EXHIBIT "B"

SCHEDULE SHOWING THE PERCENTAGE AND KIND OF OWNERSHIP
OF ALL LANDS WITHIN THE CENTRAL BISTI LOWER GALLUP SAND UNIT
TOWNSHIPS 25 AND 26 NORTH, RANGE 12 WEST, SAN JUAN COUNTY, NEW MEXICO

Tract Number	Description	No. of Acres	Serial No. & Date of Lease or Application	Basic Royalty & Percentage	Lessee of Record	Overriding Royalty and Percentage	Working Interest and Percentage
FEDERAL LANDS							
1	T26N, R12W Sec. 31: Lots 2, 3, 4 SE/4 NW/4, S/2 NE/4 SE/4, E/2 SW/4 T25N, R12W Sec. 5: Lots 3 & 4, S/2 NW/4 Sec. 6: (ALL) Lots 1, 2, 3, 4, 5, 6 & 7 SE/4 NW/4, S/2 NE/4, E/2 SW/4, SE/4 Sec. 7: (ALL) Lots 1, 2, 3 & 4 E/2 NW/4, E/2 SW/4, E/2 Sec. 8: N/2 Sec. 18: Lot 1 & NE/4 NW/4	2038.78	SF-078056 2-1-48 H.B.P.	USA 12½%	Sunray Mid-Continent Oil Company	None	Sunray Mid-Continent Oil Company - ALL
2	T25N, R12W Sec. 17: N/2, SE/4, NW/4 SW/4, E/2 SW/4 Sec. 18: NE/4, N/2 SE/4 Sec. 20: NE/4, NE/4 NW/4	1040.00	SF-078058 2-1-48 H.B.P.	USA 12½%	Sunray Mid-Continent Oil Company	None	Sunray Mid-Continent Oil Company - ALL

EXHIBIT "B" (CONTINUED)

3	T25N, R12W SEC. 21: N/2, N/2 SE/4, NE/4 SW/4	440.00	SF-078065 2-1-48 H.B.P.	USA 12½%	SHELL OIL COMPANY	3½% OF 8/8 DIVIDED AS FOLLOWS: G. E. HALL & CHRISTINE HALL 1/18 RALPH LOWE & ERMA LOWE 1/18 HAL C. PECK & JOSIE FAY PECK 1/18 J. F. POSTELLE & JESSIE POSTELLE 1/18 J. R. MARTIN & LUCILLE MARTIN 1/18 J. RALPH STEWART & VIOLA STEWART 1/18 HARRY ADAMS & ANNA EVALYN ADAMS 1/36 C. B. YARBROUGH 1/36 KATHERINE B. YARBROUGH 1/36 J. HOLT JOWELL & LILLIE B. JOWELL 1/36	SHELL OIL COMPANY ALL

EXHIBIT "B" (CONTINUED)

W. H. SLOAN &
ALBERTA SLOAN
1/18

ROBERT MURRAY FASKEN,
EXECUTOR AND TRUSTEE
UNDER THE WILL OF
ANDREW FASKEN,
DECEASED
1/18

GERALD FITZ-GERALD &
ELIZABETH FITZ-GERALD
1/36

ROBERT D. DUDEN &
NANCY MAE DUDEN
1/18

REESE CLEVELAND &
ROSELLE B. CLEVELAND
1/18

FRANK A. SCHLUTZ
1/18

R. M. BARRON &
LUCILLE C. BARRON
1/18

KATHRYN D. ASHBY
1/36

P. O. SILL
1/72

LEE ETTA HEDBERT,
AS HER SEPARATE
PROPERTY AND ESTATE
1/72

MRS. OLIVE MILLER
1/32 OF 1/36

EXHIBIT "B" (CONTINUED)

THOMAS M. &
MINNA GRODIN
3/32 OF 1/36

CHARLES D. &
LUCY S. KARUTZ
1/40 OF 1/36

GEORGE BIGAR
1/40 OF 1/36

ROBERT B. AARONSON
1/40 OF 1/36

WILLIAM & FLORENCE
D. DUBILIER
1/40 OF 1/36

WALLACE S. KARUTZ
1/8 OF 1/36

LAWRENCE L. LAVELLE
1/18 OF 1/36

MYRON LIDELL
1/18 OF 1/36

MARIE HELENE WEILL
1/18 OF 1/36

BENJAMIN J. &
HELEN G. PIENKOWSKI
1/16 OF 1/36

LEWIS OTERSEN
1/16 OF 1/36

STANLEY F. ZACHAREK
1/16 OF 1/36

ALBERT WILKES
1/16 OF 1/36

ALEXANDER S. LO RE
1/16 OF 1/36

EXHIBIT "B" (CONTINUED)

4	T25N, R12W Sec. 9: N/2 Sec. 4: Lots 1 & 2, S/2 NE/4	479.84	NM-036254 2-1-48 H.B.P.	USA 12½%	SHELL OIL COMPANY	3½% OF 8/8 DIVIDED AS FOLLOWS: G. E. HALL & CHRISTINE HALL 1/18 RALPH LOWE & ERMA LOWE 1/18 DANIEL ALAGNA 1/16 OF 1/36 DOWNEY ESTATE - DEFERRED 1/24 CONNOR ESTATE - DEFERRED 1/72 SID WEISS 1/5 OF 1/36 MORRIS LEVINE 1/5 OF 1/36 WILLIAM LEVINE 1/5 OF 1/36 HARRY LIPSHY 1/5 OF 1/36 LEWIS FREED 1/5 OF 1/36 ROBERT MIMS 1/4, E.W. MUDGE, JR. 1/4 AND GAS PRODUCERS CORP. 1/2 OF $100/ACRE OIL PAYMENT OUT OF 1½% OF 8/8	SHELL OIL COMPANY ALL

EXHIBIT "B" (CONTINUED)

HAL C. PECK &
JOSIE FAY PECK
1/18

J. F. POSTELLE &
JESSIE POSTELLE
1/18

J. R. MARTIN &
LUCILLE MARTIN
1/18

J. RALPH STEWART &
VIOLA STEWART
1/18

HARRY ADAMS &
ANNA EVALYN ADAMS
1/36

C. B. YARBROUGH
1/36

KATHERINE B. YARBROUGH
1/36

J. HOLT JOWELL &
LILLIE B. JOWELL
1/36

W. H. SLOAN &
ALBERTA SLOAN
1/18

ROBERT MURRAY FASKEN,
EXECUTOR AND TRUSTEE
UNDER THE WILL OF
ANDREW FASKEN,
DECEASED
1/18

EXHIBIT "B" (CONTINUED)

GERALD FITZ-GERALD &
ELIZABETH FITZ-GERALD
1/36

ROBERT D. DUDEN &
NANCY MAE DUDEN
1/18

REESE CLEVELAND &
ROZELLE B. CLEVELAND
1/18

FRANK A. SCHLUTZ
1/18

R. M. BARRON &
LUCILLE C. BARRON
1/18

KATHRYN D. ASHBY
1/36

P. O. SILL
1/72

LEE ETTA HEDBERT, AS
HER SEPARATE PROPERTY
AND ESTATE
1/72

MRS. OLIVE MILLER
1/32 OF 1/36

THOMAS M. &
MINNA GRODIN
3/32 OF 1/36

CHARLES D. &
LUCY S. KARUTZ
1/40 OF 1/36

GEORGE BIGAR
1/40 OF 1/36

EXHIBIT "B" (CONTINUED)

ROBERT B. AARONSON
1/40 OF 1/36

WILLIAM & FLORENCE
D. DUBILIER
1/40 OF 1/36

WALLACE S. KARUTZ
1/8 OF 1/36

LAWRENCE L. LAVELLE
1/18 OF 1/36

MYRON LIDELL
1/18 OF 1/36

MARIE HELENE WEILL
1/18 OF 1/36

BENJAMIN J. AND
HELEN G. PIENKOWSKI
1/16 OF 1/36

LEWIS OTERSEN
1/16 OF 1/36

STANLEY F. ZACHAREK
1/16 OF 1/36

ALBERT WILKES
1/16 OF 1/36

ALEXANDER S. LO RE
1/16 OF 1/36

DANIEL ALAGNA
1/16 OF 1/36

DOWNEY ESTATE -
DEFERRED
1/24

CONNOR ESTATE -
DEFERRED
1/72

EXHIBIT "B" (CONTINUED)

						SID WEISS 1/5 OF 1/36 MORRIS LEVINE 1/5 OF 1/36 WILLIAM LEVINE 1/5 OF 1/36 HARRY LIPSHY 1/5 OF 1/36 LEWIS FREED 1/5 OF 1/36 ROBERT MIMS 1/4, E. W. MUDGE, JR. 1/4, & GAS PRODUCERS CORP. 1/2 OF $100/ACRE OIL PAYMENT OUT OF 1½% OF 8/8	
5	T26N, R12W SEC. 32: SW/4 NE/4	40.00	SF-078248-A 3-1-48 EXTENDED 1-31-60	USA 12½%	JACK C. TUNSTILL	C.H. NYE 2% OF 8/8 W. J. WEAVER 1/2% OF 8/8	TEXACO INC. - ALL (THIS LEASE HELD UNDER OPTION AGREEMENT.)
	FIVE FEDERAL TRACTS CONTAINING 4308.62 ACRES OR 58.3155% OF UNIT AREA						
STATE LANDS							
6	T26N, R12W SEC. 32: S/2 SE/4	80.00	E-3148-7 H.B.P.	STATE OF NEW MEXICO 12½%	EL PASO NATURAL GAS PRODUCTS CO.	JOHN BURROUGHS & JEAN BURROUGHS 5% OF 8/8	EL PASO NATURAL GAS PRODUCTS COMPANY - ALL
7	T25N, R12W SEC. 16: ALL	640.00	E-6597-2 H.B.P.	STATE OF NEW MEXICO 12½%	LAWRENCE C. KELLY, TRUSTEE ½ EL PASO NATURAL GAS PRODUCTS COMPANY ½	AS TO N/2 OF SEC.16 T25N, R12W LAWRENCE C. KELLY, TRUSTEE, AND INDIVIDUALLY 4.75% OF 8/8 J. D. MIDDLETON .25% OF 8/8	LAWRENCE C. KELLY, TRUSTEE - ½ EL PASO NATURAL GAS PRODUCTS CO. - 1/2

EXHIBIT "B" (CONTINUED)

						As to S/2 Sec. 16 T25N, R12W Lawrence C. Kelly, Trustee and Individually 17.25% of 8/8 J. D. Middleton .25% of 8/8	
8	T26N, R12W Sec. 32: SE/4 NE/4, S/2 NW/4, NE/4 SW/4, N/2 SE/4	240.00	E-9791 2-21-56	State of New Mexico 12½%	Phillips Petroleum Company	None	Phillips Petroleum Company - All
9	T26N, R12W Sec. 32: NW/4 SW/4	40.00	B-11370-43 8-3-44 H.B.P.	State of New Mexico 12½%	Phillips Petroleum Company	James Palmer 3% of 8/8	Phillips Petroleum Company - All
10	T26N, R12W Sec. 32: S/2 SW/4	80.00	B-11370-31 H.B.P.	State of New Mexico 12½%	J. Felix Hickman	J. Felix Hickman 7% of 8/8 First Nat'l Bank of Albuquerque as Trustee for Jeffery Leigh Hickman 2½% of 8/8 Carrol T. Payne 1½% of 8/8 Merle Hickman 1½% of 8/8	Val R. Reese & Assoc. Inc. - 1/2 J. R. Modrall - 1/32 John P. Vandenburgh - 1/8 E. R. Richardson - 1/16 Thomas W. Cabeen - 1/16 Oscar M. Love - 1/8 Fred Luthy - 1/32 James E. Sperling - 1/32 Ezra M. Thompson - 1/32

Five State of New Mexico Tracts Containing 1080.00 Acres or 14.6174% of Unit Area

EXHIBIT "B" (CONTINUED)

TRACT NUMBER	DESCRIPTION	NO. OF ACRES	CONTRACT NUMBER AND DATE	BASIC ROYALTY AND ALLOTTMENT NUMBER	OVERRIDING ROYALTY	WORKING INTEREST AND PERCENTAGE
INDIAN LANDS						
11	T25N, R12W SEC. 5: SW/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-1292 H.B.P. 3-21-56	HOSKA DA WOT (JIMMIE) A/K/A JIM WHITE A/K/A JIM WHITE BENALLY - 12½% (059289)	NONE	PHILLIPS PETROLEUM COMPANY - ALL
12	T25N, R12W SEC. 9: SE/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-1228 H.B.P. 11-10-55	I TAH NIP PAH (MARY) Deceased (MARY WHITE) A/K/A MARY WHITE CHARLEY 12½% (059286)	NONE	PHILLIPS PETROLEUM COMPANY - ALL
13	T25N,R12W SEC. 5: LOTS 1 & 2 S/2 NE/4 (NE/4)	159.92	NAVAJO ALLOTTED CONTRACT No. 14-20-603-1448 H.B.P. 12-26-56	TOTAL BASIC ROYALTY 12½% DIVIDED AS FOLLOWS: KA DA PAH A/K/A MRS. HERBERT WILLIAMS (059285) - 29/64 A/K/A Mrs Joan Begine GLE NA NUP PAH 10/64 HOSKA DA WOT (JIMMIE) A/K/A JIM WHITE (059289) - 5/64 AH NI NE PAH A/K/A SALENA WHITE (059288) - 5/64 I NI PAH A/K/A JOAN WHITE (059287) 5/64 SAM BENALLY 5/64	NONE	EL PASO NATURAL GAS PRODUCTS COMPANY - ALL

EXHIBIT "B" (CONTINUED)

				I TAH NIP PAH (MARY WHITE) A/K/A MARY WHITE CHARLEY (059286) - 5/64	
14	T25N, R12W SEC. 3: SW/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-1423 ~~H.B.P.~~ 3-30-56	KA DA PAH A/K/A MRS. HERBERT WILLIAMS (059285) - 12~~1/2~~%	NONE	PAN AMERICAN PETROLEUM CORPORATION - ALL
15	T25N, R12W SEC. 4: SE/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-1424 H.B.P. 4-20-56	TOTAL BASIC ROYALTY ~~12%~~ 12½% DIVIDED AS FOLLOWS: NA PAH (JOHN) A/K/A WILLIAM L. BENALLY (059292) - 104/896 HOSKA DA WOT A/K/A JIM WHITE (059289) - 132/896 AH NI NE PAH A/K/A SALENA WHITE (059288) - 132/896 I NI PAH A/K/A JOAN WHITE, A/K/A MRS. JOAN HARRISON (059287) - 132/896 I TAH NIP PAH (MARY WHITE) Deceased A/K/A MARY WHITE CHARLEY (059286) 132/896 JOE BLACKIE (CENUS #11118) - 38/896 USHKA NAH NO TAH A/K/A ERNEST BLACKIE - 57/896 MABEL BLACKIE - 57/896	NONE	PAN AMERICAN PETROLEUM CORPORATION - ALL

EXHIBIT "B" (CONTINUED)

				GLE NA NUP PAH A/K/A MRS. JUAN DEVORE 56/896 KA DA PAH A/K/A MRS. HERBERT WILLIAMS (059285) - 56/896		
16	T25N, R12W SEC. 10: NW/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-1449 H.B.P. 4-10-56	TOTAL BASIC ROYALTY 12½% DIVIDED AS FOLLOWS: GLE NA NUP PAH 2/8 A/K/A Mrs Juan Devore KA DA PAH A/K/A - MRS. HERBERT WILLIAMS (059285) - 1/8 HOSKA DA WOT (JIMMIE) A/K/A JIM WHITE (059289) - 1/8 AH NI NE PAH A/K/A SALENA WHITE (059288) - 1/8 I NI PAH A/K/A JOAN WHITE (059287) - 1/8 I TAH NIP PAH (MARY WHITE) Deceased A/K/A MARY WHITE CHARLEY (059286) - 1/8 SAM BENALLY - 1/8	NONE	SOUTHERN UNION GAS COMPANY - ALL

EXHIBIT "B" (CONTINUED)

17	T25N, R12W SEC. 4: LOTS 3 & 4 S/2 NW/4	159.92	NAVAJO ALLOTTED CONTRACT No. 14-20-603-322 ~~10-7-53~~ 11-12-53	TOTAL BASIC ROYALTY 12½% DIVIDED AS FOLLOWS: KA DA PAH A/K/A MRS. HERBERT WILLIAMS (059285) - 43/64 HOSKA DA WOT (JIMMIE) A/K/A JIM WHITE (059289) - 3/64 AH NI NE PAH A/K/A SALENA WHITE (059288) - 3/64 I NI PAH A/K/A JOAN WHITE A/K/A MRS. JOAN HARRISON (059287) - 3/64 I TAH NIP PAH (MARY WHITE) Deceased A/K/A MARY WHITE CHARLEY (059286) - 3/64 SAM BENALLY - 3/64 GLE NA NUP PAH - A/K/A 6/64 Mrs Joan Devore	NONE	AMERADA PETROLEUM CORPORATION - ALL
18	T25N, R12W SEC. 4: SW/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-321 ~~10-7-53~~ 11-12-53 H.B.P.	KA DA PAH A/K/A MRS. HERBERT WILLIAMS (059285) - 12½% LEASE ALLOTMENT No. 011670	NONE	AMERADA PETROLEUM CORPORATION - ALL
19	T25N, R12W SEC. 5: SE/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-323 10-7-53 H.B.P. 11-12-53	TOTAL BASIC ROYALTY 12½% DIVIDED AS FOLLOWS: GLE NA NUP PAH A/K/A 2/8 Mrs Joan Devore	NONE	AMERADA PETROLEUM CORPORATION - ALL

EXHIBIT "B" (CONTINUED)

				KA DA PAH A/K/A MRS. HERBERT WILLIAMS (059285) - 1/8 HOSKA DA WOT (JIMMIE) A/K/A JIM WHITE (059289) - 1/8 AH NI NE PAH A/K/A SALENA WHITE (059288) - 1/8 I NI PAH A/K/A JOAN WHITE A/K/A MRS. JOAN HARRISON (059287) 1/8 I TAH NIP PAH (MARY WHITE) Deceased A/K/A MARY WHITE CHARLEY (059286) - 1/8 SAM BENALLY 1/8		
20	T25N, R12W SEC. 8: SW/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-324 ~~10-7-53~~ 11-12-53 H.B.P.	AH NI NA PAH A/K/A SALENA WHITE (059288) 12½%	NONE	AMERADA PETROLEUM CORPORATION - ALL
21	T25N, R12W SEC. 8: SE/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-325 ~~10-7-53~~ 11-12-53 H.B.P.	NA DES PAH OR NAH DES PAH LEASE ALLOTMENT No. 011673 12½%	NONE	AMERADA PETROLEUM CORPORATION - ALL
22.	T25N, R12W SEC. 9: SW/4	160.00	NAVAJO ALLOTTED CONTRACT No. 14-20-603-326 H.B.P. 11-12-53	I NI PAH A/K/A JOAN WHITE A/K/A MRS. JOAN HARRISON (059287) 12½%	NONE	AMERADA PETROLEUM CORPORATION - ALL

EXHIBIT "B" (CONTINUED)

23	T26N, R12W SEC. 33: S/2 SW/4	80.00	NAVAJO ALLOTTED-CONTRACT No. 14-20-603-327 ~~11-9-53~~ 12-10-53	NA PAH (JOHN) A/K/A WILLIAM L. BENALLY (059292) 12½%	NONE	AMERADA PETROLEUM CORPORATION - ALL

13 TRACTS INDIAN ALLOTTED LAND CONTAINING 1999.84 ACRES OR 27.0671% OF UNIT AREA

CENTRAL BISTI LOWER GALLUP SAND UNIT AREA	TOTALS:	5	FEDERAL TRACTS	4308.62 ACRES 58.3155%
		5	STATE OF NEW MEXICO TRACTS	1080.00 ACRES 14.6174%
		13	TRACTS INDIAN ALLOTTED LAND	1999.84 ACRES 27.0671%
				7388.46 ACRES 100.0000%

EXHIBIT C
SCHEDULE OF TRACT PERCENTAGE PARTICIPATION
CENTRAL BISTI LOWER GALLUP SAND UNIT
SAN JUAN COUNTY, NEW MEXICO

Tract Number	Description	Serial No. and Date of Lease or Application	Percentage Participation
	Federal Lands		
1	T-26N, R-12W: Sec. 31; Lot 4, S½ SE¼, SE¼ SW¼ T-25N, R-12W: Sec. 5; Lots 3 and 4, S½ NW¼ Sec. 6; (All) Lots 1, 2, 3, 4, 5, 6 & 7, SE¼ NW¼, S½ NE¼, E½ SW¼, SE¼ Sec. 7; Lots 1, 2, E½ NW¼, NE¼, N½ SE¼ Sec. 8; N½	SF-078056 2-1-48 H.B.P.	43.36811
2	T-25N, R-12W: Sec. 17; N½ NW¼, N½ NE¼, SE¼ NE¼, NE¼ SE¼	SF-078058 2-1-48 H.B.P.	2.16406
3	T-25N, R-12W: Sec. 21; N½ NE¼	SF-078065 2-1-48 H.B.P.	0.57718
4	T-25N, R-12W: Sec. 9; N½	NM-036254 2-1-48 H.B.P.	10.80302
	State Lands		
7	T-25N, R-12W: Sec. 16; All	E-6597-2 H.B.P.	6.91834
10	T-26N, R-12W: Sec. 32; S½ SW¼	B-11370-31 H.B.P.	0.37804

Note: Land description includes only area within Participating Area.

TRACT NUMBER	DESCRIPTION	NAVAJO ALLOTTED CONTRACT NO. AND DATE	PERCENTAGE PARTICIPATION
		INDIAN ALLOTTED LANDS	
11	T-25N, R-12W: Sec. 5; SW¼	14-20-603-1292 H.B.P.	4.72964
12	T-25N, R-12W: Sec. 9; SE¼	14-20-603-1228 H.B.P.	4.61741
13	T-25N, R-12W: Sec. 5; S½ NE¼	14-20-603-1448 H.B.P.	0.84103
14	T-25N, R-12W: Sec. 3; SW¼	14-20-603-1423 H.B.P.	0.93458
15	T-25N, R-12W: Sec. 4; SE¼	14-20-603-1424 H.B.P.	2.18277
16	T-25N, R-12W: Sec. 10; NW¼	14-20-603-1449 H.B.P.	3.90585
18	T-25N, R-12W: Sec. 4; SW¼	14-20-603-321 ~~10-7-53~~ 11-12-53 H.B.P.	3.41945 *
19	T-25N, R-12W: Sec. 5; SE¼	14-20-603-323 ~~10-7-53~~ 11-12-53 H.B.P.	4.36227
20	T-25N, R-12W: Sec. 8; SW¼	14-20-603-324 ~~10-7-53~~ 11-12-53 H.B.P.	1.95205
21	T-25N, R-12W: Sec. 8; SE¼	14-20-603-325 ~~10-7-53~~ 11-12-53 H.B.P.	4.09958
22	T-25N, R-12W: Sec. 9; SW¼	14-20-603-326 H.B.P. 11-12-53	4.74662
		TOTAL	100.00000

* BY AGREEMENT THE AMERADA KA-DA-PAH #1 WELL, SITUATED ON TRACT 18 WAS CREDITED WITH THE MAXIMUM PRODUCTION FACTOR IN COMPUTING "TOTAL TRACT OIL PRODUCTION DURING BASE PERIOD" WITH RESPECT TO TRACT 18 IN CONTEMPLATION OF THE USE OF SAID WELL AS AN INJECTION WELL.

UNIT OPERATING AGREEMENT

FOR THE DEVELOPMENT AND OPERATION

OF THE

CENTRAL BISTI LOWER GALLUP SAND UNIT AREA

COUNTY OF SAN JUAN

STATE OF NEW MEXICO

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UNIT OPERATING AGREEMENT

FOR THE DEVELOPMENT AND OPERATION

OF THE

CENTRAL BISTI LOWER GALLUP SAND UNIT AREA

COUNTY OF SAN JUAN

STATE OF NEW MEXICO

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I N D E X

NEP/CL

UNIT OPERATING AGREEMENT

FOR THE DEVELOPMENT AND OPERATION

OF THE

CENTRAL BISTI LOWER GALLUP SAND UNIT AREA

COUNTY OF SAN JUAN

STATE OF NEW MEXICO

THIS AGREEMENT, Made and entered into as of the _____ day of _____, 19____, by and between the parties who execute or ratify this agreement,

W I T N E S S E T H:

WHEREAS, the parties hereto as Working Interest Owners have executed as of the date hereof that certain Unit Agreement for the development and operation of the Central Bisti Lower Gallup Sand Unit Area, hereinafter referred to as "Unit Agreement" and which, among other things, provides for a separate agreement to be made and entered into by and between Working Interest Owners pertaining to the development and operation of the Unit Area therein defined.

NOW, THEREFORE, in consideration of the mutual agreements herein set forth, it is agreed as follows:

SECTION I

CONFIRMATION OF UNIT AGREEMENT

1.1 UNIT AGREEMENT CONFIRMED. The aforesaid Unit Agreement and all exhibits attached thereto are hereby confirmed and made a part of this agreement and all terms used in this agreement shall have the same meaning as indicated in the Unit Agreement unless otherwise defined herein or clearly indicated by

the context. Also, all land committed to the Unit Agreement shall constitute land referred to herein as "Unitized Lands" or "lands subject to this agreement".

1.2 DEFINITIONS. A "working interest" is an interest committed hereto which is obligated to bear or share, either in cash or out of production (other than by permitting the use of Unitized Substances for development, production, pressure maintenance, or secondary recovery purposes), a portion of all costs and expenses of drilling, developing, producing and operating the Unitized Lands under this agreement and the Unit Agreement; and a "Working Interest Owner" is the owner of a working interest. A Working Interest Owner is sometimes referred to herein simply as an "owner" or a "party hereto". A "Royalty Owner" is any party hereto who owns a right to or interest in any portion of the unitized substances or proceeds thereof other than a "Working Interest Owner". "Unitized Substances" shall mean all oil and gas (which includes gaseous substances, condensate, distillate and all associated and constituant liquid or liquefiable hydrocarbons) within or produced from the Bisti Lower Gallup Sand in the lands subject to this agreement.

SECTION II

MANAGEMENT AND CONTROL

2.1 OVER-ALL SUPERVISION BY WORKING INTEREST OWNERS. Working Interest Owners shall exercise over-all supervision and control of all matters pertaining to the development and operation of the Unitized Lands pursuant to this agreement and the Unit Agreement. In the exercise of such power each Working Interest Owner shall act solely in its own behalf in the capacity of an individual owner and not on behalf of the owners as an entirety.

2.2 PARTICULAR POWERS AND DUTIES OF WORKING INTEREST OWNERS. The matters to be passed upon and decided by Working Interest Owners in accordance with Section III hereof shall include, but not be limited to, the following:

(a) The kind, character and method of operation, including any type of pressure maintenance or secondary recovery program to be employed;

(b) Except where otherwise provided herein or in the Unit Agreement, the drilling of any well within the Unit Area either for production of Unitized Substances, for use as an injection well or for other purposes;

(c) The recompletion, abandonment, or change of status of any well in the Unit Area or use of any such well for injection or other purposes;

(d) The making of an expenditure of more than $15,000 exclusive of expenditures for drilling wells and all expenditures expressly authorized as part of some other expenditure; however, whether the expenditure involved be more or less than $15,000 prior approval of the Working Interest Owners must be secured for the following: The recompletion, or change of status of any well in the Participating Area or use of any such well for injection or other purposes; provided that in case of blowout, explosion, fire, flood or other sudden emergency, Unit Operator may take steps and incur such expenses as in its opinion are required to deal with the emergency and to safeguard life or property, but that Unit Operator shall, as promptly as possible, report the emergency to the owners.

(e) The adoption or submission of any operating and development plan to the Supervisor, Commissioner and the Commission or any regulatory body;

(f) The taking over of wells, property, and equipment as provided for in Section V hereof;

(g) The designating of a representative to appear before any court or regulatory body in matters pertaining to unit operations; provided, however, that the authorization by Working Interest Owners of the designation of any such representatives shall not prevent any Working Interest Owner from appearing in person or from designating another representative in its own behalf;

(h) The making of proper audits of the accounts of Unit Operator pertaining to operations hereunder; provided that such audits shall

(1) Not be conducted more than once each year or upon the resignation or removal of Unit Operator; and shall

(2) Be made at the expense of all Working Interest Owners other than the Working Interest Owner designated as Unit Operator; and

(3) Be upon not less than thirty (30) days written notice to Unit Operator;

(i) The subsequent joinder of any Working Interest Owner or Royalty Owner in this agreement or in the Unit Agreement as provided for in the Unit Agreement, and the determination and revision of the percentage participation to be assigned to any tract committed to this agreement and the Unit Agreement after the effective date thereof, as provided in the Unit Agreement;

(j) The preparation of any revision of Exhibit "C" to the Unit Agreement;

(k) The taking of periodic inventory under the terms of Exhibit "D" hereof;

(l) Any direct charges to the joint account for services by consultants or Unit Operator's technical personnel not covered by the overhead charges provided by Exhibit "D" hereof;

(m) The appointment or designation of the purposes of committees or subcommittees necessary for the study of any problem in connection with unit operations;

(n) The removal of Unit Operator and the selection of a successor;

(o) The enlargement or contraction of the Unit Area and the enlargement of the Participating Area;

(p) The adjustment and readjustment of investments;

(q) Any revision or amendment of the overhead rates or any other provision in the "Accounting Procedure", attached hereto as Exhibit "D";

(r) Selling or otherwise disposing of any major item of surplus equipment, the current list price of any equipment similar thereto being $1500 or more;

(s) The termination of the Unit Agreement.

2.3 APPROVED ACTION BINDING ON ALL PARTIES. Any action, determination or decision which has been approved by the Working Interest Owners pursuant to Section III shall be binding upon each and every Working Interest Owner, even though any such owner has not voted, or has voted to the contrary.

2.4 RESERVATION OF RIGHTS BY OWNERS. Working Interest Owners severally reserve to themselves all their rights, power and privileges except as expressly provided in this agreement and the Unit Agreement.

2.5 SPECIFIC RIGHTS OF OWNERS. Each Working Interest Owner shall have, among others, the following specific rights and privileges:

(a) Access to the Unit Area at all reasonable times to inspect the operations hereunder and all wells and records and data pertaining thereto;

(b) The right to receive from the Unit Operator upon written request copies of all reports to any Governmental Agency, reports of crude oil runs and stocks, inventory reports and all other data pertaining to unit operations. The cost of gathering and furnishing data not ordinarily furnished by Unit Operator to all Working Interest Owners shall be charged solely to Working Interest Owners requesting the same.

2.6 UNIT OPERATOR. SUNRAY MID-CONTINENT OIL COMPANY is hereby designated as the initial Unit Operator. Subject to the provisions of this agreement, and to the orders, directions and limitations rightfully given or imposed by Working Interest Owners, Unit Operator shall have the exclusive right and be obligated to develop and operate the Unitized Lands for the production of Unitized Substances.

2.7 POWERS AND DUTIES OF UNIT OPERATOR. To the extent necessary or convenient for the conduct of operations hereunder, and subject to the limitations herein contained, Working Interest Owners hereby delegate to Unit Operator all rights, powers and privileges granted to or conferred upon them by virtue of any contract or lease covering any land in the Unit Area or by virtue of the Unit Agreement. Unit Operator shall in the conduct of operations hereunder:

(a) Conduct all operations in a good and workmanlike manner and, in the absence of specific instructions from Working Interest Owners, shall have the right and duty to conduct such operations in the same manner as would a prudent operator under the same or similar circumstances. Unit Operator shall freely consult with Working Interest Owners and keep them advised of all matters arising in connection with such operations which Unit Operator, in the exercise of its best judgment, considers important. Unit Operator shall not be liable to Working Interest Owners for damages unless such damages result from the gross negligence or willful misconduct of Unit Operator.

(b) Keep the lands and leases in the Unit Area free from all liens and encumbrances occasioned by its operations hereunder, except the lien of Unit Operator granted hereunder.

(c) Determine the number of employees used by Unit Operator in conducting operations hereunder, the selection of such employees, the hours of labor and the compensation for services to be paid any and all such employees. Such employees shall be the employees of Unit Operator.

(d) Keep true and correct books, accounts and records of its operations hereunder.

(e) Furnish to each Working Interest Owner periodic reports of the development and operations of the Unit Area.

(f) Make all reports to Governmental authorities that it has the duty to make as Unit Operator.

(g) Furnish to each Working Interest Owner, upon written request, a copy of the log of and copies of engineering and geological data pertaining to wells drilled by Unit Operator.

(h) Settle any single damage claim not involving an expenditure in excess of Two Thousand ($2,000.00) Dollars provided such payment is a complete settlement of such claim.

(i) Take such steps and incur such expenses as are required in case of an emergency as provided in Subsection 2.2 (d) hereof.

SECTION III

EXERCISE OF SUPERVISION BY WORKING INTEREST OWNERS

3.1 DESIGNATION OF REPRESENTATIVES. Each Working Interest Owner shall designate in writing the name and address of a representative who will be authorized to act for such Working Interest Owner in all matters arising under this agreement or the Unit Agreement. Each Working Interest Owner may likewise designate an alternate to act for it in the absence of its designated representative. Such representative or alternate may be changed from time to time by notice in writing to the Unit Operator.

3.2 MEETINGS. All meetings of Working Interest Owners for the purpose of considering and acting upon any matter pertaining to the development and operation of the Unit Area which requires the consent and approval of such Owners shall be called by Unit Operator upon its own motion or at the request of one or more Working Interest Owners having a total participating interest of not less than Ten (10%) per cent. No meeting shall be called on

less than Fourteen (14) days advance written or telegraphic notice, with agenda for the meeting included. The Working Interest Owners attending such meeting shall not be prevented from amending items included in the agenda or from deciding such amended items or from deciding other items presented at such meeting. The representative of the Unit Operator shall be Chairman of each meeting.

3.3 VOTING PROCEDURE. The Working Interest Owners shall act upon and determine all matters requiring their consent as follows:

(a) In voting on any matter each Working Interest Owner shall have a voting interest equal to his or its Participating Interest, determined in accordance with Section IV of this agreement.

(b) Except as otherwise specifically provided, the consent and approval of the Working Interest Owners under the provisions of the Unit Agreement and this agreement shall be deemed to have been given if given by an affirmative vote of at least three Working Interest Owners owning at least Sixty-Five (65%) per cent of Participating Interests; provided, however, that if any Working Interest Owner owns a Participating Interest of Thirty-Five (35%) per cent or more, its vote or failure to vote shall not serve to disapprove any matter approved by vote of Eighty (80%) per cent or more of the remaining Participating Interests, and provided, further, that any project involving a total expenditure in excess of $150,000 or any determination with respect to the expansion of the Unit Area or for the drilling of any well outside the Participating Area pursuant to Subsection 8.5, an affirmative vote of at least Eighty (80%) per cent of Participating Interest shall be required for approval except that should one Working Interest Owner own more than Twenty (20%) per cent voting interest, its vote or failure to vote shall not serve to disapprove a matter unless supported by the vote of one or more other Working Interest Owners.

(c) Any Working Interest Owner not represented at a meeting may vote on any item included in the agenda of the meeting by letter or telegram addressed to the Chairman of the meeting provided such vote is received prior to the submission of such item to vote. Such vote shall not be counted with respect to any item on the agenda which is amended at the meeting.

(d) Working Interest Owners may decide any matter by vote taken by letter or telegram, provided no meeting on the matter is called as provided in Subsection 3.2 within 7 days after such proposal is dispatched to the Working Interest Owners. Unit Operator will give prompt notice of the results of such voting to all Working Interest Owners.

SECTION IV

BASIS OF PARTICIPATION

4.1 PARTICIPATING INTERESTS. The "Participating Interest" of each Working Interest Owner hereunder is equal to the sum total of the percentage participations assigned to tracts in the Participating Area in which such Working Interest Owner owns an interest; provided that if the working interests in any such tract are owned in undivided interests by two or more Working Interest Owners, the percentage participation assigned to such tract shall be divided among such owners in proportion to their undivided interests; and, provided further that, if the working interests in any tract are divided with respect to separate parcels of such tract and owned severally by different parties, the percentage participation assigned to such tract shall, in the absence of a recordable instrument among all such parties fixing the division of ownership, be divided among such parcels in proportion to the number of surface acres in each.

4.2 PERCENTAGE PARTICIPATIONS OF TRACTS. The percentage participation assigned to each tract in the initial Participating Area is set forth in Exhibit "C" of the Unit Agreement subject to revision in the event less than all tracts within the initial Participating Area are committed to this agreement and to the Unit Agreement, all in accordance with the provisions of Section 11 of the Unit Agreement. The percentage participation shall also be revised in the event the Participating Area is revised as provided in Section 11 of the Unit Agreement and in accordance with the formula and procedures set forth in Section 12 of the Unit Agreement. Said percentage participations as fixed and determined pursuant to the Unit Agreement shall govern the Participating Interests of the Working Interest Owners hereunder.

4.3 APPORTIONMENT OF COSTS AND BENEFITS. Except as herein otherwise expressly provided, all costs, expenses and liabilities accruing or resulting from exploration, development, operation and maintenance of the Unitized Lands shall be borne by the Working Interest Owners in proportion to their respective Participating Interests at the time such costs, expenses and liabilities are incurred and all Unitized Substances produced hereunder and other benefits accruing hereunder shall be owned and shared by the Working Interest Owners in proportion to their respective Participating Interests at the time such production is obtained and benefits accrue.

SECTION V

INITIAL ADJUSTMENT OF INVESTMENTS

5.1 EQUIPMENT AND FACILITIES NOT FIXTURES ATTACHED TO REALTY. Each of the parties hereto has heretofore placed and used on its tract or tracts committed to the Unit Agreement and this agreement, various well and lease equipment and other property, equipment, and facilities. It is also recognized that additional equipment and facilities may hereafter be placed and used upon the Unitized Lands as now or hereafter constituted. Each of the parties hereto considers any and all such equipment to be personal property and not fixtures attached to realty. Accordingly, said well and lease equipment and personal property is hereby severed from the mineral estates affected by said agreements, and it is agreed that any and all such equipment and personal property shall be and remain personal property for all purposes. The provisions of this Section V and also the provisions of Section VI constitute a separate agreement and understanding with respect to any and all lease and operating equipment or other personal property heretofore or hereafter placed in or on the land in the Unit Area and to the extent necessary to accomplish such separate agreement, such lease and operating equipment is taken over separate and apart from the unitization of the working interests and production effected by the Unit Agreement and this agreement.

5.2 PERSONAL PROPERTY TAKEN OVER. Upon the effective date hereof, Working Interest Owners shall deliver to Unit Operator possession of:

(a) All wells completed in the Bisti Lower Gallup Sand Formation (sometimes called "Unitized Formation") together with the casing therein;

(b) The tubing in each such well, together with the wellhead connections thereon, and all other lease and operating equipment used in the operation of such wells which Working Interest Owners determine is necessary or desirable for conducting unit operations; and

(c) A copy of all production and well records pertaining to such wells.

5.3 INVENTORY AND EVALUATION OF PERSONAL PROPERTY. Working Interest Owners shall, at unit expense, inventory and evaluate in accordance with the provisions of Exhibit "D" the personal property so taken over. Such inventory shall be limited to controllable material (except casing) as defined by the "Material Classification Manual", 1953 Print, prepared by the Petroleum Accountants Society of Oklahoma. The material and equipment inventoried shall be valued on the price basis prescribed for material in Paragraph 2 of Article III of Accounting Procedure attached hereto as Exhibit "D", the applicable conditions to be indicated on the inventory; provided, however, that material and equipment not classified to be in condition A, B, or C as specified in Paragraph 2 of Article III of Exhibit "D" shall not be taken over by Unit Operator except by special agreement with the owners of said equipment as authorized by the Working Interest Owners.

5.4 INVESTMENT ADJUSTMENT. Upon approval by Working Interest Owners of such inventory and evaluation, each Working Interest Owner shall be credited with the value of its interest in all personal property (exclusive of the casing in wells) so taken over by Unit Operator under Subsection 5.2(b), and charged with an amount equal to that obtained by multiplying the total value of all such personal property so taken over by Unit Operator under Subsection 5.2(b) by such Working Interest Owner's Participating Interest as determined in accordance with Section IV hereof. If the charge against any Working Interest Owner is greater than the amount credited to such Working Interest Owner, the resulting net charge shall be paid and in all other respects be treated as any other item of unit expense chargeable against such Working Interest Owner. If the credit to any Working Interest Owner is

greater than the amount charged against such Working Interest Owner, the resulting net credit shall be paid to such Working Interest Owner by Unit Operator out of funds received by it in settlement of the net charges described above.

5.5 GENERAL FACILITIES. The acquisition of warehouses, warehouse stocks, leasehouses, camps, facility systems and office buildings necessary for operations hereunder shall be by negotiation by and between the owners thereof and Unit Operator, subject to the approval of Working Interest Owners. There shall be no adjustment for lease roads or appurtenances thereto.

5.6 OWNERSHIP OF PERSONAL PROPERTY AND FACILITIES. Each Working Interest Owner, individually, shall by virtue hereof own an undivided interest in all personal property and facilities taken over or otherwise acquired by Unit Operator pursuant to this agreement equal to its Participating Interests. Personal property and facilities not taken over by Unit Operator shall be reclaimed by the original owner thereof and shall be removed from the Unit Area within ninety (90) days after the owners of such property are advised in writing that the property shall not be retained by Unit Operator for operations hereunder, unless said property and facilities not retained are necessary for use by the owners thereof in the operation or development of horizons not unitized under the Unit Agreement and this agreement.

SECTION VI

INVESTMENT ADJUSTMENT ON ENLARGEMENT OF PARTICIPATING AREA

6.1 ADJUSTMENT ON ENLARGEMENT OF PARTICIPATING AREA. On enlargement of the Participating Area as provided in the Unit Agreement, there shall be investment adjustments between the Working Interest Owners in the enlarged Participating Area who are parties hereto and the Working Interest Owners in the former Participating Area who are parties hereto to the end that costs and investments within the enlarged Participating Area shall be paid for by the Working Interest Owners in the enlarged Participating Area in proportion to

their respective Participating Interests in the enlarged Participating Area, and also to the end that the parties who have previously paid said costs shall be reimbursed, all in the manner as set forth in Section V hereof pertaining to the initial adjustment of investments, except that a separate adjustment for intangibles shall also be made as provided in Subsection 6.2 hereof.

6.2 SEPARATE ADJUSTMENT FOR INTANGIBLE COSTS ON ENLARGEMENT OF PARTICIPATING AREA. The Working Interest Owners in the Participating Area before its enlargement shall receive credit for the intangible cost of drilling, completing and equipping all wells drilled subsequent to the effective date hereof which are capable of producing Unitized Substances within the said enlarged Participating Area or which are utilized or to be utilized as injection wells or for other purposes within the enlarged Participating Area including all intangible costs incurred subsequent to the effective date of this agreement incident to recompleting and converting wells to injection wells and intangible costs incident to the construction of pressure maintenance and other facilities necessary to the operation of the Unitized Land. No credit shall be given for intangibles in the area to be admitted to the enlarged Participating Area and no credit shall be given for the previous cost of operating any wells or for the intangible cost of repairing or maintaining other property, nor shall there be any debit for and on account of production taken from wells prior to the effective date of the enlargement of the Participating Area. The sum total of said credit shall be apportioned to the enlarged Participating Area, and a separate cash adjustment of intangibles shall be made among Working Interest Owners through the Unit Operator to the end that the costs of said intangibles shall be paid by the Working Interest Owners in the enlarged Participating Area in proportion to their Participating Interests.

SECTION VII

DEVELOPMENT AND OPERATING COSTS

7.1 BASIS OF CHARGE TO WORKING INTEREST OWNERS. Unit Operator initially shall pay and discharge all costs and expenses incurred in the development and operation of the Unit Area. Working Interest Owners shall reimburse Unit Operator for all such costs and expenses in proportion to their respective Participating Interests computed in accordance with Section IV hereof. All charges, credits, and accounting for costs and expenses shall be in accordance with Exhibit "D" hereof. The term "Operator" as used in Exhibit "D" shall be deemed to refer to the Unit Operator, and the term "Non-Operators" as used in Exhibit "D" shall be deemed to refer to the Working Interest Owners other than Unit Operator.

7.2 BUDGETS. Before or as soon as practical after the effective date hereof, Unit Operator shall prepare a budget of estimated costs and expenses for the remainder of the calendar year and on or before the first day of each October thereafter shall prepare a budget of estimated costs and expenses for the ensuing calendar year. Such budgets shall set forth the estimated costs and expenses by quarterly periods. Unless otherwise specified in the budget, it shall be presumed for the purpose of advance billings that the estimated costs and expenses for each month of a quarterly period shall be one-third (1/3) of the estimate for the quarterly period. Budgets so prepared shall be estimates only and shall be subject to adjustment and correction by Working Interest Owners and Unit Operator from time to time whenever it shall appear that an adjustment or correction is proper. A copy of each budget and adjusted budget shall be promptly furnished each Working Interest Owner.

7.3 ADVANCE BILLINGS. Unit Operator shall have the right at its option to require Working Interest Owners to advance their respective proportions of such costs and expenses by submitting to Working Interest Owners, on or before the 15th day of any month, an itemized estimate of such costs and expenses for the succeeding month with a request for payment in advance. Within fifteen (15) days thereafter, each Working Interest Owner shall pay to Unit Operator its

proportionate part of such estimate. Adjustment between estimates and the actual costs shall be made by Unit Operator at the close of each calendar month, and the accounts of the Working Interest Owners shall be adjusted accordingly.

7.4 COMMINGLING OF FUNDS. No funds received by Unit Operator under this agreement need be segregated by Unit Operator or maintained by it as a joint fund, but may be commingled with its own funds.

7.5 LIEN OF UNIT OPERATOR. Each Working Interest Owner grants to Unit Operator a lien upon such Working Interest Owner's leasehold and other mineral interests in each tract, its interest in all jointly owned materials, equipment, and other property and its interest in all Unitized Substances, as security for payment for the costs and expenses chargeable to it, together with interest thereon at the rate of Six (6%) per cent per annum. Unit Operator shall have the right to bring any action at law or in equity to enforce collection of such indebtedness with or without foreclosure of such lien. In addition, upon default by any Working Interest Owner in the payment of costs and expenses chargeable to it, Unit Operator shall have the right to collect and receive from the purchaser or purchasers the proceeds of such Working Interest Owner's share of Unitized Substances up to the amount owing by such Working Interest Owner plus interest, as aforesaid, until paid. Each such purchaser shall be entitled to rely upon Unit Operator's statement concerning the existence and amount of any such default.

SECTION VIII

INDIVIDUAL AND UNIT OPERATIONS

8.1 RIGHT TO OPERATE IN NON-UNITIZED FORMATIONS. Any Working Interest Owner now having, or hereafter acquiring, the right to drill for and produce oil, gas, or other minerals, other than Unitized Substances, within the Unit Area shall have the full right to do so notwithstanding this agreement. In exercising said right, however, such Working Interest Owner shall exercise every reasonable precaution to prevent unreasonable interference with operations hereunder. If any Working Interest Owner drills any well into or through the

Unitized Formation, the Unitized Formation shall be cased or otherwise protected in such a manner that the Unitized Formation and the production of Unitized Substances shall not be adversely affected.

8.2 DUAL COMPLETIONS. Except for those wells taken over by the Unit which are dually completed on the effective date of this agreement, no other Unit wells may subsequently be dually completed unless and until the approval of the Working Interest Owners is obtained and such completion is made in accordance with the methods prescribed by the Working Interest Owners. Dually completed wells will be handled as follows:

(a) A lessee who contributes a well producing from more than one zone shall be obligated to segregate such zones prior to the well being taken over by the Unit in a manner satisfactory to the Working Interest Owners, the cost of such work to be borne by the lessee contributing such well. If such zones are not segregated prior to the effective date then such work shall be done by the Unit Operator as directed by the Working Interest Owners at the expense of the lessee contributing such well.

(b) Any lessee who wishes to recondition, redrill or workover any dual well taken over by the Unit under this agreement for the production of oil or gas from any formation other than the Lower Gallup Sand, shall submit its plan to the Working Interest Owners for approval, and upon such approval said work shall be performed under the supervision of the Unit Operator at lessee's own risk, cost and expense. The productive capacity or injectivity of the Lower Gallup Sand in any such well prior to such reconditioning, redrilling or reworking shall be ascertained by the Unit Operator prior to the commencement of such work, and the respective lessee so advised in writing. Said lessee shall use all reasonable, practicable and customary methods in order to so restore the productivity or injectivity of the Unitized Lower Gallup Sand to the satisfaction of the Working Interest Owners, including the drilling of a replacement well if the hole is lost.

(c) Should the Unit Operator at the direction of the Working Interest Owners do remedial work on the Lower Gallup Sand in any dually completed well, and the cost of such work, in the opinion of the Working Interest Owners, is in excess of what it would have been had the formation other than the Lower Gallup not been producing in such well, the additional cost of such work shall be chargeable to the lessee owning such other zone or formation in such well and such lessee shall be liable for such additional cost upon notification of the amount thereof by the Unit Operator. The words "Additional Cost" as used above shall mean the difference between the normal charges incurred in working over, reconditioning or redrilling a dually completed well and the normal charges for doing the same work on a well which is not dually completed.

(d) When and if the Working Interest Owners determine that the operation of a well that has been dually completed is interfering with the efficiency of the Unit Plan of Operation, Unit Operator shall advise the lessee operating such zone or formation other than the Lower Gallup Sand that such formation must be shut off or reworked by lessee under the direction of the Unit Operator and to the satisfaction of the Working Interest Owners. The work shall be done at the sole risk, cost and expense of said lessee. If said lessee shall fail or refuse to perform said work as directed by Unit Operator, then said work shall be performed by Unit Operator at the sole risk, cost and expense of said lessee. Said lessee and Unit Operator may agree upon the amount of such costs, but if they fail to agree, then the work shall be done on a competitive basis.

8.3 ACCURATE GAUGE OF TANKS. Unit Operator shall make a proper and timely gauge of all lease and other tanks within the Unit Area in order to ascertain the amount of merchantable oil in such tanks, above the pipe line connections, as of 7:00 A.M. on the effective date hereof. All such oil as is a part of the prior allowable of the well or wells from which the same was produced shall be and remain the property of the Working Interest Owners entitled thereto the same as if the Unit had not been formed; and such Working Interest Owners shall promptly remove said oil from the Unit Area. Any such oil not so removed may be sold by the Unit Operator for the account of such Working Interest Owners, subject to the payment of all royalty to Royalty Owners under the terms and provisions of the applicable lease or leases and other contracts. All such oil as is in excess of the prior allowable of the well or wells from which the same was produced shall be regarded and treated the same as Unitized Substances produced after the effective date hereof. If, as of the effective date hereof, any tract is overproduced with respect to the allowable of the well or wells on that tract and the amount of such overproduction has been sold or otherwise disposed of, such overproduction shall be regarded and included as a part of the Unitized Substances produced after the effective date hereof and the amount thereof charged to such tract as having been delivered to the persons entitled to Unitized Substances allocated to such tract.

8.4 DRILLING WITHIN PARTICIPATING AREA. All wells drilled after the effective date of this agreement within the boundaries of the Participating Area to the Bisti Lower Gallup Sand including injection wells, reworking operations, and recompleting wells and converting wells to injection wells, shall be drilled by Unit Operator for the joint account, at joint risk and expense, and upon authorization of the Working Interest Owners pursuant to Section III.

8.5 WELLS OUTSIDE OF PARTICIPATING AREA. The Unit Operator may drill any well within the Unit Area but outside the boundaries of an established Participating Area with the object of completing the same in the Bisti Lower Gallup Sand, which well is herein referred to as an "extension well", for the joint account and at joint risk and expense, upon authorization of the Working Interest Owners obtained pursuant to Section III. Such "extension wells" may also be drilled as provided by Subsection 8.6.

8.6 EXTENSION WELLS BY LEASE OWNER. In addition to the method provided in Subsection 8.5 hereof, "extension wells" may be drilled by a single party on his or its own lease as provided in Section 13 of the Unit Agreement, unless the Working Interest Owners within the Participating Area elect to drill the same as provided in Subsection 8.5 hereof. In the event there is more than one party having an interest in the lease on which the well is desired to be drilled, the same may be drilled on the authority of the majority in interest of the parties in and to said tract. Such wells may be drilled by the Unit Operator for the account of the parties financing same. If any party or parties hereto elect to drill a well or wells in accordance with the provisions of Section 13 of the Unit Agreement, the basis of contribution to the cost thereof and the final adjustment or dispostion of such costs shall be by separate agreement between the parties financing said well.

8.7 PAYING WELLS - DRY HOLES - MARGINAL WELLS. In the event any well drilled under the provisions of this Section VIII encounters production in quantities sufficient to justify the same being included in the Participating Area, there shall be an investment adjustment between the owners of the working

interests affected in accordance with the provisions of Section VI hereof. In the event any such well is a dry hole, it shall be plugged and abandoned at the sole risk, cost and expense of the parties responsible for the drilling of the well. If any such well obtains production in insufficient quantities to justify the inclusion of the lands on which the well is located in the Participating Area, the same shall be operated for the account of and the production shall be owned by the parties who participated in the cost of drilling the well in accordance with Section 13 of the Unit Agreement.

8.8 REQUIRED WELLS. In the event the Operator is required to drill an extension well upon any regular well spacing unit outside of the boundaries of the Participating Area or any development well within the Participating Area by Government order (including any Federal or State agency), or demand, whether such order or demand is initiated by the Government independent of consideration of any plan of development, or is issued as a required authorization of a plan of development, the cost of drilling and completing said well if a producer, and of plugging and abandoning the well, if a dry hole, shall be borne by all of the Working Interest Owners in said Participating Area in proportion to their interests therein, except as otherwise may be provided by separate agreement.

Notwithstanding anything in this Subsection 8.8 to the contrary, in the event the Working Interest Owners do not elect, pursuant to Section III, to drill said required well, same shall not be drilled if either of the following alternatives is available:

(a) If compensatory royalties may be paid in lieu of drilling the well and payment of same receives approval of the Working Interest Owners pursuant to Section III, Unit Operator shall pay such compensatory royalty for the joint account of the Working Interest Owners who would be chargeable with costs incurred in drilling the well; or

(b) If the drilling of the well may be avoided without penalty by contraction of the Unit Area, Unit Operator shall make reasonable effort to effect such contraction with the approval of the Director, Commissioner and the Commission.

8.9 CHARGES FOR DRILLING WELLS. All wells drilled for the joint account shall be drilled at rates comparable to competitive contract rates by properly qualified contractors; provided, however, Unit Operator, if it so desires, may employ its own tools and equipment in the drilling of wells but, in such event, the charge therefor shall not exceed the prevailing rate in the area and such work shall be performed by Unit Operator under the same terms and conditions as are customary and usual in the area in contracts of independent contractors who are doing work of a similar nature.

8.10 ABANDONMENT OF WELLS. If Working Interest Owners decide to permanently abandon any well within the Unit Area prior to termination of the Unit Agreement, Unit Operator shall give written notice of such fact to the Working Interest Owners of the tract on which such well is located and said Working Interest Owners shall have the right and option for a period of Ninety (90) days after receipt of such notice to notify Unit Operator of their election to take over and own said well and to deepen or to plug back said well to a formation other than to the Unitized Formation. Within Thirty (30) days after said Working Interest Owners have so notified Unit Operator of their desire to take over such well and the salvage value has been determined, they shall pay to Unit Operator, for credit to the joint account of the Working Interest Owners, the amount as estimated and fixed by Working Interest Owners to be the net salvage value of the casing and equipment in and on said well. At the same time the Working Interest Owners taking over the well shall agree by letter addressed to Unit Operator to effectively seal off and protect the Unitized Formation, and at such time as the well is ready for abandonment to plug and abandon the well in a workmanlike manner in accordance with applicable laws. In the event the Working Interest Owners of a tract do not elect to take over a well located thereon which is proposed for abandonment, Unit Operator shall plug and abandon the well in accordance with applicable laws.

SECTION IX

USE AND SALE OF UNITIZED SUBSTANCES

9.1 USE OF UNITIZED SUBSTANCES FOR UNIT OPERATIONS. Unit Operator shall have the right to use any one or more Unitized Substances produced from the Unitized Lands for all drilling operations, for pumping, transporting, handling and treating Unitized Substances; for injection, pressure maintenance and secondary recovery programs as may be authorized and approved by the Working Interest Owners; for fuel in camps and houses of employees serving the Unitized Lands, and for all other operations hereunder.

9.2 UNITIZED SUBSTANCES SHALL BE TAKEN IN KIND. Each Working Interest Owner shall take in kind its share of each Unitized Substance excluding the Unitized Substances used by Unit Operator under Subsection 9.1 hereof or unavoidably lost. In the event any party hereto shall fail to take in kind or to separately dispose of its share of Unitized Substances, when and if produced, Unit Operator (or any Working Interest Owner if Unit Operator fails to exercise the right) shall have the right to sell or itself purchase the same on a day to day basis at the market price in the area, if obtainable; otherwise, at the best price obtainable. Any cost incurred by Unit Operator in making any such sale shall be borne by the party whose share is sold. Any such sale or purchase by Unit Operator or any Working Interest Owner, as the case may be, shall be subject always to the right of the owner of such Unitized Substances to exercise at any time the right to take in kind or to separately dispose of its share of production not previously delivered to a purchaser pursuant hereto.

9.3 DELIVERY IN KIND TO ROYALTY OWNERS. Unit Operator is hereby authorized to deliver in kind to Royalty Owners the amounts of the Unitized Substances to which they are entitled under the provisions of Sections 11 and 12 of the Unit Agreement and to deduct such amounts from the share of each Working Interest Owner responsible therefor. Settlement for royalty interest not taken in kind shall be made by the Working Interest Owners in each tract responsible therefor under existing contracts, laws, and regulations on the

basis of the amounts of Unitized Substances allocated to such tract. If any of said tracts are burdened with overriding royalties, payments out of production or any other charges in addition to the usual royalty, the Working Interest Owners committing such tract shall bear and assume the same out of Unitized Substances allocated thereto.

SECTION X

RENTALS AND COMPENSATORY ROYALTIES

10.1 RENTALS. The Working Interest Owners in each tract shall pay all rentals, minimum royalties, advance rentals or delay rentals due under the lease thereon and shall concurrently submit to the Unit Operator the evidence of payment. If the Working Interest Owners in any tract determine not to pay any such rental, they shall notify Unit Operator at least Sixty (60) days before the due date and they shall thereupon assign to all other Working Interest Owners in the Unit Area proportionable to their interest on a surface acreage basis all of their right, title and interest under said lease; provided, however, all such assignments shall be subject to all obligations with respect to reassignments, if any, of the parties making such assignments theretofore created in favor of parties who are not parties to this agreement. In the event of failure of any Working Interest Owner to make proper payment of any delay rental through mistake or oversight where such rental is required to continue the lease in force, there shall be no money liability on the part of the party failing to pay such rental, but such party shall make a bona fide effort to secure a new lease covering the same interest and commit such lease to the Unit Agreement and, in the event of failure to secure the new lease within a reasonable time, the interest of the parties hereto shall be revised, if required, so that the party failing to pay any such rental shall not be credited with the ownership of any lease on which rental was required but was not paid. The Unit Operator shall incur no liability for failure to pay any rental due under the terms of any lease committed to said Unit Agreement; however, in the event any rentals are paid by Unit Operator, the same shall be charged and billed to the party responsible for payment of same. In the

event of loss of title to a lease for failure to pay rental, all losses occasioned thereby shall be that of the Working Interest Owners who should have paid the same.

10.2 COMPENSATORY ROYALTIES. Where the Working Interest Owners determine to pay compensatory royalty in lieu of drilling a demanded well such compensatory royalties shall be paid by Unit Operator and charged to the joint account.

SECTION XI

TITLES

11.1 WARRANTY AND INDEMNITY. Each Working Interest Owner represents and warrants that it is the owner of the respective working interests set forth opposite its name in Exhibit "B" of the Unit Agreement and hereby indemnifies and holds the other Working Interest Owners harmless from any loss due to failure, in whole or in part, of its title to any such interest, except failure of title arising out of operations hereunder; provided, however, that such indemnity shall be limited to an amount equal to the net value that had been received from the sale of Unitized Substances attributed hereunder to the interest as to which title failed. Each failure of title will be effective, insofar as this agreement is concerned, as of the first day of the calendar month in which such failure is finally determined and there shall be no retroactive adjustment of development and operating expenses, Unitized Substances or the proceeds therefrom as a result of title failure.

11.2 FAILURE BECAUSE OF UNIT OPERATIONS. The failure of title to any working interest in any tract by reason of unit operations, including non-production from such tract, shall constitute a joint loss.

SECTION XII

LIABILITY, CLAIMS AND SUITS

12.1 INDIVIDUAL LIABILITY. The duties, obligations and liabilities of Working Interest Owners shall be several and not joint or collective; and nothing contained herein shall ever be construed as creating a partnership of any kind, joint venture, or an association or trust between or among the Working Interest Owners.

12.2 SETTLEMENTS. In the event claim is made against any Working Interest Owner or any Working Interest Owner is sued on account of any matter or thing arising from the development and operation of the Unit Area and over which such Working Interest Owner individually has no control because of the rights, powers, and duties granted by this agreement and the Unit Agreement, said Working Interest Owner shall immediately notify the Unit Operator of such claim or suit. Working Interest Owners shall assume and take over the further handling of such claim or suit and all costs and expenses of handling, settling, or otherwise discharging such claim or suit shall be borne by Working Interest Owners as any other cost or expense of operating the Unitized Lands.

SECTION XIII

WITHDRAWAL OF WORKING INTEREST OWNER

13.1 WITHDRAWAL. If any Working Interest Owner so desires, it may withdraw from this agreement by conveying, assigning, and transferring without warranty of title, either express or implied, to the other Working Interest Owners who do not desire to withdraw herefrom, all of the former's rights, title and interest in and to its lease or leases, or other operating rights in the Unit Area in so far as said lease, leases or rights pertain to the Unitized Formation, together with the withdrawing Working Interest Owner's interest in all wells, pipe lines, casing, injection equipment, facilities and other personal property used in conjunction with the development and operation of the Unit Area; provided, however, that such transfer, assignment or conveyance shall not relieve said Working Interest Owner from any obligation or liability incurred prior to the date of the execution and delivery thereof. The interest so transferred, assigned and conveyed shall be taken and owned by the other Working Interest Owners in proportion to their respective Participating Interest. After the execution and delivery of such transfer, assignment or conveyance, the withdrawing Working Interest Owner shall be relieved from all further obligations and liability hereunder and under said Unit Agreement;

and the right of such Working Interest Owner to any benefits subsequently accruing hereunder and under said Unit Agreement shall cease; provided, that upon delivery of said transfer, assignment or conveyance, the assignees, in the ratio of the respective interests so acquired, shall pay to the assignor for its interest in all jointly owned equipment, casing, and other personal property the fair net salvage value thereof, as estimated and fixed by Working Interest Owners.

SECTION XIV

MISCELLANEOUS

14.1 AD VALOREM TAXES. Unit Operator shall make and file for ad valorem tax purposes all necessary renditions and returns with the proper taxing authorities or Governmental subdivisions covering all real and personal property of each Working Interest Owner within the Unit Area and used in connection with the development and operation of the Unit Area. Any Working Interest Owner dissatisfied with any proposed rendition or assessment of its interest in real or personal property shall have the right, at its own expense, to protest and resist the same. All such ad valorem taxes due and payable on account of real and personal property of each Working Interest Owner located within the Unit Area and used in connection with unit operations shall be paid by Unit Operator for the joint account in the same manner as other costs and expenses of unit operations.

14.2 INSURANCE. As to all operations hereunder, Unit Operator shall carry for the benefit and protection of the parties hereto the following insurance:

(a) Workmen's Compensation Insurance sufficient to comply with the Workmen's Compensation Law for the State of New Mexico;

(b) Employer's Liability Insurance with limits of not less than Twenty-Five Thousand ($25,000.00) Dollars per person;

(c) Comprehensive General Liability Insurance with bodily injury limits of not less than Two Hundred Fifty Thousand ($250,000.00) Dollars per person and Five Hundred Thousand ($500,000.00) Dollars per accident and Property Damage Coverage with limits of not less than Fifty Thousand Dollars ($50,000.00) per accident, and Two Hundred Fifty Thousand ($250,000.00) Dollars aggregate;

(d) Comprehensive Automobile Liability Insurance with bodily injury limits of not less than Two Hundred Fifty Thousand ($250,000.00) Dollars per person and Five Hundred Thousand ($500,000.00) Dollars per accident and Property Damage Coverage with limits of not less than Fifty Thousand ($50,000.00) Dollars per accident. Where Unit Operator charges for its exclusively owned automotive equipment on a rate which includes insurance, no additional charge for such insurance shall be made to the joint account under this Subparagraph (d).

Premiums paid for such insurance shall be charged to the joint account. Unit Operator shall not carry fire or extended coverage insurance upon the property under its control. Unit Operator shall require all contractors and subcontractors employed in operations hereunder to carry Workmen's Compensation and Employer's Liability Insurance, and satisfactory Comprehensive General Liability and Comprehensive General Automobile Insurance.

14.3 INTERNAL REVENUE PROVISION. Each of the parties hereto elects under the authority of Section 761(a) of the Internal Revenue Code of 1954, to be excluded from the application of all of the provisions of Subchapter K of Chapter 1 of Subtitle A of the Internal Revenue Code of 1954. If the income tax laws of the state or states in which the property covered hereby is located contain, or may hereafter contain, provisions similar to those contained in the Subchapter of the Internal Revenue Code of 1954 above referred to under which a similar election is permitted, each of the parties agrees that such election shall be exercised. Each party authorizes and directs Unit Operator to execute such an election or elections on its behalf and to file the election with the proper governmental office or agency. If requested by the Unit Operator so to do, each party agrees to execute and join in such an election.

14.4 FORCE MAJEURE. In the event any party hereto is rendered unable, wholly or in part, by Force Majeure to carry out its obligations under this contract other than the obligation to make payment of amounts due hereunder, it is agreed that upon such party's giving notice and reasonably full particulars of Force Majeure in writing or by telegraph to the other parties hereto within a reasonable time after the occurrence of the cause relied upon, then the obligations of the party giving the notice, so far as they are affected by Force Majeure, shall be suspended during the continuance of any liability so caused, but for no longer period; and the cause of the Force Majeure shall, so far as possible, be remedied with all reasonable dispatch. The term "Force Majeure" as employed herein shall mean any cause not reasonably within the control of the party claiming suspension.

14.5 NOTICES. All notices required hereunder shall be in writing and shall be deemed to have been properly served when sent by mail or telegram to the address of the representative of each Working Interest Owner as furnished to Unit Operator in accordance with Section III hereof.

SECTION XV

EFFECTIVE DATE AND TERM

15.1 SAME AS UNIT AGREEMENT. Subject to the provisions of Subsection 15.2, this agreement shall be binding on all parties who execute it regardless of the joinder or non-joinder of any other party; provided, however, this agreement shall not become effective until the effective date of the Unit Agreement and the term hereof shall be the same as the term of said Unit Agreement and thereafter until all unit wells have been abandoned and plugged or turned over to Working Interest Owners in accordance with Section XVI hereof, and all personal and real property acquired for the joint account of the Working Interest Owners has been disposed of by Unit Operator in accordance with instructions of Working Interest Owners.

15.2 EXECUTION. Unit Operator shall, prior to the final submission of the Unit Agreement to the Director, Commissioner, and the Indian Commissioner (or their duly authorized representatives) for final approval, submit to the Working Interest Owners a report as to the number and the percentage in interest of the Working Interest Owners and Royalty Owners who have executed the Unit Agreement. The Working Interest Owners shall determine by the affirmative vote of parties owning Participating Interests of at least Seventy-Five (75%) per cent, determined on the basis of the percentage participations set forth in Exhibit "C" of the Unit Agreement, whether or not submission of the Unit Agreement to the Director, Commissioner and the Indian Commissioner for final approval is justified. If an affirmative vote is obtained, all parties who have joined herein shall be bound hereby and shall remain a party hereto regardless of the joinder or non-joinder of any other owner who might be entitled to join herein, but in the event of a negative vote, no party hereto shall thereafter be bound by the terms of either the Unit Agreement or this agreement.

SECTION XVI

ABANDONMENT OF OPERATIONS

16.1 TERMINATION. Upon termination of the Unit Agreement the following will occur:

(a) Possession of all oil and gas rights in and to the separate tracts in the Unit Area shall revert to the Working Interest Owners thereof;

(b) Working Interest Owners of any such tract desiring to take over and continue to operate a well or wells located thereon may do so by paying Unit Operator, for the credit of the joint account, the net salvage value of the casing and equipment in and on the well and by agreeing to properly plug the well at such time as it is abandoned.

(c) With respect to all wells not taken over by Working Interest Owners, Unit Operator shall, at the joint expense of Working Interest Owners, salvage as much of the casing and equipment in or on such wells as can economically and reasonably be salvaged and shall cause the same to be properly plugged and abandoned.

(d) Working Interest Owners shall share the cost of salvaging, liquidation, or distribution of assets and properties used in the development and operation of the Unit Area in proportion to their respective Participating Interests.

SECTION XVII

COUNTERPART EXECUTION

17.1 EXECUTION BY SEPARATE COUNTERPARTS OR RATIFICATIONS. This agreement may be executed in any number of counterparts and each counterpart so executed shall have the same force and effect as an original instrument and as if all of the parties to the aggregate counterparts had signed the same instrument; or may be ratified by a separate instrument in writing referring to this agreement. Each such ratification shall have the force and effect of an executed counterpart and of adopting by reference all provisions hereof.

SECTION XVIII

SUCCESSORS AND ASSIGNS

18.1 SUCCESSORS AND ASSIGNS. The terms and provisions hereof shall be covenants running with the lands and unitized leases covered hereby and shall be binding upon and inure to the benefit of the respective heirs, successors and assigns of the parties hereto.

IN WITNESS WHEREOF, this agreement is executed as of the date first above written.

UNIT OPERATOR AND WORKING INTEREST OWNER

SUNRAY MID-CONTINENT OIL COMPANY

By_____
Vice President

_____
address

ATTEST: _____

_____
Secretary

Date of Signature:

_____

WORKING INTEREST OWNERS

AMERADA PETROLEUM CORPORATION

By _____
Vice President

_____
address

ATTEST:

_____

_____
Secretary

Date of Signature:

_____

PHILLIPS PETROLEUM COMPANY

By _____
Vice President

_____
address

ATTEST:

_____

_____
Secretary

Date of Signature:

_____

PAN AMERICAN PETROLEUM CORPORATION

By _____
Attorney in Fact

_____
address

ATTEST:

_____

_____
Secretary

Date of Signature:

_____

SOUTHERN UNION GAS COMPANY

By _____
Vice President

_____
address

_____

ATTEST:

_____
Secretary

Date of Signature:

_____

EL PASO NATURAL GAS PRODUCTS COMPANY

By _____
Vice President

_____
address

_____

ATTEST:

_____
Secretary

Date of Signature:

_____

SHELL OIL COMPANY

By _____
Vice President

_____
address

_____

ATTEST:

_____
Secretary

Date of Signature:

_____

VAL R. REESE AND ASSOC., INC.

By _____
Vice President

_____
address

_____

ATTEST:

_____
Secretary

Date of Signature:

_____

STATE OF OKLAHOMA)
) SS.
COUNTY OF TULSA)

On this_____day of_____, 19____, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of SUNRAY MID-CONTINENT OIL COMPANY, a Delaware corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and said _____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

STATE OF_____)
) SS.
COUNTY OF_____)

On this_____day of_____, 19____, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of AMERADA PETROLEUM CORPORATION, a Delaware corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and said_____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

STATE OF_____)
) SS.
COUNTY OF_____)

On this_____day of_____, 19____, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of PHILLIPS PETROLEUM COMPANY, a Delaware corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and said_____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

STATE OF _____)
) SS.
COUNTY OF _____)

On this ____ day of _____, 19___, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of PAN AMERICAN PETROLEUM CORPORATION, a _____ corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and said _____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

STATE OF _____)
) SS.
COUNTY OF _____)

On this ____ day of _____, 19___, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of SOUTHERN UNION GAS COMPANY, a _____ corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and said _____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

STATE OF _____)
) SS.
COUNTY OF _____)

On this ____ day of _____, 19___, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of EL PASO NATURAL GAS PRODUCTS COMPANY, a _____ corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and said _____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

STATE OF _____)
) SS.
COUNTY OF _____)

On this ____ day of _____, 19___, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of SHELL OIL COMPANY, a Delaware corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and that said _____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

STATE OF _____)
) SS.
COUNTY OF _____)

On this ____ day of _____, 19___, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of VAL R. REESE AND ASSOC., INC., a _____ corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and said _____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

STATE OF _____)
) SS.
COUNTY OF _____)

On this ____ day of _____, 19___, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of _____, a _____ corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and said _____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

STATE OF _____)
) SS.
COUNTY OF _____)

On this ____ day of _____, 19___, before me appeared _____, to me personally known, who, being by me duly sworn, did say that he is Vice President of _____, a _____ corporation, and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and said _____ acknowledged said instrument to be the free act and deed of said corporation.

My commission expires: _____ Notary Public

PASO-T-1955-2

EXHIBIT "D"

Attached to and made a part of UNIT OPERATING AGREEMENT FOR THE DEVELOPMENT AND OPERATION OF THE CENTRAL BISTI LOWER GALLUP SAND UNIT AREA, COUNTY OF SAN JUAN, STATE OF NEW MEXICO

ACCOUNTING PROCEDURE

(UNIT AND JOINT LEASE OPERATIONS)

I. GENERAL PROVISIONS

1. Definitions

"Joint property" as herein used shall be construed to mean the subject area covered by the agreement to which this "Accounting Procedure" is attached.

"Operator" as herein used shall be construed to mean the party designated to conduct the development and operation of the subject area for the joint account of the parties hereto.

"Non-Operator" as herein used shall be construed to mean any one or more of the non-operating parties.

2. Statements and Billings

Operator shall bill Non-Operator on or before the last day of each month for its proportionate share of costs and expenditures during the preceding month. Such bills will be accompanied by statements, reflecting the total costs and charges as set forth under Subparagraph A below:

A. Statement in detail of all charges and credits to the joint account.

B. Statement of all charges and credits to the joint account, summarized by appropriate classifications indicative of the nature thereof.

C. Statements as follows:

(1) Detailed statement of material ordinarily considered controllable by operators of oil and gas properties;

(2) Statement of ordinary charges and credits to the joint account summarized by appropriate classifications indicative of the nature thereof; and

(3) Detailed statement of any other charges and credits.

3. Payments by Non-Operator

Each party shall pay its proportion of all such bills within fifteen (15) days after receipt thereof. If payment is not made within such time, the unpaid balance shall bear interest at the rate of six per cent (6%) per annum until paid.

4. Adjustments

Payment of any such bills shall not prejudice the right of Non-Operator to protest or question the correctness thereof. Subject to the exception noted in Paragraph 5 of this section I, all statements rendered to Non-Operator by Operator during any calendar year shall conclusively be presumed to be true and correct after twenty-four (24) months following the end of any such calendar year, unless within the said twenty-four (24) month period Non-Operator takes written exception thereto and makes claim on Operator for adjustment. Failure on the part of Non-Operator to make claim on Operator for adjustment within such period shall establish the correctness thereof and preclude the filing of exceptions thereto or making of claims for adjustment thereon. The provisions of this paragraph shall not prevent adjustments resulting from physical inventory of property as provided for in Section VI, Inventories, hereof.

5. Audits

A Non-Operator, upon notice in writing to Operator and all other Non-Operators, shall have the right to audit Operator's accounts and records relating to the accounting hereunder for any calendar year within the twenty-four (24) month period following the end of such calendar year, provided, however, that Non-Operator must take written exception to and make claim upon the Operator for all discrepancies disclosed by said audit within said twenty-four (24) month period. Where there are two or more Non-Operators, the Non-Operators shall make every reasonable effort to conduct joint or simultaneous audits in a manner which will result in a minimum of inconvenience to the Operator.

II. DEVELOPMENT AND OPERATING CHARGES

Subject to limitations hereinafter prescribed, Operator shall charge the joint account with the following items:

1. Rentals and Royalties

Delay or other rentals, when such rentals are paid by Operator for the joint account; royalties, when not paid directly to royalty owners by the purchaser of the oil, gas, casinghead gas, or other products.

2. Labor

A. Salaries and wages of Operator's employees directly engaged on the joint property in the development, maintenance, and operation thereof, including salaries or wages paid to geologists and other employees who are temporarily assigned to and directly employed on a drilling well.

B. Operator's cost of holiday, vacation, sickness and disability benefits, and other customary allowances applicable to the salaries and wages chargeable under Subparagraph 2 A and Paragraph 11 of this Section II. Costs under this Subparagraph 2 B may be charged on a "when and as paid basis" or by "percentage assessment" on the amount of salaries and wages chargeable under Subparagraph 2 A and Paragraph 11 of this Section II. If percentage assessment is used, the rate shall be based on the Operator's cost experience.

C. Costs of expenditures or contributions made pursuant to assessments imposed by governmental authority which are applicable to Operator's labor cost of salaries and wages as provided under Subparagraphs 2 A, 2 B, and Paragraph 11 of this Section II.

3. Employee Benefits

Operator's current cost of established plans for employees' group life insurance, hospitalization, pension, retirement, stock purchase, thrift, bonus, and other benefit plans of a like nature, applicable to Operator's labor cost, provided that the total of such charges shall not exceed ten per cent (10%) of Operator's labor costs as provided in Subparagraphs A and B of Paragraph 2 of this Section II and in Paragraph 11 of this Section II.

4. Material

Material, equipment, and supplies purchased or furnished by Operator for use of the joint property. So far as it is reasonably practical and consistent with efficient and economical operation, only such material shall be purchased for or transferred to the joint property as may be required for immediate use; and the accumulation of surplus stocks shall be avoided.

5. Transportation

Transportation of employees, equipment, material, and supplies necessary for the development, maintenance, and operation of the joint property subject to the following limitations:

A. If material is moved to the joint property from vendor's or from the Operator's warehouse or other properties, no charge shall be made to the joint account for a distance greater than the distance from the nearest reliable supply store or railway receiving point where such material is available, except by special agreement with Non-Operator.

B. If surplus material is moved to Operator's warehouse or other storage point, no charge shall be made to the joint account for a distance greater than the distance from the nearest reliable supply store or railway receiving point, except by special agreement with Non-Operator. No charge shall be made to the joint account for moving material to other properties belonging to Operator, except by special agreement with Non-Operator.

6. Service

A. Outside Services:
The cost of contract services and utilities procured from outside sources.

B. Use of Operator's Equipment and Facilities:
Use of and service by Operator's exclusively owned equipment and facilities as provided in Paragraph 5 of Section III entitled "Operator's Exclusively Owned Facilities."

7. Damages and Losses to Joint Property and Equipment

All costs or expenses necessary to replace or repair damages or losses incurred by fire, flood, storm, theft, accident, or any other cause not controllable by Operator through the exercise of reasonable diligence. Operator shall furnish Non-Operator written notice of damages or losses incurred as soon as practicable after report of the same has been received by Operator.

8. Litigation Expense

All costs and expenses of litigation, or legal services otherwise necessary or expedient for the protection of the joint interests, including attorneys' fees and expenses as hereinafter provided, together with all judgments obtained against the parties or any of them on account of the joint operations under this agreement, and actual expenses incurred by any party or parties hereto in securing evidence for the purpose of defending against any action or claim prosecuted or urged against the joint account or the subject matter of this agreement.

A. If a majority of the interests hereunder shall so agree, actions or claims affecting the joint interests hereunder may be handled by the legal staff of one or more of the parties hereto; and a charge commensurate with cost of providing and furnishing such services rendered may be made against the joint account; but no such charge shall be made until approved by the legal departments of or attorneys for the respective parties hereto.

B. Fees and expenses of outside attorneys shall not be charged to the joint account unless authorized by the majority of the interests hereunder.

9. Taxes

All taxes of every kind and nature assessed or levied upon or in connection with the properties which are the subject of this agreement, the production therefrom or the operation thereof, and which taxes have been paid by the Operator for the benefit of the parties hereto.

10. Insurance and Claims

A. Premiums paid for insurance required to be carried for the benefit of the joint account, together with all expenditures incurred and paid in settlement of any and all losses, claims, damages, judgments, and other expenses, including legal services, not recovered from insurance carrier.

B. If no insurance is required to be carried, all actual expenditures incurred and paid by Operator in settlement of any and all losses, claims, damages, judgments, and any other expenses, including legal services, shall be charged to the joint account.

11. District and Camp Expense (Field Supervision and Camp Expense)

A pro rata portion of the salaries and expenses of Operator's production superintendent and other employees serving the joint property and other properties of the Operator in the same operating area, whose time is not allocated directly to the properties, and a pro rata portion of the cost of maintaining and operating a production office known as Operator's DISTRICT PRODUCTION office located at or near FARMINGTON, NEW MEXICO (or a comparable office if location changed), and necessary suboffices (if any), maintained for the convenience of the above-described office, and all necessary camps, including housing facilities for employees if required, used in the conduct of the operations on the joint property and other properties operated in the same locality. The expense of, less any revenue from, these facilities should be inclusive of depreciation or a fair monthly rental in lieu of depreciation on the investment. Such charges shall be apportioned to all properties served on some equitable basis consistent with Operator's accounting practice.

12. Administrative Overhead

Operator shall have the right to assess against the joint property covered hereby the following management and administrative overhead charges, which shall be in lieu of all expenses of all offices of the Operator not covered by Section II, Paragraph 11, above, including salaries and expenses of personnel assigned to such offices, except that salaries of geologists and other employees of Operator who are temporarily assigned to and directly serving on the joint property will be charged as provided in Section II, Paragraph 2, above. Salaries and expenses of other technical employees assigned to such offices will be considered as covered by overhead charges in this paragraph unless charges for such salaries and expenses are agreed upon between Operator and Non-Operator as a direct charge to the joint property.

WELL BASIS (Rate Per Well Per Month)

Well Depth	DRILLING WELL RATE	PRODUCING WELL RATE (Use Completion Depth)		
	Each Well	First Five	Next Five	All Wells Over Ten
UNITIZED FORMATION	$200.00	$35.00	$35.00	$35.00

A. Overhead charges for drilling wells shall begin on the date each well is spudded and terminate when it is on production or is plugged, as the case may be, except that no charge shall be made during the suspension of drilling operations for fifteen (15) or more consecutive days.

B. In connection with overhead charges, the status of wells shall be as follows:

(1) Injection wells for recovery operations, such as for repressure or water flood, shall be included in the overhead schedule the same as producing oil wells.

(2) Water supply wells utilized for water flooding operations shall be included in the overhead schedule the same as producing oil wells.

(3) Producing gas wells shall be included in the overhead schedule the same as producing oil wells.

(4) Wells permanently shut down but on which plugging operations are deferred shall be dropped from the overhead schedule at the time the shutdown is effected. When such wells are plugged, overhead shall be charged at the producing well rate during the time required for the plugging operation.

(5) Wells being plugged back, drilled deeper, or converted to a source or input well shall be included in the overhead schedule the same as drilling wells.

(6) Temporarily shut-down wells (other than by governmental regulatory body) which are not produced or worked upon for a period of a full calendar month shall not be included in the overhead schedule; however, wells shut in by governmental regulatory body shall be included in the overhead schedule only in the event the allowable production is transferred to other wells on the same property. In the event of a unit allowable, all wells capable of producing will be counted in determining the overhead charge.

(7) Wells completed in dual or multiple horizons shall be considered as two wells in the producing overhead schedule.

(8) Lease salt water disposal wells shall not be included in the overhead schedule unless such wells are used in a secondary recovery program on the joint property.

C. The above overhead schedule for producing wells shall be applied to the total number of wells operated under the Operating Agreement to which this accounting procedure is attached, irrespective of individual leases.

D. It is specifically understood that the above overhead rates apply only to drilling and producing operations and are not intended to cover the construction or operation of additional facilities such as, but not limited to, gasoline plants, compressor plants, repressuring projects, salt water disposal facilities, and similar installations. If at any time any or all of these become necessary to the operation, a separate agreement will be reached relative to an overhead charge and allocation of district expense.

E. The above specific overhead rates may be amended from time to time by agreement between Operator and Non-Operator if, in practice, they are found to be insufficient or excessive.

13. Operator's Fully Owned Warehouse Operating and Maintenance Expense

(Describe fully the agreed procedure to be followed by the Operator.)

LOCAL WAREHOUSING COSTS INCLUDED IN DISTRICT EXPENSE.
NONE CHARGEABLE ON CENTRAL STOCKS.

14. Other Expenditures

Any expenditure, other than expenditures which are covered and dealt with by the foregoing provisions of this Section II, incurred by the Operator for the necessary and proper development, maintenance, and operation of the joint property.

III. BASIS OF CHARGES TO JOINT ACCOUNT

1. Purchases

Material and equipment purchased and service procured shall be charged at price paid by Operator after deduction of all discounts actually received.

2. Material Furnished by Operator

Material required for operations shall be purchased for direct charge to joint account whenever practicable, except that Operator may furnish such material from Operator's stocks under the following conditions:

A. New Material (Condition "A")

(1) New material transferred from Operator's warehouse or other properties shall be priced f.o.b. the nearest reputable supply store or railway receiving point, where such material is available, at current replacement cost of the same kind of material. This will include material such as tanks, pumping units, sucker rods, engines, and other major equipment. Tubular goods, two-inch (2") and over, shall be priced on carload basis effective at date of transfer and f.o.b. railway receiving point nearest the joint account operation, regardless of quantity transferred.

(2) Other material shall be priced on basis of a reputable supply company's preferential price list effective at date of transfer and f.o.b. the store or railway receiving point nearest the joint account operation where such material is available.

(3) Cash discount shall not be allowed.

B. Used Material (Condition "B" and "C")

(1) Material which is in sound and serviceable condition and is suitable for reuse without reconditioning shall be classed as Condition "B" and priced at seventy-five per cent (75%) of new price.

(2) Material which cannot be classified as Condition "B" but which,

(a) After reconditioning will be further serviceable for original function as good secondhand material (Condition "B"), or

(b) Is serviceable for original function but substantially not suitable for reconditioning,

shall be classed as Condition "C" and priced at fifty per cent (50%) of new price.

(3) Material which cannot be classified as Condition "B" or Condition "C" shall be priced at a value commensurate with its use.

(4) Tanks, buildings, and other equipment involving erection costs shall be charged at applicable percentage of knocked-down new price.

3. Premium Prices

Whenever materials and equipment are not readily obtainable at the customary supply point and at prices specified in Paragraphs 1 and 2 of this Section III because of national emergencies, strikes or other unusual causes over which the Operator has no control, the Operator may charge the joint account for the required materials on the basis of the Operator's direct cost and expense incurred in procuring such materials, in making it suitable for use, and in moving it to the location, provided, however, that notice in writing is furnished to Non-Operator of the proposed charge prior to billing the Non-Operator for the material and/or equipment acquired pursuant to this provision, whereupon Non-Operator shall have the right, by so electing and notifying Operator within 10 days after receiving notice from the Operator, to furnish in kind, or in tonnage as the parties may agree, at the location, nearest railway receiving point, or Operator's storage point within a comparable distance, all or part of his share of material and/or equipment suitable for use and acceptable to the Operator. Transportation costs on any such material furnished by Non-Operator, at any point other than at the location, shall be borne by such Non-Operator. If, pursuant to the provisions of this paragraph, any Non-Operator furnishes material and/or equipment in kind, the Operator shall make appropriate credits therefor to the account of said Non-Operator.

4. Warranty of Material Furnished by Operator

Operator does not warrant the material furnished beyond or back of the dealer's or manufacturer's guaranty; and in case of defective material, credit shall not be passed until adjustment has been received by Operator from the manufacturers or their agents.

5. Operator's Exclusively Owned Facilities

The following rates shall apply to service rendered to the joint account by facilities owned exclusively by Operator:

A. Water, fuel, power, compressor and other auxiliary services at rates commensurate with cost of providing and furnishing such service to the joint account but not exceeding rates currently prevailing in the field where the joint property is located.

B. Automotive equipment at rates commensurate with cost of ownership and operation. Such rates should generally be in line with the schedule of rates adopted by the Petroleum Motor Transport Association, or some other recognized organization, as recommended uniform charges against joint account operations and revised from time to time. Automotive rates shall include cost of oil, gas, repairs, insurance, and other operating expense and depreciation; and charges shall be based on use in actual service on, or in connection with, the joint account operations. Truck and tractor rates may include wages and expenses of driver.

C. A fair rate shall be charged for the use of drilling and cleaning-out tools and any other items of Operator's fully owned machinery or equipment which shall be ample to cover maintenance, repairs, depreciation, and the service furnished the joint property; provided that such charges shall not exceed those currently prevailing in the field where the joint property is located. Pulling units shall be charged at hourly rates commensurate with the cost of ownership and operation, which shall include repairs and maintenance, operating supplies, insurance, depreciation, and taxes. Pulling unit rates may include wages and expenses of the operator.

D. A fair rate shall be charged for laboratory services performed by Operator for the benefit of the joint account, such as gas, water, core, and any other analyses and tests; provided such charges shall not exceed those currently prevailing if performed by outside service laboratories.

E. Whenever requested, Operator shall inform Non-Operator in advance of the rates it proposes to charge.

F. Rates shall be revised and adjusted from time to time when found to be either excessive or insufficient.

IV. DISPOSAL OF LEASE EQUIPMENT AND MATERIAL

The Operator shall be under no obligation to purchase interest of Non-Operator in surplus new or secondhand material. The disposition of major items of surplus material, such as derricks, tanks, engines, pumping units, and tubular goods, shall be subject to mutual determination by the parties hereto; provided Operator shall have the right to dispose of normal accumulations of junk and scrap material either by transfer or sale from the joint property.

1. Material Purchased by the Operator or Non-Operator

Material purchased by either the Operator or Non-Operator shall be credited by the Operator to the joint account for the month in which the material is removed by the purchaser.

2. Division in Kind

Division of material in kind, if made between Operator and Non-Operator, shall be in proportion to their respective interests in such material. Each party will thereupon be charged individually with the value of the material received or receivable by each party, and corresponding credits will be made by the Operator to the joint account. Such credits shall appear in the monthly statement of operations.

3. Sales to Outsiders

Sales to outsiders of material from the joint property shall be credited by Operator to the joint account at the net amount collected by Operator from vendee. Any claims by vendee for defective material or otherwise shall be charged back to the joint account if and when paid by Operator.

V. BASIS OF PRICING MATERIAL TRANSFERRED FROM JOINT ACCOUNT

Material purchased by either Operator or Non-Operator or divided in kind, unless otherwise agreed, shall be valued on the following basis:

1. New Price Defined

New price as used in the following paragraphs shall have the same meaning and application as that used above in Section III, "Basis of Charges to Joint Account."

2. New Material

New material (Condition "A"), being new material procured for the joint account but never used thereon, at one hundred per cent (100%) of current new price (plus sales tax if any).

3. Good Used Material

Good used material (Condition "B"), being used material in sound and serviceable condition, suitable for reuse without reconditioning:

A. At seventy-five per cent (75%) of current new price if material was charged to joint account as new, or

B. At sixty-five per cent (65%) of current new price if material was originally charged to the joint property as secondhand at seventy-five per cent (75%) of new price.

4. Other Used Material

Used material (Condition "C"), at fifty per cent (50%) of current new price, being used material which:

A. After reconditioning will be further serviceable for original function as good secondhand material (Condition "B"), or

B. Is serviceable for original function but substantially not suitable for reconditioning.

5. Bad-Order Material

Material and equipment (Condition "D"), which is no longer usable for its original purpose without excessive repair cost but is further usable for some other purpose, shall be priced on a basis comparable with that of items normally used for that purpose.

6. Junk

Junk (Condition "E"), being obsolete and scrap material, at prevailing prices.

7. Temporarily Used Material

When the use of material is temporary and its service to the joint account does not justify the reduction in price as provided in Paragraph 3 B, above, such material shall be priced on a basis that will leave a net charge to the joint account consistent with the value of the service rendered.

VI. INVENTORIES

1. Periodic Inventories, Notice and Representation

At reasonable intervals, inventories shall be taken by Operator of the joint account material, which shall include all such material as is ordinarily considered controllable by operators of oil and gas properties.

Written notice of intention to take inventory shall be given by Operator at least thirty (30) days before any inventory is to begin so that Non-Operator may be represented when any inventory is taken.

Failure of Non-Operator to be represented at an inventory shall bind Non-Operator to accept the inventory taken by Operator, who shall in that event furnish Non-Operator with a copy thereof.

2. Reconciliation and Adjustment of Inventories

Reconciliation of inventory with charges to the joint account shall be made by each party at interest, and a list of overages and shortages shall be jointly determined by Operator and Non-Operator.

Inventory adjustments shall be made by Operator with the joint account for overages and shortages, but Operator shall be held accountable to Non-Operator only for shortages due to lack of reasonable diligence.

3. Special Inventories

Special inventories may be taken, at the expense of the purchaser, whenever there is any sale or change of interest in the joint property; and it shall be the duty of the party selling to notify all other parties hereto as quickly as possible after the transfer of interest takes place. In such cases, both the seller and the purchaser shall be represented and shall be governed by the inventory so taken.

R 14 W | R 13 W | R 12 W

T 26 N

T 25 N

LPG PILOT

UNIT AREA

BISTI ENGINEERING COMMITTEE
BISTI LOWER GALLUP OIL POOL
Portions of
Township 25 & 26N Ranges 12,13 & 14W
County San Juan State New Mexico
2000 1000 0 1000 2000 4000
SCALE IN FEET
PREPARED BY SUNRAY MID-CONTINENT EXPLORATION DRAFTING SECTION

CENTRAL BISTI LOWER GALLUP SAND UNIT
BISTI POOL
SAN JUAN CO., NEW MEXICO

ENGINEERING STUDY

— Prepared By —
Central Bisti Lower Gallup Sand Unit
Engineering Committee

MAY 5, 1959

ENGINEERING STUDY

CENTRAL BISTI LOWER GALLUP SAND UNIT

BISTI POOL, SAN JUAN COUNTY, NEW MEXICO

SUNRAY MID-CONTINENT OIL COMPANY (OPERATOR)

Engineering Committee

Company	Representative
Amerada Petroleum Corporation	B. M. Boggess
El Paso Natural Gas Prod. Company	Lee Ayers
Pan American Petroleum Corporation	G. W. Eaton
Phillips Petroleum Company	E. F. Lewis
Val R. Reese and Assoc., Inc.	Val R. Reese
Shell Oil Company	M. W. McGarry, Jr.
Southern Union Gas Company	A. M. Wiederkehr
Sunray Mid-Continent Oil Company	R. E. Brooks, Chairman

ACKNOWLEDGEMENT

Appreciation is extended to the numerous engineers and geologists who worked with the Engineering Committee and its subcommittees on this assignment.

TABLE OF CONTENTS

LIST OF EXHIBITS

LIST OF EXHIBITS (Cont'd.)

LIST OF EXHIBITS (Cont'd.)

I. PURPOSE OF REPORT

The purpose of this report is to compile pertinent engineering data used by the Bisti Engineering Committee to determine the feasibility of unitization and to recommend the most economic pressure maintenance and/or secondary recovery program for the Lower Gallup Reservoir in Central Bisti Pool.

II. SUMMARY AND RECOMMENDATIONS

The Bisti Engineering Committee, as directed by the Operators Committee, studied the area of the Bisti Lower Gallup Oil Pool West of Shell's Carson Unit which now consists of two proposed units referred to as Western and Central. This report covers only the Central Unit which is delineated in Exhibit 2.

Net pay thickness was determined by two methods, (1) Microlog net pay and (2) Area under the SP curve corrected to core footage. The oil in place at bubble point conditions was calculated to be 38.04 million barrels from Microlog net pay acre feet and 62.23 million barrels from corrected SP net pay acre feet. The 63 producing wells had a cumulative oil production of 1,844,431 barrels as of February 1, 1959. Estimated ultimate recoveries and economics of the operating plans studied are as follows:

	Natural Depletion	LPG-Gas Miscible Phase Flood	Water Flood
Ultimate Recovery (8/8)			
Stock tank oil, bbls.	5,929,100	11,888,553	10,029,200
Gas sales, MMcf	7,238	9,058	4,070
Plant products, bbls.	740,000	367,400	278,000
LPG slug, bbls.	0	118,825	0
Value of Net (7/8) Recovery	$17,082,555	$32,166,419	$26,397,600
Investment Totals	$ 4,800,000	$ 5,612,000	$ 5,725,000
Total Expenses	$ 2,793,599	$ 9,750,719	$ 7,640,300
Salvage	$ 400,000	$ 602,450	$ 581,500
Operating Profit After Salvage	$ 9,888,956	$18,006,150	$13,613,800
Total Operating Profit/$ Inv.	$ 2.06	$ 3.21	$ 2.38
Benefit Operating Profit after Salvage	0	$ 8,117,194	$ 3,724,845
Total Benefit Profit /$ Inv.	0	$10.00	$ 4.02

It is recommended that the area delineated in Exhibit 2 be unitized and operated as an LPG-gas miscible displacement pressure maintenance project as described in the Engineering Committee report entitled "Plan of Operation" dated April 6, 1959.

III. CONCLUSIONS

1. The primary oil recovery to an abandonment pressure of 100 psi will be approximately 16% of the oil in place.

2. The Bisti LPG flood pilot project has been successful.

3. An LPG-gas miscible phase pressure maintenance project will return a larger profit in less time than a water flood.

IV. GENERAL FIELD INFORMATION

A. Location of Field and Unit

The Bisti Lower Gallup Oil Pool is located 20 miles south of Farmington, New Mexico in San Juan County. The 25,000 acre pool has a northwest to southeast trend that is approximately 30 miles long with a width variation from one-half to three miles.

The Operators west of Shell's Carson Unit have made joint engineering studies of all of the area shown by Exhibit 1, and are currently pursuing unitization. The area studied has been divided into two separate units also depicted on Exhibit 1. British American has been elected Operator of the proposed Western Unit. Sunray Mid-Continent has been elected Operator of the proposed Central Unit.

This report concerns only the Central Bisti Lower Gallup Sand Unit which is outlined in detail by Exhibit 2. This exhibit shows participating area and unit area for affected tracts with operator and royalty ownership. The participating area is that portion of the reservoir which has been proven productive, whereas the land between the participating area boundary and the unit boundary has not been proven. The unit boundary is extended for protection of the participating area from drainage of secondary recoverable oil and/or injected substances.

B. Geology

The Lower Gallup sandstone of the Mesa Verde group is of Upper Cretaceous age. The Bisti Lower Gallup reservoir is found at a depth of approximately 4,900 feet and has an average gross thickness of 130 feet of alternating

layers of sandstone, sandy shale, and shale, with only 10 to 20 percent having a permeability greater than one millidarcy. The low permeability sands have required heavy fracturing to stimulate production.

Exhibit 3 is a typical log illustrating the six sand stringers which compose the Lower Gallup reservoir. For the purpose of engineering work, the stringers were classified into three separate zones as shown in this exhibit. The upper stringer (Zone 1) is the principal oil horizon; it is a light gray, medium-grained, clean, well sorted sandstone. The lower four stringers (Zone 3) are silty, fine-grained sandstones with irregular dark gray, micaceous shale inclusions and partings. Zone 2 is similar to Zone 3 but generally is a better quality sandstone.

The best developed productive sands follow the axis of the long narrow sand bar which has a northwest to southeast trend. The trap which dips 70 feet per mile northwest, is of stratigraphic nature.

C. Development History

The Bisti Lower Gallup reservoir was discovered in December, 1955 when El Paso Natural Gas Company recompleted their Kelly State No. 1 in the reservoir for 646 barrels of oil per day. Drilling on adjoining leases began in February, 1956 and the majority of the Central Bisti wells were completed that year. Initial potentials of the oil wells have usually ranged from 100 to 700 barrels per day. Since all apparent good sand development in the Central Bisti Unit has been drilled, future drilling will probably be confined to a few infield locations for development of a secondary recovery drainage pattern. The number of wells completed in the participating area, cumulative oil produced, and current oil produced, are shown in Exhibit 4.

D. Well Completion Practices

The common method of well completion in the unit area has been to set 8-5/8 inch surface casing to a depth of 230 feet and circulate cement to the surface. When the Lower Gallup reservoir is drilled, an electric log and Microlog survey are conducted. The oil string of 5-1/2 inch casing is run to total depth and cemented from the casing shoe to 500 feet above the top of the pay zone. The pay zone is then perforated, sand oil fraced, and put on production.

E. Production History

Exhibit 5 shows the pertinent oil production history for the Central Bisti Lower Gallup Sand Unit. Limited local market and lack of pipe line outlet restricted production until May, 1958 when pipe line connections were completed. Several wells are now establishing a normal production decline. Delivery facilities for gas should become available in 1959.

F. Reservoir Fluid Characteristics

Samples of reservoir fluids have been analyzed from British American Marye Well No. 1 and Sunray Mid-Continent Federal C Well No. 21. The similarity of fluid properties from both samples is shown in Exhibit 6. The saturation pressure of the samples had a difference of 105 psi, i.e., Federal C No. 21 - 1,260 psia, and Marye No. 1 - 1,155 psia.

The average bubble point properties used in reservoir studies are:

Bubble point pressure at 145° F, psia	1,207
Solution gas content, cu. ft./bbl.	406
Formation volume factor, res. bbls/STB	1.26
Viscosity - centipoises	0.83

G. Reservoir Rock Characteristics

1. Core Analysis

The Engineering Committee studied all of the cored wells west of Shell's Carson Unit, completed in the Lower Gallup reservoir. Data from these wells were employed in the determination of pertinent reservoir rock characteristics. Core data in a few wells were excluded from the study because the analyses did not represent pay zones, the well cored was dry, or the well was far removed from other development. None of the wells were cored with oil base mud, consequently, capillary pressure analyses were conducted for studies of water saturation.

Since the wells cored were dispersed throughout the field and not concentrated in any one particular area, it was assumed that the data represented average properties for the entire unitized area.

2. Connate Water Saturation

The water saturations used in calculating oil in place were determined by plotting values of irreducible water saturations from capillary pressure analyses versus fluid permeability on semi-log paper. The data were fitted to a straight line using the method of least squares. The mathematical model used for this fit was:

$$Y = be^{mx}$$

Where Y = permeability, K in md
x = irreducible water saturations, S_w
b = constant
m = slope
e = 2.718

Rewritten in terms of the variables used, the equation becomes:

$$K = be^{(mS_w)}$$

A plot of these variables (K and S_w) and the results of the least squares fit are shown in Exhibit 7.

3. Porosity and Permeability

The Engineering Committee did not determine porosity and permeability. However, early in 1957 Sunray Mid-Continent engineers made statistical studies of the Bisti Lower Gallup rock characteristics. Core analyses from 20 wells west of the Carson Unit showed that 97.35 percent of the total permeability capacity was in reservoir rocks with permeabilities greater than 1.1 md. From histograms using all samples with permeabilities between 1.1 and 432 md. the average Lower Gallup rock properties were found to be 9.05 md. permeability and 14.43 percent porosity, with a water saturation of 24.5% from capillary pressure data or 28.6% from electric log studies. Exhibit 8 is frequency distribution diagrams of permeability. In this study, Zone 1 and 2 were not separated, but Zone 3 is the same as considered by the Committee.

4. Hydrocarbon Pore Volume

Having established the relationship between permeability and connate water saturations by the least squares method, core samples were selected by correlation to agree with the Microlog and SP intervals in each of the wells. The average value for $\phi (1-S_w)$ in each zone was calculated by substituting values of K in the least squares equation, solving for S_w and evaluating $\phi (1-S_w)$ for each foot of sample. The summations of $\phi (1-S_w)$ divided by the number of feet represented in that zone for the Microlog and SP intervals, gave the average values in each well. The summation of $\phi (1-S_w)$ in each zone for all wells divided by the total number of feet represented in that zone, gave average values for the field. The results of these calculations are shown in Exhibit 9.

Average values from the results of the Engineering Committee work are as follows:

$\phi\ (1-S_w)$

	ML	SP
Zone 1	0.12158	0.1059
Zone 2	0.07833	0.0643
Zone 3	0.07027	0.0661

V. STOCK TANK OIL IN PLACE AT BUBBLE POINT

A. Sand Thickness and Acre Feet Determinations

Two criteria were used to calculate the acre feet of pay. One included only the thickness of the net pay zones shown by Microlog separation, while the other, using the electric log, included the feet of pay calculated by determining the area under the SP curves in millivolt feet divided by the static SP in millivolts. The SP acre feet were corrected by a factor derived from core analyses. A tabulation showing net thickness is presented as Exhibit 10.

The procedure used is as follows:

1. Microlog Net Pay

All positive Microlog separation was counted to the nearest half-foot, provided the separation was located opposite zones indicated by the SP curve to be porous. No isolated interval was counted unless it was more than one foot thick. Thin shale laminations were deducted from the net footage if they were indicated by the Microlog to be one-half foot, or more, in thickness.

The count was obtained from the 5-inch to 100-foot recording of the Microlog instead of the 25-inch to 100-foot recording, since only a small percentage of the logs included the expanded scale.

2. SP Area

An SP shale base line through Zones 1, 2, and 3 was marked on the logs to be planimetered. Since an SP drift was noted on most of the logs analyzed, the base line was obtained by connecting the SP minimum opposite two

characteristic shales, located within the first 100 feet above the top of Zone 1. On many logs, this produced a slanting base line which compensated for the drift of the SP curve.

A consistent shale base line could not be selected below the productive zones, since most of these sections contain varying amounts of sand. As a result, the SP curve does not return to the base line.

The SP curve through the cored intervals was planimetered separately for the purpose of establishing a means of adjusting the net SP footage in the cored interval to the equivalent core footage.

3. Static SP - (SSP)

The SSP was obtained from the nearest water-bearing sandstone approximately 1,000 feet above the Lower Gallup. This sand occurs at 3,600 feet in Sunray Mid-Continent's Federal C-14 well. This was considered more reliable than a theoretical SSP calculated from the mud data. A new shale base line was picked in the vicinity of the zone selected for the SSP value.

B. Acre Feet Determinations

Two isopachous maps were prepared by the Engineering Committee for each of the three zones, one representing the Microlog pay and the other representing the SP pay. These six isopachous maps are shown in Exhibits 11 and 12, inclusive. Acre feet for each lease was determined from the isopachous maps by reading the average sand thickness within each ten acre grid, and then summing the product of thickness times grid acres within a lease.

In the evaluation of SP acre feet, it was necessary to apply a correction factor so as to adjust values of SP feet to the corresponding values from the core data. This was done by dividing net pay from core data in

each zone by feet of pay from electric logs (SP feet). For net pay from cored data, all samples above one md. were counted as one foot, and those with less than one md. were given a fraction of a foot equal to its permeability. This calculation is shown on the last page of Exhibit 10, entitled "Electric Log Analysis and Net Pay Determination." The results of these calculations are as follows:

	Correction Factor Core Footage/SP Log Footage
Zone 1	1.0203
Zone 2	0.6204
Zone 3	0.4634

C. Oil in Place at Bubble Point

The oil in place was calculated by the volumetric method.

$$\text{Oil in place in STB} = \frac{7758\ \phi\ (1-S_w)}{B_o} \times \text{acre feet}$$

Where ϕ = porosity
S_w = connate water saturation
B_o = formation volume factor at bubble point (1.26)

From the values of $\phi\ (1-S_w)$ determined for each zone in both Microlog and SP intervals, the following values of stock tank oil in place per acre foot were calculated:

	ML	SP
Zone 1	748.6	652.0
Zone 2	482.3	397.1
Zone 3	432.7	407.0

The results of the isopachous picks of corrected acre feet and the oil in place calculations are found in Exhibit 13.

The differences in values for oil in place using Microlog and SP is attributed to the fact that the SP curve will show sands of lower permeability than does the Microlog.

VI. PREDICTED PRIMARY RECOVERY FROM CENTRAL BISTI UNIT (PLAN I)

The primary recovery mechanisms causing fluid flow in the Unit Area are fluid expansion and solution gas drive.

A. Fluid Expansion

Oil recovery by fluid expansion occurred from the time the Kelly State 1 was completed until the reservoir pressure reached bubble point pressure of 1207 psi. Oil recoveries as estimated from fluid expansion data are compared with field performance data in Exhibit 14. Difference in the comparative values may be attributed to (1) fluid migration to this area of early development from undeveloped areas, (2) inaccurate determination of average weighted original reservoir pressure, (3) an error in the average field pressures which were used to arrive at field production at the time bubble point is reached, or (4) a conservative estimate of oil in place. The original reservoir pressure would need to be 3200 psi for theoretical data to check field data, and this is improbable since none of the wells exhibit an original pressure approaching this value. The field pressures are obtained from areally weighted isobaric maps. It is improbable that average pressure would measure less, for most surveys were shut in for 48 hours which is inadequate for true build-up in many wells. Also, a volumetric weighted averaged pressure would be higher because the highest pressures are in the best developed part of the reservoir. Therefore, it seems that some additional recovery was contributed by fluid migration as in (1) above.

B. Solution Gas Drive

Primary recovery by solution gas drive has been estimated by material balance calculations. Relative permeability was determined by laboratory

measurements upon 14 samples within a permeability range from 299 md. to 0.48 md. as shown in Exhibit 15. It should be noted that laboratory curves in the range of 200-299 md. are of the same order of magnitude as the average curve published by Mr. John Arps, which indicates the dirty nature of sands in Bisti. All relative permeability data were used to construct a k_g/k_o curve which represents average reservoir rock conditions for the Central Unit. The tabulation of material balance natural depletion calculations for this average k_g/k_o curve is shown on Exhibit 16. The estimated recoveries by solution gas drive are 13.66% as indicated by the material balance calculation.

Low primary recoveries are also indicated by production data in the Central Unit. As of January 1, 1959, 32 wells in Central Bisti depict a definite production decline. The remaining 32 wells lie along the longitudinal axis in best developed sands on the structure.

For the purpose of estimating oil recoveries from decline curves, it was assumed that wells which have not established early natural decline will have an average recovery of 150,000 barrels per well or 4,800,000 barrels. The estimated recovery from the wells which have decline curves that can be extrapolated was added to the 4,800,000 barrels. This estimate gave an ultimate recovery factor of 15.5% and checks the overall estimated primary recovery by fluid expansion plus solution gas drive which was estimated to be approximately 16%.

VII. DISCUSSION OF LPG PILOT PERFORMANCE

A. Production History

Since August, 1957, an LPG-miscible displacement pilot flood has been operated by Sunray Mid-Continent in Zone 1 of the Bisti Lower Gallup Field. This project area is shown in Exhibit 1. Through January, 1959, the production from the pilot producing wells during the LPG flood displacement was 262,407 barrels of stock tank oil.

In August and September, 1957, 15,800 barrels of butane and 15,215 barrels of propane, or a total of 31,015 barrels were injected into Zone 1 of the Lower Gallup Sand to form the LPG zone of miscibility. Gas injection was started immediately after the completion of the LPG injection.

Calculations were made to determine if the total volume of gas injected was greater than the total volume of withdrawals from the pilot project area. The results of these calculations are presented in graphical form in Exhibit 17. These calculations consider reservoir pressure wherein volumetric balance of the net withdrawals and injections give total net volume changes. Volume determinations are presented in tabular form in Exhibit 17C.

The following relationship was used in establishing the net reservoir injection volume:

$$V_I - V_{FPG} - N_{pB} \pm E_g \mp C_o \mp Sh_{oil} = \text{Net reservoir injection vol.}$$

Where:

V_I = is the reservoir volume of gas injected

V_{FPG} = is the reservoir volume of free gas produced

N_{pB} = is the reservoir volume of oil produced

E_g = is the volume of gas expansion

C_o = is the volume of oil compression

Sh_{oil} = is the volume of oil shrinkage

$$V_I = B_g \times V_i$$

Where: B_g - is the injected gas formation volume factor (res. bbls./SCF)

V_i - is the volume of injected gas (SCF)

$$V_{FPG} = N_p (R-R_s) B_g$$

Where: N_p - volume of stock tank oil produced

R - is the producing gas-oil ratio (SCF/STB)

R_s - is the solution gas-oil ratio (SCF/STB)

$$E_g = V_{g(1)} (B_{g2}/B_{g1}) - V_{g(1)}$$

Where: $V_{g(1)}$ - is the cumulative free gas volume in the reservoir, (total reservoir volume of gas inj. - free gas prod.), previous month (res. bbl.)

Expansion Ratio - is equal to $\frac{B_{g(2)}}{B_{g(1)}}$

Where: Subscript (1) - is previous month

Subscript (2) - is present month

$$C_o = V_{o(1)} \times C (P_{R(2)} - P_{R(1)})$$

Where: $V_{o(1)}$ - is the oil volume in the reservoir during previous month

C - is the compressibility factor for oil (vol/vol/psi)

$P_{R(2)}$ - is the reservoir pressure

Since the compression (or expansion) is continuous, oil volume at the end of each month was calculated as follows:

$$V_{o(2)} = V_{o(1)} - C_{o(2)}$$

$$SH_{oil} = (NB_o)_2 - (NB_o)_2 \text{ (SH ratio)}$$

Where: $(NB_o)_2$ - is the oil volume in the reservoir - present month (res. bbls.)

Sh ratio - is equal to $\frac{B_{o(2)}}{B_{o(1)}}$

B_o - is the oil formation volume factor (res. bbls./STB)

B. Pilot Performance Prediction

1. Oil in Place in Pilot

The oil in place was calculated separately for an enclosed 40-acre five-spot and a 90-acre area which extends 1/4 of the distance between the producing wells in the 40-acre five-spot as shown on Exhibit 18. The 40 acres enclosed by the four pilot producers are calculated to contain 560,869 barrels of stock tank oil. The large area contains 1,180,017 barrels of stock tank oil.

The oil in place for the four 10-acre grids lettered A, B, C, and D, on Exhibit 18 was calculated using average porosity and saturations determined from the injection well and the producing well draining the area. For example, the GI #1 and the Sunray Mid-Continent Federal C #1 rock properties were average for the D grid, etc.

2. Production Performance Predictions

The total predicted production from the pilot project was calculated from the actual performance of the four wells in the pilot project. These predictions are presented in graphical form on Exhibit 19. The graphs for each well were constructed by calculating the ratio of the stock tank production in barrels, divided by the reservoir voidage in barrels. This ratio was then plotted vs. the cumulative production in stock tank barrels. These calculations which are shown on Exhibit 20 were obtained by the following method:

$$Q_R = Q_s \left[B_o + (R-R_s)\, B_g \right]$$

or,

$$\frac{Q_s}{Q_r} = \frac{1}{\left[B_o + (R-R_s)\, B_g \right]}$$

$$B_g = \frac{P_s}{P_R} \times \frac{T_R}{T_s} \times \frac{Z_R}{5.61}$$

Where: B_g = the reservoir barrels of space occupied by one SCF of gas

P_s = the base pressure, psia

P_R = the reservoir pressure, psia

T_R = the reservoir temperature, ^oR

T_s = the standard temperature, ^oR

Z_R = the gas compressibility factor

B_o = the oil formation volume factor

R = the producing gas-oil ratio, SCF/STB

R_s = the solution gas-oil ratio, SCF/STB

Q_s = the stock tank oil production in barrels

Q_R = the reservoir voidage in barrels.

In Exhibit 21 the recovery efficiencies for the pilot project wells are listed. These recovery efficiencies were calculated with the assumption that there are three different possible flooding patterns occurring in the LPG project area. These three possible flooding patterns are: (1) that the production is from the 40-acre area enclosed by the four producing wells; (2) that 15% of the production is from the area outside of the area enclosed by the four producing wells; (3) that the LPG-miscible flood is sweeping an area greater than the area enclosed by the producing wells, i.e., that the total area sweep includes the 90 acres.

Theoretical calculations[1,2] were performed to predict the recovery from (1) the enclosed 40-acre five-spot and (2) the 90-acre area. The results of these calculations (shown graphically on Exhibit 22) indicate that the sweep efficiency from an enclosed 40-acre area should be 1.915 times greater than the 90-acre open area. These theoretical calculations provide a method of converting recoveries predicted from the $(\frac{Q_S}{Q_R})$ decline curves to a common basis as is done on Exhibit 21. Oil recoveries for each well were estimated from the Q_S/Q_R curves at first signs of gas breakthrough and at a producing gas-oil ratio of 20,000 cubic feet per barrel. These recoveries were divided by the oil in place calculated for each quadrant. The calculations were reduced to the enclosed five-spot basis under the assumption that an LPG flood would be operated on a true closed five-spot injection pattern.

C. Production of the LPG Slug from Pilot Area

A method was devised by which the amount of the LPG slug that has been produced each month from each of the four pilot area wells could be estimated.

The method consists essentially of comparing the measured concentrations of propane and butanes in the produced separator gases from the four pilot area wells with the concentrations of propane and butane that would have been found in the separator gases if no LPG slug had been used. The differences in concentrations, assumed to be due to the slug breaking through, when associated with the volume of produced separator gas, gave a measure of the

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1. Caudle, B. H., Erickson, R. A., and Slobod, R. L., "The Enchroachment of Injected Fluids Beyond the Normal Well Pattern," A.I.M.E., Petroleum Transactions, Vol. 204, 1955, p. 79.

2. Dyes, A. B., Caudle, B. H., and Erickson, R.A., "Oil Production After Breakthrough as Influenced by Mobility Ratio," A.I.M.E., Petroleum Transactions, Vol. 201, 1954, p. 81.

volume of propane and butane that had been a part of the slug. In order to give a complete accounting of volumes, the volumes of propane and butane that remained in the stock tank oil were estimated and added to the volumes in the separator to get the total. Details of the method will be shown with an example calculation.

The samples of separator gas that have been collected and analyzed periodically have been collected at various separator pressures and temperatures. Before the observed propane and butane concentrations could be compared with calculated values, it was necessary to select a "base" separator pressure and temperature and then correct the observed concentrations of propane and butane for the difference between the sampling temperature and pressure and the "base" values. The "base" values were 60° F and 30 psig. A set of correction charts were prepared from the results of a series of equilibrium flash vaporization calculations made for a range of temperatures, pressures and feeds that included the values encountered at the time the samples were taken. These charts allowed the observed concentrations of propane and butane in the monthly gas samples to be corrected to base temperature and pressure. The corrected concentrations were then plotted versus cumulative separator gas volume in Exhibits 23A, 23B, 23C, and 23D. These curves are labeled "actual." The dates shown on the exhibits are those on which the gas samples were taken.

A second set of equilibrium flash vaporization calculations was prepared that, in effect, predicted what the propane and butane concentrations would have been in the separator gas if the well effluent were composed of only injected gas and reservoir oil. In other words, this assumption approximates the case of no LPG injection. The computations were made for the base

conditions of 60° F and 30 psig. Values for the vaporization equilibrium constants for the components were taken from the NGAA Equilibrium Ratio Data Book, 10,000 psi convergence pressure. The results gave propane and butane concentrations for various gas-oil ratios. The monthly reports furnished values for the gas-oil ratio of each pilot well for each month. Using the monthly reports and the calculations, the propane and butane concentrations were plotted as in Exhibits 23A, 23B, 23C and 23D. These curves are labeled "no-slug".

Actually two sets of flash calculations were required to establish the "no-slug" curves of the exhibits because the composition of the injected gas was changed from the lean gas of the El Paso tap line to rich separator gas during April, 1958. One set utilized the composition of the lean gas and reservoir oil to simulate well effluents and the second set used average separator gas composition and reservoir oil. It was estimated that all the lean gas in the pilot area had been displaced by the rich gas by August 1, 1958. Accordingly, the propane and butane concentrations calculated for the "lean" well effluents were plotted in Exhibits 23A, 23B, 23C, and 23D for the period ending August 1, 1958 and thereafter the concentrations for the rich well effluents were plotted.

The difference between the "actual" curve and the "no-slug" curve at any given date is considered to be the evidence that a part of the LPG was being produced in the separator gas. The volume of the LPG slug produced with the separator gas during one month was obtained by integrating the area between the curves and between the limits of the initial and final dates. For some months early in 1958, the actual C_4 compositions in the separator gas from the Hospah #1 and Marye #1 did not exceed those calculated for the "no-slug" situation. No explanation is given for this.

The aforementioned flash vaporization calculations also provided data to show the relationship between the volumes of propane and butane contained in the gas and their volumes retained in the stock tank oil. In order to save time and effort, it was believed that the computations made for the "base" conditions would be a suitable substitute for the more accurate method of making the computation for the conditions of temperature, pressure and gas-oil ratio that prevailed at the time each gas sample was taken. Thus, Exhibit 24 was constructed from the "base" condition calculations and used to estimate the volume of propane and butane retained in the stock tank oil. The volume of propane and butane contained in the stock tank vapors was neglected because the flash vaporization calculations indicated that the amounts were less than two percent of the sum of the amounts in the separator gas and stock tank oil.

The results of the calculations are summarized in Exhibit 25.

The details of the procedure for constructing Exhibit 25 are demonstrated by the example that follows.

Reference is made to Exhibit 23D for the period 7-29-58 to 8-29-58.

Average gas-oil ratio during period (monthly report)	= 1645 cu. ft./bbl.
Cumulative separator gas produced	= 60.0-46.2 = 13.8 MMscf
Average propane concentration (actual)	= 10.65%
Average propane concentration (no-slug)	= 8.10%
Average butane concentration (actual)	= 5.08%
Average butane concentration (no-slug)	= 4.40%
Volume vaporous propane per barrel liquid propane	= 1530 SCF/bbl.
Volume vaporous butane per barrel liquid butane	= 1311 SCF/bbl.

Volume butane from slug in separator gas	=	$\frac{13.8 \times 10^6 (.0508-.0440)}{1311}$	=	71.5 bbls.
Volume butane from slug in stock tank oil (Exhibit 24)	=	71.5 x 0.31	=	22.3 bbls.
		Total		93.8 bbls.
Volume of propane from slug in separator gas	=	$\frac{13.8 \times 10^6 (0.1065-0.0810)}{1530}$	=	230 bbls.
Volume propane from slug in stock tank oil (Exhibit 24)	=	230 x 0.092	=	21 bbls.
		Total		251 bbls.

These results are found in Exhibit 25 for the month of August, 1958.

VIII. LPG ON FIELD BASIS (PLAN II)

A. Discussion

Sixteen five-spots or modified five-spots were studied for possibility of LPG-miscible flooding, as outlined on Exhibit 26. Of these areas studied, only eleven of the five-spots were considered economically feasible for LPG-miscible flooding.

The recoverable oil for each individual five-spot and an example calculation are included in Exhibit 27. These calculations show that the best areas for miscible flooding are the wells located on the fairway of the sand bar which comprises the field. Only the upper sand was considered in the calculations.

The oil in place was calculated by the standard volumetric method for each five-spot. The porosity and water saturation $\left[(1-S_w)\ \phi\right]$ used was the Zone 1 average.

The recovery factors were determined by comparison of each of the individual five-spot kh values to the kh values of the wells in the pilot project. The reduction of recovery with permeability was also indicated by laboratory experiments where various pore volumes of LPG were injected at 2000 psi into oil saturated cores and displaced with gas at 2000 psi. The volume of LPG injected was as follows:

Pore Volumes of LPG Injected in Laboratory Displacement Tests Shown in Exhibit 10

Run No.	Core L 284	Core L 285
1	1.765	1.846
2	.823	.974
3	.484	.414
4	.314	.193
5	Dry Gas	Dry Gas

B. Example Calculation LPG Flood

Phillips I-Tah-Nip #2, 9-25-12, Injection Well

Oil in place (res. bbls.) = $7758 \times \phi (1-S_w)$ AF
= $7758 (.145)(.755)(1730) = 1,470,179$ RB

Stock tank oil in place = $1470,179/1.26 = 1,166,809$ STB

Recovery by LPG flooding = 1,166,809 (recovery factor)
= $(1,166,809)(.30) = 350,048$ STB

Blow down recovery

Note: Assume that 10,000 cubic feet of gas is produced from the swept area for each barrel of oil produced.

$$350,048 \times 1.26 \times \frac{1400}{14.7} \times \frac{520}{605} \times \frac{5.61}{.835} /10,000 = 24,398 \text{ STB}$$

Total recovery = 350,048 + 24,398 = 374,446 STB

LPG flood - gas volume calculations

(1) Voidage replacement of 350,048 bbls. = V_{s_c}

$$V_{s_c} = (350,048)(B_o) \frac{1}{B_g}$$

$$V_{s_c} = 350,048 \times 1.26 \left[\frac{1400}{14.7} \times \frac{520}{605} \times \frac{5.61}{.835}\right]$$

$$= 244 \times 10^6 \text{ SCF}$$

(2) Oil compression and gas resaturation

$$\text{Free gas space at 800\#} = \frac{(HCPV)(1-S_L)}{(1-S_w)}$$

$$\text{Reservoir bbls. of oil at 800\#} = HCPV - HCPV \left(\frac{1-S_L}{1-S_w}\right)$$

$$= 1470,179 \left[1 - \frac{(1-.908)}{(1-.245)}\right] = 1,291,180$$

$$\text{Reservoir bbls. of oil at 1300\#} = (1291,180)\left(\frac{1.26}{1.2257}\right)$$

$$= 1,330,800$$

Reservoir bbls. of gas needed to swell oil from 800# to 1300# = 1,330,800 - 1,291,180 = 36,300

Reservoir bbls. space occupied by injected gas = 1,470,180 - 1,330,800 = 139,374

Reservoir bbls. space vacated due to compression and resaturation = 139,374 - 36,300 = 103,074

MMcf of gas to fill space = 103,074 x B_g = 103,074 RB x 553 SCF/RB = 57

(3) Total gas production handled throughout LPG flood displacement period.

From pilot project = 2.5 bbls. res. void/bbl. STO

Bbls. of res. void. space = $2.5 \frac{\text{bbls. res. void.}}{\text{STB}}$ - $1.26 \frac{\text{res. bbls.}}{\text{STB}}$ = 1.24 RB/STB (free gas prod.)

V_{s_c} = 1.24 x 5.61 x $1/B_g$ = 1.24 x 5.61 x 98.6

V_{s_c} = 686 CF of free gas/STB

V_{s_c} = 407 CF of sol. gas/STB

V_{s_c} = 1093 CF of gas/STB

Ultimate gas handled = (1093)(350,048) = 383 x 10^6 SCF

(4) Fuel requirement at 5% of total gas handled

V_{s_c} = 383 x 10^6 (.05) = 19.2 x 10^6 SCF

(5) LPG requirement and gas equivalent

Required LPG = $\frac{31,015 \text{ Bbls.}}{706,695 \text{ HCPV}}$ x 1,470,179 HCPV = 64,700 Bbls.

Gas equivalent = $\frac{64,600 \text{ bbls.}}{B_g}$ x B_o = 64,700 x 1.16 x 553 SCF/RB = 41.5 x 10^6 SCF

(6) LPG recovery = 80% recovery x 35% lease share =

(64,700)(.80)(.35) = 18,100 bbls.

(7) Total gas in reservoir and sales volume

	MMcf
Oil and sol. gas voidage	244.0
Oil compression and gas resaturation	57.0
Free gas at start of blow down	301.0
Sol. gas remaining in unswept area (816,761)(407)	332.0
Total gas in reservoir at start BD	633.0
Less residual gas after BD	156.5
Total gas recovered	476.5
Shrinkage, fuel, and losses at 40%	190.6
Total gas sales	285.9

(8) Total plant products = 143 bbls./MMcf x .35 lease share

= 143 x 135 x 476.5 = 18,100 bbls.

(9) Gas purchase

	MMcf
Oil and solution gas voidage	244.0
Oil compression and gas resaturation	57.0
Fuel requirements	19.2
	320.2
Less sol. gas prod. (rec. x 407)	142.5
Gas purchases (cycling thru plant)	177.7

IX. WATER FLOOD ON FIELD BASIS (PLAN III)

A. Discussion

Sixteen individual five-spots or modified five-spots were studied for the possibility of water flooding. These five-spot areas are shown on Exhibit 26. Of these areas studied, only nine of the five-spot areas were considered economically feasible for water flooding.

The recovery obtained from water flood susceptibility data is shown in Exhibit 28. A field average was used for porosity and water saturation, and oil in place was calculated by the volumetric method.

Recoverable oil calculations of each of the individual five-spots are shown in Exhibit 27. The method of calculation is shown for one five-spot by the following example:

B. Water Flood Calculations (Examples)

Phillips, I-Tah-Nip #2, 9-25-12, Injection well

$$\text{Recovery factor} = \frac{S_i - S_r}{S_i} \text{ (CF)}$$

Where S_i = initial oil saturation

S_r = residual oil saturation

CF = conformance factor (estimated 60%)

$$RF = \frac{0.67-0.344}{.67} (.60) = 29.2\%$$

$$\text{Oil in place} = 7758 \, \phi \, (1-S_w) \left(\frac{1}{B_o}\right) \text{ (acre-feet)}$$

Where ϕ = porosity = 14.5%

S_w = water saturation 24.5%

B_o = formation volume factor

$= 7758 \, (.145)(.755)\left(\frac{1}{1.26}\right)(1730)$

$= 1{,}166{,}809$ STB

Recoverable oil = 1,166,809 (.292) = 340,708 STB

Saleable Gas

Oil recovery will be carried out at a constant pressure.

Gas sales = gas recovered less fuel, losses and shrinkage.

$$V_s = n \times R_s - F$$

Where n = recoverable oil, bbls.

R_s = solution gas-oil ratio at 800#

F = shrinkage, fuel and other losses at 40% total gas produced

V_s = 340,708 x 308 - 42,000,000 = 62.9 MMcf

Plant products - 143 bbls./MMcf at 35% to lease hold

(104.9) (143) (.35) = 5,250 bbls.

Life of five-spot based on Unit Area average properties

(Note: The I-Tah-Nip is below average and five-spot life is not representative)

Average injection rate for area:

Set water injection rates equal to oil withdrawal rates

$$Q = \frac{3.07\ K_w\ h\ \Delta P}{\mu_w \log_{10} r_e/r_w} = \frac{3.07\ K_o h\ \Delta P}{\mu_o \log_{10} r_e/r_w}$$

μ_w = 0.5 P_{I_w} = 2400 psi r_e = 742 P_w = prod. well press.

μ_o = 0.8 $K_a h$ = 770 r_w = 0.23 P_e = reservoir press.

P_e	P_w	K_{rw}	K_{ro}	Q BOPD
1100	400	0.33	1.0	580
1625	800	0.33	1/2	346
1352	800	0.167	1/2	224

$$\frac{1,470,179 \text{ bbls. x } 1.25 \text{ PVWI}}{(1-.245)(346 \text{ bbls./day})(365 \text{ days/yr.})} = 19.3 \text{ years}$$

X. 70% PRODUCED GAS RE-INJECTED (PLAN IV)

Material balance calculations were made for a dispersed gas drive assuming that 70% of the produced gas would be re-injected. The tabulation of these calculations for 100% conformance are shown in Exhibit 29. It may be observed that the increased recovery estimate of five percent is minor, which would be further reduced after conformance corrections are made. Economic analyses of this process were not made since the method is obviously unattractive.

XI. PRESSURE MAINTENANCE BY GAS INJECTION (PLAN V)

Internal sweep efficiency at a pressure maintenance by gas injection was determined by laboratory measurements of two reservoir samples, one of 4.26 md. and one of 133 md. Results of these analyses are shown by Exhibit 30. The curve applying to straight gas injecting is that which is dashed from zero pore volumes injected throughout the displacement process. Using conformance factor of 0.50, it was estimated that the recovery by gas injection into the tight edge of the Unit Area will be 22.4% of the oil in place.

XII. ECONOMICS

Economic evaluation of the Central Bisti Unit will depend upon the plan of operation. For that reason, a separate report entitled "Plan of Operation" contains the details of economics which may require revision if changes in unit boundary or plan of operation are necessary.

Therefore, only a summary of economics is included in Exhibit 31. Recovery calculations are based on material balance, analysis of the pilot, and laboratory analyses.

EXHIBITS

R 14 W | R 13 W | R 12 W

T 26 N

T 25 N

LPG PILOT

EXHIBIT I

AREA WEST OF SHELL'S CARSON UNIT

CENTRAL BISTI LOWER GALLUP SAND UNIT

BISTI ENGINEERING COMMITTEE

BISTI LOWER GALLUP OIL POOL

Portions of

Township 25 & 26 N Ranges 12,13 & 14 W

County San Juan State New Mexico

2000 1000 0 1000 2000 4000

SCALE IN FEET

PREPARED BY SUNRAY MID-CONTINENT

EXPLORATION DRAFTING SECTION

◉ PROPOSED LPG & GAS INJECTION WELLS

△ PROPOSED INJECTION WELLS FOR GAS ONLY

PROPOSED FIVE SPOT INJECTION PATTERNS OUTLINE IN RED

WESTERN UNIT

CENTRAL UNIT

C2-212

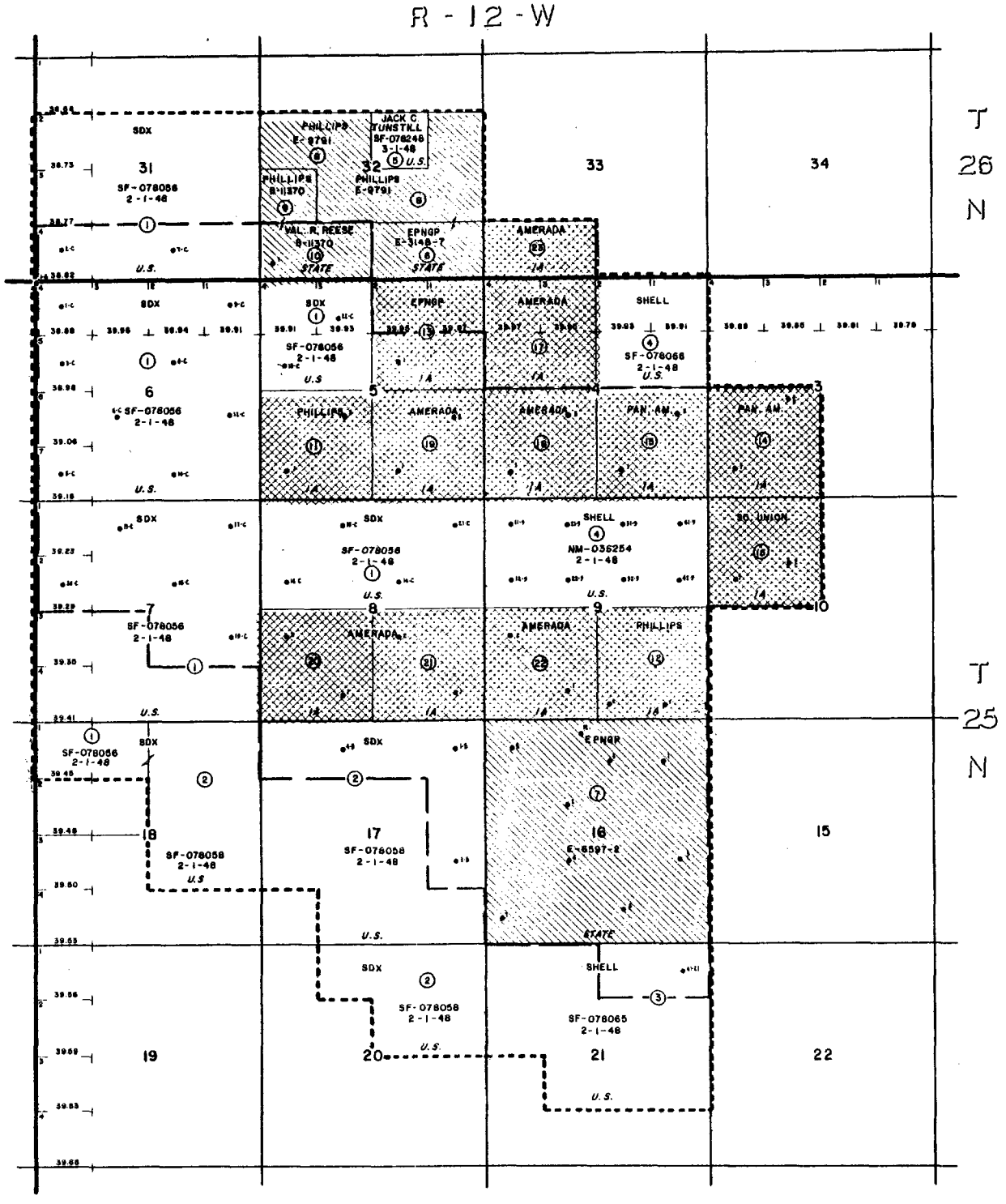


EXHIBIT-2

CENTRAL BISTI LOWER GALLUP SAND UNIT

San Juan County, New Mexico

COMPLETED JAN. 14, 1958

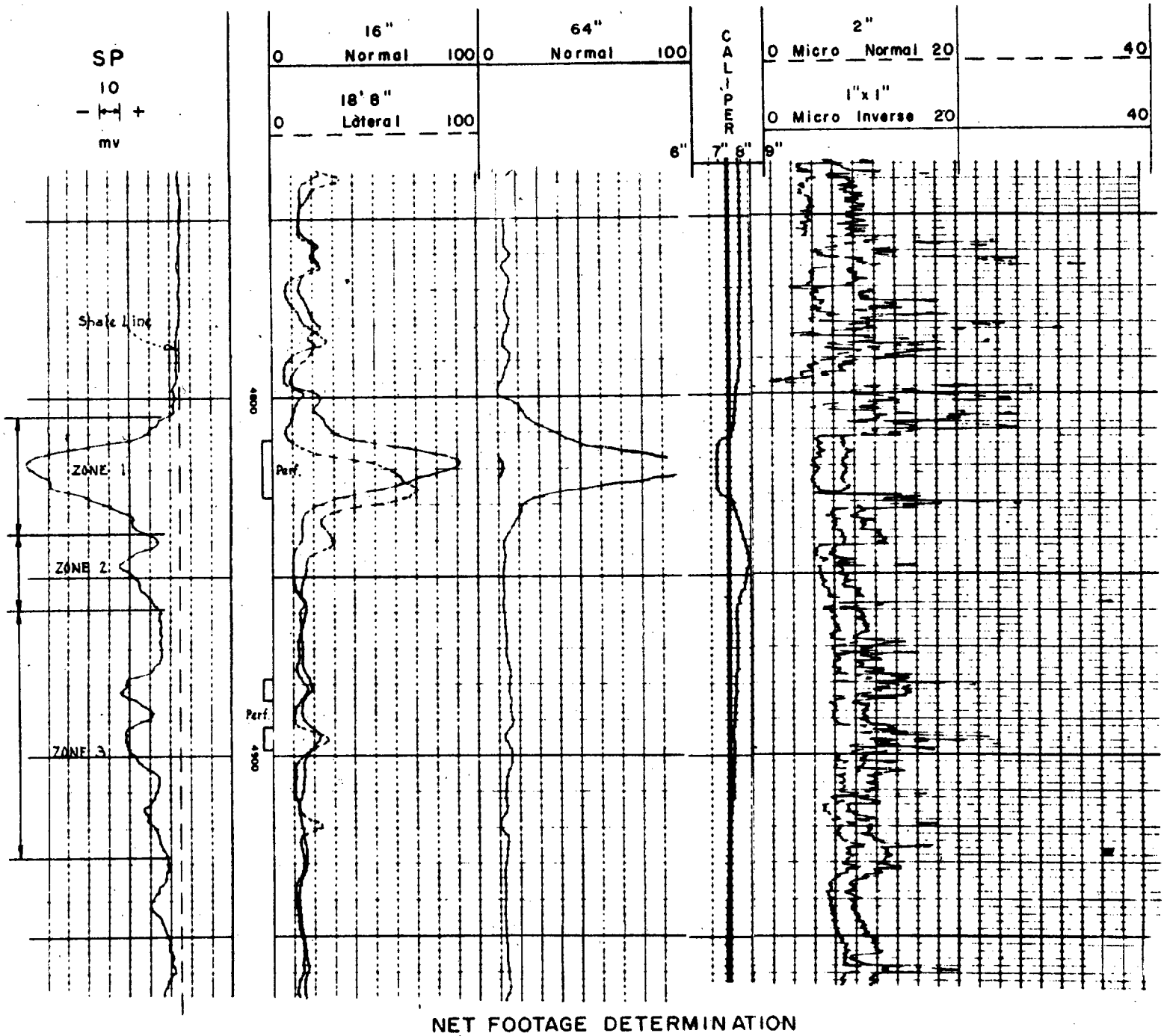
B2-330

SUNRAY MID-CONTINENT OIL COMPANY

N. M. Fed. #C-12

Sec. 6 - 25 N - 12 W

San Juan, New Mexico



NET FOOTAGE DETERMINATION

	SP					Microlog
	Area Sq.In.	Area Mv. Ft.	Ft.	Correction Factor	Net Ft.	
ZONE 1	1.92	1392	25.3'	1.04306	26.5'	15.5'
ZONE 2	.57	411	7.5'	0.6280	4.5'	0.0'
ZONE 3	1.59	1154	21.0'	0.4325	9.0'	0.0'

Rm = 2.5 @ 90° F
Rmf = 1.8 @ 87° F (M)
Rmc = 2.0 @ 85° F (M)
Max. Temp. 120° F

EXHIBIT-3

EXHIBIT 4

OIL PRODUCTION AND WELL DATA BY TRACTS
CENTRAL BISTI LOWER GALLUP SAND UNIT
SAN JUAN COUNTY, NEW MEXICO

	Cumulative Oil Prod. S.T. Bbls 7-1-58	Fraction	Current Oil Prod.** Bbls.	Fraction	Producing Wells Wells	Fraction
18	0	0	12,908	0.0367791	2	0.0312500
19	40,708	0.0397435	18,272	0.0520629	2	0.0312500
20	33,205	0.0324183	5,499	0.0156685	2	0.0312500
21	47,719	0.0465884	18,272	0.0520629	2	0.0312500
22	49,415	0.0482443	18,272	0.0520629	2	0.0312500
	171,047*	0.1669945*	73,223*	0.2086363*	10*	0.1562500*
7	200,318	0.1955721	18,484	0.0526670	9	0.1406250
13	13,258	0.0129439	2,446	0.0069695	1	0.0156250
	213,576*	0.2085160*	20,930*	0.0596365*	10*	0.1562500*
11	32,934	0.0321537	18,272	0.0520629	2	0.0312500
12	57,806	0.0564365	11,899	0.0339041	2	0.0312500
	90,740*	0.0885902*	30,171*	0.0859670*	4*	0.0625000*
14	6,913	0.0067492	2,132	0.0060748	2	0.0312500
15	15,223	0.0148623	7,893	0.0224897	2	0.0312500
	22,136*	0.0216115*	10,025*	0.0285645*	4*	0.0625000*
10	2,391	0.0023345	954	0.0027183	1	0.0156250
	2,391*	0.0023345*	954*	0.0027183*	1*	0.0156250*
3	3,354	0.0032745	584	0.0016640	1	0.0156250
4	46,692	0.0455858	36,544	0.1041258	8	0.1250000
	50,046*	0.0488603*	37,128*	0.1057898*	9*	0.1406250*
1	412,499	0.4027260	157,707	0.4493589	21	0.3281250
2	34,605	0.0337851	2,550	0.0072658	3	0.0468750
	447,104*	0.4365111*	160,257*	0.4566247*	24*	0.3750000*
16	27,227	0.0265819	18,272	0.0520629	2	0.0312500
	27,227*	0.0265819	18,272*	0.0520629*	2*	0.0312500*
BISTI	1,024,267	1.0000000	350,960	1.0000000	64	1.0000000
	1,024,267*	1.0000000*	350,960*	1.0000000*	64*	1.0000000*

* Formula: 1/3 ML oil in place + 1/3 SP oil in place + 1/3 current oil prod.

** 3 Months, July, August, September, with exceptions.

EXHIBIT 5

TABULATION OF MONTHLY OIL PRODUCTION
CENTRAL BISTI LOWER GALLUP SAND UNIT, SAN JUAN COUNTY, NEW MEXICO

	No. of Wells Produced	Oil Prod. Bbls./Mo.	Cum. Oil Prod., Bbls.
Sept., 1955	1	2,155	2,155
Oct.	1	2,963	5,118
Nov.	1	2,548	7,666
Dec.	1	2,320	9,986
Jan., 1956	1	3,258	13,244
Feb.	3	5,089	18,333
March	4	10,535	28,868
April	10	16,155	45,023
May	12	24,560	69,583
June	20	26,718	96,301
July	25	47,927	144,228
Aug.	35	42,485	186,713
Sept.	32	36,918	223,641
Oct.	31	31,538	255,169
Nov.	33	21,526	276,695
Dec.	32	20,782	297,477
Jan., 1957	25	30,862	328,339
Feb.	27	42,917	371,256
Mar.	29	61,449	432,705
April	29	53,250	485,935
May	25	22,411	508,346
June	26	26,523	534,869
July	29	31,459	566,328
Aug.	28	17,717	584,045
Sept.	27	10,054	594,099
Oct.	32	22,838	616,937
Nov.	32	19,982	636,919
Dec.	44	29,417	666,336
Jan., 1958	53	24,843	691,179
Feb.	59	28,431	719,610
March	56	33,873	753,483
April	57	50,344	803,827
May	58	128,763	932,590
June	59	116,483	1,049,073
July	60	127,609	1,176,682
Aug.	58	118,714	1,295,396
Sept.	62	116,203	1,411,599
Oct.	62	122,747	1,524,614
Nov.	62	103,057	1,627,671
Dec.	62	112,321	1,739,992
Jan., 1959	63	104,439	1,844,431

EXHIBIT 6A

RESERVOIR FLUID AND GAS ANALYSIS

(1) Component	(2) Reservoir Oil Mol %	(3) K at 1155 psia 145°F Equilibrium Const.	(4) Res. Gas Mol % (2) x (3)	(5) Mol wt. #/Mol	(6) lb/Mol (4) x (5)
N_2	1.11	4.44	4.93	28.0	1.38
C_1	19.80	4.10	81.18	16.0	13.00
C_2	5.10	1.20	6.12	30.1	1.84
C_3	9.24	0.51	4.71	44.1	2.08
C_4	7.41	0.26	1.93	58.1	1.12
C_5	4.74	0.11	0.52	72.1	0.37
C_6	4.80	0.06	0.29	86.2	0.25
C_{7+}	47.80	0.0066	0.32	228.0	0.73
	100.00		100.00		20.77

Sp. Gr. of gas = $\frac{20.77}{29}$ = 0.715 (Air = 1.00)

Density at 60 °F = 0.8553 gm/cc

°API at 60° F = 36.7°

CALCULATIONS OF GAS VOLUME FACTOR

Factor at 145° F

P_c = 670 psia T_c = 390° R

Pressure Psia P	P_r P/670	T_r 605/T_c	Z at 145° F	Z/P 10^{-4}	3.049 Z/P 10-4	B_g Bbl Res Gas/SCF 10-3	1/B_g SCF/Bbl
1155	1.72	1.55	0.86	7.446	22.703	2.270	440
1100	1.64	1.55	0.87	7.905	24.102	2.398	417
1000	1.495	1.55	0.88	8.800	26.831	2.683	373
900	1.34	1.55	0.89	9.910	30.215	3.012	332
800	1.195	1.55	0.90	11.250	34.301	3.430	292
700	1.045	1.55	0.91	13.000	39.637	3.968	252
600	0.896	1.55	0.92	15.333	46.750	4.675	214
500	0.747	1.55	0.94	18.810	57.352	5.682	176
400	0.598	1.55	0.95	23.750	72.414	7.241	138
350	0.523	1.55	0.955	27.320	83.298	8.404	119
300	0.448	1.55	0.96	32.162	98.062	10.000	100
250	0.373	1.55	0.97	38.700	117.996	12.048	83
200	0.299	1.55	0.98	49.000	149.401	14.940	67
150	0.224	1.55	0.985	66.625	203.139	20.000	50
100	0.149	1.55	0.99	99.000	301.851	30.185	34
14.7	0.022	1.55	1.00	680.272	2074.149	207.415	4.83

Calculation of gas volume factor:

$B_g = (1)\ (\frac{14.7}{P})\ (\frac{T}{520})\ (\frac{Z}{5.61})$ = Res bbl gas/SCF gas = 3.049 Z/P

EXHIBIT 6 B

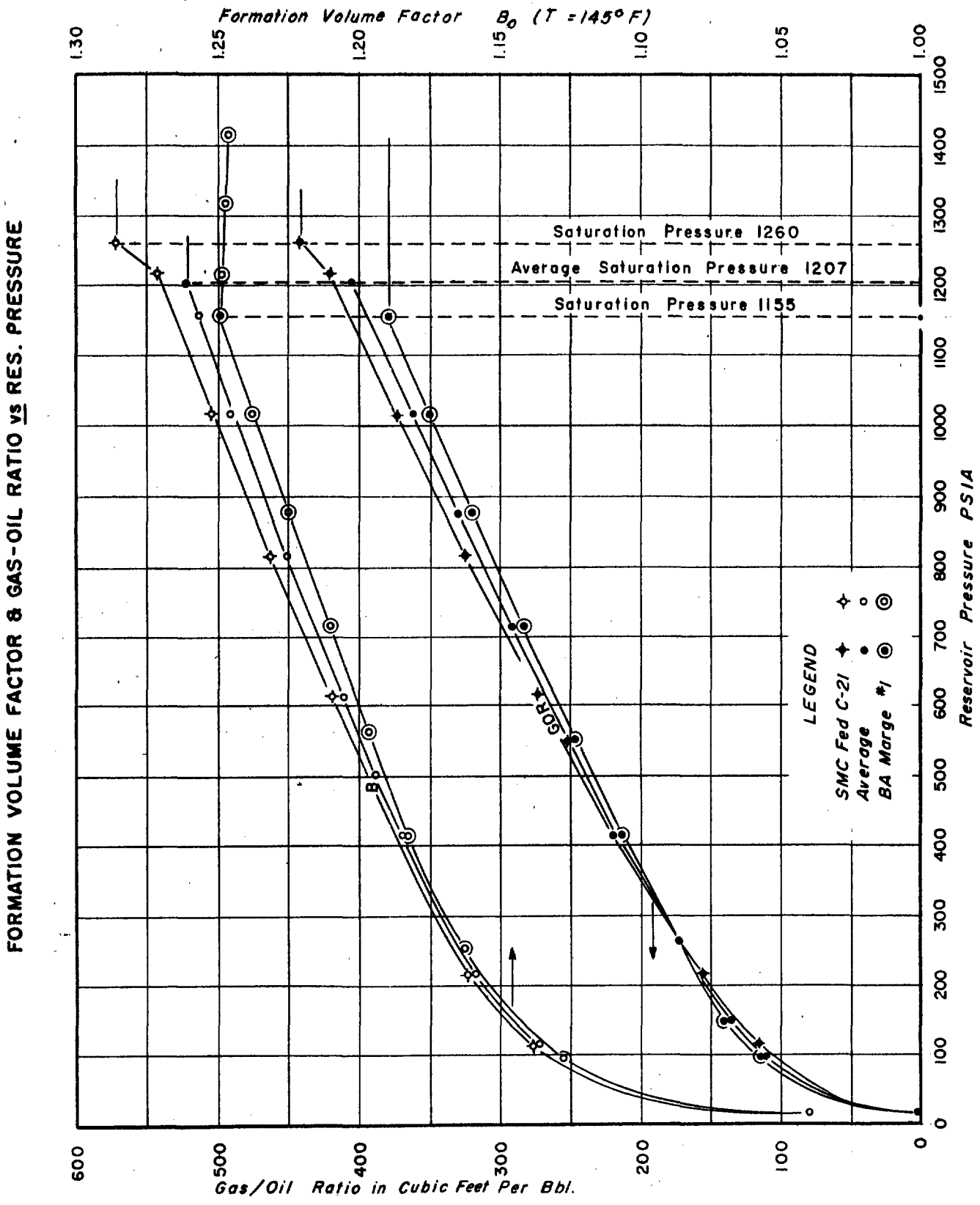

FORMATION VOLUME FACTOR & GAS-OIL RATIO vs RES. PRESSURE
Formation Volume Factor B_o (T = 145° F)
1.30
1.25
1.20
1.15
1.10
1.05
1.00
Saturation Pressure 1260
Average Saturation Pressure 1207
Saturation Pressure 1155
GOR
B
LEGEND
SMC Fed C-21
Average
BA Marge #1
600
500
400
300
200
100
0
Gas/Oil Ratio in Cubic Feet Per Bbl.
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Reservoir Pressure PSIA

EXHIBIT 6C

SOLUTION GAS-OIL RATIO

VS

FORMATION VOLUME FACTOR

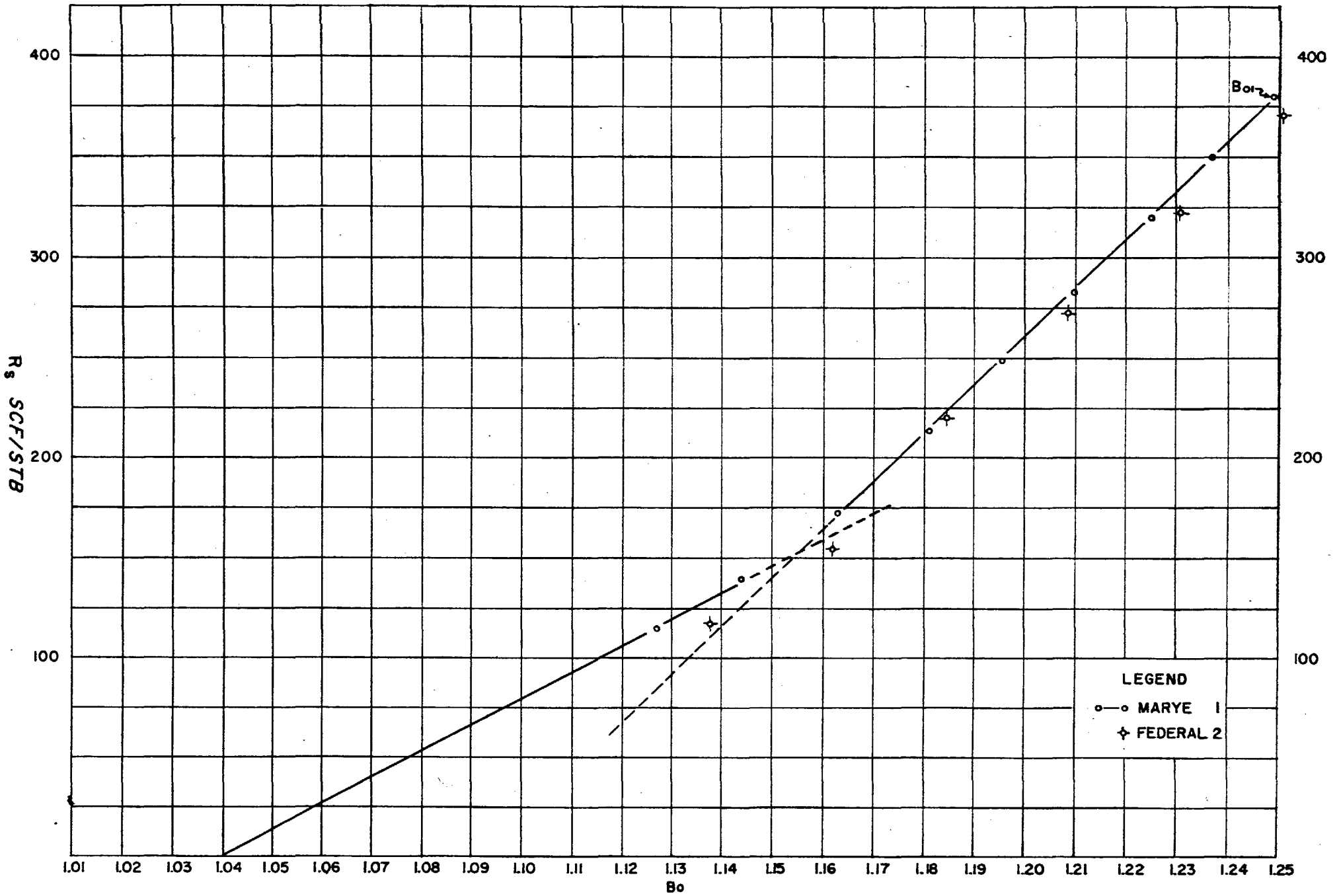
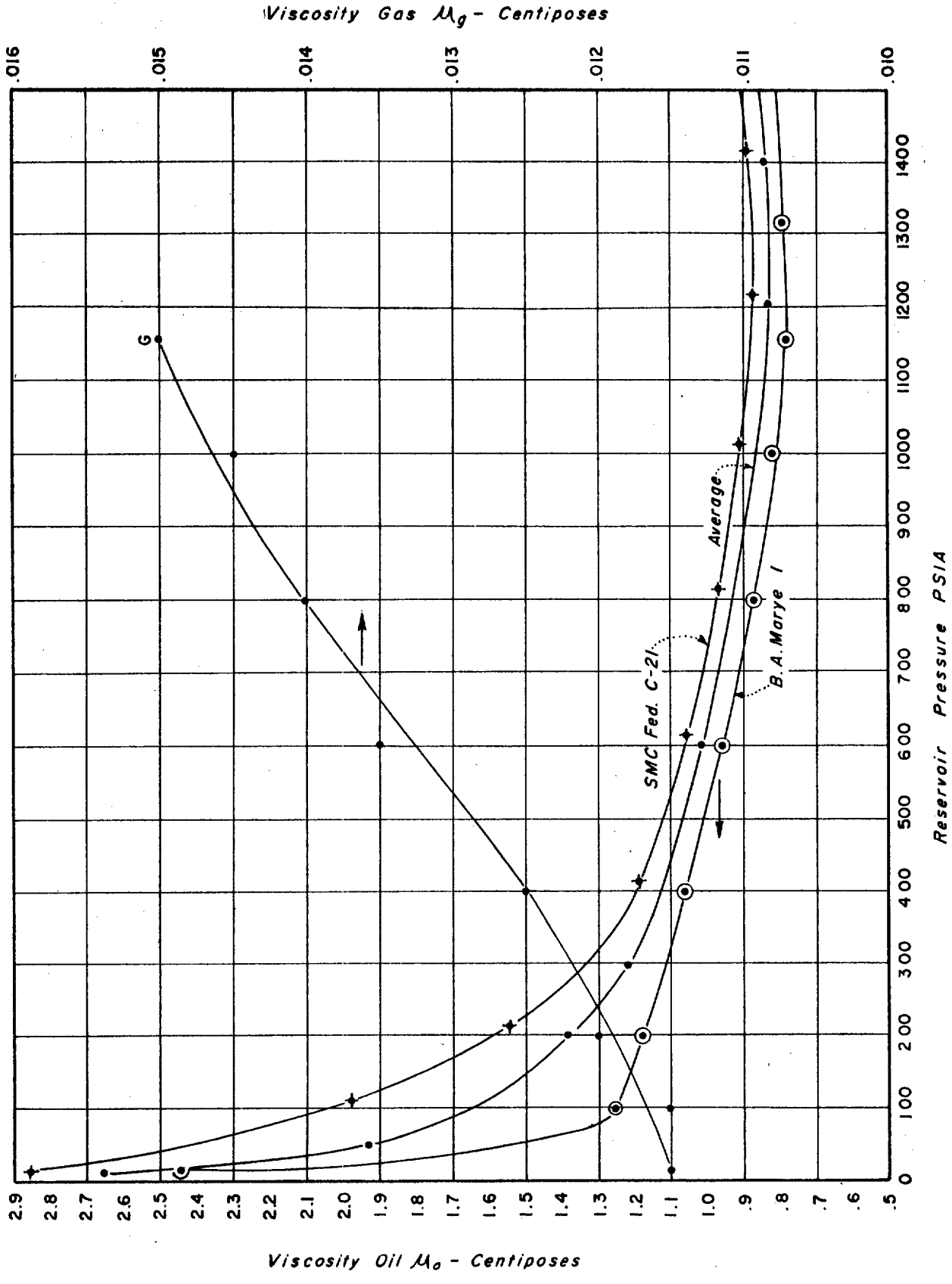


EXHIBIT 6 D

VISCOSITY vs RESERVOIR PRESSURE



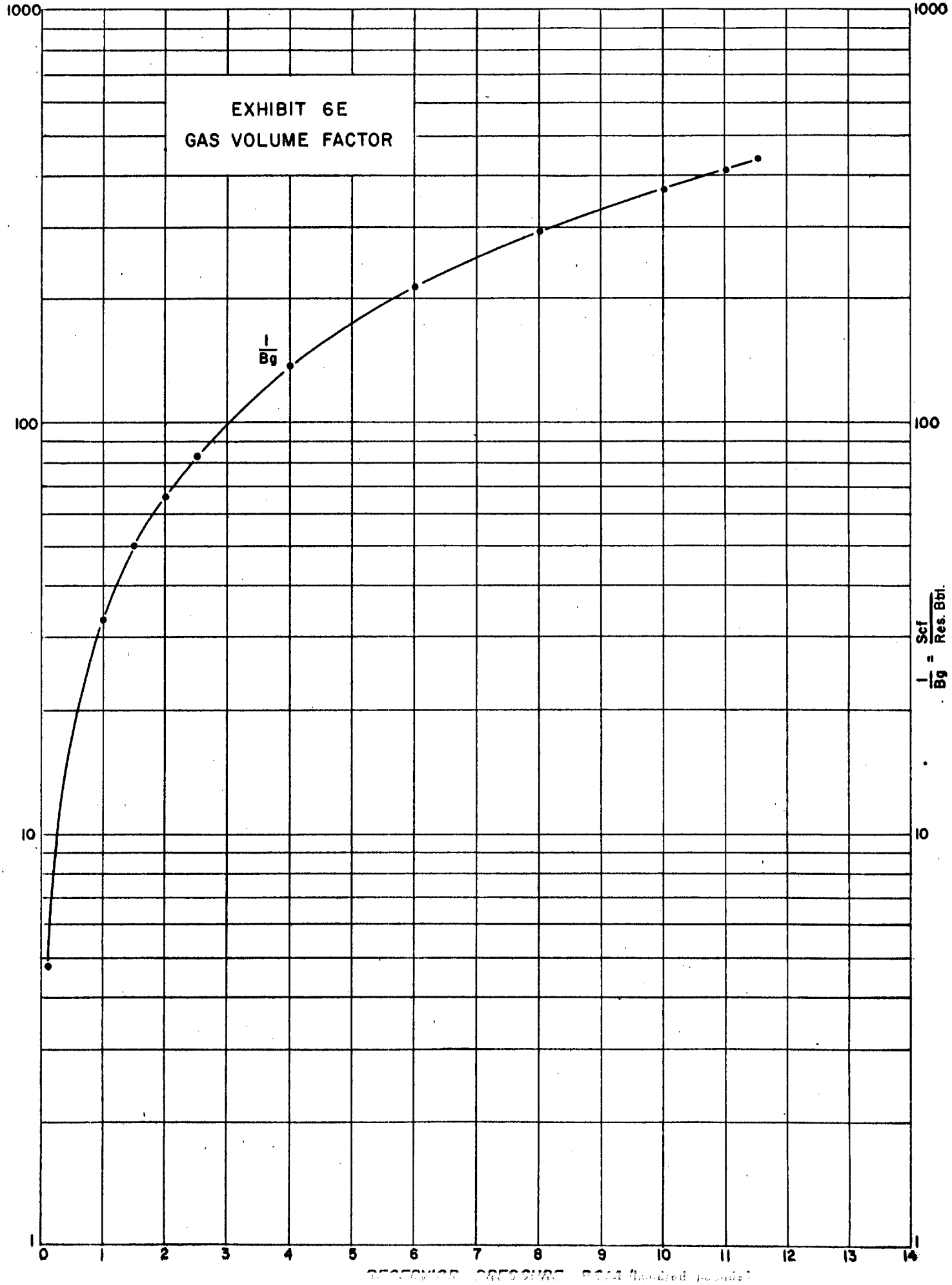
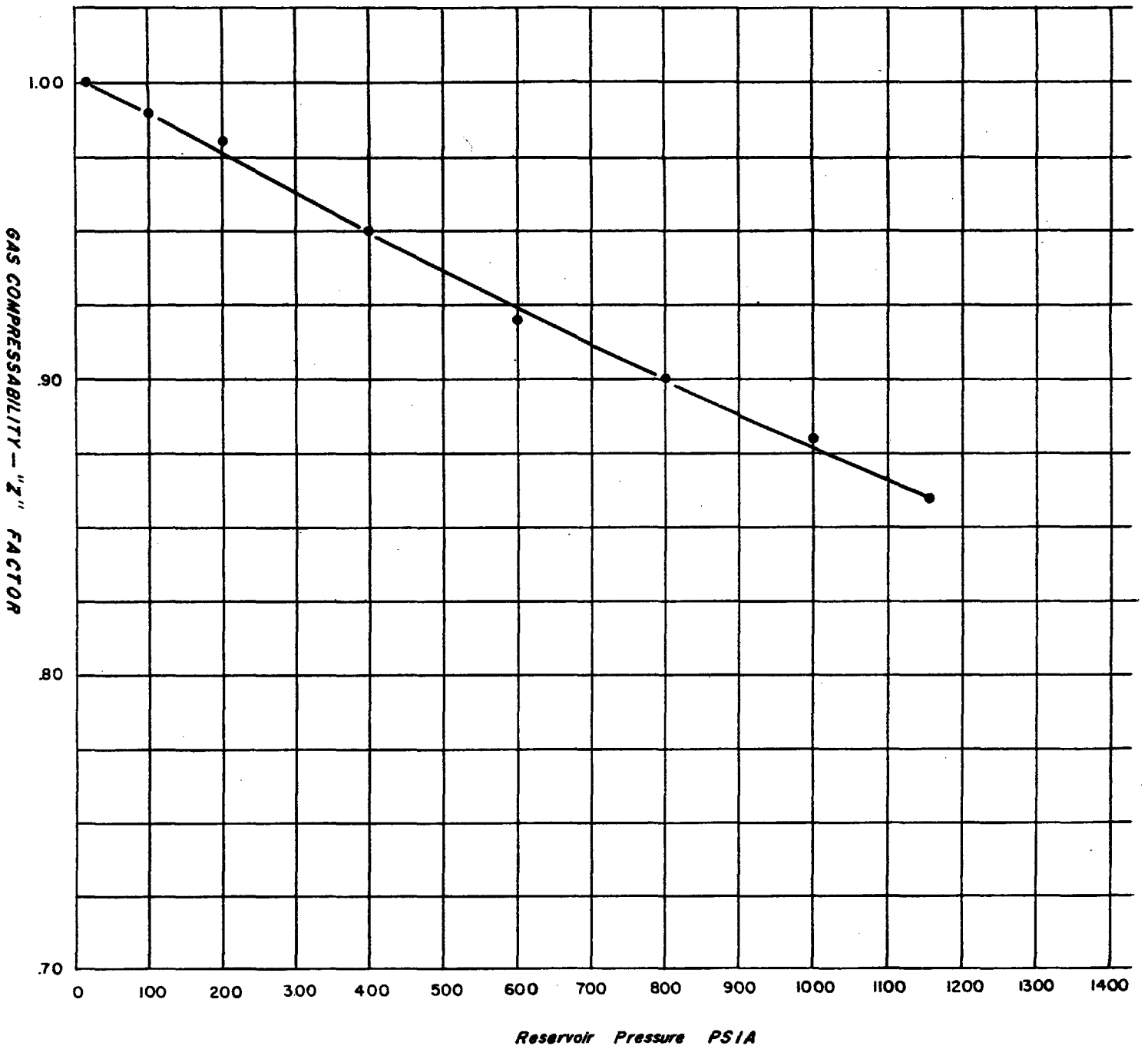


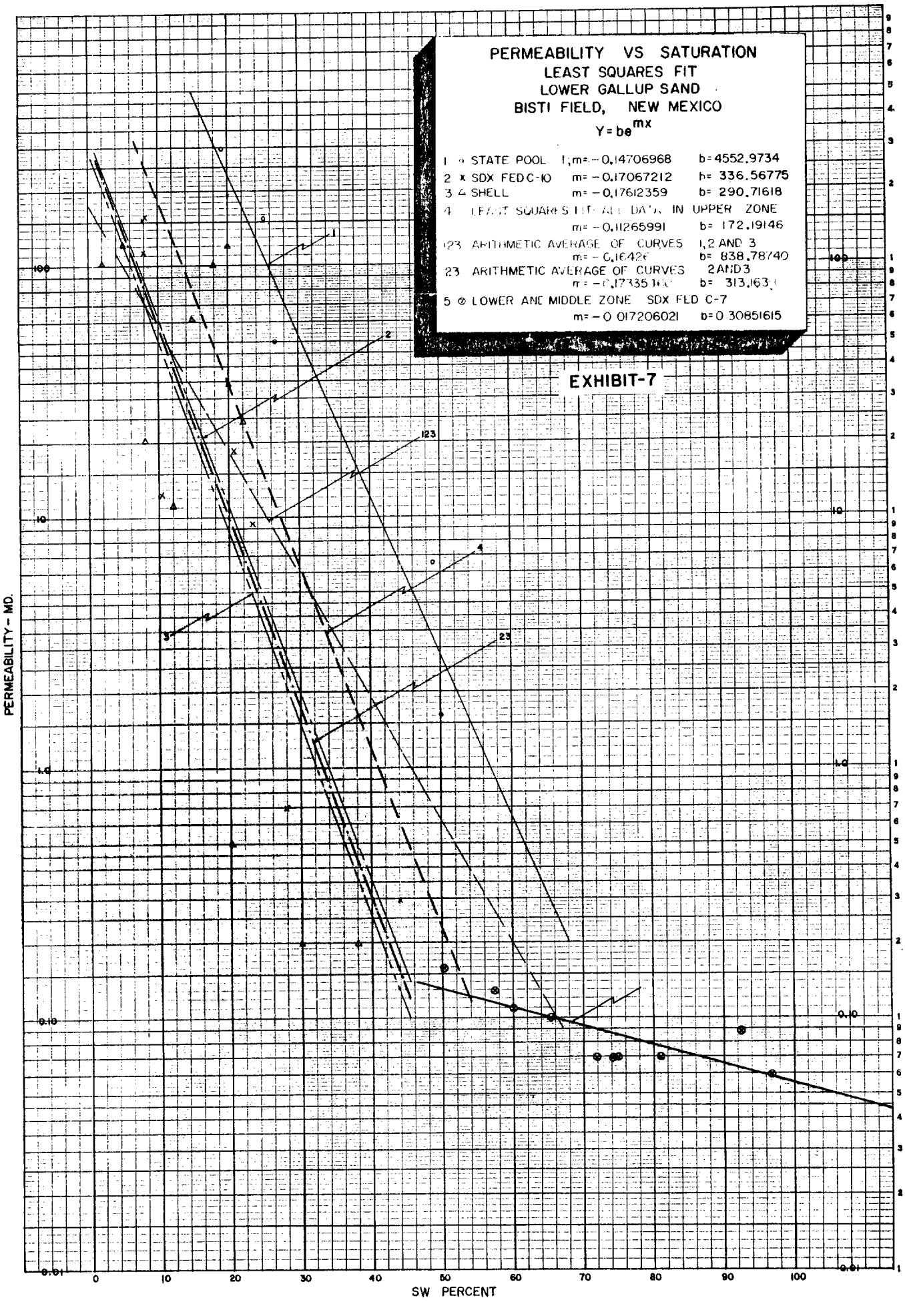
EXHIBIT 6E
GAS VOLUME FACTOR
1/Bg
1000
100
10
1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
1/Bg = Scf/Res. Bbl.

EXHIBIT 6F

"Z" FACTOR vs RESERVOIR PRESSURE

BISTI FIELD




PERMEABILITY VS SATURATION
LEAST SQUARES FIT
LOWER GALLUP SAND
BISTI FIELD, NEW MEXICO
Y = be^mx
1 ○ STATE POOL m= −0.14706968 b=4552.9734
2 x SDX FED C-10 m= −0.17067212 b= 336.56775
3 △ SHELL m= −0.17612359 b= 290.71618
4 LEAST SQUARES FIT ALL DATA IN UPPER ZONE
m= −0.11265991 b= 172.19146
123 ARITHMETIC AVERAGE OF CURVES 1,2 AND 3
m= −0.16426 b= 838.78740
23 ARITHMETIC AVERAGE OF CURVES 2AND3
m= −0.17335 b= 313.163
5 ⊗ LOWER AND MIDDLE ZONE SDX FED C-7
m= −0.017206021 b=0.30851615
EXHIBIT-7
PERMEABILITY - MD.
SW PERCENT
0
10
20
30
40
50
60
70
80
90
100
100
10
1.0
0.10
0.01

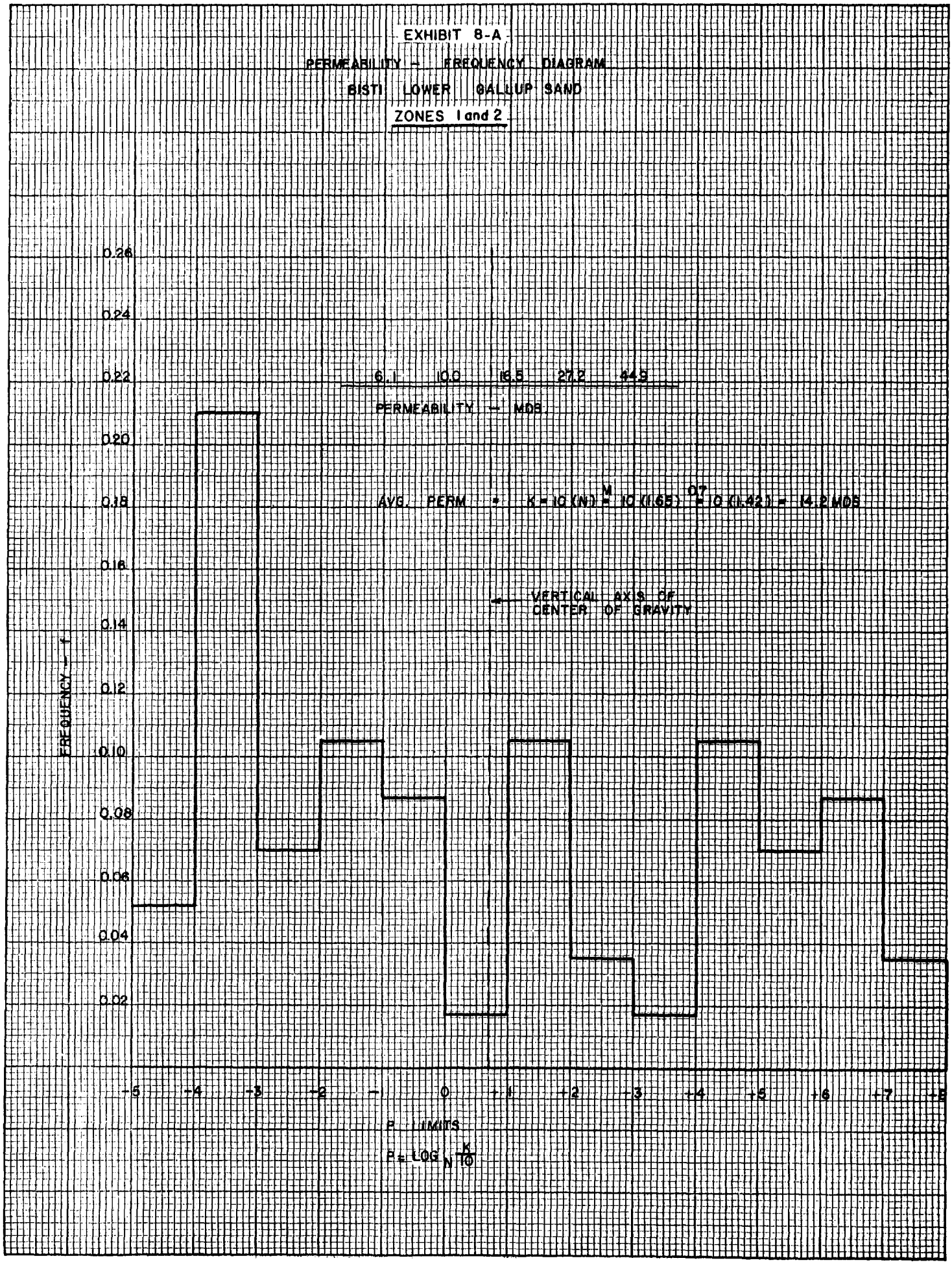


EXHIBIT 8-A
PERMEABILITY – FREQUENCY DIAGRAM
BISTI LOWER GALLUP SAND
ZONES 1 and 2
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
FREQUENCY – f
6.1
10.0
16.5
27.2
44.9
PERMEABILITY – MDS.
AVG. PERM. = K = 10 (N) = 10 (1.65) = 10 (1.42) = 14.2 MDS.
VERTICAL AXIS OF CENTER OF GRAVITY
-5
-4
-3
-2
-1
0
+1
+2
+3
+4
+5
+6
+7
+8
P LIMITS
P = LOG N K/10

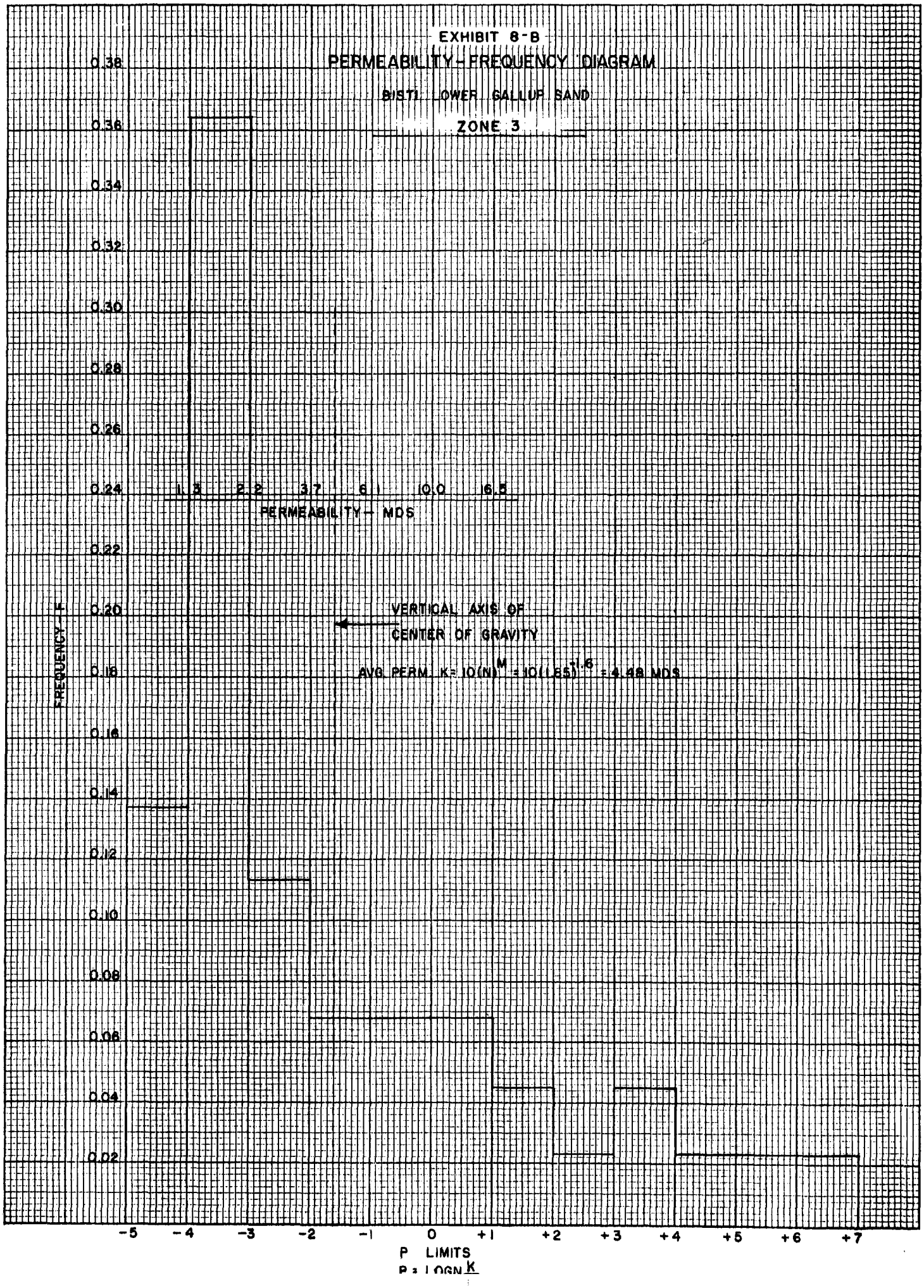


EXHIBIT 8-B
PERMEABILITY-FREQUENCY DIAGRAM
BISTI LOWER GALLUP SAND
ZONE 3
0.38
0.36
0.34
0.32
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
FREQUENCY - F
1.3
2.2
3.7
6.1
10.0
16.5
PERMEABILITY - MDS
VERTICAL AXIS OF
CENTER OF GRAVITY
AVG. PERM. K = 10(N)^M = 10(1.65)^1.6 = 4.48 MDS
-5
-4
-3
-2
-1
0
+1
+2
+3
+4
+5
+6
+7
P LIMITS
P = LOGN K

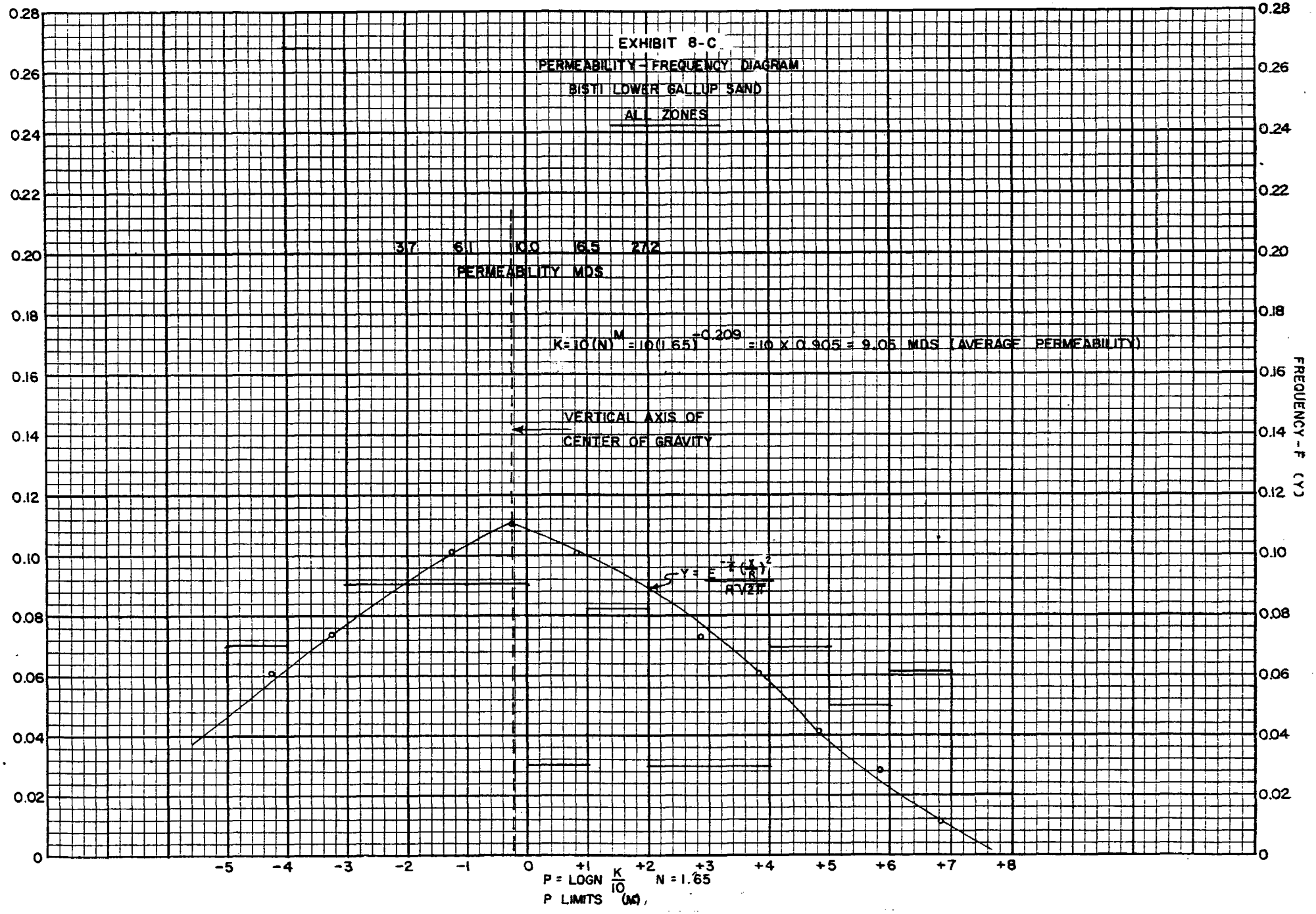


EXHIBIT 8-C
PERMEABILITY - FREQUENCY DIAGRAM
BISTI LOWER GALLUP SAND
ALL ZONES
3.7 6.1 10.0 16.5 27.2
PERMEABILITY MDS
K = 10 (N)^M = 10(1.65)^-0.209 = 10 X 0.905 = 9.05 MDS (AVERAGE PERMEABILITY)
VERTICAL AXIS OF
CENTER OF GRAVITY
Y = e^-½(X/R)^2 / R√2π
P = LOGN K/10 N = 1.65
P LIMITS (M),
FREQUENCY - F (Y)
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0
-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5 +6 +7 +8

EXHIBIT 9A

CORE ANALYSIS CALCULATION SUMMARY
BISTI HYDROCARBON PORE VOLUME FOR THE SP INTERVAL (8-22-58)

	Code	ZONE 1 Number Ft.	ZONE 1 $\Sigma\phi(1-S_w)$	ZONE 1 Avg. $\phi(1-S_w)$	ZONE 2 Number Ft.	ZONE 2 $\Sigma\phi(1-S_w)$	ZONE 2 Avg. $\phi(1-S_w)$	ZONE 3 Number Ft.	ZONE 3 $\Sigma\phi(1-S_w)$	ZONE 3 Avg. $\phi(1-S_w)$
Sunray Federal C #1	1001	24	2.9305	0.1221						
Amerada - Gle-Na-Nup-Pah #2	1002	16	1.6122	0.1008	4	0.1500	0.0375	8	0.4205	0.0526
Sunray - Federal C #14	1004	16	1.7008	0.1063	10	0.6111	0.0611	9	0.5645	0.0627
Sunray - Federal C #10	1005	16	1.8767	0.1173				11	0.5853	0.0532
Sunray - Federal C #18	1006	9	0.7755	0.0862	4	0.2476	0.0619	12	0.7141	0.0595
El Paso - Kelly State #2	1007	4	0.3551	0.0888	1	0.0793	0.0793	7	0.7002	0.1000
El Paso - Kelly State #3	1010	5	0.4375	0.0875	5	0.3543	0.0709	6	0.5431	0.0905
El Paso - Kelly State #6	1011	8	0.7666	0.0958	6	0.6394	0.1066	11	0.7142	0.0649
El Paso - Kelly State #7	1012	1	0.0351	0.0351	3	0.1340	0.0447	9	0.6518	0.0724
B/A - Salge B #5	1013	13	1.3756	0.1058	7	0.5771	0.0824			
B/A - Marye B #5	1014	18	1.7282	0.0960				6	0.4686	0.0781
Amerada - Joan White #2	1015	14	1.2930	0.0924	8	0.5106	0.0638	10	0.6577	0.0658
B /A - Douthit B #2	1016	12	1.6757	0.1396	4	0.3107	0.0777	6	0.2884	0.0481
B/A Douthit B #11	1019	14	1.3930	0.0995						
B/A Salge B #1	1021	17	2.0455	0.1203	6	0.3513	0.05855	8	0.4803	0.0600
Sunray Federal C #7	1023							3	0.0712	0.0237
B/A Marye #3	1026	5	0.5914	0.1183						
B/A Marye B #4	1027	18	2.3691	0.1316	5	0.2507	0.0501	6	0.2628	0.0438
C.M.W. - Elliott #2	1032	5	0.2477	0.0492	2	0.1255	0.0628	1	0.0436	0.0436
C.M.W. - Elliott #1	1033							2	0.0643	0.0321
Phillips Benally #2	1034	19	2.1657	0.1140	3	0.1440	0.0480	8	0.7438	0.0930
Ben.-Mon.-Gr. - Foster #1	1035	8	0.7945	0.0993						
Ben.-Mon.-Gr. - Foster #5	1037	25	2.6643	0.1065						
Phillips - Hospah B #1	1038							5	0.3633	0.0727
B/A - Douthit B #4	1040	11	1.0771	0.0979				6	0.3948	0.0658
B/A - Marye B #1	1042	18	1.8932	0.1052	2	0.0438	0.0219			
Phillips - I-Tah-Nip #1	1043	12	1.3801	0.1150	5	0.4249	0.0850	9	0.7469	0.0830
Phillips - Hospah C #1	1044	17	1.6548	0.0973						
Sunray - Bisti G.I. #1	1045	23	2.6434	0.1149						
El Paso - Sullivan D #2	1046	11	1.1851	0.1077				6	0.3605	0.0601
So. Union - Ka-Gee-Tah #1	1047	20	2.0272	0.1014	6	0.2903	0.0484	12	0.7184	0.0599
B/A - Marye #2		9	0.7146	0.0794	2	0.1161	0.0580	9	0.6010	0.0668
El Paso - Kelly State #4		1	0.0437	0.0437	5	0.3229	0.0646	10	0.7647	0.0765
El Paso - Sullivan #1-D		13	1.3259	0.1020						
El Paso - Benally #1		12	1.0616	0.0885				6	0.3747	0.0625
		414	43.8404		88	5.6776		186	12.2987	

EXHIBIT 9B

CORE ANALYSIS CALCULATION SUMMARY
BISTI HYDROCARBON PORE VOLUME FOR THE MICROLOG INTERVAL 8-22-58

		ZONE 1					ZONE 2					ZONE 3				
			No. of Samples					No. of Samples					No. of Samples			
	Code	$\phi(1-S_w)$ Zone 1	Total	Cal.	Cal. $\Sigma\phi(1-S_w)$	Average $\phi(1-S_w)$	$\phi(1-S_w)$ Zone 2	Total	Cal.	Cal. $\Sigma\phi(1-S_w)$	Average $\phi(1-S_w)$	$\phi(1-S_w)$ Zone 3	Total	Cal.	Cal. $\Sigma\phi(1-S_w)$	Average $\phi(1-S_w)$
Sunray - Federal C #1	1001	.1323	20	20	2.64681	.1323										
Amerada - Gle-Na-Nup-Pah #2	1002	.1207	4	4	.48302	.1207										
Sunray - Federal C #14	1004	.1372	11	11	1.50941	.1372	.0679	5	5	.33953	.0679	.0993	7	7	.46675	.0993
Sunray - Federal C #10	1005	.1478	11	11	1.62537	.1478						.0305	6	5	.29464	.0609
Sunray - Federal C #18	1006	.1195	2	2	.23899	.1195						.0495	7	7	.34622	.0495
El Paso - Kelly State #2	1007	.1061	2	2	.21226	.1061						.0769	1	1	.07686	.0769
El Paso - Kelly State #3	1010	.0852	4	4	.34087	.0852	.0710	1	1	.07104	.0710	.0785	1	1	.07851	.0785
El Paso - Kelly State #6	1011	.1150	1	1	.11495	.1150						.0953	2	2	.19054	.0953
El Paso - Kelly State #7	1012											.1226	1	1	.12263	.1226
B/A - Salge B #5	1013	.1080	6	6	.64472	.1080	.0922	3	3	.27667	.0922					
B/A - Marye B #5	1014	.1081	13	13	1.40572	.1081										
Amerada - Joan White #2	1015	.1186	8	8	.94867	.1186	.0872	2	2	.17439	.0872	.0733	4	4	.29366	.0733
B/A - Douthit B #2	1016	.1474	9	9	1.32647	.1474										
B/A - Douthit B #11	1019	.1057	11	11	1.16219	.1057										
B/A - Salge B #1	1021	.1348	12	12	1.61755	.1348										
Sunray - Federal C #7	1023															
B/A Marye B #4	1027	.1388	15	15	2.08146	.1388										
Phillips - Benally #2	1034	.1194	18	18	2.14976	.1194						.1042	2	2	.20846	.1042
Ben.-Mon-Gr. - Foster #1	1035	.1013	7	7	.70876	.1013										
Ben.-Mon.-Gr. - Foster #5	1037	.1311	17	17	2.22900	.1311										
Phillips - Hospah B #1	1038															
B/A - Marye #2		.0889	6	6	.53360	.0889						.0750	4	4	.29982	.0750
El Paso - Benally #1		.1022	6	6	.61296	.1022						.0663	1	1	.06634	.0663
B/A - Douthit B #4	1040	.1125	8	8	.90031	.1125										
El Paso - Sullivan #1-D		.0950	10	10	.94960	.0950										
B/A - Marye B #1	1042	.1208	10	10	1.20834	.1208										
Phillips - I-Tah-Nip #1	1043	.1303	7	7	.91228	.1303										
Phillips - Hospah C #1	1044	.0994	7	7	.69604	.0994										
Sunray - Bisti GI #1	1045	.1353	18	18	2.43622	.1353										
El Paso - Sullivan D #2	1046	.1010	10	10	1.00992	.1010										
So. Union - Ka-Gee-Tah #1	1047	.1265	11	11	1.39202	.1265						.0853	1	1	.08527	.0853
				264	32.09727	.12158			11	.86163	.07833			36	2.52970	.07027

EXHIBIT 10

BISTI FIELD, SAN JUAN COUNTY, NEW MEXICO
ELECTRIC LOG ANALYSIS AND NET PAY DETERMINATIONS

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P. Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft./ S.P.Feet (9)/(12) Ft./Ft.
Amerada														
Gle-Na-Nup-Pah #1	1	6,190	4,776	4,808		18.0	1,334	-	60	-	-	22.233	-	-
	2			4,832		0	382	-		-	-	6.366	-	-
	3			4,901	125	2.0	1,081	-		-	-	18.016	-	-
Gle-Na-Nup-Pah #2	1	6,167	4,774	4,803		4.0	721	721	48	13.24	-	15.021	15.021	0.8814
	2			4,829		0	288	288		1.97	-	6.000	6.000	0.3283
	3			4,894	120	0	836	836		7.74	-	17.417	17.417	0.4444
Ka-Da-Pa #1	1	6,170	4,758	4,788		12.0	959	-	60	-	-	15.983	-	-
	2			4,814		0	346	-		-	-	5,766	-	-
	3			4,882	124	0	908	-		-	-	15.133	-	-
Ka-Da-Pa #2	1	6,145	4,748	4,777		5.0	663	92	49	-	-	13.537	-	-
	2			4,802		0	296	41		-	-	6.033	-	-
	3			4,870	122	6.0	836	116		-	-	17.068	-	-
Nah-Des-Pah #1	1	6,239	4,752	4,779		1.5	411	-	58	-	-	7.086	-	-
	2			4,801		3.5	526	-		-	-	9.068	-	-
	3			4,882	130	1.0	1,406	-		-	-	24.241	-	-
Nah-Des-Pah #2	1	6,229	4,761	4,790		9.0	721	-	56	-	-	12.875	-	-
	2			4,814		4.0	584	-		-	-	10.428	-	-
	3			4,892	131	6.5	1,471	-		-	-	26.267	-	-
Joan White #1	1	6,226	4,739	4,768		10.0	764	-	62	-	-	12.322	-	-
	2			4,787		4.5	642	-		-	-	10.354	-	-
	3			4,872	133	2.5	1,615	-		-	-	26.048	-	-
Joan White #2	1	6,209	4,743	4,770		8.0	642	642	47	17.09	361.58	13.66	13.66	1.251
	2			4,796		2.0	570	570		7.35	40.73	12.13	12.13	0.606
	3			4,870	127	4.0	952	952		8.69	8.69	20.26	20.26	0.429
Salena White #1	1	6,254	4,770	4,798		0	418	-	50	-	-	8.360	-	-
	2			4,816		0	454	-		-	-	9.080	-	-
	3			4,896	126	4.0	1,774	-		-	-	35.480	-	-
Salena White #2	1	6,287	4,824	4,852		0	555	-	63	-	-	8,890	-	-
	2			4,870		0	361	-		-	-	5.730	-	-
	3			4,952	128	2.0	1,572	-		-	-	24.952	-	-

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft. S.P.Feet (9)/(12) Ft./Ft.
Benson, Montin and Greer														
Foster #1 *	1	6,306	5,106	5,130	(Incomp.	6.5	540	540	72	10.58	154.38	7.500	7.500	1.410
	2			?	Pent.)	0	-	-		-	-	-	-	-
	3			?		0	-	-		-	-	-	-	-
Foster #5 *	1	6,346	5,127	5,158	(Incomp.	17.0	952	952	40	20.09	1,012.09	23.800	23.800	0.844
	2			?	Pent.)	0	-	-		-	-	-	-	-
	3			?		0	-	-		-	-	-	-	-
British American														
Douthit #B-2 *	1	6,311	5,010	5,040		9.5	800	728	67	9.85	346.25	11.940	10.866	0.906
	2			5,059		0	418	418		2.14	2.14	6.239	6.239	0.343
	3			5,108	98	0	901	901		1.96	2.46	13.448	13.448	0.146
Douthit #B-4 *	1	6,208	4,950	4,979		7.5	649	649	60	13.34	50.34	10.817	10.817	1.2332
	2			-		0	0	-		-	6.18	0	0	-
	3			5,044	94	11.0	779	440		4.28		12.983	7.333	0.584
Douthit #B-11 *	1	6,398	5,157	5,189		11.0	872	872	63	18.63	-	13.841	13.841	1.346
	2			5,214		0	238	-		-	-	3.778	-	-
	3			5,250	93	0	461	-		-	-	7.314	-	-
Marye #2 *	1	6,268	4,383	4,880		5.5	534	461	50	5.3	11.10	10.680	9.220	0.5748
	2			4,897		0	187	187		0.5	0.5	3.740	3.740	0.1337
	3			4,966	113	10.0	1,370	1,370		3.1	3.2	27.400	27.400	0.1131
Marye #3 *	1	6,223	4,854	4,884		9.0	793	793	50	5.04	101.74	15.86	15.86	0.318
	2			4,908		3.0	728	-		-	-	14.56	-	-
	3			4,951(TD)		2.0	750	490		.08	.08	15.00	9.80	0.008
Marye #B-1 *	1	6,229	4,905	4,938		10.0	959	959	55	11.25	221.35	17.44	17.44	0.645
	2			4,952		0	202	202		0.54	0.54	3.67	3.67	0.147
	3			5,006	101	0	699	-		0	-	12.71	-	-
Marye #B-4 *	1	6,247	4,904	4,936		14.5	966	966	52	18.38	1,051.58	18.577	18.577	0.9894
	2			4,958		0	418	418		2.39	3.19	8.038	8.038	0.2973
	3			5,014	110	0	699	447		2.13	2.13	13.442	8.596	0.2478
Marye #B-5 *	1	6,240	4,921	4,952		13.0	1,067	634	60	16.91	1,078.21	17.783	10.566	1.6004
	2			4,970		0	238	-		-	-	3.967	-	-
	3			5,026	105	0	707	404		11.99	12.69	11.783	6.733	1.7807

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P. Feet (9)/(12) Ft./Ft.
British American (Cont'd.)														
Salge #B-1	1	6,282	4,973	5,002		12.0	865	865	53	11.22	1,179.62	16.321	16.321	0.687
	2			5,020		0	505	505		4.15	6.15	9.528	9.528	0.435
	3			5,074	101	0	937	937		3.78	8.88	17.679	17.679	0.214
Salge #B-5 *	1	6,298	4,990	5,022		6.0	671	671	49	19.13	53.13	13.694	13.694	1.3969
	2			5,044		2.5	512	512		8.39	16.39	10.449	10.449	0.8029
	3			5,092	102	0	714	-		-	-	14.571	-	-
El Paso														
Benally #1	1	6,166	4,786	4,814		6.0	656	656	55	12.84	38.24	11.927	11.927	1.077
	2			4,839		0	245	245		2.43	2.43	4.455	4.455	0.5454
	3			4,900	114	1.0	743	663		9.31	9.31	13.509	12.055	0.7722
Kelly State #1	1	6,240	4,729	4,750		2.5	332	-	52	-	-	6.384	-	-
	2			4,788		13.5	815	-		-	-	15.673	-	-
	3			4,860	131	9.0	1,384	-		-	-	26.615	-	-
Kelly State #2	1	6,256	4,746	4,770		1.5	281	281	60	2.27	5.22	4.683	4.683	0.4847
	2			4,802		0	310	310		0.59	0.59	5.166	5.166	0.1142
	3			4,874	128	1.0	822	822		10.95	17.31	13.700	13.700	0.7993
Kelly State #3	1	6,233	4,697	4,721		4.5	324	324	63	9.59	22.58	5.143	5.143	1.8647
	2			4,756		1.0	454	454		4.77	4.80	7.206	7.206	0.6619
	3			4,812 (TD)	115(Incomp)	1.0	808	808		15.05	20.47	12.825	12.825	1.1735
Kelly State #4	1	6,270	4,743	4,768		0	245	245	55	0.13	0.13	4.454	4.454	0.0292
	2			4,800		0	433	433		0.98	0.98	7.872	7.872	0.1245
	3			4,878	135	0	1,139	1,139		5.12	5.12	20.709	20.709	0.2472
Kelly State #5	1	6,239	4,734	4,760		1.5	418	-	60	-	-	6.966	-	-
	2			4,787		9.5	728	-		-	-	12.133	-	-
	3			4,870	136	9.0	1,319	-		-	-	21.983	-	-
Kelly State #6	1	6,252	4,755	4,780		1.0	469	469	60	12.1	22.20	7.816	7.816	1.548
	2			4,808		0	519	519		8.8	12.90	8.650	8.650	1.017
	3			4,888	133	2.0	1,420	1,420		3.70	3.70	23.666	23.666	0.156
Kelly State #7	1	6,270	4,728	4,754		0	238	238	60	0.4	0.4	3.967	3.967	0.101
	2			4,779		0	310	310		1.3	2.1	5.167	5.167	0.252
	3			4,856	128	1.0	1,182	1,182		5.1	6.8	19.700	19.700	0.259

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft./ S.P. Feet (9)/(12) Ft./Ft.
El Paso (Cont'd.)														
Kelly State #8	1	6,260	4,712	4,736		0	202	-	57	-	-	3.5438	-	-
	2			4,768		0	433	-		-	-	7.5964	-	-
	3			4,842	130	2.0	1,269	-		-	-	22.2630	-	-
Kelly State #10	1	6,258	4,881	4,910		5.5	699	-	58	-	-	12.0517	-	-
	2			4,926		0	195	-		-	-	3.4310	-	-
	3			4,955(TD)	-	0	671	-		-	-	11.5689	-	-
Kelly State #12	1	6,314	4,716	4,742		0	505	-	60	-	-	8.4166	-	-
	2			4,772		4.5	923	-		-	-	15.3833	-	-
	3			4,846	130	4.5	1,694	-		-	-	28.2333	-	-
Sullivan #1-D *	1	6,239	4,963	4,995		10.0	815	815	63	17.18	134.38	12.937	12.937	1.3279
	2			-		0	0	0		-	-	0	0	-
	3			5,064	101	0	663	-		-	-	10.524	-	-
Sullivan #2-D *	1	6,206	4,931	4,960		9.5	591	591	58	18.45	52.65	10.190	10.190	1.8105
	2			-		0	0	0		-	-	0	0	-
	3			5,030	99	0	692	483		5.63	8.03	11.931	8.328	0.6760
Pan American														
In-Ni-Da-Pah #1	1	6,183	4,774	4,802		7.0	728	-	72	-	-	10.111	-	-
	2			4,832		0	433	-		-	-	6.014	-	-
	3			4,896	122	0	808	-		-	-	11.222	-	-
In-Ni-Da-Pah #2	1	6,175	4,788	4,816		0	649	-	70	-	-	9.271	-	-
	2			4,839		0	310	-		-	-	4.429	-	-
	3			4,902	114	4.0	945	-		-	-	13.500	-	-
Ka-Da-Pah #1	1	6,199	4,798	4,828		0	598	-	75	-	-	7.973	-	-
	2			4,850		0	209	-		-	-	2.787	-	-
	3			4,916	118	4.5	771	-		-	-	10.280	-	-
Ka-Da-Pah #2	1	6,204	4,824	4,850		0	288	-	70	-	-	4.114	-	-
	2			4,867		0	166	-		-	-	2.371	-	-
	3			4,934	110	0	894	-		-	-	12.771	-	-

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P. Feet (9)/(12) Ft./Ft.
Phillips														
Benally #1	1	6,213	4,801	4,831		10.5	714	-	46	-	-	15.521	-	-
	2			4,853		0	260	-		-	-	5.652	-	-
	3			4,926	125	3.5	714	-		-	-	15.521	-	-
Benally #2	1	6,182	4,788	4,822		17.5	1,089	1,089	58	24.28	1,268.88	18.775	18.775	1.293
	2			4,844		0	224	224		5.88	5.88	3.862	3.862	1.522
	3			4,910	122	2.0	952	952		14.50	28.40	16.413	16.413	0.883
Hospah #B-1 *	1	6,185	4,843	4,876		9.0	865	-	50	-	-	17.300	-	-
	2			-		0	0	0		-	-	0	-	-
	3			4,950	10	0	642	397		1.34	1.34	12.840	7.940	0.1687
Hospah #C-1 *	1	6,191	4,883	4,915		7.0	815	815	50	20.15	36.05	16.300	16.300	1.236
	2			-		0	0	-		-	-	0	-	-
	3			4,988	105	0	923	-		-	-	18.460	-	-
I-Tah-Nip #1	1	6,209	4,726	4,752		7.5	735	735	65	14.39	130.53	11.31	11.31	1.272
	2			4,782		0	512	512		4.27	9.04	7.88	7.88	0.542
	3			4,861	135	0	1,262	1,262		12.76	13.39	19.42	19.42	0.657
I-Tah-Nip #2	1	6,236	4,750	4,780		12.0	815	-	60	-	-	13.583	-	-
	2			4,802		2.5	512	-		-	-	8.533	-	-
	3			4,886	136	7.0	1,377	-		-	-	22.950	-	-
Reese and Assoc.														
Hickman #1	1	6,158	4,800	4,822		No	433	-	60	-	-	7.217	-	-
	2			4,840		Microlog	288	-		-	-	4.800	-	-
	3			4,906	106		836	-		-	-	13.933	-	-
Shell														
Gov't. #11-9	1	6,186	4,759	4,793		21.0	1,529	-	55	-	-	27.800	-	-
	2			4,822		0	425	-		-	-	7.727	-	-
	3			4,888	129	15.5	1,024	-		-	-	18.618	-	-
Gov't. #12-9	1	6,198	4,750	4,781		15.5	721	-	46	-	-	15.673	-	-
	2			4,812		0	238	-		-	-	5.173	-	-
	3			4,878	128	6.5	728	-		-	-	15.826	-	-

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(7) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P. Feet (9)/(12) Ft./Ft.
Shell (Cont'd.)														
Gov't. #12-15	1	?	4,694	4,722		1.5	411	-	67	-	-	6.134	-	-
	2			4,752		4.0	1,009	-		-	-	15.059	-	-
	3			4,832	138	0	1,435	-		-	-	21.417	-	-
Gov't. #13-10	1	6,188	4,727	4,760		19.5	1,298	-	45	-	-	28.844	-	-
	2			4,786		0	332	-		-	-	7.377	-	-
	3			4,852(TD)	125+	5.0	945	-		-	-	21.000	-	-
Gov't. #14-10	1	6,246	4,770	4,803		8.0	880	-	60	-	-	14.666	-	-
	2			4,826		0	267	-		-	-	4.450	-	-
	3			4,906	136	0	1,045	-		-	-	17.416	-	-
Gov't. #21-9	1	6,184	4,750	4,782		15.0	1,161	-	53	-	-	21.905	-	-
	2			4,807		0	310	-		-	-	5.849	-	-
	3			4,876	126	0	836	-		-	-	15.773	-	-
Gov't. #22-9	1	6,206	4,757	4,790		15.5	1,103	-	55	-	-	20.054	-	-
	2			4,813		0	281	-		-	-	5.109	-	-
	3			4,884 (TD)	127	7.0	981	-		-	-	17.836	-	-
Gov't. #31-9	1	6,199	4,767	4,796		16.0	1,240	-	55	-	-	22.545	-	-
	2			4,825		0	562	-		-	-	10.218	-	-
	3			4,892	125	8.0	771	-		-	-	14.018	-	-
Gov't. #31-10 *	1	6,243	4,821	4,854		3.0	678	678	65	-	-	10.430	-	-
	2			4,874		0	209	209		-	-	3.215	-	-
	3			4,944	123	0	916	620		-	-	14.092	-	-
Gov't. #32-9	1		4,745	4,776		17.0	1,319	-	57	-	-	23.140	-	-
	2			4,803		0	339	-		-	-	5.947	-	-
	3			4,874	129	10.0	1,161	-		-	-	20.368	-	-
Gov't. #41-9	1	6,201	4,771	4,800		7.5	793	-	50	-	-	15.860	-	-
	2			4,829		0	375	-		-	-	7.500	-	-
	3			4,898	127	8.0	901	-		-	-	18.020	-	-
Gov't. #41-21	1	6,268	4,707	4,736		0	245	-	57	-	-	4.298	-	-
	2			4,765		2.0	440	-		-	-	7.719	-	-
	3			4,842	135	11.0	1,485	-		-	-	26.053	-	-
Gov't. #42-9	1	6,222	4,776	4,808		17.5	1,341	-	58	-	-	23.121	-	-
	2			4,836		0	411	-		-	-	7.086	-	-
	3			4,895(TD)	119+	6.0	836	-		-	-	14.413	-	-

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(7) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P. Feet (9)/(12) Ft./Ft.
Skelly														
Duff #2 *	1	6,385	5,166	5,196		17.0	793	-	48	-	-	16.521	-	-
	2			-		0	-	-		-	-	-	-	-
	3	Poss. water		5,258	92	0	671	671		12.9	-	13.979	13.979	0.9228
Southern Union														
Ka-Gee-Tah #1	1	6,218	4,776	4,806		11.5	1,024	1,024	52	16.25	657.25	19.692	19.692	0.825
	2			4,835		0	469	469		5.70	5.70	9.019	9.019	0.631
	3			4,904	128	1.0	1,370	901		6.79	8.09	26.346	17.326	0.391
Ka-Gee-Tah #2	1	6,233	4,794	4,822		7.0	800	-	62	-	-	12.903	-	-
	2			4,853		0	425	-		-	-	6.854	-	-
	3			4,924	130	1.0	851	-		-	-	13.725	-	-
Sunray Mid-Continent														
Bisti G.I. #1	1	6,190	4,822	4,854		17.5	1,247	1,247	55	16.26	1,248.56	22.671	22.672	0.717
	2			4,874		0	252	-		-	-	4.581	-	-
	3			4,934	112	0	887	-		-	-	16.127	-	-
Federal #B-1	1	6,240	4,754	4,778		5.0	433	-	63	-	-	6.873	-	-
	2			4,812		0	490	-		-	-	7.778	-	-
	3			4,884	130	8.0	1,255	-		-	-	19.920	-	-
Federal #B-3	1	6,271	4,755	4,784		0	274	-	63	-	-	4.349	-	-
	2			4,808		0	353	-		-	-	5.603	-	-
	3			4,882	137	13.0	1,211	-		-	-	19.222	-	-
Federal #B-4	1	6,302	4,806	4,830		0	332	-	62	-	-	5.354	-	-
	2			4,855		0	382	-		-	-	6.161	-	-
	3			4,930	124	4.0	1,500	-		-	-	24.193	-	-
Federal #C-1	1	6,196	4,830	4,862		20.0	1,233	1,233	70	18.5	774.5	22.833	22.833	0.810
	2			4,878		0	353	-		-	-	6.537	-	-
	3			4,944	114	5.0	1,161	-		-	-	21.500	-	-
Federal #C-2	1	6,171	4,832	4,863		11.0	865	-	57	-	-	15.175	-	-
	2			4,883		0	260	-		-	-	4.561	-	-
	3			4,942	110	5.0	966	-		-	-	16.947	-	-

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv.-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv-Ft/Mv (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P. Feet (9)/(12) Ft./Ft.
Sunray Mid-Continent (Cont'd.)														
Federal #C-3	1	6,199	4,816	4,848		13.0	1,031	-	65	-	-	15.861	-	-
	2			4,864		0	281	-		-	-	4.323	-	-
	3			4,932	116	1.0	1,045	-		-	-	16.076	-	-
Federal #C-4	1	6,190	4,813	4,848		21.0	1,355	-	62	-	-	21.854	-	-
	2			4,867		0	245	-		-	-	3.951	-	-
	3			4,932	119	10.0	757	-		-	-	12.209	-	-
Federal #C-5	1	6,241	4,832	4,860		7.5	642	-	50	-	-	12.840	-	-
	2			4,882		1.0	555	-		-	-	11.100	-	-
	3			4,950	118	9.0	1,218	-		-	-	24.360	-	-
Federal #C-6	1	6,211	4,818	4,847		12.0	829	-	65	-	-	12.753	-	-
	2			4,876		0	526	-		-	-	8.092	-	-
	3			4,938	120	7.5	1,024	-		-	-	15.753	-	-
Federal #C-7	1	6,163	4,827	4,842		4.0	469	-	60	-	-	7.82	-	-
	2			4,860		0	360	-		-	-	6.00	-	-
	3			4,922	95	0	851	519		0.81	0.81	14.18	8.65	0.094
Federal #C-9	1	6,170	4,810	4,841		11.0	887	-	70	-	-	12.671	-	-
	2			4,864		0	281	-		-	-	4.014	-	-
	3			4,924	114	7.0	923	-		-	-	13.185	-	-
Federal #C-10	1	6,220	4,811	4,836		11.0	894	894	58	13.41	681.57	15.41	15.41	0.870
	2			4,863		6.0	800	-		-	-	13.79	-	-
	3			4,934	123	6.0	1,377	771		3.95	5.15	23.74	13.29	0.297
Federal #C-11	1	6,258	4,838	4,867		6.5	540	-	45	-	-	12.000	-	-
	2			4,886		5.0	512	-		-	-	11.377	-	-
	3			4,960	122	19.0	1,255	-		-	-	27.888	-	-
Federal #C-12	1	6,194	4,805	4,838		15.5	1,392	-	55	-	-	25.309	-	-
	2			4,859		0	411	-		-	-	7.472	-	-
	3			4,928	123	0	1,154	-		-	-	20.981	-	-
Federal #C-13	1	6,168	4,797	4,828		8.5	1,045	-	65	-	-	16.076	-	-
	2			4,851		0	310	-		-	-	4.769	-	-
	3			4,914	117	4.0	937	-		-	-	14.415	-	-
Federal #C-14	1	6,201	4,766	4,793		11.0	865	865	55	4.44	1,032.83	15.727	15.727	0.2823
	2			4,820		6.0	844	800		10.18	31.34	15.345	14.545	0.6999
	3			4,896	130	7.0	1,089	952		4.34	18.34	19.800	17.309	0.2507

Company, Lease and Well No.	Zone	(1) Elev. RKB	(2) Interval Top	(3) Interval Bottom	(4) Gross Thickness All Zones	(5) Microlog Net Pay	(6) S.P. Area Mv.-Ft.	(7) Core Int.SP Area Mv-Ft.	(8) SSP From 4000' Zones Mv.	(9) Net Pay From Core Data	(10) Kh Core Data	(11) Mv.-Ft./Mv. (6)/(8) Ft.(S.P.Area)	(12) Mv-Ft/Mv (7)/(8) Ft.(Cored S.P.Area)	(13) Cored Ft/ S.P.Feet (9)/(12) Ft./Ft.
Sunray Mid-Continent (Cont'd.)														
Federal #C-15	1	6,207	4,789	4,817		11.0	663	-	60	-	-	11.050	-	-
	2			4,848		0	375	-		-	-	6.250	-	-
	3			4,914	125	6.0	714	-		-	-	11.900	-	-
Federal #C-16	1	6,241	4,797	4,824		7.5	577	-	60	-	-	9.616	-	-
	2			4,848		3.0	490	-		-	-	8.166	-	-
	3			4,916	119	3.0	988	-		-	-	16.466	-	-
Federal #C-17	1	6,268	4,796	4,824		11.0	793	-	65	-	-	12.200	-	-
	2			4,850		5.5	808	-		-	-	12.430	-	-
	3			4,919	123	4.0	1,168	-		-	-	17.969	-	-
Federal #C-18	1	6,281	4,836	4,862		2.0	548	548	65	2.11	2.11	8.43	8.43	0.25
	2			4,880		0	353	353		0.88	0.88	5.43	5.43	0.162
	3			4,958	122	7.5	1,615	1,298		3.82	3.82	24.85	19.97	0.191
Federal #C-19	1	6,289	4,833	4,860		4.5	577	-	65	-	-	8.876	-	-
	2			4,880		0	245	-		-	-	3.769	-	-
	3			4,954	121	7.0	1,312	-		-	-	20.184	-	-
Federal #C-20	1	6,303	4,867	4,894		4.5	512	71	45	-	-	11.376	-	-
	2			4,914		0	202	28		-	-	4.486	-	-
	3			4,987	120	6.5	1,233	171		-	-	27.398	-	-
Federal #C-21	1	6,188	4,754	4,784		15.5	1,269	-	58	-	-	21.879	-	-
	2			4,808		0	288	-		-	-	4.965	-	-
	3			4,880	126	3.0	959	-		-	-	16.534	-	-

Σ Zone 1 - 417.81 Σ Zone 1 - 409.49

Σ Zone 2 - 89.03 Σ Zone 2 - 143.506

Σ Zone 3 - 183.26 Σ Zone 3 - 395.455

* Well not in Central Bisti Unit, but included because of core analysis.

1 square inch of SP area (10 Mv. scale) = 724.6 Mv. - Ft.

SP area in Mv.-Ft. (Column #6) = $\frac{\text{Planimeter Units}}{\text{Planimeter Constant (100.5)}} \times 724.6$

SP footage (Column #11) = $\frac{\text{SP area in Mv.-Ft. (Column \#6)}}{\text{SSP from 4000' Zone (Column \#8)}}$

R 13 W R 12 W

T 26 N

T 25 N

UNIT AREA

PARTICIPATING AREA

PILOT TEST

ISOPACH - (MICROLOG SEPARATION)
Lower Gallup - Zone 1

BISTI ENGINEERING COMMITTEE

BISTI LOWER GALLUP OIL POOL

Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico

2000 1000 0 1000 2000 4000
SCALE IN FEET

PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-6-58

EXHIBIT II-A

C2-205A

R 13 W R 12 W

T 26 N

T 25 N

PILOT TEST

UNIT AREA

PARTICIPATING AREA

ISOPACH - (MICROLOG SEPARATION)
Lower Gallup - Zone 2

BISTI ENGINEERING COMMITTEE

BISTI LOWER GALLUP OIL POOL

Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico

2000 1000 0 1000 2000 4000
SCALE IN FEET

PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-18-56

EXHIBIT II-B

C2-206A

R 13 W R 12 W

T 26 N

T 25 N

UNIT AREA

PARTICIPATING AREA

PILOT TEST

ISOPACH – (MICROLOG SEPARATION)

Lower Gallup-Zone 3

BISTI ENGINEERING COMMITTEE

BISTI LOWER GALLUP OIL POOL

Portions of

Township 25 & 26 N Ranges 12, 13 & 14 W

County San Juan State New Mexico

2000 1000 0 1000 2000 4000

SCALE IN FEET

PREPARED BY SUNRAY MID-CONTINENT EXPLORATION DRAFTING SECTION

8-18-58

EXHIBIT II-C

C2-207A

R 13 W

R 12 W

T 26 N

T 25 N

PILOT TEST

UNIT AREA

PARTICIPATING AREA

ISOPACH - (SP)

Lower Gallup - Zone I

BISTI ENGINEERING COMMITTEE

BISTI LOWER GALLUP OIL POOL

Portions of

Township 25 & 26N Ranges 12, 13 & 14W

County San Juan State New Mexico

2000 1000 0 1000 2000 4000

SCALE IN FEET

PREPARED BY SUNRAY MID-CONTINENT EXPLORATION DRAFTING SECTION

8-18-58

EXHIBIT 12-A

C2-208A

R 12 W

T 26 N

T 25 N

UNIT AREA

PARTICIPATING AREA

PILOT TEST

ISOPACH - (SP)
Lower Gallup - Zone 2

BISTI ENGINEERING COMMITTEE

BISTI LOWER GALLUP OIL POOL

Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico

2000 1000 0 1000 2000 4000
SCALE IN FEET

PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-8-58

EXHIBIT 12-B

C2-209A

R 13 W

R 12 W

T 26 N

T 25 N

UNIT AREA

PARTICIPATING AREA

PILOT TEST

ISOPACH — (SP)
Lower Gallup — Zone 3

BISTI ENGINEERING COMMITTEE

BISTI LOWER GALLUP OIL POOL

Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico

2000 1000 0 1000 2000 4000
SCALE IN FEET

PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
8-18-58

EXHIBIT 12-C

C2-210A

EXHIBIT 13

Engineering Committee
4-6-59

CALCULATION OF PARTICIPATION

CENTRAL BISTI LOWER GALLUP SAND UNIT
SAN JUAN COUNTY, NEW MEXICO

Company	Lse	ML Acre Feet		ML Oil in Place		SP Acre Feet		SP Oil in Place		Formula*	Company	Lse
		Acre Feet	Fraction	Bbls	Fraction	Acre Feet	Fraction	Bbls	Fraction	Fraction		
AMRD	18	1,736.57	0.0281633	1,144,631	0.0300940	4,017.58	0.0339969	2,222,424	0.0357104	0.0341945	AMRD	18
AMRD	19	1,933.62	0.0313591	1,416,037	0.0372297	4,636.46	0.0392339	2,587,446	0.0415756	0.0436227	AMRD	19
AMRD	20	628.59	0.0101944	345,092	0.0090730	4,267.07	0.0361081	2,104,778	0.0338200	0.0195205	AMRD	20
AMRD	21	2,357.94	0.0382407	1,333,130	0.0350499	4,554.63	0.0385414	2,232,639	0.0358745	0.0409958	AMRD	21
AMRD	22	2,737.43	0.0443952	1,741,952	0.0457985	5,359.01	0.0453481	2,771,765	0.0445373	0.0474662	AMRD	22
		9,394.15*	0.1523527*	5,980,842*	0.1572451*	22,834.75*	0.1932284*	11,919,052*	0.1915178*	0.1857997*		
LPAS	7	4,351.35	0.0705695	2,199,770	0.0578352	12,849.49	0.1087328	6,039,752	0.0970480	0.0691834	LPAS	7
LPAS	13	289.85	0.0047007	207,931	0.0054668	1,477.78	0.0125050	796,263	0.0127945	0.0084103	LPAS	13
		4,641.20*	0.0752702*	2,407,701*	0.0633020*	14,327.27*	0.1212378*	6,836,015*	0.1098425*	0.0775937*		
PHIL	11	2,642.97	0.0428633	1,864,817	0.0490288	4,508.98	0.0381551	2,539,014	0.0407974	0.0472964	PHIL	11
PHIL	12	3,293.47	0.0534130	2,171,346	0.0570879	5,421.86	0.0458799	2,958,030	0.0475302	0.0461741	PHIL	12
		5,936.44*	0.0962763*	4,036,163*	0.1061167*	9,930.84*	0.0840350*	5,497,044*	0.0883276*	0.0934705*		
PNAM	14	232.87	0.0037766	105,274	0.0027678	2,265.85	0.0191737	1,194,585	0.0191948	0.0093458	PNAM	14
PNAM	15	1,026.96	0.0166551	600,294	0.0157826	3,164.49	0.0267780	1,693,457	0.0272108	0.0218277	PNAM	15
		1,259.83*	0.0204317*	705,568*	0.0185504*	5,430.34*	0.0459517*	2,888,042*	0.0464056*	0.0311735*		
RESE	10	101.78	0.0016507	59,456	0.0015631	865.80	0.0073264	439,361	0.0070598	0.0037804	RESE	10
		101.78*	0.0016507*	59,456*	0.0015631*	865.80*	0.0073264*	439,361*	0.0070598*	0.0037804*		
SHEL	3	504.40	0.0081803	220,774	0.0058045	1,412.86	0.0119557	612,823	0.0098470	0.0057718	SHEL	3
SHEL	4	7,369.75	0.1195213	4,768,461	0.1253698	10,517.51	0.0889995	5,887,105	0.0945952	0.1080302	SHEL	4
		7,874.15*	0.1277016*	4,989,235*	0.1311743*	11,930.37*	0.1009552*	6,499,928*	0.1044422*	0.1138020*		
SNRY	1	29,095.44	0.4718651	17,977,471	0.4726540	43,853.00	0.3710854	23,588,839	0.3790303	0.4336811	SNRY	1
SNRY	2	1,965.96	0.0318836	911,750	0.0239712	4,455.22	0.0377002	2,096,362	0.0336848	0.0216406	SNRY	2
		31,061.40*	0.5037487*	18,889,221*	0.4966252*	48,308.22*	0.4087856*	25,685,201*	0.4127151*	0.4553217*		
SOUN	16	1,391.56	0.0225681	966,977	0.0254232	4,547.36	0.0384799	2,470,058	0.0396894	0.0390585	SOUN	16
		1,391.56*	0.0225681*	966,977*	0.0254232*	4,547.36*	0.0384799*	2,470,058*	0.0396894*	0.0390585*		
BIST		61,660.51	1.0000000	38,035,163	1.0000000	118,174.95	1.0000000	62,234,701	1.0000000	1.0000000	BIST	
		61,660.51*	1.0000000*	38,035,163*	1.0000000*	118,174.95*	1.0000000*	62,234,701*	1.0000000*	1.0000000*		

* FORMULA: 1/3 ML Oil in Place + 1/3 SP Oil in Place + 1/3 Current Oil Production

** 3 Months - July, August, September, with exceptions

EXHIBIT 14

CALCULATION OF OIL RECOVERY BY FLUID EXPANSION
CENTRAL BISTI LOWER GALLUP SAND UNIT
SAN JUAN COUNTY, NEW MEXICO

(1) $N_p = N\Delta P\ (C_o + C_R)$

N_p = cumulative oil production

N = stock oil in place

ΔP = pressure decline from original pressure to saturation pressure

C_o = oil compressibility at 145° vol/vol/psi

C_R = rock compressibility

$C_o = 11.1 \times 10^{-6}$, $C_R = 4.2 \times 10^{-6}$, N(ML) = 38×10^6 bbls, N(SP) = 62.2×10^6 bbls.

P_i	P_s	ΔP	N	C_o+C_R	N_P
1612	1207	405	38.0×10^6	15.3×10^{-6}	235,500
1440	1207	233	38.0×10^6	15.3×10^{-6}	135,500
1612	1207	405	62.2×10^6	15.3×10^{-6}	385,400
1440	1207	233	62.2×10^6	15.3×10^{-6}	221,700

Note: The areally weighted average pressure in Range 12 for the October, 1957 survey was 1229 psi when the cumulative production was 616,937 bbls. A volumetrically weighted pressure would be higher. Oil recovery to bubble point pressure of 1207 psi is estimated to be approximately 850,000 bbls. from decline curve analysis and material balance calculations.

GAS-OIL RELATIVE PERMEABILITY RATIO

BISTI FIELD

San Juan Co., N.Mex.

Exhibit 15

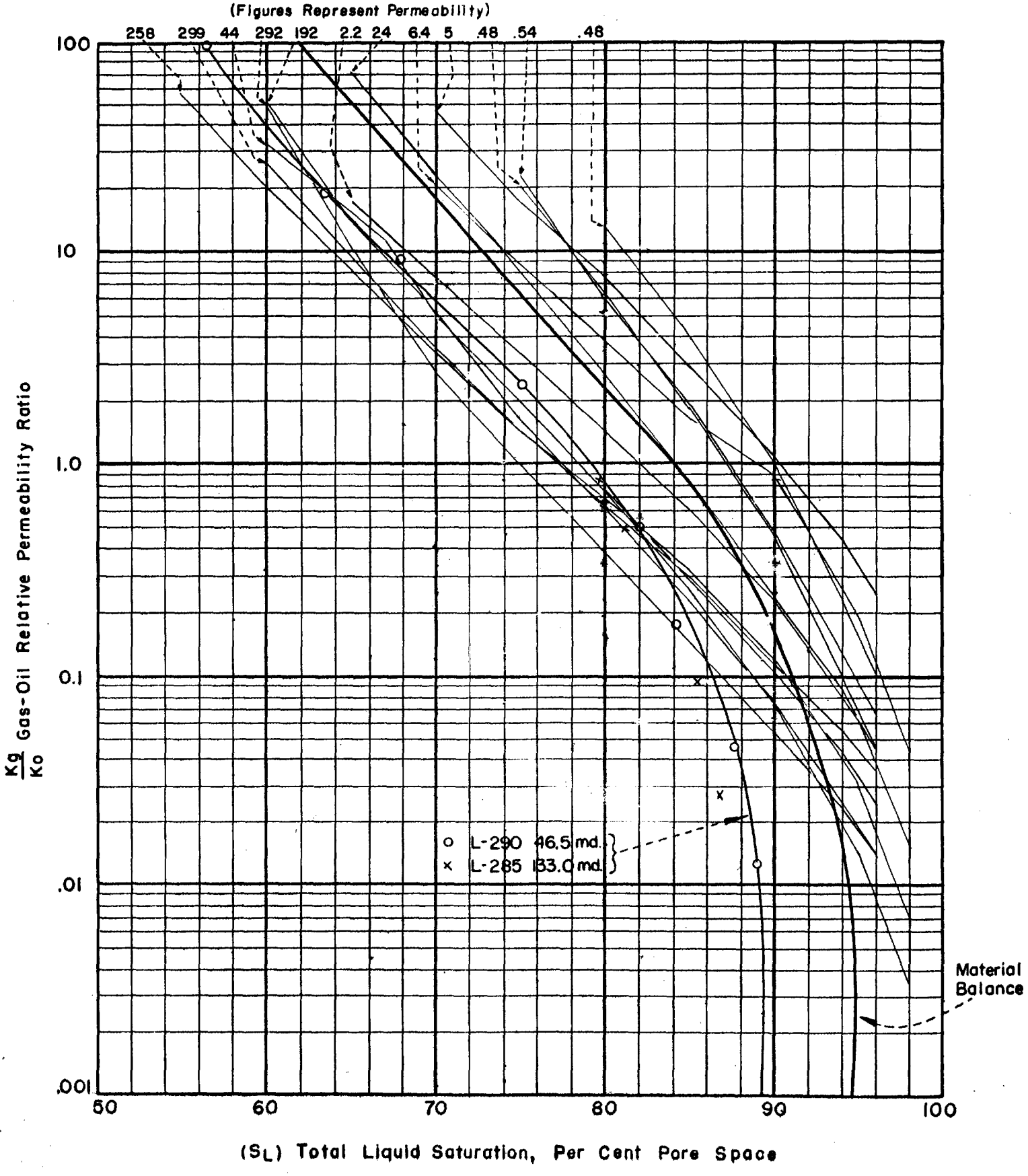


EXHIBIT 16

CALCULATED RESERVOIR PERFORMANCE
NATURAL DEPLETION
CENTRAL BISTI LOWER GALLUP SAND UNIT
SAN JUAN COUNTY, NEW MEXICO

Res. Press. Psig	$\frac{\Delta Np}{N}$	$\frac{Np}{N}$	B_o	$\frac{B_o}{B_{oi}}(1-S_w)$	Total S_L	R_s	$1/B_g$	μ_o	R	$\Delta(\frac{B_o}{B_g}-R_s)$	μ_g	$(1+mi)B_{oi}\Delta\frac{1}{B_g}$
1,207			1.2602	.755		406	476	.823	406		.0151	
1,200	.0015	.0015	1.2595	.755	.998	404	472	.825	411	4.6-	.0151	5.53-
1,100	.0313	.0329	1.2513	.750	.970	383	417	.848	448	52.2-	.0149	69.87-
1,000	.0328	.0656	1.2437	.745	.941	358	371	.868	792	35.3-	.0146	57.86-
900	.0203	.0859	1.2352	.740	.921	333	330	.895	1,559	28.1-	.0144	51.51-
800	.0119	.0978	1.2257	.734	.908	308	291	.930	2,566	26.3-	.0140	48.88-
700	.0078	.1055	1.2154	.728	.896	285	253	.972	3,702	26.7-	.0136	48.35-
600	.0058	.1114	1.2047	.722	.886	263	214	1.017	4,863	26.9-	.0132	48.64-
500	.0049	.1163	1.1940	.715	.877	240	175	1.066	5,903	25.5-	.0128	48.78-
400	.0047	.1210	1.1832	.709	.868	215	137	1.126	6,715	21.7-	.0125	48.14-
300	.0047	.1257	1.1710	.702	.858	185	100	1.217	7,256	15.3-	.0122	46.39-
200	.0051	.1308	1.1554	.692	.847	151	66	1.371	7,529	6.8-	.0119	43.55-
100	.0058	.1366	1.1324	.678	.831	110	34	1.641	7,019	2.8	.0116	39.95-

$$\frac{\overset{x+1}{\Delta}_x Np}{N} = \frac{(1-\frac{Np_x}{N})\overset{x+1}{\Delta}_x(\frac{B_o}{B_g}-R_s)-(1+m_i)(B_{oi}\overset{x+1}{\Delta}_x\frac{1}{B_g})}{(\frac{B_o}{B_g}-R_s)_{x+1}+R_{avg}\overset{x+1}{}_x(1-I)}$$

$$S_{L_{x+1}} = (1-S_w)(1-\frac{Np}{N}_{x+1})(\frac{B_o}{B_{oi}})_{x+1}+S_w$$

$$R_{x+1} = \frac{k_g}{k_o}(\frac{\mu_o}{\mu_g}\frac{B_o}{B_g})_{x+1}+R_{s_{x+1}}$$

EXHIBIT 17 A

MONTHLY NET $\frac{\text{OVER}}{\text{UNDER}}$ INJECTION

$V_1 - V_{FPG} - nB_o + E_g - C_o - Sh_o$

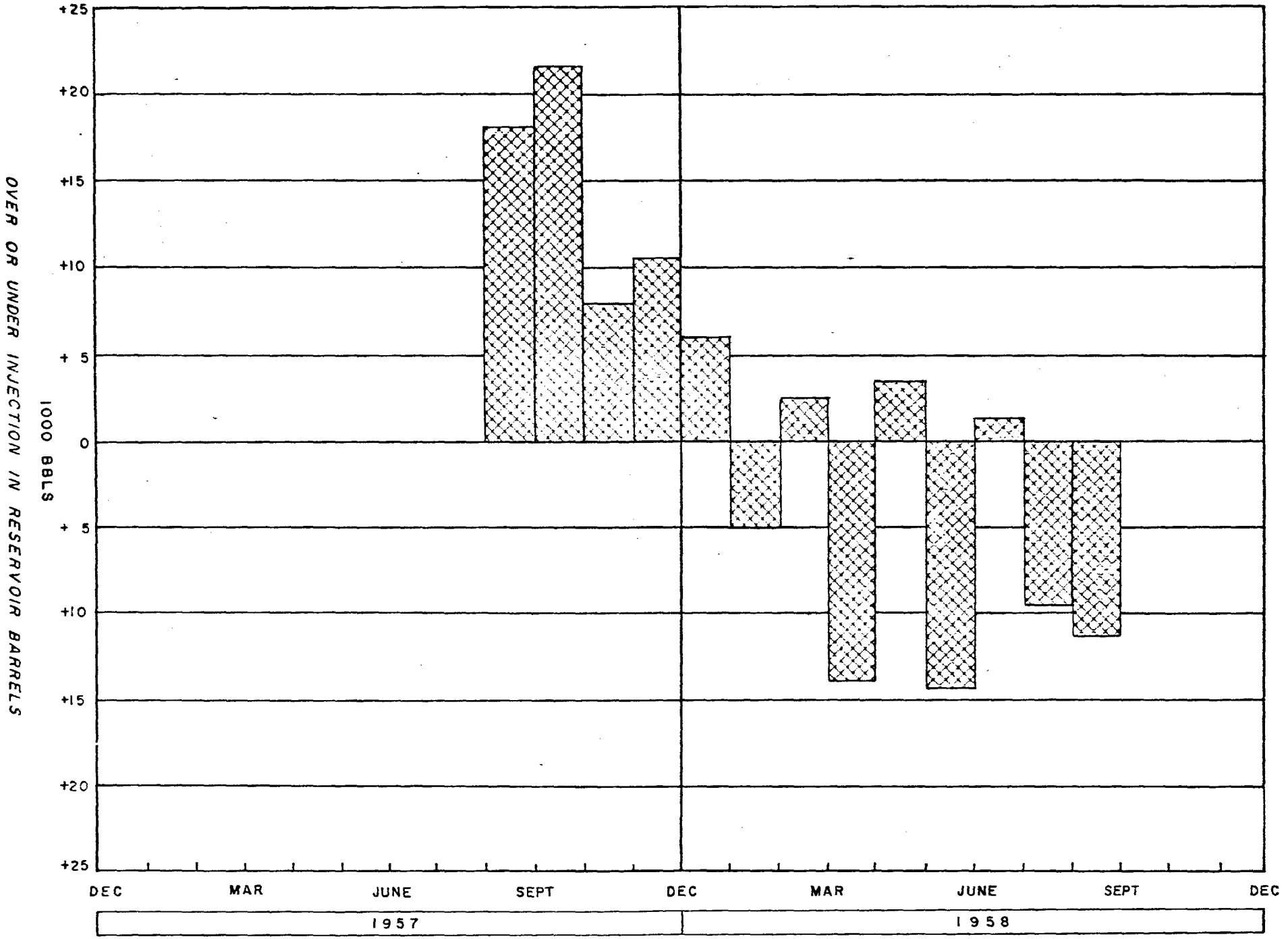


EXHIBIT 17B

CUM. NET $\frac{\text{OVER}}{\text{UNDER}}$ INJECTION

$V_i - V_{FPG} - nB_o + E_g - C_o - Sh_o$

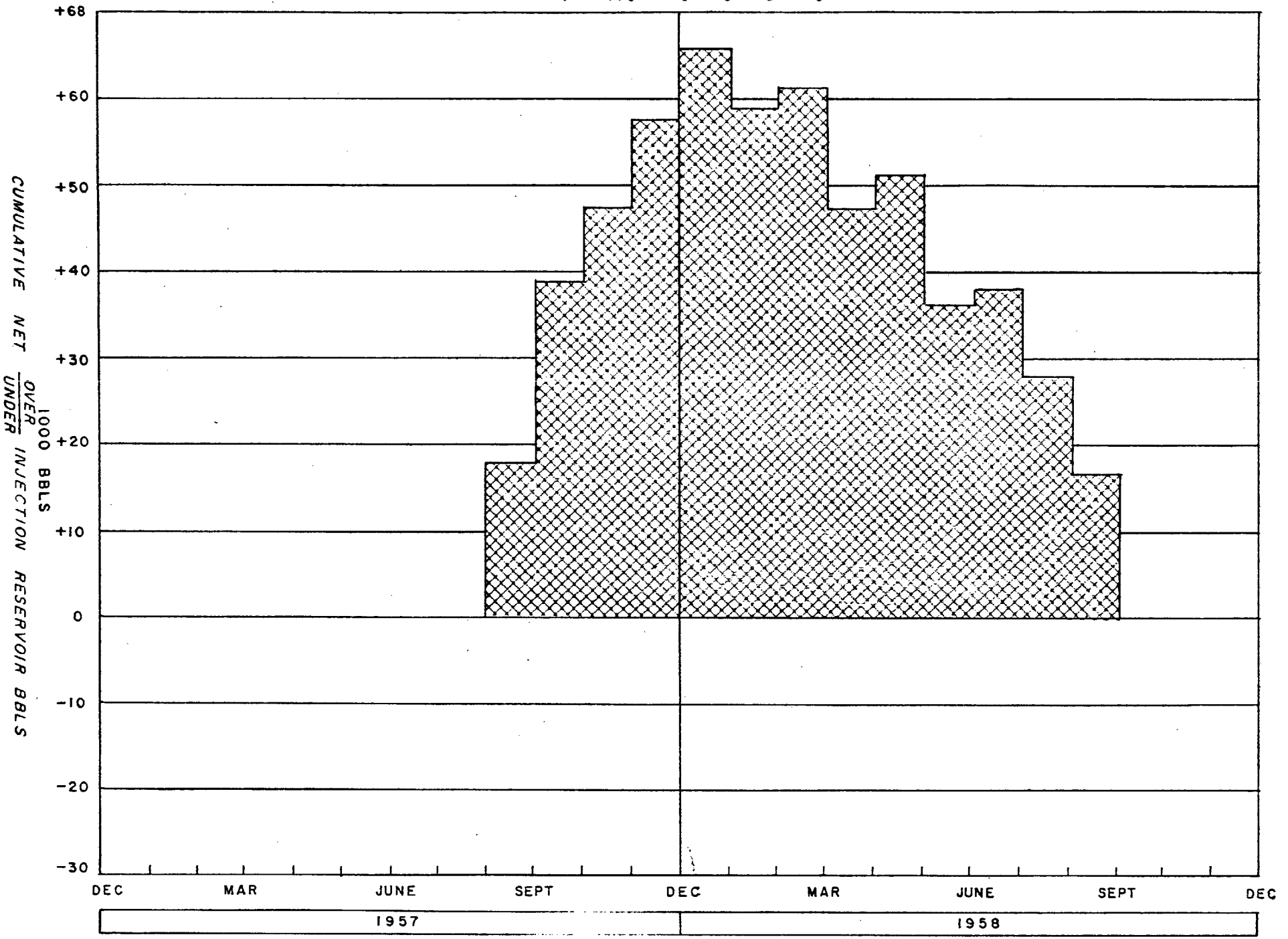


EXHIBIT 17C

VOLUMETRIC BALANCE CALCULATION OF PILOT WITHDRAWAL REPLACEMENT BY INJECTION
CENTRAL BISTI LOWER GALLUP SAND UNIT, SAN JUAN COUNTY, NEW MEXICO

PRODUCTION DATA	Sp.Gr.	(1) Reservoir Pressure psi	(2) Monthly Avg. Produced Gas Z_R	(3) Monthly Avg. Produced Gas B_g (Res Bbls/SCF)	(4) Oil Production Mo. STB	(5) Oil Production Cum. Σ(4) STB	(6) Gas Production Monthly Mcf at 15.025	(7) Gas Production Cumulative Σ(6) Mcf at 15.025	(8) Mo. Avg. GOR (6)/(4) (SCF/STB)
1957 Aug. (Last half)	1.00	1270	0.632	.001551	6,093	6,093	2,519	2,519	413
Sept.	1.00	1335	0.620	.001447	5,606	11,699	2,304	4,823	411
Oct.	0.96	1332	0.680	.001591	16,300	27,999	6,381	11,204	391
Nov.	0.94	1330	0.705	.001652	14,845	42,844	6,840	18,044	461
Dec.	0.91	1300	0.732	.001755	17,042	59,886	8,815	26,859	518
1958 Jan.	0.88	1255	0.762	.001892	14,638	74,524	11,927	38,786	815
Feb.	0.86	1215	0.779	.001998	15,749	90,273	16,495	55,281	1,047
March	0.83	1175	0.802	.002127	15,422	105,695	20,377	75,658	1,321
April	0.84	1140	0.805	.002200	17,445	123,140	35,764	111,422	2,050
May	0.84	1112	0.810	.002270	16,486	139,626	34,953	146,375	2,120
June	0.83	1088	0.818	.002343	16,632	156,258	38,621	184,996	2,322
July	0.85	1068	0.810	.002363	17,842	174,100	45,931	230,927	2,574
Aug.	0.83	1052	0.820	.002429	15,987	190,087	46,088	277,015	2,883
Sept.	0.85	1040	0.812	.002433	16,895	206,982	47,807	324,822	2,830

	B	R_s	(9) Monthly Average $(R - R_s)$ (8) $-R_s$ (SCF/STB)	(10) Monthly Average $(R - R_s)$ Bg (9)x(3) (Res Bbl/STB)	(11) QR/QS $B_o + (10)$ (Res Bbl/STB)	(12) Reservoir Voidage Monthly (4)x(11) Res Bbls	(13) Reservoir Voidage Cum. Σ(12) Res Bbls	(14) Produced Free Gas Monthly (4)x(10) Res Bbls	(15) Produced Free Gas Cum. Σ(14) Res Bbls	(16) Net Oil Voidage Monthly (12)-(14) Res Bbls	(17) Net Oil Voidage Cum. Σ(16) Res Bbls
1957 Aug. (Last half)	1.26	407	0	0.000	1.260	7,677	7,677	0	0	7,677	7,677
Sept.	1.26	407	0	0.000	1.260	7,064	14,741	0	0	7,064	14,741
Oct.	1.26	407	0	0.000	1.260	20,538	35,279	0	0	20,538	35,279
Nov.	1.26	407	54	0.089	1.349	20,026	55,305	1,321	1,321	18,705	53,984
Dec.	1.26	407	111	0.195	1.455	24,796	80,101	3,323	4,644	21,473	75,457
1958 Jan.	1.26	407	408	0.720	2.032	29,744	109,845	11,301	15,945	18,443	93,900
Feb.	1.26	407	640	1.279	2.539	39,987	149,832	20,143	36,088	19,844	113,744
March	1.258	398	923	1.963	3.221	49,674	199,506	30,273	66,361	19,401	133,145
April	1.255	390	1,660	3.652	4.907	85,603	285,109	63,710	130,071	21,893	155,038
May	1.2525	383	1,737	3.943	5.1955	85,653	370,762	65,004	195,075	20,649	175,687
June	1.251	378	1,944	4.555	5.806	96,566	467,328	75,759	270,834	20,807	196,494
July	1.249	374	2,200	5.199	6.448	115,045	582,373	92,760	363,594	22,285	218,779
Aug.	1.2475	370	2,513	6.104	7.3515	117,528	699,901	97,584	461,178	19,944	238,723
Sept.	1.247	367	2,463	5.992	7.239	122,303	822,204	101,235	562,413	21,068	259,791

EXHIBIT 17C (Cont'd.)

VOLUMETRIC BALANCE CALCULATION OF PILOT WITHDRAWAL REPLACEMENT BY INJECTION
CENTRAL BISTI LOWER GALLUP SAND UNIT, SAN JUAN COUNTY, NEW MEXICO

INJECTION DATA		(18) Monthly Avg. Inj. Gas Z_R	(19) Monthly Avg. Inj. Gas B_g (Res Bbls/SCF)	(20) Gas Injected Monthly Mcf at 15.025	(21) Gas Injected Cum. Σ(20) Mcf at 15.025	(22) Gas Injected Monthly (19x20)(1000) Res Bbls	(23) Gas Injected Cum. Σ(22) Res Bbls	(24) Cum. Fluid Inj. Σ(23) Res Bbls
1957 Aug.	-	-	-	-	(8,000)*	(8,000)*	(8,000)*	
Aug. (Last half)	-	-	-	-	(31,000)*	(23,000)*	(31,000)*	8,000*
Sept.	0.635	0.873	.002038	1,164	1,164	2,372	2,372	33,372
Oct.	0.635	0.873	.002042	20,628	21,792	42,122	44,494	75,494
Nov.	0.68	0.857	.002008	14,433	36,225	28,981	73,475	104,475
Dec.	0.68	0.860	.002061	16,026	52,251	33,030	106,505	137,505
1958 Jan.	0.68	0.863	.002143	14,592	66,843	31,271	137,776	168,776
Feb.	0.68	0.867	.002224	13,410	80,253	29,824	167,600	198,600
March	0.68	0.870	.002307	20,838	101,091	48,073	215,673	246,673
April	0.74	0.853	.002331	30,774	131,865	71,734	287,407	318,407
May	0.78	0.840	.002354	37,658	169,523	88,647	376,054	407,054
June	0.79	0.840	.002406	32,650	202,173	78,556	454,610	485,610
July	0.79	0.843	.002459	45,884	248,057	112,829	567,439	598,439
Aug.	0.82	0.827	.002449	44,720	292,777	109,519	676,958	707,958
Sept.	0.84	0.818	.002451	45,300	338,077	111,030	787,988	818,988

	(25) Expansion Ratio $\frac{B_g(19)i}{B_g(19)i+1}$	(26) Net Gain Mo. Gas Inj. (22)-(14) Res Bbls	(27) Net Injected Gas Prev. Mo. Res Vol. Res Bbls	(28) Net Injected Gas Expanded Vol. (25)x(27) Res Bbls	(29) Net Injected Gas Cum. (26)+(28) Res Bbls	(30) Total Net Res. Inj. Vol. Cum. (29)+31000 Res Bbls	(31) Total Net Res. Inj. Vol. Monthly (30)i-(30)i+1 Res Bbls
1957 Aug. (Last half)	-	0	0	0	0	8,000*	8,000*
Sept.	-	+ 2,372	0	0	2,372	33,372	25,372
Oct.	1.0020	+ 42,122	2,372	2,377	44,499	75,499	42,127
Nov.	0.9832	+ 27,660	44,499	43,756	71,416	102,416	26,917
Dec.	1.0264	+ 29,707	71,416	73,301	103,008	134,008	31,592
1958 Jan.	1.0398	+ 19,970	103,008	107,108	127,078	158,078	24,070
Feb.	1.0378	+ 9,681	127,078	131,882	141,563	172,563	14,485
March	1.0373	+ 17,800	141,563	146,843	164,643	195,643	23,080
April	1.0104	+ 8,024	164,643	166,355	174,379	205,379	9,736
May	1.0099	+ 23,643	174,379	176,105	199,748	230,748	25,369
June	1.0221	+ 2,797	199,748	204,162	206,959	237,959	7,211
July	1.0220	+ 20,069	206,959	211,512	231,581	262,581	24,622
Aug.	0.9959	+ 11,935	231,581	230,632	242,567	273,567	10,986
Sept.	1.0008	+ 9,795	242,567	242,761	252,556	283,556	9,989

* 8000 bbls. of the 31,000 bbls LPG was injected by the end of August.

EXHIBIT 17C (Cont'd.)

VOLUMETRIC BALANCE CALCULATION OF PILOT WITHDRAWAL REPLACEMENT BY INJECTION
CENTRAL BISTI LOWER GALLUP SAND UNIT, SAN JUAN COUNTY, NEW MEXICO

INJECTION DATA	(32) Inj. Net Gas In Reservoir Monthly (29)i-(29)i+1 Res Bbls	(33) Gas Expansion Monthly (32)-(26)(28)-(27) Res Bbls	(34) Gas Expansion Cum. Σ of (33) Res Bbls	(35) Oil Comp on Exp ΔP_X Ni+1 Res Bbls	(36) Oil Shrinkage $NB_o\left[1-\frac{B_{oi+1}}{B_{oi}}\right]$ Res Bbls	(37) Cumulative Vol. Change Σ [(35)+(36)] Res Bbls
1957 Aug. (Last half)	0	0	0	+ 474	-	474
Sept.	2,372	0	0	+ 488	-	962
Oct.	42,127	+ 5	+ 5	- 23	-	939
Nov.	26,917	- 743	- 738	- 15	-	924
Dec.	31,592	+ 1,885	+ 1,147	- 255	-	699
1958 Jan.	24,070	+ 4,100	+ 5,247	- 338	-	361
Feb.	14,485	+ 4,804	+ 10,051	- 301	-	60
March	23,080	+ 5,280	+ 15,331	- 60	1,158	1,158
April	9,736	+ 1,712	+ 17,043	-	1,688	2,846
May	25,369	+ 1,726	+ 18,769	-	1,359	4,205
June	7,211	+ 4,414	+ 23,183	-	789	4,994
July	24,622	+ 4,553	+ 27,736	-	1,018	6,012
Aug.	10,986	- 949	+ 26,787	-	735	6,747
Sept.	9,989	+ 194	+ 26,981	-	237	6,984

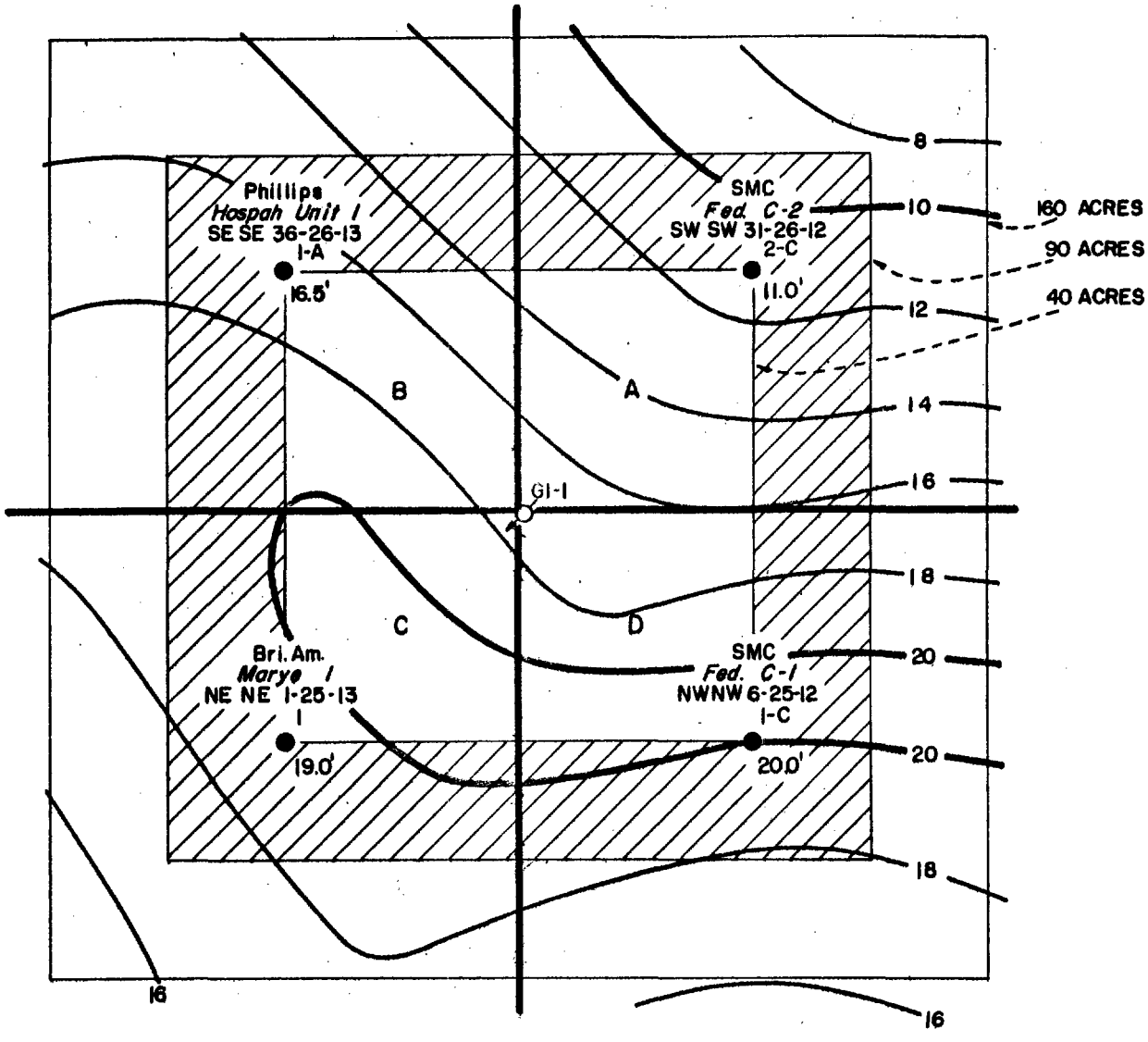
OVER / UNDER INJECTION DATA	(38) Gross Over / Under Monthly Inj (22)-(12) Res Bbls	(39) (No. Exp., Comp., SH) Cum. Σ (38) Res Bbls	(40) Mo. Net Gain (Exp., Comp., SH) (33)-(35) and (36) Res Bbls	(41) Cum. Net Gain (Exp., Comp., SH) Σ(40) Res Bbls	(42) Net Over / Under Monthly (38)+(40) Res Bbls	(43) Inj. Cum. Σ (42) Res Bbls
1957 Aug. (Last half)	+ 323	+ 323	- 474	- 474	- 151	- 151
Sept.	+ 18,308	+ 18,631	- 488	- 962	+ 17,820	+ 17,669
Oct.	+ 21,584	+ 40,215	+ 28	- 934	+ 21,612	+ 39,281
Nov.	+ 8,955	+ 49,170	- 728	- 1,662	+ 8,227	+ 47,508
Dec.	+ 8,234	+ 57,404	+ 2,110	+ 448	+ 10,344	+ 57,852
1958 Jan.	+ 1,527	+ 58,931	+ 4,438	+ 4,886	+ 5,965	+ 63,817
Feb.	- 10,163	+ 48,768	+ 5,105	+ 9,991	- 5,058	+ 58,759
March	- 1,601	+ 47,167	+ 4,182	+ 14,173	+ 2,581	+ 61,340
April	- 13,869	+ 33,298	+ 24	+ 14,197	+ 13,845	+ 47,495
May	+ 2,994	+ 36,292	+ 367	+ 14,564	+ 3,361	+ 50,856
June	- 18,010	+ 18,282	+ 3,625	+ 18,189	- 14,385	+ 36,471
July	- 2,216	+ 16,066	+ 3,535	+ 21,724	+ 1,319	+ 37,790
Aug.	- 8,009	+ 8,057	- 1,684	+ 20,040	- 9,693	+ 28,097
Sept.	- 11,273	- 3,216	- 43	+ 19,997	- 11,316	+ 16,781

$$B_g = \frac{V_R}{V_S} = \frac{P_S}{P_R} \cdot \frac{T_R}{T_S} \cdot \frac{Z_R}{Z_S(5.61)} = \frac{15.025}{P_R} \cdot \frac{605}{520} \cdot \frac{Z_R}{1(5.61)} = 3.116\left(\frac{R}{P_R}\right)\left(\frac{\text{Res Bbl}}{\text{SCF}}\right)$$

EXHIBIT 18

MAP OF PILOT AREA
BISTI LOWER GALLUP OIL POOL

San Juan County, N. Mexico



GRID	ENCLOSED FIVE SPOT ACRE FEET	ENCLOSED FIVE SPOT OIL IN PLACE	OPEN FIVE SPOT ACRE FEET	OPEN FIVE SPOT OIL IN PLACE
A	168.50	121,295	309.03	222,458
B	173.94	131,798	374.97	283,967
C	199.96	166,215	428.13	355,883
D	181.76	141,561	407.92	317,709

EXHIBIT 19A
FEDERAL C-1

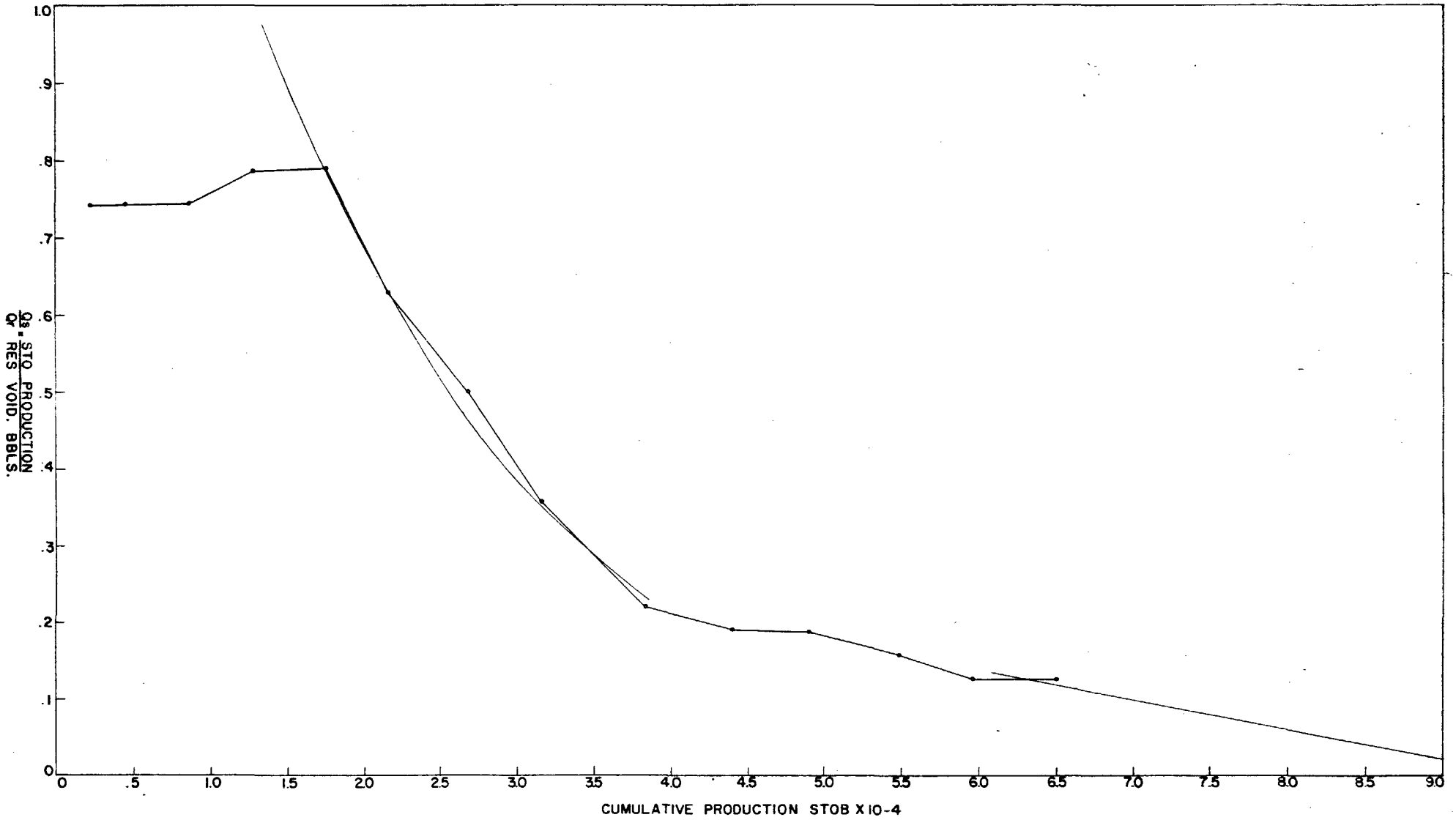


EXHIBIT 198
FEDERAL C-2

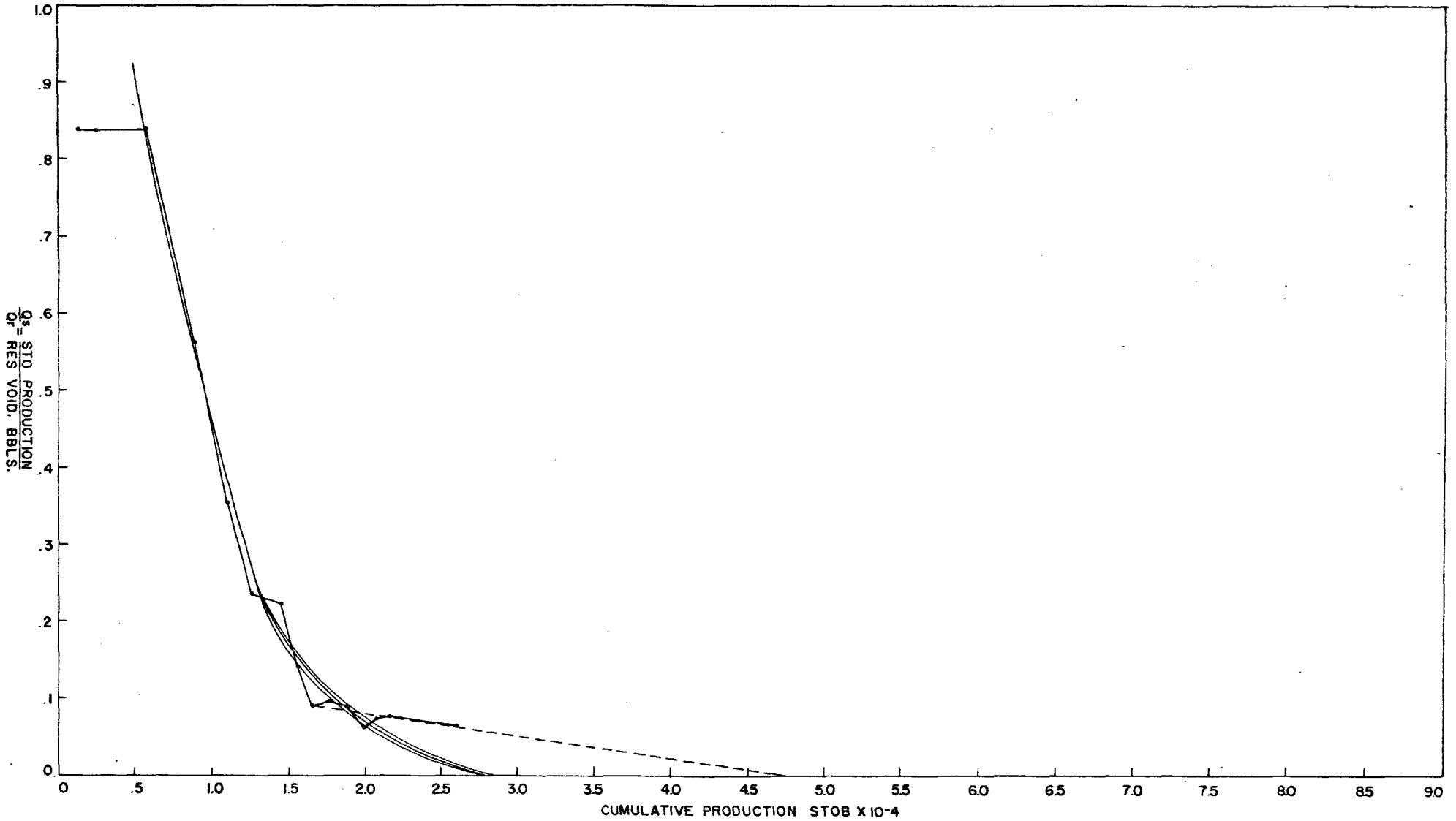


EXHIBIT 19C
HOSPAH I-A

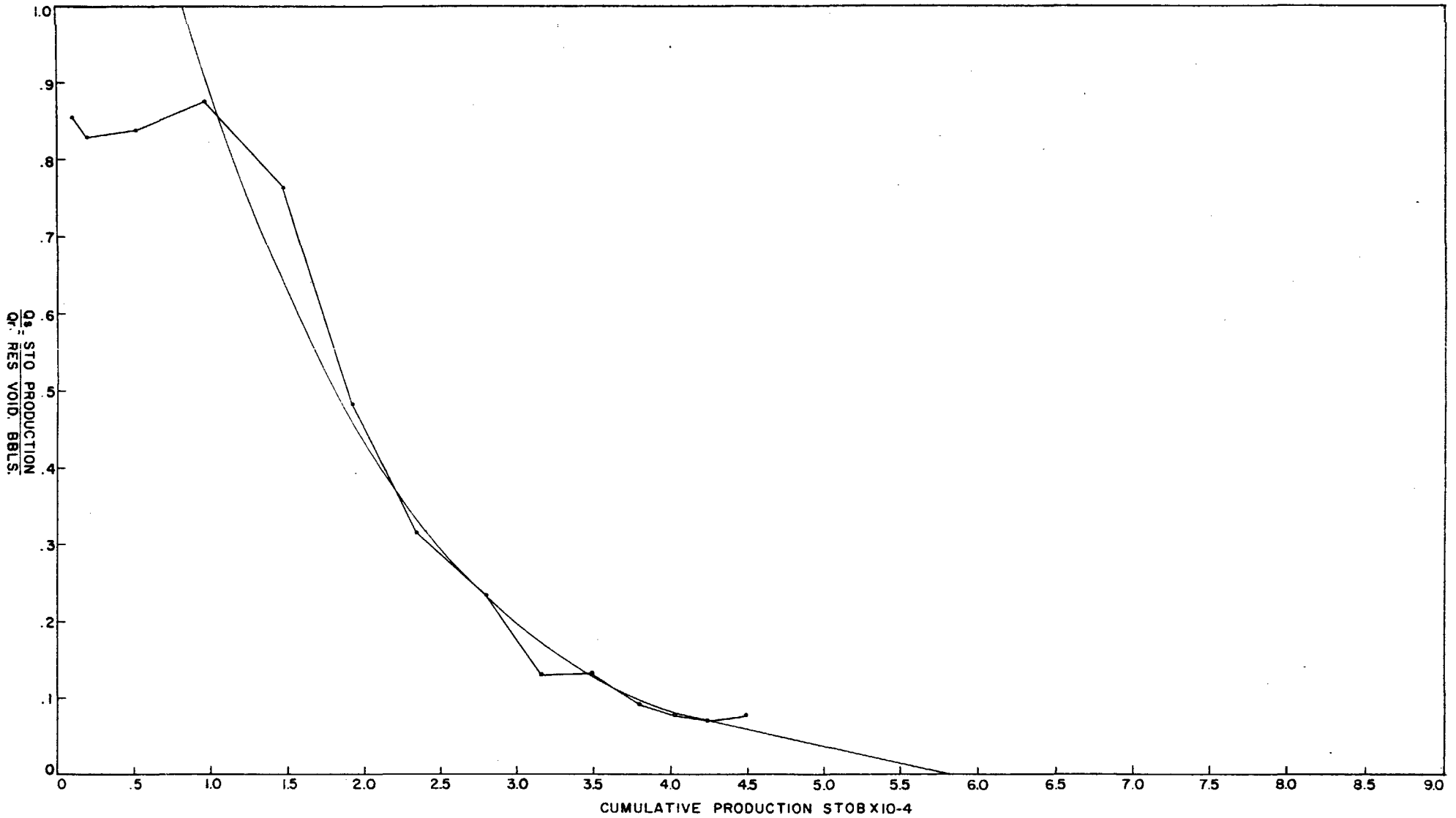


EXHIBIT 19D
MARYE I

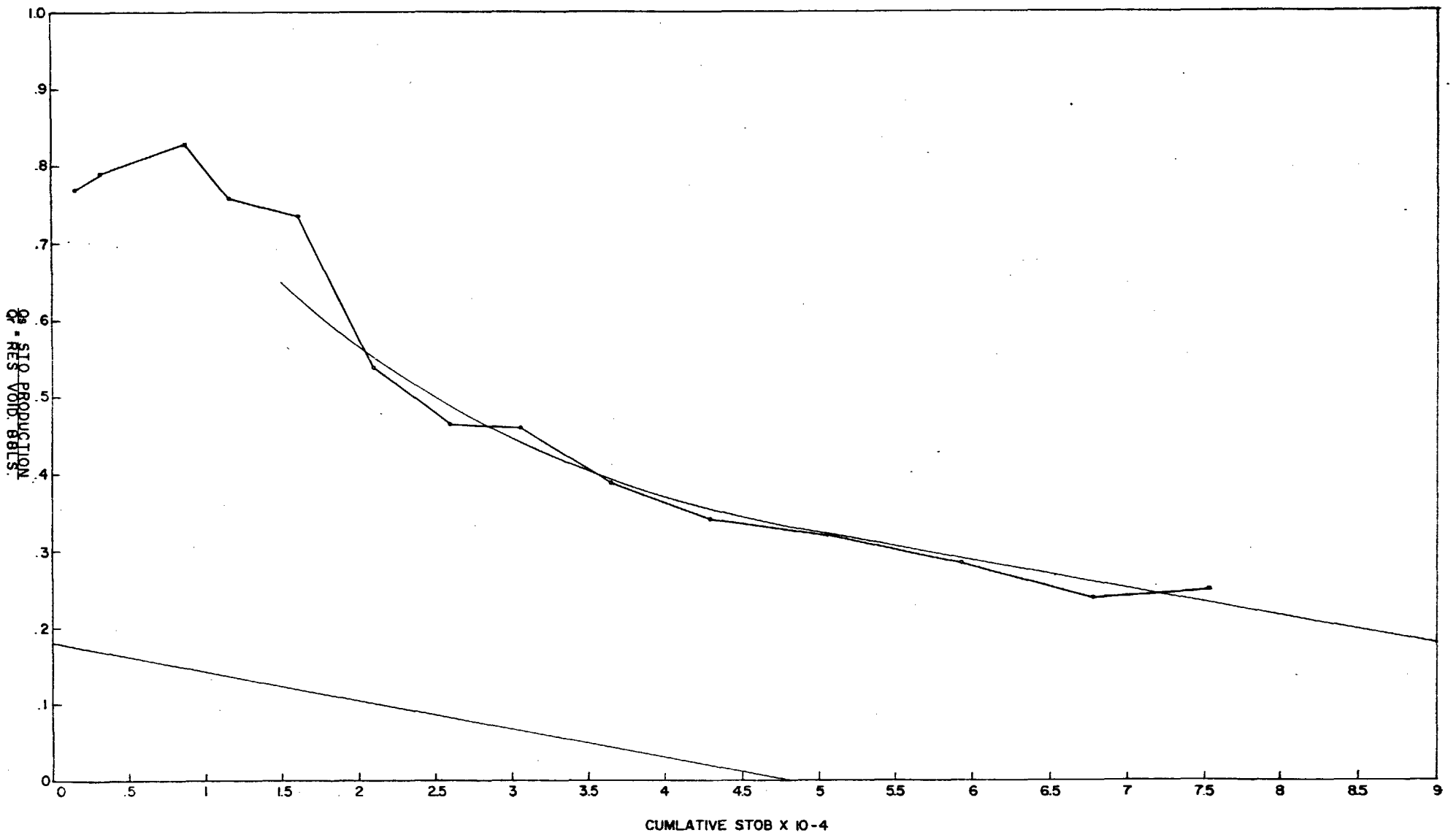


EXHIBIT 20

CALCULATIONS OF (Q_R) BARREL OF RESERVOIR VOIDAGE PER (Q_S) BARRELS OF STOCK TANK OIL PRODUCED
BISTI PILOT PROJECT, SAN JUAN COUNTY, NEW MEXICO

CALCULATIONS OF GAS FORMATION VOLUME FACTOR

Well	Mo. and Yr.	Sp. Gr.	Average Pressure	Critical Pressure	Reduced Pressure	Critical Temp.	Reduced Temp. 605/Col. 5	Z_R	$Z_R/(2)$	$B_g = 3.116(\frac{Z_R}{2})$
Federal C-1	Aug., 1957	.929	1268	657	1.929	455	1.329	.729	.0005749	.001791
	Sept.	.929	1368	657	2.082	455	1.329	.707	.0005168	.001610
	Oct.	.929	1384	657	2.106	455	1.329	.698	.0005043	.001571
	Nov.	.885	1394	658	2.118	440	1.325	.733	.0005258	.001638
	Dec.	.878	1347	658	2.047	438	1.381	.746	.0005538	.001726
	Jan., 1958	.868	1347	659	2.044	434	1.394	.752	.0005582	.001739
	Feb.	.884	1236	658	1.878	440	1.375	.765	.0006189	.001928
	March	.867	1190	659	1.805	433	1.397	.790	.0006638	.002068
	April	.876	1165	658	1.770	438	1.381	.778	.0006678	.002081
	May	.856	1144	660	1.733	431	1.403	.795	.0006949	.002165
	June	.850	1135	660	1.719	428	1.413	.799	.0007039	.002193
	July	.872	1126	659	1.708	436	1.387	.784	.0006962	.002169
	Aug.	.841	1106	660	1.675	426	1.420	.810	.0007323	.002282
	Sept.	.859	1076	659	1.632	432	1.400	.802	.0007453	.002322
	Oct.		1065							
Federal C-2	Aug., 1957	.953	1400	655	2.137	463	1.306	.671	.0004792	.001493
	Sept.	.953	1485	655	2.267	463	1.306	.660	.0004440	.001383
	Oct.	.953	1200	655	1.832	463	1.306	.710	.0005916	.001843
	Nov.	.960	1200	655	1.832	466	1.298	.707	.0005891	.001836
	Dec.	.872	1038	659	1.575	436	1.387	.801	.0007716	.002404
	Jan., 1958	.881	943	658	1.433	438	1.381	.816	.0008653	.002696
	Feb.	.866	934	659	1.417	433	1.397	.825	.0008832	.002752
	March	.832	900	660	1.363	423	1.430	.845	.0009388	.002925
	April	.822	894	660	1.354	419	1.443	.851	.0009518	.002966
	May	.824	894	660	1.354	420	1.440	.850	.0009507	.002962
	June	.844	856	660	1.296	427	1.416	.850	.0009929	.003094
	July	.856	850	659	1.289	429	1.410	.847	.0009964	.003105
	Aug.	.837	845	660	1.280	423	1.430	.852	.0010082	.003142
	Sept.	.855	812	659	1.232	430	1.406	.847	.0010431	.003250
	Oct.		809							

EXHIBIT 20 (Cont'd.)

CALCULATIONS OF (Q_R) BARREL OF RESERVOIR VOIDAGE PER (Q_S) BARRELS OF STOCK TANK OIL PRODUCED
BISTI PILOT PROJECT, SAN JUAN COUNTY, NEW MEXICO

CALCULATIONS OF GAS FORMATION VOLUME FACTOR

Well	Mo. and Yr.	Sp. Gr.	Average Pressure	Critical Pressure	Reduced Pressure	Critical Temp.	Reduced Temp. 605/Col. 5	Z_R	$Z_R/(2)$	$B_g = 3.116 (\frac{Z_R}{2})$
Hospah 1-A	Aug., 1957	.975	1296	654	1.981	472	1.281	.672	.0005185	.001616
	Sept.	.975	1377	654	2.105	472	1.281	.650	.0004720	.001471
	Oct.	.975	1322	654	2.021	472	1.281	.662	.0005007	.001560
	Nov.	.953	1322	656	2.015	463	1.306	.688	.0005204	.001622
	Dec.	.940	1354	656	2.064	459	1.318	.697	.0005147	.001604
	Jan., 1958	.862	1353	658	2.056	433	1.397	.758	.0005602	.001746
	Feb.	.782	1246	662	1.882	408	1.482	.821	.0006589	.002053
	March	.781	1162	662	1.755	408	1.482	.832	.0007160	.002231
	April	.799	1177	662	1.777	413	1.464	.822	.0006983	.002176
	May	.806	1255	660	1.901	415	1.457	.818	.0006517	.002031
	June	.783	1186	661	1.794	408	1.482	.830	.0006998	.002181
	July	.807	1138	660	1.724	415	1.457	.822	.0007223	.002251
	Aug.	.808	1172	660	1.775	416	1.454	.817	.0006970	.002172
	Sept.	.847	1114	659	1.690	428	1.413	.803	.0007208	.002246
	Oct.		1085							
Marye 1	Aug., 1957	.998	1298	654	1.984	480	1.260	.642	.0004946	.001541
	Sept.	.998	1295	654	1.980	480	1.260	.641	.0004949	.001542
	Oct.	.998	1464	654	2.238	480	1.260	.610	.0004166	.001298
	Nov.	.964	1545	655	2.358	471	1.284	.630	.0004077	.001270
	Dec.	.924	1527	656	2.327	453	1.335	.685	.0004485	.001398
	Jan., 1958	.882	1306	656	1.990	440	1.375	.755	.0005781	.001801
	Feb.	.891	1245	657	1.894	468	1.292	.680	.0005461	.001702
	March	.839	1211	658	1.840	425	1.423	.796	.0006573	.002048
	April	.857	1189	658	1.806	432	1.400	.782	.0006576	.002049
	May	.836	1180	658	1.793	423	1.430	.805	.0006822	.002126
	June	.847	1173	658	1.782	429	1.410	.795	.0006777	.002112
	July	.856	1126	658	1.711	431	1.403	.792	.0007033	.002191
	Aug.	.840	1126	658	1.711	423	1.430	.812	.0007211	.002247
	Sept.	.860	1126	658	1.711	427	1.416	.804	.0007140	.002225
	Oct.		1067							

EXHIBIT 20 (Cont'd.)

CALCULATIONS OF (Q_R) BARREL OF RESERVOIR VOIDAGE PER (Q_S) BARRELS OF STOCK TANK OIL PRODUCED
BISTI PILOT PROJECT, SAN JUAN COUNTY, NEW MEXICO

Well	Mo. and Year.	Average Pressure	R	R_S	$(R-R_S)$	B_g	$B_g (R-R_S)$	B	$B+(R-R_S)B_g$	$\frac{Q_S/Q_R}{B+(R-R_S)B_g}$	Q_S	$Q_R = Q_S/[B+(R-R_S)B_g]$
Federal C-1	Aug., 1957	1268	455	407	48	.001791	.086	1.26	1.346	0.743	2257	3,038
	Sept.	1368	461	407	54	.001610	.087	1.26	1.347	.742	1890	2,546
	Oct.	1384	459	407	52	.001571	.082	1.26	1.342	.745	4458	5,983
	Nov.	1394	414	407	7	.001638	.011	1.26	1.271	.787	4110	5,224
	Dec.	1347	410	407	3	.001726	.005	1.26	1.265	.791	4764	6,026
	Jan., 1958	1347	592	407	185	.001739	.322	1.26	1.582	.632	4182	6,616
	Feb.	1236	787	407	380	.001928	.733	1.26	1.993	.502	5101	10,166
	March	1190	1145	402	743	.002068	1.537	1.26	2.797	.358	4917	13,753
	April	1165	1964	398	1566	.002081	3.259	1.2575	4.517	.221	6645	30,015
	May	1144	2213	391	1822	.002165	3.945	1.2552	5.200	.192	5734	29,817
	June	1135	2232	388	1844	.002193	4.044	1.2545	5.299	.189	5961	26,288
	July	1126	2771	386	2385	.002169	5.173	1.2540	6.427	.156	5783	37,167
	Aug.	1106	3266	382	2874	.002282	6.558	1.2525	7.811	.128	4898	38,258
	Sept.	1076	3182	375	2807	.002322	6.518	1.2500	7.768	.129	5440	42,258
	Oct.	1065	3033	373	2660			1.2490				
Federal C-2	Aug., 1957	1400	360	407	-47	.001493	-.070	1.26	1.190	.840	1264	1,504
	Sept.	1485	360	407	-47	.001383	-.065	1.26	1.195	.837	1073	1,282
	Oct.	1200	368	407	-39	.001843	-.072	1.26	1.188	.842	3407	4,048
	Nov.	1200	685	405	280	.001836	.514	1.2600	1.774	.564	3142	5,574
	Dec.	1038	1024	366	658	.002404	1.582	1.2465	2.829	.353	2093	5,921
	Jan., 1958	943	1442	345	1097	.002696	2.958	1.2375	4.196	.238	1603	6,726
	Feb.	934	1518	343	1175	.002752	3.234	1.2370	4.471	.224	1645	7,355
	March	900	2328	335	1993	.002925	5.830	1.2340	7.064	.142	1293	9,134
	April	894	3571	333	3238	.002966	9.604	1.2338	10.838	.092	1172	12,702
	May	894	3360	333	3027	.002962	8.966	1.2338	10.200	.098	1027	10,475
	June	856	3512	325	3187	.003094	9.860	1.2300	11.090	.090	1075	11,922
	July	850	5002	323	4679	.003105	14.528	1.2290	15.757	.063	1063	16,750
	Aug.	845	3986	322	3664	.003142	11.512	1.2285	12.741	.078	880	11,212
	Sept.	812	3815	315	3500	.003250	11.375	1.2250	12.600	.079	922	11,617
	Oct.	809	4131	313	3818			1.2245				

$$Q_R = [B + (R-R_s)B_g]Q_S$$

CALCULATIONS OF (Q_R) BARREL OF RESERVOIR VOIDAGE PER (Q_S) BARRELS OF STOCK TANK OIL PRODUCED
BISTI PILOT PROJECT, SAN JUAN COUNTY, NEW MEXICO

Well	Mo. and Yr.	Average Pressure	R	R_S	$(R-R_S)$	B_g	$B_g (R-R_S)$	B	$B+(R-R_S)B_g$	$\frac{Q_S/Q_R}{\frac{1}{B+(R-R_S)B_g}}$	Q_S	$Q_R = Q_S/B+(R-R_S)B_g$
Hospah A-1	Aug., 1957	1296	352	407	-55	-.001616	-.089	1.26	1.171	.854	979	1,146
	Sept.	1377	368	407	-39	-.001471	-.057	1.26	1.203	.831	1028	1,237
	Oct.	1322	366	407	-41	-.001560	-.064	1.26	1.194	.838	3903	4,660
	Nov.	1322	334	407	-73	-.001622	-.118	1.26	1.142	.876	3779	4,316
	Dec.	1354	439	407	32	.001604	.051	1.260	1.311	.763	5075	6,653
	Jan., 1958	1353	874	407	467	.001746	.815	1.260	2.075	.482	4497	9,331
	Feb.	1256	1335	407	928	.002053	1.905	1.260	3.165	.316	4053	12,828
	March	1162	1698	395	1303	.002231	2.907	1.2575	4.265	.234	4556	19,431
	April	1177	3345	398	2947	.002176	6.413	1.2580	7.671	.130	3683	28,268
	May	1255	3335	400	2935	.002031	5.961	1.260	7.221	.138	3405	24,588
	June	1186	4742	400	4342	.002181	9.470	1.2590	10.729	.093	2969	31,854
	July	1138	5417	380	5037	.002251	11.338	1.2550	12.593	.079	2247	28,296
	Aug.	1172	6093	398	5695	.002172	12.370	1.2580	13.628	.073	2198	29,954
	Sept.	1114	5493	385	5108	.002246	11.473	1.2525	12.726	.079	2570	32,706
	Oct.	1085	5053	378	4675			1.2500				
Marye 1	Aug., 1957	1298	434	407	27	.001541	.042	1.260	1.302	.768	1593	2,074
	Sept.	1295	419	407	17	.001542	.019	1.260	1.279	.782	1615	2,066
	Oct.	1464	365	407	-42	-.001298	-.055	1.26	1.205	.830	4532	5,461
	Nov.	1545	453	407	46	.001270	.058	1.260	1.318	.759	3814	5,027
	Dec.	1527	479	407	72	.001398	.101	1.260	1.361	.735	5110	6,955
	Jan., 1958	1306	737	407	330	.001801	.594	1.260	1.854	.539	4356	8,076
	Feb.	1245	924	407	517	.001702	.880	1.260	2.140	.467	4950	10,593
	March	1211	858	407	451	.002048	.924	1.260	2.184	.458	4656	10,169
	April	1189	1044	400	644	.002049	1.320	1.2590	2.579	.388	5945	15,332
	May	1180	1179	399	780	.002126	1.658	1.2580	2.916	.343	6320	18,429
	June	1173	1271	398	873	.002112	1.844	1.2580	3.102	.322	7623	23,647
	July	1126	1419	386	1033	.002191	2.263	1.2540	3.517	.284	8749	30,770
	Aug.	1126	1646	386	1280	.002247	2.876	1.2540	4.130	.242	8011	33,085
	Sept.	1126	1615	386	1229	.002225	2.735	1.2540	3.989	.251	7963	31,764
	Oct.	1067	1647	373	1274			1.2490				

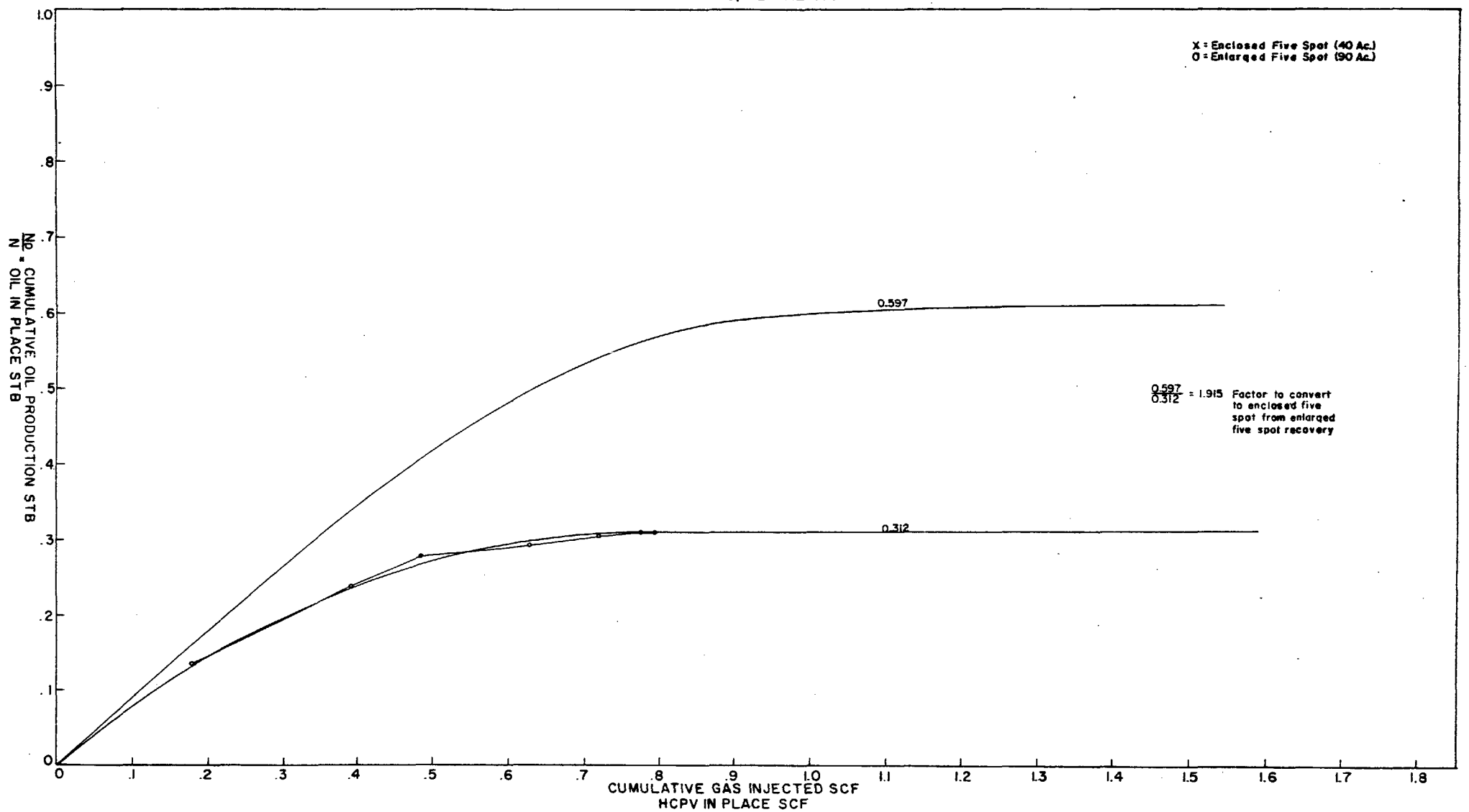
$$Q_R = [B + (R-R_s)B_g]Q_S$$

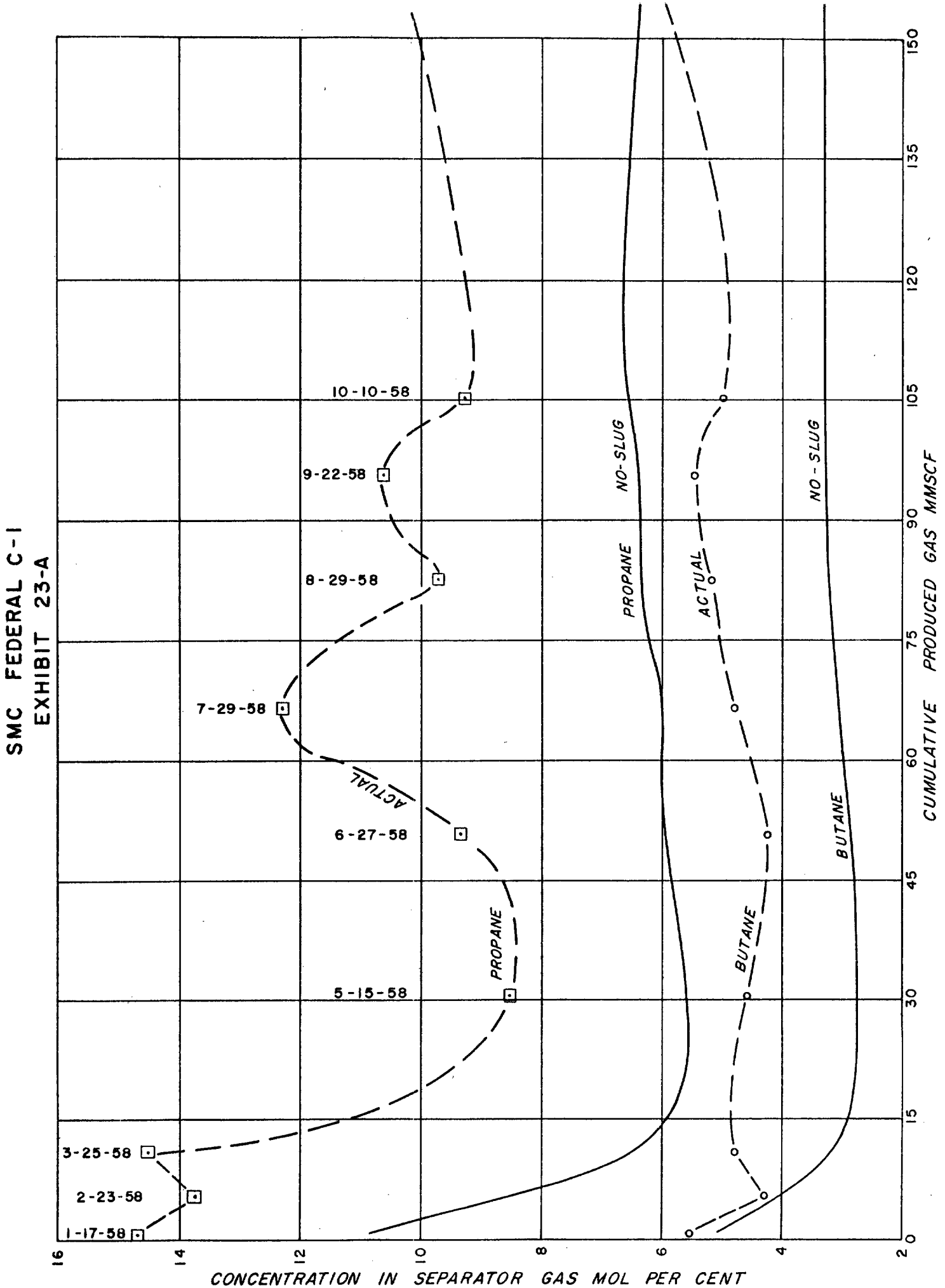
EXHIBIT 21

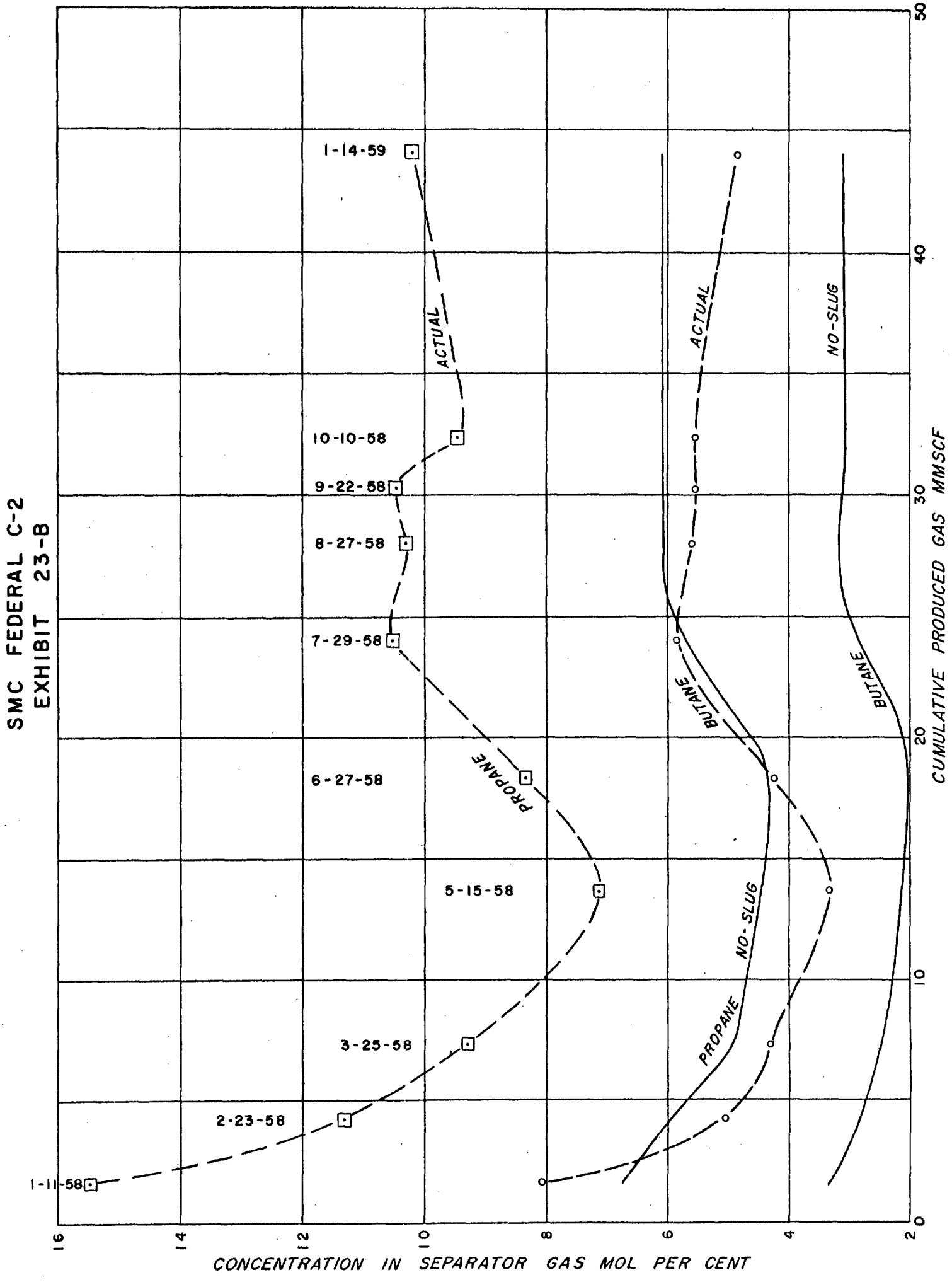
EFFICIENCY CALCULATIONS OF LPG FLOOD BASED ON PILOT PERFORMANCE
CENTRAL BISTI LOWER GALLUP SAND UNIT
SAN JUAN COUNTY, NEW MEXICO

	(1) Acre-Feet	(2) Porosity Ø %	(3) Water Saturation SW %	(4) $(1-S_W)Ø$ %	(5) N Reservoir Bbl.	(6) N STB	(7) Recovery STB QS/QR Curves	(8) Breakthrough %	(9) Recovery % QR/QS Pred.	(10) Recovery % Assuming 15% From Outside	(11) Recovery Converted To Five Spot
Enclosed Five Spot											
Federal C-1	181.76	16.6	23.8	12.65	178,367	141,561	87,500	12.4	61.7	52.5	
Federal C-2	168.50	15.9	26.5	11.69	152,832	121,295	37,500	4.7	30.5	25.9	
Hospah Unit 1	173.94	16.4	25.0	12.30	166,065	131,798	51,250	7.4	39.0	33.1	
Marye 1	199.96	16.6	18.7	13.50	209,431	166,215	128,750	9.75	79.4	67.4	
Total					706,695	560,869	304,500	8.7	54.3	46.1	
						Theoretical calculated recovery by sweep efficiency method				59.7	
Open Five Spot 1/4 Well Spacing (90 Acres)											(9) x 59.7/31.2
Federal C-1	407.92	16.6	23.8		400,313	317,709		5.5	27.6		52.9
Federal C-2	309.03	15.9	26.5		280,297	222,458		2.6	16.4		31.4
Hospah Unit 1	374.97	16.4	25.0		357,799	283,967		3.4	18.1		34.7
Marye 1	428.13	16.6	18.7		448,412	355,883		4.6	36.2		69.4
Total					1,486,821	1,180,017		4.2	25.8		49.5
						Theoretical calculated recovery by sweep efficiency method				31.2	

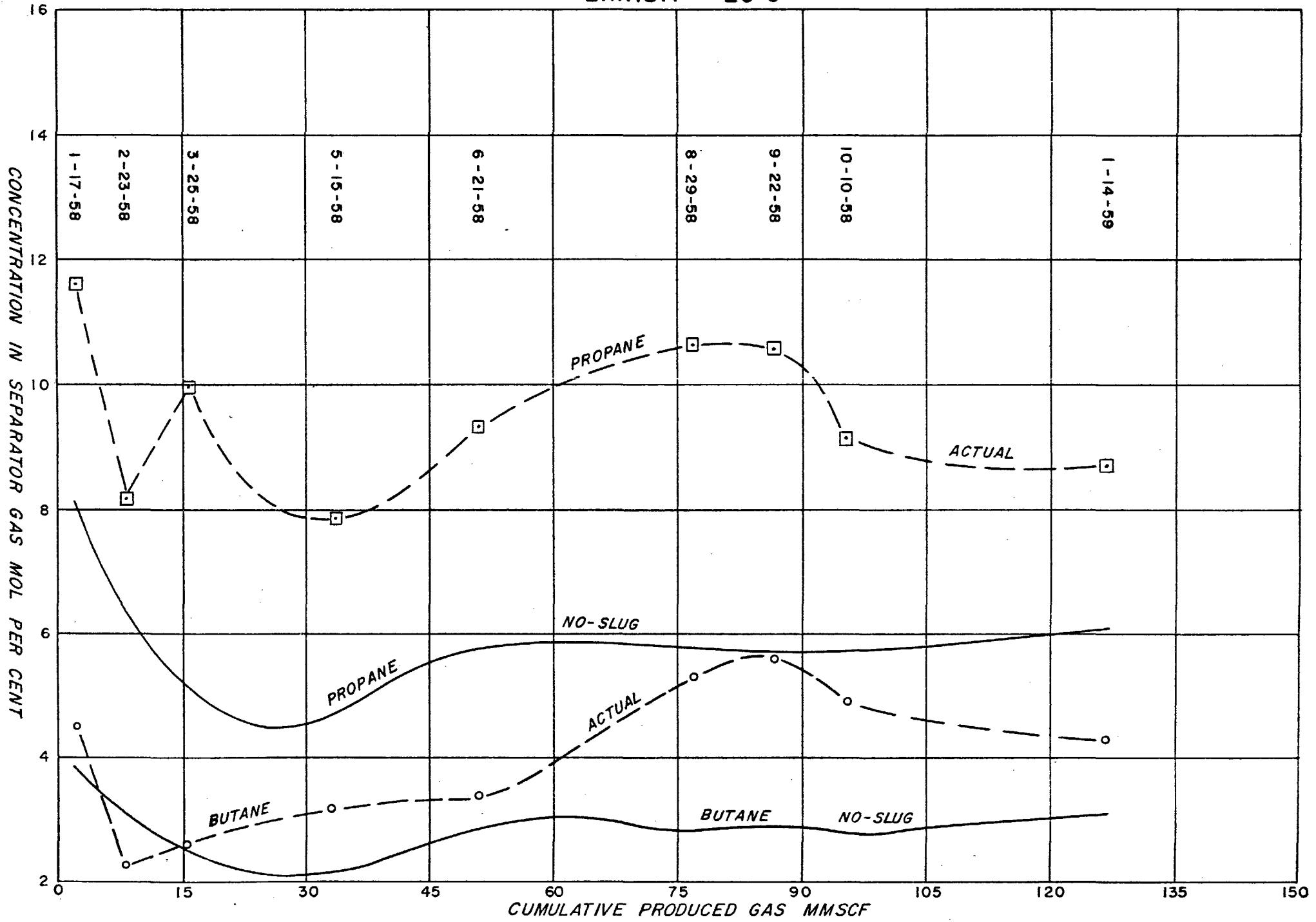
EXHIBIT 22
FIGURE
BISTI PILOT PROJECT
SAN JUAN CO, NEW MEXICO

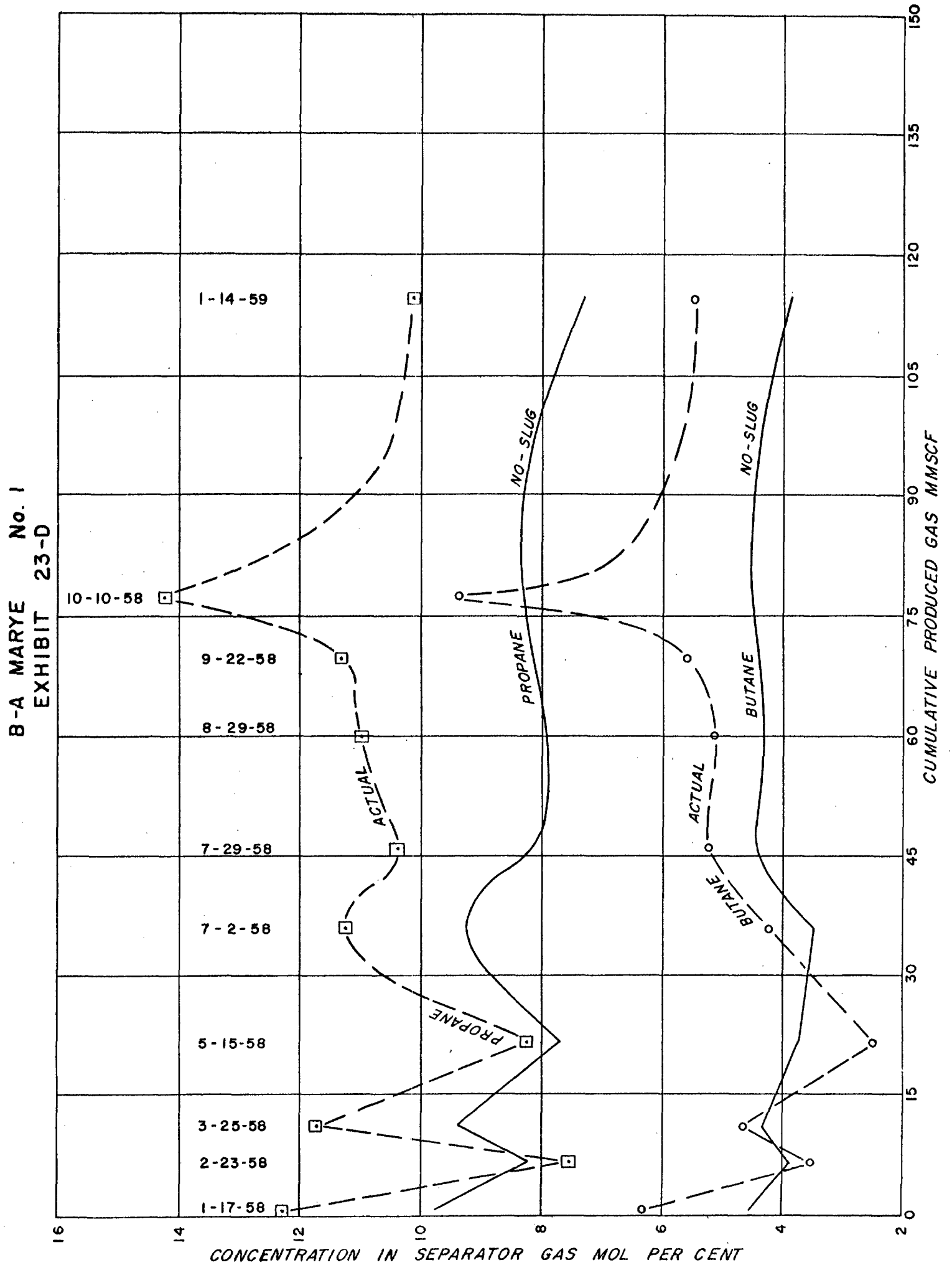



SMC FEDERAL C-1
EXHIBIT 23-A
CONCENTRATION IN SEPARATOR GAS MOL PER CENT
CUMULATIVE PRODUCED GAS MMSCF
16
14
12
10
8
6
4
2
0
150
135
120
105
90
75
60
45
30
15
0
10-10-58
9-22-58
8-29-58
7-29-58
6-27-58
5-15-58
3-25-58
2-23-58
1-17-58
ACTUAL
PROPANE
BUTANE
NO-SLUG
PROPANE
ACTUAL
BUTANE
NO-SLUG


SMC FEDERAL C-2
EXHIBIT 23-B
1-14-59
10-10-58
9-22-58
8-27-58
7-29-58
6-27-58
5-15-58
3-25-58
2-23-58
1-11-58
ACTUAL
PROPANE
BUTANE
NO-SLUG
16
14
12
10
8
6
4
2
0
10
20
30
40
50
CONCENTRATION IN SEPARATOR GAS MOL PER CENT
CUMULATIVE PRODUCED GAS MMSCF

PHILLIPS HOSPAH A-1
EXHIBIT 23-C




B-A MARYE No. 1
EXHIBIT 23-D
1-14-59
10-10-58
9-22-58
8-29-58
7-29-58
7-2-58
5-15-58
3-25-58
2-23-58
1-17-58
ACTUAL
PROPANE
NO-SLUG
PROPANE
ACTUAL
BUTANE
NO-SLUG
BUTANE
16
14
12
10
8
6
4
2
0
15
30
45
60
75
90
105
120
135
150
CONCENTRATION IN SEPARATOR GAS MOL PER CENT
CUMULATIVE PRODUCED GAS MMSCF

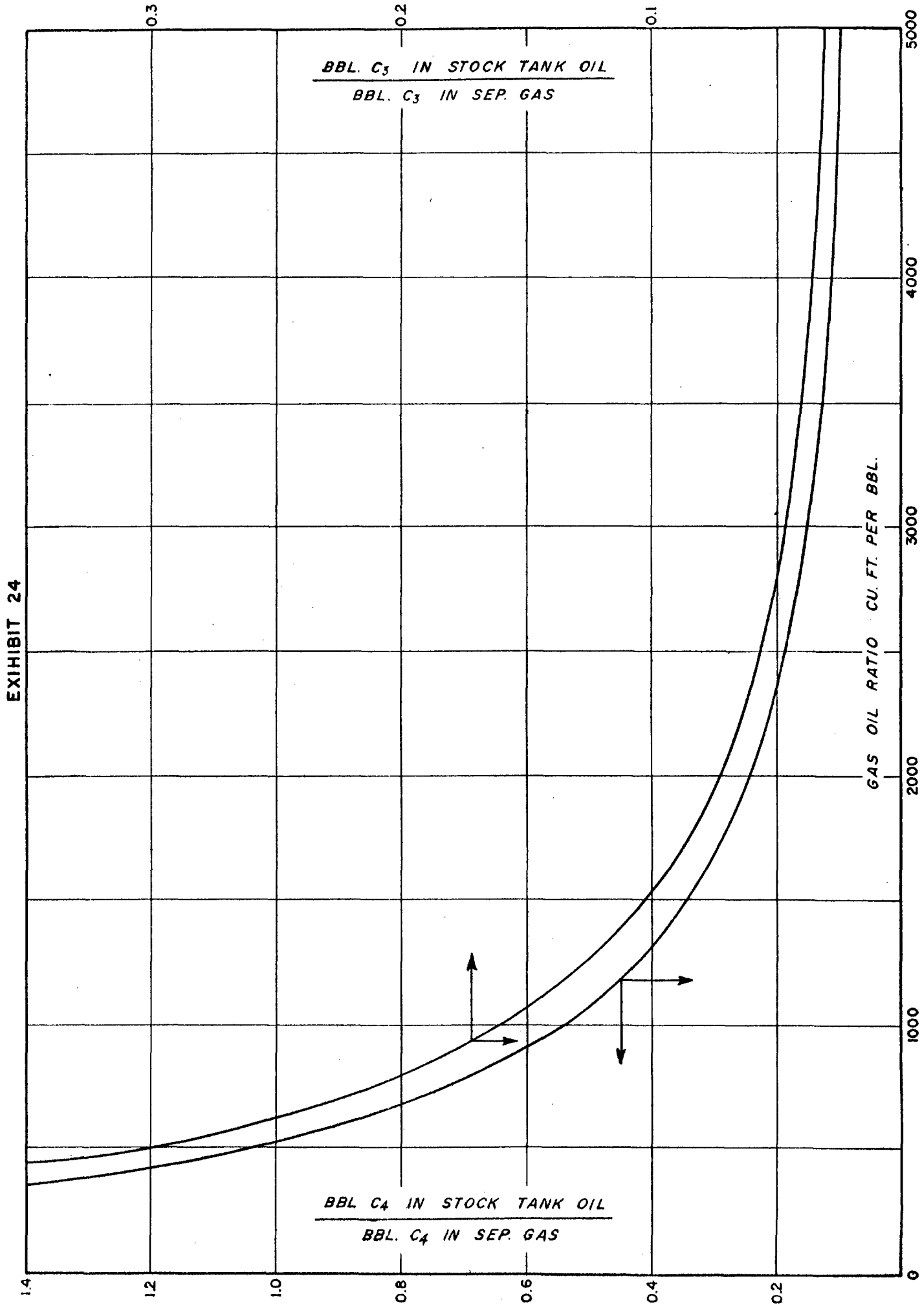
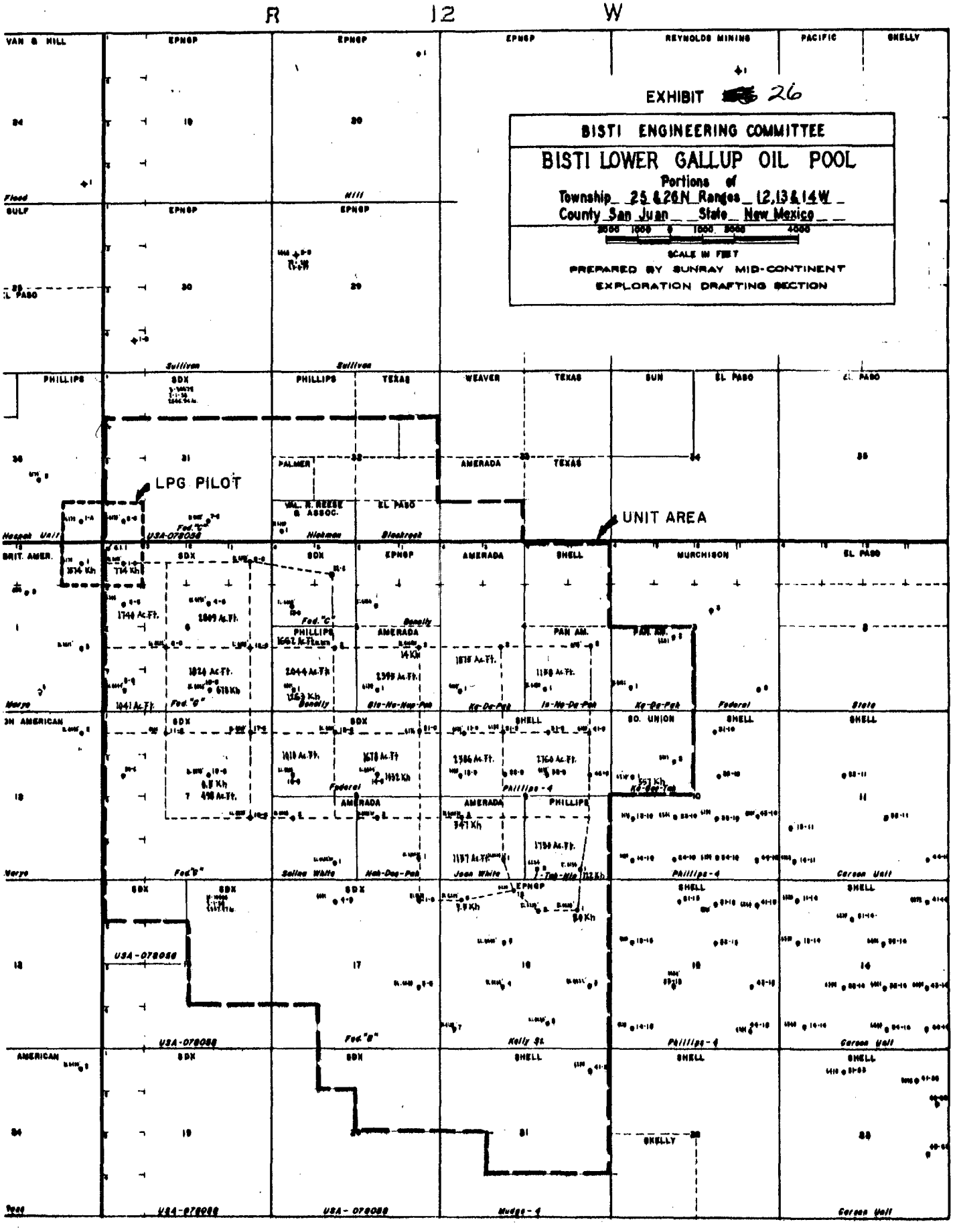

EXIHIBIT 24
BBL. C_3 IN STOCK TANK OIL
BBL. C_3 IN SEP. GAS
BBL C_4 IN STOCK TANK OIL
BBL. C_4 IN SEP. GAS
GAS OIL RATIO CU. FT. PER BBL.
0.3
0.2
0.1
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
1000
2000
3000
4000
5000

EXHIBIT 25

MONTHLY EXCESS PROPANE AND BUTANE PRODUCTION
BISTI PILOT MISCIBLE SLUG PROJECT

Month	Federal "C" #1		Federal "C" #2		Hospah #1		Marye #1		Total	Total
	C_3, bbls	C_4, bbls	C_3, bbls	C_4, bbls	C_3, bbls	C_4, bbls	C_3, bbls	C_4, bbls	C_3, bbls	C_4, bbls
Jan., 1958	83.3	16.4	130.1	89.0	98.1	21.0	48.1	55.3	360.6	181.7
Feb.	162.3	26.8	107.3	64.1	107.1	—	21.0	16.9	397.7	107.8
March	284.5	71.0	94.5	54.1	191.0	—	31.8	—	601.8	125.1
April	531.2	226.7	98.1	57.3	330.6	—	98.0	—	1057.9	284.0
May	306.9	201.9	70.7	43.4	257.6	76.3	80.1	—	715.3	321.6
June	313.1	183.7	94.8	61.2	267.1	64.4	101.1	11.2	776.1	320.5
July	534.8	229.1	159.9	115.3	332.4	108.5	143.4	85.9	1170.5	538.8
Aug.	529.7	264.0	81.9	80.3	422.4	201.7	251.0	93.8	1285.0	639.8
Sept.	424.6	292.5	97.5	73.3	436.9	293.9	324.6	182.7	1283.6	842.4
Oct.	339.1	239.3	98.5	79.1	270.0	190.1	295.4	233.8	1003.0	742.3
Nov.	212.2	171.0	72.2	58.4	165.6	120.1	210.1	181.2	660.1	530.7
Dec.	255.5	303.1	105.4	70.9	224.2	151.8	245.8	188.2	830.9	714.0
Jan. 1959	269.1	241.0	85.4	45.6	199.0	120.1	222.8	179.4	766.3	586.1
Cumulative to Feb. 1, 1959	4246.3	2466.5	1296.3	892.0	3302.0	1347.9	2074.2	1228.4	10,918.8	5934.8


R 12 W
T 26 N
T 25 N
EXHIBIT 26
BISTI ENGINEERING COMMITTEE
BISTI LOWER GALLUP OIL POOL
Portions of
Township 25 & 26 N Ranges 12, 13 & 14 W
County San Juan State New Mexico
SCALE IN FEET
PREPARED BY SUNRAY MID-CONTINENT
EXPLORATION DRAFTING SECTION
LPG PILOT
UNIT AREA
VAN G. HILL
EPNGP
REYNOLDS MINING
PACIFIC
SHELLY
GULF
EL PASO
PHILLIPS
SDX
TEXAS
WEAVER
AMERADA
SUN
MURCHISON
PALMER
VAL R. REESE & ASSOC.
BRIT. AMER.
PAN AM.
SO. UNION
AMERICAN
USA-078068
Fed. "C"
Fed. "D"
Fed. "B"
Federal
State
Carson Unit
Phillips-4
Kelly St.
Hudgs-4

C2-212

EXHIBIT 27

RECOVERABLE OIL CALCULATIONS FOR LPG AND WATER FLOODS IN 16 INDIVIDUAL 5-SPOTS
CENTRAL BISTI LOWER GALLUP SAND UNIT, SAN JUAN COUNTY, NEW MEXICO

	Acre Feet (bulk)	HCPV, bbls.	STOIP, bbls.	Sol. Gas in Place (MMcf)	Rec. Factor	Recoverable Oil, Bbls. Primary	Pressure Maint.	Blow Down	Total Rec. Oil	Rec. Gained by Secondary	Res. Oil Start BD (STB)	Recoverable Gas, MMcf: Oil and Sol.Gas Voidage	Oil Comp. and Gas Resat.	Free Gas at Start of BD	Sol. Gas in Unswept	Tot.Gas in Res. at Start of BD	Res. Gas After BD
SMC Federal C #13																	
Natural Depletion	1,662	1,411,850	1,120,000	456	.16	179,200			179,200								
Water Flood	1,662				.292		327,040		327,040	147,840	792,960					244.2	
LPG Flood	1,662				.44		492,800	34,350	527,150	347,950	627,200	344	54.7	398.7	254.5	653.2	137.7
Amerada Joan White Inj. Well #1																	
Natural Depletion	1,137	965,900	767,000	312	.16	122,720			122,720								
Water Flood	1,137				.292		223,950		223,950	101,230	543,050					167.3	
LPG Flood	1,137				.30		230,100	16,040	246,140	123,420	536,900	160	37.4	197.4	218.0	415.4	102.9
Shell Gov't. #32-9																	
Natural Depletion	2,760	2,344,600	1,865,000	760	.16	298,400			298,400								
Water Flood	2,760				.292		544,580		544,580	246,180	1,320,420					406.7	
LPG Flood	2,760				.48		895,200	62,400	957,600	659,200	969,800	624	91.0	715.0	395.0	1110.0	223.2
Phillips Benally #1																	
Natural Depletion	2,044	1,736,400	1,378,000	581	.16	220,480			220,480								
Water Flood	2,044				.292		402,370		402,370	181,900	975,630					300.5	
LPG Flood	2,044				.53		730,000	52,800	782,800	562,320	648,000	528	67.3	595.3	274.0	869.3	159.3
Amerada Gle-Na-Nup-Pah #1																	
Natural Depletion	2,395	2,034,550	1,615,000	657	.16	258,400			258,400								
Water Flood	2,395				.292		471,580		471,580	213,180	1,143,420					352.2	
LPG Flood	2,395				.46		742,900	51,800	794,700	536,300	872,100	518	79.0	597.0	367.0	964.0	196.0
SMC Federal C #14																	
Natural Depletion	1,678	1,425,500	1,130,000	460	.16	180,800			180,800								
Water Flood	1,678				.292		329,960		329,960	149,160	800,040					246.4	
LPG Flood	1,678				.53		598,900	41,750	640,650	459,850	531,100	418	55.3	473.3	216.0	689.3	130.7
Amerada Ka-Da-Pa #1																	
Natural Depletion	1,875	1,592,800	1,263,000	515	.16	202,080			202,080								
Water Flood	1,875				.292		368,800		368,800	166,250	894,200					275.4	
LPG Flood	1,875				.35		442,050	30,800	472,850	270,770	820,950	308	61.7	369.7	334.0	703.7	164.4
Shell Gov't. #12-9																	
Natural Depletion	2,386	2,026,900	1,610,000	655	.16	257,600			257,600								
Water Flood	2,386				.292		470,120		470,120	212,520	1,139,880					351.1	
LPG Flood	2,386				.48		772,800	53,850	826,650	569,050	837,200	539	78.7	617.7	361.0	978.7	192.7
SMC Federal C #3																	
Natural Depletion	1,740	1,442,700	1,145,000	466	.16	183,200			183,200								
Water Flood					.292		334,340		334,340	151,140	810,660					249.7	
LPG Flood					.53		606,850	42,297	649,147	465,947	538,150	423	56.0	479.0	219.0	698.0	132.5
SMC Federal C #5																	
Natural Depletion	1,041	863,100	685,000	278	.16	109,600			109,600								
Water Flood	1,041				.292		200,020		200,020	90,420	484,980					149.4	
LPG Flood	1,041				.305		208,925	14,562	223,487	113,887	476,075	146	33.5	179.5	194.0	373.5	90.1
SMC Federal C #18																	
Natural Depletion	498	423,360	336,000	137.8	.16	53,760			53,760								
Water Flood	498				.292		98,112		98,112	44,352	237,888					73.3	
LPG Flood	498				.22		73,920	5,152	79,072	25,312	262,080	52	16.4	68.4	107.0	175.4	47.2
SMC Federal C #16																	
Natural Depletion	1,010	856,800	680,000	277	.16	108,800			108,800								
Water Flood	1,010				.292		198,560		198,560	89,760	481,440					148.3	
LPG Flood	1,010				.30		204,000	14,219	218,219	109,419	476,000	142	33.2	175.2	194.0	369.2	91.2
Pan American In-Ni-Da-Pah #1																	
Natural Depletion	1,158	985,320	782,000	318	.16	125,120			125,120								
Water Flood	1,158						228,344		228,344	103,224	553,656					170.5	
LPG Flood	1,158						172,040	11,991	184,031	58,911	609,960	120	38.2	158.2	248.0	406.2	110.0
Phillips I-Tah-Nip #2																	
Natural Depletion	1,730	1,470,179	1,166,809	474.9	.16	186,689			186,689								
Water Flood	1,730						340,708		340,708	154,019	826,101					254.4	
LPG Flood	1,730						350,048	24,398	374,446	187,757	816,761	244	57.0	301.0	332.0	633.0	156.5
SMC Federal C #4																	
Natural Depletion	2,809	2,387,700	1,895,000	770.0	.16	303,200			303,200								
Water Flood	2,809				.292		553,340		553,340	250,140	1,341,600					413.2	
LPG Flood	2,809				.53		1,004,350	70,003	1,074,353	771,153	890,650	700	92.5	792.5	362.0	1154.5	219.2
SMC Federal C #10																	
Natural Depletion	1,820	1,549,800	1,230,000	513	.16	196,800			196,800								
Water Flood	1,820						359,160		359,160	162,360	870,840					268.2	
LPG Flood	1,829						651,900	45,437	697,337	500,537	578,100	454	60.0	514.0	236.0	750.0	142.3

EXHIBIT 27 (Cont'd.)

RECOVERABLE OIL CALCULATIONS FOR LPG AND WATER FLOODS IN 16 INDIVIDUAL 5-SPOTS
CENTRAL BISTI LOWER GALLUP SAND UNIT, SAN JUAN COUNTY, NEW MEXICO

	Total Recoverable Gas	Shrinkage Fuel Etc.	Total Gas Sales	Solution Gas Prod.	Gas Purchases 15+16+25-26	Total Gas Handled	Fuel Requirements	LPG Requirements (Bbls.)	LPG Reservoir Bbls.	LPG Gas Equiv. (MMcf)	Unit Share LPG Slug Recovered	Unit Share LPG Recovered f/Sol. Gas	Water Requirement	Benefit Recovery Bbls/AF
SMC Federal C #13														
Natural Depletion	55	22	33											108
Water Flood	100.7	40.3	60.4									5,000	2,117,775	89
LPG Flood	515.5	206.2	309.3	200.6	225.1	539.0	27	62,121	72,050	39.8	17,394	10,040		209
Amerada Joan White Inj. Well #1														
Natural Depletion	37.7	15.1	22.6											108
Water Flood	69.0	27.6	41.4									3,450	1,448,850	89
LPG Flood	312.5	125.0	187.5	93.7	116.7	251.0	13	42,500	49,300	27.3	11,900	4,690		109
Shell Gov't. #32-9														
Natural Depletion	91.6	36.6	55.0											108
Water Flood	167.7	67.1	100.6									8,400	3,516,900	89
LPG Flood	886.8	354.7	532.1	49.0	364.3	399.7	49	978	119,650	66.2	28,900	18,233		239
Phillips Benally #1														
Natural Depletion	67.7	27.1	40.6											108
Water Flood	123.9	49.6	74.3									6,200	2,604,600	89
LPG Flood	710.0	284.0	426.0	297.1	338.2	798.0	40	76,400	88,625	49.0	21,400	14,870		275
Amerada Gle-Na-Nup-Pah #1														
Natural Depletion	79.3	31.7	47.6											108
Water Flood	145.2	58.1	87.1									7,250	3,051,800	89
LPG Flood	768.0	307.2	460.8	302.4	335.6	812.0	41	89,500	103,820	57.4	25,050	15,135		224
SMC Federal C #14														
Natural Depletion	55.5	22.2	33.3											108
Water Flood	101.6	40.6	61.0									5,050	2,138,250	89
LPG Flood	558.6	223.4	335.2	243.8	262.5	655.0	33	62,722	72,750	40.2	17,550	12,200		274
Amerada Ka-Da-Pah #1														
Natural Depletion	62.0	24.8	37.2											108
Water Flood	113.6	45.4	68.2									5,700	2,389,200	89
LPG Flood	539.3	215.7	323.6	179.9	213.8	483.0	24	70,100	81,320	45.0	19,600	9,004		144
Shell Gov't. #12-9														
Natural Depletion	79.1	31.6	47.5											108
Water Flood	144.8	57.9	86.9									7,450	3,040,350	89
LPG Flood	786.0	314.1	471.9	314.5	345.2	845.0	42	89,200	103,470	57.2	25,000	15,740		239
SMC Federal C #3														
Natural Depletion	56.2	22.5	33.7											105
Water Flood	103.0	41.2	61.8									5,150		87
LPG Flood	565.5	226.2	339.3	247.0	265.0	663.0	33	63,500	73,660	40.7	17,800	12,362	2,164,050	268
SMC Federal C #5														
Natural Depletion	33.7	13.5	20.2											105
Water Flood	61.6	24.6	37.0									3,080	1,294,650	87
LPG Flood	283.4	113.4	171.0	85.0	105.9	228.0	11.4	37,950	44,022	24.3	10,600	4,254		109
SMC Federal C #18														
Natural Depletion	16.8	6.7	10.1											108
Water Flood	30.2	12.1	18.1									1,510	635,040	89
LPG Flood	128.2	51.3	76.9	30.1	42.3	81.0	4	18,600	21,575	12.0	5,200	1,506		51
SMC Federal C #16														
Natural Depletion	33.4	13.4	20.0											108
Water Flood	61.2	24.5	36.7									3,060	1,285,200	89
LPG Flood	278.0	111.2	166.8	83.0	103.4	223.0	11.2	37,700	43,700	24.2	10,550	4,154		108
Pan American In-Ni-Da-Pah #1														
Natural Depletion	38.4	15.4	23.0											108
Water Flood	70.3	28.1	42.2									3,515	1,478,000	89
LPG Flood	296.2	118.5	177.7	70.0	97.6	188.0	9.4	43,350	50,300	27.8	12,150	3,504		51
Phillips I-Tah-Nip #2														
Natural Depletion	57.3	22.9	34.4											108
Water Flood	104.9	42.0	62.9									5,025	2,205,300	89
LPG Flood	476.5	190.6	285.9	142.5	177.7	383.0	19.2	64,700	75,050	41.5	18,100	7,132		109
SMC Federal C #4														
Natural Depletion	93.1	37.2	55.9											108
Water Flood	170.4	68.2	102.2									8,500	3,581,550	89
LPG Flood	935.3	374.1	561.2	408.8	438.7	1098.0	55.0	105,050	121,850	67.4	29,400	20,460		275
SMC Federal C #10														
Natural Depletion	60.4	24.2	36.2											108
Water Flood	110.6	44.0	66.6									5,500	2,324,700	89
LPG Flood	607.7	243.0	364.7	265.3	284.7	713.0	36.0	68,200	79,112	43.7	19,100	13,278		275

EXHIBIT 28

RESTORED STATE WATER FLOOD SUSCEPTIBILITY

SUNRAY MID-CONTINENT OIL COMPANY
FEDERAL G1 NO.1 WELL
BISTI FIELD
San Juan County, New Mexico

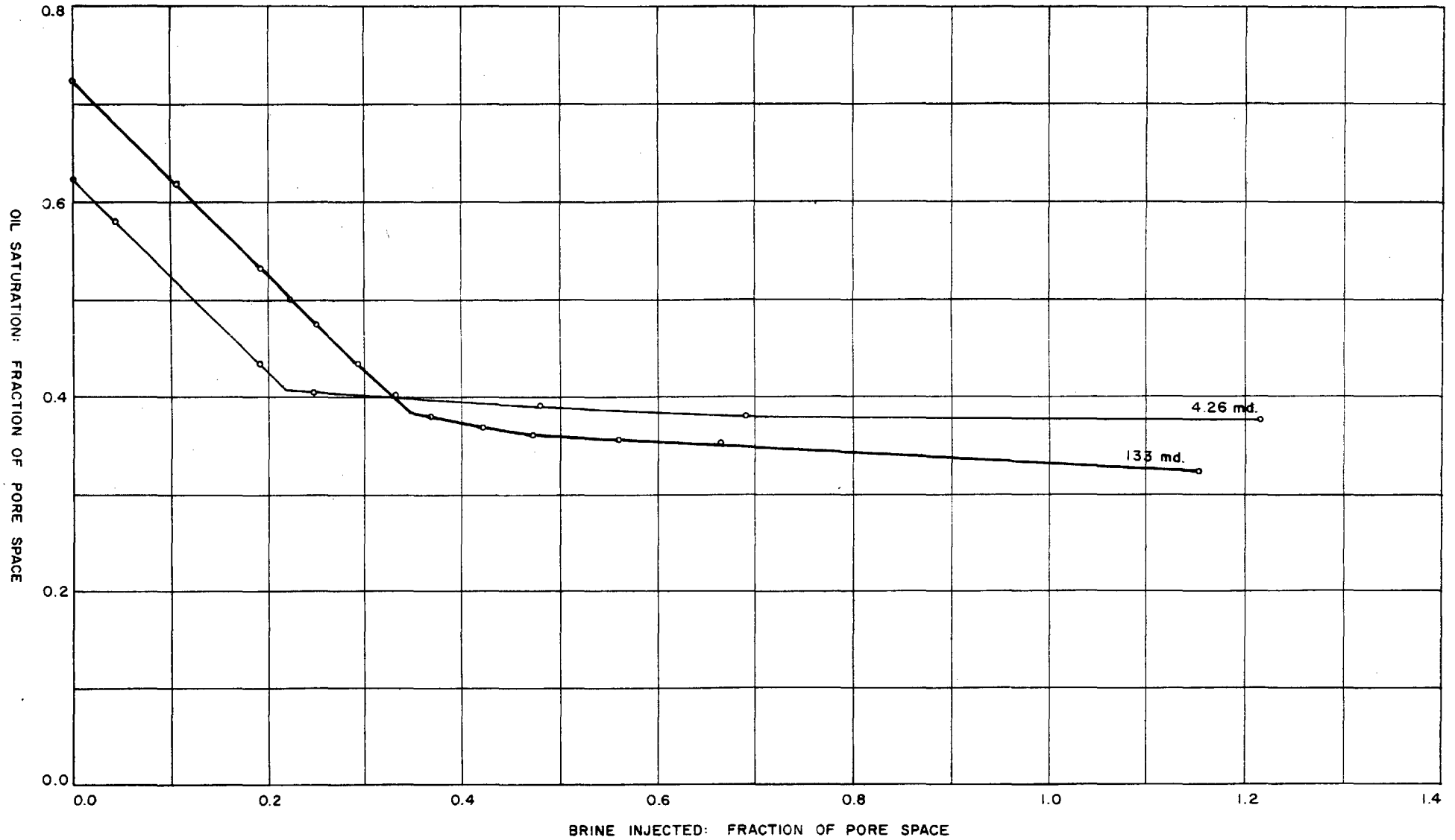


EXHIBIT 29

CALCULATED RESERVOIR PERFORMANCE
RE-INJECTION OF 70% PRODUCED GAS
DISPERSED GAS DRIVE
CENTRAL BISTI LOWER GALLUP SAND UNIT, SAN JUAN COUNTY, NEW MEXICO

70% Gas Return

Res. Press. Psig	$\frac{\Delta N_p}{N}$	$\frac{N_p}{N}$	B_o	$\frac{B_o}{B_{oi}}(1-S_w)$	Total S_L	R_s	$1/B_g$	μ_o	R	$\Delta(\frac{B_o}{B_g}-R_s)$	μ_g	$(1+mi)B_{oi}\Delta\frac{1}{B_g}$
1,207			1.2602	.755		406	476	.823	406		.0151	
1,200	.0029	.0029	1.2595	.755	.997	404	472	.825	411	4.6-	.0151	5.53-
1,100	.0590	.0619	1.2513	.750	.948	383	417	.848	685	52.2-	.0149	69.87-
1,000	.0429	.1048	1.2437	.745	.912	358	371	.868	2,476	35.3-	.0146	57.86-
900	.0217	.1265	1.2352	.740	.891	333	330	.895	5,176	28.1-	.0144	51.51-
800	.0128	.1393	1.2257	.734	.877	308	291	.930	8,058	26.3-	.0140	48.88-
700	.0089	.1482	1.2154	.728	.865	285	253	.972	10,939	26.7-	.0136	48.35-
600	.0071	.1553	1.2047	.722	.855	263	214	1.017	13,581	26.9-	.0132	48.64-
500	.0063	.1616	1.1940	.715	.845	240	175	1.066	15,684	25.5-	.0128	48.78-
400	.0063	.1679	1.1832	.709	.835	215	137	1.126	17,051	21.7-	.0125	48.14-
300	.0065	.1743	1.1710	.702	.824	185	100	1.217	17,636	15.3-	.0122	46.39-
200	.0072	.1816	1.1554	.692	.812	151	66	1.371	17,443	6.8-	.0119	43.55-
100	.0086	.1902	1.1324	.678	.794	110	34	1.641	15,399	2.8	.0116	39.95-

$$\Delta_x^{x+1}\frac{N_p}{N} = \frac{(1-\frac{N_{px}}{N})\ \Delta_x^{x+1}(\frac{B_o}{B_g}-R_s) - (1+m_i)(B_{oi}\ \Delta_x^{x+1}\frac{1}{B_g})}{(\frac{B_o}{B_g}-R_s)_{x+1} + R_{avg}\ \Delta_x^{x+1}(1-I)}$$

$$S_{L_{x+1}} = (1-S_w)(1-\frac{N_p}{N}x+1)(\frac{B_o}{B_{oi}})_{x+I} + S_w$$

$$R_{x+1} = \frac{k_g}{k_o}(\frac{\mu_o}{\mu_g}\frac{B_o}{B_g})_{x+1} + R_{s_{x+1}}$$

EXHIBIT 30
MISCIBLE SLUG DISPLACEMENT TESTS

SUNRAY MID-CONTINENT OIL COMPANY
FEDERAL GI NO.1 WELL
BISTI FIELD
San Juan County, New Mexico

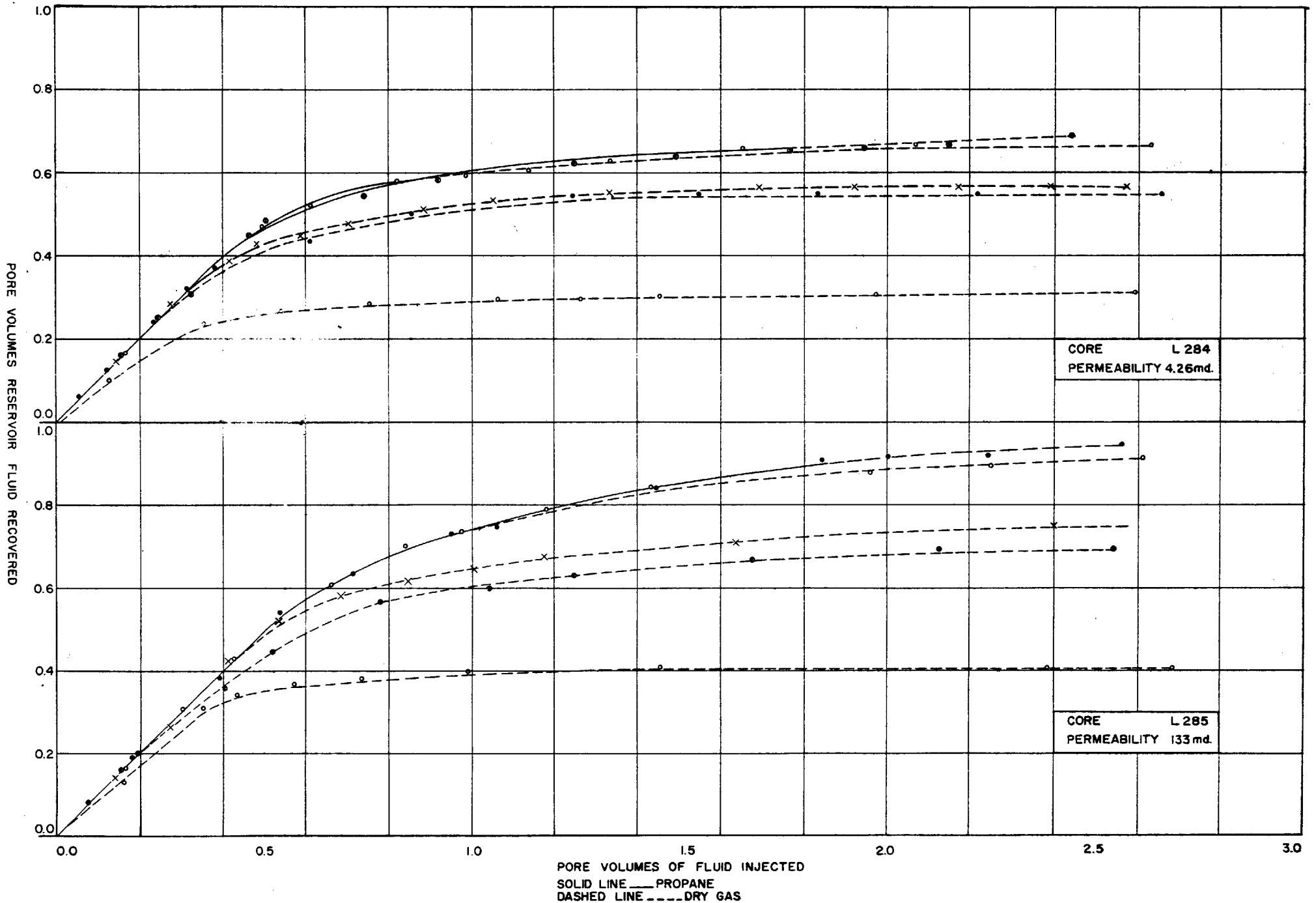


EXHIBIT 31

SUMMARY ECONOMIC COMPARISON

UNIT OPERATIONS VS COMPETITIVE NATURAL DEPLETION
CENTRAL BISTI LOWER GALLUP SAND UNIT, BISTI POOL, NEW MEXICO

	Natural Depletion	Injecting Produced Separator Gas Plus Make-up PLAN I	Injecting Plant Residue Gas Plus Make-up PLAN 2	Water Flood PLAN 3	PLAN 1 Benefit	PLAN 2 Benefit	PLAN 3 Benefit
Estimated Recovery to April 1, 1959							
Stock tank oil, bbls.	2,187,000	2,187,000	2,187,000	2,187,000	0	0	0
Casinghead gas	2,000	2,000	2,000	2,000	0	0	0
Estimated Recovery After April 1, 1959							
Stock tank oil, bbls.	3,742,100	9,701,553	9,701,553	7,842,200	5,959,453	5,959,453	4,100,100
Gas sale, MMcf	7,238	8,020	9,058	4,070	782	1,820	(3,168)
Plant products lse share, bbls.	740,000	449,000	367,400	278,000	291,000	(372,600)	(462,000)
LPG slug, lse share, bbls.	0	222,000	118,825	0	222,000	118,825	0
Estimated Gross Ultimate Recovery (8/8)							
Stock tank oil, bbls.	5,929,100	11,888,553	11,888,553	10,029,200	5,959,453	5,959,453	4,100,100
Gas sales, MMcf	7,238	8,020	9,058	4,070	782	1,820	(3,168)
Plant products, lse share	740,000	449,000	367,400	278,000	291,000	(372,600)	(462,000)
LPG slug, lse share, bbls.	0	222,000	118,825	0	222,000	118,825	0
Value of Net (7/8) Recovery							
Stock tank oil, bbls. at $2.90	$15,045,090	$30,169,863	$30,169,863	$25,449,000	$15,124,773	$15,124,773	$10,403,910
Gas sales, MMcf at 13¢ 1959, 14¢ 1964, 15¢ 1969	837,000	1,042,600	1,181,900	498,600	205,600	344,900	(338,400)
Plant products at $1.85	1,200,465	726,800	594,830	450,000	(473,665)	(605,635)	(750,465)
LPG slug, lse share at $1.85	0	410,700	219,826	0	410,700	219,826	0
Totals	$17,082,555	$32,349,963	$32,166,419	$26,397,600	$15,267,408	$15,083,864	$ 9,315,045
Investment Totals	$ 4,800,000	$ 6,431,500	$ 5,612,000	$ 5,725,000	$ 1,631,500	$ 812,000	$ 925,000
Expenses							
Lease and well including water injec.	$ 1,485,000	$ 2,953,750	$ 3,790,750	$ 5,620,000	$ 1,468,750	$ 2,305,750	$ 4,135,000
LPG purchases and injection	0	1,659,780	1,659,780	0	1,659,780	1,659,780	0
Gas purchases	0	1,023,500	1,161,000	0	1,023,500	1,161,000	0
Compressor maintenances and operation	0	446,000	95,000	0	446,000	95,000	0
State taxes at 7.6%	1,308,599	2,471,500	2,444,189	2,020,300	1,162,901	1,135,590	711,700
Totals	$ 2,793,599	$ 8,554,530	$ 9,750,719	$ 7,640,300	$ 5,760,931	$ 6,357,120	$ 4,846,700
Operating profit before salvage	$ 9,488,956	$17,363,933	$17,403,700	$13,032,300	$ 7,874,977	$ 7,914,744	$ 3,543,345
Salvage	400,000	902,123	602,450	581,500	502,123	202,450	181,500
Operating profit after salvage	9,888,956	18,266,056	18,006,150	13,613,800	8,377,100	8,117,194	3,724,845
Total operating profit return/$ invested	$2.06	$2.84	$3.21	$2.38	$5.14	$10.00	$4.02