Arithmetic average horizontal permeability:	356 md
Average interstitial water saturation:	
oil zone (% of pore space):	28.45
gas zone (% of pore space):	24.0
Reservoir rock volume:	
productive oil zone:	174,416 acre-ft
productive gas zone:	76,137 acre-ft
Ratio of original gas-cap volume to oil volume:	1:2.3

Source: Weaver and Anderson, 1966, Tables 1 and 3.

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