

Production Log Interpretation

CONFIDENTIEL
CONFIDENTIAL

Production Log Interpretation Report

Company Name: Ranger Oil Limited

Well Name: Liard P-66-A

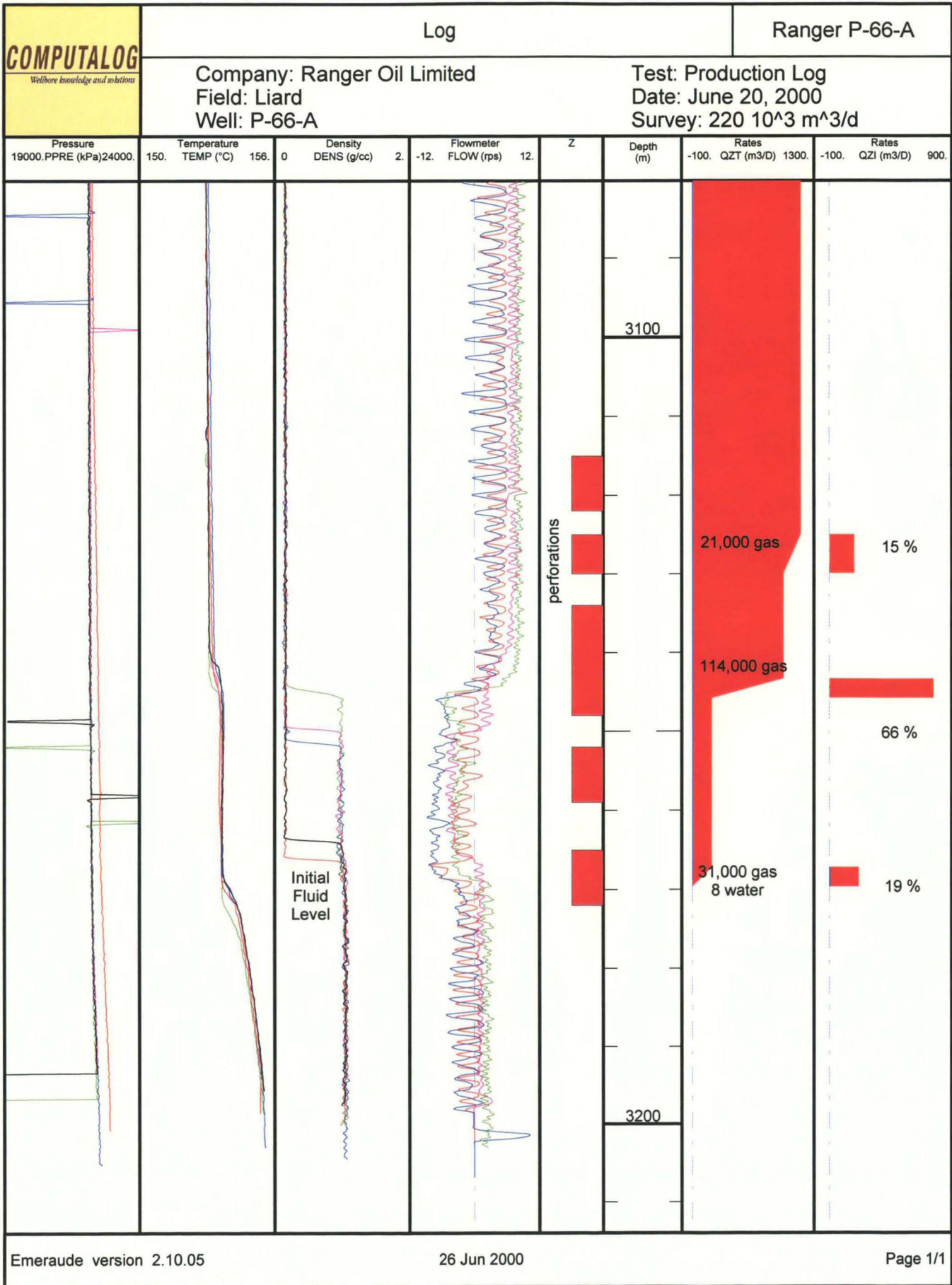
Location: Ft. Liard N.W.T.

Date: June 20, 2000

NATIONAL ENERGY BOARD
ENGINEERING BRANCH
JUL - 4 2000

COMPUTALOG

Wellbore knowledge and solutions



COMPUTALOG Wellbore knowledge and solutions	Job Information		Ranger P-66-A																																																																													
	Company: Ranger Oil Limited Field: Liard Well: P-66-A		Test: Production Log Date: June 20, 2000 Survey: 220 10 ³ m ³ /d																																																																													
<table border="0"> <tr> <td>Survey date</td> <td>June 20, 2000</td> <td>Interpretation date</td> <td>June 24, 2000</td> </tr> <tr> <td>Service company</td> <td>Computalog</td> <td>Done by</td> <td>R. Kish</td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>SURVEY</td> <td>220 10³ m³/d</td> <td></td> <td></td> </tr> <tr> <td>Surface rates:</td> <td></td> <td>Gas</td> <td>2.2E+5 m³/D</td> </tr> <tr> <td>Oil</td> <td>0 m³/D</td> <td>Water</td> <td>20. m³/D</td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>TOOLS</td> <td></td> <td></td> <td></td> </tr> <tr> <td>String O.D.</td> <td>42.8625 mm</td> <td>Capacitance</td> <td>None</td> </tr> <tr> <td>Spinner blade O.D.</td> <td>31. mm</td> <td></td> <td></td> </tr> <tr> <td>Density</td> <td>Corrected</td> <td></td> <td></td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>INTERPRETATION</td> <td>Interpretation # 1</td> <td></td> <td></td> </tr> <tr> <td>Density offset</td> <td>0 g/cc</td> <td></td> <td></td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>Flow type</td> <td>Liquid-Gas</td> <td></td> <td></td> </tr> <tr> <td>Flow model</td> <td>Duckler</td> <td></td> <td></td> </tr> <tr> <td>Vpcf mult.</td> <td>1.</td> <td></td> <td></td> </tr> <tr> <td>Vslip mult.</td> <td>1.</td> <td></td> <td></td> </tr> </table>					Survey date	June 20, 2000	Interpretation date	June 24, 2000	Service company	Computalog	Done by	R. Kish					SURVEY	220 10 ³ m ³ /d			Surface rates:		Gas	2.2E+5 m ³ /D	Oil	0 m ³ /D	Water	20. m ³ /D					TOOLS				String O.D.	42.8625 mm	Capacitance	None	Spinner blade O.D.	31. mm			Density	Corrected							INTERPRETATION	Interpretation # 1			Density offset	0 g/cc							Flow type	Liquid-Gas			Flow model	Duckler			Vpcf mult.	1.			Vslip mult.	1.		
Survey date	June 20, 2000	Interpretation date	June 24, 2000																																																																													
Service company	Computalog	Done by	R. Kish																																																																													
SURVEY	220 10 ³ m ³ /d																																																																															
Surface rates:		Gas	2.2E+5 m ³ /D																																																																													
Oil	0 m ³ /D	Water	20. m ³ /D																																																																													
TOOLS																																																																																
String O.D.	42.8625 mm	Capacitance	None																																																																													
Spinner blade O.D.	31. mm																																																																															
Density	Corrected																																																																															
INTERPRETATION	Interpretation # 1																																																																															
Density offset	0 g/cc																																																																															
Flow type	Liquid-Gas																																																																															
Flow model	Duckler																																																																															
Vpcf mult.	1.																																																																															
Vslip mult.	1.																																																																															
Comments Well logged at the following rates: 220 10³m³/d 350 10³m³/d 700 10³m³/d The gas rate from the lower zone could only be calculated on the initial 220 10³ m³/d log. After this log was run the fluid level had filled up to 3144m. The angle of the hole resulted in a large amount of water hold up and apparent down flow on the low side of the hole.																																																																																
Emeraude version 2.10.05 26 Jun 2000 Page 1																																																																																

Company: Ranger Oil Limited

Field: Liard

Well: P-66-A

Test: Production Log

Date: June 20, 2000

Survey: 220 10³ m³/d

FLUID TYPE Water - Gas

GAS

Specific gravity 0.7

N₂ % 0CO₂ % 0H₂S % 0

Z factor Beggs and Brill

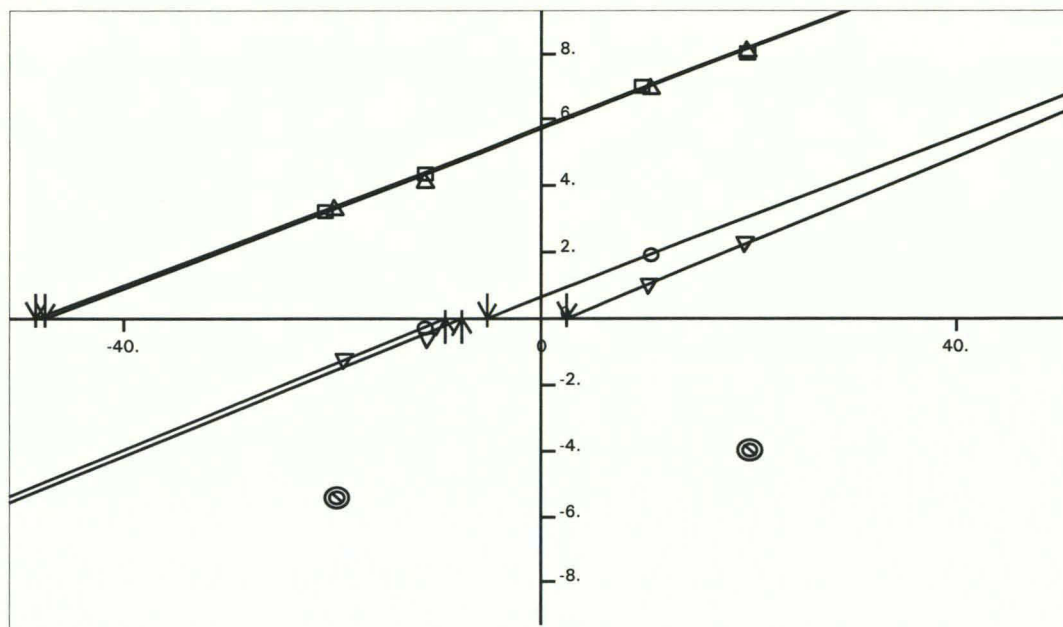
μ_g Lee et al.

WATER

Salinity, ppm 1E+5

R_{sw} KatzC_w Dodson and Standingμ_w Van-Wingen+Frick

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

 Test: Production Log
 Date: June 20, 2000
 Survey: 220 10³ m³/d


rps versus m/min

Threshold (+) 0 m/min

Threshold (-) 0 m/min

	Calib. Zone m	Slope (+)	Slope (-)	Int (+) m/min	Int (-) m/min	Int. Diff. m/min
□	3096.4-3113.9	0.119	N/A	-48.51	N/A	0.00
△	3128.7-3136.4	0.121	N/A	-47.47	N/A	0.00
○	3146.0-3150.0	0.120	0.130	-5.38	-9.51	4.13
▽	3177.1-3192.5	0.130	0.130	2.51	-7.92	10.44

Company: Ranger Oil Limited
Field: Liard
Well: P-66-A

Test: Production Log
Date: June 20, 2000
Survey: 220 10³ m³/d

Zones m	Water m3/D	Oil m3/D	Gas m3/D
3115.0-3122.0	4.172E-5	0.00	-5.02
3125.0-3130.0	9.241E-4	0.00	27619.20
3143.4-3145.9	3.21E-3	0.00	1.146E+5
3167.2-3169.7	8.01	0.00	31030.50
Total	8.02	0.00	1.733E+5

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

 Test: Production Log
 Date: June 20, 2000
 Survey: 220 10³ m³/d

Zones m	Qt res. m ³ /D	Production %
3115.0-3122.0	-3.776E-4	0.00
3125.0-3130.0	184.29	15.82
3143.4-3145.9	764.94	65.67
3167.2-3169.7	215.52	18.50

Contributions by phase

Zones m	Qw res. m ³ /D	Qo res. m ³ /D	Qg res. m ³ /D	W O G
3115.0-3122.0	0.00	0.00	-3.776E-4	
3125.0-3130.0	0.00	0.00	184.29	
3143.4-3145.9	-4.801E-14	0.00	764.94	
3167.2-3169.7	8.62	0.00	206.90	

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 220 10³ m³/d

Zone m	Corr. factor	Vm m/min	Q downhole m ³ /D	Contribution %
3115.0-3122.0	0.87	40.532	1164.74	0.00
3125.0-3130.0	0.87	40.532	1164.74	15.82
3143.4-3145.9	0.86	34.119	980.46	65.67
3167.2-3169.7	0.83	7.500	215.52	18.50

Total rates by phase

Zone m	Qw res. m ³ /D	Qw s.c. m ³ /D	Qo res. m ³ /D	Qo s.c. m ³ /D	Qg res. m ³ /D	Qg s.c. m ³ /D
3115.0-3122.0	8.62	8.02	0.00	0.00	1156.12	1.733E+5
3125.0-3130.0	8.62	8.02	0.00	0.00	1156.12	1.733E+5
3143.4-3145.9	8.62	8.02	0.00	0.00	971.84	1.456E+5
3167.2-3169.7	8.62	8.01	0.00	0.00	206.90	31030.50

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 220 10³ m³/d

ZONE 3114.0-3115.0 m

Correlation	Duckler	ID	159 mm
Regime	Single phase gas	Deviation	0 Radians
		Roughness	0
Vm	40.5 m/min		
V Superficial:		T	153 °C
Vsw	0.3 m/min	P	22123 kPa
Vsg	40.2 m/min	Rs	N/A
		Rsw	3.2 m ³ /m ³
V Average:			
Vw	0 m/min		
Vg	40.2 m/min		
Holdups:			
Yw	0		
Yg	1.		
Slippage	0 m/min		

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.272E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0067	2.035E-5	0.1300

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 220 10³ m³/d

ZONE 3124.0-3125.0 m

Correlation	Duckler	ID	159 mm
Regime	Single phase gas	Deviation	0 Radians
		Roughness	0
Vm	40.5 m/min		
V Superficial:		T	153 °C
Vsw	0.3 m/min	P	22124 kPa
Vsg	40.2 m/min	Rs	N/A
		Rsw	3.2 m ³ /m ³
V Average:			
Vw	0 m/min		
Vg	40.2 m/min		
Holdups:			
Yw	0		
Yg	1.		
Slippage	0 m/min		

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.272E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0067	2.035E-5	0.1300

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 220 10³ m³/d

ZONE 3133.0-3143.4 m

Correlation	Duckler	ID	159 mm
Regime	Single phase gas	Deviation	0 Radians
		Roughness	0
Vm	34.1 m/min		
V Superficial:		T	153 °C
Vsw	0.3 m/min	P	22136 kPa
Vsg	33.8 m/min	Rs	N/A
		Rsw	3.21 m ³ /m ³
V Average:			
Vw	0 m/min		
Vg	33.8 m/min		
Holdups:			
Yw	0		
Yg	1.		
Slippage	0 m/min		

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.270E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0067	2.036E-5	0.1300

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 220 10³ m³/d

ZONE 3145.9-3167.2 m

Correlation Duckler
 Regime Slug liquid-gas

ID 159 mm
 Deviation 0 Radians
 Roughness 0

V_m 7.5 m/min

V Superficial:

V_{sw} 0.3 m/min
 V_{sg} 7.2 m/min

T 154 °C
 P 22185 kPa
 R_s N/A
 R_{sw} 3.23 m³/m³

V Average:

V_w 0.41 m/min
 V_g 26.7 m/min

Holdups:

Y_w 0.73
 Y_g 0.27
 Slippage 26.3 m/min

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.265E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0067	2.037E-5	0.1300

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 220 10³ m³/d

ZONE 3169.7-3173.0 m

Correlation Duckler
 Regime No flow

ID 159 mm
 Deviation 0 Radians
 Roughness 0

Vm 0 m/min

V Superficial:

Vsw 0 m/min
 Vsg 0 m/min

T 154 °C
 P 22233 kPa
 Rs N/A
 Rsw 3.26 m³/m³

V Average:

Vw 0 m/min
 Vg 0 m/min

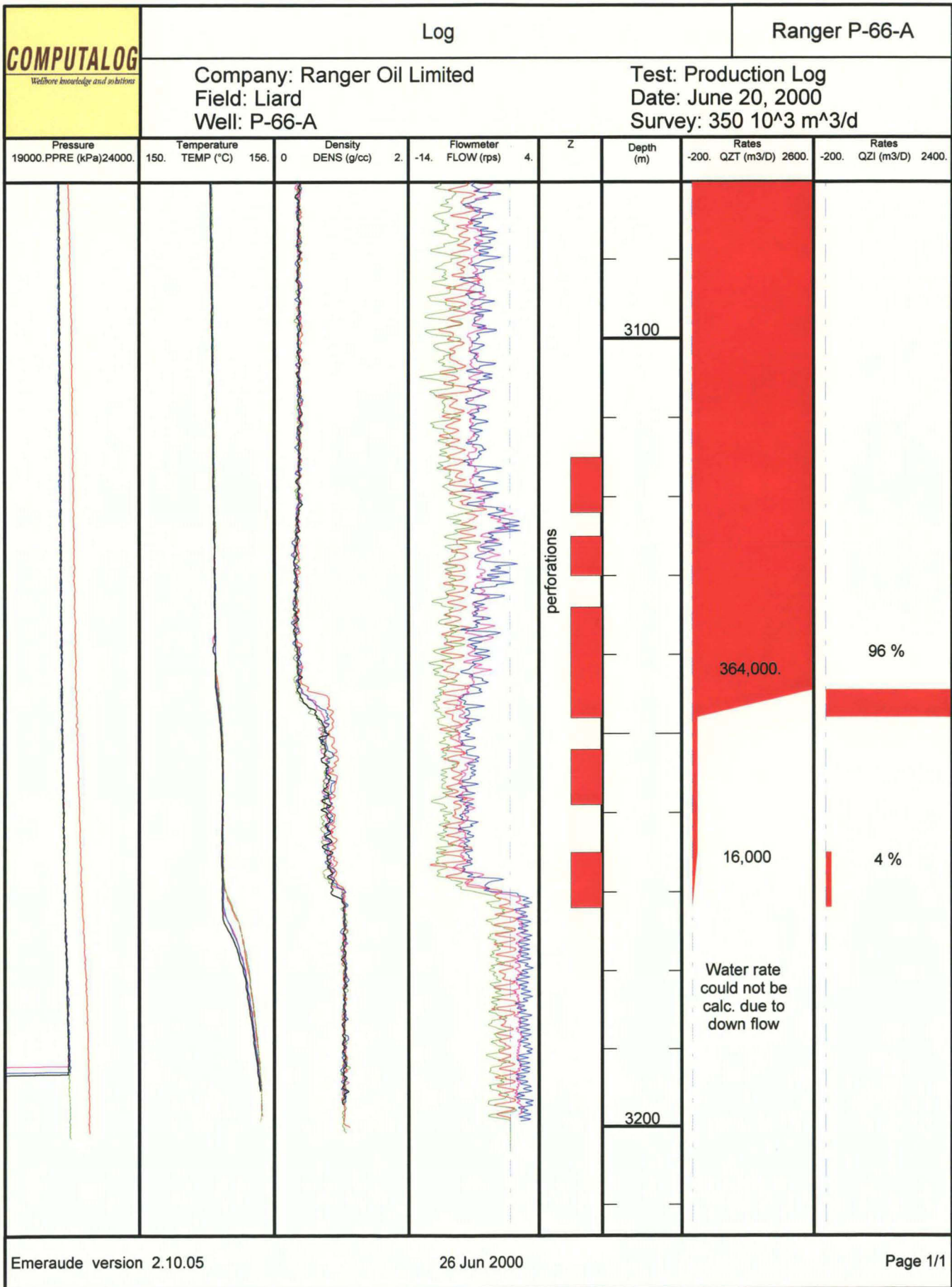
Holdups:

Yw 0
 Yg 0
 Slippage 0 m/min

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.259E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0067	2.039E-5	0.1300

Parameters
220 10³m³/d

	zone 1	zone 2	zone 3
From, m	3115	3125	3143.4
To, m	3122	3130	3145.9
Water			
FVF	1.08	1.08	1.08
Viscosity, Pa.sec	2.27E-04	2.27E-04	2.27E-04
Density, g/cc	1	1	1
Gas			
FVF	0.0067	0.0067	0.0067
Viscosity, Pa.sec	2.04E-05	2.04E-05	2.04E-05
Density, g/cc	0.13	0.13	0.13
Temperature, °C	153.02	153.03	153.17
Pressure, kPa	22123	22124	22136
Diameter, mm	1.59E+02	1.59E+02	159.4
Deviation, Radians	0	0	0
Roughness	0	0	0
Rs, m3/m3	N/A	N/A	N/A
Rsw, m3/m3	3.2	3.2	3.21
V Mixture , m/min	40.5	40.5	34.1
Visc. Mixture , Pa.sec	2.04E-05	2.04E-05	2.04E-05
Vpcf	0.87	0.87	0.86
Q total res., m3/D	1.16E+03	1164.74	980.46
dQ res., m3/D	-3.78E-04	184.29	764.94
% Qt	0	15.82	65.67
Qw total res., m3/D	8.62	8.62	8.62
Qw total s.c., m3/D	8.02	8.02	8.02
dQw res., m3/D	0	0	-4.80E-14
dQw s.c., m3/D	4.17E-05	9.24E-04	3.21E-03
Qo total res., m3/D	0	0	0
Qo total s.c., m3/D	0	0	0
dQo res., m3/D	0.00E+00	0	0
dQo s.c., m3/D	0	0	0
Qg total res., m3/D	1156.12	1156.12	971.84
Qg total s.c., m3/D	1.73E+05	1.73E+05	1.46E+05
dQg res., m3/D	-3.78E-04	184.29	764.94
dQg s.c., m3/D	-5.02E+00	27619.2	1.15E+05
V Superficial			
Vsw, m/min	0.3	3.00E-01	0.3
Vso, m/min	0	0	0
Vsg, m/min	40.232	4.02E+01	33.819
V Average			
Vw, m/min	0	0	0
Vo, m/min	0	0	0
Vg, m/min	40.232	40.232	33.819
Yw	0	0	0
Yo	0	0	0
Yg	1	1	1
Vslip, m/min	0	0	0
Vslip W-O, m/min			
Regime	Single phase gas	Single phase gas	Single phase gas
Correl.	Duckler	Duckler	Duckler
Correl. W-O	ABB - Deviated	ABB - Deviated	ABB - Deviated

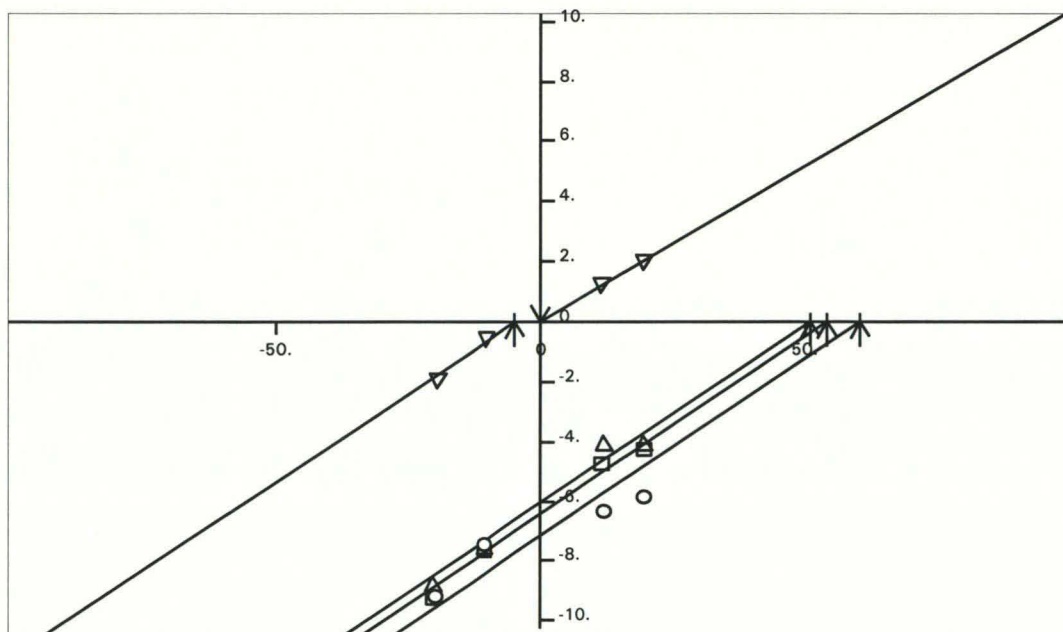


COMPUTALOG Wellbore knowledge and solutions	Job Information		Ranger P-66-A																																																																													
	Company: Ranger Oil Limited Field: Liard Well: P-66-A		Test: Production Log Date: June 20, 2000 Survey: 350 10 ³ m ³ /d																																																																													
<table border="0"> <tr> <td>Survey date</td> <td>June 20, 2000</td> <td>Interpretation date</td> <td>June 24, 2000</td> </tr> <tr> <td>Service company</td> <td>Computalog</td> <td>Done by</td> <td>R. Kish</td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>SURVEY</td> <td>350 10³ m³/d</td> <td></td> <td></td> </tr> <tr> <td>Surface rates:</td> <td></td> <td>Gas</td> <td>3.5E+5 m³/D</td> </tr> <tr> <td>Oil</td> <td>0 m³/D</td> <td>Water</td> <td>202. m³/D</td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>TOOLS</td> <td></td> <td></td> <td></td> </tr> <tr> <td>String O.D.</td> <td>42.8625 mm</td> <td>Capacitance</td> <td>None</td> </tr> <tr> <td>Spinner blade O.D.</td> <td>31. mm</td> <td></td> <td></td> </tr> <tr> <td>Density</td> <td>Corrected</td> <td></td> <td></td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>INTERPRETATION</td> <td>Interpretation # 1</td> <td></td> <td></td> </tr> <tr> <td>Density offset</td> <td>0 g/cc</td> <td></td> <td></td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>Flow type</td> <td>Liquid-Gas</td> <td></td> <td></td> </tr> <tr> <td>Flow model</td> <td>Duckler</td> <td></td> <td></td> </tr> <tr> <td>Vpcf mult.</td> <td>-2.1977</td> <td></td> <td></td> </tr> <tr> <td>Vslip mult.</td> <td>1.</td> <td></td> <td></td> </tr> </table>					Survey date	June 20, 2000	Interpretation date	June 24, 2000	Service company	Computalog	Done by	R. Kish					SURVEY	350 10 ³ m ³ /d			Surface rates:		Gas	3.5E+5 m ³ /D	Oil	0 m ³ /D	Water	202. m ³ /D					TOOLS				String O.D.	42.8625 mm	Capacitance	None	Spinner blade O.D.	31. mm			Density	Corrected							INTERPRETATION	Interpretation # 1			Density offset	0 g/cc							Flow type	Liquid-Gas			Flow model	Duckler			Vpcf mult.	-2.1977			Vslip mult.	1.		
Survey date	June 20, 2000	Interpretation date	June 24, 2000																																																																													
Service company	Computalog	Done by	R. Kish																																																																													
SURVEY	350 10 ³ m ³ /d																																																																															
Surface rates:		Gas	3.5E+5 m ³ /D																																																																													
Oil	0 m ³ /D	Water	202. m ³ /D																																																																													
TOOLS																																																																																
String O.D.	42.8625 mm	Capacitance	None																																																																													
Spinner blade O.D.	31. mm																																																																															
Density	Corrected																																																																															
INTERPRETATION	Interpretation # 1																																																																															
Density offset	0 g/cc																																																																															
Flow type	Liquid-Gas																																																																															
Flow model	Duckler																																																																															
Vpcf mult.	-2.1977																																																																															
Vslip mult.	1.																																																																															
Comments Well logged at the following rates: 220 10³m³/d 350 10³m³/d 700 10³m³/d The gas rate from the lower zone could only be calculated on the initial 220 10³ m³/d log. After this log was run the fluid level had filled up to 3144m. The angle of the hole resulted in a large amount of water hold up and apparent down flow on the low side of the hole.																																																																																
Emeraude version 2.10.05 26 Jun 2000 Page 1																																																																																

COMPUTALOG Wellbore knowledge and solutions	PVT		Ranger P-66-A
	Company: Ranger Oil Limited Field: Liard Well: P-66-A		Test: Production Log Date: June 20, 2000 Survey: 350 10 ³ m ³ /d
FLUID TYPE Water - Gas GAS Specific gravity 0.7259 N2 % 0 CO2 % 0 H2S % 0 Z factor Beggs and Brill μg Lee et al. WATER Salinity, ppm 1E+5 Rsw Katz Cw Dodson and Standing μw Van-Wingen+Frick			
Emeraude version 2.10.05 26 Jun 2000 Page 2			

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 350 10³ m³/d



rps versus m/min

Threshold (+) 0 m/min

Threshold (-) 0 m/min

	Calib. Zone m	Slope (+)	Slope (-)	Int (+) m/min	Int (-) m/min	Int. Diff. m/min
□	3094.7-3108.5	N/A	0.119	N/A	53.92	0.00
△	3132.0-3138.4	N/A	0.119	N/A	50.85	0.00
○	3154.9-3165.1	N/A	0.119	N/A	60.15	0.00
▽	3174.8-3189.2	0.104	0.119	-8.03E-2	-4.93	4.85

Company: Ranger Oil Limited
Field: Liard
Well: P-66-A

Test: Production Log
Date: June 20, 2000
Survey: 350 10³ m³/d

Zones m	Water m3/D	Oil m3/D	Gas m3/D
3144.5-3148.0	0.00	0.00	3.644E+5
3152.0-3159.0	0.00	0.00	-43.38
3165.0-3172.0	0.00	0.00	16418.50
Total	0.00	0.00	3.808E+5

Company: Ranger Oil Limited
Field: Liard
Well: P-66-A

Test: Production Log
Date: June 20, 2000
Survey: 350 10³ m³/d

Zones m	Qt res. m3/D	Production %
3144.5-3148.0	2521.71	95.70
3152.0-3159.0	0.00	0.00
3165.0-3172.0	113.21	4.30

Contributions by phase

Zones m	Qw res. m3/D	Qo res. m3/D	Qg res. m3/D	W O G
3144.5-3148.0	0.00	0.00	2521.71	
3152.0-3159.0	0.00	0.00	0.00	
3165.0-3172.0	0.00	0.00	113.21	

COMPUTALOG <i>Wellbore knowledge and solutions</i>	Total Zone Rates; Res. Cond.	Ranger P-66-A
	Company: Ranger Oil Limited Field: Liard Well: P-66-A	Test: Production Log Date: June 20, 2000 Survey: 350 10 ³ m ³ /d

Zone m	Corr. factor	Vm m/min	Q downhole m3/D	Contribution %
3144.5-3148.0	-1.94	91.693	2634.92	95.70
3152.0-3159.0	-1.80	3.940	113.21	0.00
3165.0-3172.0	-1.80	3.940	113.21	4.30

Total rates by phase

Zone m	Qw res. m3/D	Qw s.c. m3/D	Qo res. m3/D	Qo s.c. m3/D	Qg res. m3/D	Qg s.c. m3/D
3144.5-3148.0	0.00	0.00	0.00	0.00	2634.92	3.808E+5
3152.0-3159.0	0.00	0.00	0.00	0.00	113.21	16375.10
3165.0-3172.0	0.00	0.00	0.00	0.00	113.21	16418.50

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 350 10³ m³/d

ZONE 3114.0-3144.5 m

Correlation	Duckler	ID	159 mm
Regime	Single phase gas	Deviation	0 Radians
		Roughness	0
Vm	91.7 m/min		
		T	153 °C
V Superficial:		P	21055 kPa
Vsw	0 m/min	Rs	N/A
Vsg	91.7 m/min	Rsw	3.08 m ³ /m ³
V Average:			
Vw	0 m/min		
Vg	91.7 m/min		
Holdups:			
Yw	0		
Yg	1.		
Slippage	0 m/min		

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.269E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0069	2.021E-5	0.1300

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 350 10³ m³/d

ZONE 3151.0-3152.0 m

Correlation	Duckler	ID	159 mm
Regime	Bubble	Deviation	0 Radians
		Roughness	0
Vm	3.94 m/min		
V Superficial:		T	154 °C
Vsw	0 m/min	P	21104 kPa
Vsg	3.94 m/min	Rs	N/A
		Rsw	3.09 m ³ /m ³
V Average:			
Vw	0 m/min		
Vg	17.8 m/min		
Holdups:			
Yw	0		
Yg	0.22		
Slippage	17.8 m/min		

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.265E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0069	2.023E-5	0.1300

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 350 10³ m³/d

ZONE 3164.0-3165.0 m

Correlation	Duckler	ID	159 mm
Regime	Bubble	Deviation	0 Radians
		Roughness	0
Vm	3.94 m/min	T	154 °C
V Superficial:		P	21166 kPa
Vsw	0 m/min	Rs	N/A
Vsg	3.94 m/min	Rsw	3.1 m ³ /m ³
V Average:			
Vw	0 m/min		
Vg	17.8 m/min		
Holdups:			
Yw	0		
Yg	0.22		
Slippage	17.8 m/min		

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.265E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0069	2.025E-5	0.1300

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 350 10³ m³/d

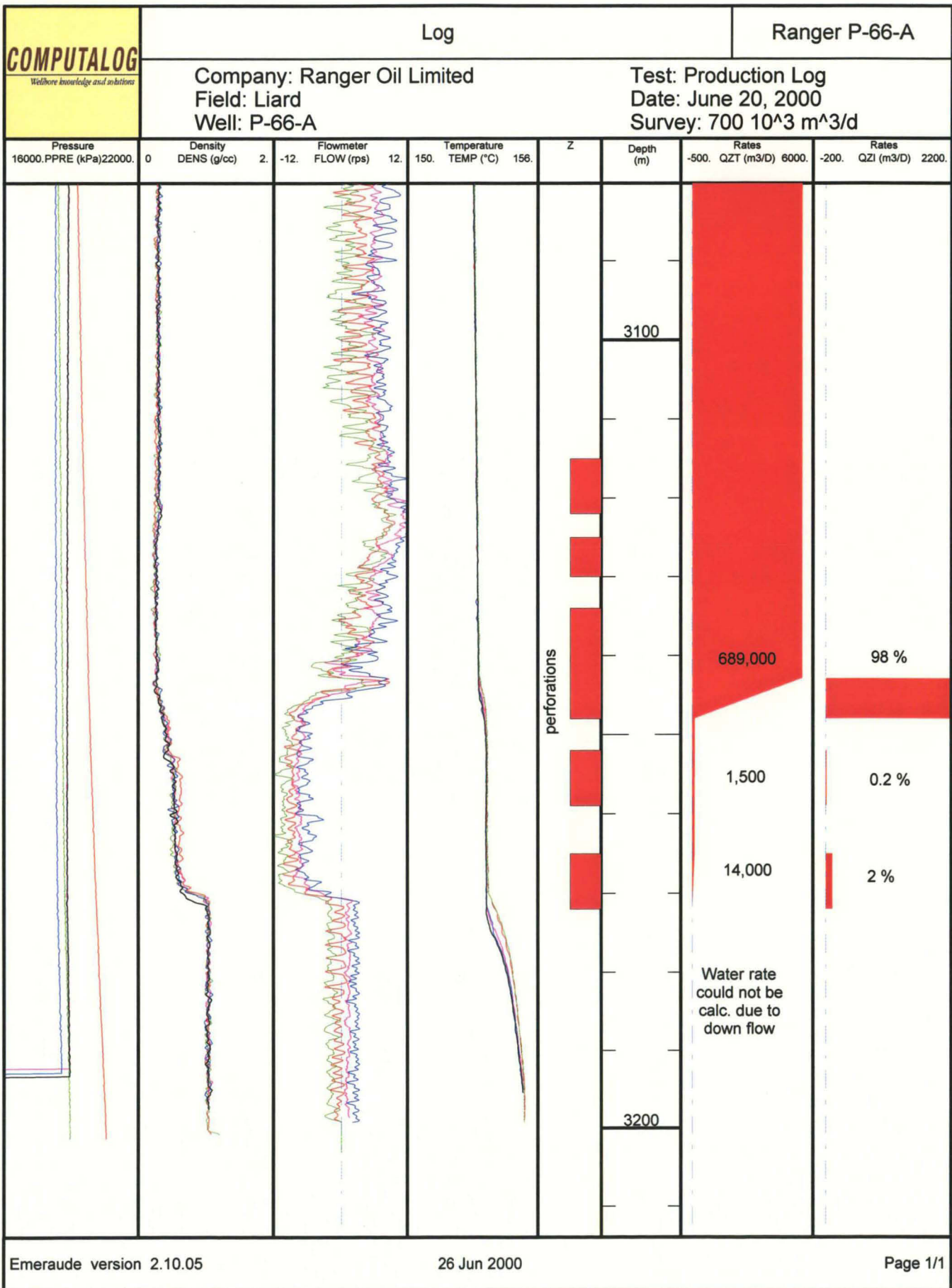
ZONE 3172.0-3173.0 m

Correlation	Duckler	ID	159 mm
Regime	No flow	Deviation	0 Radians
		Roughness	0
Vm	0 m/min		
V Superficial:		T	154 °C
Vsw	0 m/min	P	21204 kPa
Vsg	0 m/min	Rs	N/A
		Rsw	3.11 m ³ /m ³
V Average:			
Vw	0 m/min		
Vg	0 m/min		
Holdups:			
Yw	0		
Yg	0		
Slippage	0 m/min		

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.265E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0069	2.026E-5	0.1300

Parameters
350 10³m³/d

	zone 1	zone 2	zone 3
From, m	3144.5	3152	3165
To, m	3148	3159	3172
Water			
FVF	1.08	1.08	1.08
Viscosity, Pa.sec	2.27E-04	2.27E-04	2.27E-04
Density, g/cc	1	1	1
Gas			
FVF	0.0069	0.0069	0.0069
Viscosity, Pa.sec	2.02E-05	2.02E-05	2.03E-05
Density, g/cc	0.13	0.13	0.13
Temperature, °C	153.32	153.65	153.68
Pressure, kPa	21055	21104	21166
Diameter, mm	1.59E+02	1.59E+02	159.4
Deviation, Radians	0	0	0
Roughness	0	0	0
Rs, m3/m3	N/A	N/A	N/A
Rsw, m3/m3	3.08	3.09	3.1
V Mixture , m/min	91.7	3.94	3.94
Visc. Mixture , Pa.sec	2.02E-05	1.81E-04	1.81E-04
Vpcf	-1.94	-1.8	-1.8
Q total res., m3/D	2.63E+03	113.21	113.21
dQ res., m3/D	2.52E+03	0	113.21
% Qt	95.7	0	4.3
Qw total res., m3/D	0	0	0
Qw total s.c., m3/D	0	0	0
dQw res., m3/D	0	0	0.00E+00
dQw s.c., m3/D	0.00E+00	0.00E+00	0.00E+00
Qo total res., m3/D	0	0	0
Qo total s.c., m3/D	0	0	0
dQo res., m3/D	0.00E+00	0	0
dQo s.c., m3/D	0	0	0
Qg total res., m3/D	2634.92	113.21	113.21
Qg total s.c., m3/D	3.81E+05	1.64E+04	1.64E+04
dQg res., m3/D	2.52E+03	0	113.21
dQg s.c., m3/D	3.64E+05	-43.38	1.64E+04
V Superficial			
Vsw, m/min	0	0.00E+00	0
Vso, m/min	0	0	0
Vsg, m/min	91.693	3.94E+00	3.94
V Average			
Vw, m/min	0	0	0
Vo, m/min	0	0	0
Vg, m/min	91.693	17.817	17.817
Yw	0	0	0
Yo	0	0	0
Yg	1	0.221	0.221
Vslip, m/min	0	17.817	17.817
Vslip W-O, m/min			
Regime	Single phase gas	Bubble	Bubble
Correl.	Duckler	Duckler	Duckler
Correl. W-O	ABB - Deviated	ABB - Deviated	ABB - Deviated



COMPUTALOG We share knowledge and solutions	Job Information		Ranger P-66-A																																																																													
	Company: Ranger Oil Limited Field: Liard Well: P-66-A		Test: Production Log Date: June 20, 2000 Survey: 700 10 ³ m ³ /d																																																																													
<table border="0"> <tr> <td>Survey date</td> <td>June 20, 2000</td> <td>Interpretation date</td> <td>June 24, 2000</td> </tr> <tr> <td>Service company</td> <td>Computalog</td> <td>Done by</td> <td>R. Kish</td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>SURVEY</td> <td>700 10³ m³/d</td> <td></td> <td></td> </tr> <tr> <td>Surface rates:</td> <td></td> <td>Gas</td> <td>7E+5 m³/D</td> </tr> <tr> <td>Oil</td> <td>0 m³/D</td> <td>Water</td> <td>40. m³/D</td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>TOOLS</td> <td></td> <td></td> <td></td> </tr> <tr> <td>String O.D.</td> <td>42.8625 mm</td> <td>Capacitance</td> <td>None</td> </tr> <tr> <td>Spinner blade O.D.</td> <td>31. mm</td> <td></td> <td></td> </tr> <tr> <td>Density</td> <td>Corrected</td> <td></td> <td></td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>INTERPRETATION</td> <td>Interpretation # 1</td> <td></td> <td></td> </tr> <tr> <td>Density offset</td> <td>0 g/cc</td> <td></td> <td></td> </tr> <tr> <td colspan="4"> </td> </tr> <tr> <td>Flow type</td> <td>Liquid-Gas</td> <td></td> <td></td> </tr> <tr> <td>Flow model</td> <td>Duckler</td> <td></td> <td></td> </tr> <tr> <td>Vpcf mult.</td> <td>10.4309</td> <td></td> <td></td> </tr> <tr> <td>Vslip mult.</td> <td>1.</td> <td></td> <td></td> </tr> </table>					Survey date	June 20, 2000	Interpretation date	June 24, 2000	Service company	Computalog	Done by	R. Kish					SURVEY	700 10 ³ m ³ /d			Surface rates:		Gas	7E+5 m ³ /D	Oil	0 m ³ /D	Water	40. m ³ /D					TOOLS				String O.D.	42.8625 mm	Capacitance	None	Spinner blade O.D.	31. mm			Density	Corrected							INTERPRETATION	Interpretation # 1			Density offset	0 g/cc							Flow type	Liquid-Gas			Flow model	Duckler			Vpcf mult.	10.4309			Vslip mult.	1.		
Survey date	June 20, 2000	Interpretation date	June 24, 2000																																																																													
Service company	Computalog	Done by	R. Kish																																																																													
SURVEY	700 10 ³ m ³ /d																																																																															
Surface rates:		Gas	7E+5 m ³ /D																																																																													
Oil	0 m ³ /D	Water	40. m ³ /D																																																																													
TOOLS																																																																																
String O.D.	42.8625 mm	Capacitance	None																																																																													
Spinner blade O.D.	31. mm																																																																															
Density	Corrected																																																																															
INTERPRETATION	Interpretation # 1																																																																															
Density offset	0 g/cc																																																																															
Flow type	Liquid-Gas																																																																															
Flow model	Duckler																																																																															
Vpcf mult.	10.4309																																																																															
Vslip mult.	1.																																																																															
Comments Well logged at the following rates: 220 10³m³/d 350 10³m³/d 700 10³m³/d The gas rate from the lower zone could only be calculated on the initial 220 10³ m³/d log. After this log was run the fluid level had filled up to 3144m. The angle of the hole resulted in a large amount of water hold up and apparent down flow on the low side of the hole.																																																																																
Emeraude version 2.10.05 26 Jun 2000 Page 1																																																																																

Company: Ranger Oil Limited
Field: Liard
Well: P-66-A

Test: Production Log
Date: June 20, 2000
Survey: 700 10³ m³/d

FLUID TYPE Water - Gas

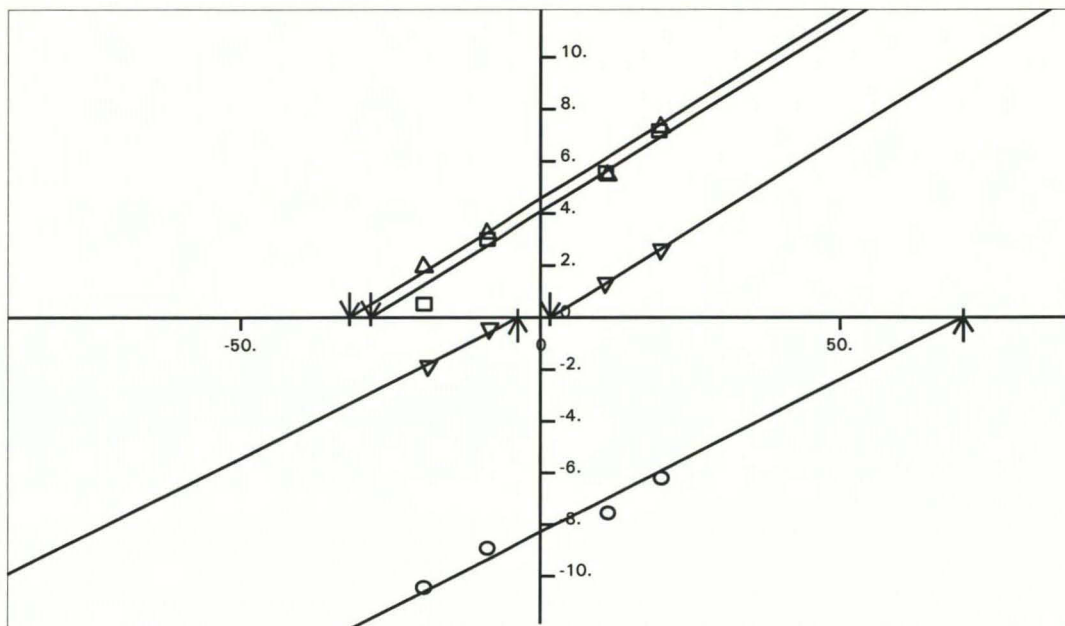
GAS

Specific gravity 0.7
N₂ % 0
CO₂ % 0
H₂S % 0
Z factor Beggs and Brill
 μ_g Lee et al.

WATER

Salinity, ppm 1E+5
R_{sw} Katz
C_w Dodson and Standing
 μ_w Van-Wingen+Frick

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

 Test: Production Log
 Date: June 20, 2000
 Survey: 700 10³ m³/d


rps versus m/min

Threshold (+) 0 m/min

Threshold (-) 0 m/min

	Calib. Zone m	Slope (+)	Slope (-)	Int (+) m/min	Int (-) m/min	Int. Diff. m/min
□	3096.0-3108.5	0.143	N/A	-28.40	N/A	0.00
△	3128.5-3138.9	0.143	N/A	-31.95	N/A	0.00
○	3158.3-3165.0	N/A	0.119	N/A	69.98	0.00
▽	3174.5-3192.2	0.143	0.119	1.70	-4.01	5.71

COMPUTALOG <i>Wellbore knowledge and solutions</i>	Zone Contributions; S.C.		Ranger P-66-A
	Company: Ranger Oil Limited Field: Liard Well: P-66-A		Test: Production Log Date: June 20, 2000 Survey: 700 10 ³ m ³ /d

Zones m	Water m3/D	Oil m3/D	Gas m3/D
3142.9-3148.0	0.00	0.00	6.891E+5
3152.0-3159.0	0.00	0.00	1582.95
3165.0-3172.0	0.00	0.00	14718.50
Total	0.00	0.00	7.054E+5

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

 Test: Production Log
 Date: June 20, 2000
 Survey: 700 10³ m³/d

Zones m	Qt res. m3/D	Production %
3142.9-3148.0	5369.70	97.68
3152.0-3159.0	12.39	0.23
3165.0-3172.0	114.91	2.09

Contributions by phase

Zones m	Qw res. m3/D	Qo res. m3/D	Qg res. m3/D	W O G
3142.9-3148.0	0.00	0.00	5369.70	
3152.0-3159.0	0.00	0.00	12.39	
3165.0-3172.0	0.00	0.00	114.91	

Company: Ranger Oil Limited
Field: Liard
Well: P-66-ATest: Production Log
Date: June 20, 2000
Survey: 700 10³ m³/d

Zone m	Corr. factor	Vm m/min	Q downhole m3/D	Contribution %
3142.9-3148.0	9.29	191.292	5497.01	97.68
3152.0-3159.0	8.58	4.430	127.30	0.23
3165.0-3172.0	8.56	3.999	114.91	2.09

Total rates by phase

Zone m	Qw res. m3/D	Qw s.c. m3/D	Qo res. m3/D	Qo s.c. m3/D	Qg res. m3/D	Qg s.c. m3/D
3142.9-3148.0	0.00	0.00	0.00	0.00	5497.01	7.054E+5
3152.0-3159.0	0.00	0.00	0.00	0.00	127.30	16301.40
3165.0-3172.0	0.00	0.00	0.00	0.00	114.91	14718.50

COMPUTALOG Wellbore knowledge and solutions	Rates @ Calculation Zones: Detailed Results	Ranger P-66-A
	Company: Ranger Oil Limited Field: Liard Well: P-66-A	Test: Production Log Date: June 20, 2000 Survey: 700 10 ³ m ³ /d

ZONE 3133.1-3142.9 m

Correlation	Duckler	ID	159 mm
Regime	Single phase gas	Deviation	0 Radians
		Roughness	0
Vm	191 m/min		
V Superficial:		T	153 °C
Vsw	0 m/min	P	18804 kPa
Vsg	191 m/min	Rs	N/A
		Rsw	2.79 m ³ /m ³
V Average:			
Vw	0 m/min		
Vg	191 m/min		
Holdups:			
Yw	0		
Yg	1.		
Slippage	0 m/min		

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.269E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0078	1.927E-5	0.1100

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 700 10³ m³/d

ZONE 3151.0-3152.0 m

Correlation Duckler
 Regime Bubble

ID 159 mm
 Deviation 0 Radians
 Roughness 0

V_m 4.43 m/min

V Superficial:

V_{sw} 0 m/min
 V_{sg} 4.43 m/min

T 154 °C
 P 18789 kPa
 R_s N/A
 R_{sw} 2.8 m³/m³

V Average:

V_w 0 m/min
 V_g 17.7 m/min

Holdups:

Y_w 0
 Y_g 0.25
 Slippage 17.7 m/min

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.265E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0078	1.927E-5	0.1100

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 700 10³ m³/d

ZONE 3164.0-3165.0 m

Correlation Duckler
 Regime Bubble

ID 159 mm
 Deviation 0 Radians
 Roughness 0

Vm 4. m/min

V Superficial:

Vsw 0 m/min
 Vsg 4. m/min

T 154 °C
 P 18794 kPa
 Rs N/A
 Rsw 2.8 m³/m³

V Average:

Vw 0 m/min
 Vg 17.8 m/min

Holdups:

Yw 0
 Yg 0.22
 Slippage 17.8 m/min

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.265E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0078	1.927E-5	0.1100

Company: Ranger Oil Limited
 Field: Liard
 Well: P-66-A

Test: Production Log
 Date: June 20, 2000
 Survey: 700 10³ m³/d

ZONE 3172.0-3173.0 m

Correlation Duckler
 Regime No flow

ID 159 mm
 Deviation 0 Radians
 Roughness 0

V_m 0 m/min

V Superficial:

V_{sw} 0 m/min
 V_{sg} 0 m/min

T 154 °C
 P 18795 kPa
 R_s N/A
 R_{sw} 2.8 m³/m³

V Average:

V_w 0 m/min
 V_g 0 m/min

Holdups:

Y_w 0
 Y_g 0
 Slippage 0 m/min

	FVF	Viscosity Pa.sec	Density g/cc
Water	1.0800	2.265E-4	1.0000
Oil+Gas	N/A	N/A	N/A
Gas	0.0078	1.928E-5	0.1100

Parameters
700 10³m³/d

	zone 1	zone 2	zone 3
From, m	3142.9	3152	3165
To, m	3148	3159	3172
Water			
FVF	1.08	1.08	1.08
Viscosity, Pa.sec	2.27E-04	2.27E-04	2.27E-04
Density, g/cc	1	1	1
Gas			
FVF	0.0078	0.0078	0.0078
Viscosity, Pa.sec	1.93E-05	1.93E-05	1.93E-05
Density, g/cc	0.11	0.11	0.11
Temperature, °C	153.27	153.62	153.62
Pressure, kPa	18804	18789	18794
Diameter, mm	1.59E+02	1.59E+02	159.4
Deviation, Radians	0	0	0
Roughness	0	0	0
Rs, m3/m3	N/A	N/A	N/A
Rsw, m3/m3	2.79	2.8	2.8
V Mixture , m/min	191	4.43	4
Visc. Mixture , Pa.sec	1.93E-05	1.75E-04	1.80E-04
Vpcf	9.29	8.58	8.56
Q total res., m3/D	5.50E+03	127.3	114.91
dQ res., m3/D	5.37E+03	12.39	114.91
% Qt	97.68	0.23	2.09
Qw total res., m3/D	0	0	0
Qw total s.c., m3/D	0	0	0
dQw res., m3/D	0	0	0.00E+00
dQw s.c., m3/D	0.00E+00	0.00E+00	0.00E+00
Qo total res., m3/D	0	0	0
Qo total s.c., m3/D	0	0	0
dQo res., m3/D	0.00E+00	0	0
dQo s.c., m3/D	0	0	0
Qg total res., m3/D	5497.01	127.3	114.91
Qg total s.c., m3/D	7.05E+05	1.63E+04	1.47E+04
dQg res., m3/D	5.37E+03	12.39	114.91
dQg s.c., m3/D	6.89E+05	1582.95	1.47E+04
V Superficial			
Vsw, m/min	0	0.00E+00	0
Vso, m/min	0	0	0
Vsg, m/min	191.292	4.43E+00	3.999
V Average			
Vw, m/min	0	0	0
Vo, m/min	0	0	0
Vg, m/min	191.292	17.683	17.802
Yw	0	0	0
Yo	0	0	0
Yg	1	0.251	0.225
Vslip, m/min	0	17.683	17.802
Vslip W-O, m/min			
Regime	Single phase gas	Bubble	Bubble
Correl.	Duckler	Duckler	Duckler
Correl. W-O	ABB - Deviated	ABB - Deviated	ABB - Deviated