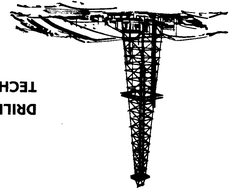


DRILL STEM TEST
TECHNICAL SERVICE REPORT

LYNES

LYNES

Phone 713/929-9132
Box 12486
Houston, TX 77017

LYNES, INC.

Box 12486
Houston, TX 77017

Operator: Texaco, Inc.
P.O. Box 3756
Los Angeles, California 90051

Well Name and No.: Logan Unit 17 #1
"HAELLL IT-01"

DST No.: 1

Address

Ticket No.: 31862

Date: 2-5-81

No. Final Copies: 5

Contractor	J & N Drilling	Top Choke	1"
Rig No.	1	Bottom Choke	8 1/2"
Spot		Size Hole	7 7/8"
Sec.	170	Size & Wgt. Pipe	3 1/2"
Twp.	19 S	Size Wt. Pipe	---
Rng.	20 E	I.D. of D.C.	---
Field	Cycock	Length of D.C.	---
County	Oregon	Total Depth	6525'
State		Interval Tested	2816-3193'
Elevation	---	Packer Depth	2816 & 3187'
Formation	---	Type of Test	Straddle

Flow No. 1 — 2 Min.
Shut-in No. 1 — --- Min.
Flow No. 2 — --- Min.
Shut-in No. 2 — --- Min.
Flow No. 3 — --- Min.
Shut-in No. 3 — --- Min.

Bottom Hole Temp. — ---
Mud Weight — 10.3
Gravity — ---
Viscosity — 47

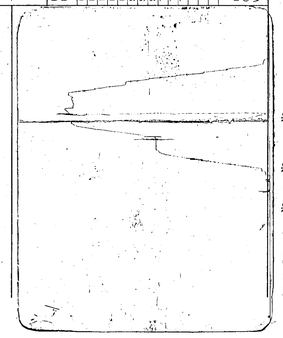
Tool opened @ 6:03 PM

Inside Recorder

PRD Make	Kuster	Cap.	2100	@ 3193'
No. 6739				

Pres.		Corrected
Initial Hydrostatic	A	1711
Final Hydrostatic	K	1693
Initial Flow	B	33
Final Initial Flow	C	42
Initial Shut-in	D	1111
Second Initial Flow	E	---
Second Final Flow	F	---
Second Shut-in	G	---
Third Initial Flow	H	---
Third Final Flow	I	---
Third Shut-in	J	---

Lynes Dist. Bakersfield, Ca.
Our Tester: John Heinchir
Witnessed By: ---



Did Well Flow — Gas ___ No ___ Oil ___ No ___ Water ___ No
RECOVERY IN PIPE: 61' Drilling mud

REMARKS: Lost packer seats in 2 minutes.

Form 1

LY-236

C21

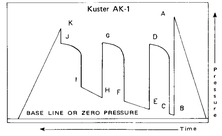
PRESSURE CHARTS

LYNES

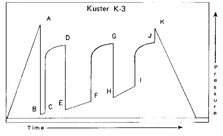
GUIDE TO INTERPRETATION AND IDENTIFICATION OF LYNES DRILL STEM TEST PRESSURE CHARTS

In making any interpretation, our employees will give Customer the benefit of their best judgment as to the correct interpretation. Nevertheless, since all interpretations are opinions based on inferences from electrical, mechanical or other measurements, we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not be liable or responsible, except in the case of gross or wilful negligence on our part, for any loss, costs, damages or expenses incurred or sustained by Customer resulting from any interpretation made by any of our agents or employees.

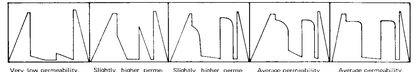
AK-1 recorders. Read from right to left.



K-3 recorders. Read from left to right.



A — Initial Hydrostatic
B — First Initial Flow
C — First Final Flow
D — Initial Shut-in
E — Second Initial Flow
F — Second Final Flow
G — Second Shut-in
H — Third Initial Flow
I — Third Final Flow
J — Third Shut-in
K — Final Hydrostatic



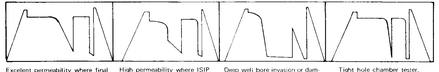
Very low permeability. Usually only mud recovered from interval tested. Virtually no permeability.

Slightly higher permeability. Again usually mud recovered.

Slightly higher permeability. Small recovery, less than 200 ft.

Average permeability. Final and initial shut-ins differ by 50 psi.

Average permeability. Strong damage effect. High shut-in pressure, low flow pressure.



Excellent permeability where final flow final shut-in pressure.

High permeability where ISIP and FSIP are within 10 psi.

Deep well bore invasion or damage. Final shut-in higher than the initial shut-in.

Tight hole chamber tester. Permeability very difficult to interpret unless the recovery is less than chamber length. Flow pressure builds up rapidly if recovery is large, similar to a shut-in.

NOMENCLATURE (Definition of Symbols)

- Q = average production rate during test, bbls/day
- Q_g = measured gas production rate during test, MCF/day
- k = permeability, md
- h = net pay thickness, ft. (when unknown, test interval is chosen)
- μ = fluid viscosity, centipoise
- Z = compressibility factor
- T_r = reservoir temperature, °Rankine
- m = slope of final SIP buildup plot, psig/cycle ($psig^2$/cycle for gas)
- b = approximate radius of investigation, feet
- r_w = wellbore radius, feet
- t_p = total flowing time, minutes
- P_i = Extrapolated maximum reservoir pressure, psig
- P_f = final flowing pressure, psig
- P.I. = productivity index, bbls/day/psi
- P.I.$_d$ = theoretical productivity index with damage removed, bbl./day/psi
- D.R. = damage ratio
- E.D.R. = estimated damage ratio
- AOF = absolute open flow potential, MCF/D
- AOF_d = theoretical absolute open flow if damage were removed
- Z = subsea depth
- W = water gradient based on salinity
- H_w = potentiometric surface

INTERPRETATION CALCULATIONS (OIL/WATER)

AVERAGE PRODUCTION RATE (DURING TEST)

$Q = \frac{140.6 \times (\text{Bbls. recovery in drill pipe open + recovered})}{\text{Minutes in actual flow time}}$

$= \frac{140.6 \times ___}{___} = ___$

$= \frac{140.6 \times ___}{___} \times \frac{___}{___} = ___$

$= ___$ bbls/day

Mud Expansion = ... Bl. (Oil Cols. Contained in Compared)

FLUID PROPERTIES — Estimated Bottom Hole Temperature

API Gravity @ 60° F ..... ° Specific Gravity @ 60° F ..... Est. Viscosity ..... cp

TRANSMISSIBILITY

$\frac{kh}{\mu} = \frac{140.6Q}{m} = \frac{___}{___} = ___$ md./ft/cp

IN SITU CAPACITY

$kh = ___ \times ___ = ___$ md./ft.

AVERAGE EFFECTIVE PERMEABILITY — Estimated Pay Thickness ..... ft. Actual Pay Thickness ..... ft.

$k = \frac{___}{___} = ___$ md.

PRODUCTIVITY INDEX

$P.I. = \frac{Q}{P_i - P_f} = \frac{___}{___ - ___} = ___$ bbl./day/psi

DAMAGE RATIO

$D.R. = \frac{0.141 \times P.I.}{k} = 0.140 \times \frac{___}{___} = ___$

PRODUCTIVITY INDEX WITH DAMAGE REMOVED

$P.I._d = P.I. \times D.R. = ___ \times ___ = ___$ bbl./day/psi

APPROXIMATE RADIUS OF INVESTIGATION

$b = \sqrt{\frac{kt}{___}} = \sqrt{\frac{___ \times ___}{___}} = ___$ ft.

Drawdown Factor = 141.2 × P.I./k = 141.2 × ..... / ..... = ... (ISIP − P_f) / ..... = ... (Potentiometric Surface − P_f) / ..... (or calculate if ISIP)

Potentiometric Surface = $H_w = Z + \frac{P_i}{W}$ = ... + ... / ..... = ...

INTERPRETATION CALCULATIONS (GAS)

ESTIMATED GAS PROPERTIES — Estimated Bottom Hole Temperature ..... °F

Gravity @ 60° F ..... Viscosity (Est.) ..... cp — Compressibility Factor (Z) .....

TRANSMISSIBILITY — Measured D.S.T. Flow Rate ..... mcf/d

$\frac{kh}{\mu} = \frac{187.5Q_g T_r}{m} = \frac{187.5 \times ___ \times ___}{___} = ___$ md./ft/cp

IN SITU CAPACITY

$kh = ___ \times ___ = ___$ md./ft.

AVERAGE EFFECTIVE PERMEABILITY — Estimated Pay Thickness ..... ft. Actual Pay Thickness ..... ft.

$k = \frac{___}{___} = ___$ md.

APPROXIMATE RADIUS OF INVESTIGATION

$b = 0.01 \sqrt{\frac{kt}{___}} = 0.01 \sqrt{\frac{___ \times ___}{___}} = ___$ ft.

ACTUAL CAPACITY

$kh = 375 \times \frac{Q_g T_r}{m} \times \frac{\ln \frac{b}{r_w}}{\ln \frac{b}{r_w} - 1} = 375 \times \frac{___ \times ___}{___} \times \frac{\ln \frac{___}{___}}{\ln \frac{___}{___} - 1} = ___$ md./ft.

ESTIMATED DAMAGE RATIO

$D.R. = \frac{Q_g T_r}{m \times \log T_r + 7.282} = ___$ D.R. = ...

ESTIMATED RANGE OF AOF POTENTIAL

Max AOF = $\frac{Q_g P_i^2}{P_i^2 - P_f^2} = \frac{___ \times ___^2}{___^2 - ___^2} = ___$ MCF/D

Min AOF = $\frac{Q_g P_i^2}{P_i^2 - P_f^2 + (P_i - P_f)^2} = \frac{___ \times ___^2}{___^2 - ___^2 + (___ - ___)^2} = ___$ MCF/D

ESTIMATED RANGE OF AOF POTENTIAL (DAMAGE REMOVED)

Max AOF$_d$ = (Max AOF) (D.R.) = ... × ..... = ... MCF/D

Min AOF$_d$ = (Min AOF) (D.R.) = ... × ..... = ... MCF/D

Drawdown Factor = (ISIP − P_f) / Q_g = (..... − .....) / ..... = ... (Potentiometric Surface − P_f) / ..... (or calculate if ISIP)

Potentiometric Surface = $H_w = Z + \frac{P_i}{W}$ = ... + ... / ..... = ...