NATIONAL PETROLEUM RESERVE IN ALASKA

HISTORY
OF
DRILLING OPERATIONS

SOUTH BARROW WELL NO. 17

HUSKY OIL NPR OPERATIONS, INC.
Edited by: S. L. Hewitt and Gordon W. Legg

For the

U. S. GEOLOGICAL SURVEY
Office of the National Petroleum Reserve in Alaska
Department of the Interior
FEBRUARY 1983

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SOUTH BARROW WELL NO. 17

INTRODUCTION

South Barrow Well No. 17 is located in the East Barrow Gas Field southeast of Barrow, Alaska (Figure 1). The field is on the National Petroleum Reserve in Alaska. The well is 1,625 feet from the north line and 2,150 feet from the west line in the northwest quarter of protracted Section 30, Township 22 North, Range 16 West, Umiat Meridian (Latitude: 71°14'00.506" North; Longitude: 156°15'34.328" West). The Alaska State Plane Coordinates are X = 705,077.78 and Y = 6,303,911.00, Zone 6. Elevations are 33' Kelly Bushing and 7' ground level. Field operations started on January 8, 1978, with the mobilization of construction crews and equipment for the building of the drilling location. Rig-up operations began February 19, 1978. The rig was released at 8:00 p.m. on April 13, 1978 after running tubing and installing tree. The tree was filled with 65% (by weight) glycol-water solution. Began rigging-down operations on April 14, 1978. Completed rig-down and move to South Barrow No. 19 on April 15, 1978.

The Barrow gas sand was the primary objective, with secondary objectives being the Sag River sandstone and several thin, but persistent sands, in the "Pebble Shale". The well was drilled to a total depth of 2,382 feet, penetrating sediments of Recent to Triassic age and terminating in the argillite of Pre-Carboniferous age. At the conclusion of the drilling operations, the well was completed and tested in the Barrow gas sand, and left as a suspended gas well.

Husky Oil NPR Operations, Inc. supervised and directed the drilling and support operations as prime contractor to the Department of the Interior, U. S. Geological Survey, Office of National Petroleum Reserve in Alaska. Brinkerhoff Signal, Inc. was the drilling contractor, and the Brinkerhoff Rig 31, a National T-20, was used to drill the well.

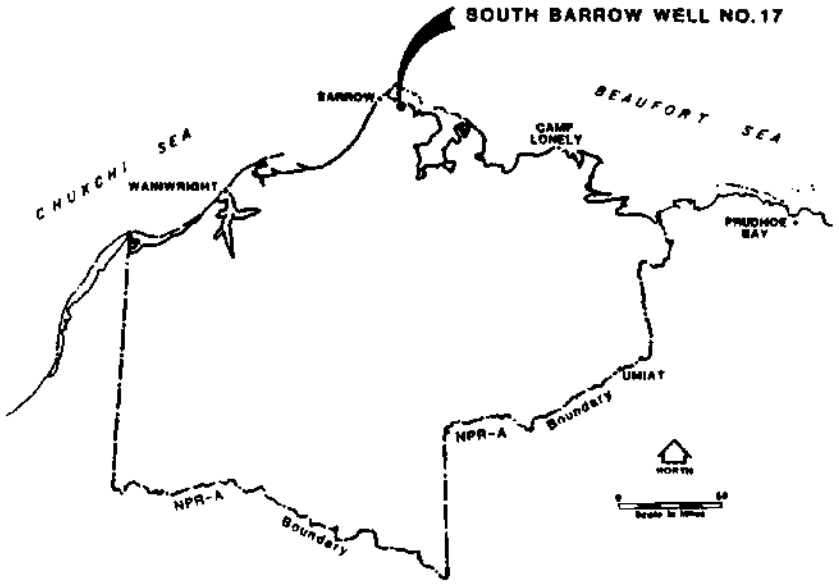

FIGURE 1 - WELL LOCATION MAP - SOUTH BARROW NO. 17

DRILLING SUMMARY

Field operations at the South Barrow Well No. 17 location began on January 8, 1978, with construction of the drilling pad. The rig and camp were moved from the South Barrow No. 16 location, starting on February 19, 1978. The rig components were moved first, and rig-up began as they arrived on location. The camp was moved on February 26 and 27, 1978. The 13-3/8" conductor was run to 80', and then was cemented with 250 sacks of Permafrost cement on February 27. A 12-inch annular blowout-preventer and diverter line were installed on the 13-3/8" conductor and pressure tested. Rig-up was completed, and the well was spudded on March 2, 1978, at 6:00 a.m.

A 12-1/4" hole was drilled from 80' to 1520', and the hole was then logged with DIL/SP and BHC-Sonic/GR logs from 1520' to the bottom of the 13-3/8" conductor. After logging, 9-5/8", 53.5#, S-95 casing was run to 1512' and cemented in with 1,330 sacks of Permafrost cement on March 7, 1978. A 12", 3,000 psi blowout-preventer stack was installed on the 9-5/8" casing. The blowout-preventer rams, choke manifold, and kill lines were tested to 3,000 psi. The Hydril was tested to 1,500 psi. To minimize formation damage from swelling clays, an inhibitive mud system of calcium chloride-lignosulfonate mud was mixed, and the system was changed over. The casing was drilled out with an 8-1/2" bit, and the formation was tested to a 0.61 psi/ft. equivalent gradient.

An 8-1/2" hole was drilled from 1520' to 2230'. At 1715', the hole was conditioned to test three sandstone stringers at 1618', 1662', and 1686' (sandstones in the "Pebble Shale"). The test, Drill-Stem Test No. 1, wa run from the casing shoe (1512') to 1715' and a 500 psi nitrogen cushio was used. It is summarized as follows:

Initial Flow Period: Open hole with no flow, bled off nitrogen to psi in 18 minutes, increased from slight blow to strong in 60 minutes gas to surface in 90 minutes (0 psi), decreased to shut in, shut wel in at 150 minutes; initial shut-in period 320 minutes; pressures a 1674' were IHP 917 psi, IFP 681 psi decreasing to FFP of 328 psi, SI 548 psi, FHP 916 psi. The temperature at 1679' was 55°F, a reported from the field.

Recovery: Gas too small to measure, fluid not measured, 6 gallons o slightly gas-cut mud in collars above tester valve, one gallon in su below tester valve.

After drilling to 2096', Core No. 1 was cut from 2096' to 2126' (30 recovered). Core No. 2 was cut from 2126' to 2147' (22' recovered). Th discrepancy in core recovery and drilled depth is due to an error in th driller's depth recorded at the time of coring. Drill-Stem Test No. 2 wa conducted over the interval 2105' to 2147' (Lower Barrow sand) with a 50 psi nitrogen cushion. It is summarized as follows:

Initial Flow Period: Gas to surface in 8 minutes, stabilized surfac flowing pressure of 700 psi on 1/4 inch choke from 15 minutes int[illegible] flowing pressure of

tool closed at 120 minutes; well shut in for 240 minutes. Pressures at 2143' were IHP 1,234 psi, flowing pressure from 688 psi to 892 psi, shut-in pressure 982 psi, and FHP was 1,234 psi. The temperature reported from the field was 60°F.

Recovery: Three gallons of rat-hole fluid from collars below circulation valve.

When the packer was unseated at the conclusion of the test, the hole began taking fluid. Approximately 390 barrels of mud were lost before the well was stabilized.

At 2230', the 8-1/2" hole was logged as follows, prior to running 7" casing: DIL/SP; BHC-Sonic/GR; FDC/CNL/CAL/GR; MLL/PML; HDT-Dipmeter. Sidewall cores were taken, with 44 shot and 42 recovered. The 7" casing was then run to 2212' and cemented with 133 sacks of Class "G" cement with two percent calcium chloride. The blowout-preventer stack was changed out to the 7" casing and pressure tested. The FO at 1258' was opened and the 7" cement job tested to 200 psi on an equivalent gradient of 0.71 psi/ft. The 7" x 9-5/8" annulus was then displaced with Arctic Pack (46 barrels) from 1169' to the surface. The 7" was drilled out to 2203' and tested to 2,000 psi. The shoe was drilled and the formation tested to an equivalent gradient of 0.61 psi/ft.

A 5-5/8" hole was drilled from 2230' to 2382'. Cores were cut as follows: Core No. 3 from 2295' to 2322', recovered 5.5'; Core No. 4, from 2322' to 2345', recovered 23'.

Drill-Stem Test No. 3 was conducted in the interval 2212' to 2322' (Sag River Sandstone) with a 500 psi nitrogen cushion. The test is summarized as follows:

Initial Flow Period: Open tool and bled nitrogen off; gas to surface in 25 minutes at 0 psi; rat-hole mud to surface in 55 minutes at 140 psi FSP on 1/4" surface choke; slightly oil-and gas-cut mud to surface (emulsion) in 65 minutes at 200 psi FSP on a 1/4" choke; well unloading in heads, maximum flowing surface pressure 255 psi on 1/4" choke; well shut in at 88 minutes; initial shut-in 242 minutes; pressures at 2298', IHP 1,292 psi, flow pressure 719 to 798 psi; SIP 1,026 psi; FHP 1,387 psi.

Recovery: Approximately 18 barrels of slightly oil- and gas-cut mud.

NOTE: Charts indicated depleting reservoir, flow pressure at 2298' increased from 719 psi to a maximum of 932 psi, then decreased to 798 psi at shut in. Approximately 92 barrels of mud were lost to the formation during reverse out.

Drill-Stem Test No. 4 was conducted in the interval 2212' to 2345' with a 500 psi nitrogen cushion. It is summarized as follows:

Initial Flow Period: Tool opened with a fair blow, decreasing; gas to surface after 120 minutes, with a decreasingly weak blow and 0 surface pressure; well shut in at 179 minutes; initial shut-in 411 minutes; pressures at 2319', bomb #982, as reported from the field were: IHP 1,395 psi, IFP 623 psi; FFP 1,051 psi; FSIP 1,158 psi; FHP 1,395 psi.

Recovery: Reversed out 24 barrels of gas- and slightly oil-cut mud, 2 gallons of slightly gas- and oil-cut mud from sub under DCIP at 455 psi.

NOTE: Charts indicated partial plugging during flow period.

At 2382', the hole was logged as follows: DLL/SP/GR, BHC-Sonic/GR, FDC/CNL/CAL/GR, MLL/PML, and HDT. After log evaluation, a decision was made to plug back and complete the well in the Lower Barrow sand. Plug No. 1 was set from total depth to 2182' (measured depth), with 54 sacks of Class "G" cement (2% calcium chloride). A CBL/VDL/CCL/GR log was run from 2173' to 1130' to insure cement bond behind the 7" casing and a drillable bridge plug was set at 2162'.

In preparation for completion of the well in the Lower Barrow sand, the 7" casing was displaced with 10.8 ppg jelled calcium-chloride water, drill pipe and collars were laid down, and the 2-7/8" tubing was picked up and stood back. The blowout-preventer stack was changed out to 2-7/8" and tested to 3,000 psi. The perforating lubricator was rigged and tested, and the casing was perforated from 2101' to 2127' with Schlumberger's 4" Hyperjet II tool (four shots per foot).

The 2-7/8" tubing was run and hung at 2127', and the blowout-preventer was removed and replaced with a test tree. The calcium-chloride water in the well was then displaced with nitrogen through the 2-7/8" tubing, vented to the atmosphere, and allowed to flow through the tubing. After rocking several times for cleanup, an initial flow was conducted to establish reasonable four-point rates. A four-point flow test and 33-hour shut-in were performed with bottom-hole pressure recorders in place (see Appendix III for details). Indicated AOF was 6.50 MMCFD with an initial reservoir pressure of 997.8 psia. The well flowed free water in conjunction with the produced gas at a final observed water-to-gas ratio of 0.031 barrels/MCF.

Pressure recorders were pulled, the well was suspended with 11.0 ppg calcium-chloride water in the hole. The test tree was removed and replaced with the blowout-preventer stack prior to pulling the 2-7/8" tubing. A Baker Model K retainer was set at 2048', and the tubing was rehung at 2039'. The tubing back-pressure valve was run, and the blowout-preventer stack was replaced with the wellhead tree. The tree was tested to 3,000 psi and left filled with a 65 percent ethylene glycol solution.

The rig was released April 13, 1978 at 8:00 p.m. Rig-down commenced, and the equipment was moved to South Barrow Well No. 19.

All logs from the South Barrow No. 17 well were recorded on magnetic tape for ease in computer interpretation. The hole was straight. The maximum deviation of 1-1/2° occurred at 1060' in the 12-1/4" hole. The 8-1/2" hole was drilled at 1/4° deviation.

Detailed drilling information, in the form of bit records, mud summary, time breakdown analysis, and casing and cementing reports, is included in the body of this report.

Form 9-331 C
(May 1963)

SUBMIT IN TRIPLICATE*
(Other instructions on reverse side)

Form approved.
Budget Bureau No. 42-R1425.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

NOTICE OF INTENT TO DRILL, DEEPEN, OR PLUG BACK

1a. TYPE OF WORK: DRILL ☒ DEEPEN ☐ PLUG BACK ☐

b. TYPE OF WELL: OIL WELL ☐ GAS WELL ☒ OTHER SINGLE ZONE ☐ MULTIPLE ZONE ☐

2. NAME OF OPERATOR: National Petroleum Reserve in Alaska (through Husky Oil NPR Operations, Inc.)

3. ADDRESS OF OPERATOR: 2525 C Street, Suite 400, Anchorage, AK 99503

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements.*)
At surface: 1625' FNL and 2150' FWL
At proposed prod. zone: Same (straight hole)

5. LEASE DESIGNATION AND SERIAL NO.: N/A

6. IF INDIAN, ALLOTTEE OR TRIBE NAME: N/A

7. UNIT AGREEMENT NAME: N/A

8. FARM OR LEASE NAME: National Petroleum Reserve in AK

9. WELL NO.: So. Barrow Well No. 17 (East Area)

10. FIELD AND POOL, OR WILDCAT: South Barrow Gas Field

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA: Sec 30, T22N, R16W, UM

12. COUNTY OR PARISH: North Slope Borough, AK

13. STATE: AK

14. DISTANCE IN MILES AND DIRECTION FROM NEAREST TOWN OR POST OFFICE*: 11.5 miles southeast of Barrow, Alaska

15. DISTANCE FROM PROPOSED* LOCATION TO NEAREST PROPERTY OR LEASE LINE, FT. (Also to nearest drlg. unit line, if any): 11,600'

16. NO. OF ACRES IN LEASE: 23,680,000

17. NO. OF ACRES ASSIGNED TO THIS WELL: N/A

18. DISTANCE FROM PROPOSED LOCATION* TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR, ON THIS LEASE, FT.: 5,200'

19. PROPOSED DEPTH: 2480'

20. ROTARY OR CABLE TOOLS: Rotary

21. ELEVATIONS (Show whether DF, RT, GR, etc.): Ground = 7'; Pad = 12; KB = 33'

22. APPROX. DATE WORK WILL START*: February 1, 1978

23. PROPOSED CASING AND CEMENTING PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	QUANTITY OF CEMENT
17 1/2"	13 3/8"(Cond.)	72# (S-95)	110' KB	± 100 Sx Permafrost to Surface
12 1/4"	9 5/8"	53.5# (S-95)	1500'	± 1020 Sx Permafrost to Surface
8 1/2"	7"	38# (S-95)	2260'	± 100 Sx Class "G" w/additives from TD to ± 1600'. Second stage: Down squeeze through FO @ ± 1300 w/± 60 sx Permafrost. Arctic Pack 9 5/8" X 7" annulus through FO @ ± 1220' w/± 60 bbls Arctic Pack.

Blowout Preventer Program

From ± 110' KB to ± 1500':
12", 3000 psi, SA Diverter Assembly

From ± 1500' to TD:
12", 3000 psi, SRRA BOP Assembly
w/3000 psi Choke Manifold and Kill Line

See Drilling Program for details.

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ANCHORAGE, ALASKA

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: If proposal is to deepen or plug back, give data on present productive zone and proposed new productive zone. If proposal is to drill or deepen directionally, give pertinent data on subsurface locations and measured and true vertical depths. Give blowout preventer program, if any.

24. SIGNED: Max Brewer TITLE: Chief of Operations DATE: December 15, 1977

(This space for Federal or State office use)
CONFORMS WITH PERTINENT PROVISIONS 30 CFR 221

Rodney A. Smith TITLE: Oil and Gas Supervisor DATE: 2/24/78

CONDITIONS OF CONCURRENCE ATTACHED

*See Instructions On Reverse Side

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUNDRY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir. Use Form 9-331-C for such proposals.)

1. oil well ☐ gas well ☒ other

2. NAME OF OPERATOR National Petroleum Reserve in Alaska (through Husky Oil NPR Operations, Inc.)

3. ADDRESS OF OPERATOR
2525 C Street, Suite 400, Anchorage, AK 99503

4. LOCATION OF WELL (REPORT LOCATION CLEARLY. See space 17 below.)
AT SURFACE: 1625' FNL, 2150' FWL
AT TOP PROD. INTERVAL:
AT TOTAL DEPTH:

5. LEASE
N/A

6. IF INDIAN, ALLOTTEE OR TRIBE NAME
N/A

7. UNIT AGREEMENT NAME
N/A

8. FARM OR LEASE NAME National Petroleum Reserve in Alaska

9. WELL NO.
South Barrow Well No. 17

10. FIELD OR WILDCAT NAME
South Barrow Gas Field

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA
Sec 30, T22N, R16W, UM

12. COUNTY OR PARISH North Slope

13. STATE Alaska

14. API NO.

15. ELEVATIONS (SHOW OF, KDB, AND WD)
33' KB

16. CHECK APPROPRIATE BOX TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

NOTICE OF INTENT TO:		SUBSEQUENT REPORT OF:
TEST WATER SHUT-OFF	☐	☐
FRACTURE TREAT	☐	☐
SHOOT OR ACIDIZE	☐	☐
REPAIR WELL	☐	☐
PULL OR ALTER CASING	☐	☐
MULTIPLE COMPLETE	☐	☐
CHANGE ZONES	☐	☐
ABANDON*	☐	☐
(other) Subsequent Notice of Spud Date		

(NOTE: Report results of multiple completion or zone change on Form 9-330.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)*

This well was spudded at 6:00 AM, March 2, 1978.

Initial hole size was 12 1/4".

Subsurface Safety Valve: Manu. and Type _____ Set @ _____ Ft.

18. I hereby certify that the foregoing is true and correct

SIGNED Max Brewer TITLE Chief of Operations DATE 9 March 78

DISTRICT SUPERVISOR DATE

MAR 1 3 1978

Conforms with pertinent provisions of 30 CFR 221

Instructions on Reverse Side

*See

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUNDRY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir. Use Form 9-331-C for such proposals.)

1. oil well ☐ gas well ☒ other

2. NAME OF OPERATOR National Petroleum Reserve in Alaska (through Husky Oil NPR Operations, Inc.)

3. ADDRESS OF OPERATOR
2525 C Street, Suite 400, Anchorage, AK 99503

4. LOCATION OF WELL (REPORT LOCATION CLEARLY. See space 17 below.)
AT SURFACE:
AT TOP PROD. INTERVAL:
AT TOTAL DEPTH:

5. LEASE
N/A

6. IF INDIAN, ALLOTTEE OR TRIBE NAME
N/A

7. UNIT AGREEMENT NAME
N/A

8. FARM OR LEASE NAME National Petroleum Reserve in Alaska

9. WELL NO.
So. Barrow Well No. 17

10. FIELD OR WILDCAT NAME
South Barrow Gas Field

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA
Sec 30, T22N, R16W, UM

12. COUNTY OR PARISH: North Slope
13. STATE: Alaska

14. API NO.

15. ELEVATIONS (SHOW DF, RT, GR, AND WD)
33' KB

16. CHECK APPROPRIATE BOX TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

NOTICE OF INTENT TO:		SUBSEQUENT REPORT OF:	
TEST WATER SHUT-OFF	☐		☐
FRACTURE TREAT	☐		☐
SHOOT OR ACIDIZE	☐		☐
REPAIR WELL	☐		☐
PULL OR ALTER CASING	☐		☐
MULTIPLE COMPLETE	☐		☐
CHANGE ZONES	☐		☐
ABANDON*	☐		☐

(other) Subsequent report of running and cementing 9 5/8" surface casing.

(NOTE: Report results of multiple completion or zone change on Form 9-330.)

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ANCHORAGE, ALASKA

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)*

Drilled 12 1/4" hole to 1520' and logged. Ran 37 joints of 9 5/8", 53.5 lb/ft, S-95, Buttress casing with the float shoe at 1512' and the duplex float collar at 1471'. Cemented with 1330 sacks of Permafrost cement at 14.7 ppg slurry weight. Full returns throughout job with 14.7 ppg slurry in returns. Cement in place at 5:00 PM on 3/6/78. WOC. Cut off 13 3/8" braden head. Cut off 9 5/8" casing and weld on 10", 3000 psi starter head. Nipple up 12", 3000 psi SRRA BOP stack. Test rams, manifold, and kelly cocks to 3000 psi and Hydril to 1500 psi. Tested 9 5/8" casing to 1500 psi. Drilled out float collar and shoe and 10' of formation. Tested formation to 0.61 psi/ft equivalent gradient with no observed leak off.

Subsurface Safety Valve: Manu. and Type _____ Set @ _____ Ft.

18. I hereby certify that the foregoing is true and correct

SIGNED May S Brewer TITLE Chief of Operations DATE 24 March 78

(This space for Federal or State office use)

Conforms with pertinent provisions of 30 CFR 221.

TITLE DISTRICT SUPERVISOR DATE 3/30/78

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUNDRY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir. Use Form 9–331–C for such proposals.)

1. oil well ☐ gas well ☒ other

2. NAME OF OPERATOR National Petroleum Reserve in Alaska (through Husky Oil NPR Operations, Inc.)

3. ADDRESS OF OPERATOR
2525 C Street, Suite 400, Anchorage, AK 99503

4. LOCATION OF WELL (REPORT LOCATION CLEARLY. See space 17 below.)
AT SURFACE: 1625' FNL; 2150' FWL
AT TOP PROD. INTERVAL:
AT TOTAL DEPTH:

5. LEASE
N/A

6. IF INDIAN, ALLOTTEE OR TRIBE NAME
N/A

7. UNIT AGREEMENT NAME
N/A

8. FARM OR LEASE NAME
National Petroleum Reserve in Alaska

9. WELL NO.
South Barrow Well No. 17

10. FIELD OR WILDCAT NAME
South Barrow Gas Field

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA
Sec 30, T22N, R16W, UM

12. COUNTY OR PARISH
North Slope

13. STATE
Alaska

14. API NO.

15. ELEVATIONS (SHOW DF, KDB, AND WD)
33' KB

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U.S. GEOLOGICAL SURVEY

16. CHECK APPROPRIATE BOX TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

NOTICE OF INTENT TO:		SUBSEQUENT REPORT OF:	
TEST WATER SHUT-OFF	☐		☐
FRACTURE TREAT	☐		☐
SHOOT OR ACIDIZE	☐		☐
REPAIR WELL	☐		☐
PULL OR ALTER CASING	☐		☐
MULTIPLE COMPLETE	☐		☐
CHANGE ZONES	☐		☐
ABANDON*	☐		☐
(other)	Subsequent Report of Running and Cementing 7" Casing		

(NOTE: Report results of multiple completion or zone change on Form 9–330.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)*

An 8 1/2" hole was drilled to 2230'. Ran 55 joints of 7", 38 lb/ft, S-95, Buttress casing with the float shoe @ 2212', duplex float collar @ 2172', lower FO @ 1258', and upper FO @ 1169'. Centralizers were run as per the original well plan. Pumped 15 barrels of water containing 2% CLA-STA. Mixed and pumped 133 sacks of Class G cement with 2% calcium chloride through drill pipe using duplex cementing technique. Cement in place at 4:30 AM on 3/21/78. Checked floats, o.k. Full returns throughou job. Opened lower FO and circulate. Close FO and landed casing. Installed tubing head and tested flange to 3000 psi. Nipple up 12", 3000 psi SRRA BOP system and tested rams, choke, and kelly cocks to 3000 psi and Hydril to 1500 psi. Opened FO @ 1258' and tested annulus to 200 psi with no bleed-off. Closed lower FO and opened FO @ 1169'. Pumped 88 barrel water wash followed by 46 barrels of 10.6 ppg Arctic Pack. Good job throughout with retort on final pack returns indicating only 1%

(See attached for continuation)

Subsurface Safety Valve: Manu. and Type _____ Set @ _____ Ft

18. I hereby certify that the foregoing is true and correct

SIGNED May Drewes TITLE Chief of Operations DATE 6 April 78

(This space for Federal or State office use)

Conforms with pertinent provisions of 30 CFR 222.

TITLE DISTRICT SUPERVISOR DATE April 10 1978

*See Instructions on Reverse Side

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ANCHORAGE, ALASKA

Subsequent Report of Running and Cementing 7" Casing
South Barrow Well No. 17
Continued

excess water. Arctic Pack in place at 11:50 PM on 3/26/78. Closed FO and pressure tested to 2000 psi o.k. Drilled cement and float collar. Tested casing to 2000 psi. Drilled out to 2240' and tested formation to 0.61 psi/ft equivalent gradient. Drilled ahead with 5 5/8" bit.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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ANCHORAGE, ALASKA

SUNDRY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir. Use Form 9-331-C for such proposals.)

1. oil well ☐ gas well ☒ other

2. NAME OF OPERATOR: National Petroleum Reserve in Alaska (through Husky Oil NPR Operations, Inc.)

3. ADDRESS OF OPERATOR: 2525 C Street, Suite 400, Anchorage, AK 99503

4. LOCATION OF WELL (REPORT LOCATION CLEARLY. See space 17 below.)
AT SURFACE: 1625' FNL; 2150' FWL
AT TOP PROD. INTERVAL:
AT TOTAL DEPTH:

5. LEASE: N/A

6. IF INDIAN, ALLOTTEE OR TRIBE NAME: N/A

7. UNIT AGREEMENT NAME: N/A

8. FARM OR LEASE NAME: National Petroleum Reserve in Alaska

9. WELL NO.: South Barrow Well No. 17

10. FIELD OR WILDCAT NAME: South Barrow Gas Field

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA: Sec 30, T22N, R15W, UM

12. COUNTY OR PARISH: North Slope

13. STATE: Alaska

14. API NO.

15. ELEVATIONS (SHOW DF, KDB, AND WD): 33' KB

16. CHECK APPROPRIATE BOX TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

NOTICE OF INTENT TO:		SUBSEQUENT REPORT OF:	
TEST WATER SHUT-OFF	☐		☐
FRACTURE TREAT	☐		☐
SHOOT OR ACIDIZE	☐		☐
REPAIR WELL	☐		☐
PULL OR ALTER CASING	☐		☐
MULTIPLE COMPLETE	☐		☐
CHANGE ZONES	☐		☐
ABANDON*	☐		☐
(other) Notice of Intent to Plug Back and Production Test			

(NOTE: Report results of multiple completion or zone change on Form 9-330.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)*

This well has been drilled to 2382' and logs run over the open hole interval. From core, DST, and log data, the Sag River Sand interval has been evaluated in this well. The operator plans to set an open hole Class G cement plug (w/2% $CaCl_2$) from TD at 2382' to ± 2180' (32' inside 7" casing). A cement retainer will be set at ± 2165' to provide a secondary seal from the Sag River. The Barrow Sand will be perforated and tested for production evaluation.

Subsurface Safety Valve: Manu. and Type _____ Set @ _____ Ft

18. I hereby certify that the foregoing is true and correct

SIGNED Max Brewer TITLE Chief of Operation DATE 6 April 78

(This space for Federal or State office use)

Conforms with pertinent provisions of 30 CFR 222.

APPROVED BY [illegible] TITLE DISTRICT SUPERVISOR DATE April 10 1978

*See Instructions on Reverse Side

Amended February 22, 1983

Form 9-330
(Rev. 5-68)

Form approved.
Budget Bureau No. 42-R355.5.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMIT IN DUPLICATE* (See other instructions on reverse side)

WELL COMPLETION OR RECOMPLETION REPORT AND LOG*

1a. TYPE OF WELL: OIL WELL ☐ GAS WELL ☒ DRY ☐ Other

b. TYPE OF COMPLETION: NEW WELL ☒ WORK OVER ☐ DEEP-EN ☐ PLUG BACK ☐ DIFF. RESVR. ☐ Other Suspended

2. NAME OF OPERATOR National Petroleum Reserve in Alaska (through Husky Oil NPR Operations, Inc.

3. ADDRESS OF OPERATOR 2525 C Street, Suite 400, Anchorage, AK 99503

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements)*
At surface 1625' FNL; 2150' FWL
At top prod. interval reported below (Straight Hole)
At total depth (Straight Hole)

5. LEASE DESIGNATION AND SERIAL NO. N/A

6. IF INDIAN, ALLOTTEE OR TRIBE NAME N/A

7. UNIT AGREEMENT NAME N/A

8. FARM OR LEASE NAME National Petroleum Reserve in Alaska

9. WELL NO. South Barrow Well No. 17

10. FIELD AND POOL, OR WILDCAT South Barrow Gas Field

11. SEC., T., R., M., OR BLOCK AND SURVEY OR AREA Sec. 30, T22N, R16W, UM

14. PERMIT NO.	DATE ISSUED	12. COUNTY OR PARISH	13. STATE
N/A	N/A	North Slope	Alaska

15. DATE SPUDDED	16. DATE T.D. REACHED	17. DATE ~~COMPL.~~ (Ready to prod.)	18. ELEVATIONS (DF, RKB, RT, GR, ETC.)*	19. ELEV. CASINGHEAD
3/2/78	4/2/78	Suspended 4/13/78	33' KB	15'

20. TOTAL DEPTH, MD & TVD	21. PLUG, BACK T.D., MD & TVD	22. IF MULTIPLE COMPL., HOW MANY*	23. INTERVALS DRILLED BY	ROTARY TOOLS	CABLE TOOLS
2382' MD & TVD	2162' MD & TVD	N/A	→	Rotary	

24. PRODUCING INTERVAL(S), OF THIS COMPLETION—TOP, BOTTOM, NAME (MD AND TVD)*
2101' to 2127' MD & TVD Barrow Sand

25. WAS DIRECTIONAL SURVEY MADE: No

26. TYPE ELECTRIC AND OTHER LOGS RUN
DIL-SP, BHC Sonic-GR, FDC, FDC-CNL, MLL-ML, HRD, Velocity

27. WAS WELL CORED: Yes

28. CASING RECORD (Report all strings set in well)

CASING SIZE	WEIGHT, LB./FT.	DEPTH SET (MD)	HOLE SIZE	CEMENTING RECORD	AMOUNT PULLED
13-3/8"	72# (S-95)	80' MD	17-1/2"	250 Sx Permafrost	None
~~9-5/8"~~	~~53.5# (S-95)~~	~~1512' MD~~	~~12-1/4"~~	~~1330 Sx Permafrost~~	None
7"	38# (S-95)	2212' MD	8-1/2"	133 Sx Class G + 2% $CaCl_2$	None

29. LINER RECORD

SIZE	TOP (MD)	BOTTOM (MD)	SACKS CEMENT*	SCREEN (MD)
None				

30. TUBING RECORD

SIZE	DEPTH SET (MD)	PACKER SET (MD)
2-7/8"	2039'	None

31. PERFORATION RECORD (Interval, size and number)
2101'-2127' MD
4" Hyperjet II
4 Shots Per Foot

32. ACID, SHOT, FRACTURE, CEMENT SQUEEZE, ETC.

DEPTH INTERVAL (MD)	AMOUNT AND KIND OF MATERIAL USED
2382'-2162' MD	54 Sx Class G + 2% $CaCl_2$ Open Hole Plug Back

33.* PRODUCTION

DATE FIRST PRODUCTION	PRODUCTION METHOD (Flowing, gas lift, pumping—size and type of pump)	WELL STATUS (Producing or shut-in)
4/7/78	Flowing	Shut-in

DATE OF TEST	HOURS TESTED	CHOKE SIZE	PROD'N. FOR TEST PERIOD →	OIL—BBL.	GAS—MCF.	WATER—BBL.	GAS-OIL RATIO
4/7/78	43 1/3	32/64		None	8283	254	None

FLOW. TUBING PRESS.	CASING PRESSURE	CALCULATED ~~24-HOUR RATE~~ →	OIL—BBL.	GAS—MCF.	WATER—BBL.	OIL GRAVITY-API (CORR.)
477.7 PSIA				6500		

34. DISPOSITION OF GAS (Sold, used for fuel, vented, etc.)
Vented

TEST WITNESSED BY

35. LIST OF ATTACHMENTS
Four Point Test Data

36. I hereby certify that the foregoing and attached information is complete and correct as determined from all available records

SIGNED [signature] TITLE Chief of Operations, ONPRA DATE

*(See Instructions and Spaces for Additional Data on Reverse Side)

INSTRUCTIONS

General: This form is designed for submitting a complete and correct well completion report and log on all types of lands and leases to either a Federal agency or a State agency, or both, pursuant to applicable Federal and/or State laws and regulations. Any necessary special instructions concerning the use of this form and the number of copies to be submitted, particularly with regard to local, area, or regional procedures and practices, either are shown below or will be issued by, or may be obtained from, the local Federal and/or State office. See instructions on items 22 and 24, and 33, below regarding separate reports for separate completions.

If not filed prior to the time this summary record is submitted, copies of all currently available logs (drillers, geologists, sample and core analysis, all types electric, etc.), formation and pressure tests, and directional surveys, should be attached hereto, to the extent required by applicable Federal and/or State laws and regulations. All attachments should be listed on this form, see item 35.

Item 4: If there are no applicable State requirements, locations on Federal or Indian land should be described in accordance with Federal requirements. Consult local State or Federal office for specific instructions.

Item 18: Indicate which elevation is used as reference (where not otherwise shown) for depth measurements given in other spaces on this form and in any attachments.

Items 22 and 24: If this well is completed for separate production from more than one interval zone (multiple completion), so state in item 22, and in item 24 show the producing interval, or intervals, top(s), bottom(s) and name(s) (if any) for only the interval reported in item 33. Submit a separate report (page) on this form, adequately identified, for each additional interval to be separately produced, showing the additional data pertinent to such interval.

Item 29: "Sacks Cement": Attached supplemental records for this well should show the details of any multiple stage cementing and the location of the cementing tool.

Item 33: Submit a separate completion report on this form for each interval to be separately produced. (See instruction for items 22 and 24 above.)

37. SUMMARY OF POROUS ZONES:

SHOW ALL IMPORTANT ZONES OF POROSITY AND CONTENTS THEREOF; CORED INTERVALS; AND ALL DRILL-STEM TESTS, INCLUDING DEPTH INTERVAL TESTED, CUSHION USED, TIME TOOL OPEN, FLOWING AND SHUT-IN PRESSURES, AND RECOVERIES

FORMATION	TOP	BOTTOM	DESCRIPTION, CONTENTS, ETC.
"Pebble Shale" (Cretaceous)	1408'	1748'	SS: thin interbedded stringers in the "Pebble Shale"; tan to salt and pepper, very fine- fine grained, well sorted, well rounded, friable, becoming poorly sorted and highly argillaceous in p[art]; fair oil staining and yellow sample fluorescence. Net sand thickness: 2[0] feet. DST No. 1 (1512-1715') - 1/4" choke, 500 psi nitrogen cushion, tool open 1[hr] minutes, gas to surface in 90 minutes, FWHP too small to measure, rate too small to measure, bottom hole flowing press[ure] as reported from the field were: IFP 666 psi, FFP 323 psi, FSIP 537 psi, recovered [no] drilling fluid.
Lower Barrow sand	2102'	2127'	SS: brown, fine-grained, friable, clean, well sorted, well rounded, fair to good visible porosity, even yellow sample fluorescence. Net sand thickness: [20]' average porosity: 24.8%, average SW: 32-56%.

38. GEOLOGIC MARKERS

NAME	TOP MEAS. DEPTH	TOP TRUE VERT. DEPTH
"Pebble Shale"	1408'	
Lower Barrow sand	2102'	
Sag River Sandstone	2277'	
Argillite	2345'	

871-233

U.S. GOVERNMENT PRINTING OFFICE: 19[xx]

Continuation of Item 37:

Formation	Top	Bottom	Description, Contents, Etc.
			Core No. 1: 2096-2126'. Cut 30 feet, recovered 30 feet. Core No. 2: 2126-2147'. Cut 22 feet, recovered 22 feet. DST No. 2: 2105-2147'. 1/4" choke, 500 psi nitrogen cushion, open 120 minutes, 1.09 MMCFD gas on 1/4" choke at 700 psi FWHP. Production Test No. 1: 2101-2127' (4 perforations per foot through 7" casing), 2-7/8" test tubing, 3/4" choke, average flow rate 5.9-6.0 MMCFD at 490-510 psi with 4.5 BWPH; CAOF 7.2 MMCFD with 200 BWPD.
Sag River Sandstone	2277'	2345'	SS: brown, very fine grained, argillaceous, silty, friable, calcareous, fossiliferous (fine fragments of pelecypods and echinoid shells), grading in places to a fossil hash, glauconite common; dark brown oil stain tea cut, orange-gold sample fluorescence; net sand thickness 17', average porosity 16%, average Sw 50%. Core No. 3: 2295-2322'. Cut 27 feet, recovered 5.5 feet. Core No. 4: 2322-2345'. Cut 23 feet, recovered 23 feet. DST No. 3: 2212-2322': 1/4" choke, 500 psi nitrogen cushion, tool open 88 minutes, gas to surface in 25 minutes, slightly oil- and gas-cut emulsified mud to surface in 65 minutes. Bottom hole pressures as reported from the field were: IFP 602 psi, peak FP 915 psi, FFP 794 psi, FSIP 1029 psi. DST No. 4: 2212-2345'. 1/4" choke, 500 psi nitrogen cushion, tool open 179 minutes; gas to surface in 120 minutes, rate and pressure too small to measure, reversed out 24 bbls. gas- and slightly oil-cut mud. Bottom hole pressures: IHP 1395 psi; IFP 623 psi; FFP 1051 psi; FSIP 1158 psi; FHP 1395 psi. * NOTE: There is a recovery discrepancy due to difference in driller's depth and core recovery.

RECEIVED
ONSHORE DIST. OFFIC
JUL 12 1978
CONSERVATION DIVISIC
U. S. GEOLOGICAL SURV.
ANCHORAGE, ALASKA

ATTACHMENT I

Four Point Flow Test - 4/11/78

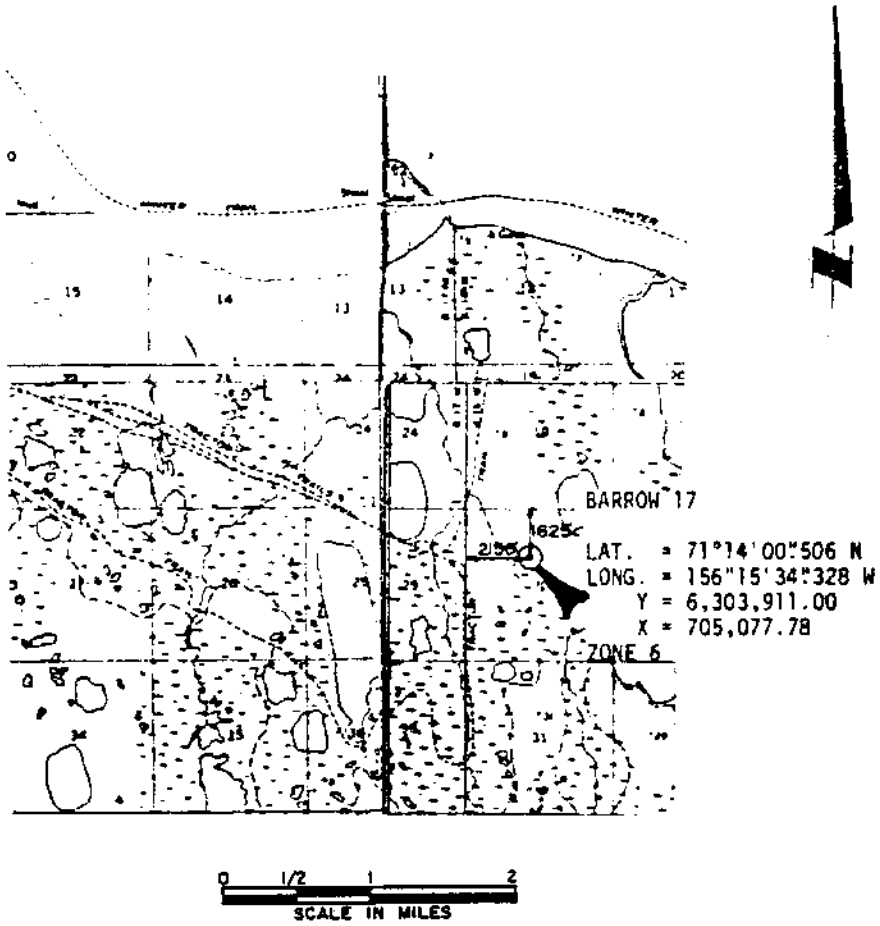
Initial Reservoir Pressure = 998.7 psia

	Choke	Pressure	Flow Rate	P2
1.	24/64	865.4 psia	2.89 M^2/d	246687.68
2.	32/64	721.3 psia	4.13 M^2/d	475331.15
3.	40/64	613.3 psia	4.70 M^2/d	619467.95
4.	48/64	477.7 psia	5.56 M^2/d	767407.55

AOF = 6.50 M^2/d

n = 0.615

c = .0013307297 $M^2/d/psia$



CERTIFICATE OF SURVEYOR

I hereby certify that I am properly registered and licensed to practice land surveying in the State of Alaska and that this plat represents a location survey made by me or under my supervision, and that all dimensions and other details are correct.

August 17, 1977

STATE OF ALASKA
No. 953-S

AS STAKED

BARROW 17

LOCATED IN

NW 1/4 PROTRACTED SEC 30 T 22 N, R 16 W UMIAT MERIDIAN, AK

Surveyed for

HUSKY OIL

N.P.R. OPERATIONS INC.

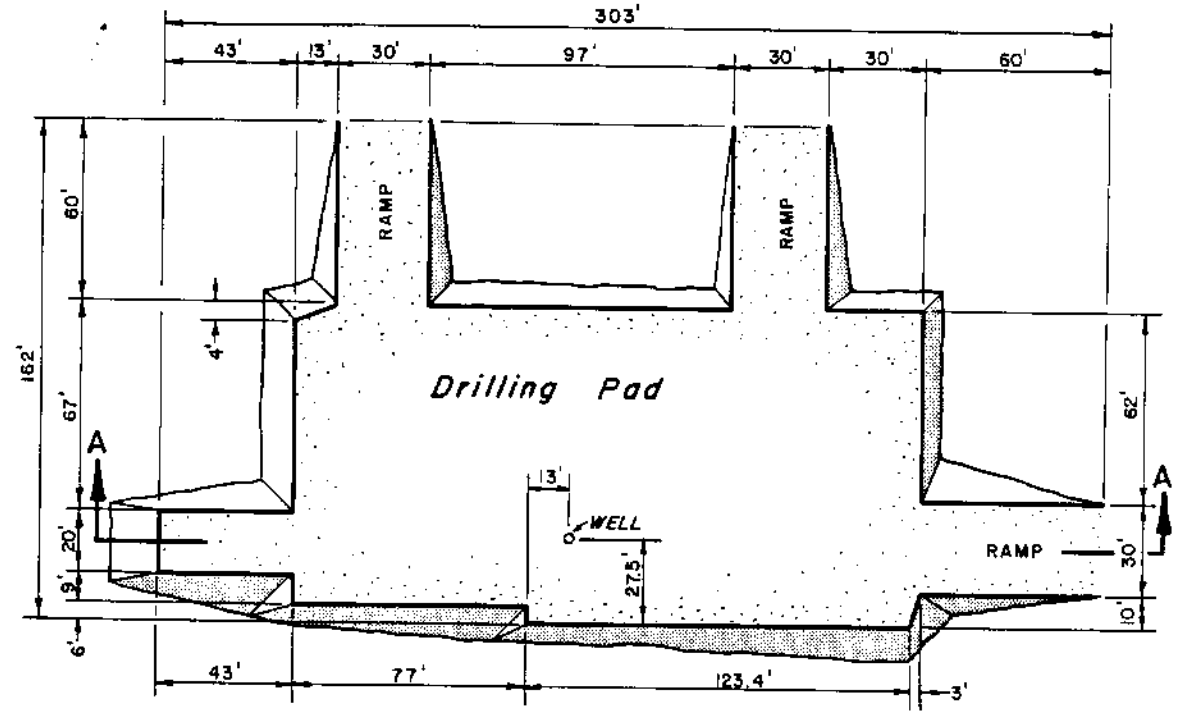
Surveyed by

Bell, Herring and Associates

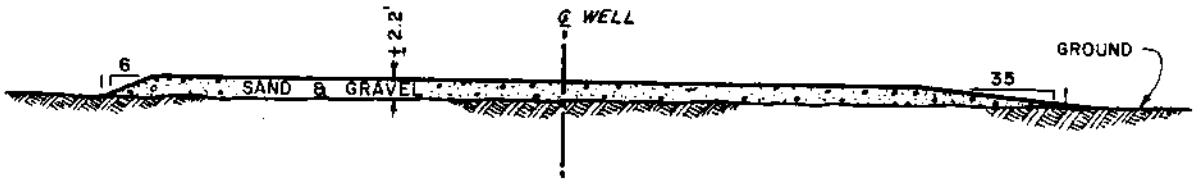
ENGINEERS AND LAND SURVEYORS

801 West Fireweed, Suite 102

ANCHORAGE, ALASKA 99503



PLAN VIEW



SECTION A-A

SOUTH BARROW No. 17 DRILL PAD

OPERATIONS HISTORY

DATE AND FOOTAGE DRILLED AS OF 6:00 A.M.	ACTIVITY
2/19/78	Preparing location for rig. Worked on ice pad for camp.
2/20/78	Cleaned out cellar. Thawed and cleaned around subbase. Set drilling line on floor. Removed hot air ducts. Broke out steam lines.
2/21/78	Drained rig water tank. Skidded rig off hole at South Barrow Well No. 16. Moved pump room, boilers, and light plant.
2/22/78	Skidded rig from No. 16 pad to No. 17 pad. Laid matting boards on visqueen. Rigged up and started small generator.
2/23/78	Set drill rig over well. Started rigging up fuel and steam lines. Hooked up lights to rig. Put spreader in subbase. Hooked up hot air to subbase.
2/24/78	Set fuel tank and laid line to rig. Set Halliburton unit and tanks. Hooked up Koomey and air lines. Worked on water and steam lines.
2/25/78	Installed steam lines from boiler to pump shed. Ran water lines to mud tanks. Set in front wind walls. Set slide and catwalk.
2/26/78	Hooked up flow line and trip tank. Picked up kelly and set rat hole. Realigned mud tanks on skid and pump shed with subbase. Worked on cementing unit. Cut drilling line. Worked on steam and mud tank heaters. Moving camp.
2/27/78	Completed moving camp. Rigged up same. Worked on water and sewer lines.
2/28/78	Finished camp rig-up. Cemented 13-3/8" conductor with 250 sacks of Permafrost cement. Cement in place 2/27/78 at 7:00 p.m. Mixed spud mud and waited on cement.
3/1/78	Cut off 13-3/8" casing. Dressed, cut and installed starter head. Welded on same. Tested kelly cock, manifold, and spud line. Nippled up blowout-preventer.

3/2/78	Tested 13-3/8" head to 750 psi. Nippled up annular blowout-preventer and diverter system. Tested blowout-preventer to 250 psi. Picked up bottom-hole assembly. Circulated at 60'; lost 1 to 2 barrels mud per minute while circulating. Annulus stayed full when not circulating. Spudded well March 2, 1978, at 6:00 a.m.
3/3/78 355'	Total Depth: 435'; Mud Weight: 8.8; Viscosity: 35. Worked on pumps and pump motor. Drilled ahead.
3/4/78 629'	TD: 1064'; MW: 9.4; Vis: 34. Drilled to 1064'. Repaired air compressor motor. Tripped for bit. Worked on air compressor.
3/5/78 456'	TD: 1520'; MW: 9.6; Vis: 41. Repaired compressor motor. Tripped in. Drilled to 1520'; circulated to log. Rigged up to log. Ran DIL/SP to 1089'. Would not go below 1089'. Logged to surface.
3/6/78 0'	TD: 1520'; MW: 9.6; Vis: 41. Rigged down Schlumberger. Tripped in to condition hole. Repaired air compressor. Rigged up and ran DIL/SP and BHC-Sonic/GR logs. Tripped in to condition for casing. Rigged up and ran 9-5/8" casing.
3/7/78 0'	TD: 1520'. Ran 37 joints of 9-5/8", 53.5#, S-95, BTC casing. Shoe at 1512' KB. Tripped in with stinger. Conditioned hole for cement. Cemented casing with 1,330 sacks of Permafrost cement. Pumped 20 barrels of water ahead and 2 barrels of water behind. Mixed 14.7 ppg cement at 6 BPM. Displaced with 10.9 barrels of mud. Final returns were 14.7 ppg. Cement in place March 6, 1978, at 5:00 p.m. Tripped out with stinger. Drained stack. Nippled down. Cleaned mud tanks and mixed mud.
3/8/78 0'	TD: 1520'; MW: 10.2; Vis: 45. Finished waiting on cement. Cut off 9-5/8" casing. Removed blowout-preventer stack. Cut off 13-3/8" casing head. Waited for weld to cool. Tested weld to 1,000 psi.
3/9/78 0'	TD: 1520'; MW: 10.2; Vis: 45. Nippled up blowout-preventer stack. Tested rams, choke manifold, kill line, and kelly cocks to 3,000 psi. Tested Hydril to 1,500 psi. Installed wear bushing. Tripped in.
3/10/78 195'	TD: 1715'; MW: 10.4; Vis: 42. Thawed and changed out kelly. Drilled float collar and cleaned out to shoe. Tested casing to 1,500 psi. Drilled shoe

and 10 feet of formation. Tested formation to 0.61 psi/ft. (11.7 ppg). Drilled to 1715' and conditioned mud. Short trip--four stands; tight hole. Conditioned and made short trip again. Conditioned mud and tripped out.

3/11/78
0'

TD: 1715'; MW: 10.4; Vis: 41. Tripped in with drill-stem test tools for Drill-Stem Test No. 1: 1512-1715'. Tested surface lines to 1,500 psi. Pressured drill pipe with 500 psi nitrogen. Set packer at 1476'. Opened tool 3/10/78 at 2:00 p.m. Tool open 2-1/2 hours, shut in 5 hours and 20 minutes. Pressures reported from the field were as follows: IHP: 922 psi; IFP: 666 psi; FFP: 323 psi; FSIP: 537 psi. Pulled packer loose at 9:30 p.m. Dropped bar and circulated out. Tripped out and laid down drill-stem test tools.

3/12/78
265'

TD: 1980'; MW: 10.9; Vis: 55. Tripped in with bit. Cleaned out 20 feet of fill. Drilled ahead. Lost ±30 barrels of mud at 1800'.

3/13/78
121'

TD: 2101'; MW: 10.9; Vis: 50. Tripped out for bit. Started swabbing four stands off bottom, pulled four more stands. Tripped back to bottom. Circulated and tripped out. Drilled 8-1/2" hole to 2096'. Made six-stand wiper trip. Circulated and conditioned mud. Tripped out for core barrel.

3/14/78
51'

TD: 2147'; MW: 10.9; Vis: 45. Cut Core No. 1: 2096-2126'. Tripped out and recovered 30 feet. Tripped in and cut Core No. 2: 2126-2147'. Tripped out and recovered 22 feet (excess recovery resulted from discrepancy in driller's depth). Reamed core hole. Tripped out and picked up drill-stem test tools for Drill-Stem Test No. 2.

3/15/78
0'

TD: 2147'; MW: 10.9; Vis: 44. Ran in hole with drill-stem test string, picked up test head, tested line to 1,500 psi. Nitrogen cushion leaking from pipe. Pulled out of hole, laid down 4, 5 and 6 joints and cemented valve in place. Ran back in hole with drill-stem test tools, set top packer at 2097', tested line to 1,500 psi. Added nitrogen cushion at 500 psi. Opened tool at 5:50 a.m. Had 610 psi on 1/4" choke.

3/16/78
0'

TD: 2147'; MW: 10.8; Vis: 45. Ran Drill-Stem Test No. 2: 2105-2147'. Tool open two hours; gas to surface in 8 minutes; 700 psi through 1/4" choke. Tool shut in four hours. Dropped bar; unable to circulate. Pulled four stands; hole did not flow. Pulled seven more stands; bottom tools at 1465', circulating sub at 1315'; hole taking fluid. Added lost-circulation material; circulated with full returns.

3/17/78 0'	TD: 2147'; MW: 10.9; Vis: 41. Tripped out with drill-stem test tools. Tested blowout-preventer equipment rams to 3,000 psi, Hydril to 1,500 psi. Tripped in with bit. Clutch on No. 2 motor went out. Tripped out to casing shoe. Changed clutch. Tripped in.
3/18/78 83'	TD: 2230'; MW: 10.8; Vis: 43. Drilled to 2230'. Made short trip. Reamed 90 feet to bottom. Circulated, surveyed, and tripped out to log. Ran DLL-SP and BHC-Sonic/GR.
3/19/78 0'	TD: 2230'; MW: 10.8; Vis: 41. Ran FDC/CNL/GR, MLL, HRD: 2222-1515'. Shot 44 sidewall cores; recovered 42. Dropped end of water hose (1" cascade valve, bushing, and 8" nipple) in hole. Cut drilling line. Tripped in hole, hit bridge at 2215'. Had 4 feet of fill in hole. Circulated and conditioned mud for casing. Pulled 12 stands; ran back to bottom; circulated. Pulled out of hole to run 7" casing.
3/20/78 0'	TD: 2230'; MW: 10.4; Vis: 42. Tripped out, laid down 6-1/4" drill collars. Picked up sixteen 4-3/4" drill collars. Rigged up to run casing. Changed to 7" rams. Ran 55 joints of 7" casing to 2222'. Shoe top at 2220.15'; duplex float collar at 2180.74'; FO top at 1178.08'; lower FO top at 1267.57'.
3/21/78 0'	TD: 2230'; MW: 10; Vis: 42. Circulated. Tripped in with duplex stinger, FO closing fingers, and RTTS. Packer set at 210'. Tripped out to redress RTTS. Tripped in to duplex collar at 2172'. Set stinger, circulated. Pumped 15 barrels of water with 2% Cla-Sta. Cemented with 133 sacks of Class "G" with 2% calcium chloride to mix water. Displaced to duplex collar. Pulled stinger floats. Cement in place at 4:30 a.m. Tripped out. Corrected depths: shoe at 2212'; duplex collar at 2172'; lower FO at 1258'; upper FO at 1169'.
3/22/78 0'	TD: 2230'; MW: 10.8; Vis: 45. Opened FO at 1258', circulated 5 hours. Tripped out, picked up blowout-preventer stack. Set OCT casing slips with 70,000 pounds casing weight. Cut 7" casing, installed tubing head and tested to 3,000 psi. Nippling up blowout-preventer stack.
23/78	TD: 2230'; MW: 10.8; Vis: 45. Nippled up blowout-preventer. Tested blind rams to 3,000 psi. Test plug moved down in head with 900 psi. Sheared hold-down screws. Picked up blowout-preventer

stack. Plug stuck in tubing hanger. Removed tubing head and installed new head and pack off. Tested to 3,000 psi. Nippled up blowout-preventer stack.

3/24/78
0'

TD: 2230'; MW: 10.8; Vis: 45. Nippled up blowout-preventer. Changed kelly. Tested pipe rams; test failed. Changed out ring basket below rams. Hydril test failed. Changed Hydril rubber. Changed 3-1/2" pipe-ram rubbers.

3/25/78
1/0'

TD: 2230'; MW: 10.5; Vis: 45. Tested blowout-preventer. New Hydril rubber blew out while testing. Replaced rubber, pipe rams, and blind rams. Tested lower kelly cock. Tested mud lines to pump. Repaired leaks.

3/26/78
0'

TD: 2230'; MW: 10.9; Vis: 38. Tested mud line, kelly hose stand pipe to 3,000 psi. Tested rams to 3,000 psi and Hydril to 1,500 psi. Picked up RTTS and FO fingers and tripped in. Hit bridge at 85'. Picked up bit and ran in to 2171'. Circulated out pieces of rubber.

3/27/78
0'

TD: 2230'; MW: 10.7; Vis: 38. Circulated and tripped out. Picked up RTTS and FO fingers. Tripped in and opened upper FO at 1168'. Closed rams and circulated. Closed FO and tested. Opened lower FO at 1258'. Attempted to pump in. Tested cement to 200 psi with no bleed-off. Closed FO and tested. Opened upper FO and water washed 9-5/8" x 7" annulus. Placed 46 barrels of Arctic Pack in 9-5/8" x 7" annulus. Closed FO and tested. Cleaned mud tanks and built mud volume.

3/28/78
33'

TD: 2263'; MW: 10.8; Vis: 44. Built mud volume. Tripped in to cement top at 2166'. Drilled float collar and cement to 2203'. Tested casing to 2,000 psi. Tripped out. Ran 7" casing scraper and reamed cement from 2166' to 2203'. Circulated and tripped out. Tripped in with bit and junk basket. Drilled 7 feet of cement and shoe at 2212'. Drilled past junk to 2240'. Tested formation to 0.61 psi/ft. gradient. Drilled from 2240' to 2263'.

3/29/78
59'

TD: 2322'; MW: 10.9; Vis: 44. Drilled to 2294'. Tripped for core barrel. Cut Core No. 3: 2294-2322' (reported as 2295-2322' on geologist's core report). Recovered 5-1/2 feet. Tripped in with drill-stem test tools for Drill-Stem Test No. 3: 2212-2322'. Installed control head. Tested lines to 1,500 psi. Placed 500 psi nitrogen cushion in drill pipe. Opened tool at 4:40 a.m. Nitrogen pressure bled to 0 psi pressure.

	Pressure increased to 20 psi at 5:25 a.m. Mud to surface at 5:35 a.m., 140 psi. Slightly oil-cut mud to surface at 5:45 a.m., 200 psi. Shut in at 6:10 a.m., 255 psi. Surface choke 1/4". Bottom choke 1/2". Packer set in 7" casing at 2200'.
3/30/78 0'	TD: 2322'; MW: 10.9; Vis: 44. Closed test tool. Pulled packer loose. Reversed out 18 barrels of slightly oil-cut mud. Circulated through choke and conditioned mud. Tripped out. Laid down test tools and recovered samples. Filled choke manifold with diesel. Tripped in and washed 40 feet to bottom. Reamed core hole. Circulated and conditioned mud. Tripped for core barrel. Tripped in with core barrel. Circulated and dropped ball.
3/31/78 23'	TD: 2345'; MW: 10.9; Vis: 42. Cut Core No. 4: 2322-2345'. Tripped out and laid down core. Recovered 23 feet. Tripped in with bit and reamed core hole. Conditioned mud and tripped out. Picked up drill-stem test tools and tripped in for Drill-Stem Test No. 4: 2212-2345'. Tested manifold and lines to 1,500 psi. Applied 500 psi nitrogen cushion. Set packer at 2195'. Opened tool 3/31/78 at 1:00 a.m. Bled off cushion in 17 minutes. Had moderate blow with gas to surface in two hours. Shut-in at 4:00 a.m.
4/1/78 0'	TD: 2345'; MW: 10.8; Vis: 40. Drill-Stem Test No. 4; closed in until 10:00 a.m. Reversed out 24 barrels of gas and slightly oil-cut mud. Unset packer. Circulated through flow line. Tripped out and laid down test tools. Tested blowout-preventer equipment to 3,000 psi, Hydril to 1,500 psi. Tripped in with bit. Dropped eight drill collars and bit through slips. Picked up fishing tools and tripped in.
4/2/78 37'	TD: 2382'; MW: 10.8; Vis: 40. Tripped in with fishing tools; screwed into fish. Circulated out trip gas. Tripped out with fish. Laid down fishing tools. Tripped in. Cut drilling line. Drilled to 2382'. Conditioned hole; made short trip. Conditioned for logs. Tripped out. Rigged up Schlumberger to log.
4/3/78 0'	TD: 2382'; MW: 10.9; Vis: 44. Ran DLL, FDC/CNL/GR, BHC/GR, MML/ML, and Dipmeter logs. Straightened drilling line. Line came off of drum. Picked up 18 joints of drill pipe and tripped in open ended. Circulated.
4/4/78	TD: 2382'; PBTD: 2180'; MW: 10.7; Vis: 42. Mixed and pumped 38 sacks of Class "G" cement with

2% calcium chloride through open ended drill pipe at 2380'. Cement in place at 7:30 a.m. Pulled out to 2170'. Reversed out approximately two barrels of cement cut mud. Pulled out to 2100'; conditioned mud. Tripped out. Waited on cement. Tripped in with bit and casing scraper. Top of plug at 2240'. Circulated and tripped out. Ran in hole open ended to 2240'. Mixed 16 sacks of Class "G" cement with 2% calcium chloride. Calculated fill to 2180'. Cement in place at 12:15 a.m. Pulled out of hole to 2170'. Reversed out. Tripped out. Tripped in with bit and casing scraper.

4/5/78 TD: 2382'; PBTD: 2190'; MW: 10.7; Vis: 38. Tripped out with bit and casing scraper. Tripped in with Baker Model K retainer, set at 2142'. Tested plug to 2,000 psi. Pulled out of hole. Ran CBL, found plug at 2183'. Tested plug and casing to 2,000 psi. Reran CBL under 500 psi. Strapped in hole; plug at 2190'. Circulated, scraped casing 2140' to 2180'. Tripped out; tripped in with Halliburton EZ drill retainer.

4/6/78 TD: 2382'; PBTD: 2162'; MW: 10.8; Vis: 35. Tripped in. Set retainer at 2162'. Tested casing to 2,000 psi. Set down on plug. Cleaned mud tanks. Mixed 250 barrels of $CaCl_2$ water to 10.8. Circulated to cool water before mixing WG-7. Mixed WG-7. Laid down drill pipe and drill collars.

4/7/78 TD: 2382'; PBTD: 2162'; MW: 10.8; Vis: 34. Finished laying down drill collars and kelly. Changed rams to 2-7/8". Tested blowout-preventer to 3,000 psi; tested lines to 2,000 psi. Picked up 70 joints of tubing and stood back. Rigged up and tested lubricator to 500 psi. Perforated 2101' to 2127', four shots per foot. Ran in hole with mule shoe and 70 joints of tubing; landed at 2127' KB. Set out blowout-preventer stack; installed Christmas tree. Tested flange and hanger seals to 3,000 psi.

4/8/78 TD: 2382'; PBTD: 2162'; MW: 10.8; $CaCl_2$ in pits. Nippled up Christmas tree. Displaced $CaCl_2$ water with nitrogen. Well started flowing at 9:00 p.m. Alternated flow between tubing and annulus until well cleaned up. Rigged up to inject alcohol into tubing. Closed pressure, 850 psi on casing and 800 psi on tubing. Flowed through; 32/64" had 680 psi, 48/64" had 510 psi. Rigged up Sperry Sun to run Hewlett Packard gauge and pressure bombs. Estimated flow rate: 6.0 MMCF. Well making 5 barrels per hour of salt water.

4/9/78 TD: 2382'; PBTD: 2162'; MW: 10.8; $CaCl_2$ in pits. Flowed through 48/64" choke. Average rate: 5.9 to 6.0 MMCF, 490 to 510 psi. Made liquid heads; flow rate: 4.5 barrels per hour. Rigged up and tested Camco lubricator to 1,500 psi. Ran Sperry Sun, Hewlett Packard, and bombs to 2101'. Shut in at 12:00 noon. Final shut in pressure: 901 psi at surface. Bottom hole pressure: 1137 psi. Blew down tubing. Flow through 48/64" choke: 710 psi. Turned well to separator; continued flow for pressure data. Pulled bomb out of hole. Shut in well. Blew down tubing. Injected alcohol into annulus. Rigged down separator lines.

4/10/78 TD: 2382'; PBTD: 2162'; MW: 10.8; $CaCl_2$ in pits. Injected alcohol into annulus while waiting for separator. Rigged up separator. Opened well at 12:00 midnight through 24/64" choke. Surface pressure: 700 psi. Bottom hole pressure: 1,060 psi. Average rate: 3 MMCF. Present rate: 3.2 MMCF on 24/64" choke.

4/11/78 TD: 2382'; PBTD: 2162'; MW: 10.8; $CaCl_2$ in pits. Flowed well 14 hours; shut in 10 hours. Opened well to flow for four-point test 4/10/78 at 6:00 a.m.

4/12/78 TD: 2382'; PBTD: 2162'; MW: 10.8; $CaCl_2$ in pits. Well shut in for pressure build-up survey (28 hours). Well stabilized.

4/13/78 TD: 2382'; PBTD: 2162'; MW: 11.0; $CaCl_2$ in pits. Well shut-in until 11:00 a.m., 4/12/78. Pulled bottom-hole pressure bombs, made gradient stops at 2051', 2001', 1501', 1001', 501', and surface. Set 30 minutes at back stop. Rigged down Camco. Tested kill and choke lines to 3,000 psi. Killed well and circulated. Checked for flow. Ran back-pressure valve and nippled down tree. Nippled up blowout-preventer. Well suspended with 11.0 ppg calcium-chloride water in hole.

4/14/78 PBTD: 2048'. Tested blowout-preventer, choke manifold, and kill lines to 3,000 psi. Tested Hydril to 1,500 psi. Tripped out with tubing. Ran Baker Model K retainer on tubing and set at 2048'. Picked up and hung tubing at 2039.33'. Installed tubing hanger and back-pressure valve. Landed tubing. Removed blowout-preventer and installed tree. Tested flange and seals to 3,000 psi. Filled tree with 65% (by weight) glycol water solution. Cleaned pits. Released rig 4/13/78 at 8:00 p.m. Began rig down.

DRILLING TIME ANALYSIS

SOUTH BARROW WELL NO. 17 (EAST AREA)

BRINKERHOFF SIGNAL, INC., RIG 31

Spudded 3/2/78, Rig released 4/13/78

Total Depth: 2,382 Feet

DATE	RIG UP/RIG DOWN	DRILLING	REAMING	TRIP	DEV. SURVEY	RIG MAINT.	RIG REPAIR	CIRC. & COND. MUD	LOGGING	CASING & CEMENT	W O C	NIPPLE UP/DOWN BOP	TEST BOP	CHANGE BHA	LOST CIRC.	FISHING	CORING	DST	PLUG BACK	SQUEEZE CEMENT	DIR. WORK	W O MAT./EQUIP.	OTHER	Operations at 6:00 a.m.
1978 2-19																						24		Page 1 of 4
2-20																						24		Comments
2-21																						24		
2-22	24																							
2-23	24																							
2-24	24																							
2-25	24																							Preparing Rig for Move
2-26																						24		Preparing Rig for Move
2-27	24																							Moved Rig to Location
2-28											13	11												Began Rigging Up
3-1												14										10		Rigging Up
3-2		8½		2½			7	1½														4½	Drilling	Rigging Up
3-3		22½																				1½	Drilling	Rigging Up
3-4		14½		5½			2½	1¼															Tripping	Moving Rig Camp
3-5		½		7¾			1½	1¾	9¼													3¼	Logging	Rigging Up
																								Preparing to Spud
																								Preparing to Spud
																								Spudded Well at 6:00 a.m.
																								Ran Schlumberger Wire line Logs

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DRILLING TIME ANALYSIS (HOURS) - HUSKY NPR OPERATIONS, INC. SOUTH BARROW WELL NO. 17

DRILLING TIME ANALYSIS (HOURS) - HUSKY NPR OPERATIONS, INC. SOUTH BARROW WELL NO. 17

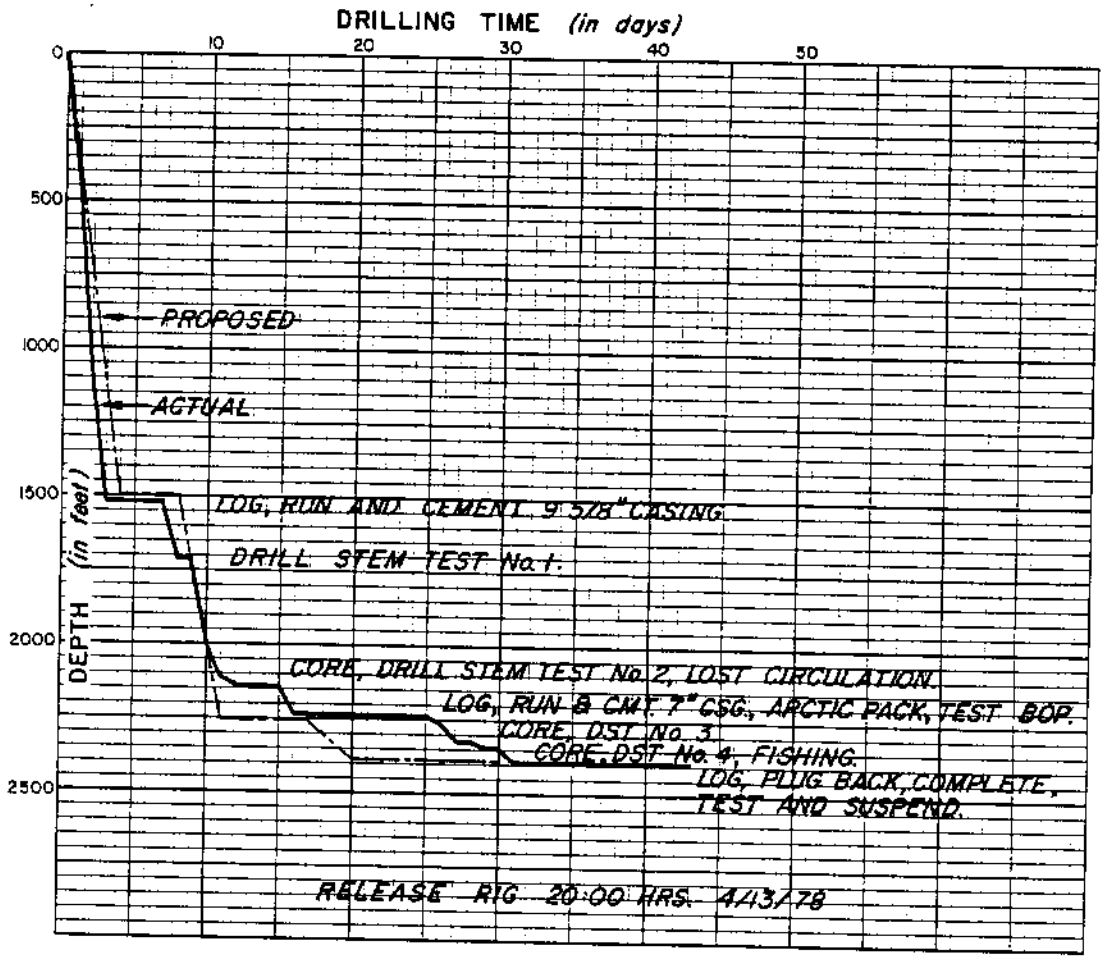
DATE	RIG UP/RIG DOWN	DRILLING	REAMING	TRIP	DEV. SURVEY	RIG MAINT.	RIG REPAIR	CIRC. & COND. MUD	LOGGING	CASING & CEMENT	W O C	NIPPLE UP/DOWN BOP	TEST BOP	CHANGE BHA	LOST CIRC.	FISHING	CORING	DST	PLUG BACK	SQUEEZE CEMENT	DIR. WORK	W O MAT./EQUIP.	OTHER	Operations at 6:00 a.m.	Comments
3-6				8¼				1½		9½		3¾											1¼	Running 9 5/8" Casing	
3-7										3		21												Waiting on Cement	
3-8												16	2½										5½	Cooling Casing Spool	
3-9		6½		3				2½					3¾										8½	Tripping	
3-10				7½				3½										10½					2½	Tripping	DST No. 1
3-11		9¾		7¾	1		3½	2																Tripping	
3-12		11½		9				3½																Drilling	
3-13			3	12½				2½									6¼							Drilling	Core No. 1: 2096' - 2126' Core No. 2: 2126' - 2147'
3-14			¾	12¼				3										6½					1¾	Tripping	
3-15				4				10½										7½					2	Testing	DST No. 2
3-16				6			7	7					2½										1½	Tripping	
3-17		6¼	½	5½	½		5	3	3														¼	Drilling	
3-18			½	2½				2½	17½														1	Logging	Ran Schlumberger Wireline Logs
3-19				4				2		12													6	Laying Down Drill Collars	
3-20				12½				8															3½	Circulating	Ran 7" casing to 2212'

DRILLING TIME ANALYSIS (HOURS) - HUSKY NPR OPERATIONS, INC. SOUTH BARROW WELL NO. 17 Page 3 of 4

DATE	RIG UP/RIG DOWN	DRILLING	REAMING	TRIP	DEV. SURVEY	RIG MAINT.	RIG REPAIR	CIRC. & COND. MUD	LOGGING	CASING & CEMENT	W O C	NIPPLE UP/DOWN BOP	TEST BOP	CHANGE BHA	LOST CIRC.	FISHING	CORING	DST	PLUG BACK	SQUEEZE CEMENT	DIR. WORK	W O MAT./EQUIP.	OTHER	Operations at 6:00 a.m.	Comments
3-21				3½				7½		1½		11											½	Trip	
3-22												17½	4										2½	Nipple Up BOP	
3-23												4½	8										11½	Nipple Up BOP	
3-24												15½	8½											Nipple Up BOP	
3-25			5	4⅛								1	11¾										2	Testing BOP	
3-26				7¾				10½															5¾	Tripping	
3-27			1¾	11¾				6															4½	Conditioning Mud	
3-28		5½		6⅛				2¼									3½	2½					4¼	Drilling	
3-29			¾	8¼				4½										7¾					2¼	Testing	Core No. 3: 2295' - 2322' DST No. 3
3-30			1¼	14				1									4½	2¼					1	Coring	Core No. 4: 2322' - 2345'
3-31				1				2					7¼					10½					3¼	Testing	DST No. 4
4-1		7½	8¼					1¼					¼			1							5½	Fishing	
4-2		1	3½					1	18¼															Logging	Ran Schlumberger Wireline Logs
4-3			8¾					3¾	1	2¼	6¾												1½	Circulating	
4-4			14¾					1	7½	¼													½	Tripping	

DRILLING TIME ANALYSIS (HOURS) - HUSKY NPR OPERATIONS, INC. SOUTH BARROW WELL NO. 17 Page 4 of 4

DATE	RIG UP/RIG DOWN	DRILLING	REAMING	TRIP	DEV. SURVEY	RIG MAINT.	RIG REPAIR	CIRC. & COND. MUD	LOGGING	CASING & CEMENT	W O C	NIPPLE UP/DOWN BOP	TEST BOP	CHANGE BHA	LOST CIRC.	FISHING	CORING	DST	PLUG BACK	SQUEEZE CEMENT	DIR. WORK	W O MAT./EQUIP.	OTHER	Operations at 6:00 a.m.	Comments
4-5			6¼					3¾															14	Tripping	
4-6			17½										3½										3	Tripping	
4-7												10½											13¾	Nipple Up BOP	
4-8																							24	Testing Well	
4-9																							24	Testing Well	
4-10																							24	Testing Well	
4-11																							24	Testing Well	
4-12								1½				3	4										15¾	Testing Well	
4-13	4½		3½										2										14	Testing BOP	Rig Released at 8:00 p. m.
4-14	24																							Rigging Down	
TOTAL HOURS	143½	93¾	76	167½	1½	-0-	26½	101½	56¾	28½	19¾	128½	58¼	-0-	1	14¼	47½	-0-	-0-	-0-	-0-	350½			



SOUTH BARROW No. 17

1625' FNL and 2150' FWL
Sec. 30, T.22 N., R.16 W., U. M.
PAD LEVEL 15' Est.
K.B. 33' Est.

HUSKY OIL *N.P.R. Operations*

NATIONAL PETROLEUM RESERVE - ALASKA

DRILLING TIME CURVE

DRILLING MUD RECORD

ARCTIC DRILLING SERVICES

COMPANY Husky Oil NPR Op.

WELL South Barrow Well No. 17

CONTRACTOR Brinkerhoff Signal, Inc. STATE Alaska

STOCKPOINT _____ COUNTY North Slope

LOCATION NPRA SEC 30 TWP 22N RNG 16W

DATE _____ ENGINEER _____

CASING PROGRAM: 13 3/8 inch at 80 ft.
9 5/8 inch at 1512 ft.
7 inch at 2212 ft.
TOTAL DEPTH 2382 ft.

DATE 1978	DEPTH feet	WEIGHT lb/gal	VISCOSITY Sec API	°F	YV °F	Yp	GELS 10 sec/10 min	pH Strip □ Meter □	FILTRATION ml API	HTHP t °F	Cake 32nds	FILTRATE ANALYSIS Pm	Pf/Mf	Cl ppm	Ca ppm	SAND %	RETORT Solids %	Oil %	Water %	CEC Mud, me/ml	REMARKS AND TREATMENT
1/28	0	8.4	38																		
3/1	0	8.4	45																		
3/2	80	8.4	45																		
3/3	400	9.0	35		8	6	2/4	8.0	20		3			600	0	0	3	0	97		Mixing spud mud.
3/4	1064	9.4	38		10	10	2/8	8.0	18		3			600	0	0	3	0	97		Nippling up.
3/5	1520	9.8	38		10	10	2/8	8.0	18		3			600	0	0	3	0	97		Testing BOPs.
3/6	1520	9.8	38		10	12	4/8	9.0	30		3			1700	10	1/4	5	0	95		Drilling.
3/7	1512				8	12	4/8	8.5	30		3			1700	2	Tr	8	0	92		Drilling.
3/8	1512	10.2	45		10	11	5/8	9.0	26		3			1400	6	Tr	11	0	89		Drilled to casing depth.
3/9	1512	10.2	45		10	11	5/8	9.0	26		3			1400	6	Tr	11	0	89		Logging. Bridge at 1069.
3/10	1715	10.4	42		1																Cleaning mud pits.
3/11	1715	10.4	41		10	16	4/10	8.5	8		1			120M	60,000	0	3	0	97		Mixed CaCl2 mud.
3/12	1952	10.9	55		20	16	4/10	8.5	8		1			120M	60,000	0	3	0	97		Nippling up.
3/13	2096	10.9	50		12	8	2/6	9.0	7		1			68M	34,000	3/4	12	0	88		POH to test.
3/14	2149	10.9	45		12	8	2/6	8.5	7		1			46M	23,000	1/2	12	0	88		DST.
3/15	2149	10.9	44		20	17	5/15	9	5		2			90M	45,000	1/2	13	0	87		Drilling.
3/16	2149	10.8	45		18	17	4/12	8.5	6		2			96M	48,000	1	14	0	86		Drilled top of Barrow Sand.
3/17	2149	10.9	41		16	15	3/9	8.5	7.5		2			92M	46,000	3/4	14	0	86		Coring.
3/18	2230	10.8	43		0	15	1/5	9.0	4.5		1			112M	55,000	1	14	0	86		
3/19	2230	10.8	41		27	12	2/7	9.0	6.5		1			109M	60,000	Tr	11	0	89		Lost 390 bbls to hole.
3/20	2230	10.8	41		17	7	2/6	9.0	6.0		2			85M	44,000	1/4	13	0	87		Repairing rig.
3/21	2230	10.9	43		19	11	2/7	8.5	4.0		1			85M	44,000	1/4	13	0	87		Drilled to casing depth.
3/22	2230	10.8	45		20	12	1/5	8.5	5.0		1			85M	44,000	1/4	13	0	87		Conditioned hole to run 7" casing
3/23	2230	10.8	45		29	12	2/6	8.5	5.0		1			85M	46,000	1/4	13	0	87		Ran 7" casing.
3/24	2230	10.8	45		29	13	1/6	8.5	5.8		2			85M	45,000	Tr	13	0	87		Cementing 7" casing.
3/25	2230	10.5	45		20	12	1/6	8.5	5.8		2			85M	45,000	Tr	13	0	87		
3/26	2230	10.9	38		10	12	2/6	8.5	6.0		2			85M	45,000	Tr	13	0	87		
3/27	2230	10.7	38		10	13	2/6	8.5	6.0		2			85M	45,000	Tr	13	0	87		
3/28	2263	10.8	44		22	11	2/5	8.5	6.0		2			85M	45,000	1/4	13	0	87		
3/29	2300	10.9	44		28	8	1/6	8.5	8.0		2			90M	48,000	Tr	13	0	87		
3/30	2300	10.9	44		28	8	1/6	8.5	8.0		2			90M	48,000	Tr	13	0	87		Arctic Packed 9 5/8"/7" annulus.
3/31	2345	10.9	42		20	7	2/6	8.5	3.0		1			82M	41,000	Tr	14	0	86		Drilled to Sag River Sand.
4/1	2345	10.8	40		10	9	2/6	8.5	3.0		1			75M	37,500	Tr	14	0	86		DST.
4/2	2383	10.8	40		20	9	2/6	8.5	3.0		1			75M	37,500	Tr	14	0	86		Lost 110 bbls of mud.
4/3	2382	10.9	44		20	8	1/6	8.5	5.4		1			90M	45,000	1/4	14	0	86		Coring.
					19	6	1/5	8.5	8.0		2			90M	45,000	Tr	14	0	86		DST.
					20	6	2/6	8.5	7.0		2			82M	41,000	Tr	14	0	86		Drilled to logging point.
					20	8	2/8	8.5	3.2		2			110M	55,000	Tr	14	0	86		Logged. Set bottom plug.

DRILLING MUD RECORD

ARCTIC DRILLING SERVICES

...perations, Inc. STATE Alaska CASING PROGRAM: 13-3/8 inch at 80 ft.

...ll No. 17 COUNTY North Slope 9-5/8 inch at 1512 ft.

...f Signal, Inc. LOCATION NPRA SEC 30 TWP 22N RNG 16W 7 inch at 2212 ft.

DATE ENGINEER TOTAL DEPTH 2382 ft.

COMPANY Husky Oil NPR

WELL South Barrow We

CONTRACTOR Brinkerho

STOCKPOINT

DATE	DEPTH	WEIGHT	VISCO...
1978	feet	lb/gal	Sec API @ °F
4/4	2382	10.7	42
4/5	2160	10.7	38
4/6	2160	10.8	35
4/7	2160	10.8	34
4/8	2160	10.8	32
4/9	2160	10.8	30
4/10	2160	10.8	28
4/11	2160	10.8	28
4/12	2127	10.8	28
4/13	2127	11.0	40

...ITY PV °F	Yp	GELS 10 sec/10 min	pH Strip □ Meter □	FILTRATION ml API	HTHP s °F	Cake 32nds	FILTRATE ANALYSIS Pm	Pf/Mf	Cl ppm	Ca ppm	SAND %	RETORT Solids %	Oil %	Water %	CEC Mud, me/ml	REMARKS AND TREATMENT
19	6	2/6	9.0	8.8		3			88M	44M	Tr	14	0	86		Waiting on cement.
18	6	1/5	9.0	10		3			80M	40M	Tr	14	0	86		Set retainer; ran CBL.
16	16	4/12	8.0	30		5			350M	175M	0	0	0	100		Cleaned pits; mixed comp. fluid.
16	8	2/8	8.0	30		5			350M	175M	0	0	0	100		Ran tubing.
			8.0						350M	175M	0	0	0	100		Testing.
			8.0						350M	175M	0	0	0	100		Testing.
			8.0						350M	175M	0	0	0	100		Testing.
			8.0						350M	175M	0	0	0	100		Testing.
			8.0						350M	175M	0	0	0	100		Testing.
8	8		8.0						350M	175M	0	0	0	100		Raised fluid weight to 11 ppg.
																Killed well.

HUSKY OIL NPR OPERATIONS, INC.
SOUTH BARROW WELL NO. 17

BIT RECORD

BIT NO	BIT SIZE	BIT MFGR.	BIT TYPE	SERIAL NO. OF BIT	JET SIZE 1	2	3	DEPTH OUT	FTGE.	HOURS RUN	ACC. HOURS	FT/HR	WEIGHT 1000 LBS.	Rotary R.P.M.	VERT. DEV.	PUMP PRESS	PUMPS No.	Liner	SPM	MUD WT.	Vis.	Dull Code T	B	G	REMARKS FORMATION DRC. FLUID, ETC.
1	12 1/4	Smith	DSJ	73BFW	12	12	12	1064	996	31 3/4	31 3/4	45	10	120	1 1/2	800			120			2	2	I	
2	12 1/4	Smith	DSJ	106FP	12	12	12	1520	456	15 1/4	47	31	10	120	1/2	1400			76	9.6	40	2	2	I	
3	8 1/2	Hughes	OSC	HC843	14	14	14	1715	195	6 1/2	53 1/2	29	25	120	1/2	500			110	10.7	46	1	2	1	
4	8 1/2	Hughes	OSC	H1817	14	14	14	2037	322	19 1/4	72 3/4	16	25	120	1/4	1100			60	10.7	46	6	4	I	
RR 3	8 1/2	Hughes	OSC	HC843	14	14	14	2096	59	2 1/2	74 3/4	29	25	120	1/4	1100			60	10.7	47	2	2	I	
5	8 1/2	Hughes	X1G	SB644	14	14	14	2147	51	3 3/4	78 1/2	17	500	120	1/4	1100			60	10.7	47	1	1	1	
RR 5	8 1/2	Hughes	X1G	SB644	14	14	14	2230	83	10	88 1/2	13	25	120	1/4	1100			60	10.8	45	6	2	I	RR #5. Drilling junk.
6	8 1/2	Reed	S116J	320675	13	13	13	2230	0	-	88 1/2	0	5	120	-	100			55	10.8	45	1	1	E	Pushed junk to bottom.
7	5 5/8	Smith	V2	AA61573	-	-	-	2230	0	-	88 1/2	0	-	-	-	500			100						Pushed Hydril rubber to bottom.
8	5 5/8	Smith	V2	AA61572	-	-	-	2284	64																
CH 2	5 1/2	Christensen	MC22	7563772	-	-	-	2322	28	3	91	9.3	10	50		1300			90						
RR 7	5 5/8	Smith	V2	AA61573	-	-	-	2322	0		REAMED RAT HOLE AFTER CORING														
CH 3	5 1/2	Christensen	MC22	7563772	-	-	-	2345	23	4		5.9	10	50		1400			90						
RR 7	5 1/2	Smith	V2	AA61573	-	-	-	2345	0		REAMED RAT HOLE AFTER CORING														
9	5 5/8	Smith	V2	62569	-	-	-				DROPPED ON END OF FISH														
10	5 5/8	Smith	V2	AA53362	-	-	-	2382	37	8 1/2	97	4	20	50		250			50						

INTRODUCTION

After the 1976 drilling season, casing requirements were reviewed and design of casing strings standardized. Every effort was made to minimize weight and grade changes for simplicity, cost effectiveness, and to reduce chances of error during handling and running operations. Casing sizes were selected to accommodate designs for wells from 2,000' to 20,000'. Steel grade selection was the controlling factor on design with low hardness (Rockwell C24-28) steel being selected for Arctic application and possible H_2S environment. Below is listed casing sizes and design criteria required by Husky:

		YIELD STRENGTH (PSI)		MINIMUM PRESSURE REQUIREMENT (PSI)		
SIZE[1]	WEIGHT	MIN.	MAX.	COLLAPSE	BURST	CONNECTION
20"	133#/ft.	55,000	80,000	1,500	3,050	STC
13-3/8"[2]	72#/ft.	95,000	110,000	3,450	5,350	BTC
9-5/8"[3]	53.5#/ft.	95,000	110,000	8,850	7,900	BTC
9-3/4"[3]	59.2#/ft.	95,000	110,000	9,750	8,540	BTC
7"	38#/ft.	95,000	110,000	12,600	9,200	BTC

(1) OD tolerance to be within API requirements unless adjustment absolutely necessary to meet ID requirements.

(2) Special drift to 12.25".

(3) Special drift to 8.50".

The following are additional requirements primarily to assure that the steel exhibits the metallurgical properties for Arctic applications and resistance to hydrogen embrittlement.

1. All pipe that is 13-3/8" OD and smaller to be quenched and tempered.

2. Run Charpy "V" notch tests on two random samples per 50 tons per heat. Minimum acceptance of 15 ft.-lb.@-50°F. Furnish test reports with order.

3. Perform all testing normally required for API approved pipe.

4. Furnish test reports for ladle analysis, quantitative analysis, and all check tests as per API requirements.

In addition, the following handling requirements were made:

1. Collars must be of same steel grade as pipe body.

2. Apply an API modified thread compound on mill-installed collar before bucking on.

3. Inspect at mill using Tuboscope's Amalog IV or equivalent on 9-3/4" and smaller, and at least magnetic particle on 13-3/8" and 20". All pipe to have special and area inspection together with full length API drifting. (Note special drifting requirements.)

4. Apply Arctic grade grease on all connections before installing thread protectors.

5. Install closed-end type thread protectors. Plastic plugs can be used to secure wrench openings in protectors.

6. Buck up thread protectors with impact wrench. Both mill and third party inspection personnel should observe the installation of thread protectors.

7. Palletize or containerize the tubulars, if possible, prior to shipment from mill. Do not haul pipe like cordwood in gondola railroad cars.

8. All pipe to be Range 3.

9. No "V" notching or metal stenciling on pipe body or collars.

Casing programmed for South Barrow Well No. 17 was as follows: 13-3/8" conductor at ±110'; 9-5/8" at ±1500'; 7" at ±2260'; 2-7/8" production tubing as needed to complete the well. Actual casing run was 13-3/8" at 80', 9-5/8" at 1512', and 7" at 2212'. A string of 2-7/8" production tubing was hung at 2039', when completing the Lower Barrow sand as a gas producer.

The 9-5/8" x 7" annulus was displaced to Arctic Pack through a FO in the 7" casing at 1168'. This was to prevent casing collapse while producing the well.

CASING TALLY
SUMMARY SHEET

DATE: March 4, 1978

FIELD South Barrow Gas Field LEASE & WELL NO. South Barrow No. 17 TALLY FOR 9 5/8" CASING

SUMMARY OF PAGE MEASUREMENTS

	NO OF JOINTS	FEET	00'S
PAGE 1	36	1483	60
PAGE 2			
PAGE 3			
PAGE 4			
PAGE 5			
PAGE 6			
PAGE 7			
PAGE 8			
PAGE 9			
TOTAL	36	1483	60

SUMMARY OF DEPTH CALCULATIONS

		NO OF JOINTS	FOOTAGE FEET	FOOTAGE 00'S
1	TOTAL CASING ON RACKS	42	1706	80
2	LESS CASING OUT (JTS NOS	6	223	20
3	TOTAL (1 - 2)	36	1483	60
4	SHOE LENGTH		1	66
5	FLOAT LENGTH		2	00
6	MISCELLANEOUS EQUIPMENT LENGTH		1487	66
7	TOTAL CASING AND EQUIPMENT FROM CEMENT HEAD (3 + 4 + 5 + 6)			
8	LESS WELL DEPTH (KB REFERENCE)			
9	"UP" ON LANDING JOINT			

Weight indicator before cementing: _____ ; after slack-off: _____ ; inches slacked off _____

SUMMARY OF STRING AS RUN

WEIGHT	GRADE	THREAD	MANUFACTURER	CONDITION NEW-USED	LOCATION IN STRING	NO OF JOINTS	FOOTAGE	INTERVAL
55.3	S-95	Buttress		New	JT NO. 1 THRU NO. 36	36	1487.26	Set at 1512 - KB
					JT NO. THRU NO.			-
					JT NO. THRU NO.			-
					JT NO. THRU NO.			-
					JT NO THRU NO.			-
					JT NO. THRU NO.			-
					JT NO. THRU NO.			-

PAGE 1 OF 1

CASING TALLY

DATE: March 4, 1978

FIELD So. Barrow Gas Field LEASE & WELL NO. So. Barrow Well No. 17 TALLY FOR 9 5/8 " CASING

JOINT NO.	FIRST MEASUREMENT FEET	FIRST MEASUREMENT .00'S	CHECK MEASUREMENT FEET	CHECK MEASUREMENT .00'S	WT GR.
1	39	28			
2	43	10			
3	41	23			
4	40	03			
5	40	35			
6	40	80			
7	39	45			
8	43	58			
9	40	94			
10	41	32			
TOTAL A	410	08			

JOINT NO.	FIRST MEASUREMENT FEET	FIRST MEASUREMENT .00'S	CHECK MEASUREMENT FEET	CHECK MEASUREMENT .00'S	WT GR.
1	41	75			
2	39	41			
3	40	00			
4	38	80			
5	42	00			
6	38	25			
37	38	85			
8					
9					
0					
TOTAL D	279	06			

1	41	20			
2	42	35			
3	42	00			
4	44	55			
5	41	05			
6	37	83			
7	38	60			
8	41	30			
9	43	35			
20	41	65			
TOTAL B	413	88			

1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
TOTAL E					

1	41	35			
2	41	00			
3	42	70			
4	40	76			
5	39	75			
6	42	32			
7	38	85			
8	42	97			
9	39	95			
30	47	90			
TOTAL C	407	15			

TOTAL A	410	08		
TOTAL B	413	88		
TOTAL C	407	15		
TOTAL D	279	06		
TOTAL E				
TOTAL PAGE	1510	17		

CASING OR LINER CEMENT JOB

Lease National Perroleum Reserve Well So. Barrow No. 17 Date March 6, 1978

Size Casing 9 5/8" Setting Depth 1512' KB Top (liner hanger) _____

Hole Size 12 1/4" Mud Gradient .449 Viscosity 41

Casing Equipment

Howco float shoe at 1512', Duplex float collar located 39 feet

above shoe. _____ (DV, FO) collars located at _____ feet

and _____ feet

Eight centralizers located 10 feet above shoe. One on every second joint above shoe and one on each of last three joints below landing joint.

_____ scratchers located _____

_____

Liner hanger and pack off (describe) _____

_____

Miscellaneous (baskets, etc.) _____

_____

Cement (around shoe)

	No. Sacks	Brand	Type	Additives	Slurry Weight	Slurry Volume
(1)	1330	Permafrost	Halliburton	None	14.7	1130 cu ft
(2)						

Cement through (DV, FO) Collar at _____ feet

	No. Sacks	Brand	Type	Additives	Slurry Weight	Slurry Volume
(3)						
(4)						

Cementing Procedure (around shoe) (cross out where necessary)

Circulated 201 bbls @ 6 BPM, pumped in 20 ~~(cu. ft.)~~, (barrels) of water prewash, used bottom plug (yes, no), mixed cement (1) above 33 minutes, cement (2) above _____ minutes, top plug ~~(yes,~~ no) displaced with 10.9 ~~(cu. ft.)~~, (barrels) in 2 minutes at rate of 5/12 BPM, CFM, (Bumped plug) (Did not bump plug). Final Pressure 600# Reciprocated pipe _____ feet while (mixing) and (displacing) cement. Displacing time 2 minutes. Had full circulation (full, partial, none, etc.). Completed job at 5:00 ~~a.m.~~, p.m.

Cementing Procedure (through (DV, FO) at _____ feet) (cross out where necessary)

Opened (DV, FO) at _____ a.m., p.m., circulated _____ bbls @ _____ BPM, pumped in _____ (cu. ft.), (barrels) _____ prewash, mixed cement (3) above _____ minutes, cement (4) above _____ minutes, dropped closing plug, displaced with _____ (cu. ft.), (barrels) in _____ minutes at rate of _____ BPM, CFM. (Bumped plug) (Did not bump plug). Final Pressure _____ Displacing time _____ minutes. Had _____ circulation (full, partial, none, etc.)

Remarks (Third Stage Job, etc.)

Float held o.k.

J. McGee
Foreman

CASING TALLY
SUMMARY SHEET

FIELD South Barrow Gas Field LEASE & WELL NO. South Barrow Well No. 17 DATE: March 16, 1978

TALLY FOR 7 " CASING

SUMMARY OF PAGE MEASUREMENTS			
	NO OF JOINTS	FEET	00'S
PAGE 1	50	1986	22
PAGE 2	5	199	79
PAGE 3			
PAGE 4			
PAGE 5			
PAGE 6			
PAGE 7			
PAGE 8			
PAGE 9			
TOTAL		2196	44

SUMMARY OF DEPTH CALCULATIONS				
		NO OF JOINTS	FOOTAGE FEET	00'S
1	TOTAL CASING ON RACKS	55	2196	94
2	7" Pup Joint		18	93
3	TOTAL (1 + 2)	55	2215	87
4	SHOE LENGTH		1	85
5	FLOAT LENGTH		1	64
6	MISCELLANEOUS EQUIPMENT LENGTH		7	44
7	TOTAL CASING AND EQUIPMENT FROM CEMENT HEAD (3 + 4 + 5 + 6)		2215	87
8	LESS WELL DEPTH (KB REFERENCE)		18	01
9	"UP" ON LANDING JOINT		3	00

Weight indicator before cementing: 70,000 ; after slack-off: – ; inches slacked off –

Centralizers Per Drilling Program

SUMMARY OF STRING AS RUN								
WEIGHT	GRADE	THREAD	MANUFACTURER	CONDITION NEW-USED	LOCATION IN STRING	NO OF JOINTS	FOOTAGE	INTERVAL
					JT NO 1 THRU NO 55	55	2215.87	As above.
					JT NO THRU NO			
					JT NO THRU NO			
					JT NO THRU NO			
					JT NO THRU NO			
					JT NO THRU NO			
					JT NO THRU NO			

PAGE 1 OF 2

CASING TALLY

DATE: March 16, 1978

FIELD So. Barrow Gas Field LEASE & WELL NO. So. Barrow Well No. 17 TALLY FOR 7" CASING

JOINT NO.	FIRST MEASUREMENT FEET	FIRST MEASUREMENT .00'S	CHECK MEASUREMENT FEET	CHECK MEASUREMENT .00'S	WT GR.
1	37	77			
2	35	17			
3	40	32			
4	35	59			
5	36	80			
6	34	19			
7	34	10			
8	36	69			
9	42	07			
10	36	77			
TOTAL A	369	47			

JOINT NO.	FIRST MEASUREMENT FEET	FIRST MEASUREMENT .00'S	CHECK MEASUREMENT FEET	CHECK MEASUREMENT .00'S	WT GR.
1	43	17			
2	42	15			
3	41	98			
4	42	59			
5	40	40			
6	42	85			
7	42	61			
8	41	70			
9	41	80			
40	42	52			
TOTAL D	422	27			

1	42	04			
2	36	47			
3	35	37			
4	37	60			
5	37	31			
6	35	78			
7	36	53			
8	38	81			
9	34	16			
20	37	26			
TOTAL B	371	33			

1	43	00			
2	41	85			
3	37	11			
4	42	90			
5	34	42			
6	41	74			
7	39	88			
8	41	50			
9	42	38			
50	39	94			
TOTAL E	404	72			

1	43	48			
2	40	20			
3	38	50			
4	41	05			
5	43	19			
6	43	77			
7	42	00			
8	42	88			
9	40	68			
30	42	68			
TOTAL C	418	43			

TOTAL A	369	47		
TOTAL B	371	33		
TOTAL C	418	43		
TOTAL D	422	27		
TOTAL E	404	72		
TOTAL PAGE	1986	22		

PAGE 2 OF 2

CASING TALLY

DATE: March 16, 1978

FIELD So. Barrow Gas Field LEASE & WELL NO. So. Barrow Well No. 17 TALLY FOR 7 " CASING

JOINT NO.	FIRST MEASUREMENT FEET	FIRST MEASUREMENT .00'S	CHECK MEASUREMENT FEET	CHECK MEASUREMENT .00'S	WT GR.
1	42	62			
2	39	74			
3	37	45			
4	42	80			
5	37	18			
6					
7					
8					
9					
0					
TOTAL A	199	79			

JOINT NO.	FIRST MEASUREMENT FEET	FIRST MEASUREMENT .00'S	CHECK MEASUREMENT FEET	CHECK MEASUREMENT .00'S	WT GR.
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
TOTAL D					

1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
TOTAL B					

1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
TOTAL E					

1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
TOTAL C					

TOTAL A	199	79		
TOTAL B				
TOTAL C				
TOTAL D				
TOTAL E				
TOTAL PAGE	199	79		

CASING OR LINER CEMENT JOB

Lease National Petroleum Reserve Well So. Barrow Well No. 17 Date March 21, 1978

Size Casing 7" Setting Depth 2212' Top (liner hanger) _____

Hole Size 8 1/2" Mud Gradient .561 Viscosity 43

Casing Equipment

Howco float shoe at 2212.87. Duplex float collar located 41.26

above shoe, at 2171.61. ~~(DV~~, FO) collars located at 1258.44

and 1168.95 feet

Twenty-three centralizers located two collars below lower FO on collar between FOs and every third collar to surface above upper FO.

_____ scratchers located _____

_____

Liner hanger and pack off (describe) _____

_____

Miscellaneous (baskets, etc.) _____

_____

Cement (around shoe)

	No. Sacks	Brand	Type	Additives	Slurry Weight	Slurry Volu
(1)	133	Halliburton	"G"	2% by Volume Howco Cla-Sta	15.8	152.9
(2)						

Cement through (DV, FO) Collar at _____ feet

	No. Sacks	Brand	Type	Additives	Slurry Weight	Slurry Volu
(3)						
(4)						

Cementing Procedure (around shoe) (cross out where necessary)

Circulated 150 bbls @ 2 BPM, pumped in 15 ~~(cu. ft.)~~, (barrels) Cla-Sta water _____ prewash, used bottom plug (yes, no), mixed cement (1) above _____ minutes, cement (2) above 9 minutes, top plug (yes, no) displaced with _____ (cu. ft.), (barrels) in _____ minutes at rate of _____ BPM, CFM, (Bumped plug) (Did not bump plug). Final Pressure _____. Reciprocated pipe _____ feet while (mixing) and (displacing) cement. Displacing time _____ minutes. Had full circulation (full, partial, none, etc.). Completed job at 4:30 a.m., ~~p.m.~~

Cementing Procedure (through (DV, FO) at _____ feet) (cross out where necessary)

Opened (DV, FO) at _____ a.m., p.m., circulated _____ bbls @ _____ BPM, pumped in _____ (cu ft.), (barrels) _____ prewash, mixed cement (3) above _____ minutes, cement (4) above _____ minutes, dropped closing plug, displaced with _____ (cu. ft.), (barrels) in _____ minutes at rate of _____ _____ BPM, CFM. (Bumped plug) (Did not bump plug). Final Pressure _____ Displacing time _____ minutes. Had _____ circulation (full, partial, none, etc.)

Remarks (Third Stage Job, etc.)

Floats held o.k.

J. McGee
Foreman

PAGE 1 OF 1 TUBING TALLY DATE: April 13, 1978

FIELD So. Barrow Gas Field LEASE & WELL NO. So. Barrow Well No. 17 TALLY FOR 2 7/8 " TUBING

JOINT NO.	FIRST MEASUREMENT FEET	FIRST MEASUREMENT .00'S	CHECK MEASUREMENT FEET	CHECK MEASUREMENT .00'S	WT GR.
1	58	15			
2	60	18			
3	60	70			
4	58	78			
5	59	61			
6	61	05			
7	60	19			
8	61	80			
9	61	72			
0	58	20			
TOTAL A	600	38			

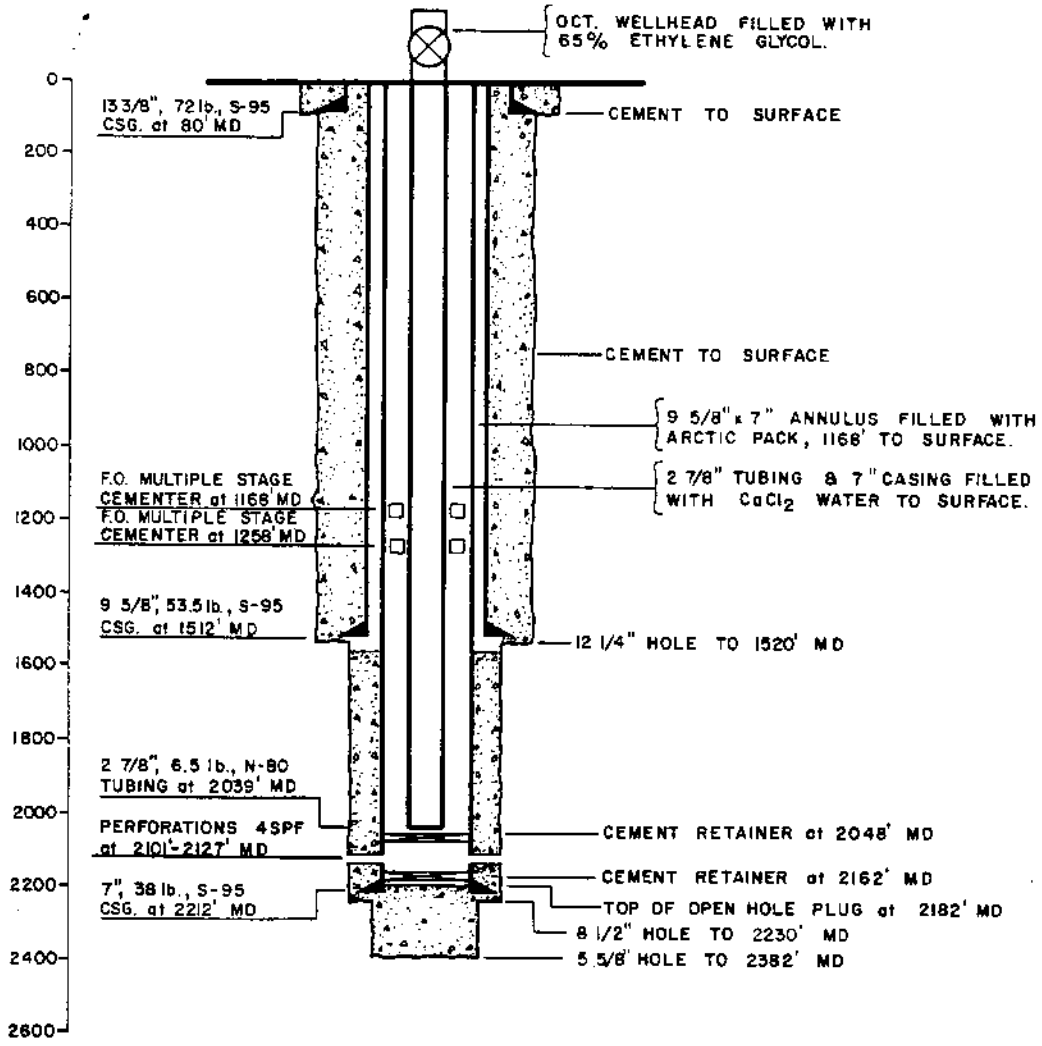
JOINT NO.	FIRST MEASUREMENT FEET	FIRST MEASUREMENT .00'S	CHECK MEASUREMENT FEET	CHECK MEASUREMENT .00'S	WT GR.
1	61	99			
2	58	34			
3	60	75			
4	62	19			
35	59	60			
6					
7					
8					
9					
0					
TOTAL D	302	87			

1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
TOTAL B					

1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
TOTAL E					

1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
TOTAL C					

TOTAL A	600	38		
TOTAL B	601	28		
TOTAL C	601	32		
TOTAL D	302	87		
TOTAL E				
TOTAL PAGE	2105	85		



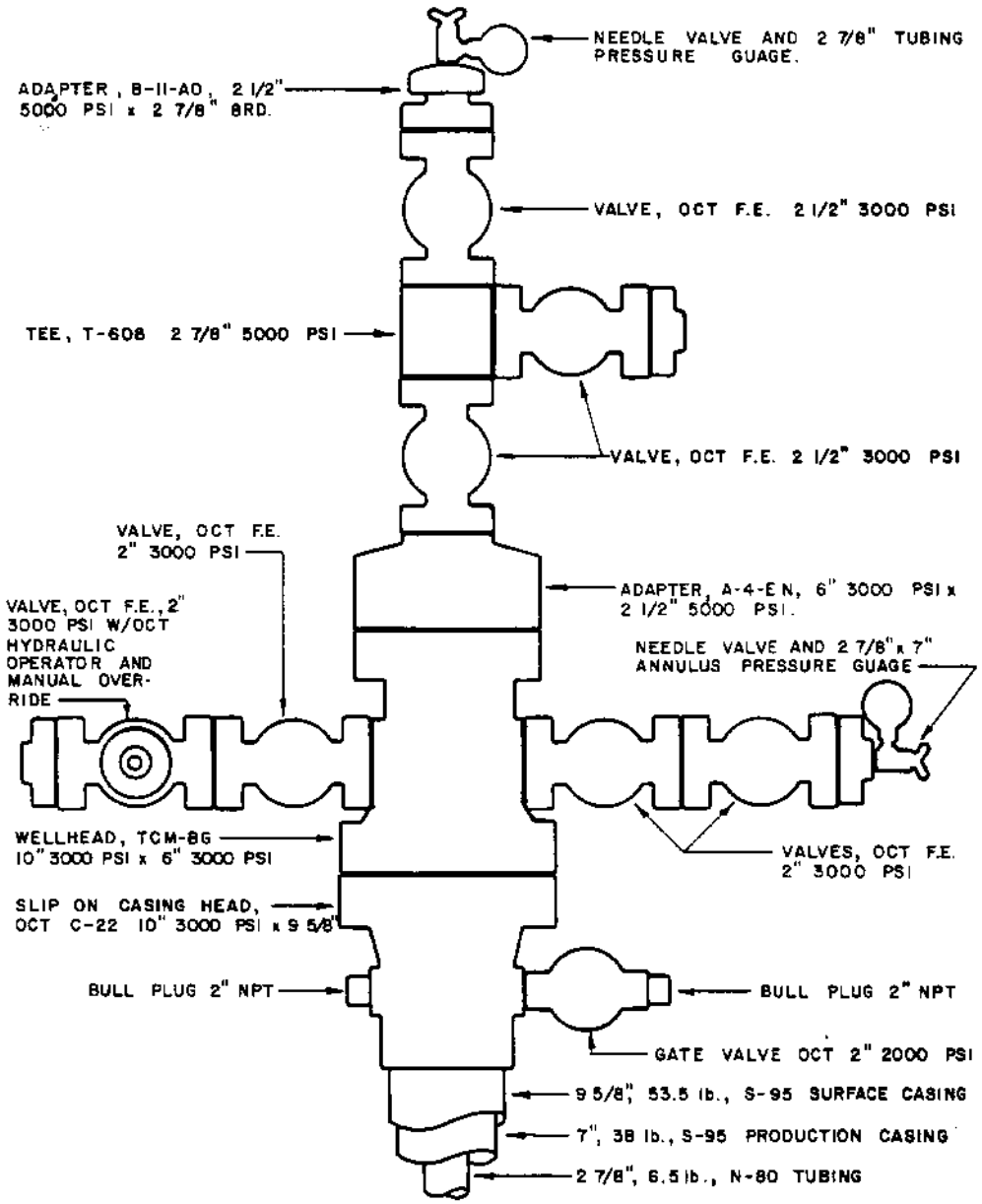
SOUTH BARROW No. 17

1625' FNL and 2150' FWL
Sec. 30, T.22N., R.16W., U.M.
PAD LEVEL 15' Est.
K.B. 33' Est.

HUSKY OIL *N.P.R. Operations*

NATIONAL PETROLEUM RESERVE - ALASKA

WELLBORE SCHEMATIC



SOUTH BARROW No. 17

1625' FNL and 2150' FWL
Sec. 30, T.22 N., R.16 W., U. M.
PAD LEVEL 15' Est.
K.B. 33' Est.

HUSKY OIL *N.P.R. Operations*

NATIONAL PETROLEUM RESERVE - ALASKA

SURFACE EQUIPMENT

ARCTIC CASING PACK

INTRODUCTION

In production wells, wells suspended through summer months, and wells completed for re-entry with temperature recording tools, Baroid Arctic Casing Pack was used between casing strings. It is a stable, highly viscous fluid which will not freeze and collapse casing set in permafrost zones. Its unique gelling characteristics exhibit excellent thermal properties (heat transfer coefficient of approximately 0.1 BTU per hour per square feet per degree F at 32°F). Composition of Baroid Arctic Casing Pack used is as follows for each 100 barrels mixed:

Diesel	82.0 barrels
Water	5.0 barrels
Salt	60.0 ppb per barrel of water
EZ Mul	12.5 ppb
Gel Tone	50.0 ppb
Barite	103.0 ppb

In South Barrow Well No. 17, the 9-5/8" x 7" annulus was displaced with Arctic Pack after running 7" casing. This was done through a FO in the 7" casing at 1168' back to the surface in anticipation of completing the well as a gas producer in lower zones.

ARCTIC PACK RECORD

DATE: March 26, 1978

I. JOB SUMMARY

Annulus volume: 9 5/8" x 7 " x 1152'	26.7	bbl
Drill pipe volume: 3 1/2 x 15.5 #/ft x 706 ' + .466'. of 2 1/16 DC	6.6	bbl
Total volume of system:	33.3	bbl
Volume of water used in water wash	88.0	bbl
Volume of water pumped at water breakthrough	40.0	bbl
Volume of pack pumped	46.0	bbl
Volume of pack pumped at breakthrough	38.0	bbl
Displacement efficiency at breakthrough	114.0	%
% Water contamination of returns at end of job	1	%

Remarks (including weather): Good job. Both wash and pack breakthrough late. Total Geltone content 47.2 ppb. Weather: -14°F, wind 9K, visibility 10 miles, 10,000' scattered.

II. PILOT TEST OF FLUIDS

A. Prepack

Retort Data:

% Oil	84	
% Water	4	
% Solids	12	
Weight	10.6	#/gal

Rheology:

	40°F	60°F	
PV	20	36	cps
YP	13	28	#/100 ft^2
10 Sec Gel	12	14	#/100 ft^2

Emulsion Stability - volts

B. Gelled Pack (20.5 #/bbl Geltone added to prepack): Not measured. Est: 2000+

Rheology (at 60 °F):

PV	00	cps
YP	00	#/100 ft^2
10 Sec Gel	60	#/100 ft^2

C. Drilling Mud (prior to displacement with water):

Wt	10.6	#/gal
PV	16	cps
YP	7	#/100 sq ft
10 Sec Gel	1	#/100 sq ft

Remarks: Mixed Pack in rig suction tank - 60 bbls. Took returns to trip tank. Mixed prepack heavy for gradient. Saved returns for use at South Barrow Well No. 19.

III. RELEVANT WELL DATA

Outer casing: 9 5/8" : 53.5 #/ft
Inner casing: 7" : 38 #/ft
Drill pipe: 3 1/2" : 15.5 #/ft
Drill Collars 4 3/4" X 2 1/16 ID
Depth of cement sleeve: 1170 ft 18' KB to Hanger.

Casing annulus volume: 26.7 bbls

Drill pipe volume (includes height to floor)	6.6	bbls
Total system volume	33.3	bbls
Rig pump capacity	17.00	strokes/bbl
Cementing unit pump capacity	20.29	strokes/bbl

Remarks: Did not down squeeze. Tested cement lap to 200 psi. Tested bottom FO to 2000 psi. Tested upper FO to 2000 psi before and after job. Circulated annulus 1 1/2 hours prior to wash.

IV. WATER WASH STEP

Volume water pumped	88	bbls
Rate	3.38	bbl/min
Volume pumped at water breakthrough (0.5 #/gal drop in weight of mud return)	40	bbls
Appearance of water at end of water wash	X	clear
		turbid
		muddy

Remarks: Pumped water off truck to rig pump. Water temperature: 34°F. Water wash at 8.4 ppg ± 2 minutes after breakthrough and 8.35 at end of wash. Started wash at 9:51 PM. Finished at 10:17 PM.

V. ARCTIC PACK DISPLACEMENT

a.	Volume of pre-mix spacer	2	bbl
b.	Total volume of gelled pack pumped	44	bbl
c.	Total number of (50 lb) sacks of Geltone added	18	sacks
d.	Average lb Geltone added per bbl	20.5	lb/bbl
e.	Pumping rate	2	bbl/min
f.	Total volume of pre-mix and gelled pack pumped at breakthrough	38	bbl
g.	Volume of returns dumped into mud system	0	bbl
h.	Volumes of fluids used to displace drill pipe	6.6	bbl of mud
		X	bbl of X
i.	Volume of uncontaminated returns	0	bbl

k. Remarks: Final water 5% - 1% excess. Prior to displacement 7% - 3% excess. Started Pack at 11:20 PM. Finished displacement at 11:50 PM.

RIG INVENTORY

Draw Works

National T-20, single drum grooved for 1" wireline with 15" double hydromatic brake, automatic breakout and make-up catheads, driven by one set GMC diesel twin 671 engines, 300 HP, through Allison torque converter, all mounted on single skid. One Westinghouse 3YC air compressor driven by main PTO.

Mast

Lee C. Moore, 95' high with 9-foot wide front by spread cantilever. Gross nominal capacity 290,000 lbs. with racking board capacity of 130 stands 4-1/2" drill pipe (doubles). Mast crown block capable of stringing eight 1" wire lines.

Subbase

Three box sections, two at ground level 8 feet high, 9 feet wide, 37 feet long; center section 8 feet 5 inches high, 9 feet wide, and 37 feet long. Clear working space from bottom of rotary beam to bottom of subbase is 14 feet 7 inches. Rotary table to bottom of subbase is 17 feet (add four inches for rig matts).

Rig Matts

Ten 4" x 16' long x 8' wide; fifteen 4" x 24' long x 8' wide.

Traveling Blocks

IDECO, 160-ton, four 1" sheave combination block and hook.

Swivel

EMSCO L-140, 6-5/8" left-hand API regular pin, 140-ton capacity.

Bails

Byron Jackson, 2-1/4" x 108", links 250-ton capacity.

Rotary Table

Oilwell 17-1/2" split square drive master bushing, 275-ton static load capacity.

Mud Tank

Three section, insulated tank. Capacity shale tank: 75 barrels; capacity middle tank: 100 barrels; capacity suction tank: 112 barrels. Shale tank equipped with shale jet and 16-barrel trip tank. Total capacity: 303 barrels.

Shaker

Single Brandt tandem separator driven by 3 HP, three-phase, 440 volt, 1750 RPM explosion-proof electric motor.

Degasser

Drilco, see-flo, driven by 7-1/2 HP, three-phase, 440 volt, explosion-proof motor with 1/2 HP, three-phase, 440 volt explosion-proof blower.

Desander

Pioneer Model S2-12; capacity: 500 GPM.

Desilter

Pioneer Model T8-6; capacity: 500 GPM.

Mud Mixer

One Dreco, driven by 5 HP, three-phase, 440 volt, 1725 RPM explosion-proof motor.

Hopper

One low-pressure mud mixing hopper.

Generators

One Caterpillar Model 3406, 210 KW; one Caterpillar, skid-mounted in Hercable house, 8' 5" high x 8' 2" wide x 29' 5" long; one Caterpillar Model D-333, 100 KW standby.

Boilers

Two Continental, 40 HP, 120 psi, diesel-fired, skid-mounted in Hercable house, 8' 4" high x 8' wide x 35' long.

Steam Heaters

Seven Model 90H Trane steam heaters; three Model 96H Trane steam heaters.

Tongs

Byron Jackson, Type "C", short lever, with heads.

Indicator

(Weight) Cameron, Type "C", up to 400,000 lbs.

Indicator

(Rotary Torque) Martin Decker hydraulic piston wheel type with remote gauge at Driller's position.

Indicator

(Tong Torque) Martin Decker, hydraulic piston type with remote gauge.

Mud Box

OKE mud box with 3-1/2" and 4-1/2" rubbers.

Slips

One set for 3-1/2" drill pipe. One set for 4-1/2" drill pipe.

Elevators

One set for 3-1/2" drill pipe, 18 degrees taper. One set for 4-1/2" drill pipe, 18 degrees taper.

Kelly

One square 4-1/4" drive, 4" FH pin, 6-5/8" API regular left-hand box. One square, 3-1/2" drive, 3-1/2" IF pin, 6-5/8" API regular left-hand box.

Kelly Bushing

VARCO, square drive, 3-1/2" rollers.

Pumps

(Drilling and Cementing) Two Halliburton, HT-400D, single acting piston pumps with Gist Oil Tool API fluid ends, each driven by GMC diesel 8V-71N, 300 HP engines through an Allis-Chalmers torque converter, Model 8FW1801-1 and a twin-disc power shift transmission, Model No. T-A-51-2003. Continuous duty with 5-1/2" API pistons at maximum of 75 SPM will produce 185 GPM for each pump with maximum pressure up to 3,000 psi. Both pumps can be run simultaneously if desired. The discharge mud line furnished by contractor from pumps to swivel connection is designed for 3,000 psi working pressure. Each pump unit mounted on 8' 4" high x 10' wide x 40' long covered skid.

Air Compressors

One LeRoi 34C mounted on draw works compound. One Ingersoll Rand Model 71-T2-T3011 TM, driven by 10 HP, 440 volt, 1,725 RPM explosion-proof electric motor.

Water Tanks

One 7' high x 9' wide x 20' long, insulated water tank, mounted in the subbase; capacity: 225 barrels. One 17' 4" long x 6' 4" wide; capacity: 120 barrels.

Fuel Tanks

One 20' long x 8' 6" wide; capacity: 6,000 gallons.

Blowout Preventer Equipment

One ten-inch, 900 dual Shaffer gate LWS with three-inch flanged side outlet one side.

One - ten-inch 900 GK Hydril.
One - ten-inch 900 drill spool with two-inch flanged outlets both sides.
One - set 4-1/2" pipe rams.
One - set 3-1/2" pipe rams.
One - set blind rams.
One - upper kelly cock T1W 6-5/8" regular LH box to pin.
Two - T1W 10,000 psi lower kelly cocks, 4-1/2" XH joints.
Two - T1W 10,000 psi lower kelly cocks, 3-1/2" IF joints.
One - inside preventor, 10,000 lb. Hydril, 4-1/2" XH.
One - inside preventor, 10,000 lb. Hydril, 3-1/2" IF.

Choke Manifold

Three-inch, 3,000 lb., with one two-inch OCT adjustable choke; one two-inch OCT positive choke and space for automatic choke.

Closing Unit

One 80-gallon Hydril closing unit with four nitrogen bottle backup. Four-station Koomey control manifold with four-station air-operated remote stations.

Drill Pipe

5,000 feet, 4-1/2", 16.6 lb., Grade E, 4-1/2" XH joints;
5,000 feet, 3-1/2", 15.5 lb., Grade E, 3-1/2" IF joints.

Drill Collars

Nineteen - 6-1/4' x 2-1/4" x 30' four-inch H90 tool joints.
One - 6-1/4" x 2-1/4" x 30' four-inch H90 x 4 1/2" regular bottom collar.
Nineteen - 4-3/4" x 1-3/4" x 30' x 3-1/2" IF x 3-1/2" regular bottom collar.
One - 4-3/4" x 1-3/4" x 30' x 3-1/2" IF x 3-1/2" regular bottom collar.

Subs

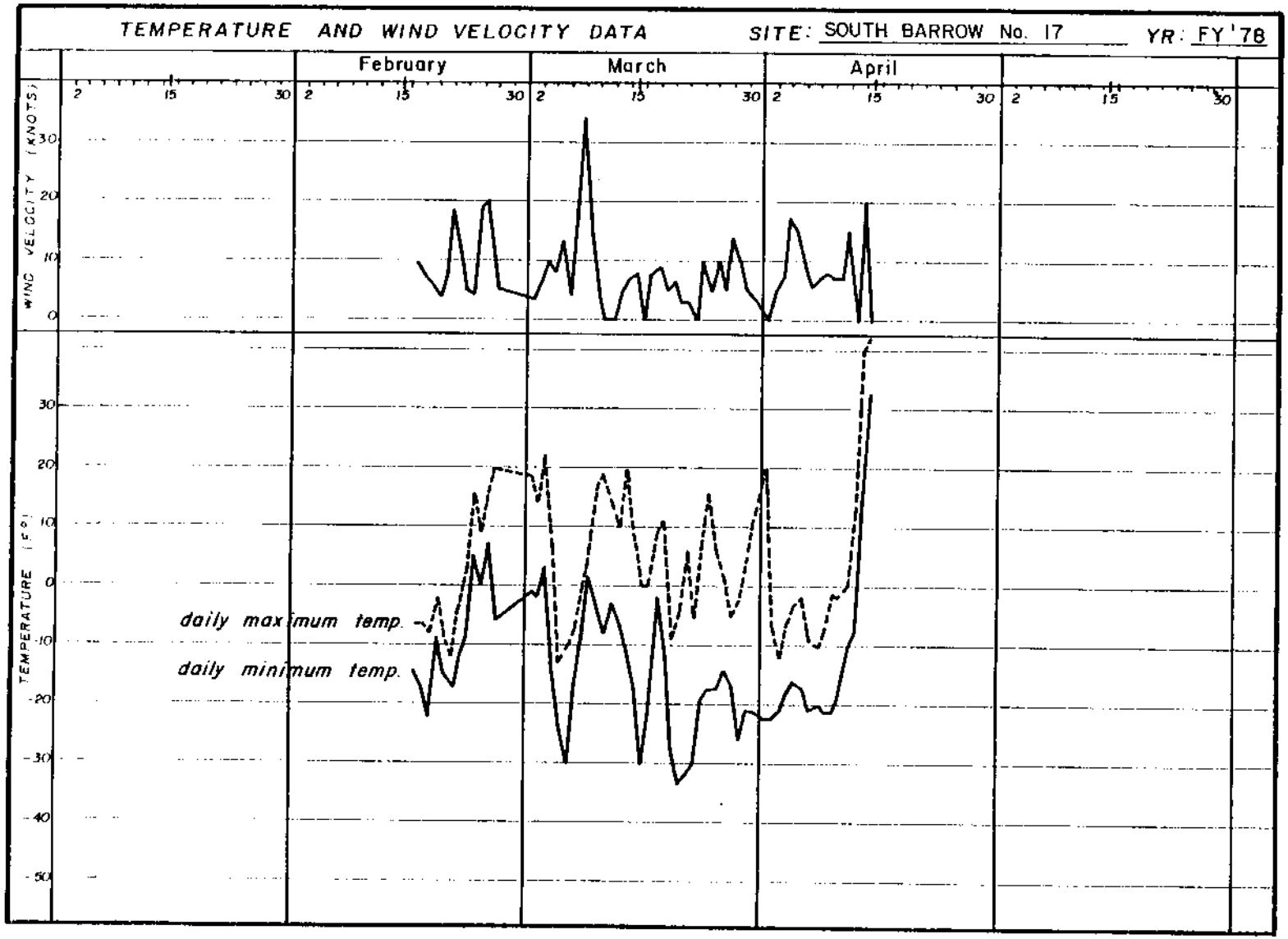
Two - 4-1/2" XH kelly savor subs.
Two - 3-1/2" IF kelly savor subs.
Two - 4-1/2" XH box to 4" H90 pin (DC crossover).
Two - 4" H90 box to 4-1/2" regular box (bit sub).
Two - 3-1/2" IF box to 2-7/8" API regular box (bit sub).

Forklift

One 966 Caterpillar, equipped with 60-inch forks.

Pipe Racks

One - V door ramp with stairs.
One - Tail walk section, 6' 1" wide x 43" high x 42 feet long.
Four - Pipe rack sections, 43" high x 4' wide x 28 feet long.


TEMPERATURE AND WIND VELOCITY DATA
SITE: SOUTH BARROW No. 17
YR: FY '78
February
March
April
2
15
30
WIND VELOCITY (KNOTS)
30
20
10
0
TEMPERATURE (°F)
30
20
10
0
-10
-20
-30
-40
-50
daily maximum temp.
daily minimum temp.

ENGINEERING MEMORANDA

SOUTH BARROW WELL NO. 17

PRODUCTION TEST NO. I
April 7-13, 1978

This memoranda is a presentation of the reservoir data gathered and reservoir calculations from the production test of the Barrow sand in the South Barrow Well No. 17. Table I presents basic well and formation data. Table II is a listing of primary analysis results. These are original gas in place, back-pressure analysis, pressure buildup analysis, and pressure gradient test analysis. Presented next is a discussion of each analysis. Conclusions and recommendations are followed by data, graphs, and example calculations.

TABLE I - WELL AND FORMATION DATA

1.	Barrow sandstone, early-middle Jurassic.	
2.	Perforations 2101 to 2127 feet at 4 spf.	
3.	Gross sand thickness	l = 26 feet
4.	Net pay thickness	h = 10 feet
5.	Bulk porosity in net pay	ϕ_B = 26.6%
6.	Effective porosity in net pay	ϕ_e = 21.9%
7.	Average water saturation in net pay	S_w = 53.7%
8.	Gas gravity	e_g = 0.572
9.	Critical temperature	T_c = 343.6 ^oR
10.	Critical pressure	P_c = 669.4 psia
11.	Reservoir temperature	T_i = 527 ^oR
12.	Initial reservoir pressure	P_i = 997.8 psia
13.	Initial gas compressibility	z_i = 0.87

TABLE II - ANALYSIS OF TEST RESULTS

A. Volumetric Reserves:

Original gas in place = 341.18 McF/AcFt.

B. Backpressure Analysis:

Absolute open flow = AOF = 6.50 MMcF/D
Back pressure slope = n = .615
Back pressure constant = C = .0013307 $\frac{MMcF/D}{PSI^2}$

C. Pressure Buildup Analysis:

Initial reservoir pressure	P_i = 997.8 psia
Permeability thickness	kh = 493.80 md ft

Permeability	$k = 49.38$ md
Skin	$S = .474$
Skin pressure drop	$\Delta P_s = 29.86$ psi
Productivity index	$J_a = 12.26 \frac{\text{McF/d}}{\text{psi}}$
Flow efficiency	$E_f = .942$
Gas mobility	$M = 4156.56$ md/cp
Effective wellbore radius	$r_w' = 2.40$ inch
Approximate radius of investigation	$r_{inv} = 524$ ft
Initial gas water ratio	$GWR_i = 10.50$ MCF/bbl
Final gas water ratio	$GWR_f = 32.16$ MCF/bbl

D. Wellbore Pressure Gradient Survey:

BHP at 2092 ft	971 psia
Fluid level	1895 ft
WHP	844.0 psia
Fluid gradient	.457 psi/ft
BHP at 2109	978.9 psia

DISCUSSION OF DATA, ANALYSIS TECHNIQUE, AND RESULTS

Original Gas in Place

The porosity, water saturation, and reservoir temperature used in the calculation of Original Gas in Place were derived from log analysis and are representative of the 10 feet of net pay selected between 2104 and 2114 feet. The initial reservoir pressure was derived from the buildup analysis and corrected to a depth of 2109 feet as indicated by the gradient survey. Gas properties were from laboratory analysis of produced samples.

The calculated value of Original Gas in Place is 341.18 McF/Ac ft. This is 14.4% higher than the assumed value of 298.2 McF/Ac ft in use for the South Barrow field. The primary cause of this difference is the porosity of 21.9% as opposed to the 16.0% in use as an average field porosity.

Four Point Backpressure Analysis

There were many mechanical problems, both before and during the four point test which complicate the analysis. Among these were the production of free formation water in intermittent heads, repeated failures of the line heater, failure of alcohol injection equipment, failure and freezeoff of liquid production metering devices, failure of the separator meter run straightening vanes, separator liquid carryover, flow line freezeoff, hydrate formation, and finally the intermittent failure and eventual miscalibration of the Hewlett-Packard continuous downhole pressure recorder. The result was a highly fluctuating flow-pressure history. As the pressure recorder used for analysis was the Sperry-Sun 8-minute recorder hung at 2092 feet, correlation of exact wellhead flow rate to bottom hole pressure presented some difficulty.

However, it was assumed that the pressure tool was above the static fluid level during the flow periods and below the static fluid level during the shut-in period as indicated by the pressure gradient test. This assumption yields an initial bottom hole pressure of 997.8 psia at 2109 feet and flowing bottom hole pressures read directly from the tool. The resultant back pressure curve yields an AOF of 6.5 MMcf/d with n = 0.615.

Pressure Buildup Analysis

The buildup period selected for analysis was the shut-in period following the initial "6 hour" flow period. This selection was due to the fact that the preceding flow most closely approximated the theoretical criterion of constant flow rate and that the pressure buildup was the "smoothest" of those measured.

The buildup was analyzed on the basis of shut-in pressure vs log $\frac{T+\Delta T.}{\Delta T}$ Point

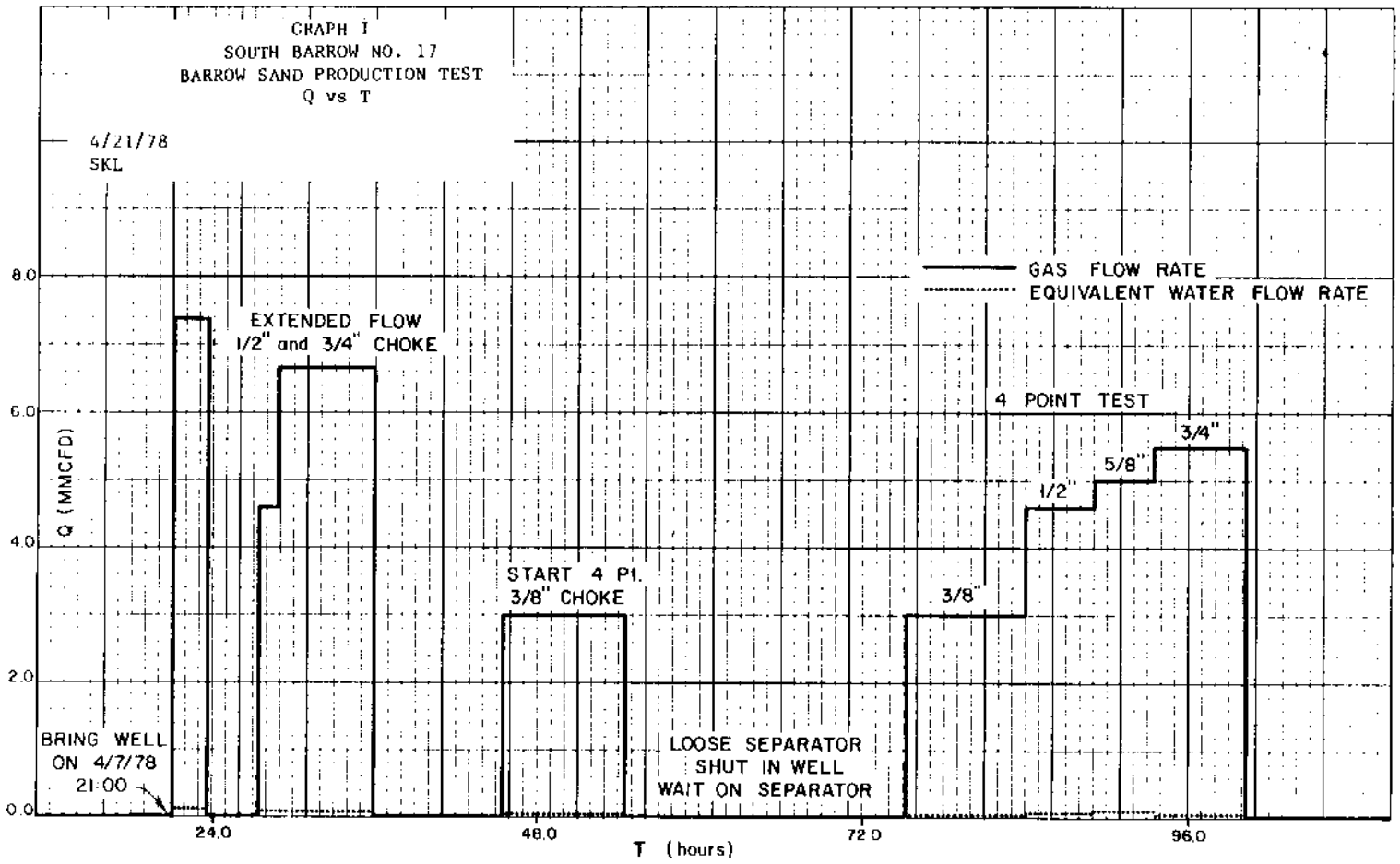
hole pressure tool. Modifications of equipment design and location and limiting the percentage drawdown and flow period lengths were indicated as being necessary. Such modifications were implemented in subsequent testing (i.e., So. Barrow No. 19) and proven valid.

DATA AND EXAMPLE CALCULATIONS

Attached are the data and calculations listed below.

1.	Graph I	Q vs T
2.	Example Calculation I	Original Gas in Place
3.	Graph II	$P_c^2-P_T^2$ vs Q
4.	Example Calculation II	Back Pressure Data
5.	Graph III	Pvs $T+\Delta T/\Delta T$
6.	Example Calculation III	Buildup Analysis
7.	Graph IV	P vs D
8.	Example Calculation IV	Gradient Analysis

Stephen K. Lewis
Reservoir Engineer


GRAPH I
SOUTH BARROW NO. 17
BARROW SAND PRODUCTION TEST
Q vs T
4/21/78
SKL
GAS FLOW RATE
EQUIVALENT WATER FLOW RATE
EXTENDED FLOW
1/2" and 3/4" CHOKE
4 POINT TEST
3/4"
5/8"
1/2"
3/8"
START 4 PT.
3/8" CHOKE
BRING WELL
ON 4/7/78
21:00
LOOSE SEPARATOR
SHUT IN WELL
WAIT ON SEPARATOR
Q (MMCFD)
8.0
6.0
4.0
2.0
0.0
24.0
48.0
72.0
96.0
T (hours)

EXAMPLE CALCULATION I

Volumetric Reserve Calculation

Original Gas in Place - McF/AcFt

43560 Ft^2/Ac

ϕ_e = 21.9%

Sw = 53.7%

P_i = 997.8 psia

T_i = 67°F

Z_i = .870

T_{sc} = 520°R

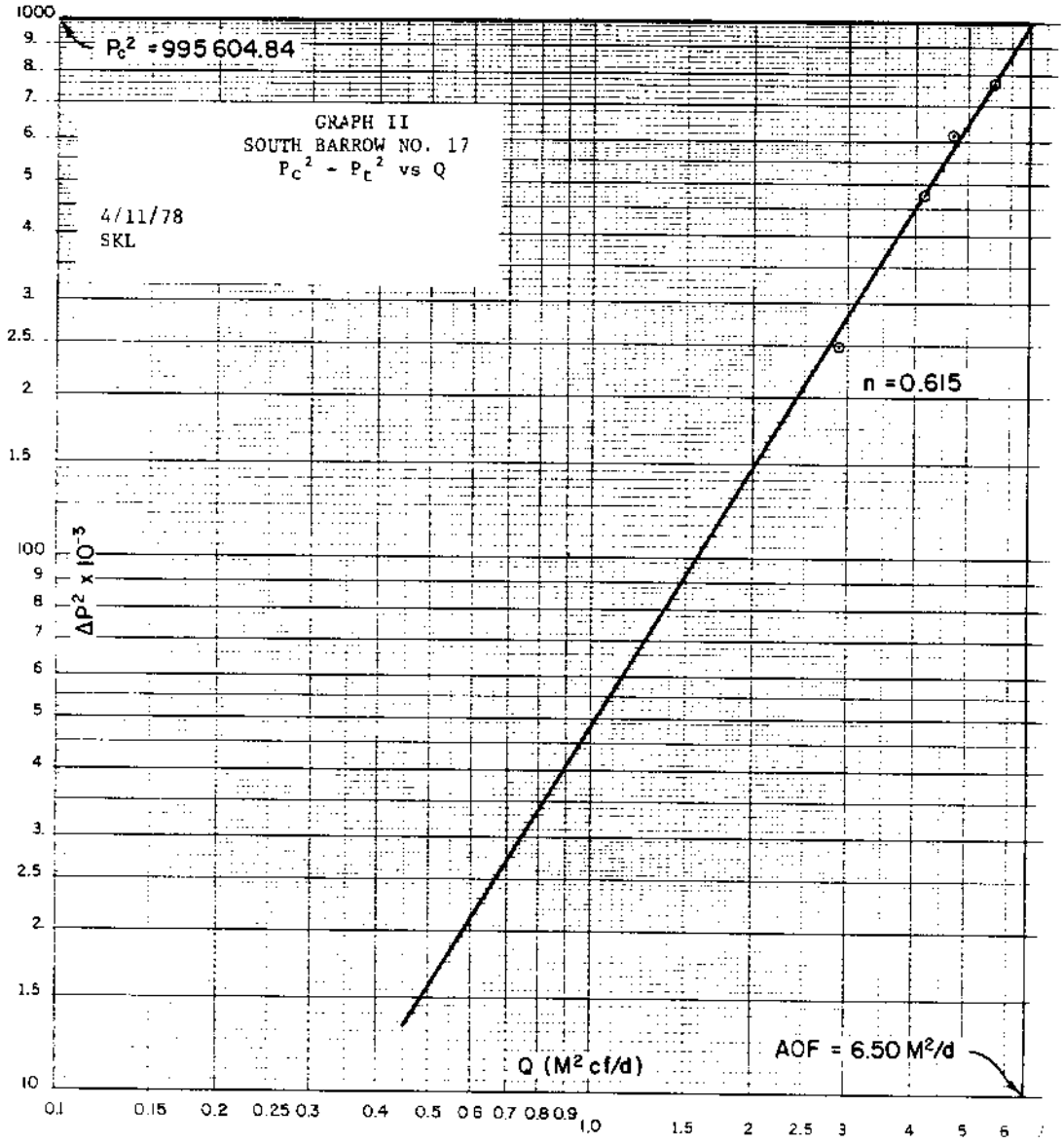
P_{sc} = 14.65 psia

$$OGIP = A \phi Sg \frac{P_i}{P_{sc}} \frac{T_{sc}}{T_i} \frac{1}{Z_i}$$

$$= 43560 \times .219 \times .463 \times \frac{997.8}{14.65} \times \frac{520}{527} \times \frac{1}{.87}$$

= 341.18 McF/Ac Ft

ATTACHMENT 2


P_c^2 = 995 604.84
GRAPH II
SOUTH BARROW NO. 17
$P_c^2 - P_t^2$ vs Q
4/11/78
SKL
n = 0.615
AOF = 6.50 M²/d
$\Delta P^2 \times 10^{-3}$
Q (M^2 cf/d)
1000
9
8
7
6
5
4
3
2.5
2
1.5
100
9
8
7
6
5
4
3
2.5
2
1.5
10
0.1
0.15
0.2
0.25
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.5
2
2.5
3
4
5
6

EXAMPLE CALCULATION II

Four Point Flow Test - 4/11/78

Initial Reservoir Pressure = 998.7 psia

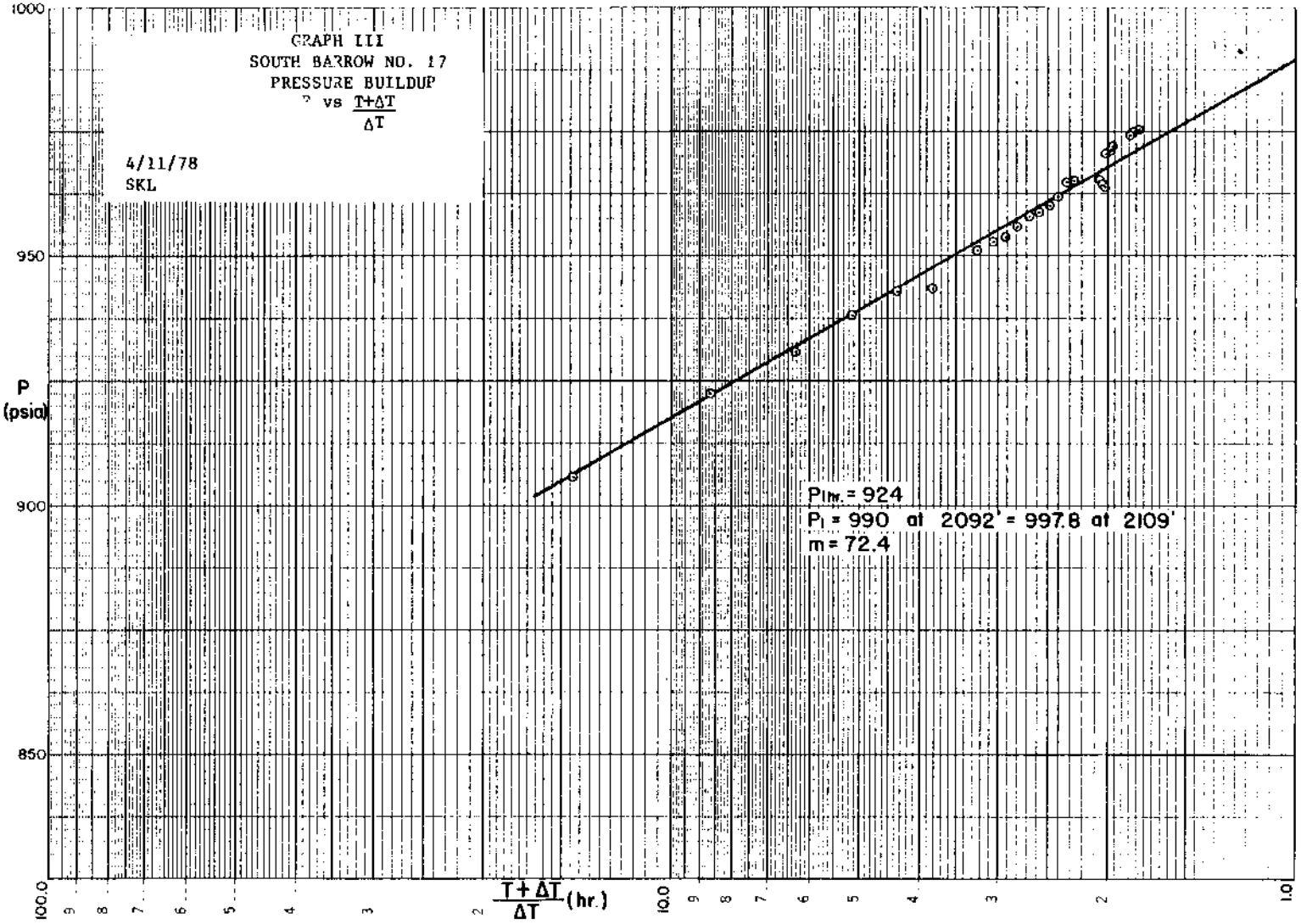
	Pressure	Flow Rate	ΔP^2
1.	865.4 psia	2.89 M^2/d	246687.68
2.	721.3 psia	4.13 M^2/d	475331.15
3.	613.3 psia	4.70 M^2/d	619467.95
4.	477.7 psia	5.56 M^2/d	767407.55

AOF = 6.50 M^2/d

n = 0.615

c = .0013307297 $M^2/d/psia^2$

ATTACHMENT 4


GRAPH III
SOUTH BARROW NO. 17
PRESSURE BUILDUP
P vs (T+ΔT)/ΔT
4/11/78
SKL
P (psia)
1000
950
900
850
100.0
10.0
1.0
(T+ΔT)/ΔT (hr.)
Pinv. = 924
P1 = 990 at 2092' = 997.8 at 2109'
m = 72.4

EXAMPLE CALCULATION III

First Buildup - Sperry Sun Tool 99 at 2092'

I. $B_g = Z \frac{T}{T_{sc}} \frac{P_{sc}}{\frac{Pi-Pwf}{2}}$

$T_c = 343.6\ ^{o}R$ $T_R = 1.53376$

$P_c = 669.4$ $P_R = \frac{756.73}{669.4} = 1.1304$

$Z = .898$

$Bg = .898 \frac{527}{520} \frac{14.65}{756.73} = .017619$

II. $\mu g = \mu i \times \mu g/\mu i = 0.0108 \times 1.1 = .01188$

III. $C_t = SgCg + SwCw + CF = (.463 \times .0012) + (.537 \times 3.3 \times 10^{-6}) + (3.3X10^{-6}) =$
$C_t = .0005606721$

IV. $kh = \frac{28984\ q\ \mu gBg}{m}$

$= 493.80$ mdf+

$k = 49.38$ md

$q = 5.893$
$m = 72.4$
$h = 10$
$P1hr = 924$
$Pwf = 517.46$
$rw = 4.25"$
$\emptyset = .219$

V. $S = 1.1513 \left(\left(\frac{P_{1hr} - P_{wf}}{m} \right) - \log \left(\frac{k}{\emptyset \mu C + r_w^2} \right) + 3.2275 \right)$

$S = .474$

VI. $\Delta P_s = m \times .87(S) = 72.4 \times .87\ (.474)$
$= 29.86$ PSI

VII. Productivity Index = J

$Ja = \frac{q}{P_i - P_{wf}} = \frac{5893}{997.8 - 517.46} = 12.26 \frac{McF/d}{PSI}$

$J_i = \frac{q}{(P_i - P_{wf}) + \Delta P_s} = \frac{5893}{(997.8 - 517.46) + 29.86} = 11.55 \frac{McF/d}{PSI}$

Flow Efficiency $= \frac{Ji}{Ja} = .942$

ATTACHMENT 6

VIII. Average Gas Mobility = M

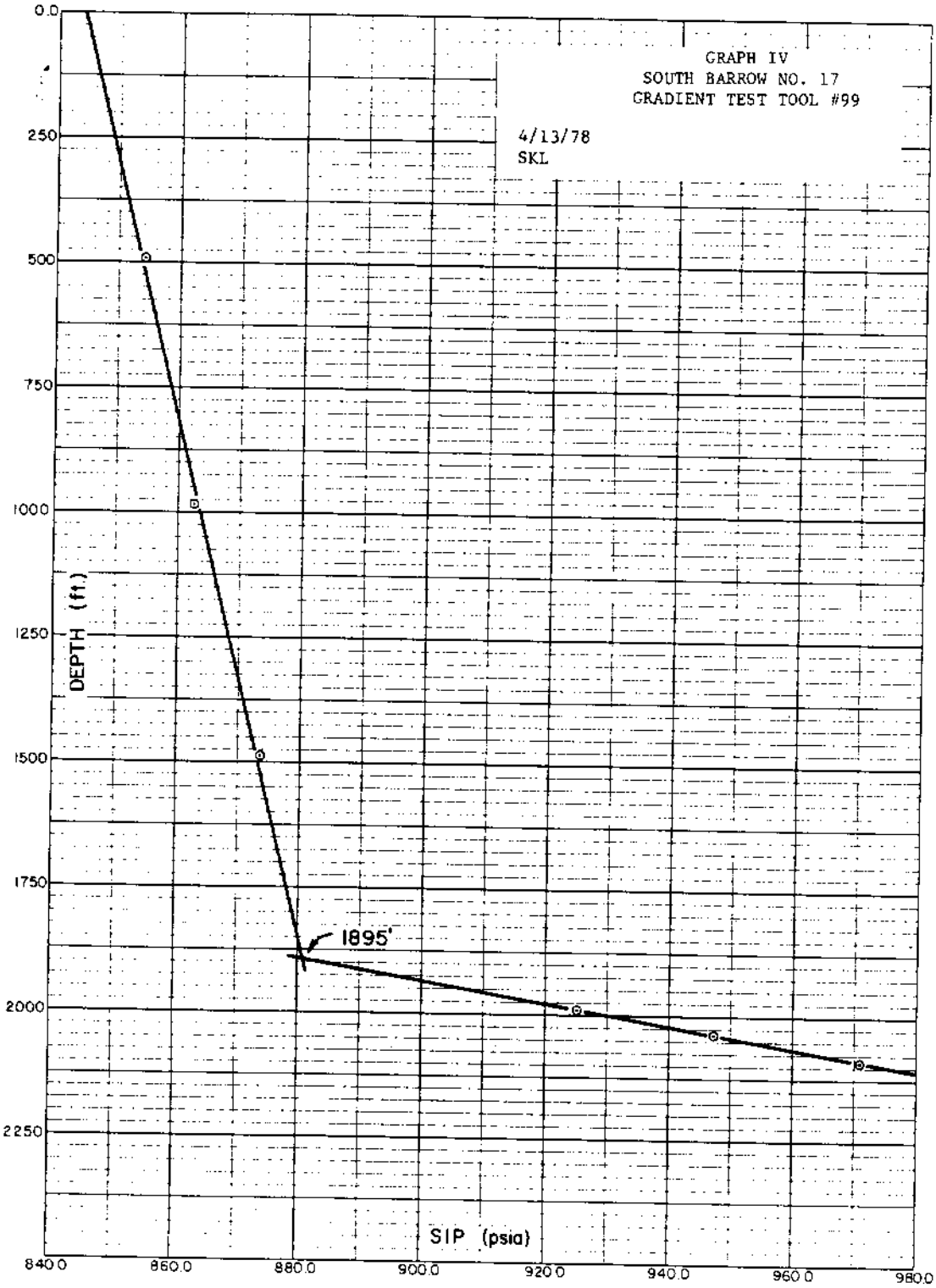
$$M = \frac{kg}{\mu g} = \frac{49.38}{.01188} = 4156.56 \text{ md/CP}$$

IX. Effective Wellbore Radius = $r_w{}^i$

$$r_w{}^i = r^w e^{-s} = 2.65 \text{ inches}$$

X. Approximate Radius of Investigation r_{inv}

$$r_{inv} \sqrt{\frac{0.00105\ k +}{\phi\ \mu\ C_T}} = 524 \text{ ft}$$


GRAPH IV
SOUTH BARROW NO. 17
GRADIENT TEST TOOL #99
4/13/78
SKL
DEPTH (ft.)
0.0
250
500
750
1000
1250
1500
1750
2000
2250
1895'
SIP (psia)
840.0
860.0
880.0
900.0
920.0
940.0
960.0
980.0

EXAMPLE CALCULATION IV

Pressure Gradient Test - 4/13/78

D	L	P	ΔP	Gradient
2092	0	971.1	0	-
2042	50	947.3	23.8	.476
1992	50	225.4	21.9	.438
1492	500	873.7	51.7	.1034
992	500	862.1	11.6	.0232
492	500	854.8	7.3	.0146
0	492	848.0*	6.0*	.0122*

*Extrapolated from Plot of P. vs D.

ATTACHMENT 8

ADDENDUM

HISTORY OF DRILLING OPERATIONS

SOUTH BARROW WELL NO. 17

ADDENDUM
HISTORY OF DRILLING OPERATIONS
SOUTH BARROW WELL NO. 17

INTRODUCTION

South Barrow Well No. 17 had been previously completed as a suspended producible gas well on April 13, 1978. The well had achieved a calculated absolute open flow potential of 6.50 MMCFGPD. There was a severe problem with water production accompanying the gas. Water production was calculated at an average of about 200 barrels/day at the 6.50 MMCFGPD rate (based on the measured ratio of 0.031 barrels of water per MCF). The water production was considered to be excessive for sustained gas production and the well was judged to be "non-commercial" in the Lower Barrow sandstone at this location.

A decision was later made to attempt a completion in the Upper Barrow sandstone (the East Barrow Gas Field had established gas production from the Upper Barrow sandstone in the South Barrow Well No. 15). On March 7, 1979, rigging up operations began. Brinkerhoff Signal, Inc., Rig No. 31, was the contractor.

OPERATIONS HISTORY

DATE AND OPERATION AS OF 6:00 A.M.	ACTIVITY
3/17/79	Set in rig, pumphouse, boiler, Tioga. Hooking up steam lines. Heating water in tank.
3/8/79	Rig up. Clean ice from rat-hole cellar and mouse hole. Fill pits. Mixing mud. Picked up 60 joints 3-1/2" drill pipe, 6 - 4-3/4" drill collars. Pick up kelly and swivel. Test upper and lower kelly cock to 3,000 psi. Rig up line from 7" annulus to choke. No pressure on well.
3/9/79	Mix 300 barrels of calcium-chloride mud and let cool. Rig up choke manifold and test to 3,000 psi. Remove Xmas tree. Nipple up blowout preventer.
3/10/79	Nipple up blowout preventer. Test 2-7/8" pipe and blind rams and choke manifold to 3,000 psi; Hydril to 1,500 psi. Laid down blowout preventer and tubing hanger. Circulated. Stabbed into retainer at 2048'. Pumped 4 barrels. No flow in 2 hours. Pull out of retainer. Circulate 2 hours. Measure out retainer at 2042'. Change rams to 3-1/2".

3/11/79 Tested 3-1/2" pipe rams to 3,000 psi; Hydril to 1,500 psi. Installed wear bushing. Run in hole with Baker retrieving mill and junk sub. Milled retainer at 2142'. Pulled out of hole and recovered retainer. Left slip and retrievable rubber in hole. Go in with 5-5/8" bit and junk sub jars to 2167'. Circulate. Watch for flow. Pull out of hole. Pick up casing scraper.

3/12/79 Ran casing scraper to 2162'. Circulated. Pulled out of hole. Plug back total depth 2170'. Rig up Schlumberger. Sheared gamma-ray collar locator tool off rope socket with lubricator while seating lubricator in Hydril. Wait on fishing tools. Ran Bowen overshot 4-3/4" guide, 2-7/8" grapple, 3-7/16" outside diameter on drill pipe. Run in hole to 2159'. Attempt to get over fish. Pulled out of hole. No recovery. Checked overshot. Ran back in hole.

3/13/79 Ran in hole with overshot. Pulled out of hole. Recovered fish. Rig up and run Schlumberger Gamma-Ray Collar Locator Log 2163' to 1100'. Set Baker retainer at 2090'. Rig down Schlumberger. Ran in hole with Baker stinger. Squeezed perforations at 2127' to 2101' with 35 sacks of "G" cement. Maximum pressure 1,200 psi. Final pressure 600 psi. Cement in place 7:45 p.m. 3/12/79. Pulled 2 stands. Reversed out no cement.

3/14/79 Ran in hole with bit and casing scraper to top of cement at 2088'. Clean out to retainer at 2090'. Circulate. Pulled out of hole. Rig up Schlumberger. Test lubricator to 500 psi. Perforations 4 shots/foot from 2038-2048', 2054-2065', and 2080-2088'. Break down Schlumberger. Pick up Halliburton test tools. Run in hole. Make up Halliburton head. Set tool at 2027'. Inject nitrogen cushion.

3/15/79 Put nitrogen cushion in drill pipe to 500 psi. DST No. 1, perforate 2038-2048', 2054-2065' and 2080-2088'. Packer set at 2027'. Tool open 7:00 a.m. 3/14/79, pressure at 7:00 a.m., 500 psi. Open tool at 8:30 a.m., 60 psi. Gas to surface, estimated 27 MCFPD on 8/64" choke. At 10:00 a.m., pressure 120 psi, gas at rate of 140 MCFPG. Shut in 10:00 a.m. to 4:00 p.m. After 2nd open, 135 psi at 4:12 p.m., fluid to surface with slightly oil-cut mud (trace of oil, 30.81° API). At 4:45 p.m., 108 psi, 45 MCFPD; 5:00 p.m., 150 psi, 6 MCFPD; misting and slugging fluids; 6:00 p.m., pressure 145 psi, 58 MCFPD. Shut in 6:00 p.m. to 10:00 p.m. Reversed out, circulated and conditioned mud; pulled out of hole, lay down test tools. Run in

hole with bit to 2090'. Circulate. Pressures, DST No. 1, gauge at 2055' were IH 1,094 psi; IF 568 psi, FF 429 psi, FSIP 966 psi, FH 1,107 psi.

3/16/79 Circulated. Laid down 3-1/2" drill pipe and 4-3/4" drill collars. Lay down kelly. Change pipe rams to 2-7/8". Test rams to 3,000 psi. Ran 68 joints 2-7/8" tubing with 22' mule shoe joint. Injection lines 1/4" at 1100' and 1700'. Ran 7 - 2-7/8" by 7" centralizers. Tubing bottom 2085.66'. Install blowout preventer in tubing hanger. Landed tubing. Nipple down blowout preventer.

3/17/79 Wait on parts for rig generators. Received parts for one generator. Start generator, Tioga heater and boilers. Hook up steam and water lines. Install Xmas tree.

3/18/79 Nipple up tree and test to 3,000 psi. Rig up to circulate. Cut weight to 9.0 ppg. Hook up injector lines. Hook up flow lines to test tank. Waiting on well to flow.

3/19/79 Waiting on well to flow. Thaw out lines to test tank. Open well on tubing at 7:45 a.m. with 420 psi, 9:00 a.m. Unloaded approximately 2 barrels of fluid. Shut well in at 11:00 a.m. Thaw out lines. Shut in 3 hours. Tubing pressure 360 psi 7-1/4 hours. Bleeding well. Bled to 0 psi, slight flow after 8-3/4 hours. Inject nitrogen in annulus.

3/20/79 Five and one-half hour shut in. Casing pressure 580 psi, tubing pressure 460 psi. Rig up Camco and check fluid level. Fluid at 1400' in 13 minutes. Blow well down. Shut in 3-1/2 hours. Casing pressure 745 psi, tubing pressure 705 psi after 5 minutes. Blow well down. Shut in 6 hours. Casing pressure 840 psi, tubing pressure 814 psi.

3/21/79 Twelve hour shut in. Tubing pressure 900 psi, casing pressure 925 psi. Flow test 8 hours through 6/64" choke. Casing pressure 485 psi, tubing pressure 526 psi. Stabilized flow rate 128.3 MCFGPD. Shut in 6 hours. Casing pressure 873 psi, tubing pressure 812 psi.

3/22/79 Well shut in 20-3/4 hours. Casing pressure 879 psi, tubing pressure 900 psi. Four point test Upper Barrow sandstone. Shut in. Casing pressure 879 psi. First flow, 4/64" choke, 71.74 MCFGPD. Flowing pressure 739.9 psi. Second flow 6/64" choke, 115.94 MCFGPD. Flowing pressure 535 psi. Terminated test

after two rates due to excessive draw down. Well shut in 5 hours. Casing pressure 840 psi, tubing pressure 795 psi.

3/23/79 — Well shut in 29 hours. Shut-in casing pressure 895 psi, tubing pressure 800 psi.

3/24/79 — Well shut in 53 hours. Casing pressure 905 psi, tubing pressure 769 psi.

3/25/79 — Well shut in 72 hours. Casing pressure 911 psi, tubing pressure 730 psi. Running pressure gradient survey.

3/26/79 — Finish running Camco pressure gradient survey. Rig down Camco. Close valves on tree. Wing valve on tubing head leaking. Greased valve. Cleaned mud tanks. Release rig 6:00 p.m., 3/25/79. Rig down.

3/27/79 — Rigging down. Rig down Halliburton unit and test house. Blown down mud pumps. Attempt to set blowout preventer. Unable to set. Repair leaking tubing head valve. Clean rig and equipment.

3/28/79 — Clean rig and equipment. Set blowout preventer. Work on tubing head valve and pack with grease. Valve leaking. Pressure on choke 916 psi. Hook up mud tanks and mud pumps. Rig up blow down line and kill line. Mixing calcium-chloride mud to kill well.

3/29/79 — Mixing calcium-chloride mud to 9.5 ppg. Let mud cool. Hook up line to test tank. Test kill line to 3,000 psi. Pull blowout preventer. Shut in. Casing pressure 916 psi. Pump 106 barrels 9.5 ppg mud. Shut pump down. Casing pressure 225 psi. Mixing mud to 10.2 ppg. Let mud cool. Kill well. Watch well for flow.

3/30/79 — Watch for flow. No flow 2 hours. Change valve on tubing head. Replaced 3 valves in choke manifold. Test choke manifold to 3,000 psi. Cut mud weight to 8.8 ppg. Displace hole with 8.8 ppg mud. Hook up to annulus to inject nitrogen. Casing pressure 700 psi, tubing pressure 265 psi.

3/31/79 — Inject nitrogen. Tubing open. Annulus pressure 900 psi. Well kicked through tubing at 1:00 a.m. Flare well on 8/64" choke through annulus. Casing pressure 0 psi. Shut in tubing pressure 104 psi.

4/1/79 — Flare through 8/64" choke through tubing 8-3/4 hours. Casing pressure 20 psi, tubing pressure 125 psi. Well

making small amount of fluid. Shut in 6-1/2 hours. Casing pressure 800 psi, tubing pressure 790 psi after 1/2 hour. Flow tubing on 8/64" choke. Casing pressure 560 psi, tubing pressure 500 psi. Well making small amount of fluid. Shut in 6 hours. Casing pressure 900 psi, tubing pressure 910 psi after 1/2 hour. Flow tubing on 6/64" choke. Casing pressure 460 psi, tubing pressure 470 psi. Dry gas. Inject total of 10 gallons of alcohol, 7 hours. Shut in. Casing pressure 900 psi, tubing pressure 915 psi.

4/2/79 — Shut in 10 hours. Casing pressure 900 psi; tubing pressure 915 psi. Install blowout preventer. Unhook line from wellhead. Valves holding OK. Breakout line to test tank. Clean pits. Release rig 9:00 p.m. 4/1/79. Drain pumps. Put glycol in manifold and pumps. Rig down Swaco choke. Unhook line for move. Clean and wash rig.

4/3/79 — Install back-up valve on annulus. Put new rubber in Hydril. Install radiator in light plant. Clean up choke manifold house. Break out fittings. Rigging down for move.

4/4/79 — Build shelves for welder and mechanic. Clean up blowout-preventer bolts. Clean and oil floor safety valves and kelly cock. Wait on location.

4/5/79 — Rigged up fuel barrels for move. Roll up electric lines. Set blowout preventer in shop and pulled rams. Change 3-1/2" rams to 2-7/8". General location cleanup.

4/6/79 — Remove skirting around camp. Move roustabout skid and generator to South Barrow No. 6. Prepare to move camp to South Barrow Well No. 6. Last Report.

FINAL RESULTS

After evaluating test results and performing calculations on reservoir parameters, an engineering memorandum was prepared on the production test of the Upper Barrow sandstone, South Barrow Well No. 17 (see attached memorandum of May 17, 1979 by Stephen K. Lewis). The conclusion on the part of the testing engineer was to the effect that "the Upper Barrow sandstone, as penetrated in South Barrow Well No. 17, is not a commercially producible zone".

South Barrow Well No. 7 was left as a suspended producible gas well.

M E M O R A N D U M

May 17, 1979

TO: J. M. McCarthy

FROM: S. K. Lewis

SUBJ: Production Test, Upper Barrow Sand, South Barrow Well No. 17

The Upper Barrow Sand was perforated in Barrow No. 17 from 2038' to 2048', from 2054' to 2065', and from 2080' to 2088'. Perforations were at four shots per foot, using a 4" Hyperjet II gun.

After clean up, the well was tested. Testing consisted of an 8-hour Stabilized One-Point flow, a 24-hour buildup, an Equal Time Two-Point flow, and a 72-hour buildup.

Back pressure analysis was performed on the three flow periods.

Reservoir analysis was prepared on the stabilized drawdown. Data, calculations, and resultant calculated values are presented below.

Back Pressure Analysis

The backpressure slope was established from the Equal Time Two-Point flow and Absolute Open Flow was based on the Stabilized One-Point flow.

Backpressure Parameters

n = 0.659
AOF = 132 McF/D

Drawdown Analysis

The drawdown analysis technique was based on the semilog plot of Pwf vs log Tp and the pressure equation:

$$Pwf = P_i - \frac{28984\ q\ \mu g B g}{kh}\left[\log Tp + \log \frac{k}{\emptyset \mu g C_t r_w^2} - 3.2275 + 0.86859\ S\right]$$

Reservoir parameter analysis was based on test results and values of $\emptyset$, S_w, and h derived from the H. J. Gruy log analysis as published in the Reservoir Engineering and Geologic Study of the East Barrow Field on December 20, 1978.

Calculated Reservoir Parameters

Flow Capacity = kh = 1.233145 md.ft.
Permeability = k = 0.0616527 md
Skin Factor = S = -2.496
Productivity Index = J = 0.240 McF/d psi
Gas Mobility = M = 5.0727 md/cp
Effective Wellbore Radius = r_w^1 = 51.568 inch
Radius of Investigation = 20. 747 ft

Conclusions

Based on well performance while being tested and the attached test analysis, it is concluded that the Upper Barrow Sand, as penetrated in Barrow Well No. 17, is not a commercially producable zone.

All estimated ultimate Recoverable Reserves in the Upper Barrow Sand which have been assigned to Barrow No. 17 should be removed from current reserve estimates. Based on 640 acre spacing, this would result in a Recoverable Reserve cut of 1.440 BCF.

S. K. Lewis
Senior Engineer

Copy to: Bob Lantz

I. $B_g = \bar{z} \frac{T}{T_{sc}} \frac{P_{sc}}{\frac{P_i - P_{wf}}{2}}$

$P_i = 971.90$ psia
$T = 55.2^oF$
$P_c = 664$ psia
$T_c = 334^oF$
$P_{wf} = 548.85$

a. 1. $P_r = \frac{\frac{P_i - P_{wf}}{2}}{664} = \frac{\frac{971.9 + 548.85}{2}}{664} = \frac{760.375}{664} = 1.145$

2. $T_r = \frac{T}{T_c} = \frac{515.2}{334} = 1.543$

3. From Poettmann & Carpenter tables:

$\bar{z}$ at $T_r = 1.543$ & $P_r = 1.145$ $\quad Z = 0.899$

b. $\therefore B_g = .899 \frac{515.2}{560} \frac{14.65}{760.375}$

$B_g = 0.0159352$

II. μ_g from Carr et al

a. $\mu_g = \mu_l \times \mu/\mu_l \qquad \mu_l = 0.01095 \qquad \mu/\mu_l = 1.11$

$\therefore \mu_g = 0.01095 \times 1.11 = 0.1021545$ cp = .0215

III. $C_t = S_g C_g + S_w C_w + C_f$

$S_g = .414$
$S_w = .586$
$C_w = 3.3 \times 10^{-6}$
$C_f = 3.3 \times 10^{-6}$

a. C_g from Trube

$C_g = \frac{C_{pr}}{P_c}$ at $P_r = 1.145$ & $T_r = 1.543$ $\quad C_{pr} = 1.02$

$\therefore C_g = \frac{1.02}{664} = .001536$

b. $C_t = (.414 \times .001536) + (.586 \times 3.3 \times 10^{-6}) + 3.3 \times 10^{-6} = .000641138$

IV. $kh = \frac{28984\ q\ \mu_g B_g}{m}$

a. From flow test:

$q = 101.705$ McF/d

$m = 463$

b. $kh = \frac{28984\ (101.705)\ 0.0121545\ (0.0159352)}{463}$

$kh = 1.233145$ md ft

c. at $h = 20$ ft

$k = .0616572$ nd

V. $S = 1.1513 \left[\left(P_i - P_{1\ hr} \right) - \log \left(\frac{k}{\phi \mu\ C_t\ r_w^2} + 3.2275 \right) \right]$

a. $P_i = 971.9$ psi $P_{1\ hr} = 878$ psi

$k = 0.0616572$ nd $\quad \phi = .1544$

$\mu = 0.0121545$ cp $\quad C_t = 0.000641138$

$r_w = 135417$ $\quad m = 463$

b. $S = 2.495979$

VI. $J = \frac{q}{P_i - P_{wf}} = \frac{101.705}{(971.9 - 548.05)\ \text{psi}}$ McF/d

$J = 0.240$ McF/d/psi

VII. $M = \frac{k_g}{\mu_g} = \frac{.0616572}{.0121545} = 5.0727$ nd/cp

VIII. $r_w^{\,1} = r_w\ e^{-s} = 4.25\ e^{2.495979} = 51.568$ inch

IX. $r_{inv} = \sqrt{\frac{0.00105\ k\ T_p}{\phi\ \mu\ C_t}} = 20.747$ ft $= 20.747$ ft

FIELD DATA SHEET

Completion Test
Stabilized 1 point

Type Test: ☐ Initial ☐ Annual ☒ Special — Test Date: 3/20/79	Lease No. or Serial No.
Company: Husky Oil NPR Operations — Connection	Allottee
Field: East Barrow — Reservoir: Upper Barrow — Location	Unit
Completion Date: 3/16/79 — Total Depth: 2382 — Plug Back TD: 2090 — Elevation: 33' KB	Farm or Lease Name
Csg. Size: 7" — Wt.: 38 — d: 5.920 — Set At: 2212 — Perforations: From 2038-48, 2054-65, To 2080-88	Well No.: Barrow #17
Tbg. Size: 2 3/8 — Wt.: 6.5 — d: 2.441 — Set At: 2086 — Perforations: From — To	Sec.: 30 — Twp – Blk: 22N — Rge – Sur: 16W U.M.
Type Completion (Describe): Single zone Gas Well — Packer Set At: None	County or Parish: North Slope
Producing Thru: Annulus — Reservoir Temp. F: 56.6 @ 2060 — Mean Annual Temp. F: 11.5 — Baro. Press. – P_a: 30.48" Hg P_a – 15.3	State: Alaska
L: 2063 — H: 2063 — G_g: 0.571 — % CO_2: — — % N_2: 3.55 — % H_2S: —	Prover: 2" — Meter Run — Taps

DATE Time of Reading	ELAP. TIME Hrs.	WELLHEAD WORKING PRESSURE Tbg. Psig	Csg. Psig	Temp. F	METER OR PROVER Pressure Psig	Diff.	Temp. F	Orifice	REMARKS (Include liquid production data: Type – API Gravity – Amount)
12:20	0	900	975					6/64	
13:20	1	790	775	35	760		10		Oil, 30.81°API, Trace
14:20	2	698	675	35	661		10		
15:20	3	622	590	35	581		10		
16:20	4	575	546	36	531		11		
17:20	5				500				
18:20	6	537	495	38	483		13		
19:20	7	570	485	40	472		15		
20:20	8	526	485	42	472		18	6/64	

PAGE 1 OF 1 DATA BY SKL

Form BPT 1

ONE-POINT BACK-PRESSURE TEST REPORT

Completion Test

Type Test: ☐ Initial ☐ Annual ☒ Special — Test Date: 3/20/79	Lease No. or Serial No.
Company: Husky Oil NPR Operations Inc — Connection	Allottee
Field: East Barrow — Reservoir: Upper Barrow — Location	Unit
Completion Date: 3/16/79 — Total Depth: 2382 — Plug Back TD: 2090 — Elevation	Farm or Lease Name
Csg. Size: 7" — Wt.: 38 — d: 5.920 — Set At: 2212 — Perforations: From 2038-48, 2054-65, To 2080-88	Well No.: Barrow #17
Tbg. Size: 2 7/8 — Wt.: 6.5 — d: 2.441 — Set At: 2086 — Perforations: From — To	Sec.: 30 — Twp-Blk: 22N — Rge-Sur: 16W UM
Type Completion (Describe): Single Gas — Packer Set At: —	County or Parish: North Slope
Producing Thru: Annulus — Reservoir Temp. F: 566 @ 2060 — Mean Annual Temp. F.: 11.5 — Baro. Press. - P_a: 30.48" B_a = 15.3	State: Alaska
L: 2063 — H: 2063 — G_g: 0.571 — % CO_2: — % N_2: 3.55 — % H_2S: — Prover: 2" — Meter Run — Taps	

NO.	FLOW DATA: Prover Line Size X Choke Orifice Size	Press. psig	Diff. h_w	Temp. F	TUBING DATA: Press. psig	Temp. F	CASING DATA: Press. psig	Temp. F	Duration of Flow, Hr.
SI					900		925		
1.	2 x 6/64	472		18	526		485	43	8

NO.	Coefficient (24-Hour)	$\sqrt{h_w P_m}$	Pressure P_m	Flow Temp. Factor, F_t	Gravity Factor, F_g	Super Compress. Factor F_{pv}	Rate of Flow Q, Mcfd
1.	0.1446		487.3	1.043	1.323	1.046	101.705

NO.	P_r	Temp. R	T_r	Z
1.	.734	478	1.431	.914

Gas Liquid Hydrocarbon Ratio — Mcf/bbl

API Gravity of Liquid Hydrocarbons 30.81 deg.

Specific Gravity Separator Gas .571 x x x x x x x x x x

Specific Gravity Flowing Fluid

Critical Pressure 664 psia

Critical Temperature 334 R

4.09 — P_f 966.767 — P_f^2 934638.4323 — P_c 940.3 — P_c^2 88416

$P_c^2-P_f^2$	P_w	P_w^2	$P_c^2-P_w^2$	P_s	P_s^2	$P_f^2-P_s^2$
633864				545.853	301239.62	633398.8167

NO.	P_t	P_t^2
1.	500.3	250300.0

$\left[\frac{P_c^2}{P_c^2-P_w^2}\right] = \_\_\_\_$

$\log\left[\frac{P_c^2}{P_c^2-P_w^2}\right] = \_\_\_\_$

$n \log\left[\frac{P_c^2}{P_c^2-P_w^2}\right] = \_\_\_\_$

$\left[\frac{P_c^2}{P_c^2-P_w^2}\right] = \left[\_\_\_\_\right.$

$\left[\frac{P_c^2}{P_c^2-P_w^2}\right]^n = \_\_\_\_$

$\left.\frac{\ }{2}\right]^n$

If subsurface pressure data are used, substitute P_f for P_c and P_s for P_w in above formulas.

$AOF = Q\left[\frac{P_c^2}{P_c^2-P_w}\right.$

Mcfd

Commission ____

Company ____

Others ____

AOF ____

n ____

(Source of n)

Form BPT 6

Face Pressure

☆ Sperry Sun Subsur Recorder

FIELD DATA SHEET

Equal time
4 Point

Type Test: ☐ Initial ☐ Annual ☑ Special — Test Date: 3/21/79 — Lease No. or Serial No.:

Company Connection: Husky Oil NPR Operations — Allottee:

Field: East Barrow — Reservoir: Upper Barrow — Location: — Unit:

Completion Date	Total Depth	Plug Back TD	Elevation	Farm or Lease Name
3/16/79	2382	2090	37' KB	

Csg. Size	Wt.	d	Set At	Perforations: From	To	Well No.
7"	38	5.92	2212	2038-48, 2054-65, 2080-84		Barrow #17

Tbg. Size	Wt.	d	Set At	Perforations: From	To	Sec.	Twp - Rlk	Rge - Sur
2 7/8	6.5	2.441	2066	—		30	22N	16W U.M.

Type Completion (Describe): Single Zone Gas Well — Packer Set At: None — County or Parish: North Slope

Producing Thru	Reservoir Temp. F	Mean Annual Temp. F	Baro. Press. - P_a	State
Annulus	56.6 @ 2060	11.5	30.57 P_b=15.3	Alaska

L	H	G_g	% CO_2	% N_2	% H_2S	Prover	Meter Run	Taps
2063	2067	0.571	—	3.55	—	2"		

DATE Time of Reading	ELAP. TIME Hrs.	WELLHEAD WORKING PRESSURE Tbg. Psig	Csg. Psig	Temp. F	METER OR PROVER Pressure Psig	Diff.	Temp. F	Orifice	REMARKS (Include liquid production data: Type - API Gravity - Amount)
20:45	0	720	909					4/64	
21:45	1.0	647	806	43	787		10	C	Oil, 30.8 °API, Trace
22.30	1.5	810	762	34	752		9	V	
22.45	2.0	900	757	34	742		9	4/64	
22:40	0							6/64	
23:25	1.76	717	665	30	649		05	C	Oil, 30.8 °API, Trace
00:15	1.93	630	580	29	575		04		
00:45	1.93	600	549	29	535		04	V	
00:49	2.0	599	546	29	537		04	6/64	
									Test Terminated due to Excessive Drawdown

PAGE 1 OF ____ DATA BY ____

Form BPT 1

MULTIPOINT BACK-PRESSURE TEST REPORT

Type Test: ☐ Initial ☐ Annual ☒ Special — Test Date: 9/21/79 — Lease No. or Serial No.

Company: Husky Oil NPR Operations Inc. — Connection — Allottee

Field: East Barrow — Reservoir: Upper Barrow — Location — Unit

Completion Date: 3/16/70 — Total Depth: 2382 — Plug Back TD: 2080 — Elevation: 37' KB — Farm or Lease Name

Csg. Size: 7" — Wt.: 23# — d: 5.920 — Set At: 2212 — Perforations: From: 2075-45, 2054-65, 2080-88 — To — Well No.: Barrow #17

Tbg. Size: 2⅜ — Wt.: 6.5 — d: 2.441 — Set At: 2086 — Perforations: From — To — Sec.: 30 — Twp - Blk: 22N — Rge - Sur: 16W UM

Type Completion (Describe): Single Gas — Packer Set At — County or Parish: North Slope

Producing Thru: Annulus — Reservoir Temp. F: 156 @ 2060 — Mean Annual Temp. F.: 11.5 — Baro. Press. - P: 30.57 Pa = 15.94 — State: Alaska

L: 2063 — H: 2063 — G_g: 0.591 — % CO_2: — — % N_2: 3.55 — % H_2S: — — Prover: 2" — Meter Run — Taps

FLOW DATA / TUBING DATA / CASING DATA

NO.	Prover Line Size	X	Choke Orifice Size	Press. psig	Diff. h_w	Temp. F	Press. psig	Temp. F	Press. psig	Temp. F	Duration of Flow, Hr.
SI	2"						900		905		
1.			4/64	745		9	800		752	34	2
2.			6/64	537		4	590		548	24	2
3.											
4.											
5.											

NO.	Coefficient (24-Hour)	$\sqrt{h_w P_m}$	Pressure P_m	Flow Temp. Factor, F_t	Gravity Factor, F_g	Super Compress. Factor F_{pv}	Rate of Flow Q, Mcfd
1.	0.06569		760.34	1.053	1.323	1.085	75,496
2.	0.1446		552.34	1.059	1.323	1.057	112,278
3.							
4.							
5.							

NO.	P_r	Temp. R	T_r	Z
1.	1.172	469	1.404	0.850
2.	0.809	464	1.389	0.895
3.				
4.				
5.				

Gas Liquid Hydrocarbon Ratio _____ Mcf/bbl

API Gravity of Liquid Hydrocarbons _____ deg.

Specific Gravity Separator Gas _____ xxxxxxxxxx

Specific Gravity Flowing Fluid xxxxxxx _____

Critical Pressure 664 psia _____ psia

Critical Temperature 334 R _____ R

P_c 920.34 P_c^2 847025.7156 — P_t 971.944 P_t^2 944675.1391

NO.	P_t	P_t^2	$P_c^2 - P_t^2$	P_w	P_w^2	$P_c^2 - P_w^2$	P_a	P_a^2	$P_t^2 - P_a^2$
1.	767.34	588810.6756	258215.0				843.664	711768.9449	232906
2.	563.34	317351.9556	529673.76				629.504	396251.55	548.394
3.									
4.									
5.									

AOF 132.0 Mcfd

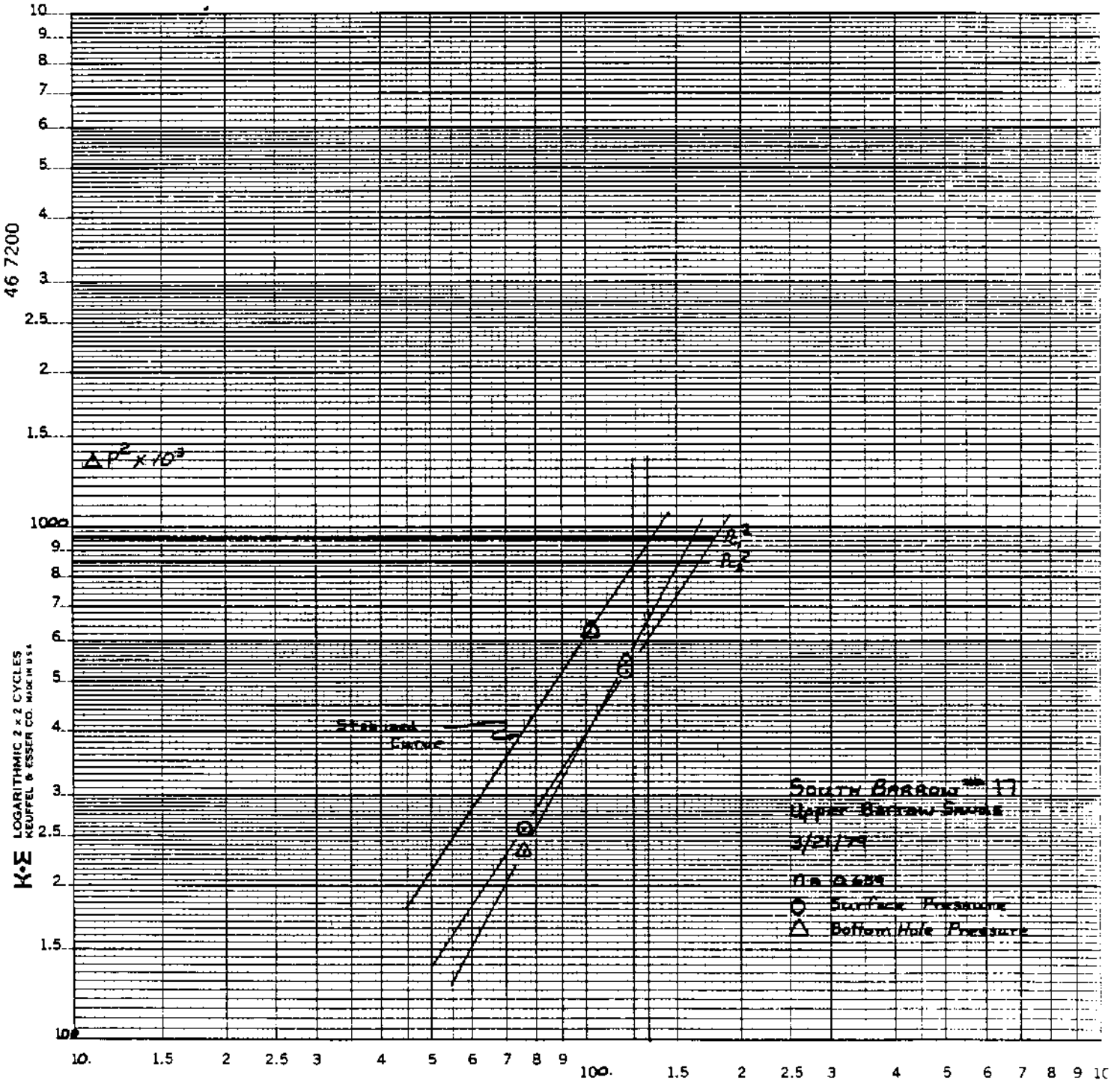
n .659

Commission _____

Company SKLewis

Others _____

Form BPT 5


46 7200
KE LOGARITHMIC 2 x 2 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.
ΔP² x 10³
Stabilized Curve
South Barrow #17
Upper Barrow Sands
3/21/79
Surface Pressure
Bottom Hole Pressure
Q (Mcf/d)