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PEL 5 AND PEL 6; PATCHAWARRA EAST BLOCK

EROMANGA BASIN AND COOPER BASIN

PENNIE 1 TEST REPORTS

Submitted by

Santos Ltd
1996

Enquiries: Customer Services
Ground Floor
101 Grenfell Street, Adelaide 5000

Telephone: (08) 8463 3000
Facsimile: (08) 8204 1880

PRIMARY INDUSTRIES AND RESOURCES SA

Santos Ltd
A.C.N. 007 550 923
39 Grenfell Street
Adelaide SA 5000
GPO Box 2319
Adelaide SA 5001
Telephone: (08) 218 5111
Facsimile: (08) 212 5476

Santos

Ref: PED: 1322/96

28 October 1996

Mr N Taylor
Joint Interests Manager
Delhi Petroleum Pty Ltd
c/- Esso Australia Ltd
12 Riverside Quay
SOUTHBANK VIC 3000

Dr M Clegg
Engineering Manager
Boral Energy Resources
60 Hindmarsh Square
ADELAIDE SA 5000

Dr Chris Longman
General Manager
Crusader Limited
27th Floor
12 Creek Street
BRISBANE QLD 4000

Mr T Aust
Mines and Energy SA
PO Box 151
EASTWOOD SA 5063

Gentlemen,

Re: Pennie 1 DST 1 - PEDSA No. 032/96

Please find attached an interpretation of the above DST.

DST 1 (9338' - 9400' KB-L, Epsilon 93-5 & 93-7) the tool was opened for a 10 minute pre-flow at 10:42 to a closed chamber, a flow rate of approximately 16 MMscf/d was calculated. Following a 49 minute initial build-up, the tool was opened to a 0.5 inch choke with the pressure building dramatically (to 1903 psig) when a leak in the flare line appeared. The tool was closed at 11:56 to repair the flare line. At 12:17 the tool was opened to a 0.75 inch choke for the main (third) flow and a mean stabilised rate of approximately 18.9 MMscf/d (1600 psig) was calculated using the choke equation. The fluid recovery was lost due to the drill string being filled with mud to allow reverse circulation. Radial flow was identified from the main shut-in period with reservoir flow capacity of 3509 md.ft (163 md) and an apparent skin factor of +1.5 being interpreted. A barrier to flow was interpreted from the late time data at a distance of approximately 110 ft. from the wellbore. Alternatively, the character of the radial derivative may indicate a very high permeability streak resulting in frac-like behaviour. A reservoir pressure of 4150 psia, at a depth of 9350 ft.KB, was determined from the main build-up. No depletion was apparent during the test.

If you have any queries about the above results please contact Richard Leslie on (08) 8224 7898.

Yours faithfully,

G. GUGLIELMO
Manager - Petroleum Engineering

cc. *R.D. Leslie / G.J. Schumacher*
JS Evanochko w/o attachments
PA Min w/o attachments
Well file

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Pennie 1 DST 1 December 1995

Well Test Analysis Report

Analyst name	C.J. Thompson
Company	Santos Limited
Field	Pennie
Well	1
Date	7/12/95
Formation	Epsilon 93-5 & 93-7 sands
Test	DST 1
Depth Reference - MSL	182 ft.ASL
Gauge Type	Panex
Gauge Number	1273
Gauge Depth - Measured	9350 ft.KB
Gauge Depth - Vertical	-9168 ft.SS
Test Interval Top	9338 ft.KB
Test Interval Bottom	9400 ft.KB

Remarks: The well was opened for a 10 minute pre-flow at 10:42 to a closed chamber, a flow rate of approximately 16 MMscf/d was calculated. Following a 49 minute initial shut-in, the tool was opened to a 0.5 inch choke with pressure increasing dramatically (to 1903 psig) when a leak in the flare line appeared. The tool was closed at 11:56 to repair the flare line. At 12:17 the tool was opened to a 0.75 inch choke for the main (third) flow and a mean stabilised rate of approximately 18.9 MMscf/d (1600 psig) was calculated using the choke equation. The tool was closed at 13:26 for a 127 minute final shut-in. The liquid recovery was lost due to the drill string being filled with mud to allow reverse circulation.

The test overview indicates rapid pressure build-up during shut-in periods and that the well unloaded the cushion approximately 15 minutes into the final flow.

From the radial derivative (Log-Log plot) a period of radial flow was identified in the early time data of the main build-up and wellbore storage is not observable. Following this initial period of radial flow is a transition to a second period of radial flow. This is interpreted to represent the influence of a single barrier to flow. Alternatively, the character of the radial derivative could also indicate the influence of a very high permeability streak resulting in Frac-like behaviour. Analysis of the main flow was not conduted as the well was still cleaning up and the flow was not completely stable.

Extrapolation of the initial period of radial flow (main build-up) on the Horner plot indicates a reservoir flow capacity of approximately 3509 md.ft (163 md) with an apparent skin factor of 1.5. This is in agreeance with the initial build-up which indicated a flow capacity of 3507 with an apparent skin factor of 1.

Extrapolation of the second radial flow regime (main build-up) on the Horner plot suggests a likely distance of approximately 110 ft. to the permeability barrier. The development of this flow regime during the initial build-up is apparent but not certain.

A reservoir pressure of 4150 psia, at the gauge depth (9350 ft.KB), was determined, from the main build-up, by extrapolation of the single fault radial flow regime on the Horner plot. Depletion following the main flow is not evident.

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Well Test Analysis Report		

Reservoir Description
Fluid type : Gas
Well orientation : Vertical
Number of wells : 1
Number of layers : 1

Layer Parameters Data

	Layer 1
Formation thickness	21.50 ft
Average formation porosity	0.131
Water saturation	0.256
Gas saturation	0.744
Formation compressibility	4.3468e-6 psi-1
Total system compressibility	1.2099e-4 psi-1
Layer pressure	4150.0239 psia
Temperature	268.0000 deg F

Well Parameters Data

	Well 1
Well radius	0.354 ft
Distance from observation to active well	0.0000 ft
Wellbore storage coefficient	0.00 bbl/psi
Well offset - x direction	0.00 ft
Well offset - y direction	0.00 ft

Fluid Parameters Data

	Layer 1
Gas gravity	0.9230 sp grav
Water-Gas ratio	0.0000 STB/MMscf
Water salinity	0.0000 ppm
Check Pressure	4150.0000 psia
Check Temperature	268.0000 deg F
Gas density	15.6632 lb/ft3
Initial gas viscosity	0.026694 cp
Gas formation volume factor	4.4999e-3 ft3/scf
Water density	58.701 lb/ft3
Water viscosity	0.18512 cp
Water formation volume factor	1.06244 RB/STB
Initial Z-factor	0.90551
Initial Gas compressibility	1.5555e-4 psi-1
Water compressibility	3.5677e-6 psi-1

Layer 1 Correlations
Ug Correlation : Carr et al

Layer Boundaries Data
Layer 1 Boundary Type : Single fault
L1 Boundary : No-flow

	Layer 1
L1	106.2946 ft
L2	0.0000 ft
L3	0.0000 ft
L4	0.0000 ft
Drainage area	0.0000 acres
Dietz shape factor	0.0000

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Layer 1 Model Data

Layer 1 Model Type : Radial homogeneous

	Layer 1
Permeability	163.2032 md
Skin factor (Well 1)	1.5323
Rate dependent skin coefficient (D)	0.0000 1/(Mscf/day)

Layer 1 P/U/Z Table

Pi psia	Initial gas viscosity cp	Zi
0.0000	0.0126452	1.000
200.0000	0.01278956	0.9752
400.0000	0.01311214	0.95107
600.0000	0.01351041	0.92788
800.0000	0.01389447	0.90595
1000.0000	0.01441568	0.88567
1200.0000	0.01500523	0.86747
1400.0000	0.01568053	0.85175
1600.0000	0.01635141	0.8389
1800.0000	0.0170223	0.82917
2000.0000	0.01771112	0.8227
2200.0000	0.01853585	0.81944
2400.0000	0.01936058	0.81924
2600.0000	0.02018531	0.82184
2800.0000	0.02103093	0.82693
3000.0000	0.02188108	0.8342
3200.0000	0.02273124	0.84337
3400.0000	0.02358139	0.85417
3600.0000	0.02443154	0.86636
3800.0000	0.02528169	0.87974
4000.0000	0.02611396	0.89414
4200.0000	0.02688739	0.9094
4400.0000	0.02766082	0.92542
4600.0000	0.02843426	0.94206
4800.0000	0.02920769	0.95926
5000.0000	0.02998113	0.97692

Rate Change Data

Time Hours	Pressure psia	Rate MMscf/day
7.91614	4576.5498	0.0000
8.09945	4033.0100	16.0000
8.87854	4145.1401	0.0000
9.14935	3982.3701	18.0000
9.49514	4131.8999	0.0000
10.66167	3976.2100	18.9000
12.77393	4137.6602	0.0000

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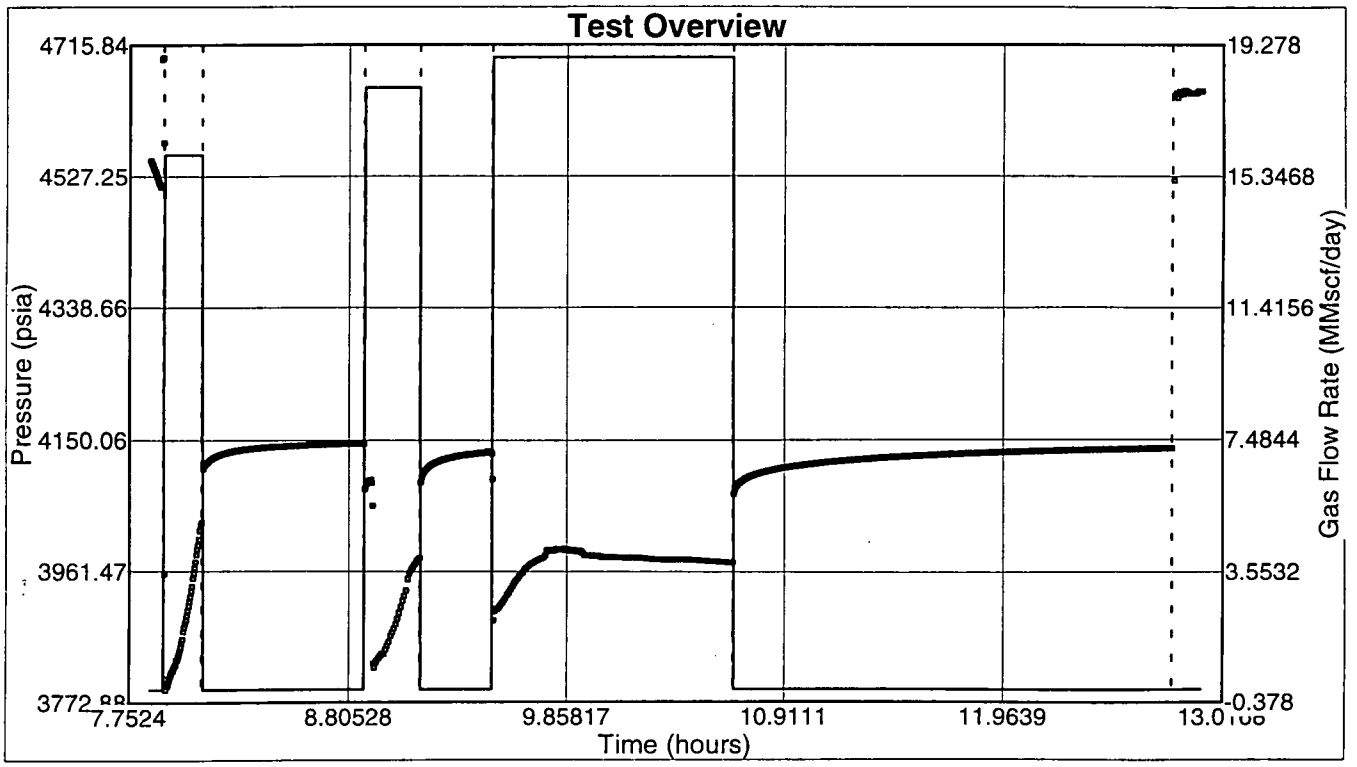
Well Test Analysis Report



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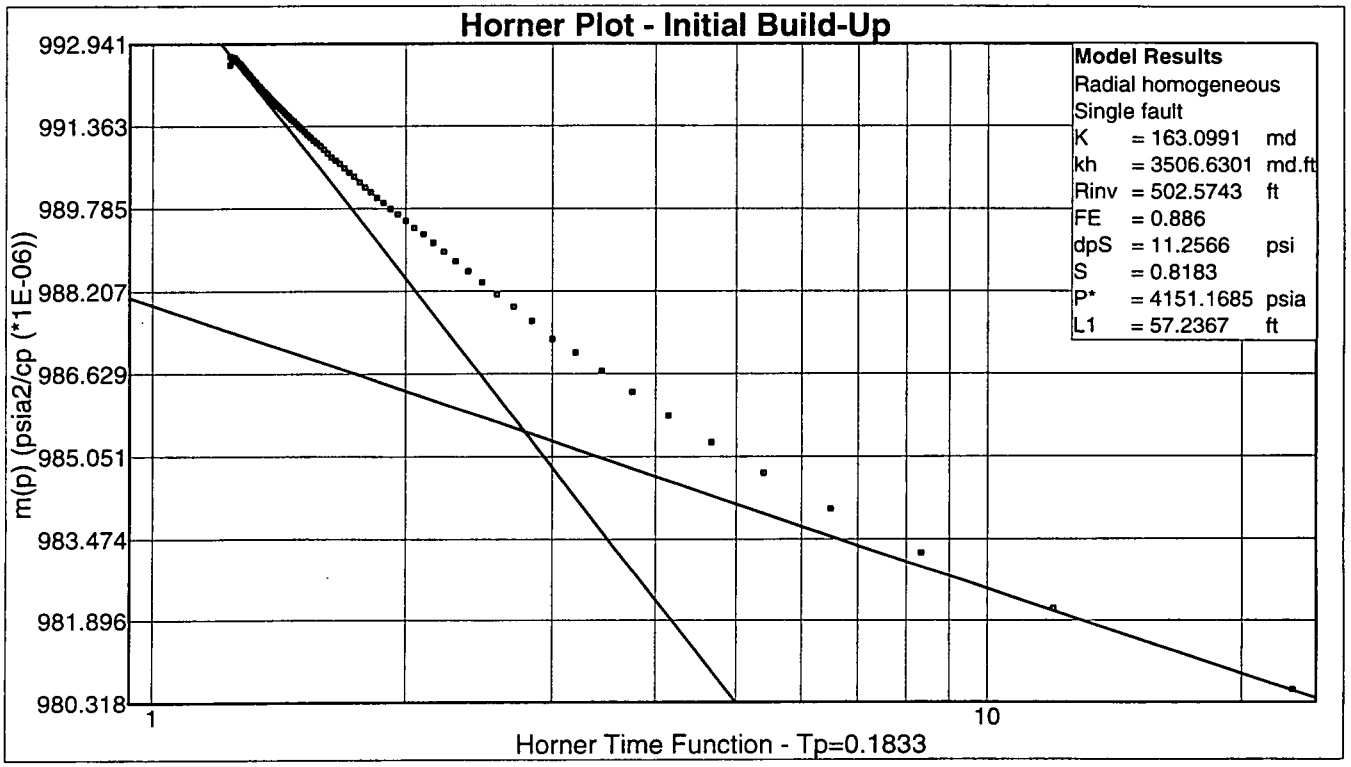
Well Test Analysis Report		



Horner Plot - Initial Build-Up Model Results
Radial homogeneous
Single fault

	Value
Permeability	163.0991 md
Permeability-thickness	3506.6301 md.ft
Radius of investigation	502.5743 ft
Flow efficiency	0.8860
dP skin (constant rate)	11.2566 psi
Skin factor	0.8183
Extrapolated pressure	4151.1685 psia
Distance to nearest fault	57.2367 ft

Horner Plot - Initial Build-Up Line Details
Line type : Radial flow
Slope : -5.43372
Intercept : 987.937
Coefficient of Determination : Not Used

	Radial flow
Extrapolated m(p)	987.9367 psia2/cp (*1E-06)
Extrapolated pressure	4131.7505 psia
m(p) at dt = 1 hr	987.5395 psia2/cp (*1E-06)
Pressure at dt = 1 hour	4130.5928 psia

Line type : Single fault radial flow
Slope : -20.4409
Intercept : 994.599
Coefficient of Determination : Not Used

	Single fault radial flow
Extrapolated m(p)	994.5987 psia2/cp (*1E-06)
Extrapolated pressure	4151.1685 psia
m(p) at dt = 1 hr	993.1045 psia2/cp (*1E-06)
Pressure at dt = 1 hour	4146.8135 psia

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Well Test Analysis Report		

Number of Intersections = 1

Intersection 1
First Line : Radial flow
Second Line : Single fault radial flow
Intersection time : 0.06596
Distance to nearest fault : 57.2367 ft

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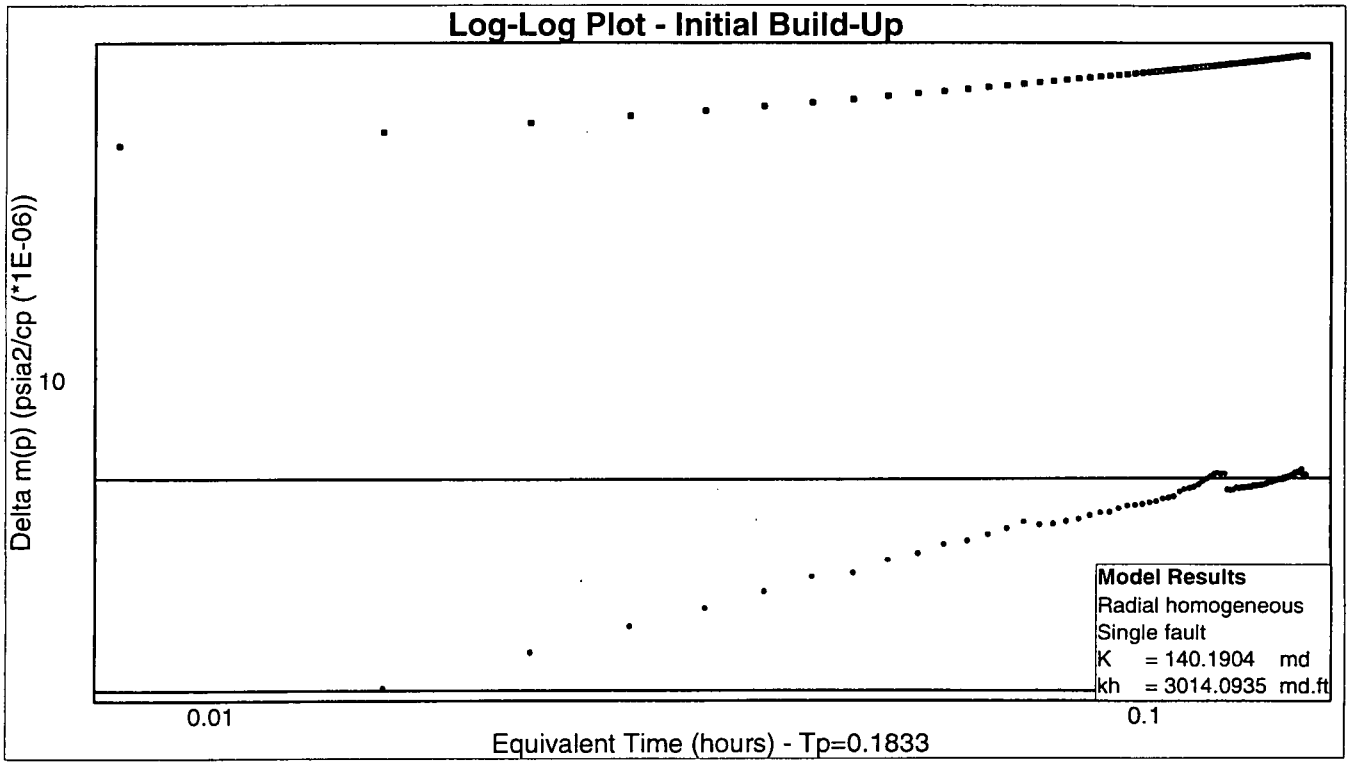
Well Test Analysis Report



Log-Log Plot - Initial Build-Up Model Results

Radial homogeneous

Single fault

	Value
Permeability	140.1904 md
Permeability-thickness	3014.0935 md.ft

Log-Log Plot - Initial Build-Up Line Details

Line type : Radial flow
Slope : 0
Intercept : 2.74546
Coefficient of Determination : Not Used

Line type : Single fault radial flow
Slope : 0
Intercept : 6.63847
Coefficient of Determination : Not Used

Number of Intersections = 0

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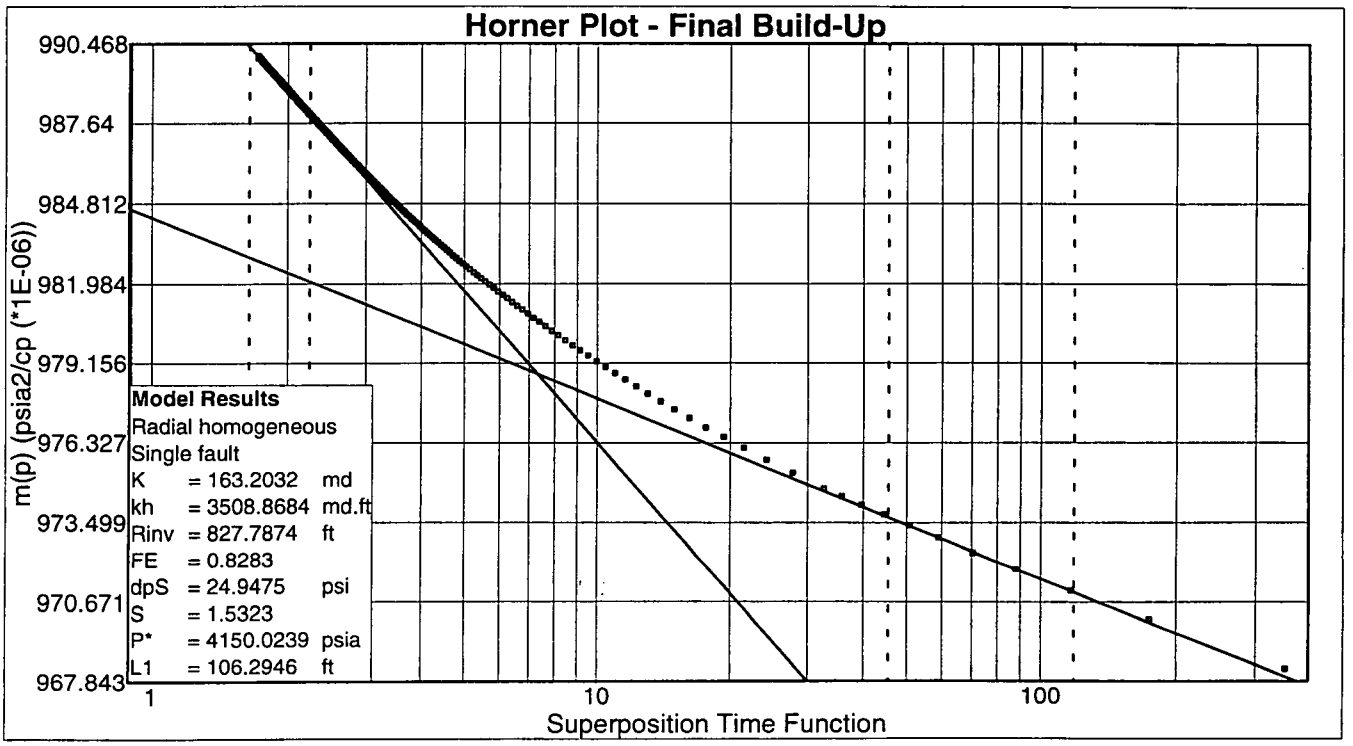
Well Test Analysis Report



Horner Plot - Final Build-Up Model Results

Radial homogeneous

Single fault

	Value
Permeability	163.2032 md
Permeability-thickness	3508.8684 md.ft
Radius of investigation	827.7874 ft
Flow efficiency	0.8283
dP skin (constant rate)	24.9475 psi
Skin factor	1.5323
Extrapolated pressure	4150.0239 psia
Distance to nearest fault	106.2946 ft

Horner Plot - Final Build-Up Line Details

Line type : Radial flow

Slope : -6.41448

Intercept : 984.321

Coefficient of Determination : 0.999553

	Radial flow
Extrapolated m(p)	984.3215 psia2/cp (*1E-06)
Extrapolated pressure	4121.2129 psia
m(p) at dt = 1 hr	981.8287 psia2/cp (*1E-06)
Pressure at dt = 1 hour	4113.9468 psia

Line type : Single fault radial flow

Slope : -17.8511

Intercept : 994.206

Coefficient of Determination : 0.999774

	Single fault radial flow
Extrapolated m(p)	994.2060 psia2/cp (*1E-06)
Extrapolated pressure	4150.0239 psia
m(p) at dt = 1 hr	987.2688 psia2/cp (*1E-06)
Pressure at dt = 1 hour	4129.8037 psia

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Well Test Analysis Report		

Number of Intersections = 1

Intersection 1
First Line : Radial flow
Second Line : Single fault radial flow
Intersection time : 0.19776
Distance to nearest fault : 106.295 ft

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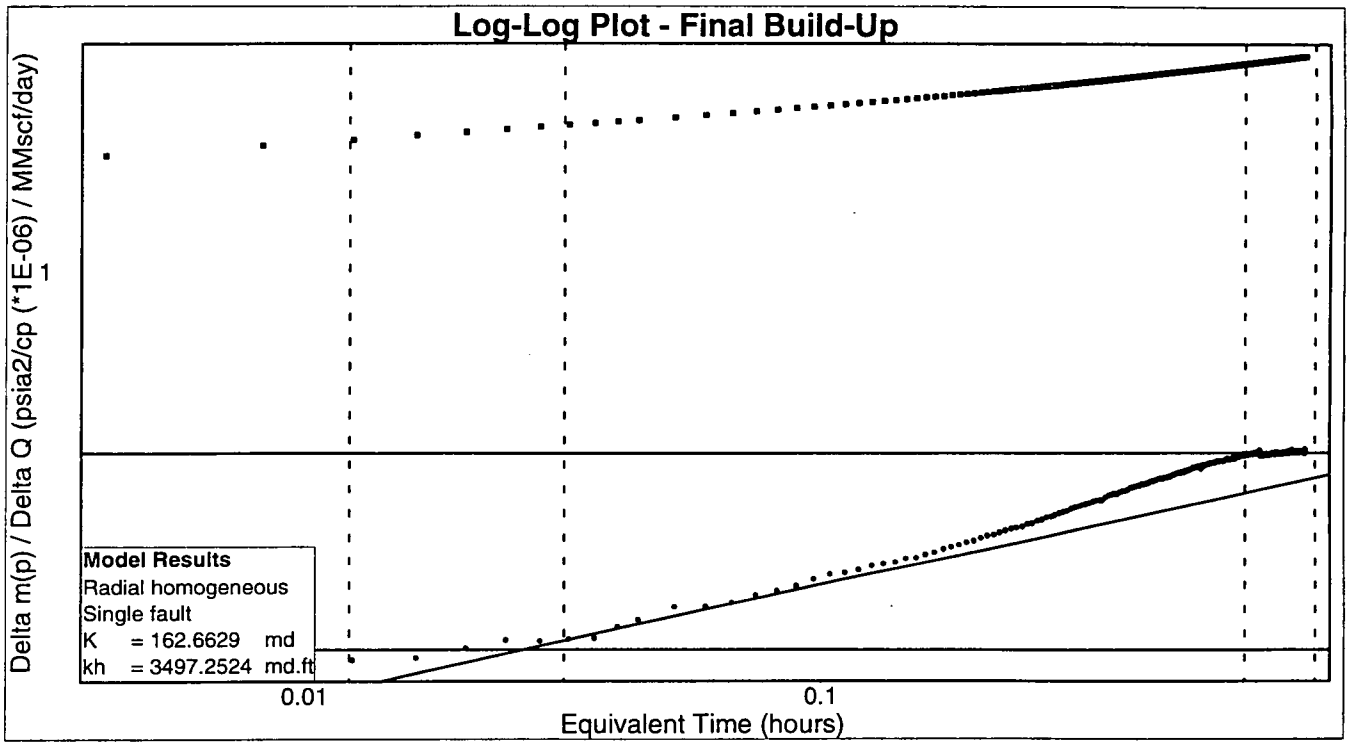
Well Test Analysis Report



Log-Log Plot - Final Build-Up Model Results

Radial homogeneous

Single fault

	Value
Permeability	162.6629 md
Permeability-thickness	3497.2524 md.ft

Log-Log Plot - Final Build-Up Line Details

Line type : Radial flow
Slope : 0
Intercept : 0.147885
Coefficient of Determination : Not Used

Line type : Free model line
Slope : 0.25
Intercept : 0.366526
Coefficient of Determination : Not Used

Line type : Single fault radial flow
Slope : 0
Intercept : 0.40266
Coefficient of Determination : Not Used

Number of Intersections = 0