SoCalGas-145

Agenda for D.O.G. Annual Review Meeting for Aliso Canyon (May 26, 1988)

I.19-06-016

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AGENDA FOR D.O.G. ANNUAL REVIEW MEETING FOR ALISO CANYON MAY 26, 1988

ATTENDING

D. R. Horstman
J. D. Mansdorfer
M. E. Melton
K. M. Taira
R. W. Weibel
P. J. Kinnear, Division of Oil and Gas
M. Stettner, Division of Oil and Gas

The topics to be covered in the meeting include project performance, geology, engineering, conservation, pollution prevention and operations.

MEM:hr
5/17/88

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REVIEW OUTLINE FOR ALISO CANYON ANNUAL REVIEW MEETING
WITH DIVISION OF OIL AND GAS

MAY 26, 1988

Geology

1. Interpretation
2. Studies in progress

Project Performance

1. Report on injection pressures and reservoir pressures
2. Volume of gas in storage vs. pressure/z (Hysteresis Curve)
3. Reservoir fluid distribution
4. Annual rate of oil produced vs. cumulative oil (former oil reservoirs)
5. Unusual or unpredicted occurrences

Engineering

1. Reservoir data changes or additions
2. Evaluation of performance anomalies
3. Changes in the composition of gas injected

Conservation (Waste or loss of natural resources)

1. Report on monitoring programs
2. Losses detected and corrective measures taken
3. Changes or additions to monitoring programs

Pollution Prevention

1. Report on well shut-in system (a) status of installation, (b) testing results on critical wells, (c) alterations to system
2. Water disposal methods
3. Spill prevention and containment

Operations

1. Wells drilled, abandoned, converted, or reworked
2. Unusual occurrences or problems

GEOLOGY

A 1978 geologic study of the Aliso Canyon field performed by the consulting firm Scientific Software Corporation indicated that gas had not migrated out of the defined boundaries (Frew fault on the west, Ward fault and Roosa fault on the north and fluid contacts on south and east). Isobaric maps drawn during recent shut-in periods indicate permeability barriers in the field with wells on the north west side (IW 70, F-2 and F-3), as well as IW 69 and SS-5 behaving differently than the rest of the field. It has been substantiated by Dr. Katz that gas is migrating to tighter zones in that area which has caused the shift in the P/Z curve. This low permeability area has been verified by pressure buildup tests.

The conclusions of the 1978 Geological Study showed:

1. Reservoir Boundaries

South and East Sides:		Water aquifer
West Side	:	Frew Fault
North Side	:	Ward/Roosa Fault

2. SS-1-0 is an observation wells which test the communication between the storage zone and the Ward fault block. We still have no conclusive evidence that there is any communication between the two fault blocks.

3. The geologic structure is sound and competent to hold storage gas within the reservoir boundaries.

4. The northwest area represents 30% of initial gas cap volume, and 12% of the total reservoir pore volume.

5. The shift in the Hysteresis Curve has been due to:

   a. Gas moving into and out of tighter areas of the reservoir.

   b. Some fault blocks, with restricted communication, being repressurized and depressurized.

   c. Gas going into and out of the oil band.

6. Reasons for tilted water/oil contact along the south flank:

   a. Sand-shale facies change.
   b. Step segments offset by older faults.

During 1987, geologic consultant, Henry Walrond updated the geologic interpretation to include 13 wells drilled after the 1978 study. Changes in the geologic interpretation were minimal.

While abandoning Porter 4, the MP shale was tested for possible migrated gas from well leaks. The interval produced no gas.

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ALISO CANYON
PROJECT PERFORMANCE

Injection Pressures

Figures IA, 1B, and 1C show the variation of the average reservoir pressure with inventory for the 1985-87 injection cycles. The stabilized reservoir pressure is always maintained at less than discovery pressure.

Assuming a 0.7 psi/ft. fracture gradient for an 8000 ft. well, the wellbore pressure required to fracture the formation will be 5600 psig, which is 2000 psig greater than we ever encounter at Aliso Canyon.

Hysteresis Curve

Figure 2 is an updated graph of P/Z versus inventory (the data is also listed in Table 2). The shift in reservoir pressures from 1974 to date when plotted versus injected gas content is a combination of the repressurization of low pressure gas cap areas in the various fault blocks and of gas going into solution in crude oil some distance from the wellbore.

During the past four years the reservoir has not been filled to capacity. As a result the hysteresis curve has shifted to the left. This could be a result of gas coming out of solution, gas coming from tight regions of the reservoir, or gas returning from another fault block, such as the Ward fault block to the northwest. The volumetric weighting of reservoir blocks has been updated based upon observed pressure response in these blocks (see Figure 3). This revised reservoir weighting is used to calculate the current hysteresis curve, Figure 2.

Oil Production

Table 3 presents annual oil production figures, starting from 1970 to date. At Aliso Canyon, the total oil production through 1987 was 25,442,518 barrels. Figure 4 shows the annual oil production versus cumulative oil production.

Figure 5 is a graph of cumulative oil production versus cumulative gas production.

The performance of the reservoir since 1970 is shown on Figure 6. The plots of annual pressures decline through 1972. The semi-annual plot from the start of storage operations illustrates the high and low range of inventory pressures.

Unusual Occurrences

There have been no unusual occurrences since the April 1987 DOG review.

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TABLE 1

ALISO CANYON

Underground Gas Storage Facility
(Statistical Data)

Year storage field was activated	1973
Discovery pressure	3602 psig
Name and geologic age of formation	Sesnon - Miocene Frew - Eocene
Formation structure	Faulted anticline
Formation thickness	150' to 400'
Depth range for wells (MD)	7100' to 9400'
Average Bottom-hole pressure at 70 Bcf	3600 psig
Average Bottom-hole temperature	180 °F
Cushion gas	91 Bcf
Working gas	70 Bcf
Number of Wells	
Gas Storage	99
Observation well	11

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FIGURE 1A
ALISO CANYON STORAGE FIELD RESERVOIR, INJECTION PRESSURES & INVENTORY VS TIME

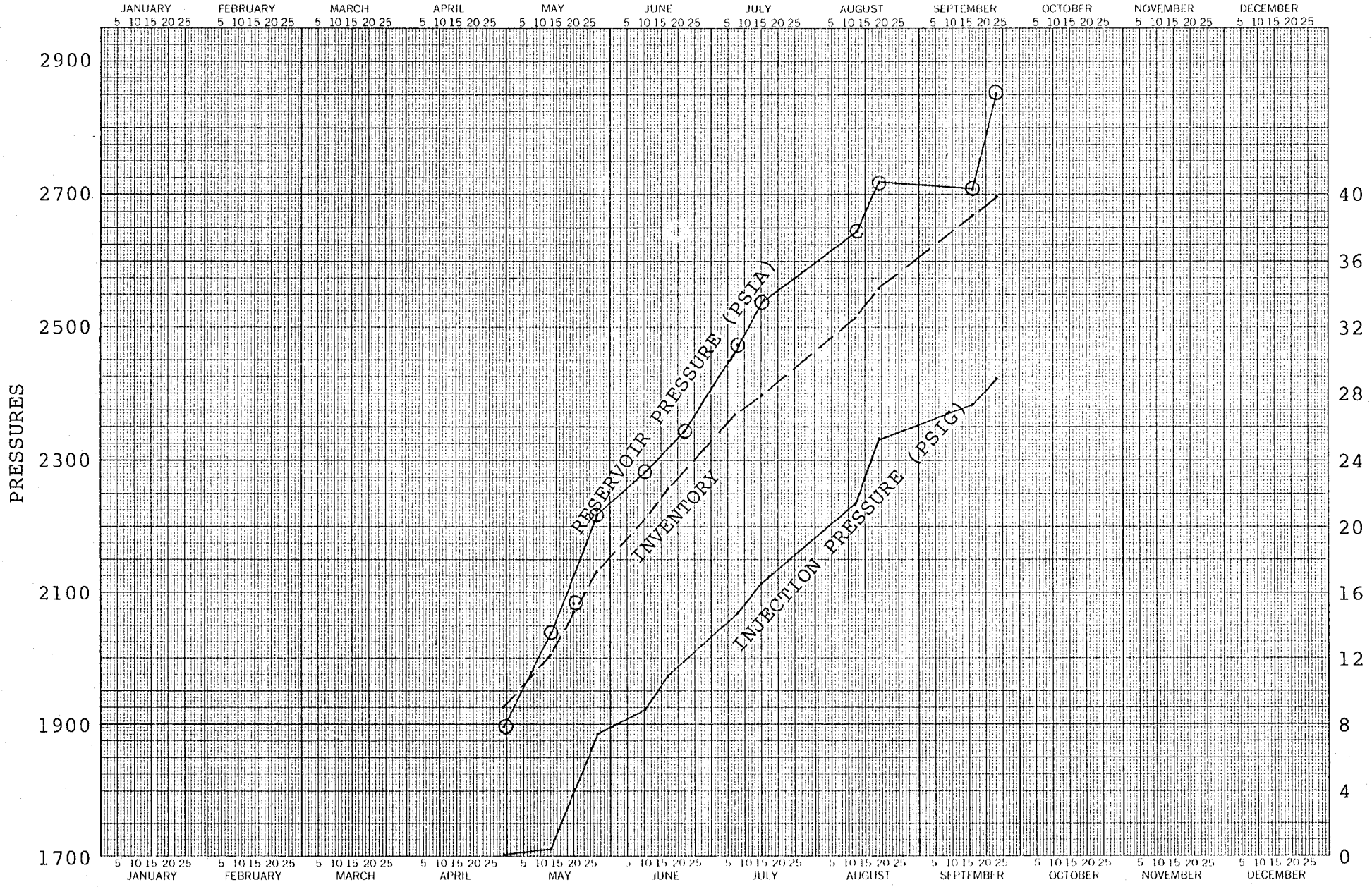

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FIGURE 1B

ALISO CANYON STORAGE FIELD RESERVOIR, INJECTION PRESSURES & INVENTORY VS TIME

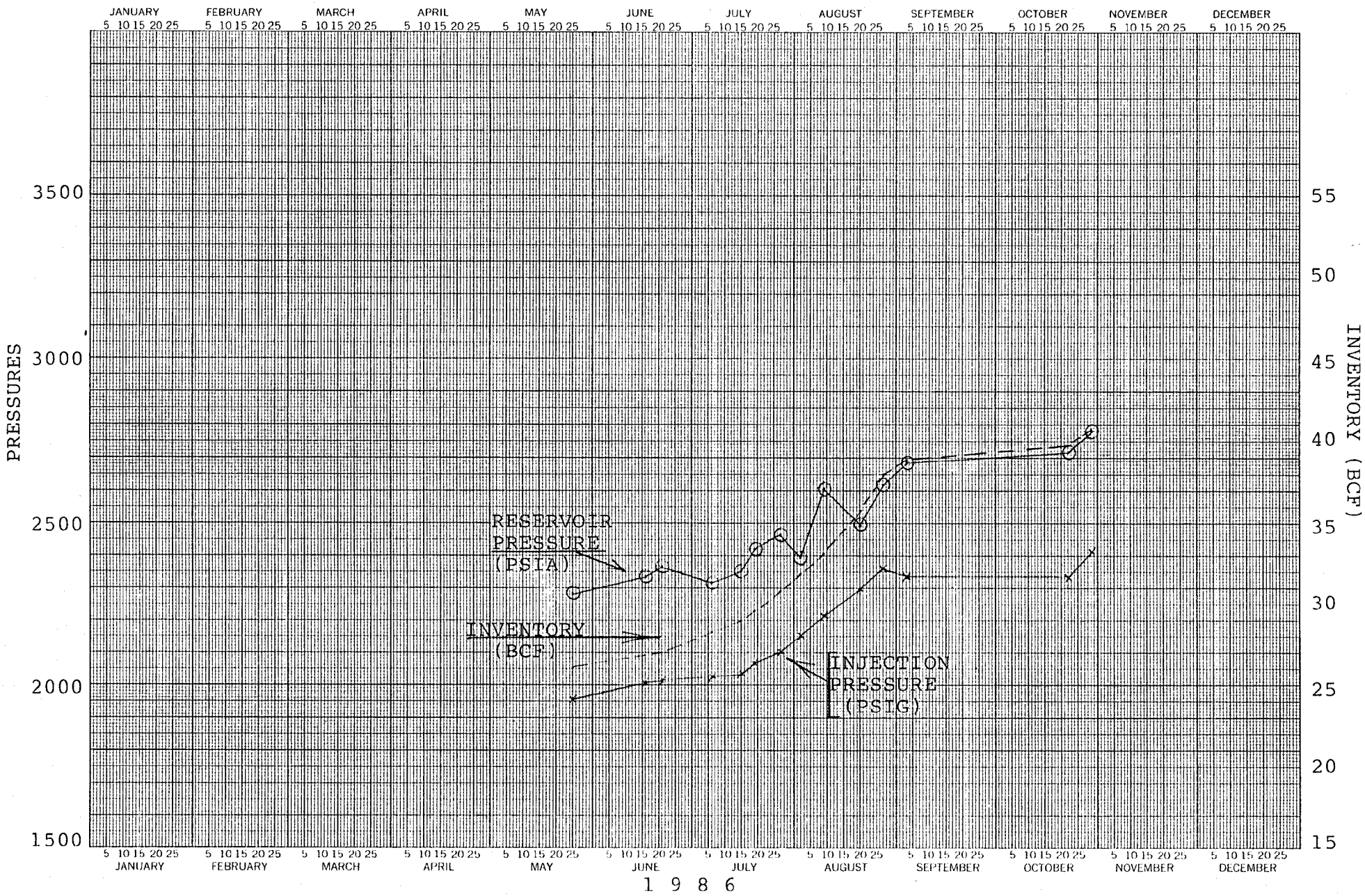

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FIGURE 1C

ALISO CANYON STORAGE FIELD RESERVOIR, INJECTION PRESSURES & INVENTORY VS TIME

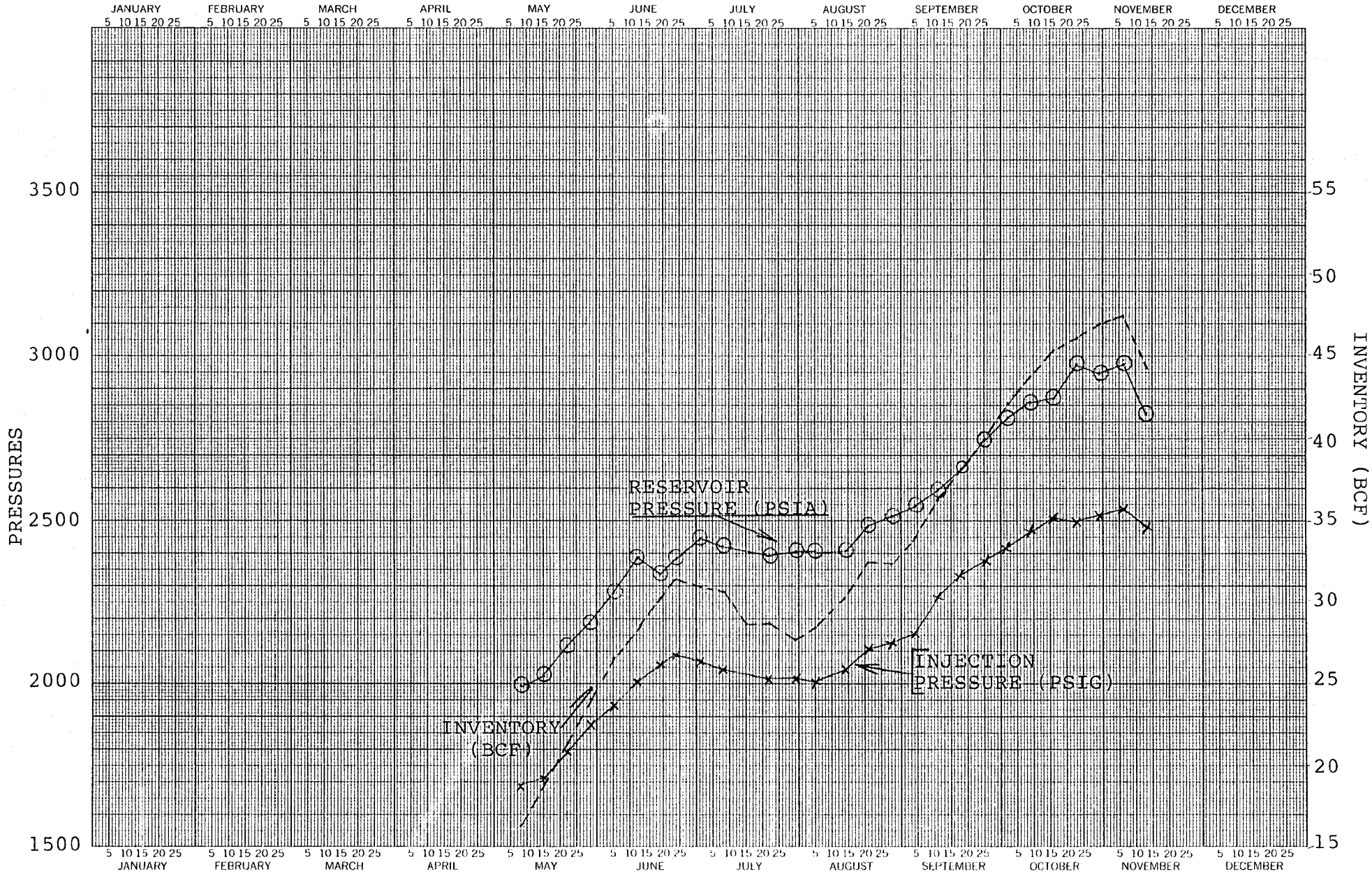

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TABLE 2

ALISO CANYON

POINT	DATE	AVERAGE RESERVOIR PRESSURE (PSIA)	P/Z (PSIA)	INVENTORY (BCF)
1	1/10/74	2127	2445	1.5
2	10/19/74	3404	3872	42.1
3	4/22/75	2391	2762	19.0
4	9/19/75	3380	3848	49.1
5	1/22/76	2526	2921	28.7
6	11/24/76	3420	3888	59.4
7	2/7/77	2793	3227	42.0
8	9/15/77	3427	3895	62.5
9	3/12/78	2665	3082	40.7
10	11/30/78	3536	4000	69.1
11	4/13/79	2222	2560	19.9
12	11/28/79	3486	3952	70.0
13	3/31/80	2949	3400	50.4
14	11/3/80	3364	3832	67.0
15	4/1/81	2835	3274	50.4
16	12/2/81	3468	3934	68.9
17	4/19/82	2238	2579	25.3
18	9/24/82	3502	3967	70.0
19	3/17/83	2492	2881	35.3
20	11/28/83	2801	3236	44.5
21	11/19/84	3160	3625	56.8
22	4/18/85	1942	2219	11.9
23	4/30/86	2306	2661	25.3
24	10/15/86	2680	3099	38.8
25	3/18/87	1710	1935	0.3
26	11/23/87	2749	3178	38.0

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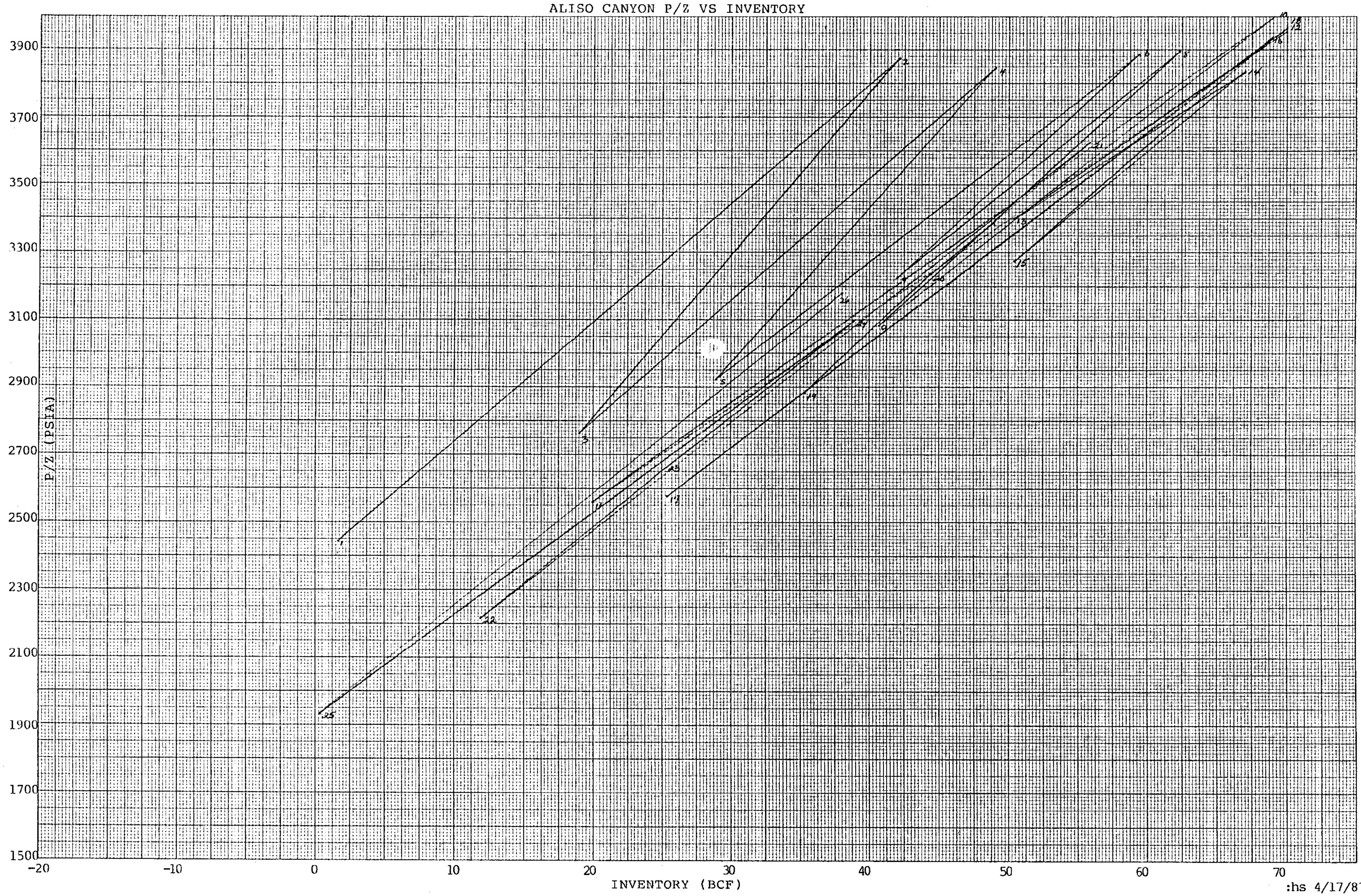
ALISO CANYON P/Z VS INVENTORY



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K&E 10 X 10 TO THE CENTIMETER 25 X 38 CM. KEUFFEL & ESSER CO. MADE IN U.S.A.

FIGURE 3

ALISO CANYON

BOTTOM HOLE LOCATIONS

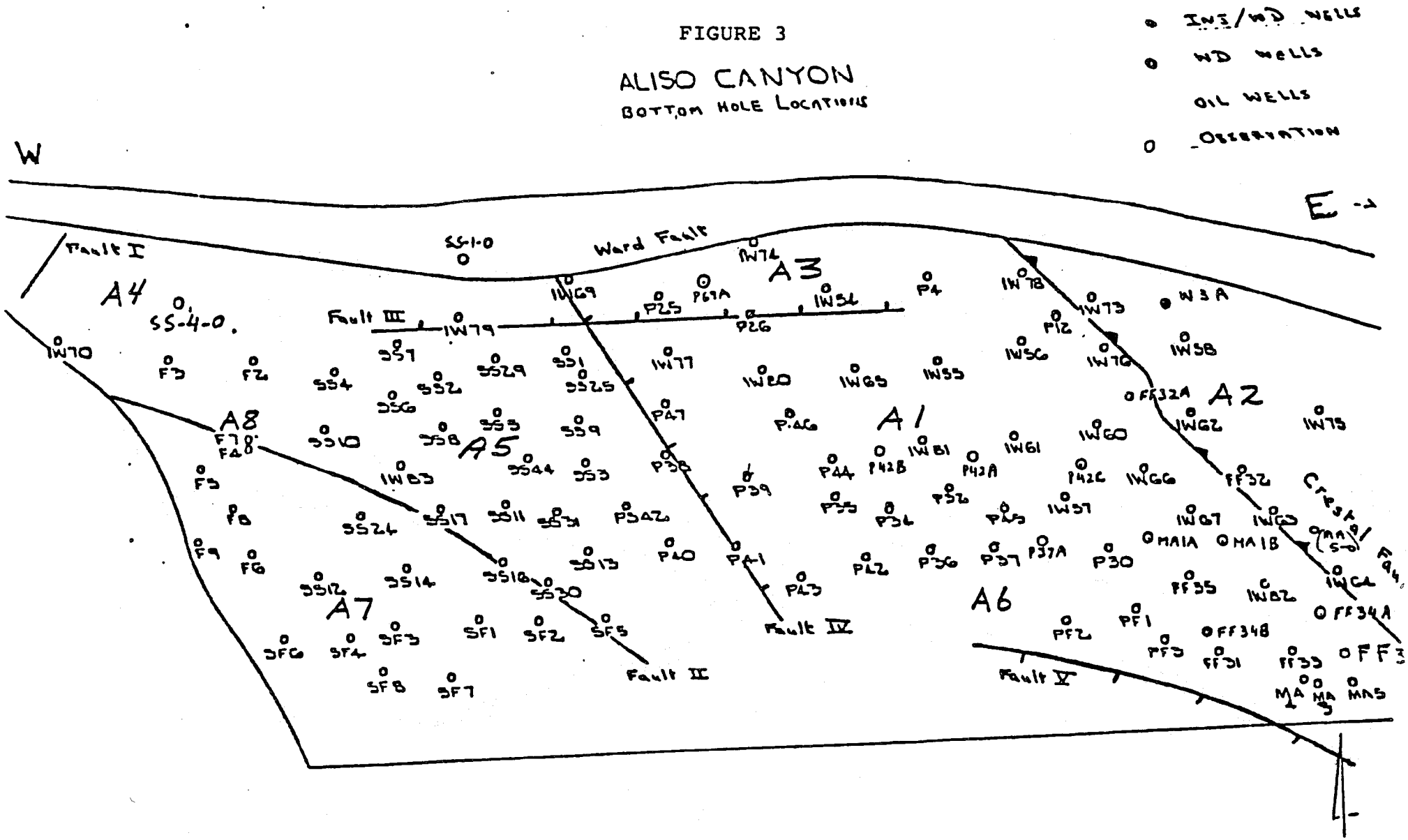

TABLE 3
ALISO CANYON OIL PRODUCTION

YEAR	OIL (Bbls/Yr)	CUMULATIVE OIL (Bbl)
1970	529,023	21,600,000
1971	496,016	22,096,016
1972	368,978	22,464,994
1973	203,709	22,668,703
1974	228,813	22,897,516
1975	298,639	23,196,155
1976	233,997	23,430,152
1977	288,107	23,718,259
1978	293,964	24,012,223
1979	164,505	24,176,728
1980	143,595	24,320,323
1981	175,414	24,495,737
1982	183,525	24,679,262
1983	91,502	24,770,764
1984	119,302	24,890,066
1985	171,307	25,061,373
1986	202,317	25,263,690
1987	178,828	25,442,518

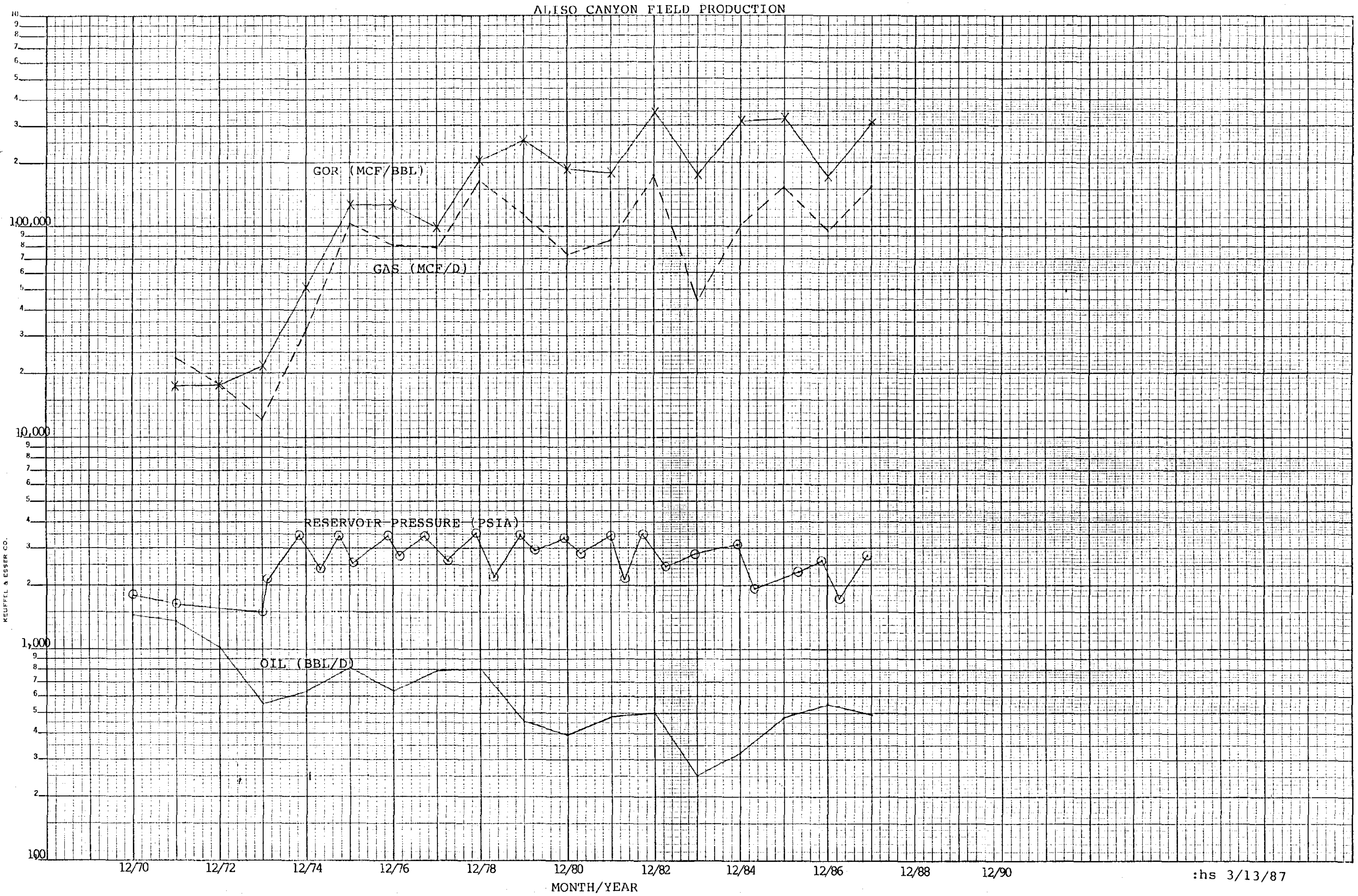

FIGURE 4

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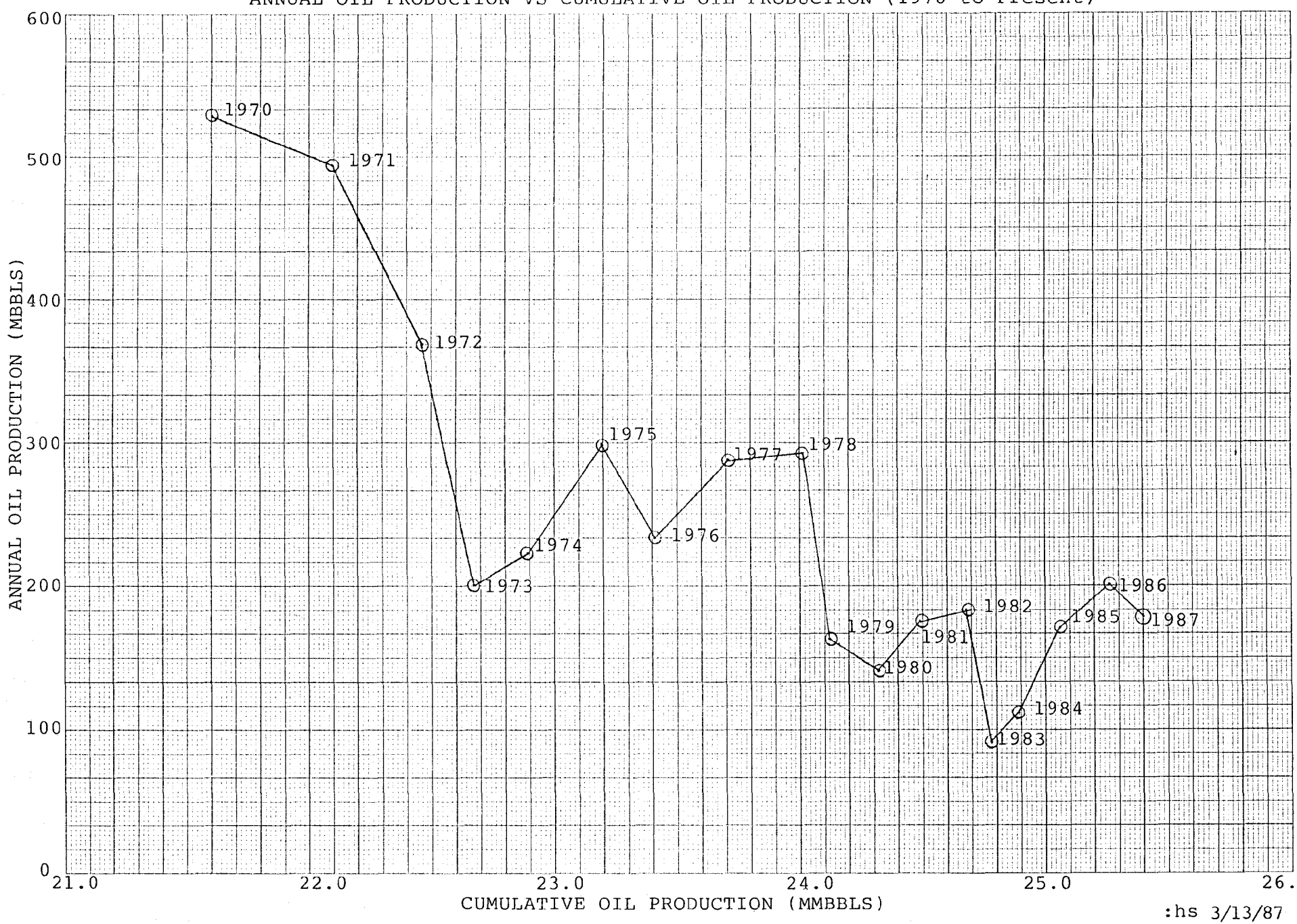

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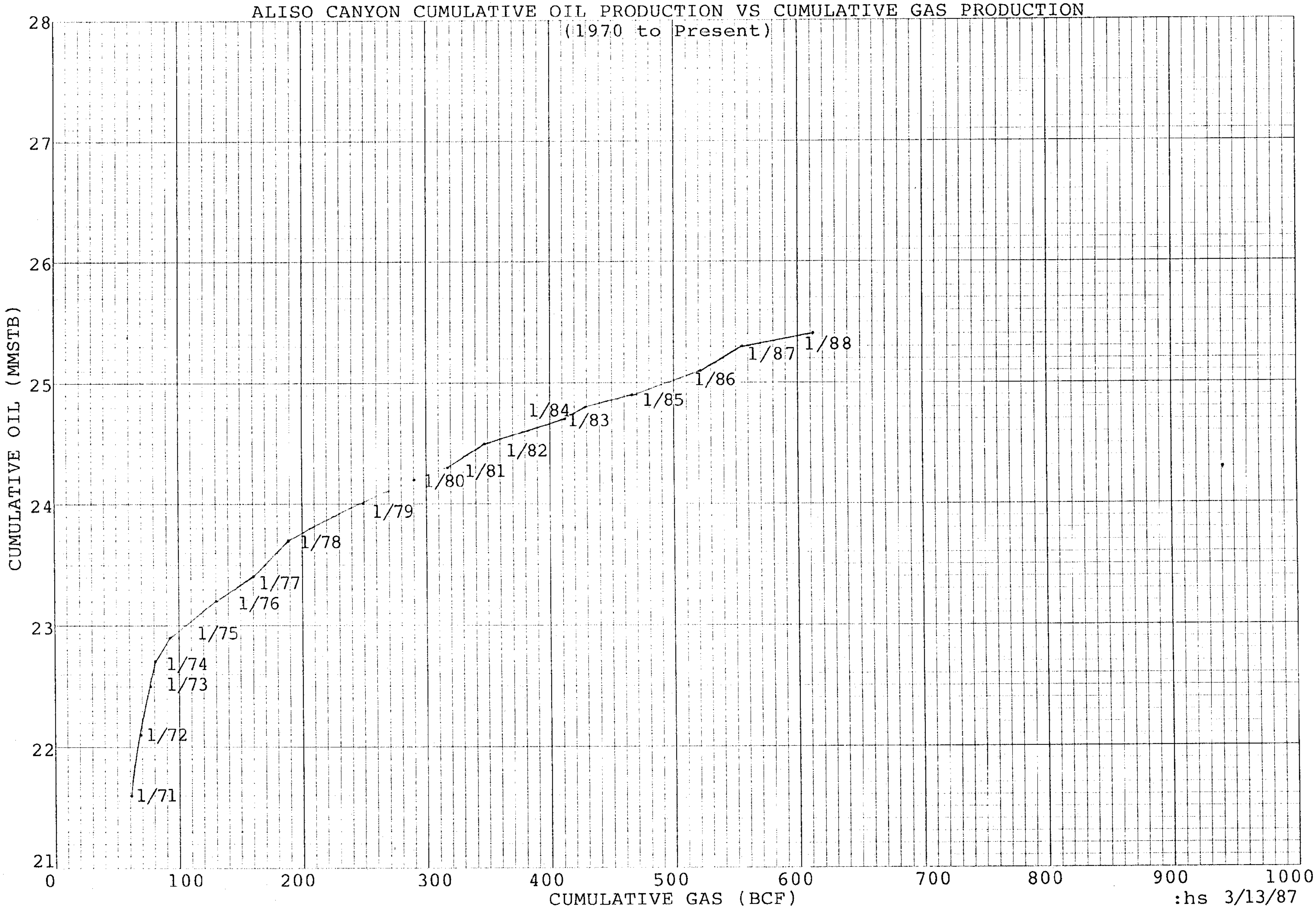
FIGURE 5

ALISO CANYON CUMULATIVE OIL PRODUCTION VS CUMULATIVE GAS PRODUCTION
(1970 to Present)



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ENGINEERING

1. Reservoir data changes or additions

No new wells have been drilled since the last DOG review. Most reservoir parameters are fairly well fixed from our major geologic study and log analysis. Subtle changes in gas saturation may have caused significant changes in the effective gas permeability and individual well deliverabilities. Each well is tested two to three times per year to determine its optimum sand free deliverability.

2. Evaluation of Performance Anomalies

During the past four seasons the demands for seasonal peaking has been low, so the field has not been filled to capacity. During this time the P/Z curve has actually shifted to the left, indicating a gas gain in the free gas cap. This could be from gas coming out of solution, gas coming from tight regions of the reservoir, or gas returning from another fault block such as the Ward fault block to the northwest.

3. Gas Analysis

Source gas for Aliso Canyon storage is still predominantly from the Permian Basin Mid-Continent area. As received, both the hydrocarbon distribution and helium content of this gas distinguish it from California gas. Table 4 represents a typical storage gas analysis.

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TABLE 4

GAS ANALYSIS

Typical Injection Gas for Aliso Canyon and Honor Rancho*

Component	Volume Percent
Nitrogen	1.11505
CO2	.97714
Methane	89.85590
Ethane	6.44613
Propane	1.35720
I-Butane	.08752
N-Butane	.09674
I-Pentane	.02106
N-Pentane	.01889
C6	.02432

* Sampled from Transmission system at Meter No. 3000-10 at Quigley, April 14, 1985.

Gas gravity	0.6163

CONSERVATION

Monitoring Programs

A monitoring program is developed as a means of ensuring the integrity of the gas storage operation of the reservoir. The variety of the programs include integrity logs on the storage zone wells, pressure monitoring of selected observation wells around and above the storage zone, gas analysis monitoring of abandoned wells located in and around the storage project and the monitoring of production of nearby fields. As a whole, the monitoring programs provides a focused means of assuring a safe and efficient operation.

Table 5 lists the normal monitoring activities at this field. The well problems listed in Figure 5A were discovered, analyzed, and remedied using routine operating procedures. Examples of field data that are effective monitoring tools are as follows:

Table 6	A five week summary of annular pressures.
Figure 7	A plot of annular pressure for a given well.
Table 7	Barhole reading for wellsite surface emission.
Table 8	Field helium counts.
Figure 8	Example of a temperature survey through a water injector zone.
Figure 9	Noise log showing noise around bottom-hole hardware.

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TABLE 5
SUMMARY OF THE ALISO CANYON MONITORING PLAN

STORAGE ZONE WELLS

	ITEM	FREQUENCY OF DATA COLLECTION	PRIMARY RESPONSIBILITY	COMMENTS
1.	Flow Tests	Annually	Resident Reservoir Engineer	All wells are flow tested for sand, production and back-pressure curves, annually.
2.	Wellhead Pressures (including surface casing annular pressures)	Weekly	Station	Copies to Staff.
3.	Plot of Surface Casing Annular Pressures	Weekly	Resident Reservoir Engineer	To be reviewed twice yearly with Underground Storage Staff.
4.	Wellhead Inspections	Monthly	Station	To be reported to Underground Storage Staff on daily activity report whenever leakage is found.
5.	Temperature Surveys	Semi-annually	Resident Reservoir Engineer	Copies to Staff.
6.	Noise Logs	As needed	Resident Reservoir Engineer	Copies maintained in Division and Underground Storage files.
7.	Tracer Surveys	As needed	Resident Reservoir Engineer, Staff will normally assist.	A detailed explanation of methods and results to be prepared by resident for each well. Copy sent to Underground Storage Staff.
8.	Neutron Logs	As needed	Underground Storage Staff	Copy to Division.
9.	Reservoir Shut-ins	Twice a year	Reservoir Engineer	Hysteresis Curve and Isobaric Maps to be updated by Underground Storage Staff.
10.	Annular Blowdown	As needed	Resident Reservoir Engineer	To recommend and implement annular blowdown tests and programs to determine corrective action needed, and to prevent fracture of primary cement at surface string shoe.
11.	Annular Helium Samples	Annually	Engineering Test Center	To monitor gas content in the annular.

SUMMARY OF THE ALISO CANYON MONITORING PLAN

NON-STORAGE ZONE WELLS

	ITEM	FREQUENCY OF DATA COLLECTION	PRIMARY RESPONSIBILITY	COMMENTS
1.	Wellhead Pressures (including surface casing annular pressures)	Weekly	Station	Copies to Staff.
2.	Plot of Surface Casing Annluar Pressures	Weekly	Resident Reservoir Engineer	To be reviewed with Underground Storage Staff twice yearly.
3.	Bottom-hole Pressure	Quarterly	Resident Reservoir Engineer	Copies to Staff.
4.	Temperature Surveys	Quarterly	Resident Reservoir Engineer	Copies to Staff.
5.	Wellhead Inspections	Weekly	Station	Copy of report to Resident Reservoir Engineer.
6.	Noise Logs	As needed	Resident Reservoir Engineer	Copies maintained in Division and Underground Storage files.
7.	Tracer Surveys	As needed	Resident Reservoir Engineer, Staff will normally assist	A detailed explanation of methods and results to be prepared by Resident and copy sent to Underground Storage Staff.
8.	Neutron Logs	As needed	Underground Storage Staff	Copy to Division.

Table 5, Page 3

SUMMARY OF THE ALISO CANYON MONITORING PLAN

SURFACE OBSERVATIONS

	ITEM	FREQUENCY OF DATA COLLECTION	PRIMARY RESPONSIBILITY	COMMENTS
1.	Production from Annular Blowdowns	As needed	Station	Data to be plotted by Resident Reservoir Engineer.
2.	Inspection of Well Cellars	Weekly	Station	Copy of report to Resident Reservoir Engineer.
3.	Gas Scope Survey of BarHoles	Monthly	Station	Copy of report to Resident Reservoir Engineer.
4.	Flame Ionizaton Survey of Abandoned Wellsites	Semi-Annually	Pipeline	Copy of report to Resident Reservoir Engineer.
5.	Flame Ionization Survey of Storage Field Pipelines	Annual	Pipeline	Copy of report to Resident Reservoir Engineer.
6.	Monitoring Production from nearby fields	Monthly	Underground Storage Staff	Data to be plotted by Staff with copies to Resident Reservoir Engineer.

FIGURE 5A

ALISO CANYON
Losses Detected and Corrective Measures Taken
April 1986 through March 1987

Well	Problem	Detected	Corrective Measures Taken
F 4	Casing Leak	1/2/88	Plug set to reduce leakage. Workover to install protective string scheduled for August.
IW 77	Shoe Leak	8/24/87	Well not killed because rate of leakage is low.
SS 17	Shoe leak	11/8/85	Well not killed because rate of leakage is low.
SS 29	Shoe Leak	9/24/87	Well not killed because rate of leakage is low.
SS 30	Shoe Leak	1986	Well not killed because rate of leakage is low.

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TABLE 6

ALISO CANYON WEEKLY ANNULUS REPORT

WELL NAME	WEEK 1 4/5/88	WEEK 2 4/12/88	WEEK 3 4/17/88	WEEK 4 4/24/88	WEEK 5 5/1/88	(WEEK 4)-(WEEK 3)	(WEEK 5)-(WEEK 4)
SURFACE ANNULUS							
IW 54	0	0	0	0	0	0	0
IW 56	60	65	60	70	60	10	-10
IW 57	0	0	0	0	0	0	0
IW 58	0	0	0	0	0	0	0
IW 61	50	50	60	70	60	10	-10
IW 62	2	0	0	1	0	1	-1
IW 63	10	20	10	5	20	-5	15
IW 64	10	15	3	20	1	17	-19
IW 65	0	2	0	2	2	2	0
IW 66	0	0	0	0	0	0	0
IW 67	3	0	0	0	0	0	0
IW 69	0	0	0	0	0	0	0
IW 70	0	0	0	0	0	0	0
IW 73	1	0	0	1	1	1	0
IW 74	0	0	0	0	0	0	0
IW 75	2	5	2	2	2	0	0
IW 76	3	2	0	3	2	3	-1
IW 77	0	0	0	0	0	0	0
IW 78	3	10	20	20	20	0	0
IW 79	0	0	0	0	0	0	0
IW 80	0	0	0	0	0	0	0
IW 81	80	100	60	50	80	-10	30
IW 82	60	13	0	45	0	45	-45
IW 83	10	3	10	0	0	-10	0
FF 31	0	0	0	0	0	0	0
FF 32	0	0	0	0	0	0	0
FF 32A	0	0	0	0	0	0	0
FF 33	0	0	0	0	0	0	0
FF 34A	0	0	0	0	0	0	0
FF 34B	0	0	0	0	0	0	0
P 12	3	2	3	2	5	-1	3
P 26	20	20	10	20	30	10	10
P 30	0	0	0	0	0	0	0
P 32	2	10	10	0	10	-10	10
P 34	0	0	0	0	0	0	0
P 35	0	0	0	0	0	0	0
P 36	0	0	0	0	0	0	0
P 37	0	0	0	0	0	0	0
P 37A	0	0	0	0	0	0	0
P 38	0	0	0	0	0	0	0
P 39	0	0	0	0	0	0	0
P 40	0	0	0	0	0	0	0
P 42A	0	0	0	0	0	0	0
P 42B	10	10	10	5	10	-5	5
P 42C	0	0	0	0	0	0	0
P 44	0	2	0	5	10	5	5

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ALISO CANYON WEEKLY ANNULUS REPORT

WELL NAME	WEEK 1 4/5/88	WEEK 2 4/12/88	WEEK 3 4/17/88	WEEK 4 4/24/88	WEEK 5 5/1/88	(WEEK 4)-(WEEK 3)	(WEEK 5)-(WEEK 4)
P 45	0	0	0	0	0	0	0
P 46	0	0	0	0	0	0	0
P 47	0	0	0	0	0	0	0
P 50A	0	0	0	0	0	0	0
P 68A	3	10	5	5	5	0	0
P 69A	0	0	0	0	0	0	0
PS 42	0	0	0	0	0	0	0
F 2	0	0	0	0	0	0	0
F 3	0	0	0	0	2	0	2
F 4	0	0	0	2	0	2	-2
F 5	0	0	0	0	0	0	0
F 7	0	0	0	0	0	0	0
SS 2	0	0	0	0	0	0	0
SS 3	0	0	0	0	0	0	0
SS 4	0	0	0	0	0	0	0
SS 5	0	0	0	0	0	0	0
SS 6	0	0	0	0	0	0	0
SS 7	0	0	0	0	0	0	0
SS 8	0	-2	0	0	0	0	0
SS 9	0	0	0	0	0	0	0
SS 10	0	0	0	0	0	0	0
SS 11	0	0	0	0	0	0	0
SS 17	0	0	0	0	0	0	0
SS 24	20	20	20	20	0	0	-20
SS 25	0	0	0	0	0	0	0
SS 29	0	0	0	0	0	0	0
SS 31	5	0	5	0	0	-5	0
SS 44	-2	0	-2	0	0	2	0
W 3A	50	50	50	50	50	0	0
PF 1	0	0	0	0	0	0	0
PF 2	40	40	0	35	40	35	5
MA 1A	0	0	0	0	0	0	0
MA 1B	10	5	15	10	5	-5	-5
MA 3	0	0	0	0	0	0	0
MA 4	0	0	0	0	0	0	0
MA 5A	0	0	0	0	0	0	0
DA 1	0	0	0	0	0	0	0
FF 34	0	0	0	0	0	0	0
FF 35	0	0	0	0	0	0	0
IW 55	0	0	0	0	0	0	0
IW 60	0	0	0	0	0	0	0
P 14	70	70	70	70	70	0	0
P 25	0	0	0	0	0	0	0
P 42	0	0	0	0	0	0	0
SS 1	0	0	0	0	0	0	0
SS 1-0	0	0	0	0	0	0	0
SS 4-0	0	0	0	0	0	0	0

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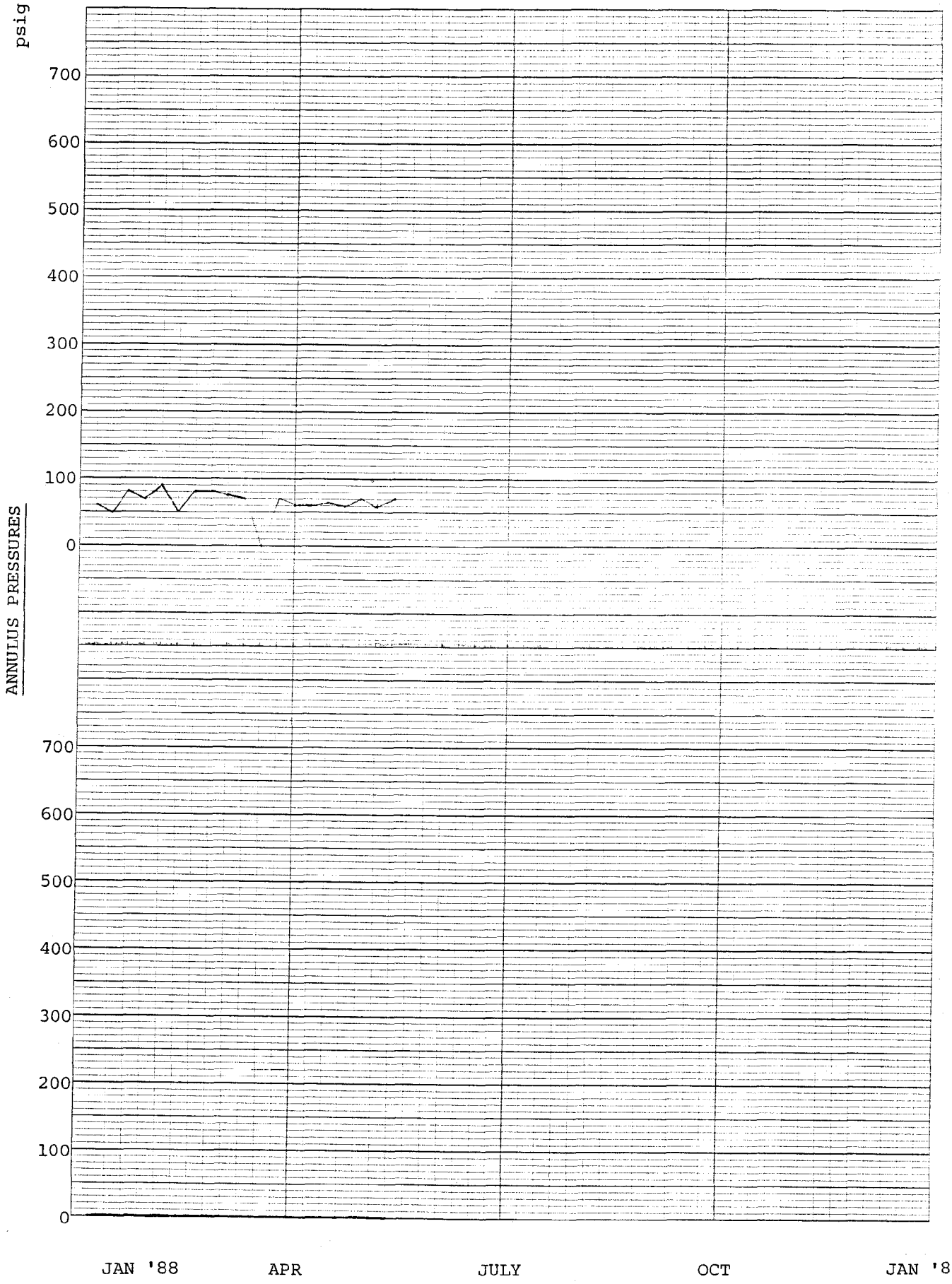
ALISO CANYON WEEKLY ANNULUS REPORT

WELL NAME	WEEK 1 4/5/88	WEEK 2 4/12/88	WEEK 3 4/17/88	WEEK 4 4/24/88	WEEK 5 5/1/88	(WEEK 4)-(WEEK 3)	(WEEK 5)-(WEEK 4)
W 3	0	0	0	0	0	0	0
F 6	0	0	0	0	0	0	0
F 8	0	0	0	0	0	0	0
F 9	0	0	0	0	0	0	0
SF 1	0	0	0	0	0	0	0
SF 2	0	0	0	0	0	0	0
SF 3	0	0	0	0	0	0	0
SF 4	0	0	0	0	0	0	0
SF 5	0	0	0	0	0	0	0
SF 6	65	65	65	65	65	0	0
SF 7	0	0	0	0	0	0	0
SF 8	0	0	0	0	0	0	0
SS 12	0	0	0	0	0	0	0
SS 13	0	0	0	0	0	0	0
SS 14	0	0	0	0	0	0	0
SS 16	0	0	0	0	0	0	0
SS 30	0	0	0	0	0	0	0
INNER ANNULUS							
IW 63	20	50	50	45	40	-5	-5
IW 65	0	1	0	0	0	0	0
FF 32	0	0	0	0	0	0	0
P 12	0	0	0	0	0	0	0
P 26	10	10	5	10	10	5	0
P 30	0	0	0	0	0	0	0
P 32	0	0	0	0	0	0	0
P 45	0	2	0	0	0	0	0
P 69A	0	0	0	0	0	0	0
F 3	60	60	60	70	0	10	-70
SS 3	0	0	0	0	0	0	0
SS 4	0	0	0	0	1	0	1
SS 5	0	0	0	0	0	0	0
SS 6	0	0	0	0	0	0	0
MA 1B	5	10	5	2	10	-3	8
SS 1	0	0	0	0	0	0	0
SS 1-0	0	0	0	0	0	0	0
SS 4-0	0	0	0	0	0	0	0
SF 1	105	150	150	150	150	0	0
SS 12	0	420	420	0	0	-420	0
ANNULUS 3							
P 12	0	0	0	0	0	0	0

FIGURE 7



DUPLICATE SAMPLE

RUN DATE : 02/12/88
START DATE: 03/01/88 END DATE: 05/31/88

SOUTHERN CALIFORNIA GAS COMPANY
LEAKAGE SURVEY INSPECTION REPORT

ENTERED MAR 9 1988 REPORT NO. L44570-1

DIVISION : NORTH BASIN (26) ORG CODE: JBO TYPE: WELL INSPECT: INSTRUMENT CLASS LOC (CYCLE): ANNUAL (1)
SURVEY ID : DA-2 CRITICAL: YES LOCATION: DA-2 STRIP MAP:
COMMENTS : NON-COMPANY LENGTH: 0.00

ENDING DATE: 3/3/88 STARTING DATE: 3/3/88
SURVEYED BY: DL, MV REVIEW BY: PB
REASON: ROUTINE METHOD: F.I.

BAR HOLE SUMMARY

NUMBER MADE: _____ SURFACE: _____
REPAIRED: _____ PERMIT NO: _____

	DATE WORKED	TIME STARTED STOPPED	LOCATION STARTED STOPPED	LEAK INDICATIONS FOUND	REMARKS
1	3-3-88	11:53	DA-2	0%	
2				0%	
3				0%	
4	3-3-88	11:54	DA-2	0%	
5					

	ADDTL WORK	ORDER ISSUED	DATE COMPLETED
1			
2			
3			
4			
5			

RCB

TABLE 8

TEST & DEVELOPMENT CENTER REPORT

Project No: C58

Reported By: P. Mahoney

Report Date: 2-11-88

Request: Conduct quarterly Helium analyses on 76 Texaco and Chevron Wells at Aliso Cyn. Also determine the helium level on a So Cal. Gas Well for reference.

Requested By: T. Mansdorfer *Mail Location:* 9380 *Request Date:* 1-28-88

Division/ Work Group: No. Basin Transmission

On 2-9 & 2-10-88, Helium levels were determined on the above wells as requested.

See attached chart for results.

Tested By: P. Mahoney

cc:

Approved By: Joe Sullivan 2/17/88

HARDISK1/RPTFORM2

HELIUM ANALYSIS ON WELLS AT ALISO CANYON - PROJECT C-58

TESTED BY: P. Mahoney 1st QUARTER 1988 YEAR

Well No.	Date Run	PPM Helium	Status	Well No.	Date Run	PPM Helium	Status
DA-2	2-9	18		P-54	2-9	5	
DA-3	2-9	—	No Gas	P-57	2-9	Less than 5	
DA-4	2-9	5		P-58	2-9	—	No Gas
DA-5	2-9	7		P-60	2-9	Less than 5	
DA-6	2-9	Less than 5		P-61	2-10	19	
DA-7	2-9			P-63	2-10	12	
DA-8	2-9	Less than 5		P-65	2-10	9	
DA-9	2-9	Less than 5		P-66	2-9	6	
DA-10	2-9	8		P-68	2-10	11	
FF-1	2-10	Less than 5		P-69	2-9	Less than 5	
FF-11	2-10	Not available; oil in pit		P-70	2-9	Less than 5	
FF-30	2-10	Less than 5		P-71	2-10	Not available; work over rig.	
FF-31 ANN	2-10	267		P-72	2-10	19	
FF-35 ANN	2-10	211		PS-20	2-9	11	
FF-38	2-10	Less than 5		15-P	2-9	Less than 5	
MA-2	2-9	—	No Gas	ROOSA-1	2-9	Less than 5	
ODAS-1(7)	2-9	Less than 5		SCCO-1	2-9	10	
OSLW-1	2-9	Less than 5		SS4-0Tbg	2-9	63	
O.T. 2	2-10	Less than 5		SS4-0Csg	2-9	28	
O.T. 3A	2-10	Less than 5		SS-18	2-9	9	
P-1	2-10	Not available; oil in pit		SS-19	2-9	9	
P-2	2-10	9		SS-21	2-9	Less than 5	
P-3	2-10	9		SS-22	2-9	—	No Gas
P-6	2-10	Less than 5		SS-23	2-9	Less than 5	
P-[illegible]	2-10	Less than 5		SS-26	2-9	5	
P-[illegible]	2-10	7		SS-27	2-9	10	
P-12A	2-10	Less than 5		SS-28	2-9	9	
P-13	2-10	Less than 5		SS-32	2-9	5	
P-14	2-10	Less than 5		SS-33	2-9	Less than 5	
P-15	2-10	Less than 5		SS-34	2-9	25	
P-17	2-10	Less than 5		SS-35	2-9	Less than 5	
P-18	2-10	11		SS-39	2-9	—	No gas
P-19	2-10	—	No gas	SS-40	2-9	Less than 5	
P-27	2-9	Less than 5		SS-45	2-9	Less than 5	
P-28	2-9	Less than 5		SS-46	2-9	9	
P-33	2-9	—	No gas	UnionT.F.	2-9	Less than 5	
P-52	2-9	—	No gas	W-3 Tbg	2-9	—	No gas Oil
P-53	2-9	—	No gas	W-3 Csg	2-10	7	

So. Calif Gas Co Reference: IW62 - 257 ppm - 2/10/88

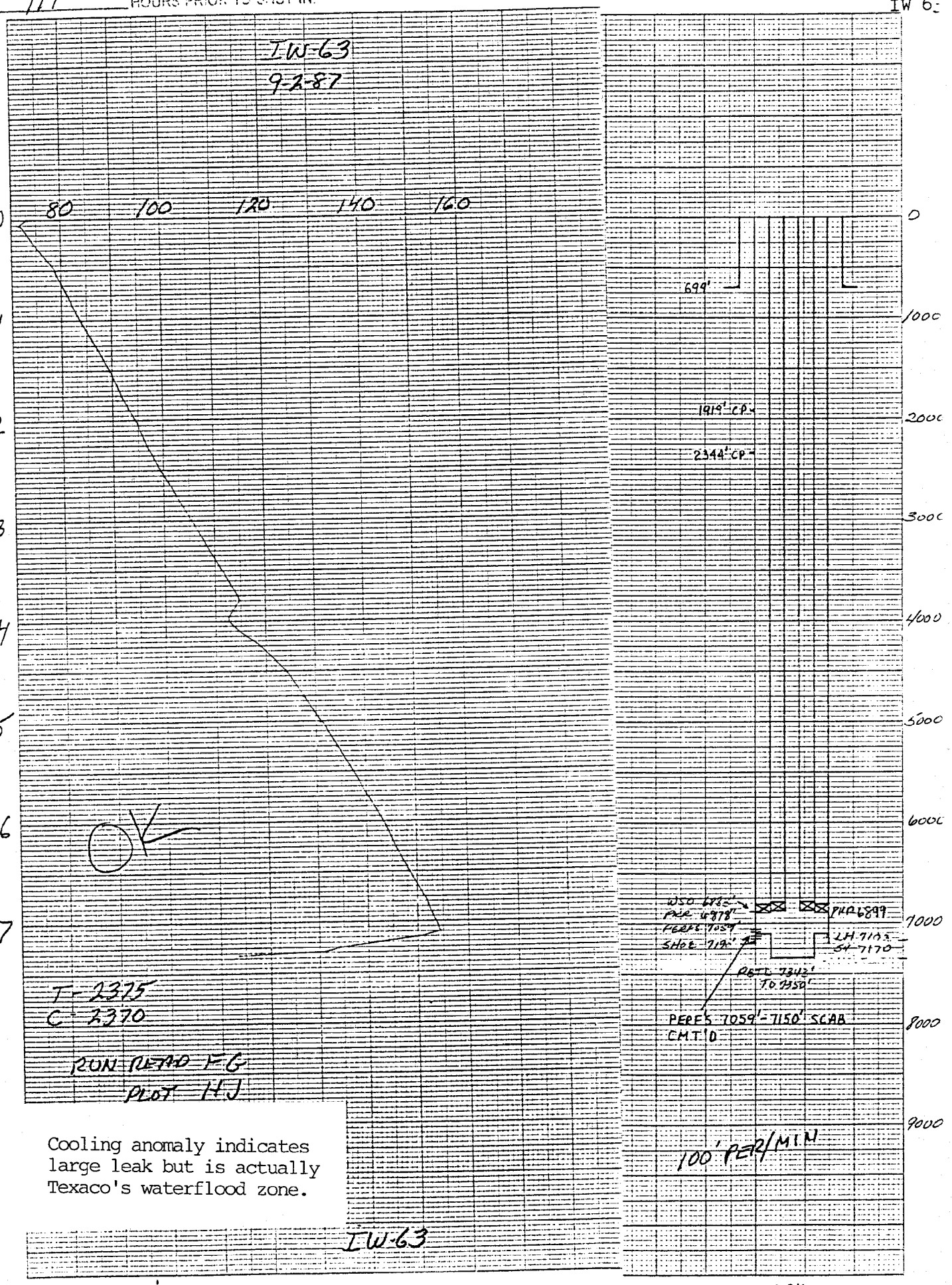
MSTRFORM/MF0030

SHUT IN 13 DAYS PRIOR TO SURVEY.
HOURS 117 HOURS PRIOR TO SHUT IN.

FIGURE 8

ALISO CANYON

IW 63



Cooling anomaly indicates large leak but is actually Texaco's waterflow zone.

IW-63

10/6/87 RES

4-25-84

46 1512

10 X 10 TO THE CENTIMETER
KEUFFEL & ESSER CO. MADE IN U.S.A.

FIGURE 9

PERMANENT DATUM	13'K.B.	ELEVATION	2592'
LOG MEASURED FROM	MAT	CORRECTED TO	TBG TAIL
TOTAL DEPTH	9140	OBSERVED DEPTH (Pickup)	9140
TOP OF LOGGED INTERVAL	2000	BOTTOM LOGGED INTERVAL	9120
TYPE OF FLUID IN HOLE	GAS	FLUID LEVEL	9000
LOG RECORDED BY	R. HELMS	WITNESSED BY	J. MANSDORFER

CASING AND TUBING RECORD

Size	Weight	From	To
13-3/8	55#	0	1010
7	26-32	0	8476
5-5/16	22	4845	8334
5	18	8334	9140

TUBING 2-7/8" to 4794' & 2-3/8 to 8856'

PACKER(S) 8849

MANDREL(S)

PERFORATIONS 8872-9140 @ INTERVALS

WELL STATUS SHUT-IN GAS STORAGE

Pressure	Producing	Injecting	Shut-in
TBG			1640
CSG			

INJ. RATE TYPE

OBS. RATE

PRODUCTION: RATES Oil Water Gas Gravity: °API

BOTTOM TEMPERATURE N/A

LOGGING UNIT 711 LINE SIZE 3/16" LINE LENGTH 18,400'

TOOLS USED (2) 5'BARS, COLLAR LOCATOR, TEMPERATURE, NOISE

TOOL NUMBERS 4035

DIAMETER 1-3/8"

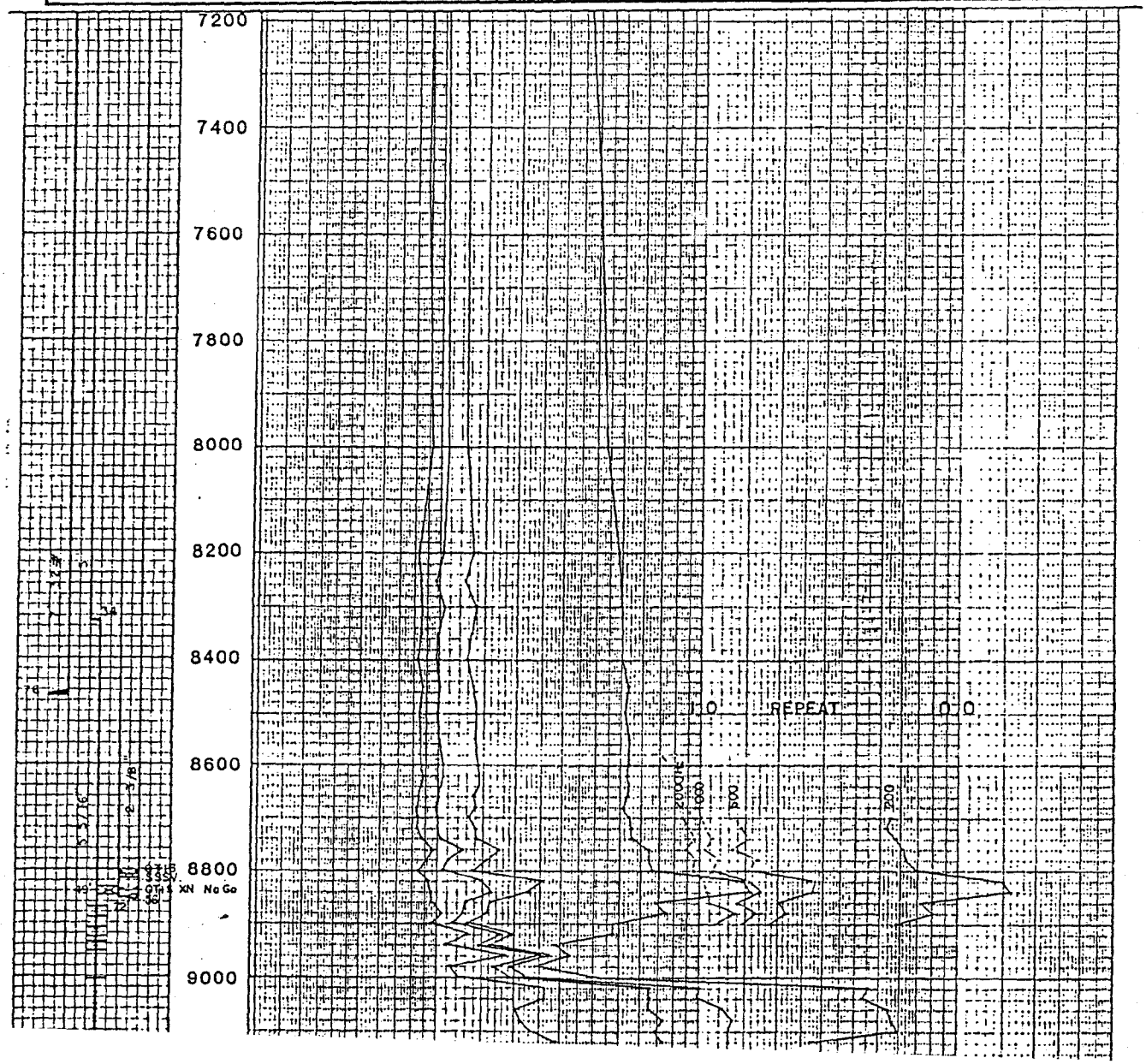
RESULTS AND REMARKS: NO APPARENT LEAKAGE IN THIS WELL. THERE MAY BE SOME FLOW FROM THE PERFS AS WELL AS FROM THE TUBING.

COMPANY SOUTHERN CALIFORNIA GAS CO.
WELL NO. STANDARD SESNON 17
FIELD ALISO CANYON
COUNTY LOS ANGELES STATE CA.
DATE 1-29-86

PURPOSE OF SURVEY
CHECK FOR GAS MIGRATION ABOVE TOP PERFORATION.

FLO-LOG INC.

NOISE LOG



ENVIRONMENTAL PROTECTION

WELL SAFETY SYSTEMS

All wells at Aliso Canyon are equipped with surface safety systems that are designed to shut the well in to prevent loss of gas and oil in the event of damage to surface piping. The surface safety system consists of fail-close pneumatic operated gate valves that are closed by any of the following:

1. Low pressure pilot - shuts well in if a break in the piping causes pressure to drop below 300 psi.

2. High pressure pilot - shuts well in if pressure in withdrawal line exceeds 710 psi.

3. Sacrificial sand erosion probe - shuts well in if sand erosion wears hole in thin walled probe.

4. Fusible plug - shuts well in if a fire occurs in well cellar.

5. Remote shutdown station - allows well to be shut in manually from no closer than 150 feet away from wellhead.

All surface safety systems are tested twice a year.

Aliso Canyon does not have any critical wells that would require subsurface safety valves. However, three wells that are in high risk landslide areas are equipped with subsurface safety valves that are actuated by the same system as the surface safety valve. These valves are tested twice a year.

All workover and drilling rigs at Aliso Canyon are equipped with Class III or better blowout prevention equipment.

WATER DISPOSAL

Produced water is disposed of by Texaco. Texaco blends produced water from their wells in the Porter, Aliso and Del Aliso Zones with water from Southern California Gas Company wells in the Sesnon-Frew and re-injects it into the Porter and Aliso Zones.

SPILL PREVENTION

The Company has various written procedures that deal with spills of hazardous liquids. These procedures attempt to prevent such spills by requiring periodic inspections of wellheads, piping and tankage. The procedures also contain plans for dealing with spills if they occur. All tanks have secondary containment walls. All natural water courses within the field have catch basins that will trap any oil that would reach them if a field gathering line developed a leak. The oil could then be removed by vacuum truck.

ALISO CANYON FIELD

PART II

DESIGN AND OPERATING INFORMATION

ONSHORE OIL PRODUCTION FACILITY

A. Facility Drainage:

1. Drainage from containment storage area is controlled as follows: See SPCC Plan Attachment #3.
2. The procedure for supervising the drainage of rain water from secondary containment into a storm drain or an open watercourse is as follows: See SPCC Plan Attachment #3.
3. Field drainage ditches, road ditches, and oil traps and well cellars, are inspected at regularly scheduled intervals for accumulations of oil. Yes
See SPCC Plan - Inspections - Monthly, and Pipeline Ground Patrol Report. All oil is vacuum-truck skimmed and hauled away.

B. Bulk Storage Tanks: (Design, materials of construction, and failsafe engineering features)

1. Tanks are bolted or welded steel construction with fixed roofs that conform to oil field standards. They are set on crushed rock foundations, and the roofs contain pressure-vacuum relief devices.
2. Secondary containment design, construction and materials: The containment design consists of reinforced concrete blocks walls, concrete walls, earthen dikes, or combinations of these.

B. Bulk Storage Tanks: (continued)

3. Tank examination methods and procedures:
The Station Supervisor shall make sure that annually all tanks are inspected externally, and if opened for cleaning they are inspected internally. In either case, if he deems it necessary, he will call a tank construction specialist for consulting advice regarding preventative maintenance. A copy of the inspection report shall be maintained at the station office and one copy at the division office in Newhall. See SPCC "Plan - Inspections - Annual - Tanks".

C. Facility Transfer Operations:

1. In making the rounds of the station, the operator will note any sources of leaks in the oil collecting and waste water facilities. He shall record on the Monthly Inspection form his findings and action taken. See "SPCC Plan - Inspections - Monthly". The Station Supervisor shall review these daily forms, comment if necessary, initial them and leave them on file for three years.

ALISO CANYON FIELD

PART II

DESIGN AND OPERATING INFORMATION

ONSHORE OIL PRODUCTION FACILITY

PAGE 3

C. Facility Transfer Opertions: (continued)

2. Flow line maintenance program to prevent spills: The main waste water, oil-waste water and oil lines shall be monitored daily and an annual leakage survey made. Any leaks and results of the annual survey will be recorded on form "SPCC Plan - Inspections - Annual - Gathering Lines".

D. Oil Drilling and Workover Facilities:

1. A blowout preventer (BOP) assembly and well control system is installed before drilling below any casing string, and as required during workover operations. Yes

2. The BOP assembly is capable of controlling any expected wellhead pressure. Yes

3. Casing and BOP installations conform to state regulations. Yes

ALISO CANYON

SPCC PLAN ATTACHMENT #2

OIL SPILL CONTINGENCY PLANS AND

WRITTEN COMMITMENT OF MANPOWER

Southern California Gas Company has provided secondary containment, where practicable, to contain a major oil spill. Even so, we also provide:

A strong oil spill contingency plan. Yes

A written commitment of manpower. Yes

Plan A

Spill judged to be controllable on the property with Company complement of men and equipment. A Company manpower force of twenty-five men, two supervisors, one truck crane with tools, skip loader, and one hundred sand bags are available.

Plan B

Backup of contract men and equipment if it is evident that a spill will get off the property is as follows:

Equipment and Personnel

Men	Trucks	Contractor	Telephone Number
40	10	Hood Corporation	(213) 945-1411
60	20	Zapata Constructors Inc.	(213) 630-5801
10	3	M. H. Cook Pipeline Co.	(213) 636-1109

Plan B (continued)

Equipment - Cranes

Cranes	Contractor	Telephone Number
3	John Thomas	(714) 549-1544
5	Owl Constructors	(213) 638-8761
4	Bob Hills Inc.	(213) 426-6445

Vacuum Trucks

Size (Bbls)	No.	Contractor	Telephone Number
60	6	Ecology Control Inc.	(805) 648-5123
100	12	Ecology Control Inc.	(805) 648-5123
65	1	J.M.T. Oil, Inc.	(805) 259-8920
75	1	J.M.T. Oil, Inc.	(805) 259-8920
120	4	J.M.T. Oil, Inc.	(805) 259-8920
123	3	J.M.T. Oil, Inc.	(805) 259-8920

Plan B (continued)

Dozer, Skip Loaders and Dump Trucks

Dozers		Skips		Dump Truck			
No.	Size	No.	Size	No.	Size	Contractor	Telephone No.
3	(2)-D-6 (1)-D-8	1	2 Yd	4	3 Axle	Macco Const.	(213) 630-5801
2	(1)-D-6 10-d-8					M.H. Cook Pipeline Co.	(213) 636-1109
3	JD 450	4	-	6	3 Yd	Hood Corp.	(213) 945-1411

If it becomes evident that a spill will get into the Los Angeles Flood Control System, the Shift Supervisor will notify the Station Superintendent, or the Senior On-Call Supervisor, who will call the Los Angeles County Flood Control District and apprise them of the spill and location. Twenty-four hour telephone number is (213) 772-4914. Week days telephone number is (213) 223-2111, extension 7416.

OPERATIONS
April 1987 through April 1988

1. New wells drilled: None

2. Well workovers:

Well	Reason
P 12	Install pumpout plug.

3. Well converted to observation:

None

4. Wells abandoned:

Well	Reason
MA 5	Unproductive well.
P 4	Unproductive well.
P 42	Unproductive well.
P 43	Unproductive well.
PF 3	Unproductive well.

No unusual incidents or problems have occurred since the last D.O.G. review meeting.

JDM:hr
5/24/88