

NATIONAL PETROLEUM RESERVE IN ALASKA

GEOLOGICAL REPORT

SOUTH BARROW WELL NO. 18

HUSKY OIL NPR OPERATIONS, INC.  
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For the

U. S. GEOLOGICAL SURVEY  
Office of the National Petroleum Reserve in Alaska  
Department of the Interior  
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COMPOSITE LITHOLOGY LOG (In Pocket)

## GEOLOGIC SUMMARY

### INTRODUCTION

South Barrow Well No. 18 was drilled on the nose of a small east plunging structure, approximately 10 miles southeast of Barrow, Alaska. Drilling below conductor casing (95') began on September 22, 1980. Lower Cretaceous and Jurassic rocks were penetrated. The well was terminated on October 5, 1980 in the basal portion of the Lower Barrow sandstones at total measured depth of 2,135 feet. The rig was released on October 14, 1980 after production tests were completed. Six conventional cores were cut and two production tests performed.

In each of the South Barrow wells drilled after South Barrow No. 13, an inhibitive mud system, containing calcium-chloride, was used after intermediate casing (commonly 9-5/8" to about 1,500 feet). This was done to minimize damage to potential reservoirs caused by swelling clays, which are present in the Barrow sandstones and the Sag River Sandstone (determined by water susceptibility tests on cores from the South Barrow Nos. 12 and 13). The high concentrations of calcium-chloride used below the intermediate casing necessitated running a dual laterolog, as the high calcium and chloride ion concentration in the mud adversely affects the measurement of conductivity by the dual induction log. The dual induction log was run in the upper part of each well where fresh-water-mud was used.

South Barrow Well No. 18 was completed as a producible gas well in the Lower Barrow sandstone from perforations at 2056.5-2076.5' in the 7" casing. Calculated AOF was 1.65 MMCFGPD (see Appendix G).

### PRE-DRILLING PROGNOSIS

The primary objective of the well was the Lower Barrow sandstone which was expected at a subsea depth of -2035'. A thickness of 20-25' of porous sandstone was anticipated. Secondary objectives were the Upper Barrow sandstone and possibly thin sandstones in the lower part of the "Pebble Shale".

### POST-DRILLING SUMMARY

The Lower Barrow sandstone, expected at a subsea depth of -2035', was encountered at -2022'. Twenty feet of good porous sandstone with good hydrocarbon shows were present. Porosities varied from 20-29% with low water saturations of 20-33% (E-log). Two production tests were performed on this sandstone. The first, through perforations at 2056-2076', flowed gas at the rate of 340 MCFGPD. Test No. 2, through perforations 2056.5-2076.5', flowed at a calculated AOF of 1.65 MMCFGPD (see Appendix G).

Fair to good porosities (15-18%) were present in the Upper Barrow sandstone, but water saturations were fairly high (59-86%) and permeabilities generally low.

Hydrocarbon shows were present in the Torok and Kingak Formations and in the "Pebble Shale", but the sandstones were thin and not deemed worthy of testing.

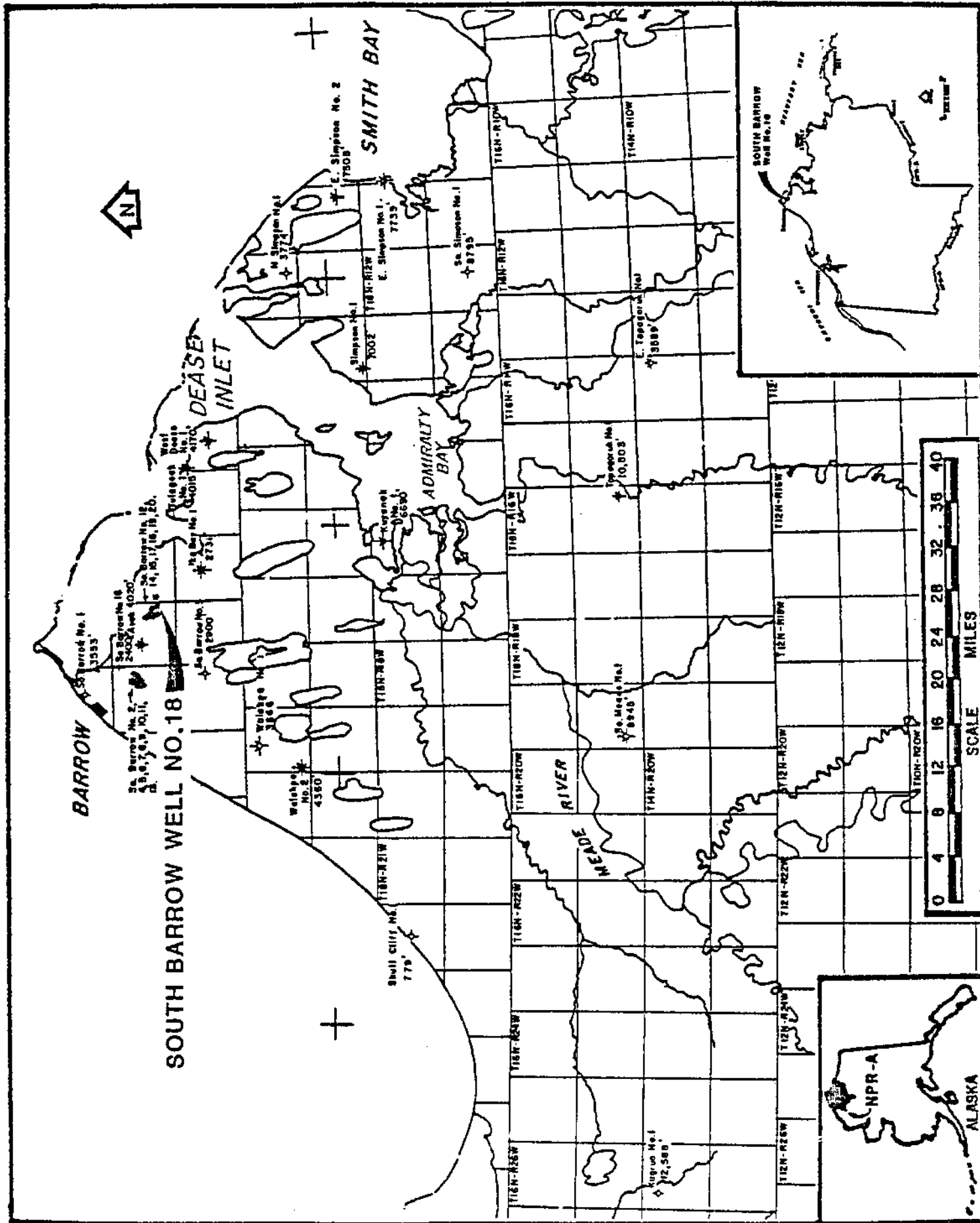
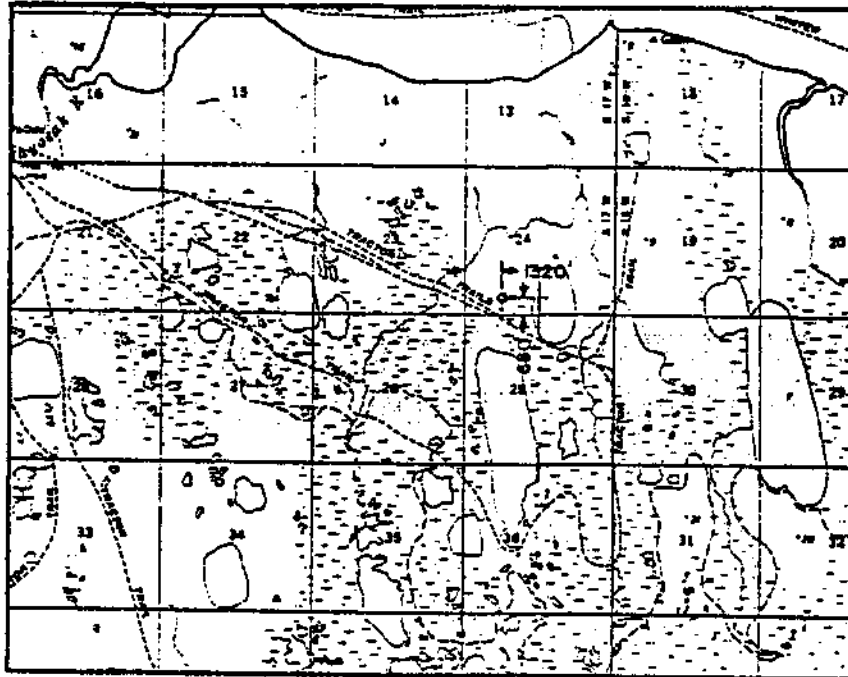


FIGURE 1 - LOCATION MAP - SOUTH BARROW WELL NO. 18



**BARROW GAS WELL No 18**

LAT. = 71° 14' 22.98"  
 LONG. = 156° 18' 41.00"  
 Y = 6,306,022.15  
 X = 698,905.52  
 ZONE 6

**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.




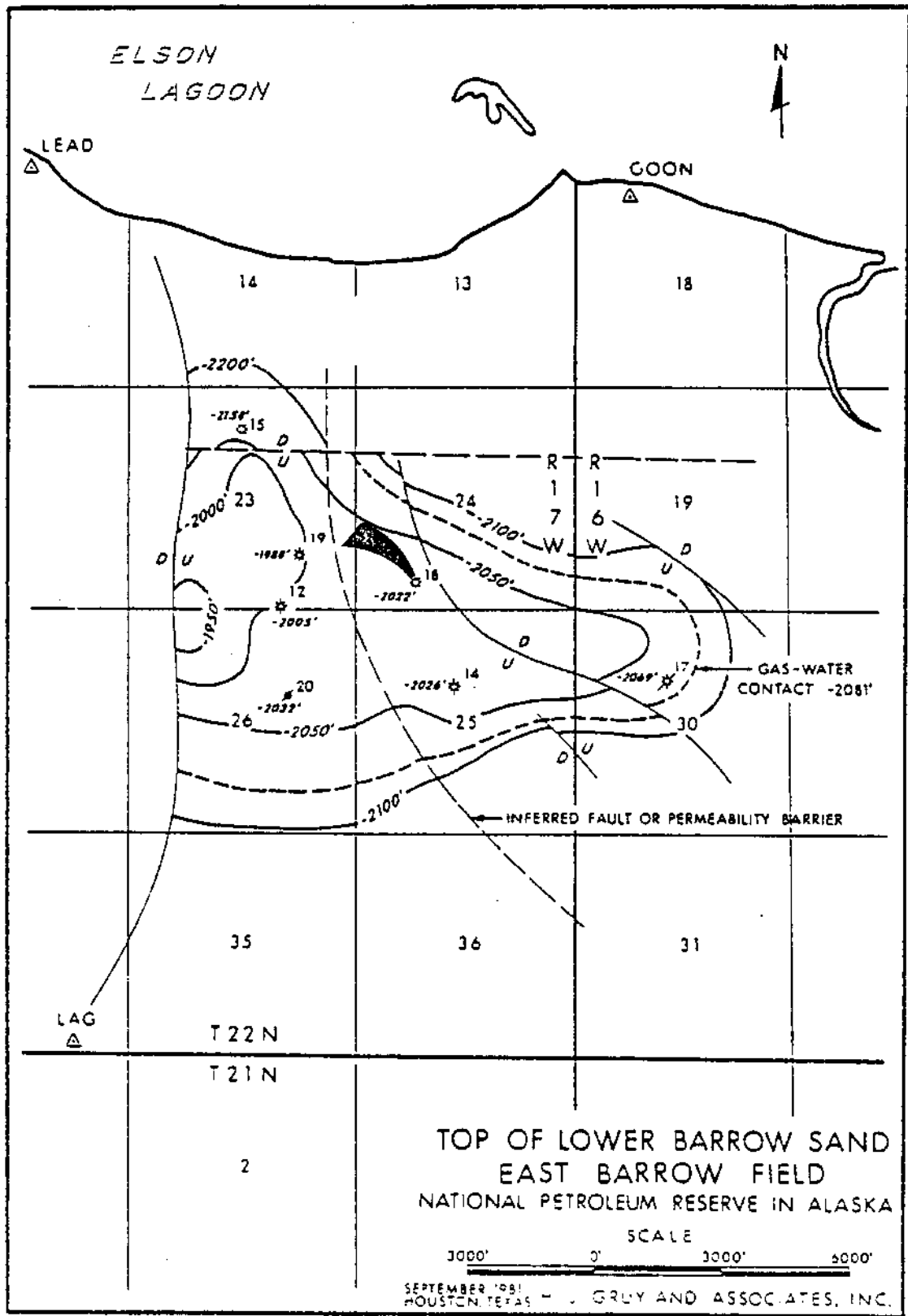
<p>AS STAKED  <b>BARROW GAS WELL No. 18</b>          LOCATED IN          SW 1/4 PROTRACTED SEC. 24, T22N, R17W, UMIAT MERIDIAN, AK.</p>
<p>SURVEYED FOR  <b>HUSKY OIL</b>          N. P. R. OPERATIONS, INC.</p>
<p> <b>TECTONICS INC.</b>          P.O. BOX 4-2265, ANCHORAGE, AK 99508</p>

FIGURE 2 - CERTIFICATE OF SURVEYOR - SOUTH BARROW WELL NO. 18



Revised after H. J. Gruy  
FIGURE 3, STRUCTURE, TOP OF LOWER BARROW SAND



WELLSITE GEOLOGIST'S REPORT  
BY: R. G. BROCKWAY

INTRODUCTION

South Barrow Well No. 18, 660' FSL, and 1320' FWL, SW 1/4, protracted Section 24, T22N, R17W, Umiat Meridian, drilled from under conductor casing September 22, 1980, and terminated on October 5, 1980, at a depth of 2,135 feet.

Sedimentary rocks of the Torok Formation and "Pebble Shale" of Cretaceous age and the Kingak Formation, including the Barrow sandstones, of Jurassic age were penetrated. Zones of interest were primarily the Upper and Lower Barrow sandstones with possible sandstones in the "Pebble Shale" as secondary objectives.

Hydrocarbon shows were present in all formations, but only the Lower Barrow sandstone (2052-2072') was deemed worthy of testing. A production test was performed on the Lower Barrow sandstone and obtained a calculated AOF of 1.65 MMCFGPD. Well No. 18 extended the South Barrow Gas Field approximately one-half mile east and north of existing wells in the field.

STRATIGRAPHY

WIRELINE TOPS

	<u>Drilled Depth (BKB)</u>	<u>Subsea Depth KB 30'</u>
CRETACEOUS		
Torok Formation	95'	-65'
"Pebble Shale"	Samples start 1373'	-1343'
JURASSIC		
Kingak Formation	1758'	-1728'
Upper Barrow sandstone	1976'	-1946'
Lower Barrow sandstone	2052'	-2022'
Total Depth	2135'	-2105'

CRETACEOUS

Torok Formation: 95-1373'

The Torok Formation is composed of interbedded claystones and siltstones. The claystones are light gray to light brownish-gray, soft, silty, and slightly carbonaceous. The siltstones are light to medium gray and

gray-brown, soft, and clayey, with carbonaceous flakes, traces of pyrite and fossil fragments, and with rare silty limestone stringers. A few thin sandstone stringers are present above 1245', but increase in frequency below this depth. These sandstones, which do not exceed 5' in thickness, are light to medium gray, very fine grained, subangular, medium sorted, partly silty and clayey and slightly carbonaceous. Minor oil and gas shows were observed in the lower sandstones.

A 60' core was scheduled at 1350' in an effort to core the contact between the Torok Formation and the "Pebble Shale". After cutting 21', the core barrel jammed and only 12' of gray-brown shale with 85° fractures and hydrocarbon stains was recovered. A second core was immediately cut (1371-1400') which also jammed after 29'. Twenty-two and one-half feet of this core was recovered and consisted of dark brownish-gray fissile, flaky shale with fish fragments common, indicating that this core was from the "Pebble Shale".

No evidence of the Torok-"Pebble Shale" contact was present in the second core, so it is assumed that Core No. 1 jammed at or near the contact, losing that portion of the core from the core barrel. Electric logs show the contact at 1373', but the difference in depth may have been an error in pipe tally.

#### "Pebble Shale": 1373-1758'

Lithology of the "Pebble Shale" is dark gray-brown and dark brownish-gray, fissile, slightly micaceous, carbonaceous shales with "floating" rounded, slightly frosted quartz grains and dark gray to black chert pebbles and granules and scattered pyrite inclusions. Fish fragments were noted in Core No. 2. Interbedded with these shales are light gray and gray-brown micaceous, carbonaceous siltstones. At 1560', a series of evenly spaced (20-30') thin bedded sandstones occur to a depth of 1680'. These sands are 3' to 5' in thickness, light gray to light gray-brown, very fine to fine grained, subangular to subrounded, silty and clayey, moderately friable, and carbonaceous with an estimated 7-15% porosity and hydrocarbon shows.

Core No. 3 (1703-1763') was cut in order to obtain the Cretaceous-Jurassic contact. The contact was encountered at 1757.6' in the core. The upper 42' of Core No. 3 was composed of interbedded siltstones, sandstones and shales. The siltstones are brownish-gray to dark gray-brown, sandy, and carbonaceous. The sandstones are very light brown to gray-brown, very fine to medium grained, subangular and contained hydrocarbon shows. The shales are dark brown, fissile, and carbonaceous with fish fragments. Some glauconite grains were present in the upper 4.5'. Scattered throughout the interval were black and dark gray chert grains and pebbles, rounded quartz grains, and pyritized plant or fossil remains. Large pyritized and carbonized wood fragments were also present.

At 1745', a transitional zone begins. At this point, the shales become very dark gray-brown, moderately to very carbonaceous, and sandy with rounded quartz grains resembling those found "floating" in the shales of

the upper part of the formation. Occasionally these sand grains occur in clusters forming sand inclusions in the shales. At 1752.5' to 1753.4', they become plentiful enough to form a shaly, medium to very coarse grained, rounded to subrounded sandstone, with black chert pebbles common. A slight hydrocarbon show was observed in this sand.

Dark chert pebbles and granules are common to abundant throughout the transition zone with a general downward increase in size, reaching measurements of two inches in diameter.

Immediately below the transition zone is a 0.6' conglomerate (1757-1757.6'). This conglomerate, which came from the core barrel as unconsolidated material, is composed primarily of light to dark gray and black chert pebbles up to two inches in diameter, with occasional light quartz granules and pebbles giving it a slightly "salt and pepper" appearance. A portion of the unconsolidated material was washed, and traces of dark gray shale, probably the cementing matrix of the conglomerate was detected. Some very light gray, very soft clayey siltstone and silty clay were also present. The siltstone and clay from the washed material could belong in the conglomerate, but probably belongs to the uppermost siltstone and shales immediately below the conglomerate.

A similar conglomerate was also observed in South Barrow Well No. 15, Section 23, T22N, R17W, Umiat Meridian at a depth of 1911'. Whether it is present in other nearby wells is not known at this time.

## JURASSIC

### Kingak Formation: 1758-2135'

Interbedded shales and claystones, siltstones, and sandstones comprise the Kingak Formation with the sandstones most prominent below 1916'. The claystones and shales are light gray to light brownish-gray, soft, and silty, with scattered sand grains and streaks of gray-brown carbonaceous shale. The siltstones are light gray, light tannish-gray to tan, partly clayey, slightly micaceous, contain grains and pellets of glauconite and are rarely sideritic.

Although the sandstones are most prominent in the lower portion of the formation, they do not exceed 4' in thickness and are generally very fine grained, light gray to white, subangular, friable, and slightly glauconitic with a clay matrix.

Hydrocarbon shows were present in two beds at 1916-1920' and 1963-1967'. The latter bed is a fine grained, glauconitic sandstone with coal stringers or partings which appear to be a good marker bed in locating the Upper Barrow sandstone some 7' to 10' below, at least in this well and in South Barrow Well No. 15. Light gray-brown shales and siltstones separate this sandstone from the Upper Barrow sandstone.

Upper Barrow sandstone: 1976-2052'

The Upper Barrow sandstone (1976-2052') is light brown to gray-brown, fine grained, subangular, medium sorted, and quartzose with scattered glauconite pellets and grains, carbonaceous grains, pyrite inclusions, and thin interbedded shales and siltstones varying in color from light gray-brown to dark gray-brown. Core No. 4 was taken in the interval 1990-2020' and consisted of predominantly sandstone as described above with tight shaly zones. Porosity streaks up to 22% (Appendix E) were present with slight shows of hydrocarbons. Some fossil fragments and pyrite replaced plant remains were observed with one large fossil resembling an ammonite in the interval 2005-2006.5'. No tests were performed in the Upper Barrow.

Separating the Upper Barrow sandstone from the Lower Barrow sandstone is a 2-3' gray-brown shale, which is hard to distinguish in the drill cuttings, but shows well on the drilling-time logs.

Lower Barrow sandstone: 2052-2072'

The Lower Barrow sandstone (2052-2072') has a good porous 20' of sandstone. Below the porous sandstone is a sandstone, siltstone and shale interval. The Lower Barrow sandstone is the main gas-producing reservoir of the East Barrow Gas Field. The sandstone is a fine to medium grained, very light to light brown, subangular to subrounded, medium to well sorted, and quartzose, with scattered glauconite grains, fossil fragments and casts and large wood fragments. Core No. 5 (2051-2072') was taken in the Lower Barrow sandstone. (A slight discrepancy in depths is noted between the E-logs and core depth. E-logs indicate top of Lower Barrow at 2052', but Core No. 5 starts at 2051' in Lower Barrow. There may be an error in pipe measurement. Fifteen and one-half feet of core were recovered from Core No. 5 and were comprised of sandstones with an average porosity of 23% (Appendix E). It contained an even dull to faint light yellow hydrocarbon fluorescence and good instant cut in chloroethane. Electric-log computations show 20-29% porosity and 20-33% water saturation (Appendix C). A production test was performed through perforations at 2056.5-2076.5' with a calculated AOF of 1.65 MMCFGPD (Appendix G).

The lower part of the Kingak Formation, which includes Core No. 6, is composed of interbedded sandstones and siltstones. The sandstones are medium to light gray-brown, fine to very fine grained, subangular, shaly and silty with scattered glauconite and pyritized fossil fragments. The siltstones are gradational with the sandstones and are gray-brown to light gray, sandy and shaly.

Below 2095', the section is composed predominately of siltstone with gray-brown and light gray-brown interbedded shales. The well was terminated in this sequence. Hydrocarbon shows became very weak in Core No. 6 and were very weak or absent below.

## HYDROCARBON INDICATIONS

By the use of a microscope, ultra-violet light, and chromatograph, several hydrocarbon shows were observed during the drilling of South Barrow No. 18. The first shows encountered were present in the lower Torok interval 1215-1373'. Here the thin sandstones had a dull yellow fluorescence under the ultra-violet light with a light yellow streaming cut in the upper 85'. Below 1300', the fluorescence becomes light medium yellow to bright yellow with instant light yellow to slow light yellow streaming cut. No visible staining was observed under the microscope except in the 12' of shale recovered from Core No. 1. Here a wet, watery looking stain occurred on the bedding planes and was scattered along the 85° fractures which were present throughout the 12'. This staining had a light bluish-yellow fluorescence and instant light bluish-yellow cut and had a good gassy odor. Some minor gas shows were recorded by the chromatograph (maximum 480 units).

Most of the thin sandstones in the "Pebble Shale" exhibit some hydrocarbon show including gas indications on the chromatograph. Although no visible staining was observed, nearly all of these sandstones showed a dull yellow to gold fluorescence and instant light yellow streaming cut. Because these sandstones did not exceed 5' in thickness, it was deemed not worthy of testing, although one sandstone at 1452-1454' had 970 units of gas.

Hydrocarbon shows were minimal through the upper part of the Kingak Formation with the exception of two sandstones at 1916-1920' and 1963-1967'. The upper sandstone had a good medium yellow fluorescence and light bluish-yellow streaming cut. The lower sandstone exhibited only a trace of fluorescence and cut, but at 1916', the background gas increased to a high of 280 units, indicating that the thin sandstones in the upper Kingak contained some gas.

In the Upper Barrow sandstone, the chromatograph readings indicate only a general increase in total gas, reaching 300 units at 2003', but a definite increase in petroleum vapors from a high of 60 units in the Kingak to an average of 180 units in the Upper Barrow. Core No. 4 (1990-2020') did not display any visible staining under the microscope, but under the ultra-violet light reflected a faint dull yellow to faint whitish-yellow fluorescence and a very slow to instant light yellow cut. Electric logs show that the best porosity zone in the Upper Barrow is from 1995-2022' with an average of 15-18%. This is well supported by the core analysis on Core No. 4 (see Appendix E), although occasional thin zones reached porosities up to 22%. Permeability varied greatly from 0.07 to 115 millidarcies with the better permeability occurring in very thin zones.

The density and porosity logs indicate some gas present, but calculated water saturations are high with intervals 1986-1994' having 86%, 2000-2010' having 62%, and 2010-2020' at 59%, using a 0.25 water resistivity, which was obtained from a drill-stem test sample chamber from South Barrow No. 15 (Appendices C & E).

No tests were performed on the Upper Barrow sandstone.

The Lower Barrow sandstone (2052-2072') showed increased gas readings up to 420 units and exhibited a faint light yellow to dull yellow fluorescence and instant light yellow to light bluish-yellow cut through the interval 2056-2066'. A dull yellow fluorescence was noted above, and below this zone to a depth of 2079'. Electric logs show porosities of 20-29% through this sandstone (Appendix D). Core analysis of 15' of sandstone recovered in Core No. 5 (2051-2072') showed an average porosity of 20.3% with a maximum of 27%. Permeability varied from a low of 38 millidarcies to a very high 2,627 millidarcies. It is very probable that the extremely high readings of permeability (four in number), are not representative of the sandstone and possibly reflect small induced fractures or bed disturbance. The highest reading of 2,627 millidarcies at 2059' was from a sample apparently taken from a section of core immediately above a pulverized and shattered zone from 2059-2060'. A vertical fracture was noted in a tight sandstone stringer from 2061-2061.6'. Millidarcies in the 200-400 range appear to be more typical of this sandstone with thin less permeable and porous zones present (Appendix E).

Gas is indicated in the Lower Barrow sandstone by a cross-over of the neutron and density porosity logs and a lowered density on the density log. A production test was performed through perforations from 2056.5-2076.5', with a calculated AOF of 1.65 MMCFGPD (see Production Test, Appendix G).

A core analysis of Core No. 6 (2072-2087') shows an average porosity of 13.7% with a high of 17.9%. Although porosities are still fair in this core, the permeability drops drastically with only one sample at 2075' reaching as high as 40 millidarcies, and generally is less than 2.0 millidarcies. Electric logs through this zone indicate an average of 10-11% porosity on the density porosity log with a wide separation from the neutron curve indicating a shaly content to the rocks. Core descriptions also state that the core is becoming shaly and silty, and hydrocarbon shows are nil below 2079'.

A correlation of the coregraph and the FDC-CNL porosity log indicates that the original depths on Cores No. 5 and No. 6 should be lowered approximately four to five feet.

#### PRODUCTION TESTS

Two production tests were performed. The first, through perforations at 2056-2076', only produced at a rate of 340 MCFPD after being "rocked" with gas from South Barrow No. 19. The well was then killed with  $\text{CaCl}_2$  water and reperforated at 2056.5-2076.5'.

Production Test No. 2 was opened through a 14/64" choke with FWHTP 420 psi and calculated at 1.05 MMCFGPD, with a FBHP of 592 psi. The choke was changed to 20/64" two hours before end of test with tubing pressure stabilizing at 390 psi. Final calculated rate was 1.37 MMCFGPD with FBHP

at 437 psi. The well was then shut in for four hours and established a final shut-in pressure of 950 psi. (History of Drilling Operations, South Barrow Well No. 18, Husky Oil NPR Operations, September 1982, page 3.)

Calculated Absolute Open Flow was 1.65 MMCFGPD (Appendix G).

#### STRUCTURAL DATA

South Barrow Well No. 18 was drilled on the nose of a small east-plunging structure located in Sections 19 and 30, T22N, R16W, and Sections 23, 24, 25 and 26, T22N, R17W, Umiat Meridian, approximately 10 miles southeast of Barrow, Alaska.

Several small faults have been postulated by H. J. Gruy and Associates, Inc. (Figure 3) on the east end of the mapped structure (Figure 3), but after correlating South Barrow Well No. 18 with surrounding wells (South Barrow Nos. 19, 14, and 17), it appears that the difference in structural relief can be explained by the dip rate. If faulting is actually present, the displacement would have to be very small.

After correlation, it was found that the top of the Lower Barrow sandstone in Well No. 18 is 49' higher than South Barrow No. 17, 17' higher than South Barrow No. 14, and 27' lower than South Barrow No. 19. Correlation with South Barrow No. 15, which is 136' lower than South Barrow No. 18, is somewhat more complicated, and the difference in structural position may well be due to faulting, which is indicated by the dipmeter log from South Barrow No. 15.

Faulting does not appear to be present in Well No. 18 except for possibly one zone at 790-950'. From an average of 10° in a northwest direction, dips increase to 43-50° in this interval. Immediately below the 790-950' zone dips decrease to 25°, but there is no change in direction of dip. If a fault is present, then it cuts the well bore at 950'. Correlation with other wells shows very little or no change in total interval from the point of the possible faulting to the top of the "Pebble Shale".

# PERTINENT DATA AND APPENDICES

## Appendix

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SUMMARY OF PERTINENT DATA \*

WELL NAME: South Barrow Well No. 18  
 API NO.: 50-023-20017  
 OPERATOR: Husky Oil NPR Operatons, Inc.  
 LOCATION: 1320' FWL, 660' FSL, (SW 1/4),  
 protracted Section 24, T22N, R17W  
 Umiat Meridian, North Slope Borough, Alaska  
 COORDINATES: Latitude: 71°14'22.98"N  
 Longitude: 156°18'41.00"W  
 X = 698,905.52  
 Y = 6,306,022.15  
 Zone 6  
 ELEVATION: 7' Ground, 12' Pad, 30' Kelly Bushing  
 DATE SPUDDED: September 22, 1980  
 TOTAL DEPTH: 2,135 feet  
 DATE REACHED  
 TOTAL DEPTH: October 5, 1980  
 DATE RIG RELEASED: October 14, 1980  
 STATUS: Shut in.  
 CASING: 13-3/8" @ 95'  
 9-5/8" @ 1519'  
 7" @ 2126'

LOGGING RECORD:

DIL/SFL/GR/SP	106-1513'
DLL/MSFL/GR	1520-2112'
BHCS/GR/TTI	106-1508'
	1520-2116'
FDC/CNL/GR/CAL	1520-2124'
FDC/GR/CAL/RR	1520-2124'
HDT Dipmeter, Run No. 1	106-1517'
HDT Dipmeter, Run No. 2	1520-2120'
CBL/VDL/GR/CC	1200-2079'
Mudlog	90-2125'
Dc Exponent	90-2125'
Computed Logs	
Saraband	1524-2093'
Dipmeter Arrow Plot	122-1514'
Dipmeter Arrow Plot	1537-2082'

SIDEWALL CORES:           None

CONVENTIONAL CORES: \*\*

<u>No.</u>	<u>Interval</u>	<u>Recovery</u>	<u>Formation</u>
1	1350-1371'	12.0'	Torok
2	1371-1400'	22.5'	"Pebble Shale"
3	1703-1763'	60.0'	"Pebble Shale" & Kingak
4	1990-2020'	29.0'	Upper Barrow
5	2051-2072'	15.5'	Lower Barrow
6	2072-2087'	14.5'	Kingak

PRODUCTION TESTS:

No. 1   Perforated 2056-2076'.   Flowed 340 MCFGPD.

No. 2   Reperforated 2056.5-2076.5'.   Flowed (calculated) 1.37  
MMCFGPD.

WELLSITE GEOLOGIST:           R. G. Brockway

WELL LOG ANALYST:            Armour Kane

CONTRACTOR:                 Brinkerhoff Signal, Inc.

MUD LOGGER:                 The Analysts

OTHER AVAILABLE DATA:    Gearhart-Owen Pressure Test  
                                  (Hewlett-Packard Pressure Data)

\*   Copies and/or reproducibles of all  
geological data are available from:

National Oceanic and Atmospheric Administration  
EDIS/NGSDC (D62)  
325 Broadway  
Boulder, CO 80303

\*\*   Coregraph available on Cores 1-6.

SOUTH BARROW WELL NO. 18  
DRILL CUTTINGS AND CORE DESCRIPTIONS  
BY  
R. BROCKWAY - 90-2125'

DRILLED DEPTH  
(FEET, BELOW  
KELLY BUSHING)

0 - 90	No recovery.
90 - 215	Claystone: light gray, medium gray, silty, very soft, partly carbonaceous, interbedded with Siltstone: very light to medium gray, clayey, soft, scattered sand grains and stringers.
215 - 240	Siltstone: light and very light gray, clayey, very soft, carbonaceous, coal grains.
240 - 255	Claystone: as above, coal grains and chips common (contamination?).
255 - 280	Siltstone: as above.
280 - 290	Claystone: light gray-brown, partly silty, trace gray silty shale.
290 - 343	Siltstone: light gray, clayey, very slightly sandy, interbedded and interlaminated with Claystone: light gray and light gray-brown, sandy, rare chert pebbles, and Sand: loose, medium to coarse grained, subangular, scattered granules, coal grains and chips, crinoid and shell fragments.
343 - 350	Sand: loose, medium to coarse grained, subangular, quartz, chert, and coal, probable clay matrix.
350 - 440	Siltstone, Claystone and Sand: interbedded and interlaminated, as above, scattered foraminifera.
440 - 456	Sand: loose, varicolored, fine to medium grained, subangular to subrounded, quartz, chert, coal and mafic grains, pyritic, trace of glauconite, shell fragments.
456 - 577	Claystone: very light gray, very soft, sandy, slightly silty, interbedded and interlaminated with Siltstone: very light gray, clayey, very soft, partly sandy, and Sand: loose, varicolored, fine to medium grained, as above, shell fragments, some gray, firm, argillaceous, limy siltstone stringers and inclusions.

- 577 - 588 Siltstone: gray, limy, argillaceous, carbonaceous flakes, fossil fragments; limestone streaks, gray, silty, argillaceous, firm.
- 588 - 854 Siltstone: very light gray, very soft, clayey with gray limy siltstone inclusions, pyrite inclusions, chert pebbles, rare echinoid and shell fragments, a few limestone inclusions and stringers, trace of coal, some interbedded claystone.
- 854 - 860 Sandstone: light gray, very fine grained, subangular, very soft, clayey.
- 860 - 1145 Claystone: very light gray, very silty, interbedded with Siltstone: very light gray, clayey, gray limy siltstone inclusions, scattered gray and light brown limestone stringers, pyrite inclusions, varicolored chert granules and pebbles; thin light gray, very fine grained, soft, friable sandstone stringers below 1050'.
- 1145 - 1217 Siltstone: very light to light medium gray, partly clayey, carbonaceous flakes, varicolored chert pebbles common, carbonaceous shale and siltstone inclusions, pyrite inclusions, trace of coal, scattered sandstone and argillaceous limestone inclusions, a few claystone beds.
- 1217 - 1230 Sandstone: light to medium gray, very fine to fine grained, subangular, moderately well sorted, silty, clayey, soft, friable, slightly carbonaceous to coaly, fair porosity, no stain, dull yellow fluorescence, light yellow streaming cut.
- 1230 - 1247 Claystone: light medium gray, silty, soft, abundant pebbles and inclusions, as above.
- 1247 - 1253 Sandstone: as above, fluorescence and cut, as above.
- 1253 - 1297 Siltstone: light to medium gray, clayey, soft with interbedded Sandstone: light to medium gray, very fine grained, dull yellow fluorescence, light yellow streaming cut, and Claystone: light gray, soft.
- 1297 - 1305 Sandstone: light gray, very fine to fine grained, subangular, partly silty and clayey, slightly carbonaceous, fair porosity, no stain, pale yellow to bright yellow fluorescence, instant light yellow to streaming medium yellow cut.
- 1305 - 1333 Claystone: soft, silty, interbedded with Sandstone: as above, and Siltstone: gray to light brownish-gray, soft, slightly carbonaceous, scattered shell fragments.

1333 - 1350 Sandstone: light gray-brown, very fine grained, subangular, moderately well sorted, silty, clayey, carbonaceous, coal inclusions, fine grained streaks, soft, friable, rare glauconite, poor porosity, light medium yellow to bright yellow fluorescence, slow light yellow cut (partly streaming), appears very slightly stained, rare siltstone interbeds.

1350 - 1371 Core No. 1: Cut 21', Recovered 12'

1350.0-1362.0' Shale: gray-brown, fissile, flaky  
(12.0') ("poker chip"), micromicaceous, carbonaceous flakes with very thin brown siltstone partings and laminae, bedding horizontal, 85° fractures throughout core, good gassy odor, wet watery looking stain on bedding planes, occasionally on fractures, with light bluish-yellow fluorescence, instant light bluish-yellow cut, occasional chips have bleeding gas when slightly heated, siltstone partings and laminae have bluish-yellow fluorescence and instant light yellow cut, appear slightly stained.

1362.0-1371.0' No recovery.  
(9.0')

1371 - 1400 Core No. 2: Cut 29', Recovered 22.5'

1371.0-1393.5' Shale: dark brownish-gray, fissile,  
(22.5') flaky, micromicaceous, scattered disseminated pyrite crystals, and fine pyrite inclusions, fish fragments common, a few altered fossil fragments, thin coaly parting at 1391.5', core is highly fractured and shattered, slight hydrocarbon odor at 1392.5', dip approximately 3° at 1388.5-1391.5'.

1393.5-1400.0' No recovery.  
(6.5')

1400 - 1410 Shale: dark gray-brown, partly silty, fissile, rare fish fragments, trace of very light gray bentonitic shale.

1410 - 1422 Sand: loose, fine to medium grained, subrounded to subangular, predominantly quartz, rare chert grains, probably clay filled, trace of siltstone stringers.

- 1422 - 1443 Shale: brownish-gray to dark brownish-gray, partly silty, becoming very carbonaceous, fissile, trace of light gray bentonite shale, white calcite common (fracture fill?), siltstone laminations.
- 1443 - 1450 Sand: loose, as above, trace of glauconite.
- 1450 - 1475 Shale: as above, trace of light gray bentonite, sandstone stringers, pyrite inclusions.
- 1475 - 1520 Sand: loose, fine to medium grained, subangular quartz, chert and glauconite grains, trace of very fine to fine grained sandstone, subangular, glauconitic, soft, friable, zones with fair porosity, interbedded Shale: as above.
- 1520 - 1557 Shale: dark brownish-gray, fissile, carbonaceous, scattered rounded quartz grains, trace of bentonitic shale, with interbedded Sandstone: light brown to light gray, very fine to fine grained, subangular to subrounded, slightly clayey, and Siltstone: light gray and gray-brown, trace of white and clear calcite.
- 1557 - 1562 Sandstone: light gray, very fine to fine grained, subrounded to subangular, slightly clayey, silty, friable, fair porosity, gold fluorescence, instant light yellow streaming cut, slight odor when heated.
- 1562 - 1569 Shale: brownish-gray, carbonaceous, fissile.
- 1569 - 1573 Sandstone: as above.
- 1573 - 1590 Shale: brownish-gray, as above, limestone stringer at 1580'.
- 1590 - 1617 Sandstone: light gray to medium gray, fine to very fine grained, subangular to subrounded, carbonaceous, coal grains, trace of pyrite, gold fluorescence, instant light yellow streaming cut, interbedded with Siltstone: brownish-gray, shaly, carbonaceous, and Shale: dark gray-brown, fissile, carbonaceous.
- 1617 - 1626 Sandstone: light gray, light brownish-gray, fine to very fine grained, subrounded to subangular, carbonaceous, clayey, coal grains, trace of pyrite, rare glauconite, fair porosity, dull yellow fluorescence, pale yellow streaming cut.
- 1626 - 1637 Siltstone and Shale interbedded: gray-brown, micaceous, carbonaceous.
- 1637 - 1645 Sandstone: as above, fair porosity, fluorescence and cut, as above.

- 1645 - 1672 Sandstone, Siltstone and Shale: interbedded, as above.
- 1672 - 1676 Sandstone: light gray-brown, fine grained, subrounded to subangular, carbonaceous, scattered white and brown grains, some very coarse quartz grains, rare chert granule, scattered very dull gold fluorescence, very slow medium yellow cut.
- 1676 - 1703 Sandstone: as above, interbedded with Siltstone: brownish-gray, carbonaceous, slightly micaceous, and Shale: dark gray-brown, slightly micaceous, fissile, scattered glauconite grains and pellets, pyrite inclusions, trace of tan and light brown siderite.
- 1703 - 1763 Core No. 3: Cut 60', Recovered 60'
- 1703.0-1730.2' (26.8') Siltstone: brownish-gray to dark gray-brown, sandy, shaly, carbonaceous, micaceous, occasional pyrite inclusions; interbedded with Sandstone: gray-brown to dark brown, very fine grained, silty and shaly, carbonaceous, tight, occasional medium to very coarse, rounded quartz grains, and dark chert pebbles, rare glauconite, 6" bed at 1707.0-1707.5', with fair porosity, bright yellow fluorescence, light yellow streaming cut, and pyrite replaced fossil or plant remains, occasional large pyritic wood fragment, beds from few millimeters to 2-1/2 meters, generally 60-70 centimeters.
- 1730.2-1744.7' (14.5') Shale: dark to very dark brownish-gray, very sandy, carbonaceous, silty, with pyrite plant fragments and some fish fragments; with Siltstone: gray-brown at 1739-1742'.
- 1744.7-1757.0' (12.3') Shale: very dark brown, gray, carbonaceous, sandy, silty, sand grains are rounded quartz grains, chert pebbles common, with interbedded Sandstone: dark gray to dark gray-brown, rounded to subrounded, rounded quartz grains, in part conglomeratic, with dark chert pebbles (to 3.5" in diameter), very faint dull yellow fluorescence, faint slow medium yellow cut, vertical fracture at 1755' with bleeding hydrocarbons.

1757.0-1757.6' (0.6')	Conglomerate, dark chert and quartz pebbles, predominantly loose; "salt and pepper", pebbles to 2"; trace of very light gray, clayey siltstone as possible matrix; trace of very light gray silty claystone; very slight fluorescence, faint cut.
1757.6-1758.0' (0.4')	Shale: gray, silty, micromicaceous, scattered sandstone inclusions, trace of glauconite.
1758.0-1761.5' (3.5')	Siltstone: light gray, shaly, micromicaceous, pyrite-replaced plant remains, brachiopod at 1760'.
1761.5-1763.0' (1.5')	Shale: light gray, clayey, very silty, firm, micromicaceous, vertical fracture.
1763 - 1830	Claystone: light tannish-gray, silty, scattered sand grains, interbedded with Siltstone: light tannish-gray, clayey, glauconitic, slightly micaceous, and some Sandstone: very light tannish-gray, very fine grained, subangular, glauconitic, silty, clayey, pyrite inclusions.
1830 - 1867	Siltstone: light tannish-gray to light brown, clayey, sideritic, slightly calcareous, glauconite pellets, slightly sandy, with interbedded Claystone: light tannish-gray, silty, soft, streaks of gray-brown, carbonaceous shale.
1867 - 1875	Sandstone: light brown, very fine grained, subangular, sideritic, glauconitic, slightly calcareous; no shows.
1875 - 1945	Siltstone: light tannish-gray to tan, partly clayey, sideritic streaks, glauconite pellets, slightly carbonaceous, interbedded with Claystone and Shale: light gray-brown to brown, silty, soft, and Sandstone: very light to light gray, subangular, very fine grained, very friable, clay matrix, 2-3' bed at 1919' with good medium yellow fluorescence, light bluish-yellow cut.
1945 - 1949	Sandstone: white, slightly "salt and pepper", very fine grained, subangular to subrounded, very friable, rare glauconite; no shows.
1949 - 1963	Claystone: very light gray, sandy, silty; with very light gray, slightly carbonaceous siltstone interbeds.
1963 - 1968	Sandstone: white, very light gray, light tan, slightly "salt and pepper", fine grained, subangular, clayey, glauconite pellets and grains common to abundant, fair porosity, coal stringer; no shows.



1968 - 1978	Siltstone and Shale, interbedded: light gray-brown, micaceous, trace pyrite, slightly carbonaceous.
1978 - 1990	Sandstone: very light gray, light tan, fine to very fine grained, subangular, friable, glauconite pellets and grains, scattered carbonaceous grains; no shows, interbedded and interlaminated shale and siltstone.
1990 - 2020	<u>Core No. 4: Cut 30', Recovered 29'</u>
1990.0-1999.5' (9.5')	Sandstone: light to very light brown, fine grained, subangular, medium to well sorted, clay matrix, quartzose, glauconite grains and pellets, some shaly partings, trace of pyrite, scattered carbonaceous grains, rare mica flakes, porosity varies, estimated 10-25%, faint pale yellow fluorescence, very slow medium yellow cut.
1999.5-2000.4' (0.9')	Siltstone: gray-brown, micaceous, carbonaceous, rare glauconite grain, trace of pyrite-replaced plant remains or fossils, some small sandstone inclusions and partings.
2000.4-2019.0' (18.6')	Sandstone: light tan to gray-brown, fine to very fine grained, medium sorted, glauconitic, clayey, shaly partings, large fossil at 2005.5' (ammonite?), porosity varies tight to fair, faint whitish-yellow to light yellow fluorescence, very slow to instant light yellow cut.
2019.0-2020.0' (1.0')	No recovery.
2020 - 2032	Sandstone: very light tannish-gray, fine grained, clay matrix, glauconitic, spotty faint yellow fluorescence, slight light yellow cut, trace wood fragments.
2032 - 2036	Siltstone and Shale: brownish-gray, rare glauconite, trace of pyrite and wood fragments.
2036 - 2051	Sandstone: light tannish-gray, fine grained, subangular, glauconitic, poor porosity, faint light yellow fluorescence, very slight cut, shale and siltstone stringers at 2043-2045', coal partings and wood fragments.

2051 - 2072

Core No. 5: Cut 21', Recovered 15.5'

- 2051.0-2061.0'  
(10.0') Sandstone: very light to light brown, fine to medium grained, subangular, medium to well sorted, glauconitic, poor to good porosity, dull yellow to medium bright yellow fluorescence, instant light medium yellow cut, fractured and pulverized from 2059-2060'.
- 2061.0-2061.6'  
(0.6') Quartzite: light brown, fine grained, rounded, partly cherty, tight, vertical fracture, large wood fragments and pelecypod.
- 2061.6-2066.5'  
(4.9') Sandstone: light brown, medium to fine grained, subrounded to subangular, well sorted, quartzose, becomes clayey and shaly at base, with pelecypod casts and large wood fragments, porosity decreases downward from good to poor, light yellow fluorescence, instant bluish-yellow cut, fractured and pulverized.
- 2066.5-2072.0'  
(5.5') No recovery.

2072 - 2087

Core No. 6: Cut 15', Recovered 14.5'

- 2072.0-2079.2'  
(7.2') Sandstone: fine to medium grained, light brown to very light brown, subangular to subrounded, medium to well sorted, quartzose, scattered glauconite, clayey, shale inclusions and partings, slightly dolomitic, abundant pelecypods at 2075', dull yellow to good light yellow fluorescence, instant bluish-yellow to slight medium yellow cut, fair odor, poor to fair porosity.
- 2079.2-2083.7'  
(4.5') Sandstone: gray-brown, very fine grained, very silty and shaly, rare glauconite, grades to sandy siltstone and back in approximately 1' beds, hard and tight; no shows.
- 2083.7-2086.5'  
(2.8') Sandstone: light gray-brown, fine to very fine grained, clayey to very shaly, fossil fragments, trace of pyrite-replaced plant remains.
- 2086.5-2087.0'  
(0.5') No recovery.

2087 - 2095 Sandstone: light tannish-gray, clayey to sideritic, soft to hard, partly siliceous, fine to very fine grained, rare glauconite, with interbedded Siltstone: gray-brown.

2095 - 2125 Siltstone: gray-brown to light gray, carbonaceous, micaceous, interbedded with Shale: gray-brown to light gray-brown, fissile, slightly carbonaceous, trace of pyrite inclusions.

2125 - 2135 No samples caught.

Total Depth of Well - 2,135 Feet.

## ARMOUR KANE

Well Log Analyst  
18360-6 Cantara St  
Redeada, Ca. 91335  
(213) 993-0586

October 9, 1980

Mr. S. L. Hewitt  
Husky Oil/NPR Operations, Inc.  
2525 C Street  
Anchorage, Ak 99503

Dear Mr. Hewitt:

Logging operations were begun by Schlumberger on South Barrow No. 18 at about 1800 hours October 4, 1980, and DLL, CNL/FDC, EHC and HRD were completed at 0500 hours October 5, 1980. Some problems were encountered with the DLL but were quickly overcome and resulting log quality was good to excellent on all logs except the BHC which was badly affected by gas in the mud column resulting in numerous spikes and skips from the base of the Lower Barrow up to casing.

Log tops were: Kingak at 1754, Upper Barrow at 1974 and Lower Barrow at 2052. Correlation with South Barrow No. 15 was very good with the corresponding tops in No. 15 at 1898, 2107 and 2138 respectively which puts No. 18 about 135 feet higher than No. 15.

Quantitative interpretation indicates the Upper Barrow to be tight and shaly and mostly water-bearing with Sw values ranging from 59% to 86% and porosities in the 15% to 18% range. The Lower Barrow appears to be a very good gas sand with porosities from 20% to 29% and Sw values of 20% to 33%. CNL/FDC "crossovers" certainly confirm the presence of gas as does the constant "bubbling" during logging. The attached tabulation shows porosity and Sw values, Sw having been computed using Rw of 0.25 based on water analysis of the water recovered from the Lower Barrow in No. 15. The porosities at 2052-60 and 2060-66 were corrected from a CNL/FDC crossplot. Because of the rapid change in resistivity and the porosity fluctuations it is difficult to get a precise average over the whole 20 foot interval but a reasonable average of 35 ohms for resistivity and 23% porosity was used resulting in Sw of 33% which should be in the ball park.



Armour Kane

# Log Analysis

Company:	HUSKY OIL/NPR OPERATIONS, INC.	Well:	SOUTH BARROW #15
Field:	NORTH SLOPE	County:	
		State:	ALASKA

DEPTH	RT	$\phi_o$	$\phi_N$	Sw	REMARKS
1986-94	12	15	27	86	
2000-10	18	17	27	62	
2000-20	17	18	24	59	
2052-60	35	23	22*	33	
2060-66	60	29	23*	20	
2066-70	20	20	24	50	
2052-70	35	23	22	33**	

\* POROSITIES CORRECTED FROM CNL/PDC CROSSPLAT

\*\* AVERAGE VALUE PROBABLY NOT PRECISE BUT IN THE BALL PARK

USED  $R_w = 0.25$  FOR SW CALCULATIONS BASED ON WATER ANALYSIS FROM #15  
25,000 ppm.



HUSKY OIL NPR OPERATIONS, INC.  
U.S. GEOLOGICAL SURVEY ONPRA

LOGGING REPORT

WELL NAME SOUTH BARROW #18

Date 9/4-5/80 Driller Depth 2125'

Elevation 30 KB Logger Depth 2124'

Logs Run and Intervals

DLL/GR/MSFL	1520-2112'
GR/CAL/CNL/FDC	1520-2124'
GR/BHCS/TTI	1520-2116'
HDT-Dipmeter	1520-2120'

Additional Logs to Run

NONE

Zones of Interest

Depth	Gross Thickness	Net Feet of Porosity	Lith	Porosity	S <sub>w</sub> %	Probable Fluid Content
1986-1994'	8	8	Ss	15	86	Water
2000-2010'	10	10	Ss	17	62	Gas-Water
2010-2020'	10	10	Ss	18	59	Gas-Water
2052-2060	8	8	Ss	*23	33	Gas
2060-2066	6	6	Ss	*29	20	Gas
2066-2070	4	4	Ss	20	50	Gas

Discussion:

\* Ø corrected by CNL/FDC Crossplot. Used R<sub>w</sub>=0.25 for S<sub>w</sub> values. BHCS badly affected by gas in mud column.

Log Tops & Correlations:

	#18	#15
KINGAK	1754'	1893'
UPPER BARROW SD	1974'	2109'
LOWER BARROW SD	2052'	2188'

Additional Evaluation Plans:

RON BROCKWAY

Wellsite Geologist

A. KANE

Log Analyst



HUSKY OIL NPR OPERATIONS, INC.  
U.S. GEOLOGICAL SURVEY ONPRA

LOGGING REPORT

WELL NAME BARROW #18

Date 9-26-80 Driller Depth 1520'

Elevation 30' KB Logger Depth 1516'

Logs Run and Intervals

DIL/SFL	106-1513'
BHC6/GR	106-1508'
Dipmeter	106-1517'

Additional Logs to Run

None

Zones of Interest

Depth	Gross Thickness	Net Feet of Porosity	Lith	Porosity	Probable Fluid Content

Discussion:

Log Tops & Correlations:

PEBBLE SHALE 1372'

Additional Evaluation Plans:

RON BROCKWAY

Wellsite Geologist

Log Analyst

**CORE LABORATORIES, INC.**  
*Petroleum Reservoir Engineering*  
 DALLAS, TEXAS

PAGE 1

U.S.G.S./HUSKY OIL CO., OFR. DATE : 13-OCT-80 FILE NO : RP-3-617  
 SOUTH BARROW NO. 18 FORMATION : ANALYSIS : WSP/ILS  
 SOUTH BARROW DRILG. FLUID: NWL LABORATORY: ANCHORAGE  
 NORTH SEDGE, ALASKA LOCATION :

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY (MD) MAXIMUM	90 DEG VERTICAL	FOR %	GRAIN BUN.	FLUID SATS.		DESCRIPTION
						OIL	WTR	
core #4								
1	1970.0	3.17		16.6	2.66	4.6	68.2	ss/vf-fgr cly
2	1991.0	3.79		13.3	2.68	4.2	70.4	same
3	1992.0	115.		19.9	2.66	6.0	72.4	same
4	1993.0			18.3	2.66	4.4	68.0	*sum. fluid analysis*
5	1994.0			15.4	2.62	5.3	69.6	*sum. fluid analysis*
6	1995.0			17.5	2.65	5.7	71.6	*sum. fluid analysis*
7	1996.0			17.5	2.61	5.9	69.0	*sum. fluid analysis*
8	1997.0	0.07		9.6	2.68	5.0	62.7	same
9	1998.0			21.5	2.66	3.6	65.5	*sum. fluid analysis*
10	1999.0	0.68		12.1	2.69	8.7	59.5	same
11	2000.0	91.		22.1	2.64	3.4	71.2	ss/vf-mar cly
12	2001.0			16.9	2.65	4.2	54.3	ss/vf-fgr cly *sample failure*
13	2002.0	1.35		14.8	2.65	6.5	67.2	same
14	2003.0	111.		20.2	2.65	4.5	51.2	ss/vf-mar cly
15	2004.0	0.41		12.2	2.67	8.2	46.6	ss/vf-fgr cly
16	2005.0	14.		16.9	2.64	11.5	65.6	same
17	2006.0			19.3	2.63	6.9	53.1	*sum. fluid analysis*
18	2007.0	79.		20.8	2.64	4.9	37.2	ss/vf-fgr cly
19	2008.0	13.		17.1	2.64	9.0	22.4	same
20	2009.0	10.		16.4	2.65	9.4	51.8	same
21	2010.0	1.95		13.6	2.66	10.8	53.9	same
22	2011.0	27.		19.2	2.62	9.4	58.5	same
23	2012.0	8.17		16.7	2.64	11.5	50.9	same
24	2013.0	6.27		15.9	2.65	11.0	53.6	same

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*Petroleum Reservoir Engineering*  
 DALLAS, TEXAS

PAGE 2

U.S.G.S./HUSKY OIL CO., DPK. DATE : 13-OCT-80  
 SOUTH BARRON RD. 18 FORMATION :

FILE NO : BF-3-617  
 ANALYSTS : WSP,TLS

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY (MD)		POR %	GRAIN DEN.		FLUID SATS.		DESCRIPTION
		MAXIMUM	90 DEG VERTICAL		GRAIN DEN.	OIL	WTR		
25	2014.0			18.1	2.64		11.2	49.8	*sum. fluid analysis*
26	2015.0	20.		17.5	2.64		13.7	58.5	same
27	2016.0	11.		17.6	2.65		8.6	50.3	same
28	2017.0			18.7	2.64		10.7	47.5	same
29	2018.0	2.64		15.6	2.64		9.9	57.5	same
core #5									
30	2051.0	369.		22.1	2.65		8.0	59.7	ssif-mar
31	2052.0	207.		21.0	2.69		8.8	62.4	same
32	2053.0	2421.		27.0	2.62		15.9	60.3	same
33	2054.0	297.		18.1	2.73		11.8	53.7	same;sid
34	2055.0	78.		12.4	3.00		12.4	49.6	same;sid
35	2056.0	309.		21.5	2.64		9.1	54.8	ssif-mar
36	2057.0	38.		11.3	2.93		10.0	47.7	ssivf-mar sid slauc
37	2058.0	1578.		25.2	2.66		10.6	50.8	ssif-mar
38	2059.0	2627.		26.6	2.63		9.3	47.6	same
39	2060.0			22.4	2.67		12.8	61.6	same;slay *sample failure*
40	2061.0	754.		22.4	2.66		15.1	61.5	ssif-mar
41	2062.0	54.		13.1	2.90		12.6	48.5	ssivf-mar sid
42	2063.0	392.		21.7	2.68		9.9	48.2	ssivf-mar
43	2064.0	1036.		24.7	2.65		8.1	45.0	same
44	2065.0	53.		19.9	2.66		15.3	66.3	same;slay
45	2066.0			14.2	2.82		16.0	62.1	same *sum. fluid analysis*
core #6									
46	2072.0	8.70		16.2	2.70		11.8	81.1	ssivf-mar sid

These analyses, opinions or interpretations are based on observations and materials supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representations, as to the productivity, proper operations, or profitability of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

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*Petroleum Reservoir Engineering*

DALLAS, TEXAS  
 U.S. OIL & GASES DIVISION OF THE BUREAU OF MINES  
 U.S. GEOLOGICAL SURVEY DIVISION OF THE BUREAU OF MINES  
 DATE: 13-DEC-80  
 LOCATION: FURNACHTON

FILE NO : RP-3-617  
 ANALYSTS : WSP, JLS

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MD Darcy	POK %	GRAIN DEN.	FLUID OIL	SATS. GIR	DESCRIPTION
47	2073.0	6.93	16.2	2.68	8.0	58.9	same
48	2074.0	5.95	15.1	2.70	6.7	83.6	same
49	2075.0	40.	17.9	2.68	14.7	69.2	same
50	2076.0	19.	17.9	2.63	9.3	62.5	same
51	2077.0	1.90	14.4	2.71	9.8	61.8	same
52	2078.0	0.20	9.9	2.55	9.0	57.8	same
53	2079.0	2.08	14.2	2.64	6.7	75.1	same
54	2080.0	1.56	10.4	2.67	8.4	78.7	same
55	2081.0	0.54	11.3	2.67	9.8	74.4	same
56	2082.0	0.87	12.0	2.65	8.0	77.4	same
57	2083.0	0.14	9.5	2.67	6.6	76.5	same
58	2084.0	0.63	13.0	2.65	11.5	73.4	same
59	2085.0	1.56	13.3	2.65	8.0	75.0	same

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GAS ANALYSIS REPORT


Company Husky Oil Company Date April 17, 1981 Lab No. 7101  
 Well No. South Barrow No. 19 Location \_\_\_\_\_  
 Field NPPB Formation Lower Barrow Sand  
 County \_\_\_\_\_ Depth \_\_\_\_\_  
 State Alaska Sampling Point Production Test No. 2  
 Line pressure \_\_\_\_\_ (psig); Sample pressure 550 (psig); Temperature \_\_\_\_\_ °F; Container number \_\_\_\_\_  
 Remarks Sample taken October 13, 1980

Component	Mole % or Volume %	Gallons per MCF
Oxygen	0	
Nitrogen	4.37	
Carbon dioxide	TRACE	
Hydrogen sulfide		
Helium	0.1	
Methane	95.11	
Ethane	0.02	
Propane & Higher	TRACE	TRACE
Total		TRACE
GPM of pentanes & higher fraction		
Gross btu cu. ft. @ 60° F. & 14.7 psia (dry basis)		961
Specific gravity (calculated from analysis)		0.574
Specific gravity (measured)		0.575

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

MEMORANDUM

October 24, 1980

  
TO: R. J. Mead

FROM: Dan Lowe

SUBJ: So. Barrow Well No. 18 Flow Test

Barrow Well No. 18 was flow tested from October 10 through 13, 1980. The zone tested was the Lower Barrow Sands from 2056.5' to 2076.5'. This was a four point back pressure test through cased hole with four shots per foot perforating the 7" casing.

The pay zone had a thickness of 21 feet and an average porosity of 23.8%. The following are the results of this test, as determined from the Horner plots that were plotted by Gearhart-Owen.

Average Effective Permeability (k) = .95 md

Skin Effect (S) = .21

Damage Ratio (DR) = 1.12

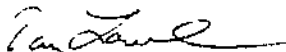
Radius of Investigation (b) = 21.35'

Calculated Absolute Open Flow (AOF) = 1.65 MMCFD

The well was flowed for twenty-four hours before being cleaned up enough to test. At the time the test was begun, there was only dry gas being produced; but it is most probable that the formation still does contain a few barrels of CaCl water. Because this water is in the formation, this well is expected to perform better than as tested.

Before Well No. 18 is connected to the PR Station, it will be necessary to let the well fully clean up for about a week. The very corrosive nature of the CaCl water would do much harm to the pipeline and metering facilities.

Although the information from the well test does not indicate any damage, a thorough clean up of the well before production is highly recommended.

  
Dan Lowe

Copy to: R. Lantz  
C. C. Livingston

PRODUCTION TEST

	<u>Annulus Pressure</u>	<u>Tubing Pressure</u>
<u>October 12, 1980</u>		
13:54	Opened well through tubing on 16/64" choke with 720# surface pressure on annulus. Tubing pressures low	
14:54	345#	Too low to read, could hold w/finger
15:54	440#	Getting condensate from flowline
15:55		Water to surface, flowed for approx. 3 min.
16:20	450#	210#
16:50	435#	Still blowing condensate
18:30	460#	175#
19:30	480#	250#
20:30	490#	260#
22:00	490#	315#
23:00	495#	300#
24:00	500#	320#
<u>October 13, 1980</u>		
01:00	500#	320#
02:00	510#	330#
03:00	520#	340#
04:00	520#	350#
05:00	520#	360#
06:00	520#	380#
07:00	535#	375#
07:30	485#	400#
	Changed flow to annulus	
08:00	415#	390#
09:00	400#	390#
10:00	400#	395#
11:00	405#	400#
12:00	420#	400#
12:19	Changed to 14/64" choke, flow through annulus	
12:20	450#	420#
13:20	500#	420#
14:15	535#	430#
14:30	530#	430#
14:45	530#	430#
15:00	525#	425#
15:06	600#	450#
	Switched to 6/64" choke	

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PRODUCTION TEST (Cont.)

	<u>Annulus Pressure</u>	<u>Tubing Pressure</u>
<u>October 13, 1980</u>		
15:15	650#	490#
15:30	720#	500#
15:30	Closed well to check choke for icing	
15:32	740#	510#
15:39	Closed well, choke icing up, changed to 12/64" choke, flow through annulus	
15:42	Well opened 780#	520#
16:00	720#	500#
16:30	680#	500#
17:00	665#	485#
17:30	650#	490#
18:00	645#	490#
18:14	Changed to 20/64" choke, flow through annulus	
18:17	Opened well, much water condensate, cleared in approximately 3 min.	
18:17	640#	490#
18:30	520#	420#
19:00	310#	390#
19:30	300#	390#
20:00	300#	390#
20:18	Well shut in for pressure buildup	