LYNES

Virq's

BRIGHT NAME IN THE OIL PATCH

Inflatable and Conventional Packer Tools

DRILL STEM TEST
TECHNICAL SERVICE REPORT

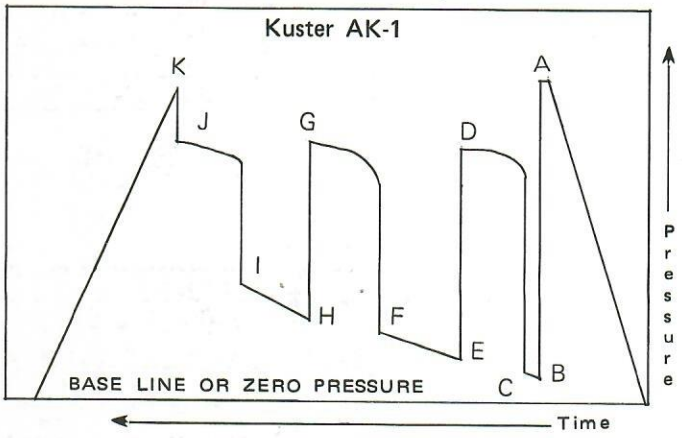
File

LYNES

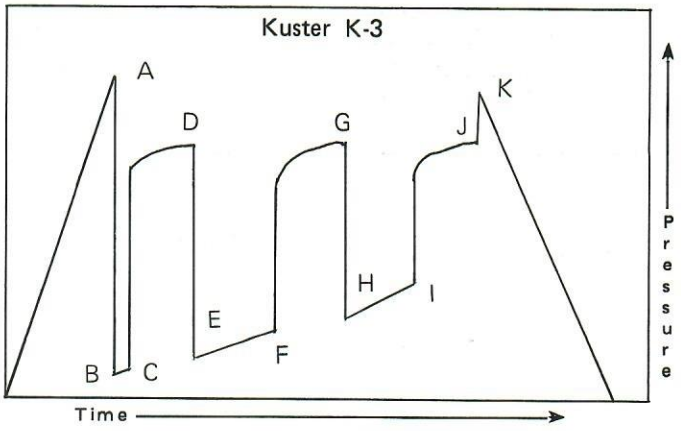
GUIDE TO INTERPRETATION AND IDENTIFICATION OF LYNES DRILL STEM TEST PRESSURE CHARTS

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.

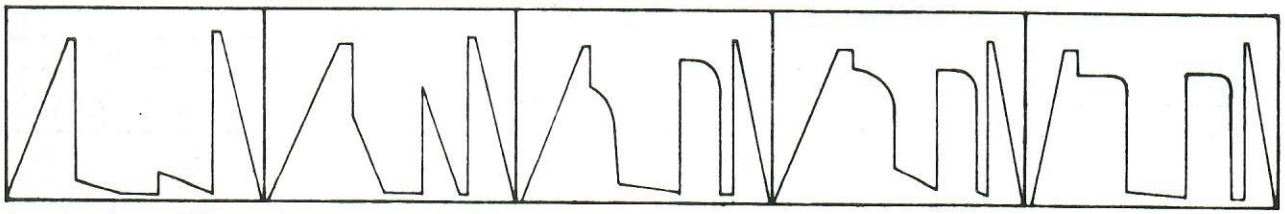
AK-1 recorders. Read from right to left.



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



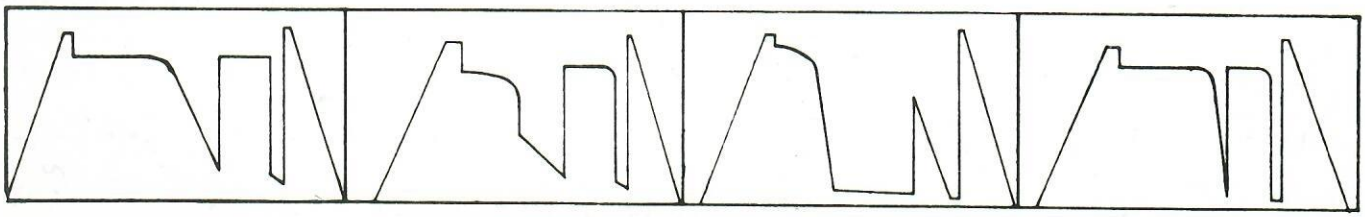
Very low permeability. Usually only mud recovered from interval tested. Virtually no permeability.

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.



Excelent 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.

Phone
522-1206 Area 303

LYNES UNITED SERVICES
DIVISION OF LYNES, INC.

Box 712
Sterling, Colo. 80751

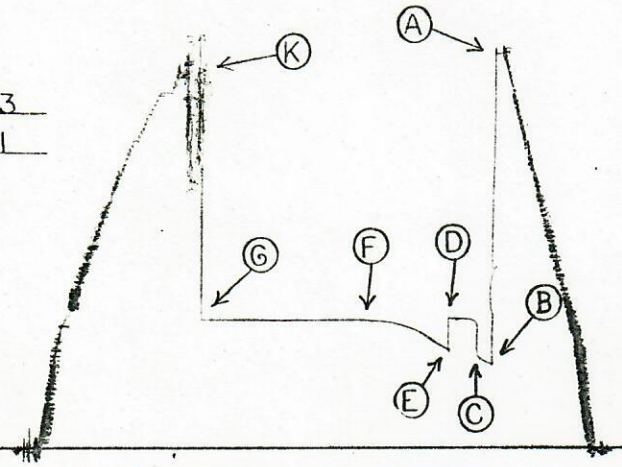
RECEIVED
NOV 26 1975
COLO. OIL & GAS CONS. COMM.

Operator Oxford Exploration Co.
Address See Distribution
Well Name and No. Meier # 1
Ticket No. 1663
Date 11-15-75
DST No. 1
No. Final Copies 6

Contractor	Exeter Drlg. Northern	Top Choke	1"
Rig No.	5	Bottom Choke	9/16"
Spot	NE	Size Hole	7 7/8"
Sec.	23	Size Rat Hole	None
Twp.	12 N	Size & Wt. D. P.	4½" 16.60
Rng.	52 W	Size Wt. Pipe	None
Field	--	I. D. of D. C.	2½"
County	Logan	Length of D. C.	180'
State	Colorado	Total Depth	5235'
Elevation	4444' "Ground"	Interval Tested	5177'-5187'
Formation	"J" Sand	Type of Test	Conventional Straddle

Flow No. 1	10 Min.
Shut-in No. 1	20 Min.
Flow No. 2	60 Min.
Shut-in No. 2	120 Min.
Flow No. 3	-- Min.
Shut-in No. 3	-- Min.
Bottom Hole Temp.	142
Mud Weight	9.8
Gravity	--
Viscosity	80
Tool opened @	9:45 AM.

I-1663
R-4481



PRD Make Kuster AK-1
No. 4481 Cap. 5200 @ 5182'

Press		Corrected
Initial Hydrostatic	A	2643
Final Hydrostatic	K	2534
Initial Flow	B	565
Final Initial Flow	C	620
Initial Shut-in	D	873
Second Initial Flow	E	664
Second Final Flow	F	858
Second Shut-in	G	864
Third Initial Flow	H	--
Third Final Flow	I	--
Third Shut-in	J	--
Pressure Below Bottom Packer Bled To		1140

Our Tester: Roger Seeman
Witnessed By: Parks & Gagliardo

Did Well Flow – Gas No Oil No Water No

RECOVERY IN PIPE: 2000' Slightly gas cut water = 26.93 Bbl.

1st Flow- Tool opened with good blow, increased to bottom of bucket in 3 minutes, and remained thru flow period.

2nd Flow- Tool opened with good blow to bottom of bucket, decreased at end of flow period.

REMARKS: Breakdown of 2nd Shut-in not practical.

LYNES UNITED SERVICES
DIVISION OF LYNES, INC.

Operator Oxford Exploration Co. Lease & No. Meier # 1 DST No. 1

FIRST SHUT IN PRESSURE:

TIME(MIN) PHI	(T"PHI) /PHI	PSIG
0.0	0.0000	620
2.0	6.0000	852
4.0	3.5000	861
6.0	2.6667	865
8.0	2.2500	868
10.0	2.0000	870
12.0	1.8333	871
14.0	1.7143	871
16.0	1.6250	872
18.0	1.5556	872
20.0	1.5000	873

EXTRAPLN OF FIRST SHUT IN : 877.9 M : 28.1

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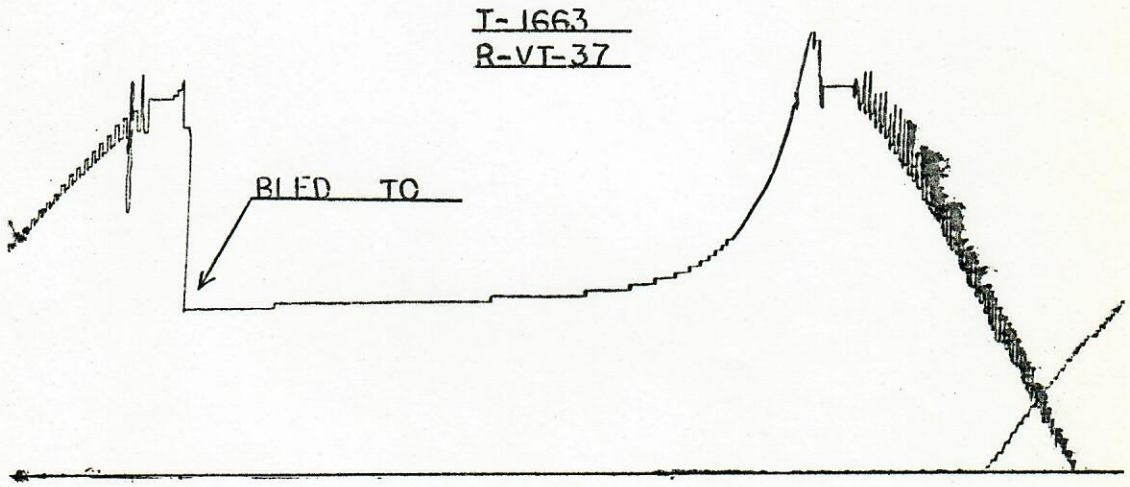
Operator Oxford Exploration Co. Lease & No. Meier # 1 DST No. 1



This recorder blanked off below the bottom packer and since pressure bled to only 1140 lbs., which is more than the shut-in pressure, the bottom packer held. Recorder No. VT-37

LYNES UNITED SERVICES
DIVISION OF LYNES, INC.

Fluid Sample Report

Date 11-15-75 Ticket No. 1663

Company Oxford Exploration Co.

Well Name & No. Meier # 1 DST No. 1

County Logan State Colorado

Sampler No. -- Test Interval 5177'-5187'

Pressure in Sampler 25 PSIG BHT 142 °F

Total Volume of Sampler: 2150 cc.

Total Volume of Sample: 2100 cc.

Oil: None cc.

Water: 2100 cc.

Mud: None cc.

Gas: None cu. ft.

Other: None

Resistivity

Water: @ of Chloride Content ppm.

Mud Pit Sample 4.9 @ 60 of Chloride Content 1300 ppm.

Gas/Oil Ratio Gravity °API @ °F

Where was sample drained

Remarks:

LYNES UNITED SERVICES
DIVISION OF LYNES, INC.

DISTRIBUTION OF FINAL DST REPORTS

Operator Oxford Exploration Co. Lease Meier Well No. 1

Original & 1 copy: Oxford Exploration Co., 1030 Denver Club Bldg., Denver, Colorado, 80202.

1 copy: Exeter Exploration Co., Attn: Mr. Bill Taylor, 2300 Lincoln Center Bldg., Denver, Colorado, 80203.

1 copy: Mrs. Geraldine Kerr, % Alex Aven-Resource Management & Analysis Group, First National Bldg., Oklahoma City, Oklahoma 73102.

1 copy: Helmet Petroleum, 1016 Metrobank Bldg. , Denver, Colorado, 80202.

1 copy: Anderson Petroluem Co., 1200 Denver, Club Bldg., Denver, Colorado, 80202, Attn: Steve Anderson.

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_f = 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_o = total flowing time, minutes
- P_o = Extrapolated maximum reservoir pressure, psig
- P_f = final flowing pressure, psig
- P.I. = productivity index, bbls./day/psi
- $P.I._t$ = 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_t = theoretical absolute open flow if damage were removed
- $\bar{Z}$ = subsea depth
- W = water gradient based on salinity
- H_w = potentiometric surface

INTERPRETATION CALCULATIONS (OIL/WATER)

AVERAGE PRODUCTION RATE DURING TEST

$Q = \frac{1440 \text{ (drill collar capacity x recovery + drill pipe capac. x recovery)}}{\text{initial flow time + final flow time}}$

$= \frac{1440 [(\quad)(\quad) + (\quad)(\quad)]}{(\quad) + (\quad)}$

$= \frac{1440\ (.0145 \text{ or } .0073)(\quad)}{(\quad)}$ Mud Expansion = —..... ft. (Drill Collar Conversion Is Considered)

= ..... bbls./day

FLUID PROPERTIES — Estimated Bottom Hole Temperature °

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

TRANSMISSIBILITY

$\frac{kh}{\mu} = \frac{162.6Q}{m} = \frac{162.6\ (\quad)}{(\quad)} =$ ..... md.-ft/cp

IN SITU CAPACITY

$kh = (\quad)(\quad) =$ ..... md.-ft.

AVERAGE EFFECTIVE PERMEABILITY — Estimated Pay Thickness Ft. / Actual Pay Thickness Ft.

$k = \frac{(\quad)}{(\quad)} =$ ..... md.

PRODUCTIVITY INDEX

$PI = \frac{Q}{P_o - P_f} = \frac{(\quad)}{(\quad) - (\quad)} =$ ..... bbl./day-psi

DAMAGE RATIO

$D.R. = \frac{0.183\ (P_o - P_f)}{m} = \frac{0.183 [(\quad) - (\quad)]}{(\quad)} =$ .....

PRODUCTIVITY INDEX WITH DAMAGE REMOVED

$P.I._t = P.I. \times D.R. = (\quad)(\quad) =$ ..... bbl./day-psi

APPROXIMATE RADIUS OF INVESTIGATION

$b = \sqrt{kt_o} = \sqrt{(\quad)(\quad)} =$ ..... ft.

Drawdown Factor $= \frac{I.S.I.P. - F.S.I.P. \times 100}{I.S.I.P.} = \frac{(\quad) - (\quad)}{(\quad)} \times 100 =$ ..... % (4% to 5% is considered serious or substantial)

Potentiometric Surface $= H_w = \bar{Z} + \frac{P_o}{w}$ $h_w =$ ..... $+ \frac{(\quad)}{(\quad)} = +$ ..... $\pm$ ..... ft.

INTERPRETATION CALCULATIONS (GAS)

$R(T_f) =$ .....°

ESTIMATED GAS PROPERTIES — Estimated Bottom Hole Temperature °

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

TRANSMISSIBILITY — Measured D.S.T. Gas Rate = ... mcf/d.

$\frac{kh}{\mu} = \frac{1637\ Q_g ZT_f}{m} \quad \frac{1637\ (\quad)(\quad)(\quad)}{(\quad)} =$ ..... md.-ft./cp.

IN SITU CAPACITY

$kh = (\quad)(\quad) =$ ..... md.-ft.

AVERAGE EFFECTIVE PERMEABILITY — Estimated Pay Thickness Ft. / Actual Pay Thickness Ft.

$k = \frac{(\quad)}{(\quad)} =$ ..... md.

APPROXIMATE RADIUS OF INVESTIGATION

$b = 0.02\sqrt{kt_oP_o} = 0.02\sqrt{(\quad)(\quad)(\quad)(\quad)} =$ ..... ft.

ACTUAL CAPACITY

$kh = \frac{3270\ Q_g \mu Z T_f \log(0.472\frac{b}{r_w})}{P_o^2 - P_f^2} = \frac{3270\ (\quad)(\quad)(\quad)(\quad)(\quad)}{(\quad) - (\quad)} =$ ..... md.-ft.

DAMAGE RATIO — $E.D.R. = \frac{(P_o^2 - P_f^2)}{m(\log T_o + 2.65)}$

$D.R. = \frac{\text{In Situ Capacity}}{\text{Actual Capacity}} = \frac{(\quad)}{(\quad)} =$ ..... E.D.R. = ...

ESTIMATED RANGE OF AOF POTENTIAL

Max. AOF $= \frac{Q_g P_o^2}{P_o^2 - P_f^2} = \frac{(\quad)(\quad)}{[(\quad) - (\quad)]} = \frac{(\quad)}{(\quad)} =$ ..... MCF/D

Min. AOF $= \frac{Q_g P_o}{\sqrt{P_o^2 - P_f^2}} = \frac{(\quad)(\quad)}{\sqrt{[(\quad) - (\quad)]}} = \frac{(\quad)}{(\quad)} =$ ..... MCF/D

ESTIMATED RANGE OF AOF POTENTIAL, DAMAGE REMOVED

Max. AOF_t = (Max. AOF) (D.R.) = (\quad)(\quad) = ... MCF/D

Min. AOF_t = (Min. AOF) (D.R.) = (\quad)(\quad) = ... MCF/D

Drawdown Factor $= \frac{ISIP - FSIP \times 100}{ISIP} = \frac{(\quad) - (\quad)}{(\quad)} \times 100 =$ ..... % (4% to 5% is considered serious or substantial)

Potentiometric Surface $= H_w = \bar{Z} + \frac{P_o}{W}$ $H_w =$ ..... $+ \frac{(\quad)}{(\quad)} = +$ ..... $\pm$ ..... ft.