

Stetind PL 283



Formation Evaluation Report Well 6605/8-1

Operator:



Partners:





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Hydro Oil & Energy

Well 6605/8-1
Formation Evaluation Report

Page: 2 of 128
Date: 24.07.06
Rev.: Final

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1 Introduction

The exploration well 6605/8-1 (Figure 1-1) in PL 283 (Hydro (30%, operator), Chevron (25%), ConocoPhillips (25%) and Petoro (20%)) was spudded in June 2005 on the Stetind structure. The main objective for well 6605/8-1 was to test the hydrocarbon potential in the Upper Cretaceous Lysing A6 prospect situated on the western flank of the Fles North rotated fault block structure in the Vøring Basin. The secondary objective of the well was to evaluate the potential in the Nise Formation. The well was drilled with waterbased mud through the Lysing Formation and 50 m into strata of Turonian age (Figure 1-2 and Figure 1-3). Total depth of the exploration well is 4490m MD RKB. The water depth is 838m MSL. Gas was encountered in the Lysing Formation. The well was permanently plugged and abandoned.

This report summarizes the formation evaluation of the Stetind well 6605/8-1 including the petrophysical interpretation, wireline formation tester results, production test and PVT analysis. A summary of the formation evaluation data acquisition is found in Chapter 3.

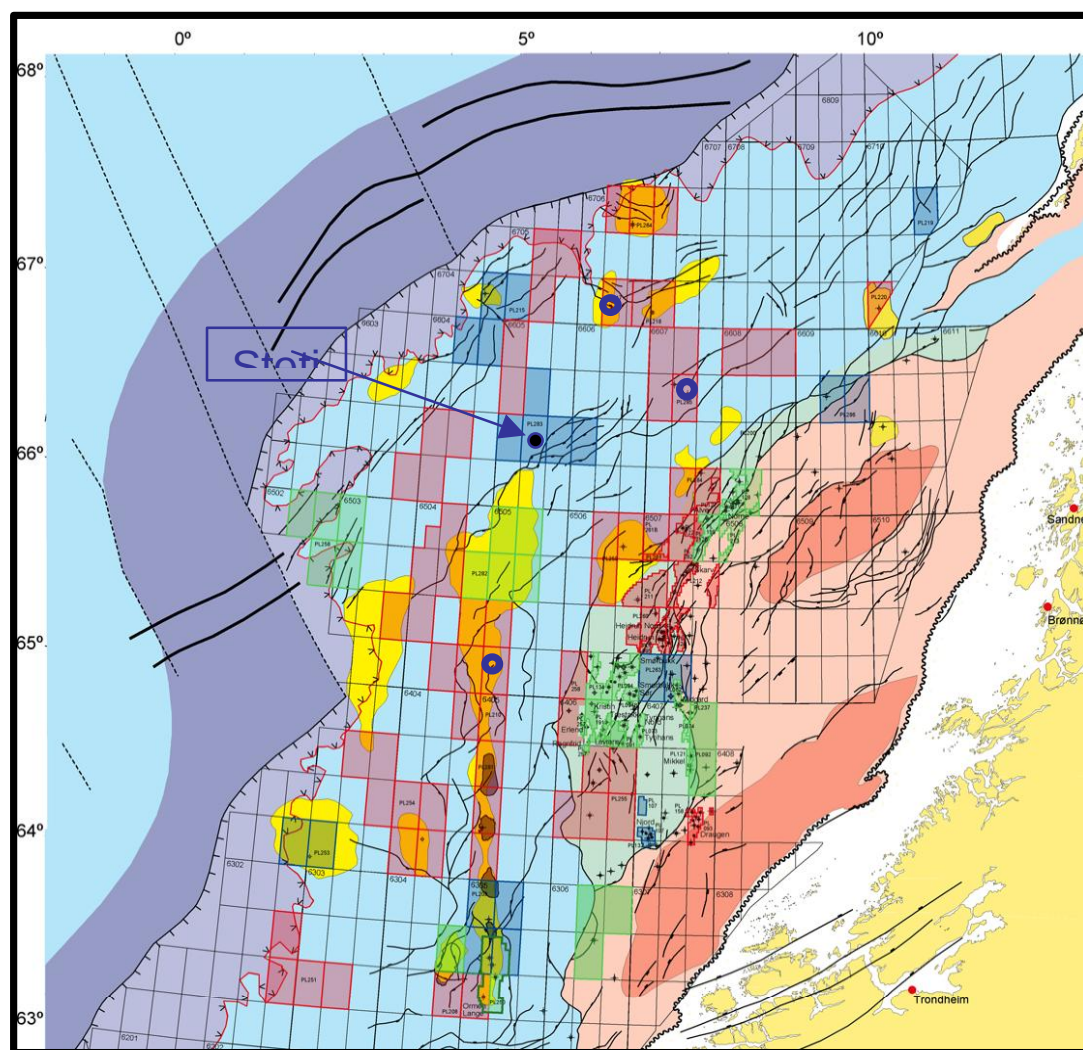


Figure 1-1: Well location



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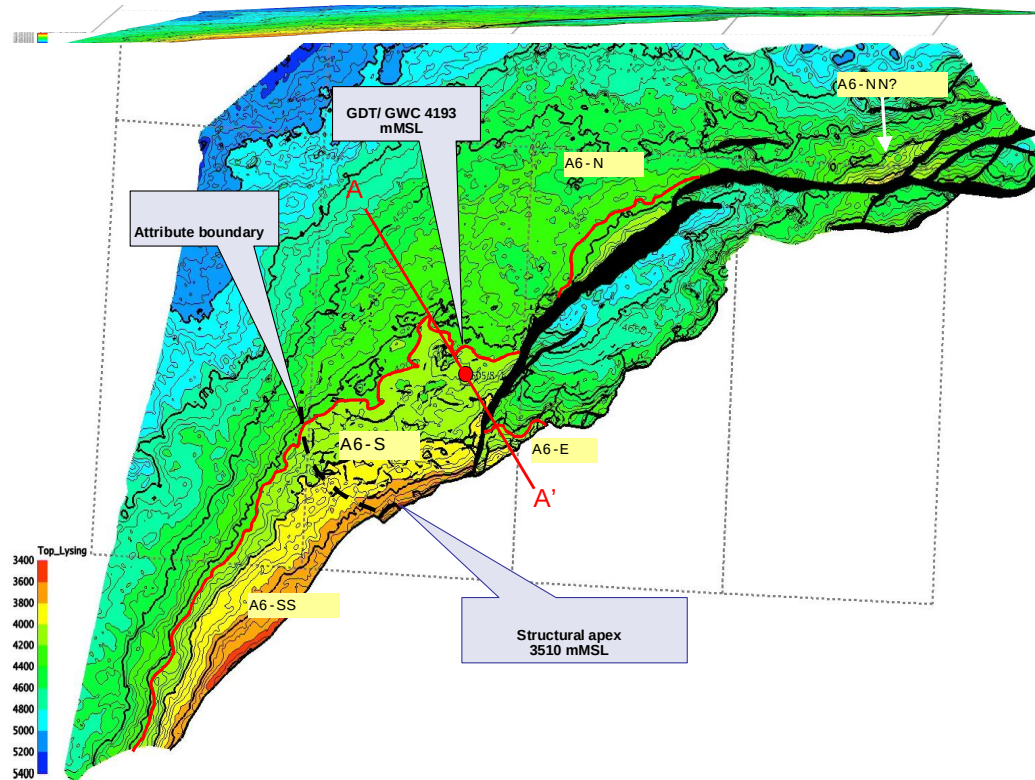


Figure 1-2: Top map of Lysing formation

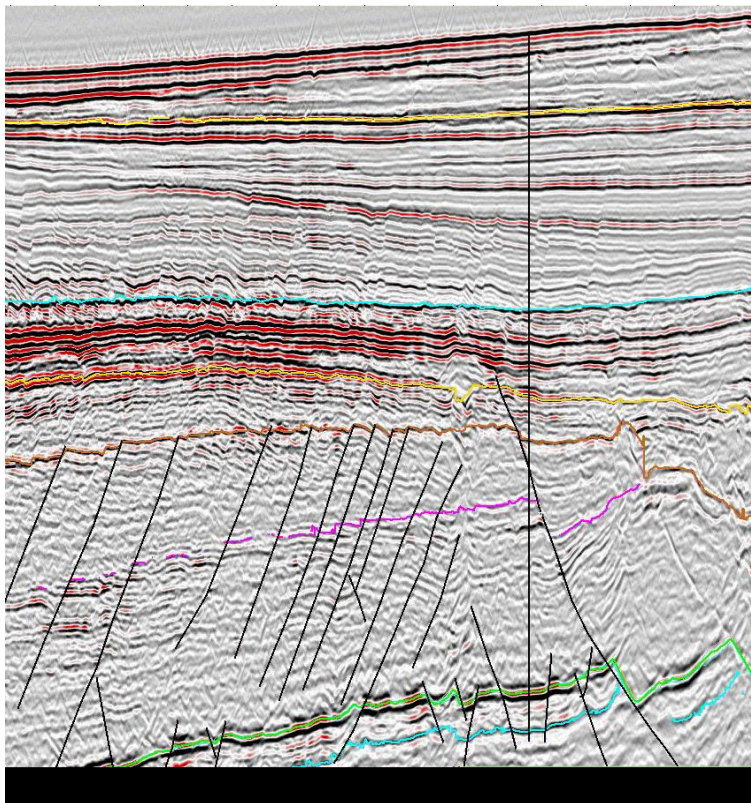


Figure 1-3: NW-SE Cross-section through the Lysing formation (A – A')

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2 Summary and Conclusions

Well 6605/8-1 was drilled with waterbased mud to 4490 m MD RKB. A very lean gas was encountered at two levels in the approximately 70 m thick Lysing Formation (top Lysing @ 4184 m MD RKB). Different pressure regimes were observed in the two gas zones, which are separated by a water interval containing residual gas. The reservoir rock properties are relatively poor (see CPI Figure 4-10) with permeability around 1 mD, low net to gross, low net pay and low gas saturation.

The formation evaluation data includes:

- Cores
- LWD logs
- WL logs
- MDT formation pressure data
- MDT fluid samples (gas and water)
- MDT mini-tests
- Production test
- PVT data

The main conclusions are:

- The petrophysical interpretation shows porosities in the range 0.12 to 0.16, low net-to-gross (in the order of 37%), low net pay (approximately 2.5 to 6 m net pay in upper gas zone and 1 m in the lower zone) and high water saturation (in the order of 70%). Petrophysical averages are presented in Table 4-6.
- Fluid samples showed that the Lysing Formation is gas filled in two intervals. A gas water contact in the upper gas zone is defined using the only two good pressure points (one in gas, and one in water). The free water level (FWL) is estimated to 4193 m TVD MSL giving a gas column of 37 m.
- The gas zone is in imbibition phase with residual gas present in the water leg.
- The lower gas zone is encountered below the water leg. This zone is very thin - in the order of 1 m net – and it has a higher pressure (approximately 20 bar) than the gas zone above. No GWC – only GDT - can be defined in the lower gas zone.
- Three pressure transient tests - two minitests and one production test - were performed in the Lysing sandstone. These gave a very low permeability-thickness of 2, 2.5 and 3.6 mDm respectively. This corresponds to a permeability in the range of 0.5-1.5 mD. This seems to be somewhat lower than the relatively sparse core permeability measurements (see CPI Figure 4-10). The results from the test interpretations are given in Table 7-3, Table 7-5 and Table 8-8.



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- There is no evidence of depletion during the production test. However, the test shows presence of three no-flow boundaries in the well vicinity (Table 8-8).
- The gas samples were collected during both MDT and the production test. The PVT analysis demonstrate a lean gas with GCR of $230\,000\text{ Sm}^3/\text{Sm}^3$ from the Petrotech minilab. The PVT properties are presented in Figure 11-4 and Figure 11-5.
- The gas in the lower gas zone (@ 4253 m MD RKB) is slightly more wet than gas in the upper part of the well.
- The best MDT water sample was collected in open hole using the guard probe; zero contamination was measured. The water is lowsaline with a total salinity of 6472 mg/l. The formation water properties are shown in Table 11-3 and Table 11-4.
- Formation propagation pressure (FPP) of 830 bar and instantaneous shut-in pressure (ISIP) of 815 bar were estimated in the mini-frac tests, Figure 10-7 and Figure 10-8.
- Reservoir temperature is estimated to 146 °C @ 4230 m MD RKB.
- The H₂S and CO₂ content were measured to 4.5 ppm and 6.2 vol% respectively.



3 Formation Evaluation Data Acquisition

The formation evaluation program in well 6605/8-1 comprised coring, logging and production testing, and an evaluation of the data is found in the following chapters.

3.1 Summary of formation evaluation data acquisition

The well was logged with MWD/LWD (Table 4-1). One core was cut starting approximately 6 meters below top reservoir. It jammed after 9m. There was 100% recovery in the cut section (Table 4-3). In addition sidewall core plugs were cut in the non-cored sections.

A full wireline logging suite was run across the reservoir section (Table 4-2). The Schlumberger Modular Dynamic Tester (MDT) wireline tool was used for measuring formation pressures, reservoir fluid sampling and mini-tests. Several MDT runs had to be performed in order to fulfil the WFT objectives. The MDT was run in both open hole and case hole. Due to tight formation and high invasion only a very limited number of good pressure points were obtained. In addition samples of gas (around 4210 and 4253 m MD RKB) and water (around 4231 m MD RKB) were taken, and two mini-tests with probe and dual packer were performed in the best gas bearing interval (around 4210 m MD RKB).

The objectives of the wireline formation testing (WFT) were:

- Obtain formation pressures, fluid gradients & contacts in the Lysing formation.
- Possible fluid scanning to determine fluid type where gradients are not conclusive.
- Collect high quality HC samples from the Lysing formation.
- Collect high quality water samples from the Lysing formation if hydrocarbon is present.
- Mini-test in the upper part of the reservoir.

The well was thereafter cemented, and a production test (DST) was performed in the upper part of the reservoir (4184.0 – 4211.5 m MD RKB). Almost all the gas bearing formation was perforated keeping a safe distance to underlying water to avoid potential hydrate in case of water coning.

The following test objectives were defined:

- Estimate well productivity
- Estimate the kh-product, permeability and formation skin
- Estimate reservoir extension/communication
- Collect representative reservoir fluid samples from wellhead and separator.
- Estimate the initial reservoir pressure
- Estimate the reservoir temperature.
- Establish the formation mechanical properties



In order to verify fluid type below the best gas bearing sand (@ approximately 4210 m MD RKB) MDT was run in cased hole for fluid sampling. To pass an expected deep filtrate zone the well was perforated on wireline with Schlumbergers deepest penetrating charges, and dual packer MDT was run. However, only formation water, which was heavily contaminated, was retrieved.

The objectives of cased hole wireline formation testing (WFT) were:

- Identify fluid type – gas or water
- Take fluid samples
- Estimate R_w in case of water
- Estimate reservoir pressure
- Estimate permeability

3.2 Summary of formation evaluation

The **petrophysical interpretation** (Chapter 4) includes:

- MWD/LWD logs
- Wireline logs
- Conventional core measurements from whole core and sidewall cores
- Special core analysis (SCAL) measurements

The **fluid contacts** (Chapter 5) are estimated from:

- Wireline formation tester (WFT) pressure measurements and logs
- PVT

The **sampling with the MDT** is presented in Chapter 6 – Wireline Formation Sampling. Samples were taken in:

- Gas
- Water

The two mini-tests are analysed in Chapter 7. The test and **analytical test interpretation** are presented in Chapter 8. The **estimation of reservoir temperature** is presented in Chapter 9 and **analysis of the minifrac** in Chapter 10. Finally an overview of **PVT results** (gas and formation water) are given in Chapter 11.



4 Petrophysical Interpretation

Petrophysical analysis was carried out for the Lysing Reservoir. The input parameters to the petrophysical evaluation have been derived based on the current data available (February 2006) from electrical wireline logs, formation pressures data (MDT), conventional core analysis, special core analysis and fluid data. In addition, thin section and XRD analysis have been used to build the petrophysical model.

4.1 Log Data Acquisition and quality

Schlumberger provided the MWD/LWD services as summarized in Table 4-1. There are complete gamma ray and resistivity logs over most of the well interval. Some depth shifts were required to match the reference wireline logs; these are documented in the report from Logtek (Ref./4/).

Bit run	Logging Suite	LWD logging tools	Top (meters)	Bottom (meters)	Comments
1		Motor-MWD	862	957	Directional only
2	GR-REMP-DEN-NEU-PRES-MECH-AC	ARC-ADN-SONIC	957	2000	Pilot Hole
3	REMP-GR-MECH-PRES	ARC	957	1343	BHA tendency did not manage to keep vertical
4	REMP-GR-MECH-PRES	ARC	1343	2005	
5	GR-REMP-PRES-MECH-AC	ARC-RAB-SONIC	2005	2597	
6	GR-REMP-PRES-MECH-AC	ARC-RAB-SONIC	2597	2734	POOH due MWD Failure
7	GR-REMP-PRES-MECH-AC	ARC-RAB-SONIC	2734	2900	
8	REMP-GR-MECH-PRES	ARC	2900	2900	Open 14 1/2" to 17 1/2" hole
9	GR-REMP-PRES-MECH-AC	ARC-SONIC	2900	3163	POOH to change Bit
10	GR-REMP-PRES-MECH-AC	ARC-SONIC	3163	3175	POOH due to low ROP
11	GR-REMP-PRES-MECH-AC	ARC-SONIC	3175	3521	POOH due to low ROP
12	GR-REMP-PRES-MECH-AC	ARC-SONIC	3521	4100	
13	GR-REMP-DEN-NEU-PRES-MECH-AC	ARC-ADN-RAB-SONIC	4100	4100	POOH to change Bit
14	GR-REMP-DEN-NEU-PRES-MECH-AC	ARC-ADN-RAB-SONIC	4100	4190	Drilled to core point
15	GR-REMP-DEN-NEU-PRES-MECH-AC	ARC-ADN-RAB-SONIC	4190	4512	

Table 4-1 MWD/LWD run in well 6605/8-1

Schlumberger provided the wireline services as summarized in Table 4-2. High quality log data were recorded over the entire reservoir section. There were good hole conditions with minimal tool sticking during the wireline data acquisition. The main observation is summarized below:

- FMI: good quality apart from the Lysing Reservoir where the images were highly influenced by thick mudcake
- HRLA: showed large invasion profile in the permeable zones, which give lower resistivity response which could give a too low value for Rt



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- MDT: a large number of supercharged pressure measurements was experienced. This is most likely due to large mud invasion, which could have caused near wellbore formation damage.

Density, neutron and gamma ray measurements (TLD/CNL/GR) were recorded with 8" vertical resolution processing, and these logs together with the laterolog resistivity (HRLA) data were acquired with high-resolution sampling of 0.0508 meters/sample. This high resolution was used for the CPI calculations.

Wireline formation tester services included the acquisition of formation pressure measurements from the MDT tool as summarized in Table 5-1. Sidewall cores were acquired with the mechanical sidewall-coring tool (MSCT). Initial recovery was not good (61%) and conventional core measurements could only be made on the 21 recovered samples.

Date	Run #	Section	Tool string	Start depth	End depth	Comment
06.08.2005	1A	12 1/4"	PEX-HRLA-ECS-DSI	3385.0	1998.0	Not able to pass 3385m.
25.08.2005	2B	8 1/2 "	PEX-HRLA-ECS-DSI	4514.5	3687.0	Made 2 main log run due to low compensation on 1 pass
26.08.2005			BOP TEST			
26.08.2005	2A	8 1/2 "	MDT (PS-PG)	4252.7	4246.8	2 stations, 2 tight. Lost communication with / unable to power up MDT. POOH
27.08.2005	2B	8 1/2 "	MDT (PS-PG-2MS-2SC)	4246.8	4238.5	2 Multisampler w/ 6xSPMC and 6xMPSR, 1x2 3/4SC and 1x1SC. 7 stations, 1 dubious (good), 6 supercharged/tight. Lost comm as above. No sampling. POOH
28.08.2005	2A	8 1/2 "	VSP	4510.0	2710.0	
28.08.2005	2B	8 1/2 "	MDT (PS-PG-2MS-2SC)	4237.5	4191.7	2 Multisampler w/ 6xSPMC and 6xMPSR, 1x2 3/4SC and 1x1SC 34 attempts to test on 22 stations. 5 good. Standard probe hydraulic failure. Guard probe pretest & sampling. Filled 4x450ccMPSR. Stuck. Released electrical weak point and pulled cable and cable head out of hole.
29.08.2005	2B	8 1/2 "	FISHING MDT TOOL			Recovered 100% MDT tool and multisamplers/sample chambers
31.08.2005			WIPER TRIP			Cool mud temp and circ out approx 100L formation fluid pumped to the well from MDT run 2C.
01.09.2005	Misrun	8 1/2 "	MRCT (50 cores)	---	---	Failure in cartridge unit. Unable to core. POOH
01.09.2005	2A	8 1/2 "	FMI	4514.0	4100.0	
02.09.2006	2C	8 1/2 "	MDT Dual packer (PS-1MS-2SC)	4211.5	4191.0	1 Multisampler w/ 2xSPMC and 4xMPSR, 2x2 3/4-gallonSC 4209,5m: Std probe, Pre-test, Transient test, filled 1x250ccSPMC, 2x450ccMPSR, 1x2 3/4 G. @ 4211,5m: Dual packer, Minitest (VIT), filled 1x250cc, 1x450cc. Pulled up to 4191,6m: Dual packer, attempted Minitest (VIT). Ruptured packer
03.09.2005			"WAIT"	---	---	MRCT engineer off duty until 02:00 due to 8hrs rest. Waiting to start rig up of MRCT. Simultaneously redressing MDT for next run.
04.09.2005	Misrun	8 1/2 "	MRCT (50 cores)	---	---	Failure in coring unit. Unable to fully retract. Pulled out to swap with backup coring unit only.
04.09.2005	Misrun	8 1/2 "	MRCT (50 cores)	---	---	Noise from coring engine, unstable to operate. "Nothing works"..... And no more MRCT back-up tools
04.09.2005		8 1/2 "	MDT Dual packer (PS-2MS)	---	---	Redressing MDT dual packer for 2MS. Internal O-ring for packer damaged. Waiting for new with chopper in morning the 5th sept.
04.09.2005			WIPER TRIP			Waiting for MDT spare parts (O-rings) for the packers. Waiting for weather to come down for to hoist back-up MSCT from boat. Cool mud temp and circ out approx 290L formation fluid pumped to the well from MDT run 2D.
05.09.2005	2D	8 1/2 "	MDT Dual packer (PS-2MS)	4428.5	4244.0	2 Multisampler w/ 2xSPMC and 10xMPSR. 2SC and CFA out due to failure. 4244-4246m: Std.probe, 6 pre-tests all supercharged. 4252-4253,5m: Std.probe, 11 pre-tests. 7 good in lower part, 4 supercharged in upper part. 4253m Dual packers: 1 good pre-test and filled 1x450cc w/water and 1x450cc w/gas. 4372,5-4374m: Std.probe, 7 pre-test all tight/supercharged. 4426-4428,5m: Std.probe, 5 pre-test all tight/supercharged.
08.09.2005	2A	8 1/2 "	MSCT (50 cores)	4438.5	4148.0	Planned 50 cores. Toolfailure after 44 attempts. Recovered 25 cores. 19 empty. Toolfailure due to oil leak/loss in MSCT tool.

Table 4-2 Open hole wireline logs run in well 6605/8-1



4.1.1 Composite log

Logtek made composite logs in accordance with NPD requirements (Ref./4/). One hybrid composite was made for the entire well (hybrid of MWD/LWD and wireline measurements) where the MWD/LWD data were depth shifted to match the reference wireline logs. Three petrophysical composite logs were generated; one with merged depth matched MWD/LWD data, one with standard 0.1524 meters/sample wireline data (sonic) and one with the high resolution 0.0508 meters/sample wireline data (resistivity, density, neutron and gamma ray). The latter was used in the petrophysical evaluation.

4.1.2 Environmental and invasion correction

The wireline contractor performed environment and invasion corrections during acquisition. The following corrected curves were used in the petrophysical interpretation:

- Gamma ray, corrected for hole size and mud weight (curve 'EHGR')
- Density, corrected for bit size and mud weight (curve 'RHO8'),
- Neutron, corrected for hole size, stand-off, mudcake, borehole salinity, formation salinity, mud weight, pressure and temperature (curve 'HTNP')
- Resistivity R_t and R_{xo} , invasion corrected from the five HRLA laterolog resistivity measurements, (curves 'RT_HRLT' and 'RXO_HRLT')

4.2 Core Data Acquisition

Conventional core measurements were performed on core plugs from both the whole core and from the sidewall cores. Due to the rather short cored interval of 9 meter the sidewall core data was used in addition to the conventional core data in the petrophysical interpretation. The results from the sidewall cores were used even though these measurements are considered to be of lower quality due to the possibility of mechanical damage during acquisition. In particular fractures can cause too high values for permeability. Both the core measurements and the sidewall core measurements are plotted on the CPI (track 7&11 in Figure 4-10).

The conventional core data include helium porosity, Klinkenberg corrected gas permeability and grain density measurements. Although the mud was doped with Tritium tracer, core saturation measurements were not made due to poor experience in previous wells drilled with similar high salinity water based mud when trying to correct for high mud filtrate contamination.

The cores were depth shifted to match the wireline logs as summarized in Table 4-3. The depth shifts were determined from both comparison core- and log gamma ray and core- and log porosity.

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Core no.	Top [m MD RKB]	Bottom [m MD RKB]	Recovery (%)	Depth shift (m)	Formation
1	4190,00	4199,00	100	-0.70	Lysing

Table 4-3: Core depth shift Lysing Reservoir well 6605/8-1

4.3 Petrophysical Special Core Analysis

A petrophysical special core analysis (SCAL) program was initiated at Reslab during Autumn 2005 and will be completed by the end of 2006. Evaluations are being performed on thirteen 1" core plugs taken with the mechanical sidewall coring tool (MSCT) during wireline acquisition and eight 1.5 inch core plugs that are drilled out from the conventional core before slabbing. The SCAL program is summarized in Table 4-4.

1" MSCT core plugs	No of plugs
Initial petrophysical tests	
FF and Kw at 20 bar NCP	13
FF, Kw and FF @ 20-50-100-150-200 bar NCP	13
Clay Content	
Co/Cw analysis using 4 salinities, 20 °C	10
Co/Cw analysis using 4 salinities, 130 °C	10
CEC analysis, incl. cleaning	21
Primary drainage	
Gas/brine PcRI using porpus plate methode, 6-8 steps	6
Karl Fisher for saturation control	6
1 1/2" core plugs	No of plugs
End-trims	
CEC analysis, incl. cleaning	8
XRD analysis, incl. cleaning	8
Initial petrophysical tests	
FF and Kw at 20 bar NCP	8
FF, Kw and FF @ 20-50-100-150-200 bar NCP	8
Primary drainage	
CoCw analysis using 4 salinities, 20 °C	4
CoCw analysis using 4 salinities, 130 °C	4
Gas/brine PcRI using porpus plate methode, 6-8 steps	4
Karl Fisher for saturation control	4

Table 4-4 Petrophysical Special Core Analysis Lysing Reservoir well 6605/8-1

4.4 Shale volume calculation

'VSH' was determined from the average of the gamma ray and the density-neutron log shale indicators. Linear relationships were applied for both indicators. The core description, XRD and thin section work (Ref./5/) were used as input to the Vsh calculation. From the petrographical study the clays of the sandstone consists of kaoline and illite. A histogram of the gamma ray (Figure 4-1) show the input values used for sand- and shale gamma ray. The density-neutron crossplot and the shale parameters used are shown in Figure 4-2.



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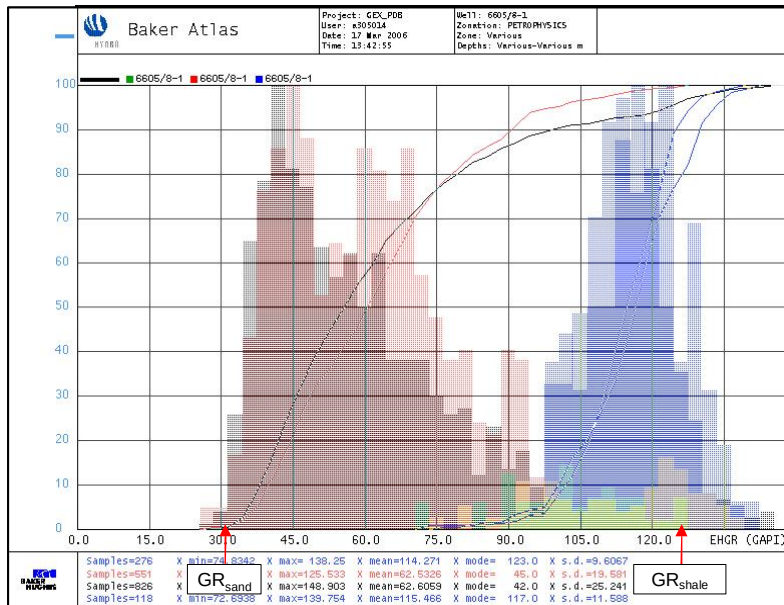


Figure 4-1 Histogram of gamma ray Lysing Reservoir, well 6605/8-1

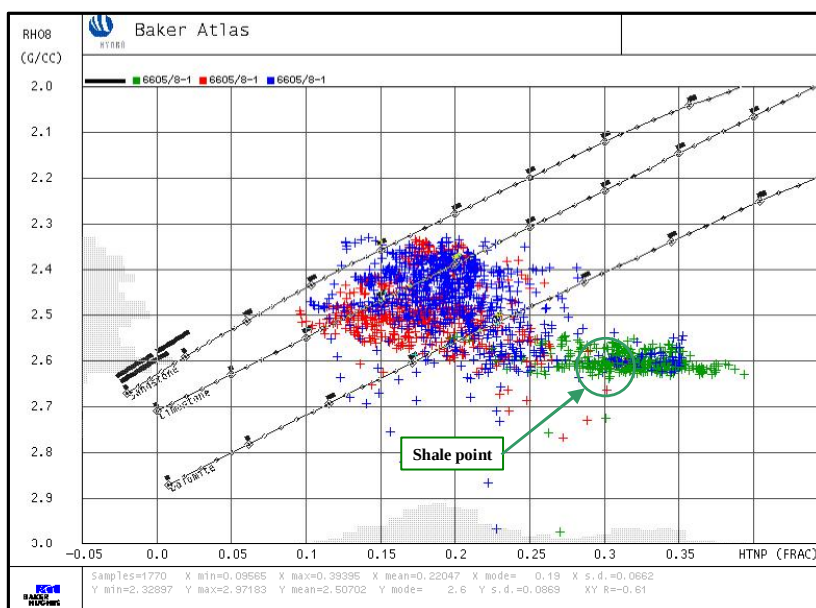


Figure 4-2 Cross plot of density-neutron log Lysing Reservoir, well 6605/8-1

4.5 Porosity

The total porosity PHIT was determined by calibration of the density log with the overburden corrected core porosity. The overburden correction factor is estimated to 0.96 (Figure 4-3). The effective log porosity (PHIE) has been calculated using the total porosity corrected for clay effects.

The core-log calibrations were constrained through the rock matrix/grain density 'Rhoma'



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value of 2.67 g/cc, which was determined from a histogram of the conventional core grain density measurements (Figure 4-4).

Figure 4-5 show the fluid density 'Rho_f' values, which are input for calculating PHIT from the density log response equation. Only the facies B (for definition of facies B see Ref./6/) was applied in the core-log calibration cross plots to ensure that the calibrations were made over the better quality reservoir samples. The estimated log porosity is shown in the CPI (track 7 Figure 4-10).

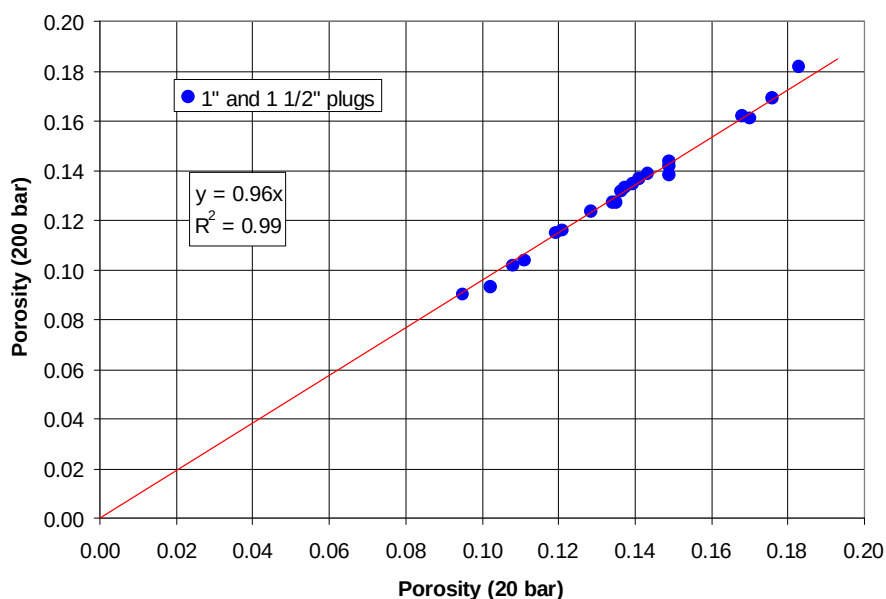


Figure 4-3 Core porosity overburden correction Lysing Reservoir well 6605/8-1

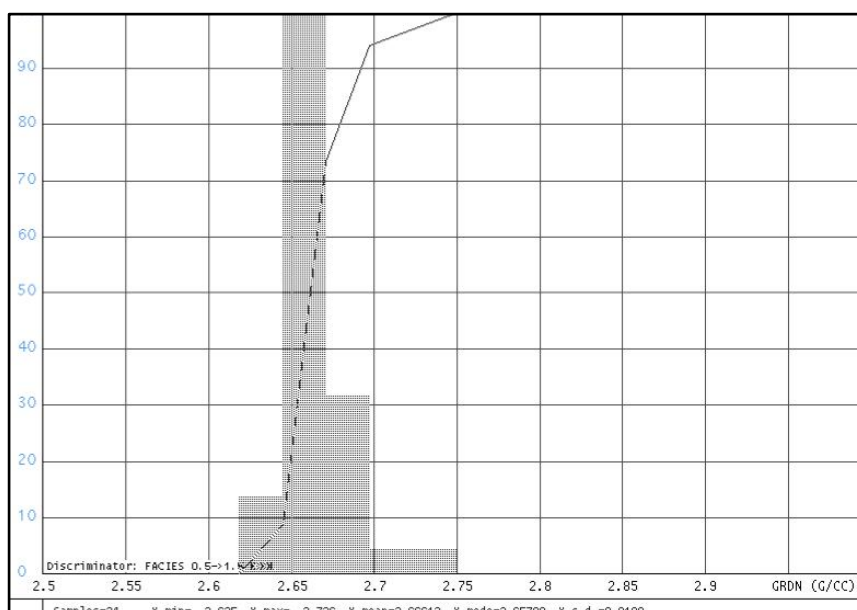


Figure 4-4 Histogram of core grain density Lysing reservoir, well 6605/8-1



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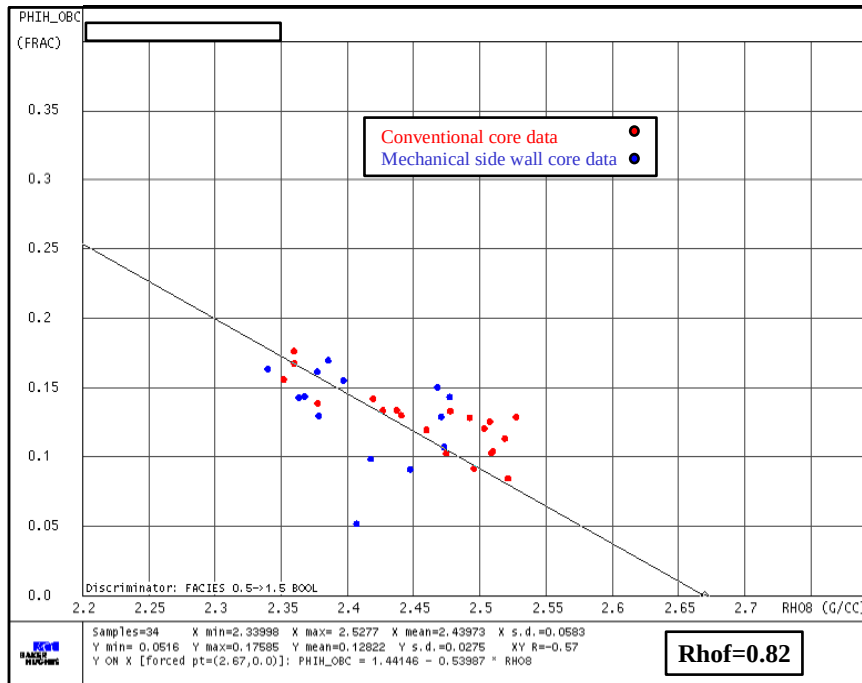


Figure 4-5 Cross plot of core porosity vs. density log Lysing Reservoir, well 6605/8-1

4.6 Permeability

A log derived (Khlog) permeability was derived from regression between core porosity (overburden corrected) versus core permeability (Klinkenberg corrected) for facies B (Figure 4-6). This was further used in the 3-geological model (Ref./6/). The limited number of core measurements gives a large uncertainty in the log derived permeability estimates due to short cored interval and a limited number of plugs from the mechanical sidewall coring tool.

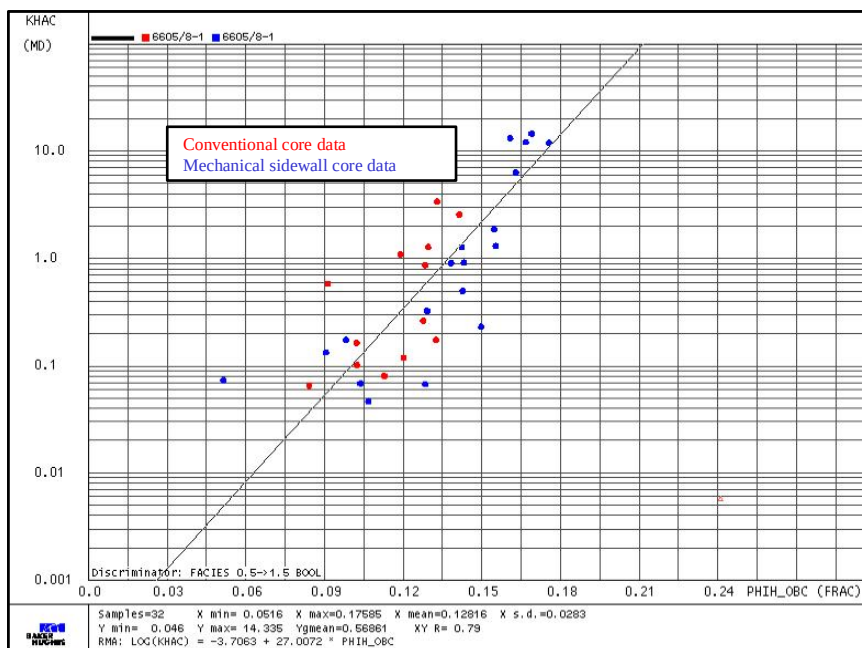


Figure 4-6 Cross-plot of porosity vs permeability (Facies B) Lysing Reservoir well 6605/8-1



4.7 Water Saturation

The Waxman & Smith equation was used to calculate water saturation from the wireline logs. The thin section studies and XRD analysis (Ref./5/) demonstrated presence of illite and kaolin in the reservoir. The Co/Cw measurements were performed on the core plugs and showed conductivity contribution. The fresh water sample of approximately 6500 mg/l taken with the MDT proved that the Waxman & Smith shaly sand equation is suitable; the effect of saturation calculation increases with decreasing salinity.

Formation resistivity (R_t), and the invaded zone resistivity (R_{xo}) were taken from the Schlumberger's invasion corrected laterolog measurements (RT_HRLT and RXO_HRLT).

Formation temperature of approximately 146°C was measured from MDT run 2E. Run 2E was taken in 7" liner after the test was finished. The temperature is assumed to be near the formation temperature. The gradient of 4.3°C/100m used over the reservoir section was estimated based on the measured temperature of 146°C at 4230m MD and the measured temperature at sea bottom of -1°C.

A water sample was taken using the guard probe. The mud was doped with tritium tracer when drilling the reservoir section. The water sample had zero contamination. Formation water resistivity R_w of 0.25 ohm-m at 145 °C was used in the interpretation. This is based on the resistivity of 0.97 ohm-m measured at 20°C (Table 11-3 and Table 11-4) on the water sample converted to reservoir temperature. Synthetic formation water was made and R_w was measured at reservoir condition (145°C and 614 bar) and a R_w of 0.16 ohm-m was measured. The reasons for the large difference between the two measurements will be investigated.

Co/Cw measurement were measured on 1" and 1 1/2" core plugs at laboratory temperature and at 200 bar net confining pressure. From the analysis BQv and FF* were determined. To estimate the m^* the porosity at 200 bar and FF* at 200 bar were plotted. A value of m^* of 1.94 was determined as shown in Figure 4-7.

The porosity versus Qv was plotted to determine any correlation between the porosity and Qv. There are different relationships between the 1" and 1 1/2" core plug data set. This could be due to the gentler cleaning and drying technique used on the 1 1/2" plug set compared to the conventional cleaning procedure. Based on the plot, a constant Qv of 0.15 meq/cm³ is used in the water saturation equation, see Figure 4-8.



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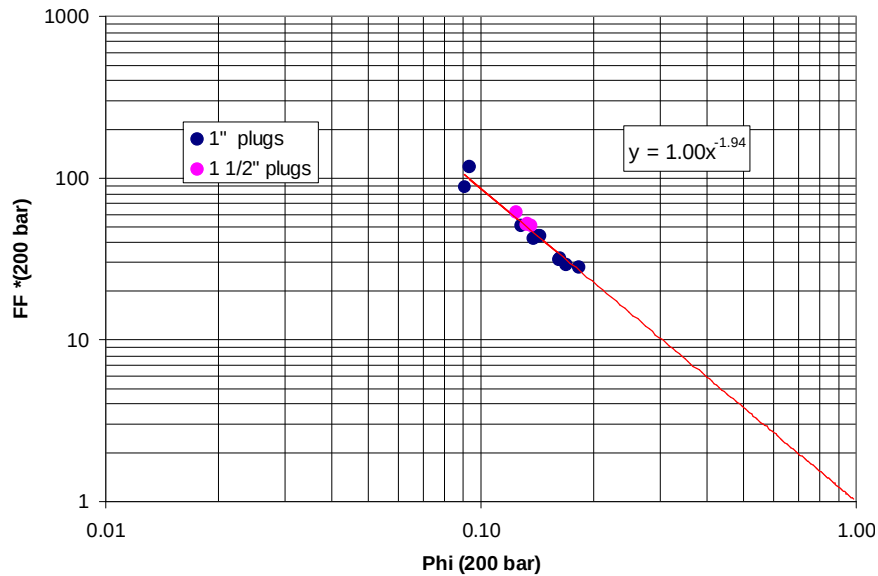


Figure 4-7 Porosity at 200 bra vs F*, Lysing Reservoir, well 6605/8-1

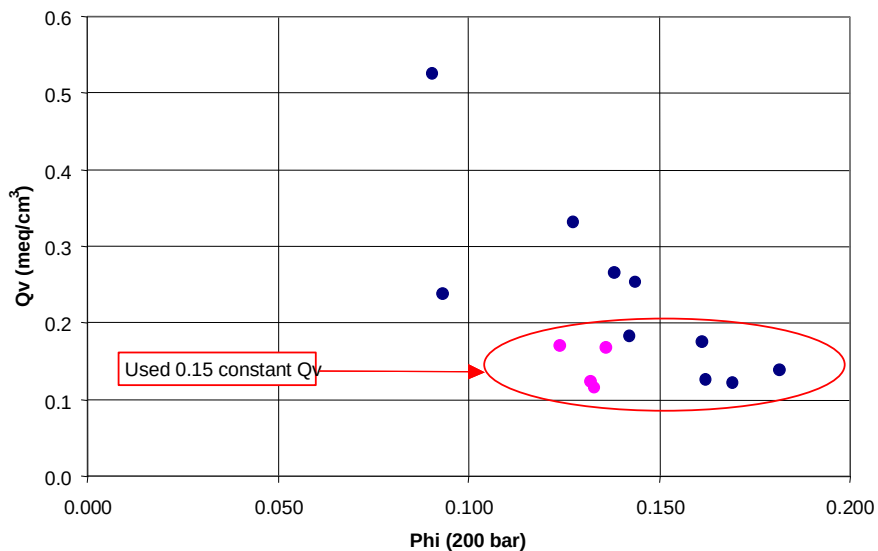


Figure 4-8 Porosity vs Qv Lysing Reservoir, well 6608/5-1

4.8 Net Reservoir

The gas zone porosity cut-off used is 0.09 based on a permeability cut off in the order of 0.1 mD. The core-derived porosity cut-offs are applied to the calculated effective porosity (PHIE).

The core porosity measurements are more closely represented by total porosity than effective porosity; the latter corrected for clay. In interval with a high clay volume this will have a large effect. This is because the core preparation procedures (drying at 60°C and 40% humidity) remove most of the capillary and clay bound water, which is linked to the micro porosity. This will also have an effect on the measured permeability.



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The limited core data will in addition add an uncertainty in the porosity cut-off determination. Since the reservoir consists of low porosity-permeability sands the selection of porosity cut-off has a large impact of the calculated net reservoir and thus the petrophysical averages.

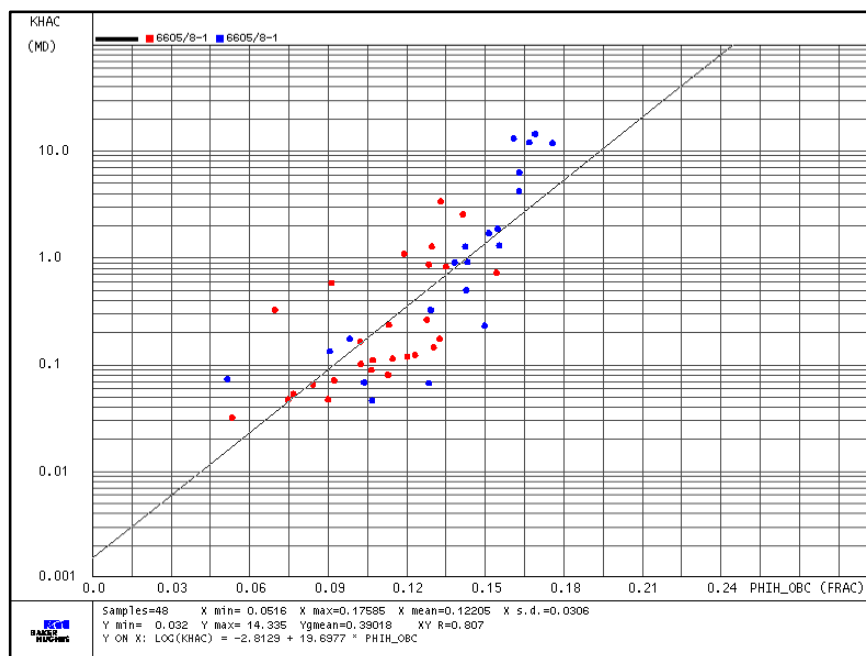


Figure 4-9 Cross-plot of overburden core porosity vs permeability Lysing Reservoir, well 6605/8-1



4.9 Petrophysical Input Parameters

The input parameters used is documented in the previous chapters and are summarized in Table 4-5.

Well 6605/8-1: Petrophysical input parameters			Parameter (depths in m. MD RKB):
Calculation	Parameter Description	Units	Lysing Reservoir 4184.00-4254.2
Shale volume	Gamma ray (GR) minimum value	GAPI	30
	Gamma ray (GR) maximum value	GAPI	120
	Matrix density	G/CC	2.67
	Shale density	G/CC	2.60
	Neutron matrix porosity	FRAC	-0.02
	Neutron shale point	FRAC	0.30
Core Porosity	Horiz. helium porosity - Overburden correction	FRAC	0.96
Log Porosity	Rock matrix/grain density	G/CC	2.67
	Fluid density	G/CC	0.820
	Shale density	FRAC	2.45
Saturation (Waxman &Smit)	Formation temperature measured from MDT run 2E	DEGC	145 °C at 4230 m MD RKB / 4202 m TVD MSL
	Formation temperature curve	DEGC	4.3 °C/100
	Formation water resistivity Rw	OHMM	Rw = 0.24 @ 145 °C @ 4230m MD RKB
	Cementation factor (a)		1.00
	Cementation exponent (m*)		1.94
	Saturation exponent (n*)		2.00
	parameter (Qv)	meq/cm ³	0.15 (constant)
	parameter (B)		13.8 @ 4230 mRKB MD
Net Reservoir	Cut-off value for Effective Porosity (PHIE)	FRAC	> 0.09
	Cut-off value for Vshale (VSH)	FRAC	< 0.40

Table 4-5 Petrophysical Input parameters

4.10 Main petrophysical results

Plot of the wireline logs, core data and the petrophysical evaluation results are shown in Figure 4-10, and the petrophysical net sand averages are presented in Table 4-6.

ZONE	Top m MD RKB	Bottom M MD RKB	Gross m	Net m	Net/Gross (frac)	Phie (frac)	Swe (frac)
A	4184.0	4198.6	14.6	2.0	0.14	0.107	0.87
B	4198.6	4212.7	14.1	5.0	0.35	0.137	0.73
C	4212.7	4224.5	11.8	5.8	0.50	0.121	0.96
D	4224.5	4233.7	9.2	6.4	0.69	0.131	0.85
E	4233.7	4242.9	9.2	4.0	0.43	0.117	0.89
F	4242.9	4247.2	4.3	2.1	0.50	0.133	0.77
G	4247.2	4252.1	4.9	-	-	-	-
H	4252.1	4254.3	2.2	0.9	0.42	0.144	0.73
Lysing reservoir	4184.0	4254.3	70.3	26.3	0.37	0.127	0.84

Table 4-6 Petrophysical net sand averages Lysing reservoir, well 6605/8-1



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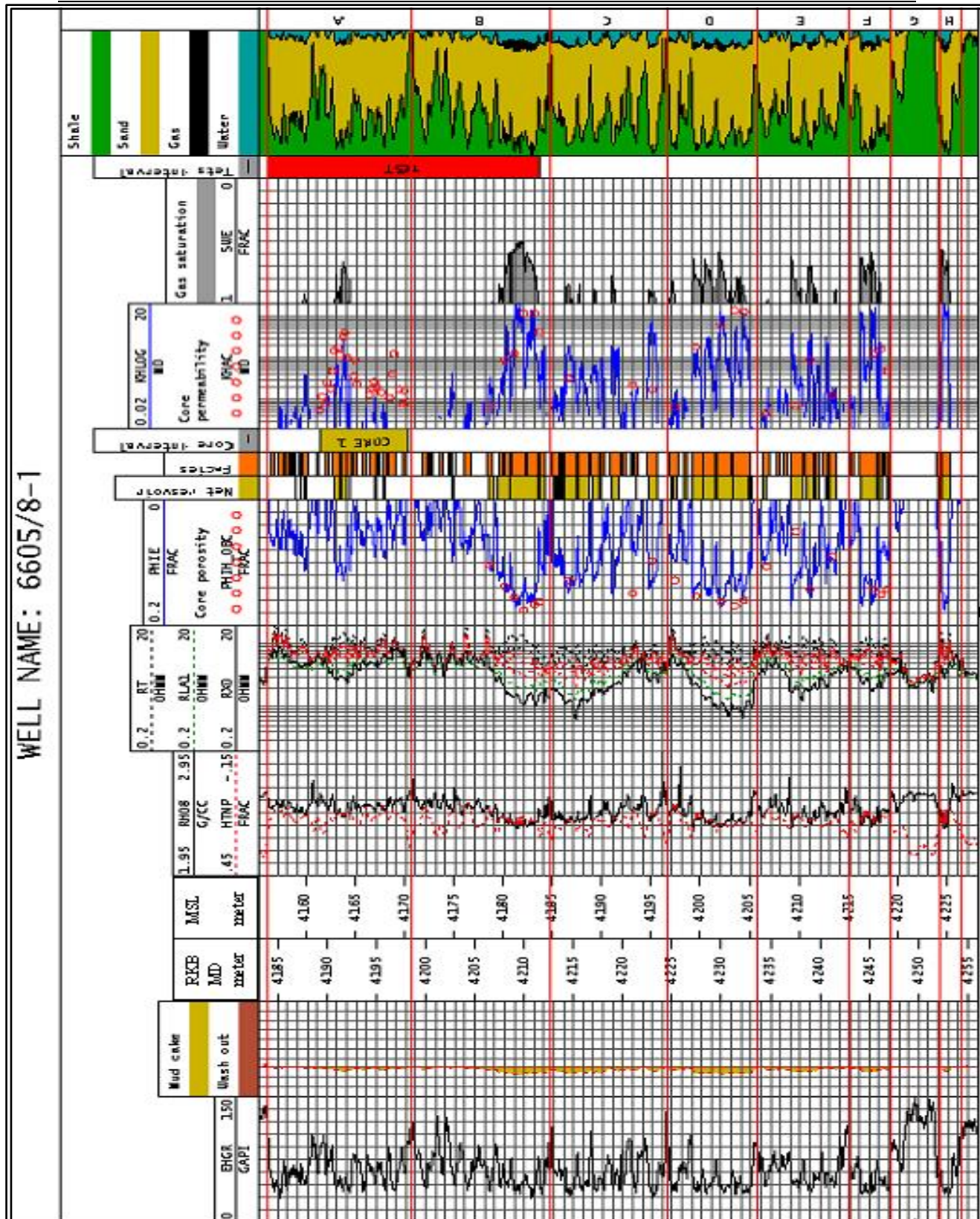


Figure 4-10 Raw logs and petrophysical interpretation Lysing Reservoir, well 6605/8-1



4.11 Discussions of the petrophysical results

There is generally good agreement between the log and core porosity in the sand with low shale content. However, in the shale/silt parts of the reservoir the core porosity (total) are much higher than the log calculated porosity (effective). This difference is most likely related to micro porosity; the cleaning and drying procedures will remove the water bound the micropores in the core plugs, which gives a larger porosity.

During drilling of this section, high gas content was measured throughout the entire interval. Gas has been calculated based on the petrophysical interpretation in the best reservoir quality sands in the Lysing Reservoir. Gas samples were taken above the FWL (Chapter 6) and two mini tests with the MDT tool were performed (Chapter 7) at 4211 m MD RKB. A gas test in the interval 4184-4211 m MD RKB produced gas as described in Chapter 8. A clean water sample was taken at 4230 m MD RKB. The calculated gas saturation from the petrophysical interpretation below the interpreted FWL is therefore believed to be residual gas.

In the bottom sand of the Lysing reservoir (below a two metre shale section) movable gas was found - MDT samples were taken. This gaszone has a higher pressure (approximately 20 bar) than both the gas and water zone above. The log interpretation shows slightly higher gas saturation here compared to the water-sampling zone. The bottom sand is believed to be isolated from the main reservoir section. Generally the high water saturation in the gas zone is due to poor reservoir properties.

The limited core measurements available results itself in an uncertainty in the porosity cut off determination. Since the reservoir consists of low porosity-permeability sands the chosen porosity cut-off have an impact on the calculated net reservoir and the petrophysical averages. Plot of porosity from 0.07 to 0.15 (Figure 4-11) shows that there is almost a linear relationship between the porosity cut-off and the net reservoir thickness. Hence porosity cut-off will have a large impact on net reservoir thickness.

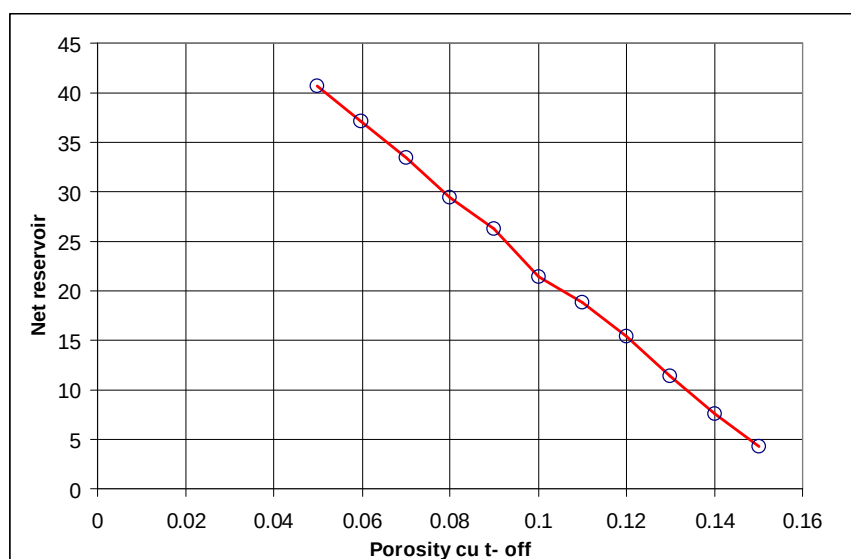


Figure 4-11: Net reservoir versus porosity cut-off



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Hydrocarbon pore volume (HPV) has been calculated for different porosity cut-offs (Figure 4-12) in the interval from top reservoir and down to GWC. Thus, using a porosity cut-off less than 0.10 will give an increase in the HPV.

Using a water saturation cut-off of 0.75 above GWC has a large impact on the calculated reservoir thickness. The net pay thickness is 2.6 meter compared to net reservoir thickness of 6.0 m using (Figure 4-13) a porosity cut-off of 0.09. The invasion profile from the HRLA logs is consistent with calculated net reservoir using a cut-off of 0.09.

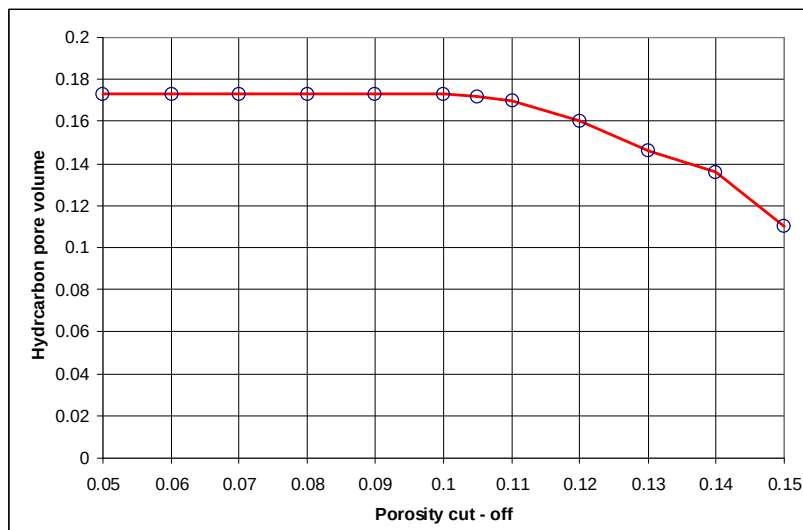


Figure 4-12: Hydrocarbon pore volume versus porosity cut-off

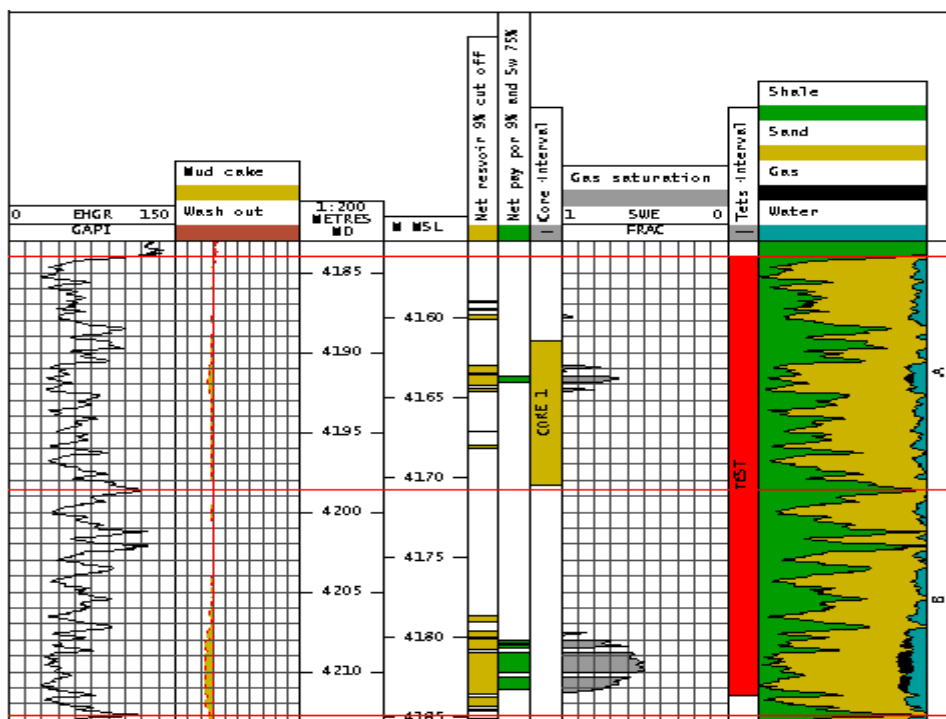


Figure 4-13: Net pay and net sand

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5 Fluid Contact Levels

The interpretation of the formation fluid contacts is based on the following information:

- Electrical logs
- Formation pressure points
- Fluid logging
- PVT analysis

5.1 Wireline Formation Tester Data Acquisition

A total of 66 pressure tests were attempted in open hole with the MDT (Run 2A through 2D) as listed in Table 5-1. All pressure values are from the CQG quartz gauge. Only eleven of the pressure tests were considered successful, the rest of the pressure tests were tight, abandoned or supercharged. The invasion of the water based mud with high salinity into the low permeable reservoir most likely caused a damage zone near the well bore; high skin values were obtained from the dual-packer minitest. This may be the reason why it was very difficult to get high quality formation pressure measurements in the reservoir.

5.2 Formation Pressure analysis

Figure 5-1 shows the formation pressures versus depth. The formation pressure measurements are plotted together with the petrophysical interpretation as shown in Figure 5-2. The density of the synthetic formation water has been measured at reservoir temperature and pressure to 0.965 g/cc (Table 11-6). The water gradient has been forced through the best point at 4231m MD RKB in the water zone. The initial pressures estimated from the MDT minitests (see Table 7-3 and Table 7-5) agree well with the MDT pressure points at this level.

From PVT data a gas density of 0.25 g/cc has been estimated. The gradient has been drawn to the best formation pressure measurements in the gas zone. The gas gradient and the water gradient intersect at 4193m TVD MSL (4221m MD RKB), which is evaluated to be the FWL.

During drilling gas was measured continuously in the mud. Further, gas is also interpreted (see Chapter 4) in the water zone. This gas must be residual. A formation with gas overlying a residual gas zone is in imbibition. In such a system the FWL are the same as the GWC.

The GDT in the well is determined to be at the bottom of the tested interval at 4183m TVD MSL (4212m MD RKB), see Figure 5-2.

In the lower gas interval which is very thin, only 1 m - we also have GDT; a GWC could not be estimated.



Depth		Run No.	Date	TEST No.	FILE No.	Mud pressure before (bar)	Formation pressure (bar)	Mud pressure after (bar)	Mobility (md/cp)	Gauge	Comment
MD RKB (m)	MSL TVD (m)										
4252.67	4224.80	2A	28-aug-05	2	87	658.614	-	658.528	-	BQP1	Dry_Test
4252.03	4224.16	2A	28-aug-05	3	88	658.294	-	658.208	-	BQP1	Dry_Test
4248.62	4220.76	2B	28-aug-05	2	108	657.728	-	657.327	-	BQP1	Unrecognizable
4248.02	4220.16	2B	28-aug-05	3	109	656.617	-	656.346	-	BQP1	Unrecognizable
4247.19	4219.33	2B	28-aug-05	4	110	656.121	-	655.838	-	BQP1	Unrecognizable
4246.08	4218.22	2B	28-aug-05	5	111	655.602	-	655.507	-	BQP1	Dry_Test
4243.15	4215.29	2B	28-aug-05	6	112	654.830	-	655.014	-	BQP1	Unrecognizable
4240.82	4212.96	2B	28-aug-05	7	113	654.605	-	654.051	-	BQP1	Dry_Test
4240.33	4212.47	2B	28-aug-05	-1	114	-	-	-	-	BQP1	Unrecognizable
4232.34	4204.48	2B	28-aug-05	2	137	653.376	613.749	653.200	8.7	BQP1	Volumetric_Pretest
4230.01	4202.16	2B	28-aug-05	4	138	652.545	-	652.486	-	BQP1	Unrecognizable
4223.04	4195.18	2B	28-aug-05	7	140	651.392	-	650.797	-	BQP1	Unrecognizable
4210.81	4182.97	2B	28-aug-05	8	141	649.570	-	649.581	4.0	BQP1	Unrecognizable
4209.14	4181.29	2B	28-aug-05	11	142	649.329	612.187	649.294	0.02	BQP1	Volumetric_Pretest
4191.71	4163.87	2B	29-aug-05	13	143	646.341	-	646.734	-	BQP1	Unrecognizable
4237.50	4209.70	2B	29-aug-05	15	146	653.633	-	653.683	-	BQP1	Unrecognizable
4233.20	4205.30	2B	29-aug-05	17	147	652.504	613.691	652.612	11.2	BQP1	Volumetric_Pretest
4230.60	4202.80	2B	29-aug-05	20	148	652.159	-	652.197	-	BQP1	Unrecognizable
4226.80	4198.90	2B	29-aug-05	21	149	651.528	-	651.566	-	BQP1	Dry_Test
4223.10	4195.20	2B	29-aug-05	22	150	650.988	-	650.970	-	BQP1	Dry_Test
4220.70	4192.90	2B	29-aug-05	23	151	650.609	-	650.658	-	BQP1	Unrecognizable
4218.80	4191.00	2B	29-aug-05	24	155	650.428	617.477	650.575	2.6	BQP1	volumetric_limited_draw_down
4214.50	4186.60	2B	29-aug-05	25	156	650.090	-	650.071	-	BQP1	Unrecognizable
4208.20	4180.30	2B	29-aug-05	28	157	648.989	-	649.095	-	BQP1	Unrecognizable
4206.40	4178.60	2B	29-aug-05	30	158	648.809	-	648.824	-	BQP1	Unrecognizable
4204.10	4176.30	2B	29-aug-05	31	159	648.460	-	648.495	-	BQP1	Dry_Test
4202.60	4174.80	2B	29-aug-05	32	160	648.229	-	648.258	-	BQP1	Dry_Test
4199.70	4171.90	2B	29-aug-05	33	161	647.738	-	647.775	-	BQP1	Dry_Test
4195.60	4167.80	2B	29-aug-05	34	162	647.117	-	647.228	-	BQP1	Unrecognizable
4209.40	4181.60	2C	02-sep-05	-1	239	656.289	612.259	-	5.1	BQP1	Volumetric_Pretest
4211.00	4183.20	2C	02-sep-05	1	222	656.113	-	656.077	-	BQP1	Unrecognizable
4209.10	4181.20	2C	02-sep-05	5	225	655.605	-	655.572	-	BQP1	Unrecognizable
4210.80	4183.00	2C	02-sep-05	6	226	656.065	-	655.999	-	BQP1	Unrecognizable
4209.70	4181.80	2C	02-sep-05	7	227	655.722	-	655.670	-	BQP1	Unrecognizable
4208.10	4180.20	2C	02-sep-05	8	228	655.358	-	655.336	-	BQP1	Unrecognizable
4191.80	4164.00	2C	02-sep-05	10	229	652.846	-	652.886	-	BQP1	Unrecognizable
4191.00	4163.20	2C	02-sep-05	11	230	652.789	-	652.792	-	BQP1	Unrecognizable
4191.40	4163.60	2C	02-sep-05	12	231	652.950	-	652.894	-	BQP1	Unrecognizable
4196.80	4169.00	2C	02-sep-05	17	237	653.873	-	653.772	-	BQP1	Dry_Test
4208.10	4180.20	2C	02-sep-05	18	238	656.709	-	656.203	-	BQP1	Unrecognizable
4209.50	4181.60	2C	03-sep-05	-1	242	655.077	612.077	-	3.6	BQP1	Volumetric_Pretest
4253.50	4225.66	2D	07-sep-05	-1	296	662.056	636.409	-	1.9	BQP1	Volumetric_Limited_draw-down
4253.20	4225.35	2D	07-sep-05	-1	297	661.934	636.398	661.724	1.4	BQP1	Volumetric_Limited_draw-down
4253.00	4225.10	2D	07-sep-05	6	298	661.743	-	663.032	-	BQP1	Unrecognizable
4252.60	4224.70	2D	07-sep-05	7	299	662.926	-	662.750	-	BQP1	Unrecognizable
4252.30	4224.50	2D	07-sep-05	8	300	662.665	-	662.498	-	BQP1	Unrecognizable
4253.70	4225.82	2D	07-sep-05	9	302	661.594	637.360	661.813	1.8	BQP1	Volumetric_Limited_draw-down
4253.40	4225.55	2D	07-sep-05	-1	303	661.746	636.742	-	2.2	BQP1	Volumetric_Limited_draw-down
4246.00	4218.15	2D	07-sep-05	12	306	660.312	634.037	660.537	0.3	BQP1	Volumetric_Limited_draw-down
4245.70	4217.80	2D	07-sep-05	13	307	660.535	-	660.390	-	BQP1	Unrecognizable
4245.00	4217.20	2D	07-sep-05	14	308	660.255	-	660.259	-	BQP1	Unrecognizable
4246.50	4218.70	2D	07-sep-05	16	311	660.505	633.057	660.469	0.1	BQP1	Volumetric_Limited_draw-down
4246.20	4218.40	2D	07-sep-05	17	312	660.466	-	660.435	-	BQP1	Unrecognizable
4253.00	4225.10	2D	07-sep-05	18	318	662.348	-	661.870	-	BQP1	Unrecognizable
4373.80	4345.90	2D	07-sep-05	19	322	679.658	-	679.745	-	BQP1	Unrecognizable
4373.50	4345.50	2D	07-sep-05	20	323	679.670	-	679.654	-	BQP1	Unrecognizable
4373.20	4345.20	2D	07-sep-05	21	324	679.579	-	679.551	-	BQP1	Unrecognizable
4372.90	4345.00	2D	07-sep-05	22	325	679.494	-	679.487	-	BQP1	Unrecognizable
4372.60	4344.60	2D	07-sep-05	23	326	679.412	-	679.388	-	BQP1	Dry_Test
4372.60	4344.60	2D	07-sep-05	24	327	679.372	-	679.375	-	BQP1	Dry_Test
4372.30	4344.40	2D	07-sep-05	25	328	679.314	-	679.303	-	BQP1	Dry_Test
4428.00	4400.10	2D	07-sep-05	26	330	687.827	-	687.908	-	BQP1	Dry_Test
4427.70	4399.70	2D	07-sep-05	27	331	687.794	-	687.767	-	BQP1	Dry_Test
4426.40	4398.40	2D	07-sep-05	28	332	687.485	-	687.491	-	BQP1	Dry_Test
4426.10	4398.20	2D	07-sep-05	29	333	687.429	-	687.427	-	BQP1	Dry_Test
4428.23	4400.25	2D	07-sep-05	30	336	687.783	-	687.840	-	BQP1	Unrecognizable

Table 5-1 Formation pressure measurements (MDT), well 6605/8-1



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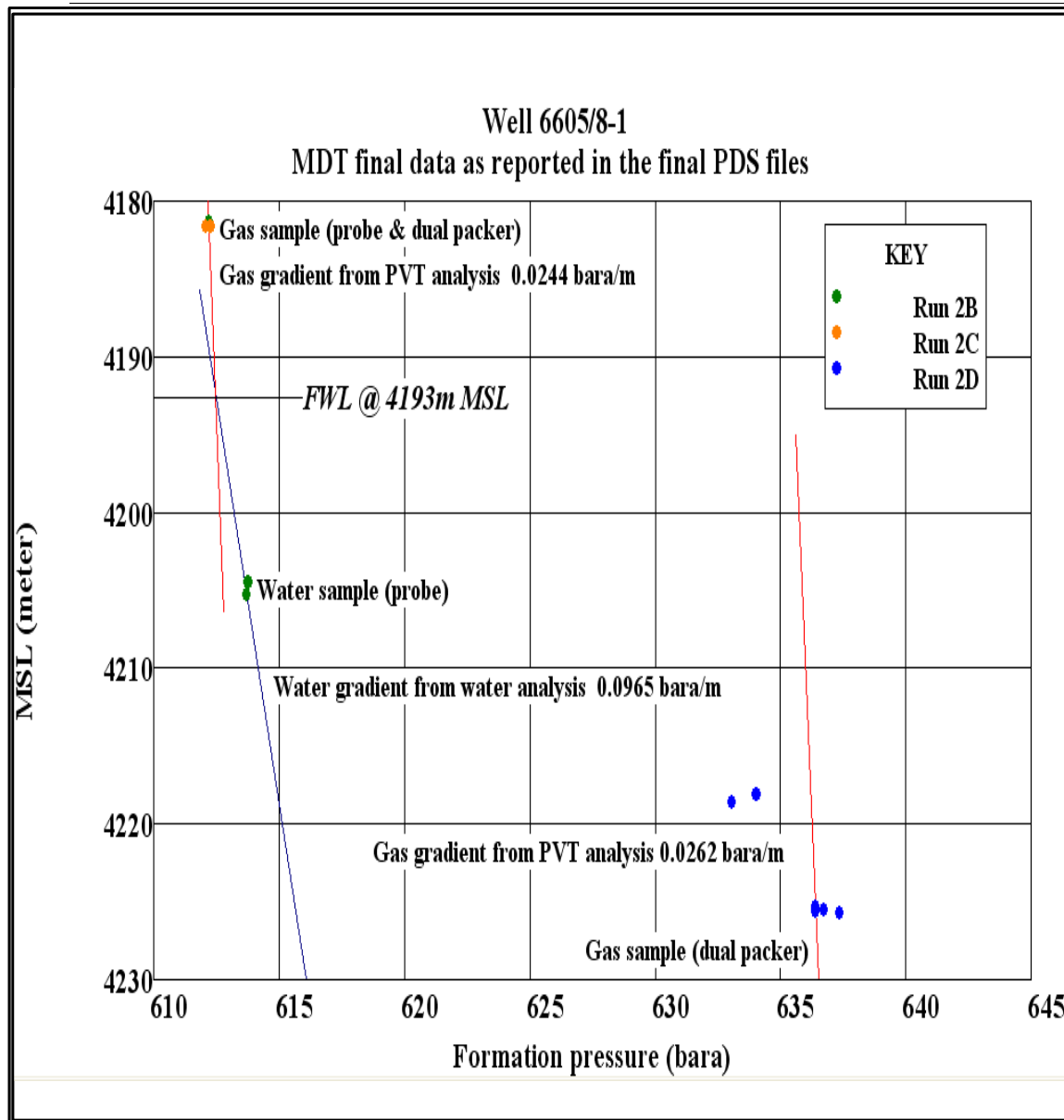


Figure 5-1 Formation pressure versus depth plot, Lysing Reservoir well 6605/8-1



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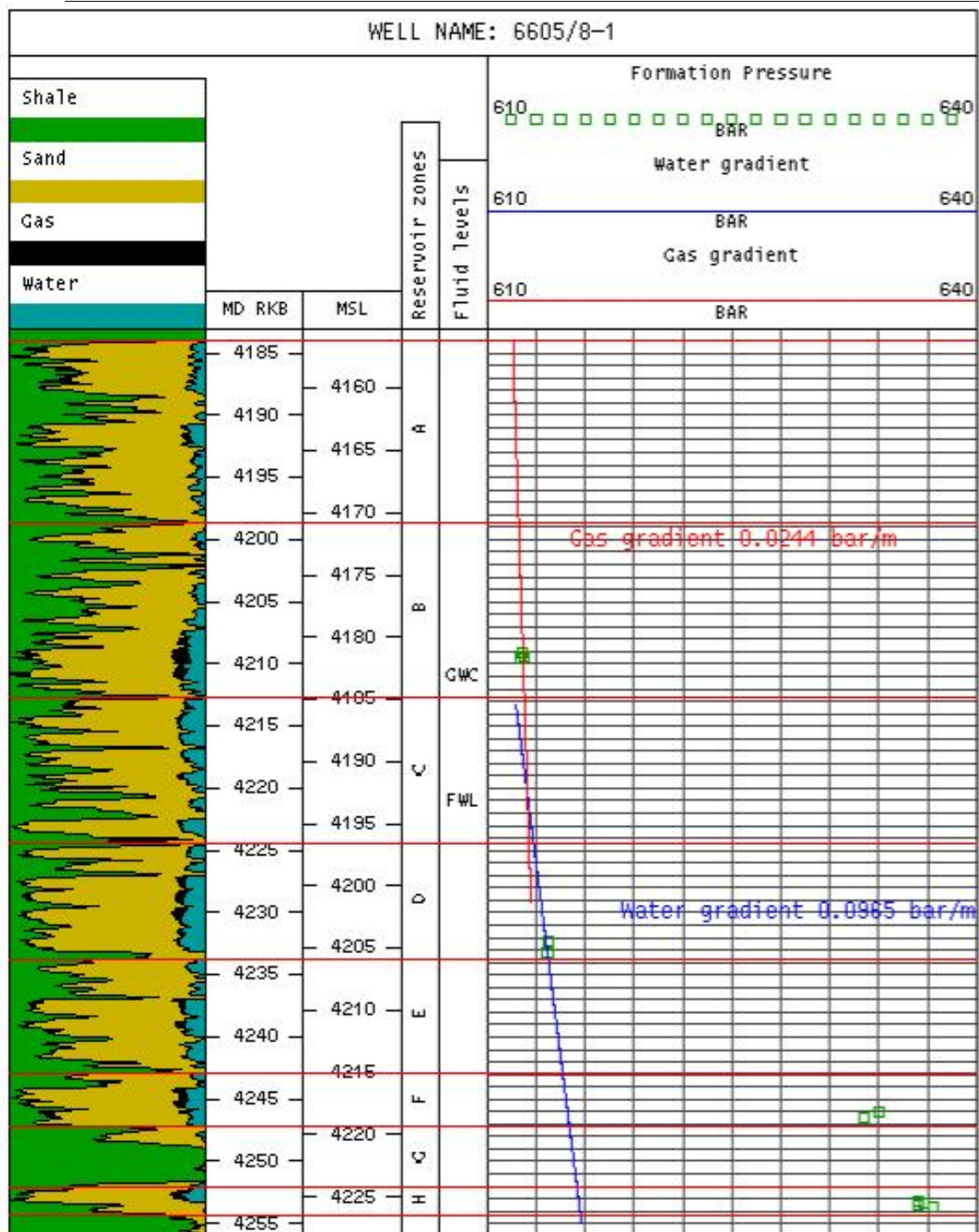


Figure 5-2 CPI and formation pressure measurements, Lysing Reservoir, well 6605/8-1



6 Wireline Formation Sampling

Six MDT runs were performed in order to fulfil the WFT objectives (see Chapter 3.1). A complete list of the sampling intervals is given in Table 6-1 below. The different MDT runs are summarized in Table 6-2, and sequence of events is found in appendixes 13.10.1 and 13.10.3 (open – and cased hole respectively).

A total of 12 samples were taken; 6 gas samples and 6 water samples. Technical details of the sampling such as bottle number, filling sequence, pressure drawdown, pump volume, mobility, filling time, MDT tool-string configurations etc. are located in appendix 13.2.

Sampling depth (m MD RKB)	Log run #	Fluid type	Sampling probe
4231.4	2B	Water	Guard probe
4209.4	2C	Gas	Large diameter probe
4210.85-4211.86	2C	Gas	Dual packer module
4252.5-4253.5	2D	Gas	Dual packer module
4230.0-4230.55	2E	Water	Dual packer module, cased hole

Table 6-1: List of all sample intervals

6.1 WFT operations summary

Tritium tracer was added to the mud in this well during coring, and for correction for mud filtrate contamination in the formation water samples. In general, the sampling program suffered from several operational problems/failures. These were:

- MDT electronic failure and computer crashes.
- Equipment failure of the pump due to extended pumping as well as electrical failures.
- Large drawdown and low flowrate due to low mobilities.
- OFA/CFA failure due to low output on CFA amp.
- Bad rope socket causing tool failure.
- Loss off hydraulic seal over probe packer and dual packer elements.
- Tool sticking and resulting fishing operation.

The **MDT run 2A** are regarded as a total failure since no useful results were achieved. During both of these runs, sever problem with the 50V power supply to the MDT-tool was experienced. In both runs the MDT-tool had to be pulled to surface premature; hence it was not possible to complete the MDT run objectives. A total of 2 pre-tests were achieved, both tight/supercharged.

In the **MDT run 2B** is two separate runs with the same tool string. In the first of these seven pre-tests were taken – all tight. In the second ‘run’ the new guard probe was used. This probe has the ability to set up and maintain a larger “cleanup cone” during sampling. The probe consists of two inflow areas, like a doughnut, where the inner area is the sampling inlet. In order to maintain this larger "cleanup cone", two pumps must be configured on the string.

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During the first part of the sampling operation, the guard probe worked extremely well. The first sample was captured with 0 % mud filtrate contamination (see Chapter 11.4).

Unfortunately, the outer seal failed after the first sampling. As a consequence, the next two samples had some filtrate contamination, 5 % and 10 % respectively. A further detail of this failure is discussed in Chapter 6.2.3.

3 out of 4 attempted samples were captured during MDT run 2B. The first sample, MPSR #55, did not open, which is evident when inspecting the pressure plot (see Figure 6-5). Five pH injections/measurements were conducted during cleanup and sampling. This is a technique, which uses a dye to measure the downhole pH during a sampling operation.

After completing the sampling at 4231.4m, the MDT was stuck. Some time was spent trying to free the tool without any success. The ECRD was burned and the wireline was pulled to surface. The MDT tool was then easily fished with an overshot on drillpipe since no cable was left in the wellbore.

The large diameter probe (LDP) was used for sampling gas/condensate in **MDT run 2C**. The LDP probe was also used in the first minitest in this run. No major tool failure was experienced during the MDT run 2C except that the tool became stuck after sampling at 4209.4m. It was decided to set the packer module and continue the sampling. The sampling interval is therefore referred to an interval rather than a specific depth. The LDP probe was also set in order to perform a vertical interference test after the second sampling operation in run 2C. The MDT-tool was free when the packer elements were deflated.

When running in hole for **MDT run 2D**, the tool had to be pulled to surface due to multiple tool/system failure. The MDT-tool was redressed and the back-up LFA was installed. After the sampling and minitest at 4252.5-4253.5m were completed, the next sampling operation had to be aborted due to rupture of the upper packer element. Most likely this is due to a mixture of wear and tear and the high temperature in the well, above 135 degC which was the packer temperature rating.

The MDT was also run in cased hole, **MDT run 2E** after the testing was finished. In order to perform sampling through the casing, a separate perforation run was run prior to the MDT. Based on the CBL- and USIT-logs (see Figure 6-1), the casing was perforated on wireline from 4230-4230.55m using Schlumbergers deepest penetrating charges (5 spf Powerjet Omega). The well was perforated in 1.62 SG mud. The MDT was then run, and set at 4230.2m (packer interval 4229.7-4230.7m). During the cleanup and sampling, the packer elements had to be re-inflated many times. No obvious reason was found for this problem except possibly an effect of the high temperature in the well (rubber element was stretching). 3 out of 4 MPSR bottles were filled during this run, but the quality of the samples are questionable. It seemed like there was a small leak over the packer to the wellbore during the whole operation. The imprints on the packer elements showed that the packers have been located partly in the perforated interval (Figure 6-2).

The upper pump became plugged during the job. However, it was resolved by using the lower pump to flush through the upper pump. The MDT-tool was inflated and standing still for ~36 hours. When it was going to be released, it was stuck and the ECRD had to be burned.

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Apparently, mud was settling around the upper packer element and plugging off the tool. The tool was recovered with an overshot on drillpipe without any problems.

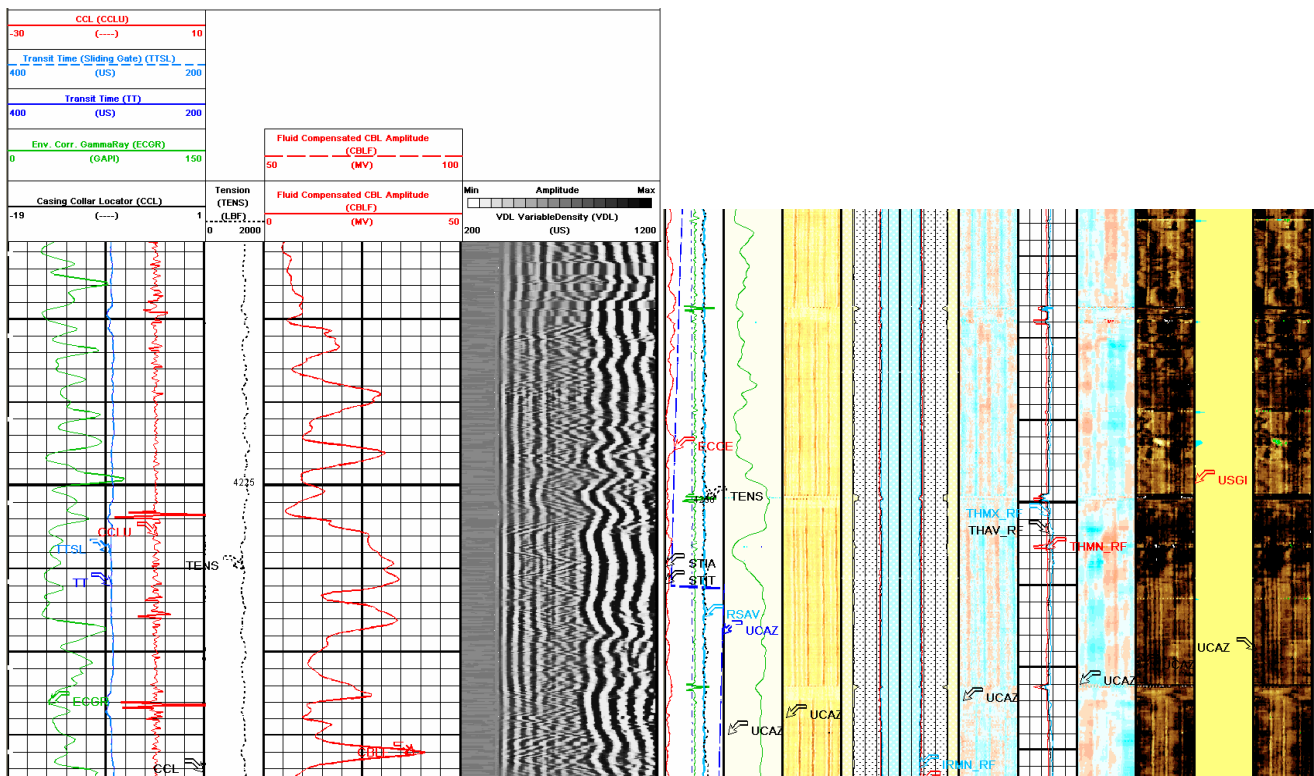


Figure 6-1: CBL- and USIT-log over the perforated zone, 4230.0 - 4230.6m MD

The MDT tool sampling configurations were run with a combination of the LFA- and CGA-modules. The LFA module was in general run in the OFA mode. The LFA/CGA combination gives an improved control (in realtime) of the fluid composition during the clean-up.

In general, due to the low permeability sandstone, the pump rate had to be kept at a relatively low rate to avoid a large drawdown or seal failure. The clean-up volumes are therefore significantly smaller than normally expected when sampling high quality samples. The clean-up volumes are listed in appendix 13.2. The fluid logging curve mnemonics are given in appendix 13.2.3.



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Figure 6-2: Packer elements after cased hole MDT

6.2 Fluid Sampling Summary

The reservoir mobilities were on the low side (Table 5-1); hence all of the sampling operations were struggling obtaining a fair flow of formation fluid. To minimize this limitation, three sampling operations were conducted with the dual packer module. Nevertheless, the drawdowns experienced during most of the sampling jobs are relatively high (60-100 bar).

There was some uncertainty with respect of fluid type in the sand body around 4230m MD in the Upper Lysing. Therefore a special designed cased hole MDT job was executed. The result of this operation is described in more detailed in section 6.2.5 below.

One of the main reasons for the problems experienced with the telemetry is that a new type of wireline was used. This cable had not been qualified for the temperatures seen in the Stetind well with the "older set" of MDT-modules. The sampling is described in detail in the following chapters - from top to bottom in openhole section in the well with the cased hole sampling at the end.



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Date	Log run	No. of total and 'good' pre-tests	Sampling depth (m MD RKB)	MDT Samples taken		Run objectives	Operational comments
				Gas	Water		
26.08.05	2A	2 (0)	n/a	n/a	n/a	Pressure points	No pressure points were achieved during run 2A. Tool failed after 2nd pre-test due to insulation problem of trolex plug or collector.
27.08.05	2B	7 (0)	n/a	n/a	n/a	Pressure points and sampling	Tool failure while RIH. Multiple tool/system failure. POOH to change rope socket. RIH, but finally unable to power up the MDT. All 7 pre-tests tight.
28.08.05	2B	20 (4)	4231.4	n/a	MPSR:3	Pressure points and sample formation water	Pre-tests abandoned after 34 attempts due to hydraulic leakage in standard probe. Sample formation water with guard probe. Outer seal failure after 2nd sample. OFA module "out of order". Tool stuck, retrieved by fishing.
02.09.05	2C	12 (2)	4209.4	MPSR:2 SPMC:1 MRSC:1	n/a	Pressure points, fluid sampling and "minitest " test	After finishing pre-tests, sampled gas through large diameter probe. After first minitest, tool was stuck. Decided to set packer module and sample more and finish run 2C with another minitest over packer interval with LDP set (VIT). CFA data unreliable due to low output on CFA amp. Tool free when deflating packer modules.
			4209.4 (Minitest)	n/a	n/a		
			4210.85-4211.86	MPSR:1 SPMC:1	n/a		
			4210.85-4211.86 (VIT)	n/a	n/a		
05.09.05	2D	26 (5)	4252.5-4253.5	MPSR:2	n/a	Pressure points and sampling	Changed to backup LFA (in OFA mode) due to failure on 50V system. Large number of pre-tests tight or supercharged. Tried to sample with PS @4253.4m. Aborted after 2 litres pumped. Sampled with dual packer module. Upper packer burst after last sampling.
30.09.05	2E	n/a	4230-4230.55	n/a	MPSR:3	Sample formation fluid	This run verified that the sand body at 4230m is water filled. Had a small leakage over packer elements during entire job. Not very good samples. Tool stuck, had to be fished after completing job.

Table 6-2: MDT logging overview

6.2.1 Sampling Gas at 4209.4m MD RKB (Upper gas)

The gas sampled at 4209.4m MD RKB is the gas interval with best formation properties. As seen in Figure 6-3 below, the pressure drawdown still was more than 60 bar before collecting the 2 ¾ gallon chamber and the 1st MPSR bottle. The rate was reduced before the two last samples were captured, but still the drawdown is significant (>30 bar). The temperature is gradually increasing through out the job. When the 2 ¾ gallon chamber was transferred offshore some water was found in the container.

Pressure & Temperature Development @ 4209.4m MD

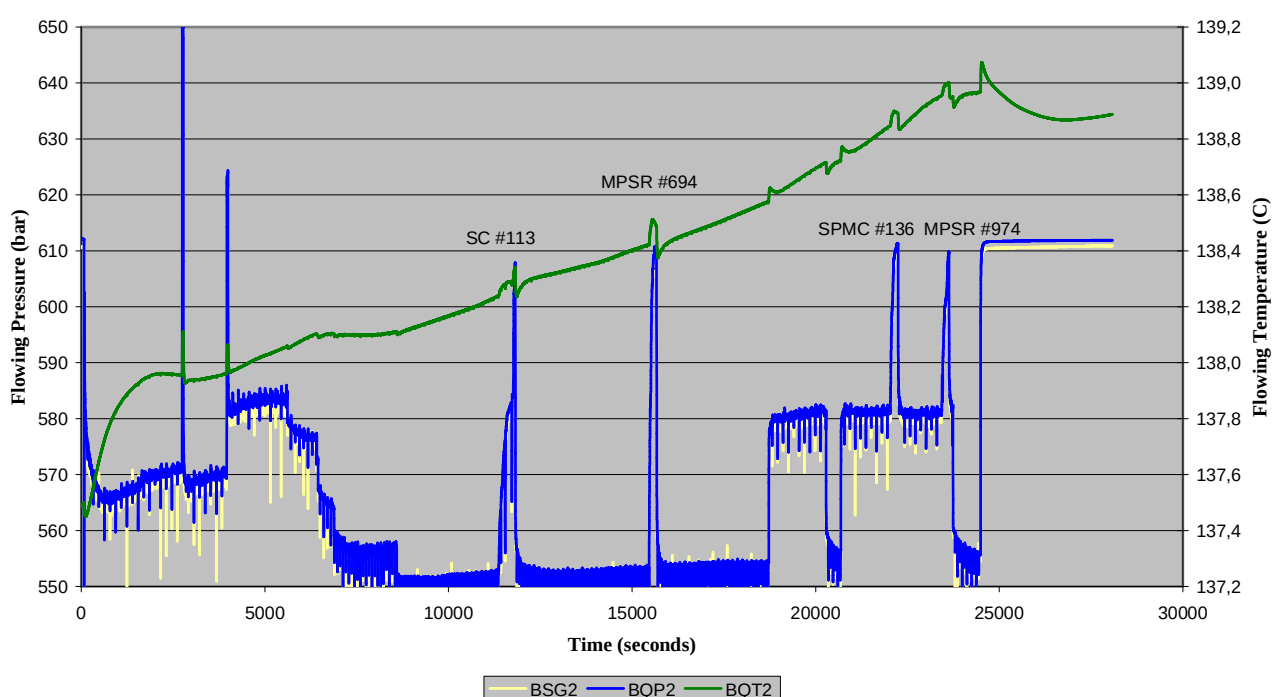


Figure 6-3: Pressure and temperature development at 4209.4m MD

6.2.2 Sampling Gas at 4210.85-4211.86m MD RKB (Upper gas)

As described in earlier section, the tool had become stuck during sampling through the probe at 4209.4m MD RKB. It was therefore decided to set the dual packer module for more sampling from the sandbody before one possibly had to fish the toolstring (it became free after the dual packer sampling operation).

As can be seen in Figure 6-4, the drawdown was reduced significantly when using the dual packer elements. With the dual packer module, the inflow area is dramatically increased; hence the ability to flow is much better. With a significantly lower drawdown more than twice the volume of formation fluid was pumped (129 vs. 278 l) in a shorter time.



The temperature starts off more than 1 degC higher than the last temperature readings (when using the large diameter probe). However, it drops down to around 139.45 degC before it starts to climb up again. The reason for the initial higher temperature may be due to heat generated from working the internal equipment inside the dual packer MDT. The same effect can be seen at the end of the operation when the temperature jumps up when the packers are deflated.

Since the packer module is used, no resistivity measurements are available, but the indication of water is clear. The volume of water seems to decrease over time, which may indicate that the formation is starting to clean up. The pressure drawdown is also by far the lowest seen during any of the sampling operations (< 4 bar). In that respect, the last sample captured, SPMC #188, should be the one with best quality or "highest volume" of the heavier HC's components.

Pressure & Temperature Development @ 4210.85-4211.86m MD

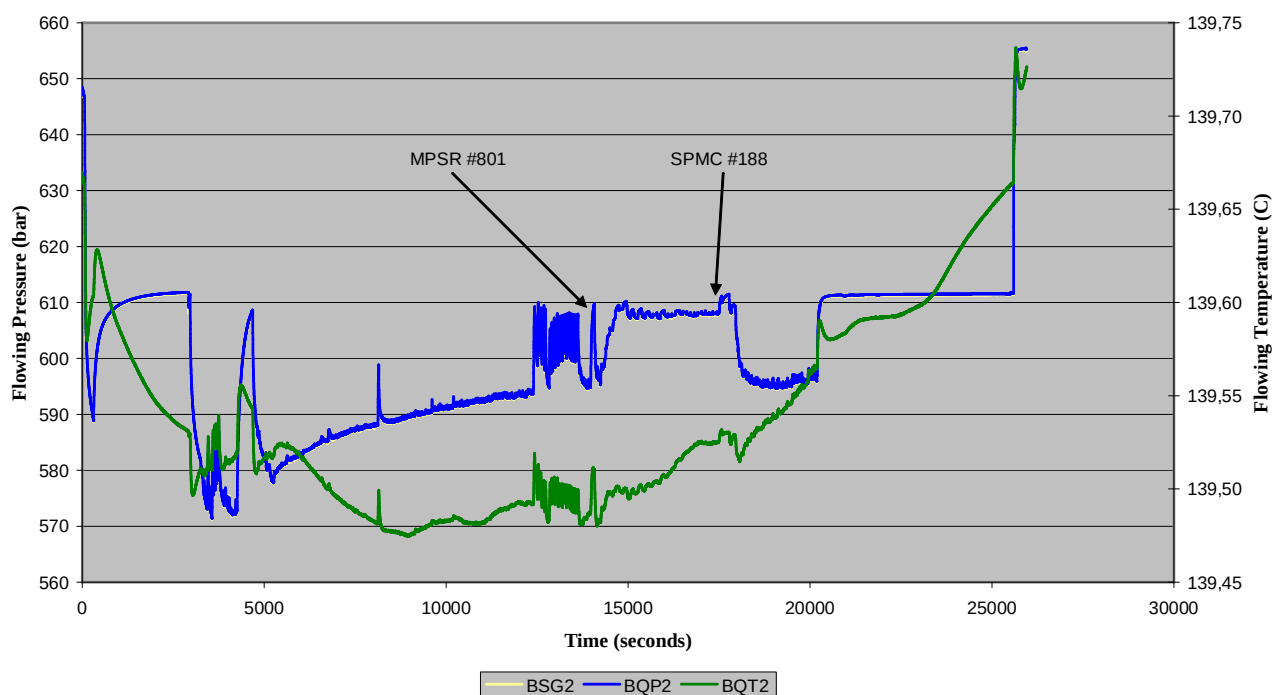


Figure 6-4: Pressure and temperature development at 4210.85-4211.86m MD

6.2.3 Sampling Formation Water at 4231.4m MD RKB

One of the two probes was dressed with the new and improved guard probe for this sampling interval. The pressure recordings shown in Figure 6-5 below, is from this probe. The strain gauge records the outer pressure on the guard probe and the quartz gauge records the flowline pressure (inner). The pressure and temperature development starting from the capturing first sample is shown in Figure 6-5 and Figure 6-8. (A new file was started after sample MPSR #783 was captured; hence two separate plots.)



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In Figure 6-6, the filling operation of sample MPSR #36 has been zoomed in. The later analysis of the formation water was surprisingly fresh, and there was a discussion if the bottle was filled completely with formation water or some volume of distilled water was already inside the bottle. By pinpointing exactly when the bottle opened and closed, using the average pumping rate just before the bottle was full and assuming 100% efficiency (pumping water), it has been verified that the MPSR #36 was completely filled with formation water.

One should note that the outer seal failed after ~29800 sec. This is seen as a sudden pressure increase on the strain gauge. The two last sample captured are therefore sampled without the effect of the guard probe (main reason for the higher mud filtrate contamination of the samples, ref. section 11.4).

The resistivity during the filling operations is very stable (see Figure 6-7), indicating that the cleanup has been very good. The sudden drop of the resistivity corresponds well with the loss of the outer seal of the guard probe. As soon as the outer part of the guard probe failed, influx of mud filtrate starts to contaminate the formation fluid!

Pressure & Temperature Development @ 4231.4m MD Guard probe

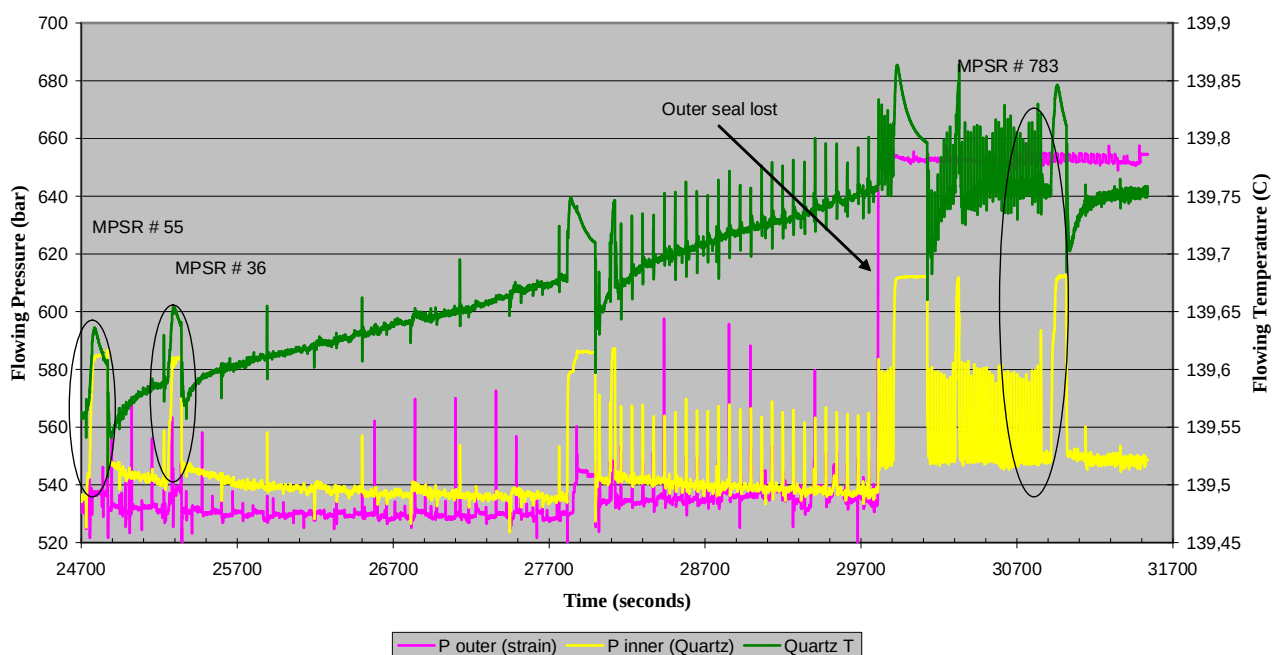


Figure 6-5: Pressure and temperature development at 4231.4m MD

Pressure & Temperature Development @ 4231.4m MD
Filling of MPSR Bottle #36

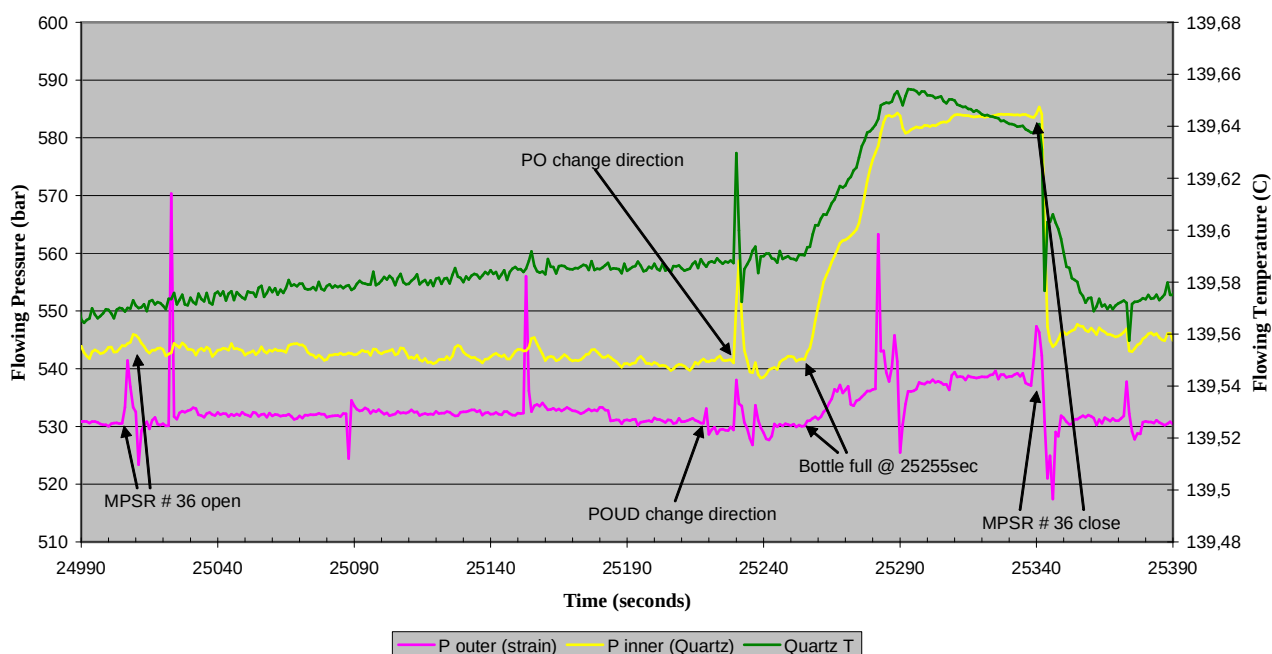


Figure 6-6: Filling of MPSR bottle #36 at 4231.4m MD

Pressure & Temperature Development @ 4231.4m MD
Filling of MPSR Bottles

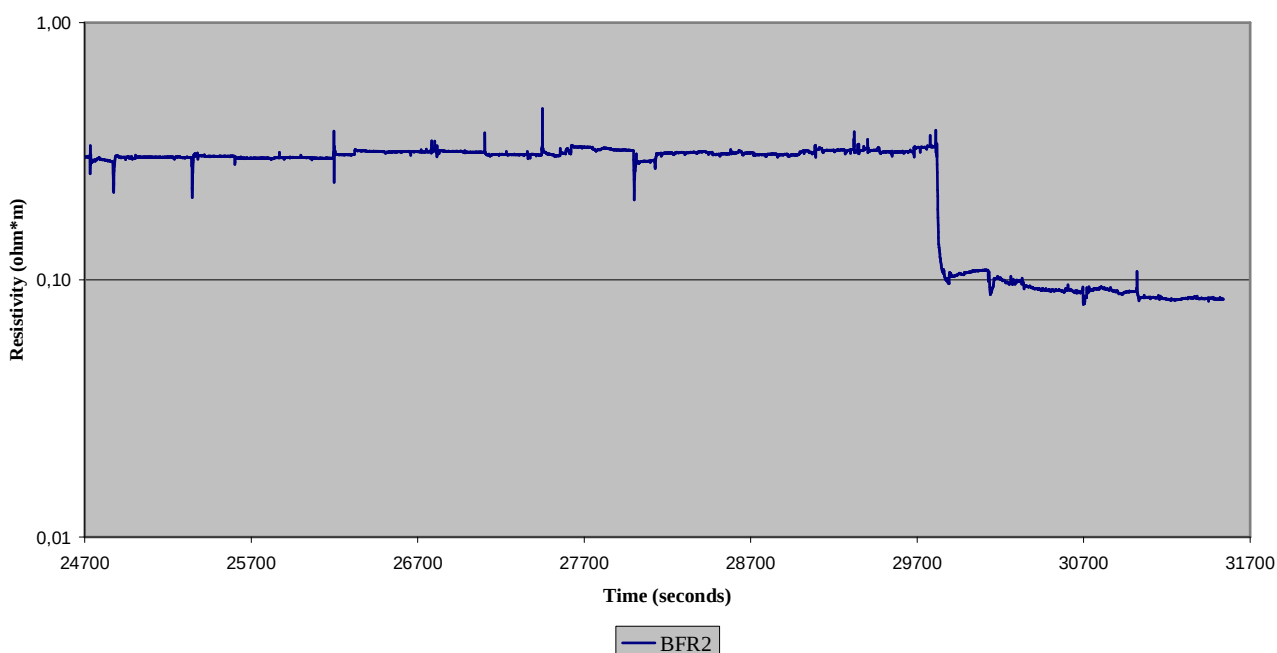


Figure 6-7: Resistivity during filling of the MPSR bottles at 4231.4m MD

Pressure & Temperature Development @ 4231.4m MD

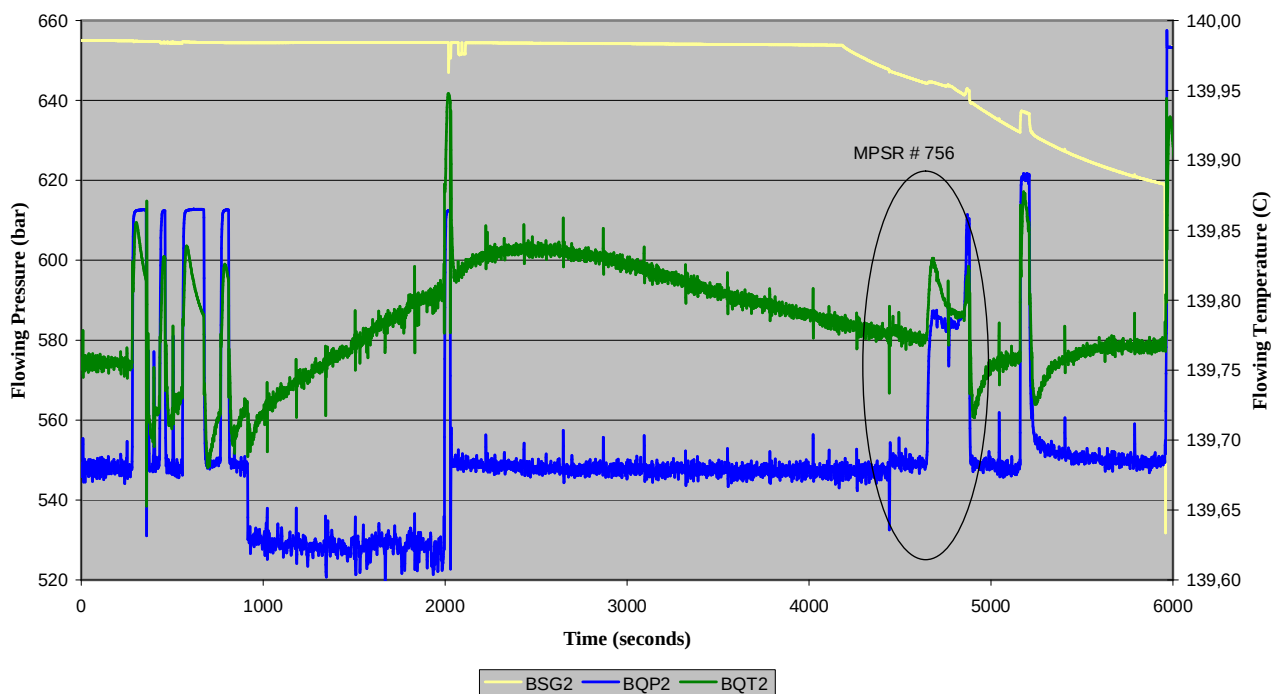


Figure 6-8: Pressure and temperature development at 4231.4m MD, last part of sampling

Formation Fluid Resistivity @ 4231.4m MD

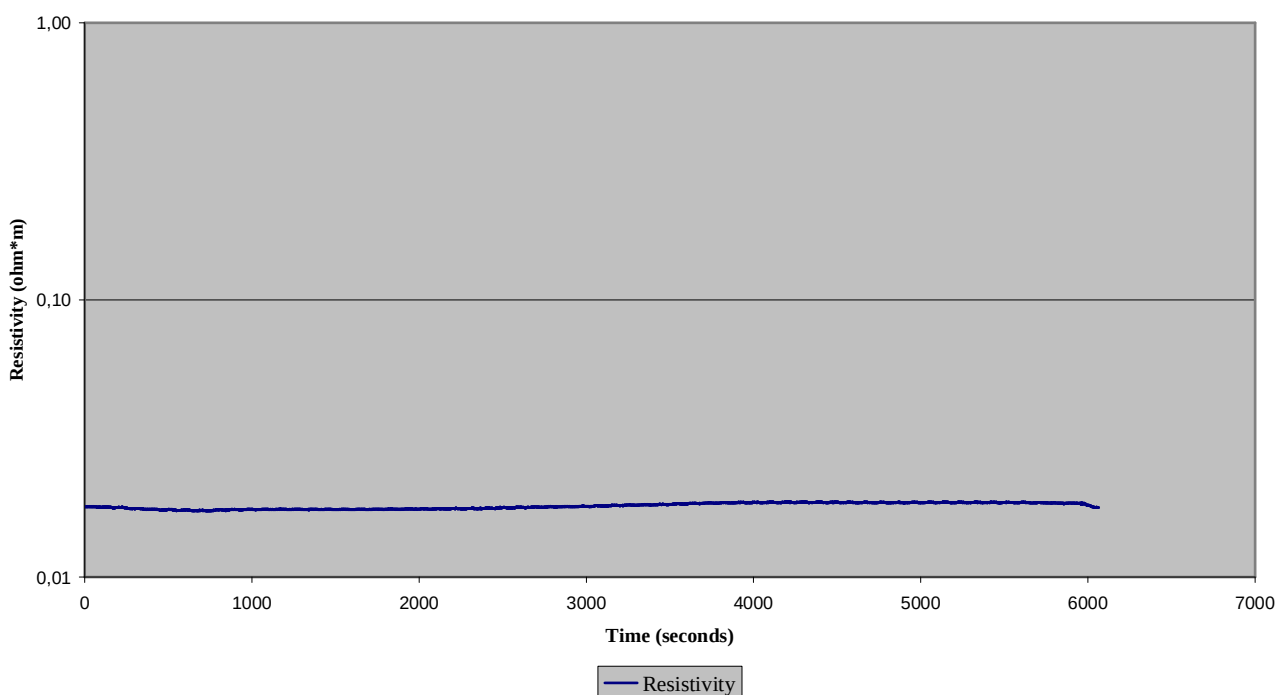


Figure 6-9: Resistivity during last part of sampling at 4231.4m MD

Downhole measurement of pH was also conducted during this sampling operation, see Figure 6-10. The water was measured to a pH of about 4.5, which corresponds well with the relatively high content of CO₂ seen in the PVT analysis, ref section 11.4.

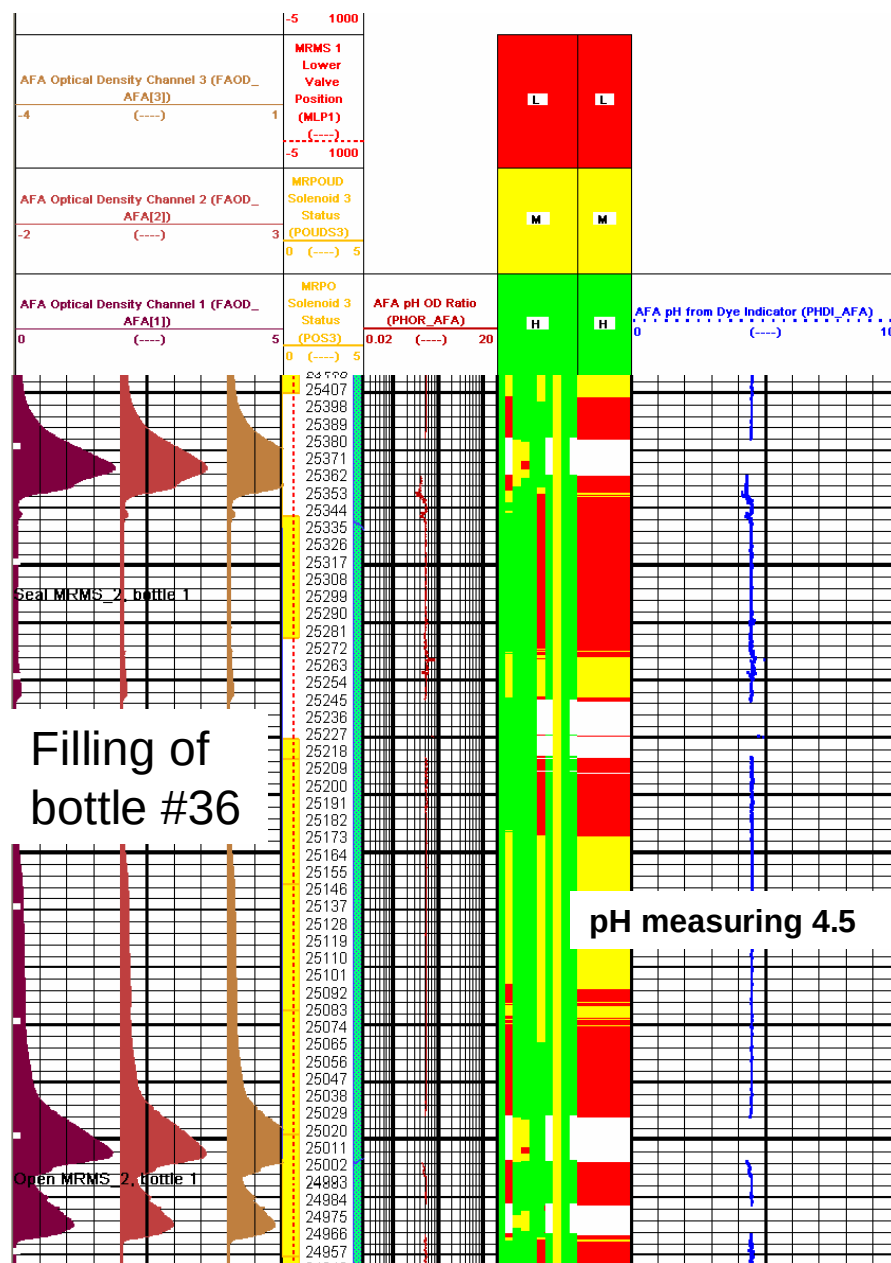


Figure 6-10: Downhole measurement of pH during filling of water sample MPSR #036

6.2.4 Sampling Gas at 4252.5-4253.5m MD RKB (Lower gas)

Two samples were captured at this depth. The formation here had a very low mobility, and more than 100 bar drawdown was experienced even when using the dual packer module, see Figure 6-11. Only 66 liters was pumped during the entire operation.

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A flash was performed on sample MPSR #768, the assumption being made that it was a condensate sample. The liquid was dark brown in color, turning black when left to stand (Ref./10/). Sample MPSR #930 contained more HC's (by volume) than MPSR #768, as verified from the PVT analysis of the two samples, Ref./10/.

Pressure & Temperature Development @ 4252.5-4253.5m MD

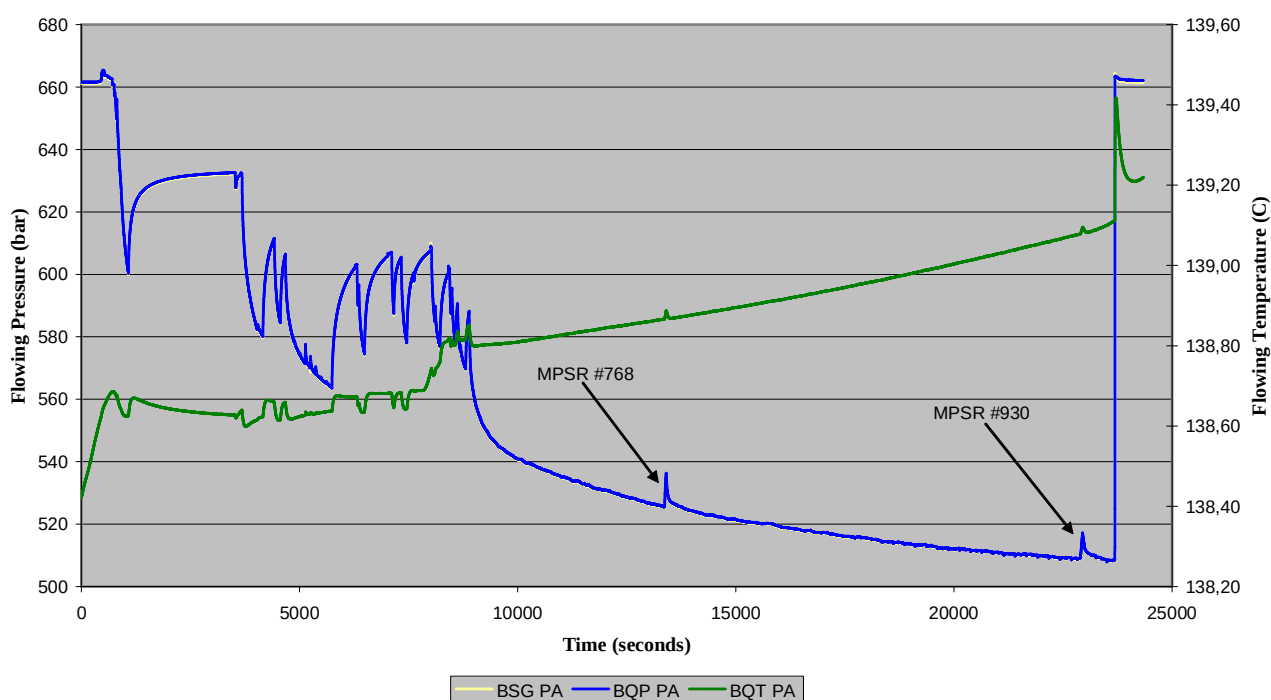


Figure 6-11: Pressure and temperature development at 4252.5-4253.5m MD

6.2.5 Sampling Formation Water at 4230-4230.55m MD RKB, Cased Hole

The samples captured during this run were done after the liner had been cemented and the test performed. The main objective was to verify which type of reservoir fluid was present at this depth. The flow was directed through the PS_1 probe in order to measure the resistivity, which is normally not available when conducting sampling with the dual packer module.

Three files (#69, #70 and #71) have been spliced in order to get the complete overview of the job. More than 2000 litres of formation fluid were pumped from this interval during approximately 24 hrs. The drawdown seen in Figure 6-12 is relatively significant, more than 50 bar. Apparently, no significant cleanup effects are seen from the pressure development plot. The drawdown is reduced with about 10 bar over the period, but then it stabilizes. The temperature development is gradually increasing to about 146 degC where it seems to stabilize. Since water is being pumped, the corresponding heat capacity and hence the

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temperature read, should bring the temperature close to the reservoir temperature at the end of the job. More discussion on this can be found in Chapter 9.

There are quite a few pressure spikes on the plot. These are from the re-inflation of the dual packers. Through out the job, the internal pressure in the packers dropped, and regularly they had to be re-inflated in order to maintain the hydraulic seal across the sampling interval. It is believed that this reinflation of the packers caused some new mud / mud filtrate to enter into the sample interval, which is seen as small spikes on the optical channels.

An interesting observation is the variation of the resistivity measured (Figure 6-13). The resistivity should exhibit a stabilized value after some time. However, it does not. Why this is happening, is difficult to explain. One possible reason may be that there is a leak from the wellbore; hence well fluid is flowing together with the formation fluid. But if this is to be true, the mixture of formation fluid and formation water would have made the optical densities and gas normalized data much more erratic and unstable. The pressure would also this leakage better if it had been a continuous leaking path. Another plausible explanation is that there is a continuous flow of completion/filtrate fluid from behind the liner, which is flowing together with the formation water. The quantity is probably not large, but the fluid behind the liner is much more salty (contains significantly more NaCl). Therefore, the resistivity is varying as the quantity of the fluid from the annulus is being produced. At the end of the job, there is still annulus fluid produced with the formation water. (This was later verified by the analysis of the water sample captured, see section 11.4.)

To summarize, the quality of the water samples from the cased hole sampling are questionable. It is likely to believe that the formation fluid contains a large amount of annulus fluid (from behind the liner) with unknown composition. The fluid logging verified that there is a water zone in the reservoir at 4230-4230.55m MD, but the samples cannot be used for determining the formation fluid composition; see also section 11.4 for more information.

Pressure & Temperature Development @ 4230-4230.55m MD

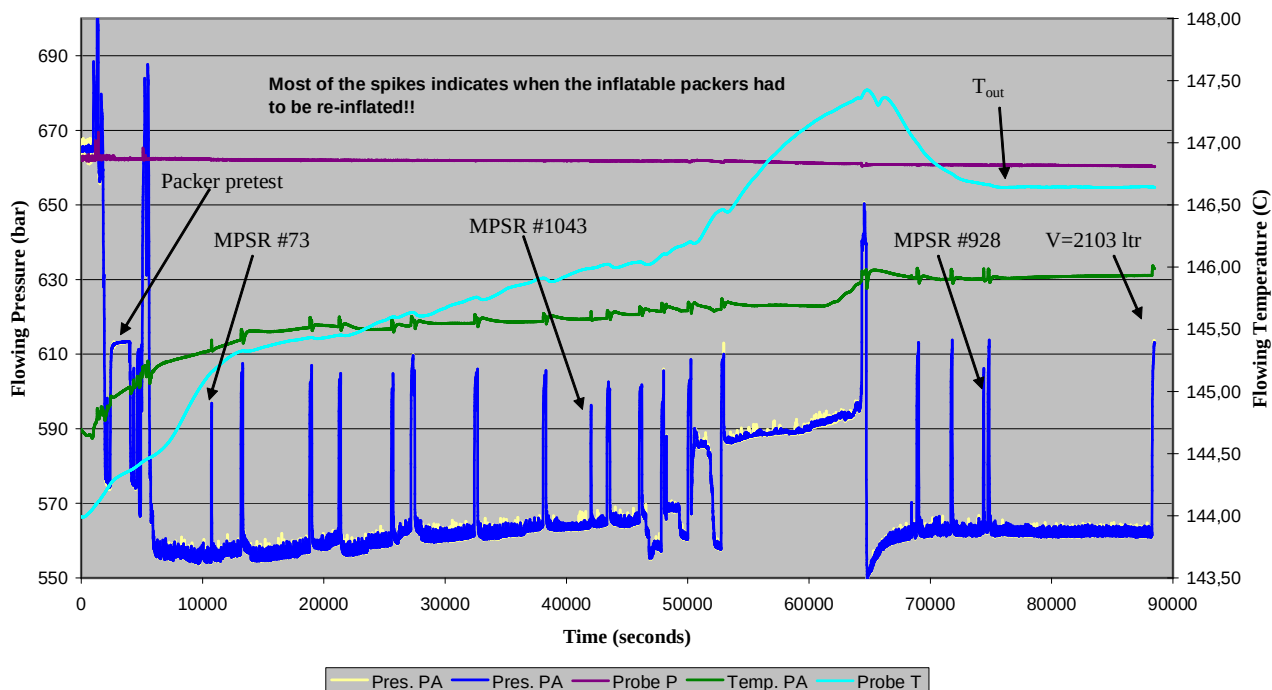


Figure 6-12: Pressure and temperature development at 4230-4230.55m MD

Formation Fluid Resistivity @ 4230-4230.55m MD

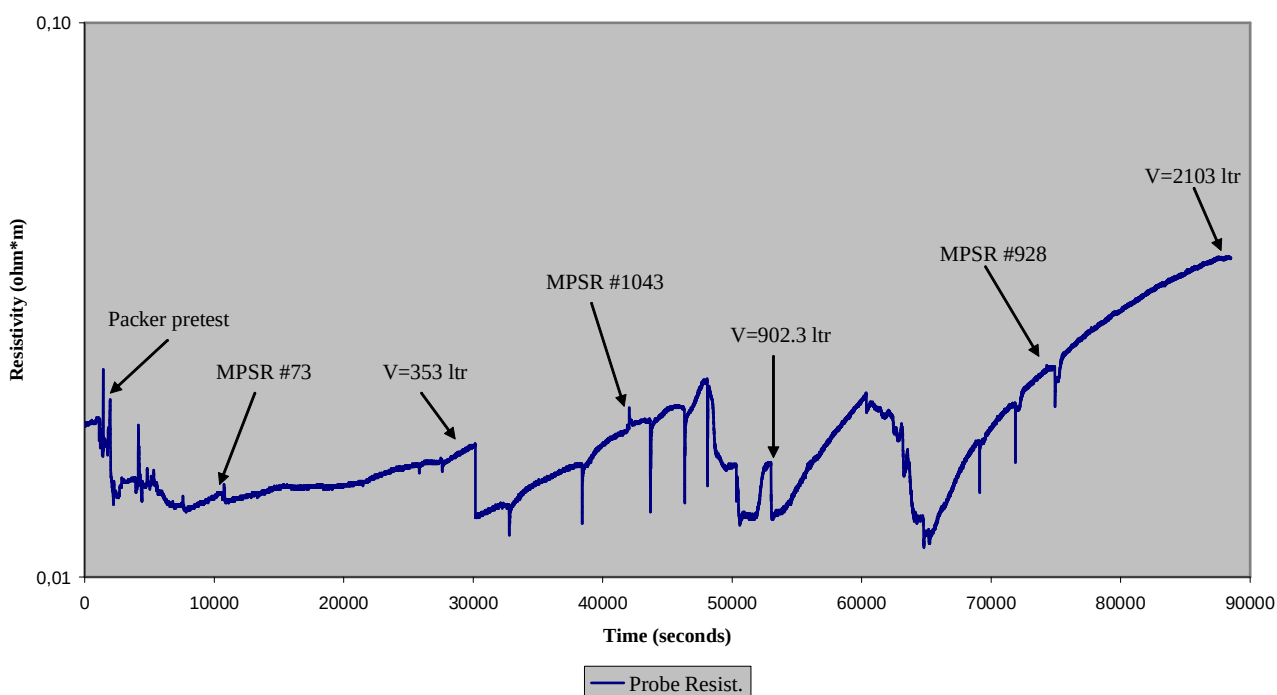


Figure 6-13: Resistivity development at 4230-4230.55m MD

6.3 Offshore WFT Fluid Transfer

Oilphase transferred most of the MDT samples offshore (Ref./2/), but some samples were sent directly to Petrotech (Ref./10/) for transfer and analysis. In Table 6-3 are given a complete list of the samples taken by MDT.

Sample No.	Sample Date	MDT Bottle No.	Sample Nature	Sample Point	Transfer company	Bottle No.
Run 2B (open hole, formation water)						
1.01	29.08.05	MPSR 036	Bottomhole Sample	4231.4 m	Oilphase	CSB 4499-EA
1.02	29.08.05	MPSR 783	Bottomhole Sample	4231.4 m	Oilphase	CSB 7007-MA
1.03	29.08.05	MPSR 756	Bottomhole Sample	4231.4 m	Oilphase	CSB 5661-EA
Run 2C (open hole, upper gas)						
1.04	02.09.05	MRSC 113	Atmospheric	4209.4 m	Oilphase	5 l plastic
1.05	02.09.05	MPSR 694	Bottomhole Sample	4209.4 m	Petrotech	N/A
1.06	02.09.05	SPMC 136	Monophasic Bottomhole Sample	4209.4 m	Oilphase	SSB 1561-EA
1.07	02.09.05	MPSR 974	Bottomhole Sample	4209.4 m	Petrotech	TS 83803
1.08	03.09.05	MPSR 801	Bottomhole Sample	4210.85-4211.86 m	Petrotech	TS 83303
1.09	03.09.05	SPMC 188	Monophasic Bottomhole Sample	4210.85-4211.86 m	Oilphase	SSB 9803-MA
Run 2D (open hole, lower gas)						
1.10	07.09.05	MPSR 768	Bottomhole Sample	4252.5-4253.5 m	Oilphase	4469-EA
1.11	07.09.05	MPSR 930	Bottomhole Sample	4252.5-4253.5 m	Oilphase	5992-MA
Run 2E (cased hole, formation water)						
1.12	01.10.06	MPSR 73	Bottomhole Sample	4230.0 – 4230.55 m	Petrotech	TS-85603
1.13	01.10.06	MPSR 1043	Bottomhole Sample	4230.0 – 4230.55 m	Petrotech	TS 83605
1.14	01.10.06	MPSR 928	Bottomhole Sample	4230.0 – 4230.55 m	Petrotech	PT 2130

Table 6-3: Sample list of transferred PVT bottles from the MDT sampling

In **run 2B** the samples were transferred to Oilphase conventional sample bottles (CCB). A small volume of sample 1.03 (MPSR #756) was flashed into a 1 liter glass bottle at the rig and analyzed offshore for chloride by MI and to Schlumberger for resistivity analysis. Not enough gas was available from the sample to perform any analysis on the gas from the sample.



The large 2 ¾ gallon chamber MRSC #113 (**run 2C**) was drained directly into a large 5 liters plastic container. The total sample volume was 1.7 liters where 1.5 liters were water and 0.2 liter was 'oil'. The gas was delivered the mudlogger offshore for GC analysis. Schlumberger analyzed the water for pH and resistivity.

Oilphase transferred the single-phase samplers (SPMC) offshore, while the MPSR sample bottles were sent directly to Petrotech by a chartered helicopter (**run 2C**).

Oilphase transferred the samples taken in **run 2D** offshore.

All samples from the cased hole MDT (**run 2E**) was sent to Petrotech for transfer and analysis.

7 Wireline Formation Tester, minitest

Two minitests were performed, using the MDT tool, in the Stetind well. One minitest was performed at 4209.4 m MD RKB (run #2C) through a large diameter probe, while the other minitest was performed over the interval 4210.85-4211.86m MD RKB (run #2C) using the dual packer module. The sequences of events for the MDT operations are given in appendix 13.10.1.

7.1 Interpretation, Large Diameter Probe minitest @ 4209.4m MD RKB

Figure 7-1 shows the pressure and pumping rate during the single probe minitest. The last build-up, which was also the longest, is analyzed. The rate history was made using cumulative pumped volume and pressure (Table 7-2).

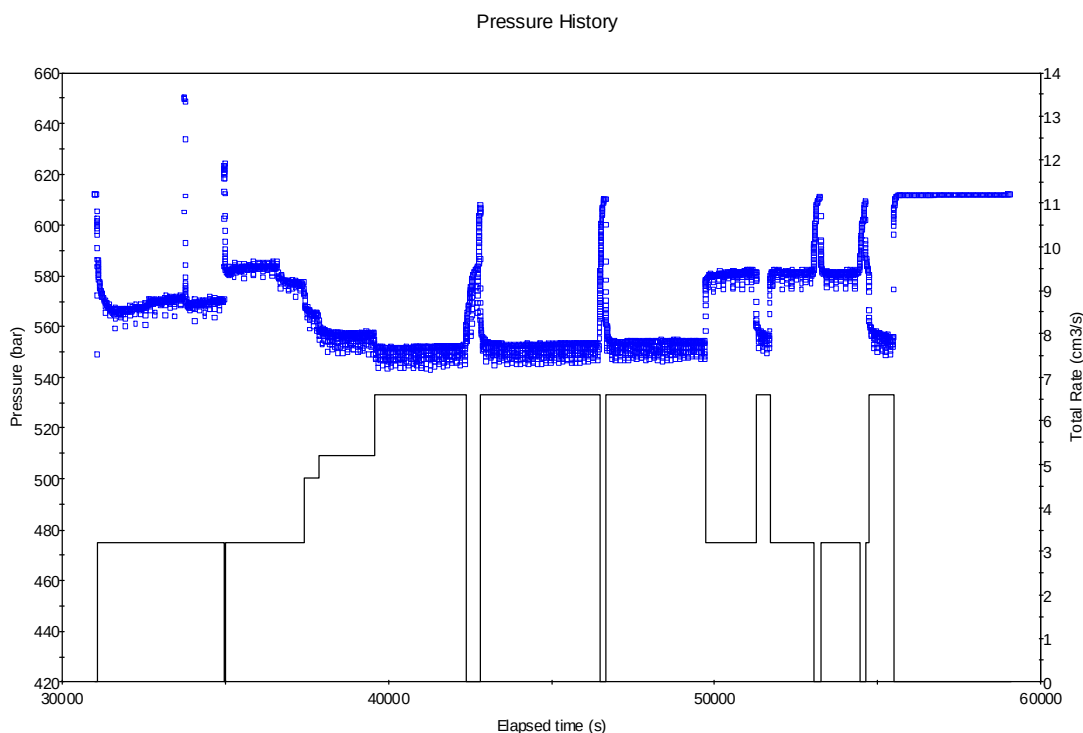


Figure 7-1: Pressure and pumping rate, single probe

The log-log plot of the pressure build-up is shown in Figure 7-2. The interpretation of the pressure data shows that it is difficult to find a model where the early time data fit the observed pressure, the reason for this can be the near well bore effects. The data have a fairly well defined radial flow period, which gives a permeability thickness of 2 mDm and a permeability of 0.5 & 0.9 mD using a production height of 4.1 and 2.2 m respectively. This permeability-thickness estimate is somewhat lower than the interpretations from the dual-packer minitest (see next Chapter) and the production test (see section 8.3). The skin value is



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high (310), high values are often seen with single probe test, as there is a large geometrical skin factor. The results from the interpretation are given in Table 7-3.

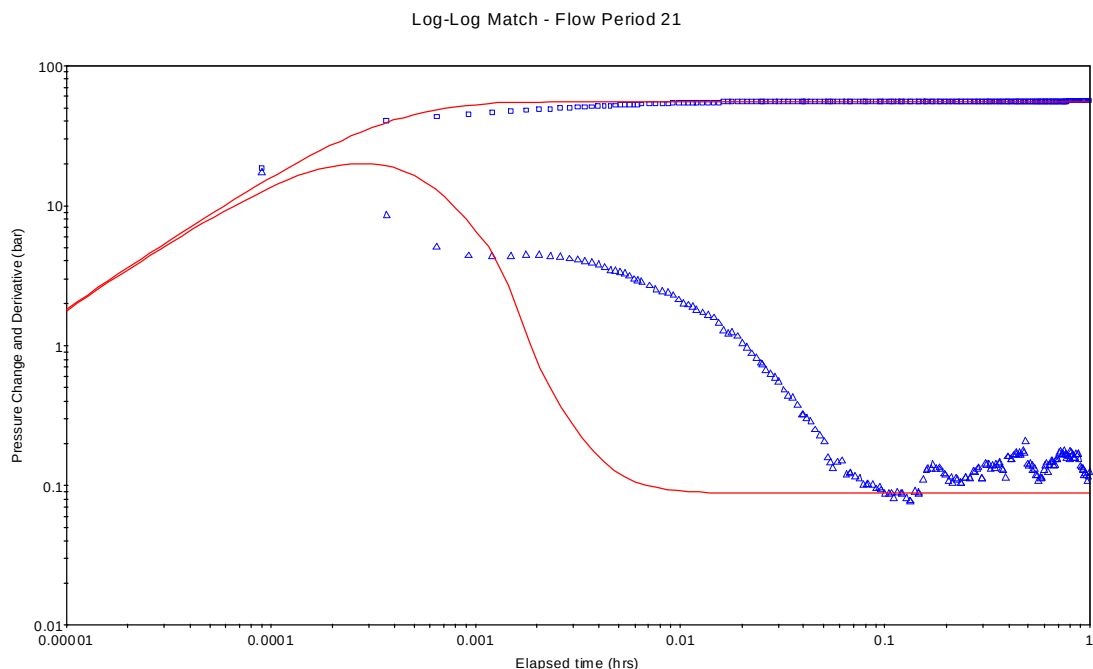


Figure 7-2: Log-log and derivative plot of the pressure build-up

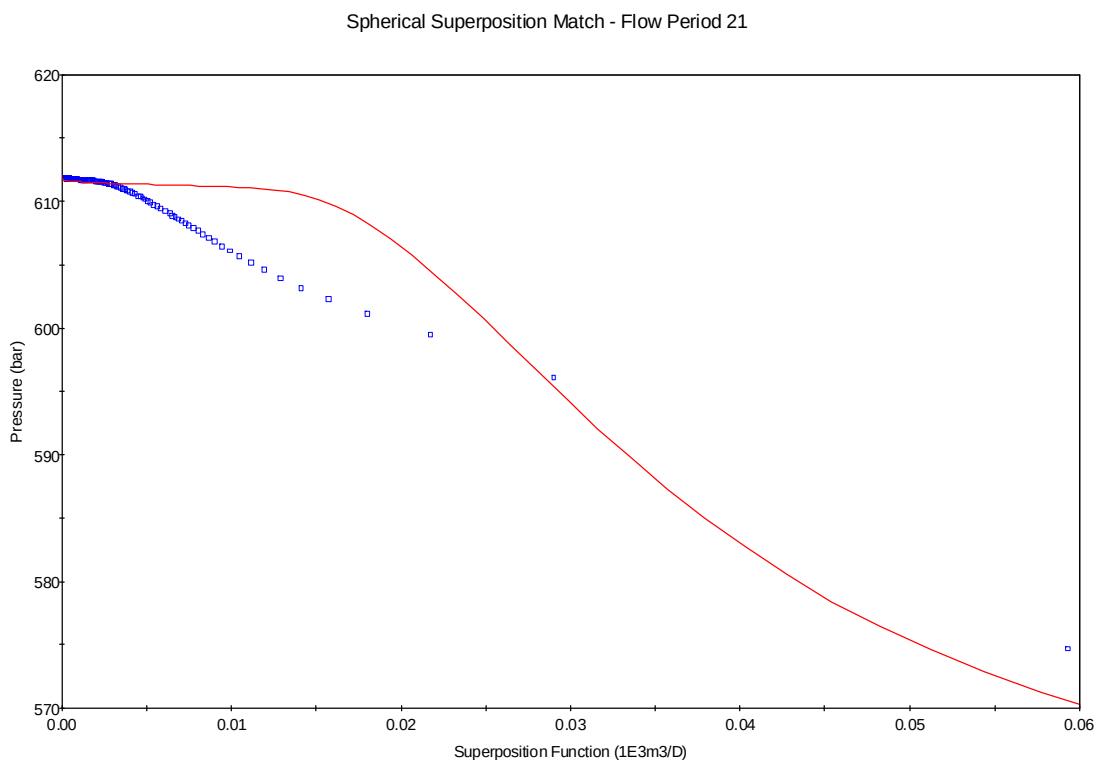


Figure 7-3: Superposition plot of the last pressure build-up

The extrapolated pressure in the superposition plot in Figure 7-3 gives a pressure of 611.8 bar (@ 4209.4 m MD RKB), which is assumed to be a good estimate of the reservoir pressure.

Figure 7-4 shows a comparison between the simulated and the measured reservoir pressure. There is good agreement during the last flow and pressure build-up periods. The difference in the earlier flow periods is most likely changing skin due to clean-up.

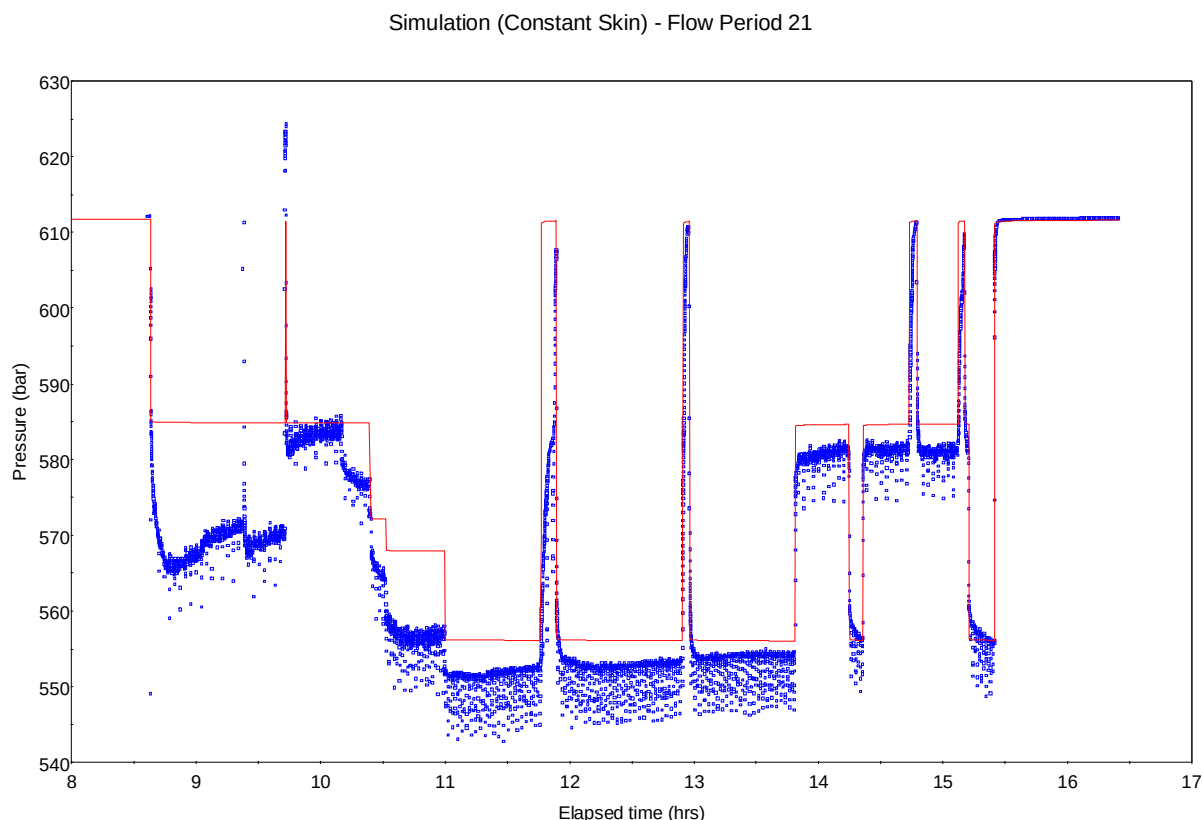


Figure 7-4: Simulated (red curve) and observed bottom hole pressures

Parameter	Value
Porosity, ϕ (fraction)	0.15
Production height, h (m)	4.1 & 2.2
Well radius, r_w (m)	0.108
Gas viscosity, μ (cp)	0.033
Total compressibility, c_t (bar^{-1})	0.00048

Table 7-1: Input parameters for the analysis

Table 7-2 shows the pumping rates and durations used in the analysis. Table 7-1 lists the input parameters for the interpretation.



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Flow period			Duration (hrs)	Gas rate, q_g (m ³ /d)
	Start time	End time		
1	05/09/05 00:00:00	05/09/05 08:38:07	8.635	0
2	05/09/05 08:38:07	05/09/05 09:42:52	1.079	0.276
3	05/09/05 09:42:52	05/09/05 09:43:23	0.009	0
4	05/09/05 09:43:23	05/09/05 10:10:20	0.449	0.276
5	05/09/05 10:10:20	05/09/05 10:23:57	0.227	0.276
6	05/09/05 10:23:57	05/09/05 10:31:34	0.127	0.406
7	05/09/05 10:31:34	05/09/05 10:59:56	0.473	0.449
8	05/09/05 10:59:56	05/09/05 11:46:15	0.772	0.570
9	05/09/05 11:46:15	05/09/05 11:53:49	0.126	0
10	05/09/05 11:53:49	05/09/05 12:54:33	1.012	0.570
11	05/09/05 12:54:33	05/09/05 12:57:56	0.056	0
12	05/09/05 12:57:56	05/09/05 13:48:51	0.849	0.570
13	05/09/05 13:48:51	05/09/05 14:14:53	0.434	0.276
14	05/09/05 14:14:53	05/09/05 14:21:34	0.112	0.570
15	05/09/05 14:21:34	05/09/05 14:44:04	0.375	0.276
16	05/09/05 14:44:04	05/09/05 14:47:34	0.058	0
17	05/09/05 14:47:34	05/09/05 15:07:27	0.331	0.276
18	05/09/05 15:07:27	05/09/05 15:10:42	0.054	0
19	05/09/05 15:10:42	05/09/05 15:12:27	0.029	0.276
20	05/09/05 15:12:27	05/09/05 15:25:00	0.209	0.570
21	05/09/05 15:25:00	05/09/05 16:24:48	0.997	0

Table 7-2: Pumping rates and durations

Table 7-3 shows the results from the interpretation of the single probe test.

Results	h=4.1m	h=2.2m
Initial reservoir pressure, P_i (bar) @ 4209.4 m MD RKB,	611.8	611.8
Last well flowing pressure, P_{wf} (bar)	556.1	556.1
Permeability thickness product, kh (mDm)	2	2
Permeability, k (mD)	0.5	0.9
Skin, s	311	310
Radius of investigation, r_i (m)	16	22
Pressure drop due to skin, Δp_s (bar)	55	55

Table 7-3: Results from the interpretation of the single probe test

7.2 Interpretation, Dual Packer minitest @ 4210.8-4211.8m MD RKB

Figure 7-5 shows the pressure and pump rate the minitest over the interval 4210.8-4211.8 m MD RKB. The rate history was made using cumulative pumped volume and pressure (Table 7-4). On the pressure build-up there are a few “mini-draw downs” (Figure 7-6). The pressure anomalies are most likely caused by adjusting packer pressure.

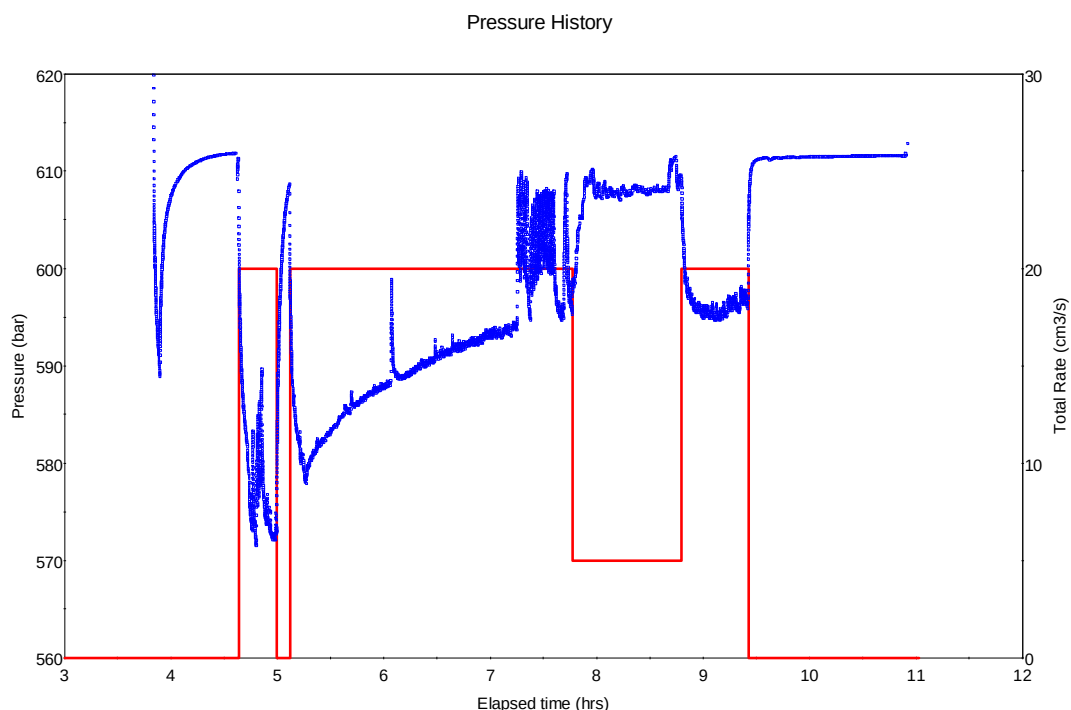


Figure 7-5: Rate history - dualpacker minitest

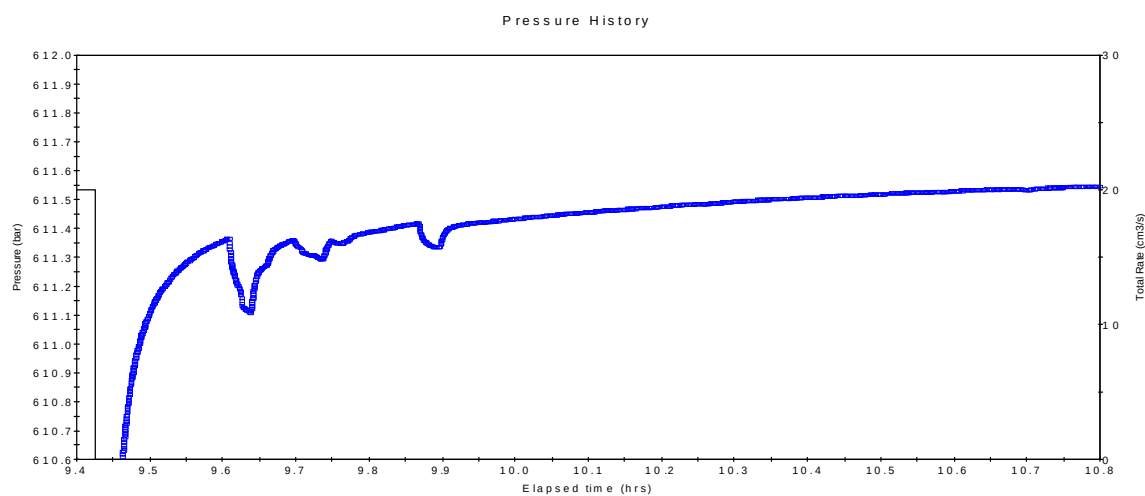
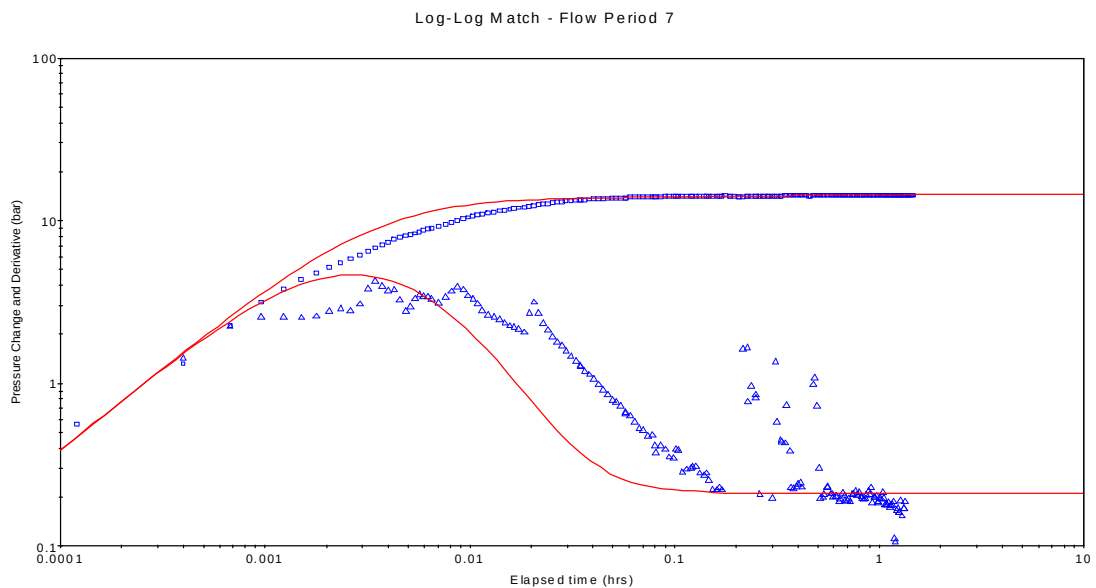


Figure 7-6: Pressure versus time during the pressure build-up

Flow period			Duration (hrs)	Gas rate, q_g (m ³ /d)
	Start time	End time		
1	05/09/05 00:00:00	05/09/05 04:38:20	4.639	0
2	05/09/05 04:38:20	05/09/05 04:59:50	0.358	1.728
3	05/09/05 04:59:50	05/09/05 05:06:56	0.119	0
4	05/09/05 05:06:56	05/09/05 07:46:19	2.656	1.728
5	05/09/05 07:46:19	05/09/05 08:47:51	1.026	0.432
6	05/09/05 08:47:51	05/09/05 09:25:33	0.628	1.728
7	05/09/05 09:25:33	05/09/05 10:54:09	1.600	0

Table 7-4: Pumping rate and durations, dual packer test

The log-log plot of the build-up (Figure 7-7) also shows these effects both in the early time data and in the radial acting period. The interpretation of the radial acting period gives a permeability height of 2.6 mDm. Using a production height of 4.1 and 2.2 m gives a reservoir permeability of 0.6 and 1.1 md respectively. This is slightly higher than the value from the single probe test. The calculated skin factor is 21 & 28, which is in the same order as the skin value from the initial build-up in the later production test (section 8.3). The results from the interpretation are given in Table 7-5. The same input parameters as for the probe minitest (Table 7-1) were used.


Figure 7-7: Log-log plot of the pressure and the derivative during the build-up

The extrapolated pressure in the superposition plot in Figure 7-8 gives a pressure of 611.8 bar (@ 4210.8 4211.8m MD RKB), which is the same pressure found from the single probe minitest.

Spherical Superposition Match - Flow Period 7

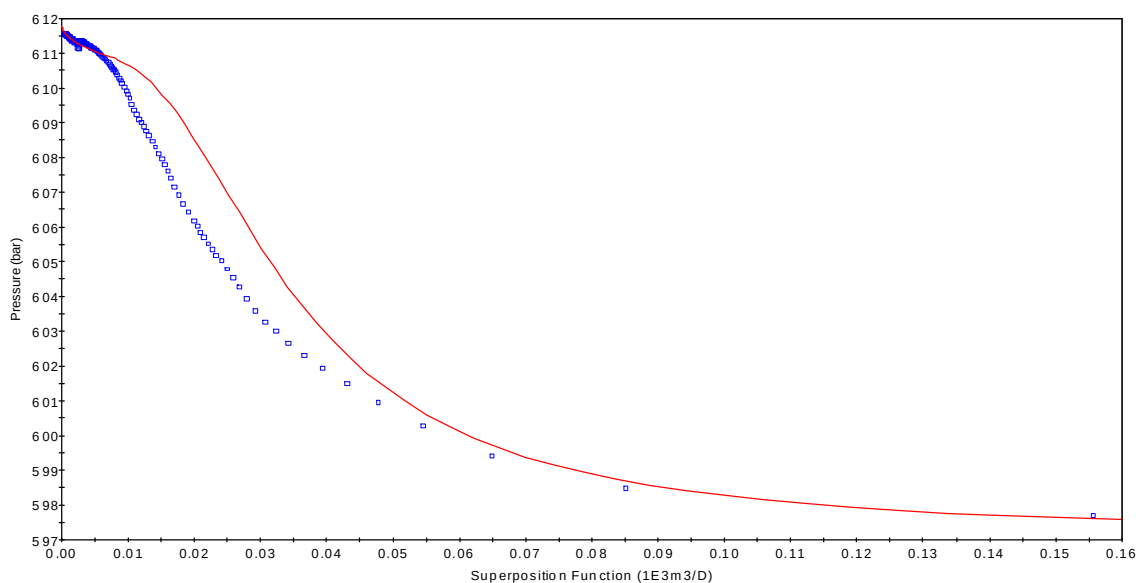


Figure 7-8: Superposition plot of the pressure build-up

Figure 7-9 shows the comparison between the simulated and the observed reservoir pressure response. There is a good agreement during the last flow and pressure build-up periods. The earlier periods are clearly showing that the reservoir is cleaning up.

Simulation (Constant Skin) - Flow Period 7

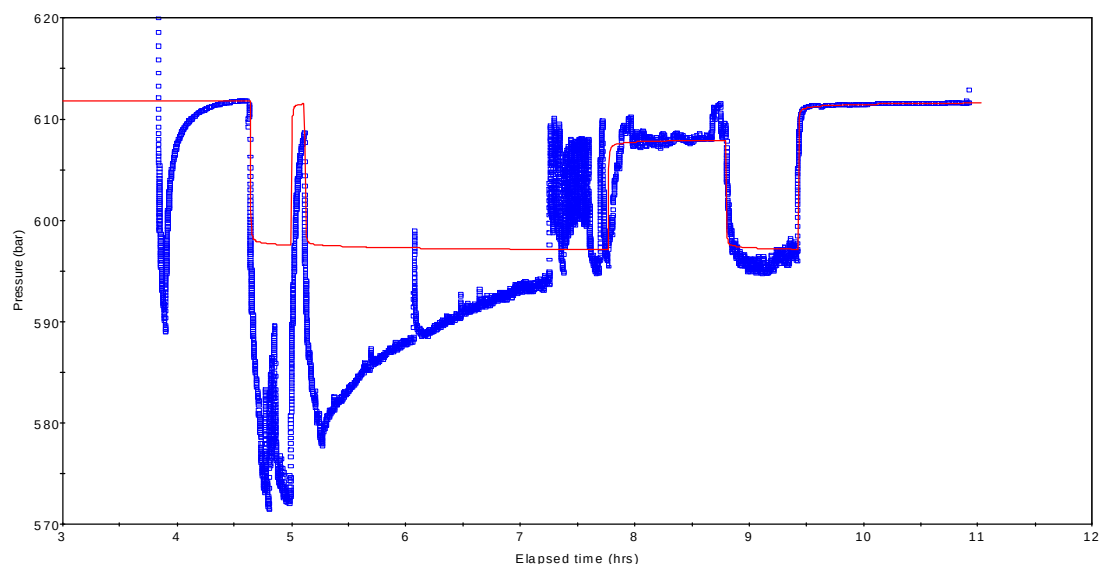


Figure 7-9: Simulated (red curve) and observed bottom hole pressures

Table 7-1 lists the input parameters for the interpretation, and Table 7-5 shows the results from the interpretation of dual packer test.

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Results	h=4.1m	h=2.2m
Initial reservoir pressure, P_i (bar) @ 4210.8-4211.8 m MD RKB,	611.8	611.8
Last well flowing pressure, P_{wf} (bar)	597.1	597.1
Permeability thickness product, kh (mDm)	2.5	2.5
Permeability, k (mD)	0.6	1.1
Skin, s	29	29
Radius of investigation, r_i (m)	21	28
Pressure drop due to skin, Δp_s (bar)	13	12

Table 7-5: Results from the interpretation of the dual packer test

8 Evaluation of the production test

One production test (4184.0 – 4211.5 m MD RKB) was performed in the gas bearing section of the Lysing Formation. This chapter contains the data acquisition and test interpretation.

8.1 Operations Summary

The operations started with picking up TCP guns commenced at 12:50 on September 15th. The detailed Sequence of events as per Power Well Service well test report, Ref./13/, and test string configuration are presented in Appendix 13.10.2 and 13.9 respectively). The well was displaced to 1.62 calcium-bromide brine prior to running in with the test string.

The 3 ½” test string was run without problems, dummy fluted hanger run and pulled back to space out. Ran in hole with landing string consisting of a sub sea test tree (SSTT), retainer valve and lubricator valve (LV). The operations had to be stopped at this point as the weather was closing in. The lubricator valve was broken out and the test string was crossed over to drillpipe and landed off in the wear bushing. Operations were suspended from 11:00 19th to 07:30 20th September.

Operations were continued and the remainder of the landing string run in hole. The surface test tree head was made up and kill/flow Coflexip hoses connected. Final pressure tests of the landing string flow head and the surface lines were completed. The packer was set at 23:05 on 20th September and a 35 bar packer integrity test was performed with good results. A second wire line correlation run was made to confirm that the TCP guns were located at the correct depth. The top shot was confirmed to be at 4184 m MD RKB. The string was displaced with 17.4 m³ 60/40 glycol-water mixture via the OMNI-valve to create the required underbalance during perforation.

The test string was pressured up to 500 bar to activate the TDF firing head and then bled back to 80 bar at the choke manifold to get the required under-balance. The well was **perforated** at 12:45 21th September against closed choke manifold.

The well was opened for the **initial flow** at 12:46 on a 16/64” adjustable choke at the choke manifold. The choke size was increased to 100/64” before the well was shut in down hole at the LPR-N valve for the **initial build-up**.

Perforated interval	4184.0 – 4211.5 (4156.1 - 4183.6) m MD RKB (m TVD MSL)
Perforating guns	Halliburton tubing conveyed guns, 4 5/8” 12 sfp 60 deg phasing HMX Millennium charges
Underbalance	Approximately 65 bar (60/40 water-glycol cushion, well displaced to 1.62 calcium-bromide brine)
Packer depth	4161.1 m MD RKB
Tubing	3 ½ “ below seabed, 4 ½ “ landing string

Table 8-1: Completion data

During the initial flow the well was flowed through the separator and all fluids flowed into the calibration tank. Fluids from the calibration tank was later transferred to slop tanks, there was no discharge of fluids throughout the whole test.

After an initial build up of two hours the well was reopened for **main flow** on a 16/64” adjustable choke at the heater and gradually increased to a 68/64” adjustable choke with flow diverted via the steam heat exchanger and the test separator. The gas was flared and all fluids diverted to the calibration tank.

Chemicals (glycol at the SSTT and methanol at the LV) had to be injected because the well head temperatures continued to be low also after the cushion was recovered. The methanol was first substituted with glycol so that sampling could commence; the injection at the SSLV was slowly reduced and finally stopped completely. Injection at the SSTT was maintained at 3.7 l/min throughout the whole test except for a ten minutes period when the pump lost suction. During these ten minutes the sonic sand detector picked up signs of solids in the flow, once injection was re-established this disappeared. This was probably an indication of hydrate forming; the flowing condition was very close to the hydrate envelope.

When the sampling was started it was clear that it would be impossible to collect PVT sample sets as the condensate rate was too low. Sampling from the min-lab at the Thornton manifold also proved difficult.

A severe gale warning was issued during the main flow period and it was therefore decided to stop the main flow prematurely. After a main flow period of 33 hrs the well was shut in down hole for the **main build-up** period. The LPR-N valve proved to be closing in steps and the valve did not close completely until after approximately one hour (see Figure 8-6). This had a severe effect on the early time pressure build-up data (ref. Chapter 8.3). An investigation showed that the sealing area in the valve was damaged (Figure 8-1 and Ref./15/).



Figure 8-1: LPR-N ball valve after test



After a pressure build-up of 68 hours a mini-frac program was carried out. The string was filled with 1.62 SG mud. The mini-frac program was completed with four cycles at 75, 100, 160 and 400 l/min. The results and pressure plots over the mini-frac cycles can be seen in chapter 9. At the end of the mini-frac, the well was flow checked and found OK. After the complete test string was out of the hole the well was permanently plugged and abandoned.

8.2 Summary of data acquisition and production data

An overview of the data acquisition during the test is presented in Table 8-2. The test consisted of two flow and build-up periods (initial and main); ref. Table 8-3. A multirate flow was planned, but due to low productivity this was cancelled. It would be impossible to obtain stable flow and rate measurements for several flows with lower flowrates than what was obtained in main flow (app. 100 000Sm³/d).

Surface data acquisition	- 'Standard' surface data acquisition system - Sandec
Bottom hole gauges	- 6 x Spartek Quartz gauges. Placed in a carrier above the packer. Ported to the tubing. - 2 x Spartek Sapphire gauges. Placed in a carrier above the packer. Ported to the annulus.
Sampling	- Gas samples at the WH - Trace elements at the separator - Other samples at the separator

Table 8-2: Summary of data acquisition during the test

Event	Start (date& start time)	Duration (hrs:min)
Perforating	21.09.05 12:45	-
Initial flow	21.09.05 12:46	0:20
Initial build-up	21.09.05 13:06	1:57
Main flow	21.09.05 15:03	23:59
Main build-up	23.09.05 00:07	68:39
Minifrac	25.09.05 21:57	2:23

Table 8-3: Main events of the test

8.2.1 Production data

Bottomhole pressure and temperature are presented in Figure 8-2, and bottomhole pressure and gas rate are shown in Figure 8-3. A steadily falling gas rate combined with a very low bottomhole pressure is observed. The pressure at the wellhead was only 20-30 bar. Figure 11-3 shows gas rate and GCR during main flow. The combination of low gas rate and dry gas caused that no condensate rates could be measured at the test separator. The CGR presented



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in Figure 11-3 are taken from the Petrotech mini-lab measurements (Ref./8/). The surface production data and gauge data are reported in Ref./13/ and Ref./14/, and a summary of key data is given in appendix 13.4 and Table 8-4. The gauge data are evaluated in Chapters 8.3 (pressure) and 9 (temperature).

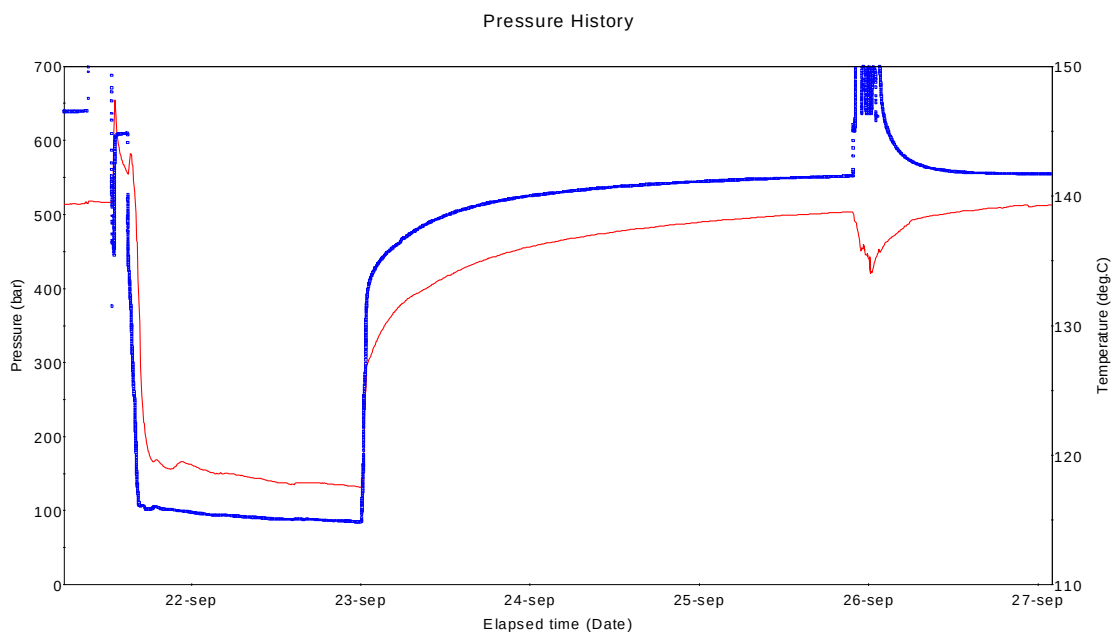


Figure 8-2: Bottomhole pressure (blue) and temperature (red)

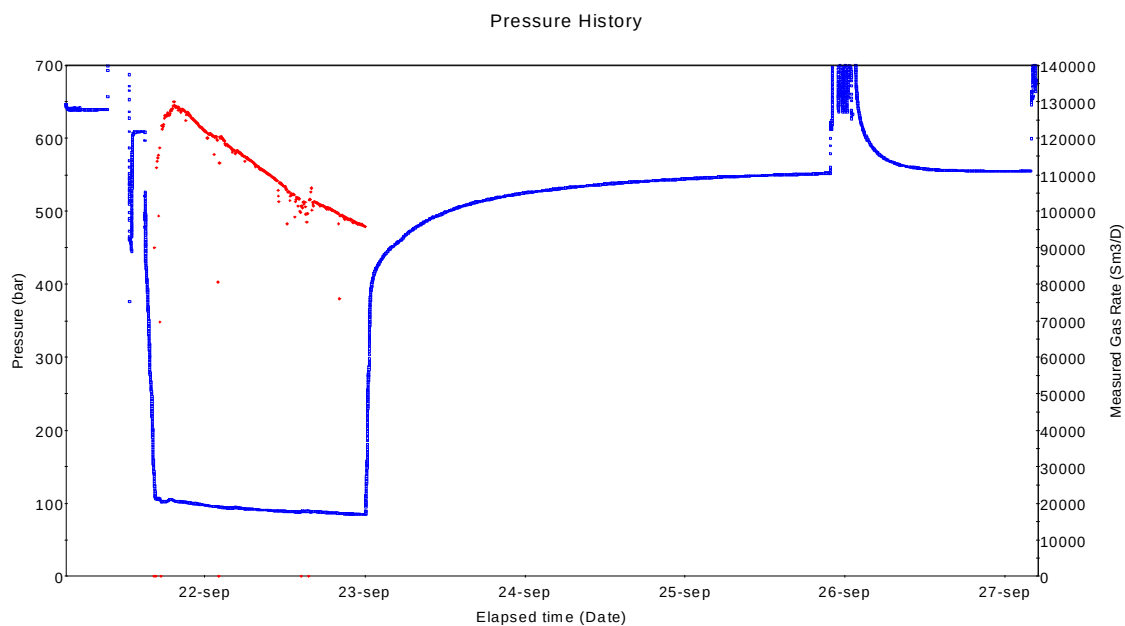


Figure 8-3: Botthole pressure and gas rate

Production data (Main flow - 22/9 18:00)	
Choke size (inch) (heater choke)	1
Gas rate, q_g (Sm ³ /d)	101 000
Condensate rate, q_c (Sm ³ /d)	~ 0.4
GCR (Sm ³ / Sm ³) (Petrotech)	230 000
Water rate, q_w (Sm ³ /d)	< 6
BHP (bar) (Spartek gauge 20396)	87.4
BHT (°C) (Spartek gauge 20396)	117.8
WHP (bar)	24.1
WHT (°C)	9.1
P_{sep} (bar)	10.8
T_{sep} (°C)	12.3
BSW (%)	12% condensate 88% water
Sand production – (kg/d) (Sandec)	0
Fluid data (Petrotech)	
H ₂ S (ppm)	4 - 5
CO ₂ (%)	6.5
Gas gravity, ρ_g (air = 1)	0.62
Condensate density at 15 °C, ρ_o (g/cm ³)	0.84

Table 8-4: Key production figures

8.2.2 Fluid sampling

The sampling performed by Petrotech is reported in Ref./8/. As previously mentioned, no condensate rates could be measured at the test separator. Hence, no samples for recombination could be taken. To avoid hydrates, glycol had to be injected into the well stream at all times.

The results from the gas trace elements analysis and mini-lab sampling are given in Chapters 11.1 and 11.2. A summary is presented in Table 8-4.

8.3 Analytical Test Interpretation

The test interpretation was performed using the transient interpretation software Interpret. The pressure gauge 20396 was selected for the analysis.

8.3.1 Gauge Evaluation

Eight pressure gauges were run in two gauge carriers. Two of the gauges were reading the annulus pressures while the other six were ported to the tubing and were measuring the formation pressure (Table 8-5). All the pressure gauges worked well during the duration of the test. The six Spartek gauges ported to the tubing were compared and the result is shown in Figure 8-4.

The pressure gauges all show good pressure readings and are all suitable for analysis (Figure 8-4). The pressure gauge no. 20396 - the reference gauge in Figure 8-4 - is also used for the test analysis. The pressure gauges #20396 together with the gauge # 20406 also have the highest sampling rates, every 2 seconds.

Gauge	Sensor depth (m MD RKB (m TVD MSL))	Comments
Spartek sapphire # 77415	4152.7 (4124.9)	Annulus, worked ok
Spartek sapphire # 77289	4152.7 (4124.9)	Annulus, worked ok
Spartek quartz # 20406	4153.2 (4125.4)	Tubing, worked ok
Spartek quartz # 20396	4153.2 (4125.4)	Tubing, worked ok
Spartek quartz # 20398	4156.3 (4128.5)	Tubing, worked ok
Spartek quartz # 20397	4156.3 (4128.5)	Tubing, worked ok
Spartek quartz # 20356	4156.9 (4129.1)	Tubing, worked ok
Spartek quartz # 20429	4156.9 (4129.1)	Tubing, worked ok

Table 8-5: Gauges used in test

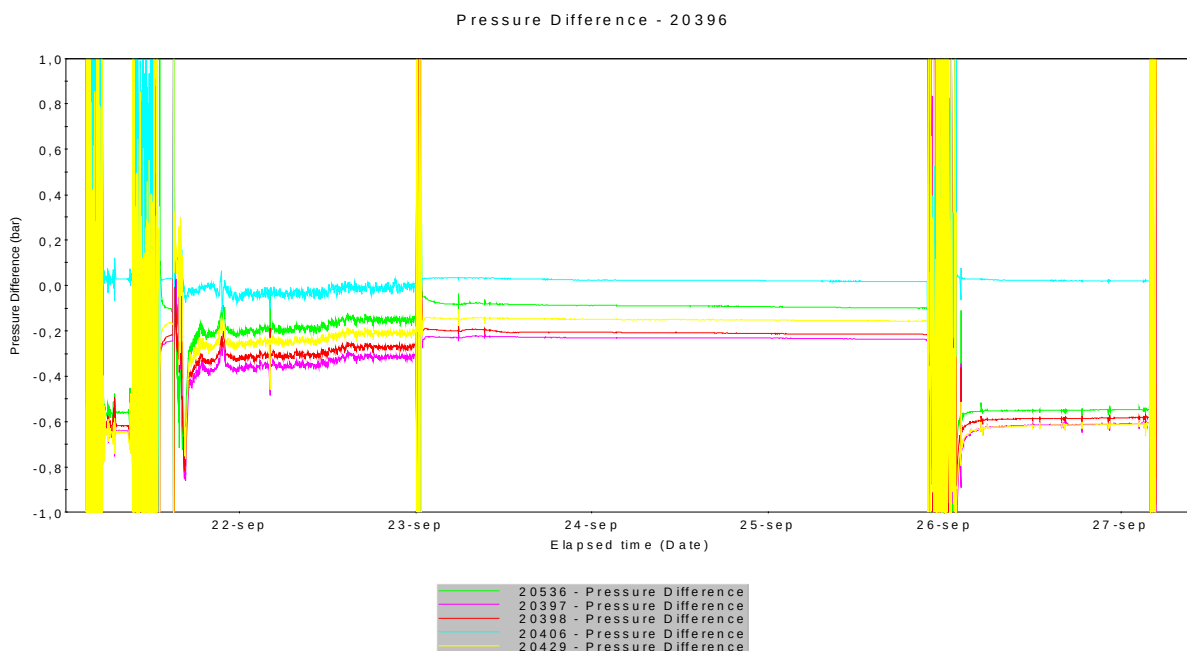


Figure 8-4: Gauge comparison (reference gauge #20396)

8.3.2 Rate history and test interpretation parameters

The rate history was prepared using the separator gas rate and bottom hole pressure and is shown in Table 8-6 and Figure 8-5. The gas rate was estimated for the periods when no



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separator data was available. For initial flow the rate tuned until the derivative for both initial and main build-up matched (see (Figure 8-7)).

The input parameters for the test interpretation are presented in Table 8-7. These are based on average petrophysical parameters and PVT. The largest uncertainty is related to the height. The interval 4184-4211.5m MD was perforated in the Lysing formation. However, only a few intervals contribute to the flow. Using net pay a height of 2.6 m is achieved, while net sand gives 6 m. Both these heights are used in the analysis.

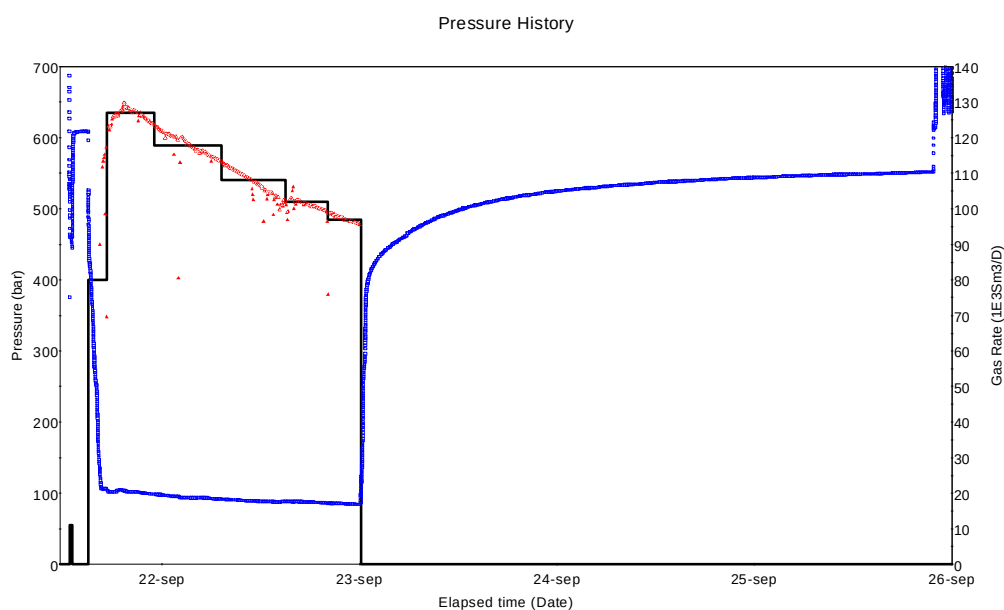


Figure 8-5: Rate history and bottomhole pressure

Flow period	Start time	End time	Duration (hrs)	Gas rate, q_g ($\text{Sm}^3 \times 10^3/\text{d}$)
1	15/09/05 00:00:00	21/09/05 12:46:15	156.7707	0
2	21/09/05 12:46:15	21/09/05 13:05:42	0.3244	11
3	21/09/05 13:05:42	21/09/05 15:01:00	1.9215	0
4	21/09/05 15:01:00	21/09/05 15:01:29	0.0082	0
5	21/09/05 15:01:29	21/09/05 17:18:40	2.2862	80
6	21/09/05 17:18:40	21/09/05 23:01:09	5.7081	127
7	21/09/05 23:01:09	22/09/05 07:14:09	8.2167	118
8	22/09/05 07:14:09	22/09/05 15:00:09	7.7667	108
9	22/09/05 15:00:09	22/09/05 20:08:39	5.1417	102
10	22/09/05 20:08:39	23/09/05 00:08:44	4.0015	97
11	23/09/05 00:08:44	25/09/05 21:45:58	69.6206	0
12	25/09/05 21:45:58	29/09/05 04:31:59	78.7669	0
12	25/09/05 21:45:58	21/09/05 12:46:15	156.7707	0

Table 8-6: Rate history

Parameter	Value
Porosity, ϕ (fraction)	0.15
Production height, h (m)	2.6 to 6
Well radius, r_w (m)	0.108
Gas formation factor, B_g (rm ³ /Sm ³)	0.0031
Gas viscosity, μ (cp)	0.033
Total compressibility, c_t (bar ⁻¹)	0.00048

Table 8-7: Input parameters

8.3.3 Main build-up

The beginning of the main build-up was influenced by a leaking downhole tester valve (LPR-N); the valve closed in steps, see Figure 8-6 and Figure 8-7. Debris probably got caught between the sealing area and the ball, during the build-up this was slowly washed away and made the valve close in steps until it closed completely. The first half hour of the early data are influenced by the leaking valve.

On the log-log plot radial flow start to develop after approximately 2-3 hours in the main build-up (Figure 8-7). However, using also the initial flow we see that radial flow occur after 0.3-0.5 hrs. An increase in the derivative after 3-4 hours indicates presence of a no-flow boundary. In addition to this it was necessary to introduce additional two no-flow boundaries in order to match the initial pressure (Chapter 8.3.4, Figure 8-9 and Figure 8-10); there is no evidence for depletion in the data. The model used for matching is a homogenous model with wellbore storage and an open ended rectangle with 3 no-flow boundaries. A large reduction in skin from initial to main build-up can be seen comparing the Δp curves in Figure 8-7.

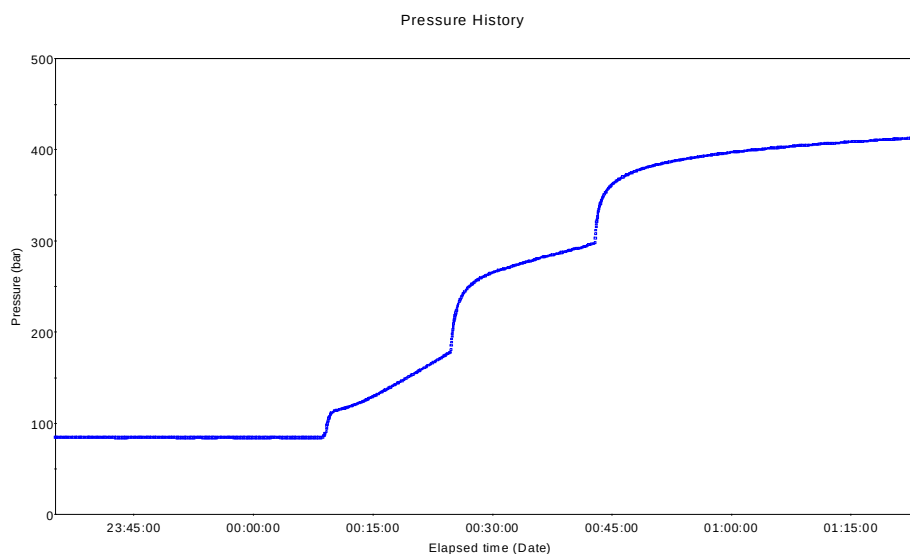


Figure 8-6: Pressure development at the start of main build-up

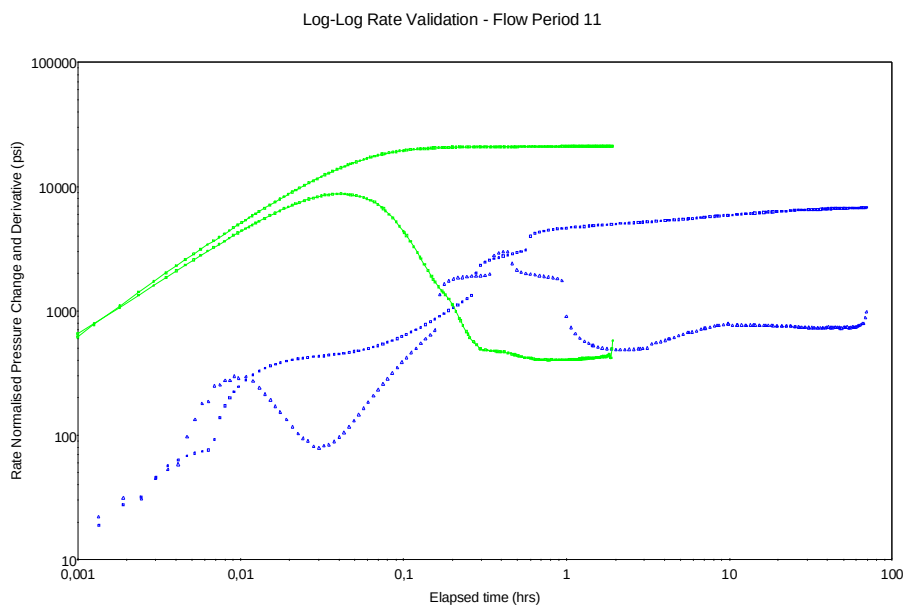


Figure 8-7: Log-log rate validation of initial and main build-up

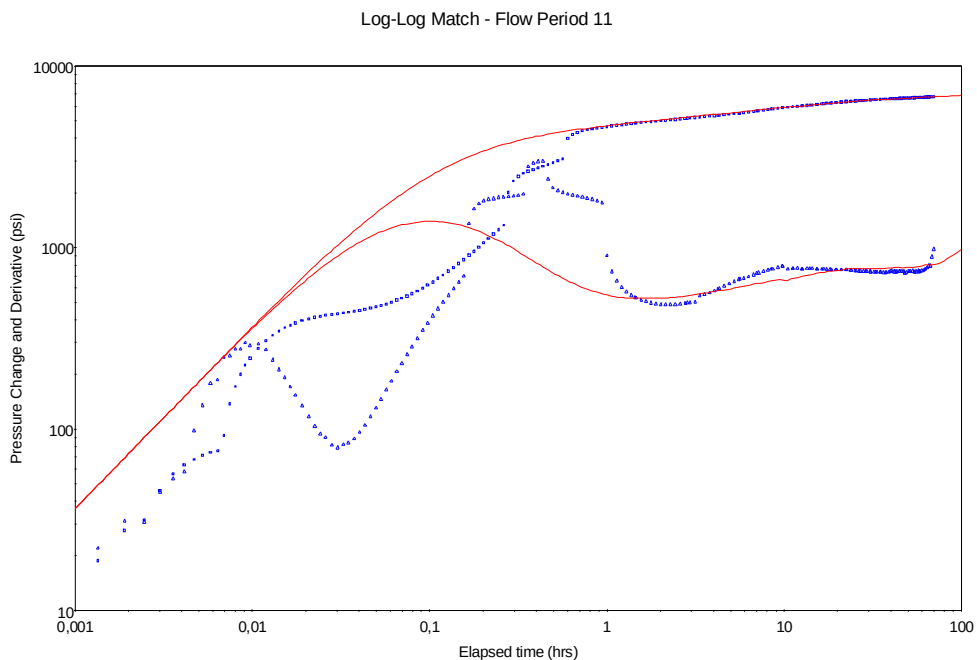


Figure 8-8: Log-log plot of main build-up

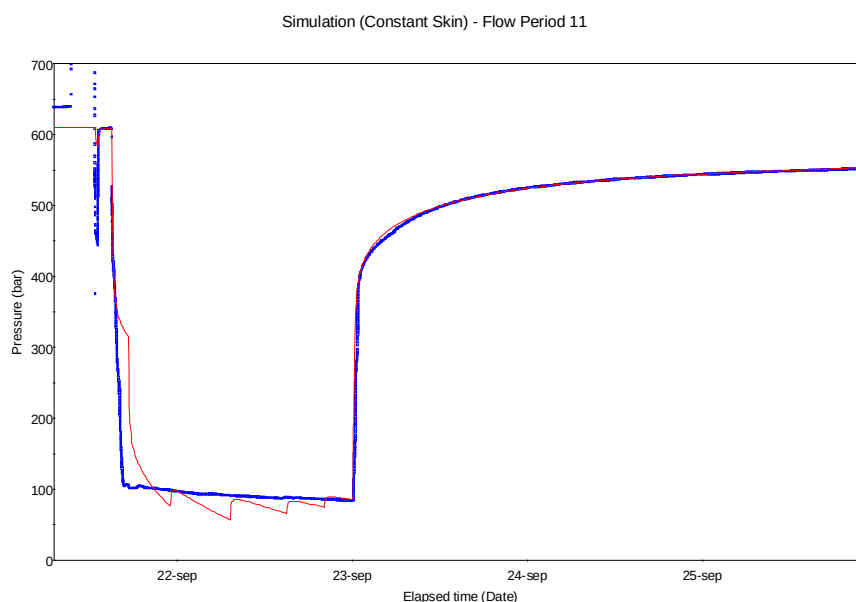


Figure 8-9: Simulation plot (based on main build-up)

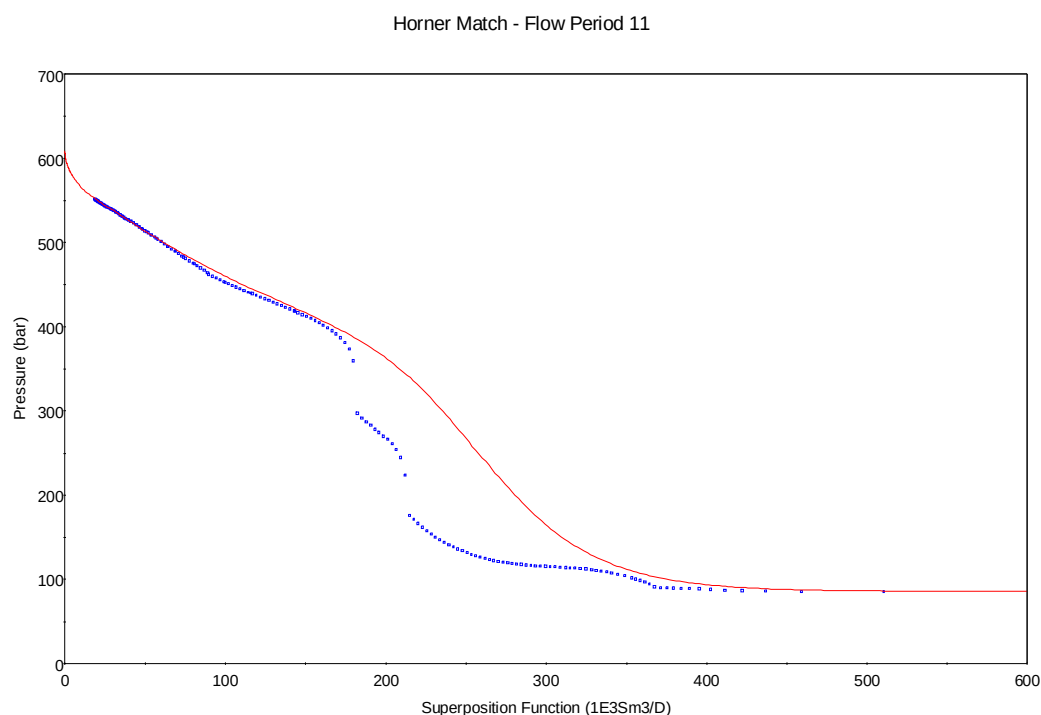


Figure 8-10: Superposition plot of main build-up

A fairly good matched is achieved for the late time data ($t > 1$ hr). Due to the leaking tester valve – ref. earlier discussion – it is not possible to match the early data. The interpretation gives a permeability-thickness product (kh) of 3.6 mDm and permeability between 1.4 to 0.4 mD using a height of 2.6 and 6 meters (net pay and net sand respectively). This agrees

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reasonable well with the kh obtained from the mini-tests performed with the MDT-tool in open hole.

The three no-flow boundaries are close to the wellbore: 20, 60 and 150 m using permeability of 1.4 mD. For lower permeability ($k = 0.4$ mD) the boundaries moves closer to the well: 13, 40 and 100 m. The results from the test interpretation are summarized in Table 8-8.

Main build-up	h=2.6m	h=6m
Initial reservoir pressure, P_i (bar) @ 4153.2m MD RKB	609.7	609.7
Permeability thickness product, kh (mDm)	3.6	3.6
Permeability, k (mD)	1.4	0.6
Skin, s	1.2	1.6
Wellbore storage, C (m^3/bar)	0.0048	0.0048
Distance to first no-flow boundary, d_1 (m)	20	13
Distance to second no-flow boundary, d_2 (m)	60	40
Distance to third no-flow boundary, d_3 (m)	150	100
Radius of investigation, r_i (m)	180	80
Last well flowing pressure, P_{wf} (bar) [gauge #20396]	85	85
Pressure drop due to skin, Δp_s (bar)	61	82

Table 8-8: Main results from the test interpretation (main build-up)

8.3.4 Initial build-up

In the log-log plot of the initial build-up two periods can be observed (Figure 8-7) wellbore storage period followed by a radial flow period starting at approximately 0.3hrs and lasting for almost one log cycle. It is also evident that the skin in the initial build-up is significantly higher than the main build-up (higher Δp).

The initial flow had duration of approximately 20 min, and the following build-up lasted for 2 hrs. It is uncertain if all the completion fluid (brine) was produced up and above the tester valve during the initial flow period. The pressure gradient used between the pressure gauge and the mid perforation could therefore be somewhat erroneous; the appropriate pressure gradient to use should be higher if some of the brine was left between the gauge and the perforated interval and hence made the column heavier. However, this error will have only minor importance.

The same model as for the main flow (kh and boundaries) was used when matching the initial build-up. Different values for skin (the well was not cleaned up; skin significantly reduced from initial to main build-up) and wellbore storage coefficient (no leaking tester valve) were used (Table 8-9). An iterative procedure with tuning boundaries for main build-up and matching the final part of the initial build-up to estimate initial pressure was performed. In the enlarged superposition plot (Figure 8-11) the pressure extrapolates to 609.7 bar. In Figure 8-12, Figure 8-13 and Figure 8-14 the matching of the initial build-up are presented.



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Extrapolation of the initial pressure from the production test, using the pressure gradient from the MDT measurements, 0.025 bar/m, gives a pressure of 610.8 bar at mid perforation, 4197.8m MD RKB. The extrapolated MDT pressure is approximately 612 bar at the same depth.

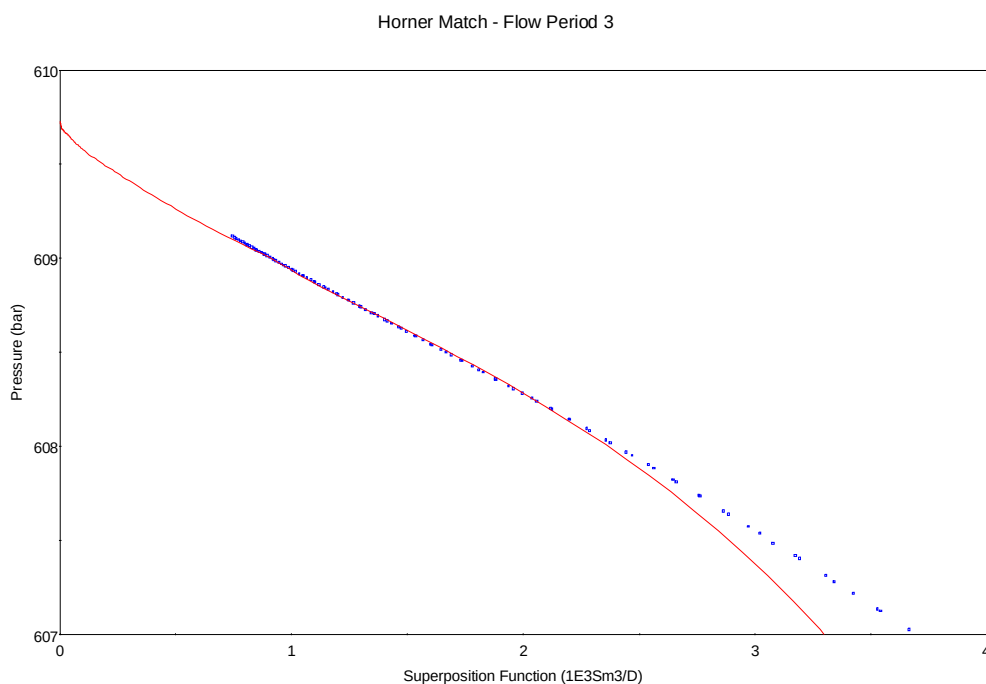


Figure 8-11: Enlarged superposition plot of initial build-up - extrapolation to initial pressure

Initial build-up	h = 2.6m	h=6m
Initial reservoir pressure, P_i (bar) @ 4153.2m MD RKB	609.7	609.7
Permeability thickness product, kh (mDm)	3.6	3.6
Permeability, k (mD)	1.4	0.6
Skin, s	24	24.4
Wellbore storage, C (m ³ /bar)	0.00029	0.00029
Distance to first no-flow boundary, d_1 (m)	20	13
Distance to second no-flow boundary, d_2 (m)	60	40
Distance to third no-flow boundary, d_3 (m)	160	105
Radius of investigation, r_i (m)	30	20
Last well flowing pressure, P_{wf} (bar) [gauge #20396]	444.5	444.5
Pressure drop due to skin, Δp_s (bar)	139	141

Table 8-9: Main results from the test interpretation (initial build-up)

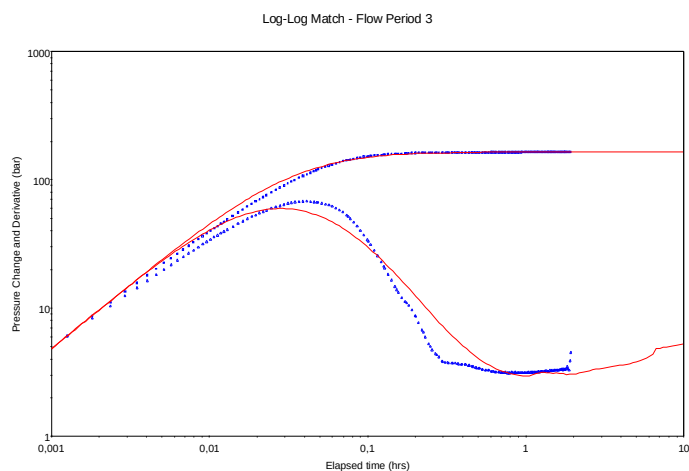


Figure 8-12: Log-log plot of initial build-up

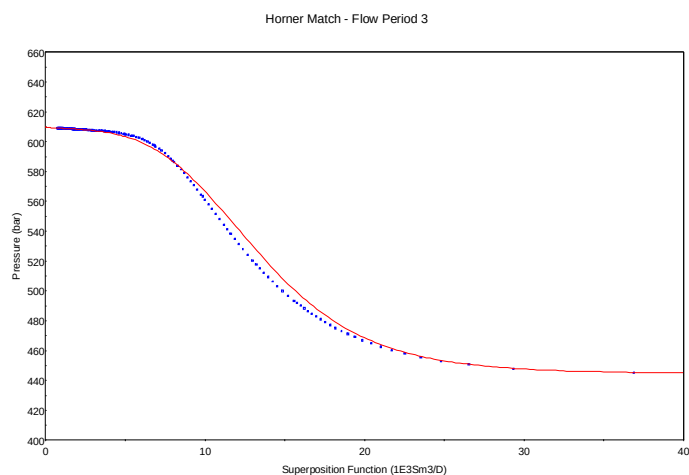


Figure 8-13: Superposition plot of initial build-up

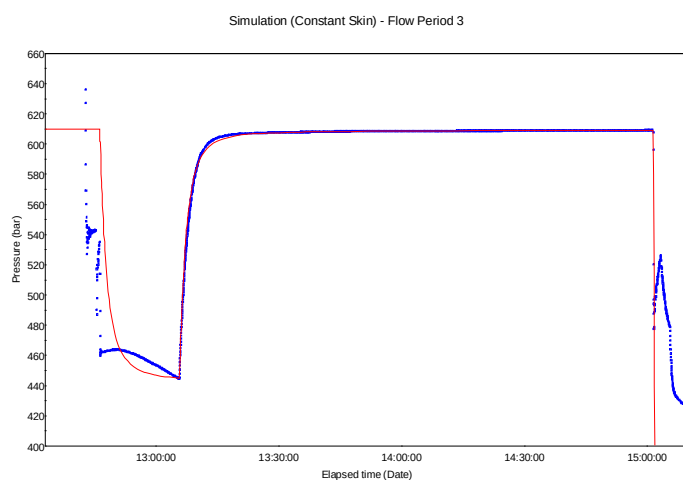


Figure 8-14: Simulation plot (based on initial build-up)

9 Formation Temperature Interpretation

The bottom hole temperatures were recorded both during the production test and during the different logging operations.

The drawdown during the production period was large, approximately 530 bar at the end of the main flow period. The expansion of the gas and subsequent cooling therefore had a strong effect on the flowing gas temperature. The last recorded flowing bottom hole temperature during the main flow was 116 degC (Figure 9-1) which is approximately 25-30 degC below the expected reservoir temperature. The temperature during the build-up is building up and approaching 140 degC.

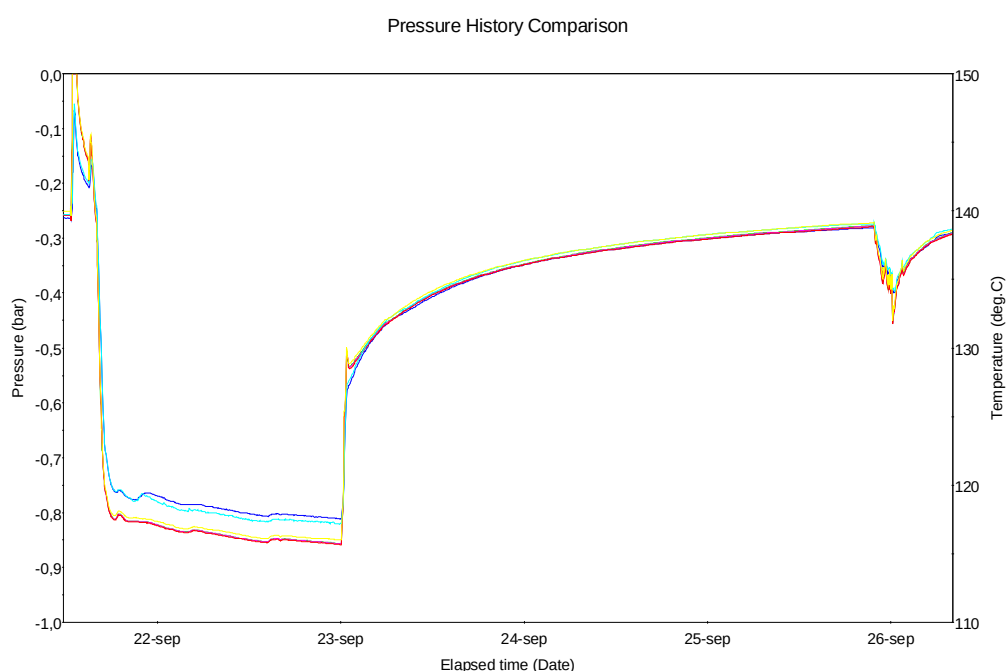


Figure 9-1: Temperature from the production test

The best estimate for the reservoir temperature is the recordings made during the cased hole MDT run. This recordings probably give the best representation of the reservoir temperature as the fluid/reservoir had essentially been undisturbed since the liner was cemented which was almost 3 weeks before the cased hole MDT run was made. The bottom hole temperature recorded during the cased hole MDT is shown in Figure 9-2.

The bottom hole temperature is estimated to be approximately 146 degC @ 4230m MD RKB. The average temperature gradient to seabed (0 degC) is approximately 4.3 degC/100 meters.



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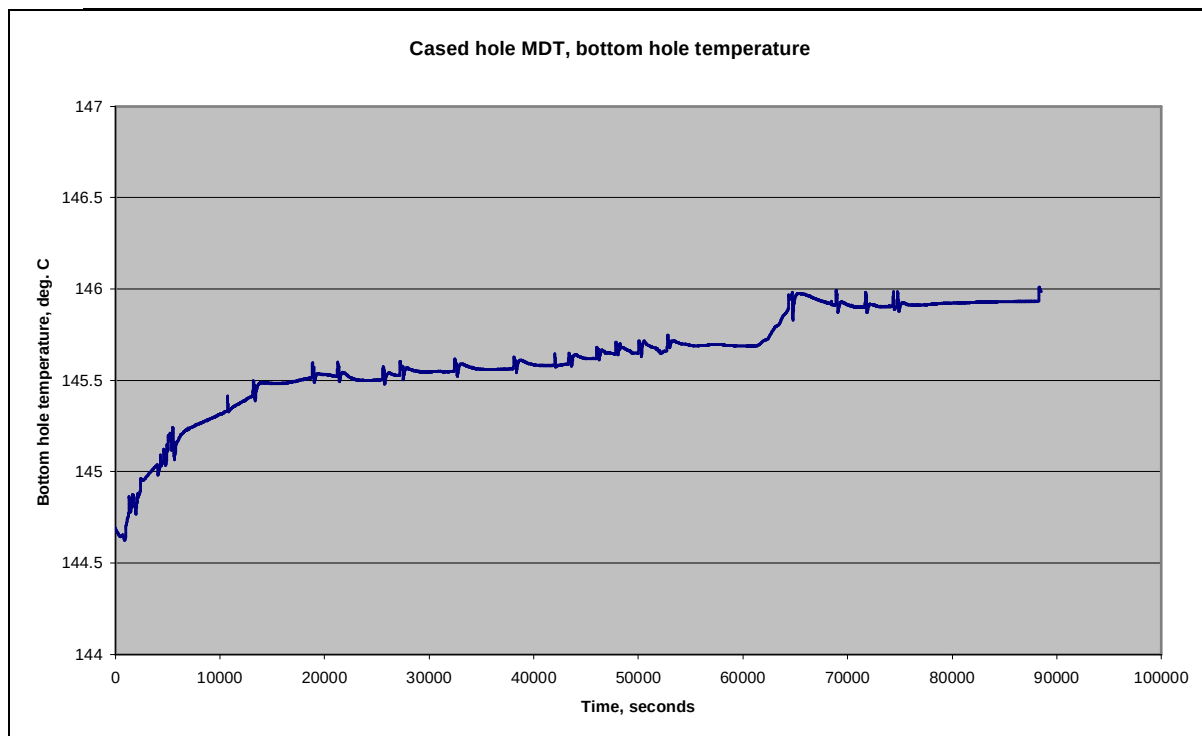


Figure 9-2: Cased hole MDT, bottom hole temperature

10 Mini Fracture Test

A mini-frac was carried out on the well 6605/8-1 using 1.62 g/cm³ brine through the perforations located at 4179.5 – 4209 m TVD RKB. A downhole pressure gauge was used in addition to the readings on the wellhead. The pressure gauge downhole was located at 4151m TVD RKB.

The readings with no flow and zero pressure on the wellhead, showed a downhole pressure at 633 bar, which in terms correspond to the hydrostatic pressure from the brine column. If calculating the bottomhole pressure using the brine density of 1.62 g/cm³, the bottomhole pressure should be 660 bar, giving a discrepancy with respect to the actual readings. Plotting the two readings against each other it is clearly seen that both pressures plots on top of each other, with a difference of approx 632 bar, see Figure 10-1. Only test #4 shows a little difference between the two readings at propagation.

Whether this is an index error or the reported brine weight was wrong, will not be discussed here. Only the bottomhole readings will be discussed here. Since the pressure gauge was located approx 29 m above top perforations, an additional pressure of 4.6 bar should be added to the readings to obtain the correct pressures at top perforation.

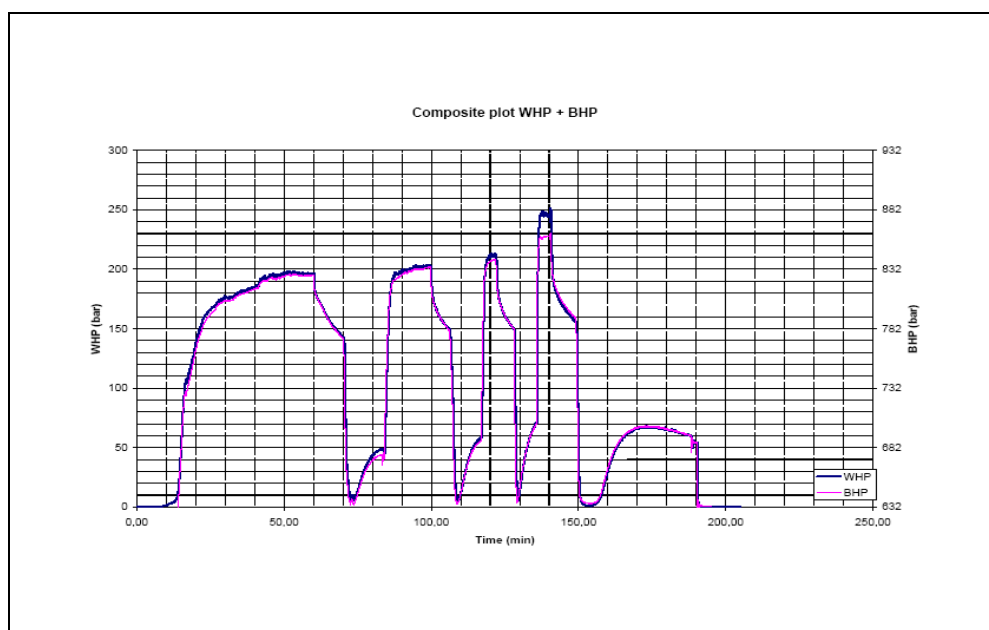


Figure 10-1: Bottomhole and wellhead pressures for all minifrac cycles

Cycle #1 This cycle was carried out with a flow rate of 75 l/min. The test shows a not so clear break down pressure, but the propagation pressure is set to be approx. 827 bar.

Cycle #2 was carried out with 100 l/min. The test shows a steady build up in pressure, with no clear break down pressure, but stabilizes at a pressure of 833 bar.

Cycle #3 was carried out with 160 l/min. This test follow the pressure build up as cycle #2, and the pressure stabilizes at 840 bar.

Cycle #4 was carried out with 400 l/min, and the pressure quickly stabilizes at 860 bar.

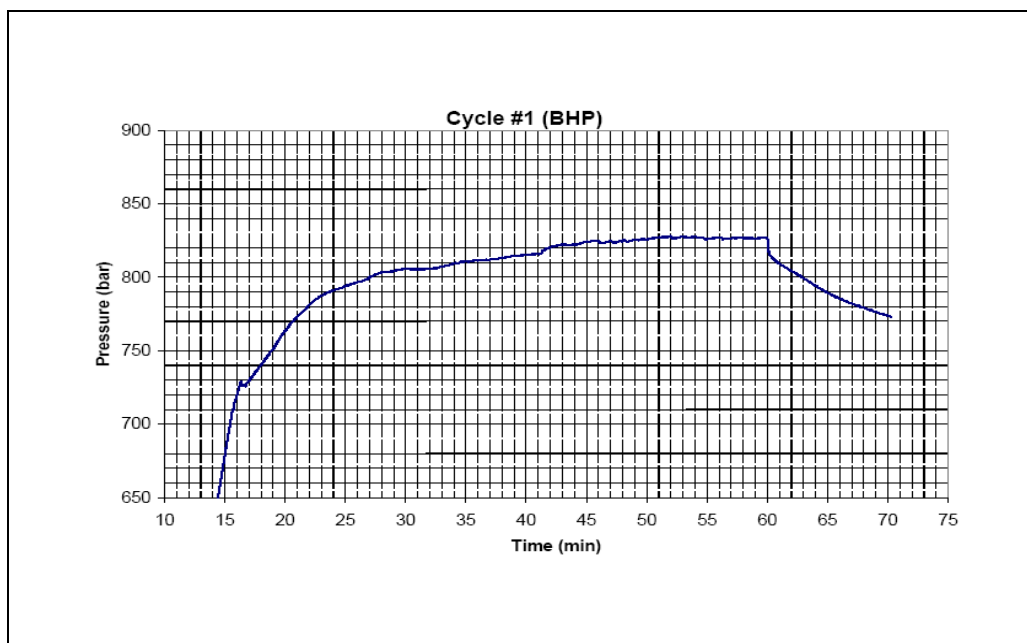


Figure 10-2: Bottomhole pressure during mini-frac cycle no.1 (75 ltr/min)

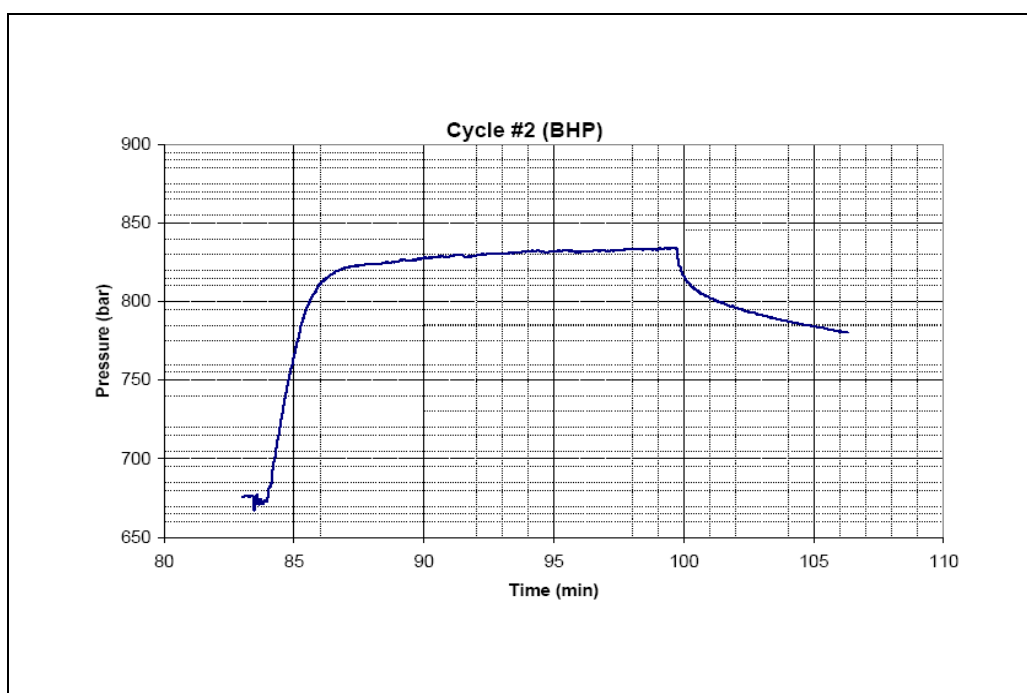


Figure 10-3: Bottomhole pressure during mini-frac cycle no. 2 (100 ltr/min)

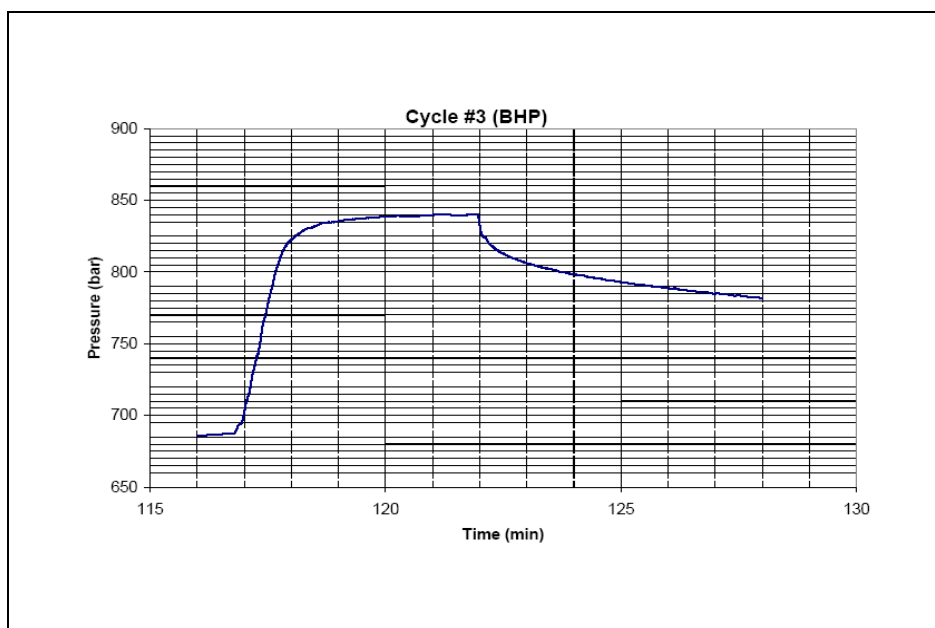


Figure 10-4: Bottomhole pressure during mini-frac cycle no. 3 (160 ltr/min)

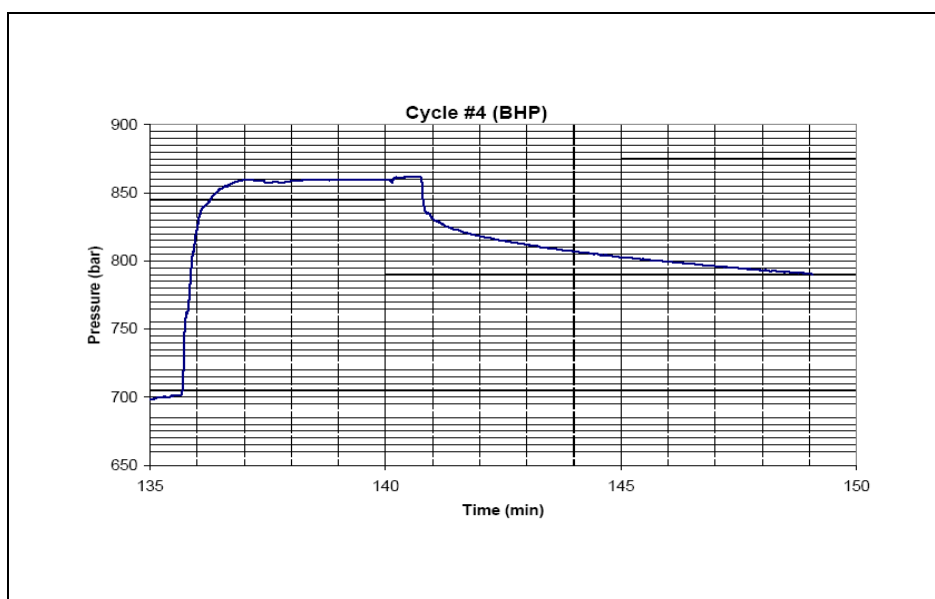


Figure 10-5: Bottomhole pressure during mini-frac cycle no.4 (400 ltr/min)

10.1 Pressures during Pump-Up

A comparison of the pressure build up during the cycles is seen on the Figure 10-6. Cycle #2 - #4 have almost the same pressure build up with respect to volume pumped. Cycle #1 has a significant lower pressure build up, probably due to matrix leak off.



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To determine the minimum horizontal stress from this mini-frac test, all of the fall-off pressures has been plotted to identify the ISIP, which corresponds to the minimum in-situ stress. See Figure 10-7.

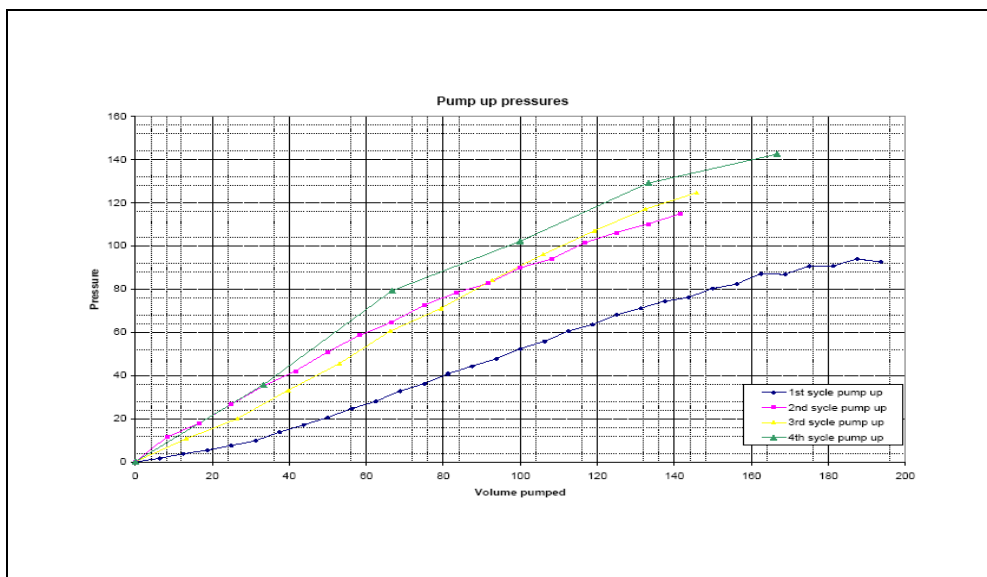


Figure 10-6: Bottomhole pressure build-up during pumping

10.2 Pressure during Fall-Off

On Figure 10-7 the fall-off pressures have been plotted for each test. Using both inflection point method and dP/dt , see Figure 10-8, it is clearly seen that a change of slope is seen at approx of 180 bar (WHP) which correspond to 810 bar BHP for all of the tests.

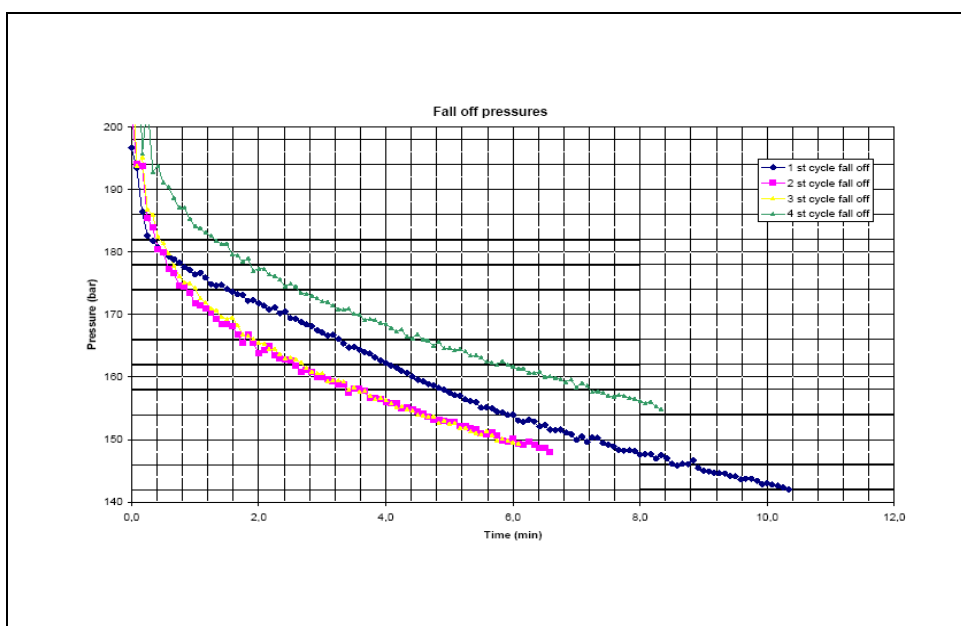


Figure 10-7: Fall-off pressures for the four different cycles

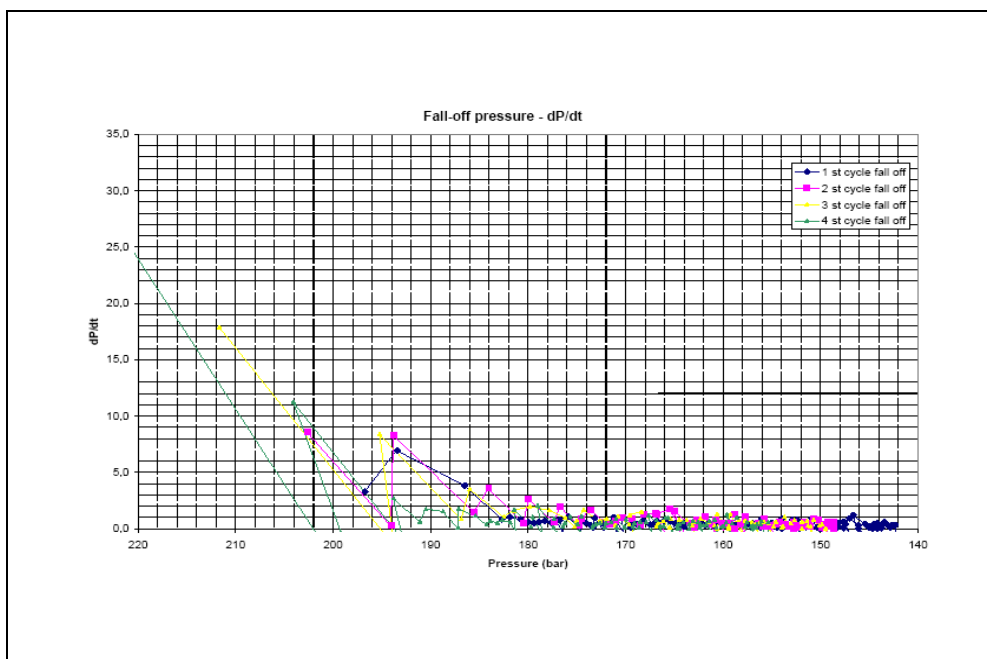


Figure 10-8: Derivative plot of the fall-off pressures

10.3 In-situ stress determination

The minimum in-situ stress is determined to be approximately $810 \text{ bar} + 4.6 \text{ bar} \approx 815 \text{ bar} \approx 1.99 \text{ sg}$.

10.4 Fracture propagation pressure

The fracture propagation pressure is set to be approximately $825 \text{ bar} + 4.6 \approx 830 \text{ bar} \approx 2.02 \text{ sg}$ with zero flow.

11 Fluid Analysis and Results

This section discusses both the onshore quality check of the samples and PVT analysis. Only the main results are stated in this chapter; for more details reference are made to the reports; Ref./7/ to Ref./12/.

11.1 Trace elements

Trace elements were measured on the gas (gas gravity, H₂S, CO₂, radon and mercury), condensate (density) and water phase (Ref./8/). The key measurements in the gas phase are presented in Figure 11-1, and average values are presented in Table 11-1. For the H₂S measurements the early data was excluded; only the stabilised values are used. For mercury the 1st and last point are excluded for estimation of the average value.

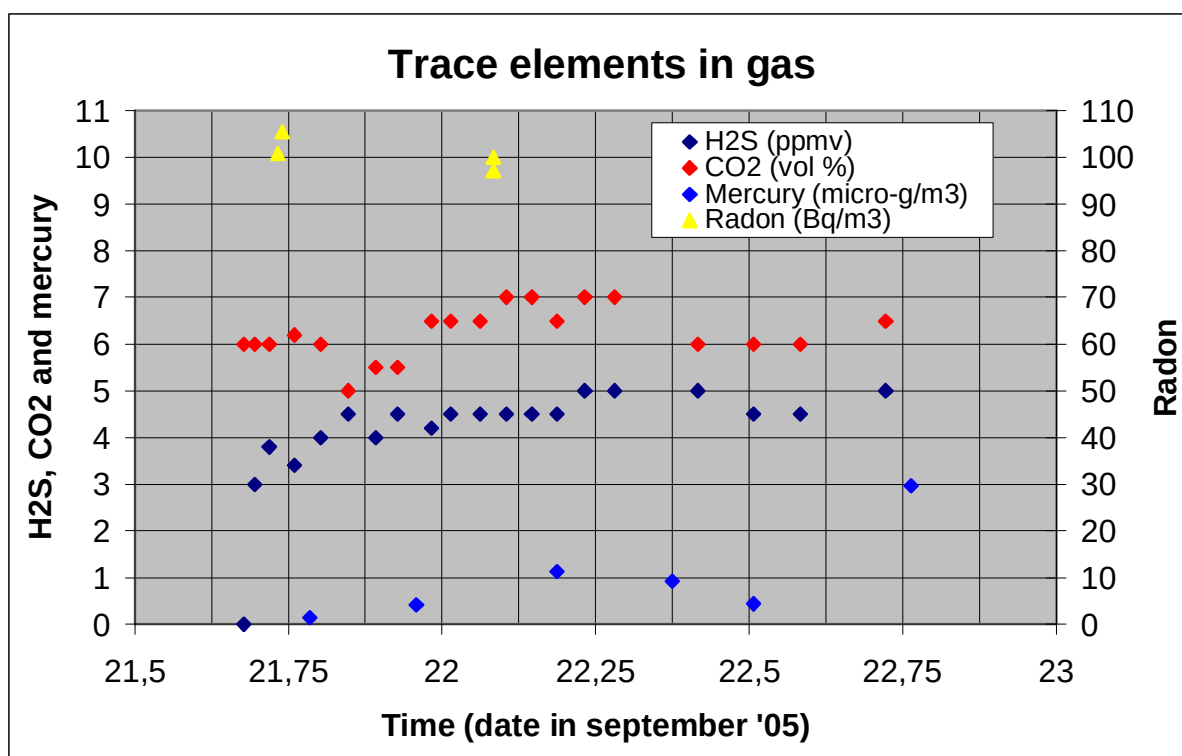


Figure 11-1: Trace elements measured in the gas phase

H ₂ S (ppmv)	4.5
CO ₂ (vol %)	6.2
Radon (Bq/m ³)	101
Mercury (µg/ m ³)	0.7

Table 11-1: Average values for trace elements

The condensate and gas density are given in Figure 11-2. The condensate densities are taken downstream choke, at the minilab (one sample – 0.853 g/cc) and at the separator (one sample – 0.873 g/cc). Both the density from the minilab and at the separator are somewhat higher than the samples taken downstream choke (see Chapter 13.7).

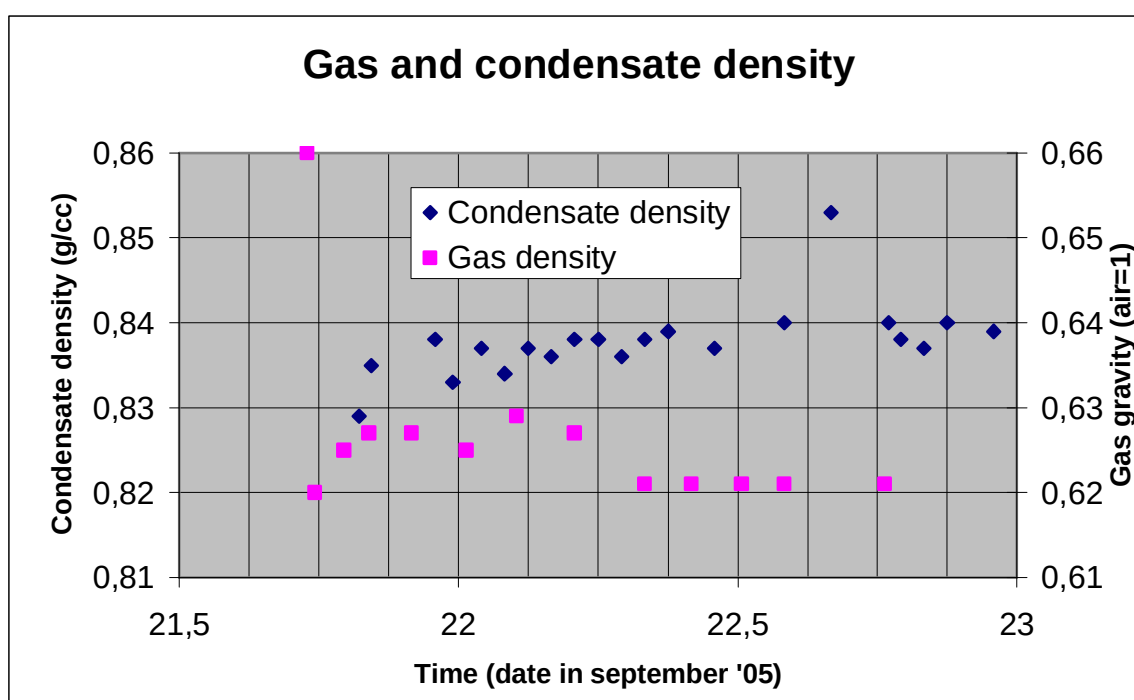


Figure 11-2: Gas and condensate density

11.2 Minilab measurements

The measured GCR with the mini-lab seem to be reasonable consistent with values varying between 200 000 and 250 000 Sm³/ Sm³ (Figure 11-3). There are two high-GCR outliers which both seem to be non-representative. Excluding these the average GCR is estimated to 230 000 Sm³/ Sm³.

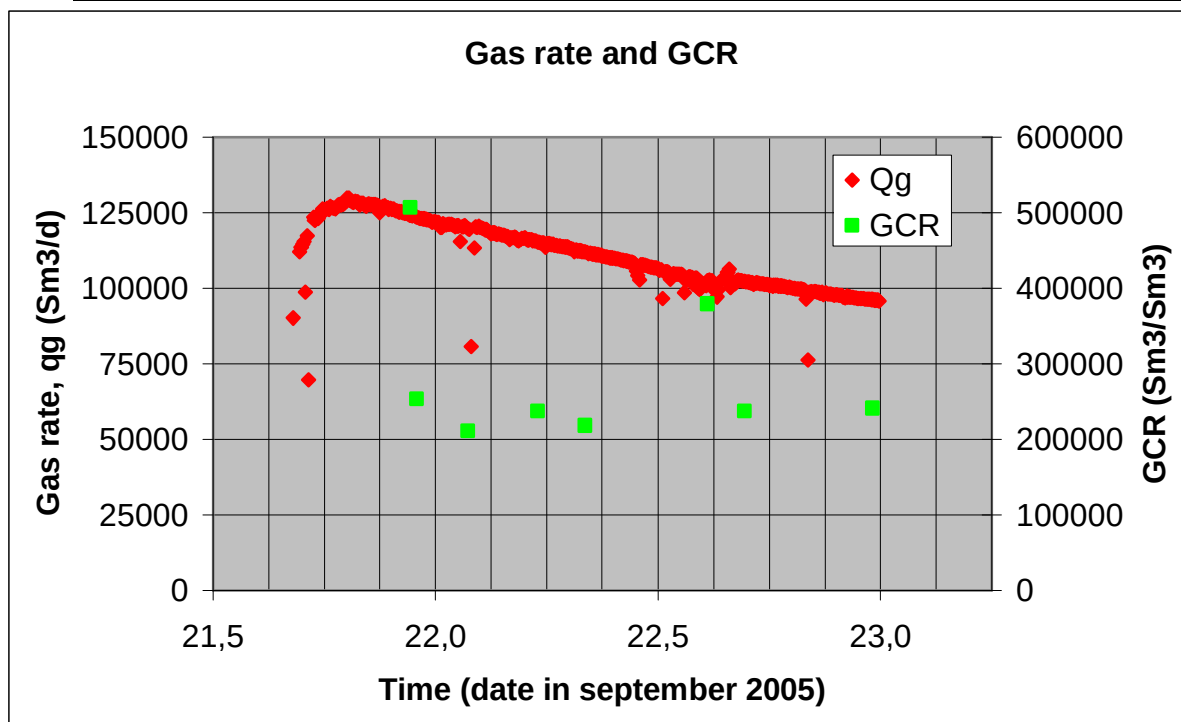


Figure 11-3: Gas rate and GCR during main flow

11.3 Gas Analyses

Analysis of the gas was performed at Petrotech (Ref./10/) and Hydro (Ref./12/). The PVT results are evaluated in Ref./12/.

In Table 11-2 the composition of the upper and lower gas presented. The composition of the 'upper gas' is based on recombination of gas sample A-2127 and condensate sample # 32 (composition, molecular weight and density) both taken during the test (see sample list in Chapter 13.5). The composition of the 'lower gas' is based on sample 6992-MA (see sample list in Chapter 13.3).

Based on the composition PVT properties (gas formation volume factor and viscosity) were made from EOS calculations, presented in Figure 11-4 and Figure 11-5, respectively. The gas in the upper and lower zone are somewhat different; the gas in the upper zone is somewhat leaner than the gas in the lower zone.

Black-Oil PVT Properties

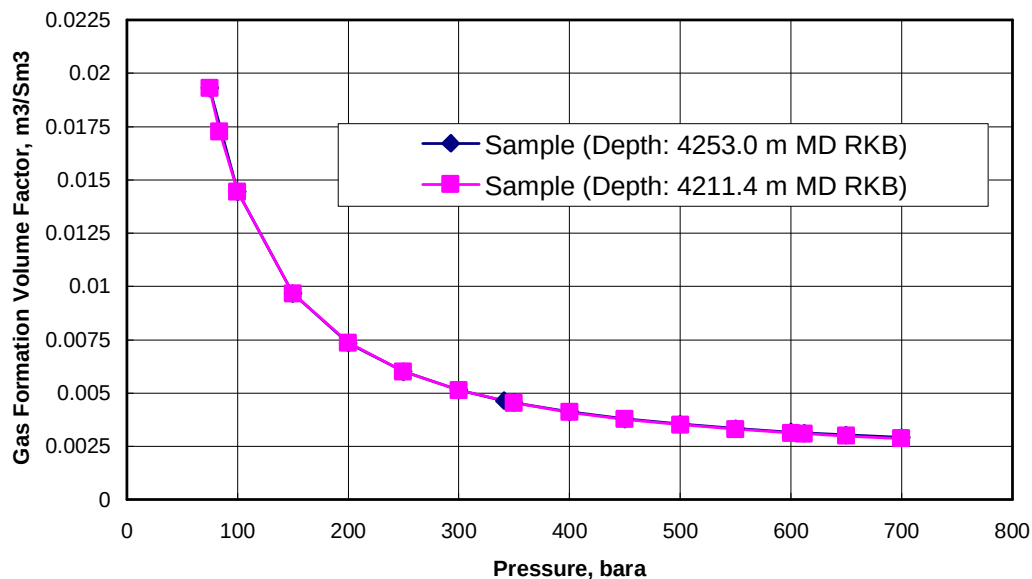


Figure 11-4: Gas formation volume factor

Black-Oil PVT Properties

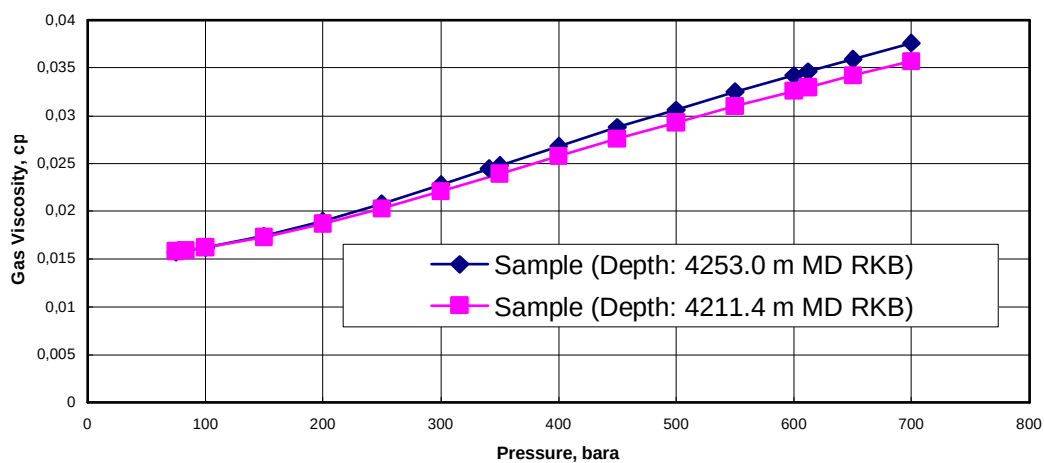


Figure 11-5: Gas viscosity

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Components	Upper gas (mole %)	Lower gas (mole %)
N ₂	0.692	0.75
CO ₂	4.593	4.022
H ₂ S	0.000	0.000
C1	91.272	90.501
C2	2.389	2.554
C3	0.533	0.733
iC4	0.071	0.120
nC4	0.068	0.161
iC5	0.031	0.086
nC5	0.019	0.075
C6	0.032	0.145
C7	0.096	0.216
C8	0.111	0.203
C9	0.037	0.089
C10+	0.056	0.346

Table 11-2: Composition of upper and lower gas

11.4 Formation Water Analyses

Formation water was sampled with the MDT (see Table 6-3) in open hole using the guard probe (log run 2B @ 4211.4 m MD RKB; 3 samples) and later in cased hole using dual packer at the approximate same depth (log run 2E @ 4230.0 - 4230.55; 3 samples). Water samples were also recovered from the production test.

All the water samples have been analysed by Petrotech (Ref./9/ and Ref./10/). Norsk Hydro Research Centre has evaluated the results from these analyses (Ref./7/). In addition ChevronTexaco has analyzed one sample from the cased hole MDT run and have evaluated the water sampling results (Ref./11/).

Only one sample is considered representative – the pressurized samples MPSR #036 (sample 1.01 in Table 6-3). This was taken with the guard probe and zero contamination was measured. Due to leaks across the packer the samples which were taken later in time at this depth increased contamination (5 & 10%) were reported (see Figure 6-5). All the cased hole samples are heavily contaminated and are not considered representative. Water samples were also recovered during the test. However, these are not considered representative formation water samples.

The reported measurements are all based on the MPSR sample #036. The ion composition of the sample formation water and the calculated synthetic formation water are given in Table 11-3 below. In the rightmost column the calculated ion composition of the formation water



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has been corrected for the dead volume of distilled water, which is sampled together with the sampled formation water. In Table 11-4 the main PVT results are presented.

		Mudfiltrate (as reference)	Formation water – measured	Formation water. corr. for dead volume
Cl	mg/l	136655	2901	2996
SO ₄	mg/l	406	0	0 *
Br	mg/l	236	16	17
Li	mg/l	1	2	2
Na	mg/l	64 471	2695	2784
K	mg/l	48 918	411	425
Mg	mg/l	48	6	6
Ca	mg/l	435	137	142
Sr	mg/l	4	5	5
Ba	mg/l	0	13	13 **
Acetate	mg/l	894	273	282
Formate	mg/l	133	13	13

Table 11-3: Ion composition of the formation water. MPSR #036. taken at 4231.4m MD

* Assuming no sulphate in the formation water

** Assuming some barium has precipitated with sulphate in mud filtrate.

GWR	4.4 Sm ³ /Sm ³
pH	6.7
CO ₂	36.1 mol%
Density	1.008 kg/Sm ³
Resistivity	0.973 ohm-m@ 20 degC

Table 11-4: Main results of PVT analysis of sample MPSR #036

Comments: Flashed onshore from single phase. General description - light, milky brown, translucent fluid.

The compositional analysis of the flashed gas from sample MPSR #036 is given in Table 11-5. The gas has a relatively large amount of CO₂, which corresponds to the downhole measured pH of 4.5, see Figure 6-10. Synthetic formation water was made and resistivity was measured (Table 11-6).

Component	Weight %	Mol %
N2	0.927	0.874
CO2	60.251	36.133
H2S	0.000	0.000
C1	37.929	62.398
C2	0.537	0.472
C3	0.077	0.046
iC4	0.004	0.002
nC4	0.006	0.003
iC5	0.012	0.004
nC5	0.002	0.001
C6	0.003	0.001
C7	0.149	0.044
C8	0.055	0.015
C9	0.006	0.001
C10+	0.041	0.007
Total	100.000	100.000

Table 11-5: Summary of PNA analysis of flashed water sample MPSR #036

Pressure (bar)	Temperature (degC)	Resistivity @ 20 degC (Ohm-m)
614	140	0.683
614	145	0.647
614	150	0.626

Table 11-6: Resistivity of synthetic formation water

The BTEX results in the formation water were found to be (MPSR #036):

- § Benzene: 3700 µg/L
- § Toluene: 2800 µg/L
- § Ethylbenzene: 70 µg/L
- § m/p-Xylene: 350 µg/L
- § o-Xylene: 120 µg/L

The $\text{Sr}^{87}/\text{Sr}^{86}$ isotope analysis on the formation water was measured to (MPSR #036):

- § $\text{Sr}^{87}/\text{Sr}^{86}$ - 0.712

12 References

- Ref./1/ "Well Programme 6605/8-1". Norsk Hydro. April 2005.
- Ref./2/ "Field Operation Reports. Well 6605/8-1". Schlumberger. September 2005.
- Ref./3/ "Daily Drilling Reports. Well 6605/8-1". Norsk Hydro. September 2005.
- Ref./4/ "Logtek". R_WLC_PETROPHYSICAL_COMPOSITE_1_INF. February 2006
- Ref./5/ "Hydro". Standard Core Description Well 6605/8-1. November 2005
- Ref./6/ "Hydro". Well 6605/8-1. Discovery Report PL283 Stetind. April 2006
- Ref./7/ "Evaluation of Water Samples. Stetind". Kari Ramstad. Norsk Hydro. November 2005.
- Ref./8/ "Well Stetind 6605/8-1. DST 1. Onsite sampling and analysis of gas, condensate and water sampling". Petrotech. July 2006.
- Ref./9/ "Field Stetind. On-shore analysis of water samples from DST1". Petrotech. November 2005.
- Ref./10/ "Well 6605/8-1. Stetind samples; Validity checks and analysis of MDT water and condensate samples". Petrotech. July 2006.
- Ref./11/ "Stetind 6605/8.1. Final Review of Water Samples Collected by MDT and during DST. Analyzed by AUTC". ChevronTexaco. January 2006.
- Ref./12/ "PVT evaluation of Stetind". Jarle Larsen. Hydro. July 2006.
- Ref./13/ "Down Hole & Surface Data Acquisition Report". PowerWell/Halliburton. December 2005. Doc.no. PWS-31-O-RP-008.
- Ref./14/ "Stetind gauge report". Halliburton. July 2006.
- Ref./15/ Investigation report on LPR-N leakage. Well 6605/8-1 Stetind. Halliburton. October 2005.



13 Appendices

In the following chapters operational details of well 6605/8-1 can be found.

13.1 General Well Data

Well name:	6605/8-1
Drilling operator name:	Norsk Hydro Produksjon AS
Geodetic datum:	ED50
Coordinates:	66° 21` 51.80`` N      5° 34` 39.40`` E
UTM coordinates:	7363090.58 N 615296.80 E
UTM zone:	31
Drilled in production licence:	283
Area:	NORWEGIAN SEA
Drill permit:	1083-L
Drilling facility:	TRANS. LEADER
Drilling days:	127
Wellbore entry date:	14.06.2005
Wellbore completion date:	18.10.2005
Original wellbore purpose:	WILDCAT
Wellbore purpose:	WILDCAT
Wellbore status:	P&A
Wellbore contents:	GAS
Discovery wellbore:	NO
Seismic location:	inline NH0202 &4436crossline NH0202-5031
Kelly bushing elevation (KB) [m]:	23.5
Water depth [m]:	838
Total depth (MD) [m]:	4513



13.2 MDT Sampling Operation Details - Schlumberger

13.2.1 8 ½" Open Hole Samples

Sampling/Scanning Summary

Client:	Hydro ASA
Field:	Stetind
Well:	6605/8-1

Rig:	TO Leader
Date:	09.sep.05
Run:	1A

Sample	DLIS file	MD (m)	Formation	Fluid	P(form) (Bar)	P(hyd) (Bar)	Mobility (MD/CP)	Cleanup (L/mns)	Temp(form) (DegC)
[1]	171	4231,4	Lysing	Water	614,12	654,00	7	271/624	140,4
[1]	172	4231,4	Lysing	Water	614,12	654,00	7	271/624	140,4
[2]	240	4209,4	Lysing	Cond	612,24	656,00	10,8	129/408	137,5
[3]	244	4211,4	Lysing	Cond	611,55	-	-	278/337	139,5
[4]	316	4253,0	Lysing	Cond	632,53	661,59	-	66/317	141,1

Details

	Open ETIM	Sample Chamber	Chamber Slot	Chamber-Serial(s)	Temp (degC)	Drawdown Pressure (bar)	Max.Shut-in Pressure (bar)	OCM Predicted Contam.(%)	LFA GOR (m3/m3)	CFA GOR (m3/m3)	Opening Pressure (bar)
[1a]	24994	MRMS2	MPSR-1	#36	140,4	75,6	859	n/a	n/a	n/a	108,8
[1b]	30702	MRMS2	MPSR-4	#783	140,4	67,6	890	n/a	n/a	n/a	108,8
[1c]	35941	MRMS1	MPSR-4	#756	140,4	67,4	885	n/a	n/a	n/a	108,8
[2a]	9713	2 3/4 gal	MRSC-3	#113	137,5	69,2	881	n/a	n/a	n/a	108,3
[2b]	15353	MRMS1	MPSR-1	#694	137,7	66,2	882	n/a	n/a	n/a	408
[2c]	21924	MRMS1	SPMC-2	#136	137,9	35,7	879	n/a	n/a	n/a	551
[2d]	23138	MRMS1	MPSR-6	#974	138	34,2	880	n/a	n/a	n/a	354
[3a]	13940	MRMS1	MPSR-5	#801	138,6	16,3	880	n/a	n/a	n/a	422
[3b]	17399	MRMS1	SPMC-3	#188	139,5	3,5	865,5	n/a	n/a	n/a	558
[4a]	13161	MRMS2	MPSR-4	#768	140,9	107	795	n/a	n/a	n/a	68
[4b]	22638	MRMS1	MPSR-6	#930	141,1	124	774	n/a	n/a	n/a	333

Chamber	Volume	#Strokes	MPSR Bottle#	Dead Volume	Lost Volume
SPMC (Oilphase)	250 cc	0,43	3	10,3 cc	3,5 cc
MPSR (Standard)	450 cc	0,77	2	13,9 cc	6,5 cc
MRSC-GA (1g)	3,785 L	6,5	6	14 cc	6,6 cc
MRSC-JA (2.75g)	0,41 L	17,8	1	14,8 cc	7,4 cc
MRSC-EC (6g)	22,71 L	38,8	5	15,7 cc	8,3 cc
MRSC-ED (18g)	68,14 L	116,5	4	16,2 cc	8,8 cc

* Hydrocarbon Samples - Dead volume filled with Disteilled water
* Water Samples - Dead volume filled with Disteilled air



13.2.2 Cased Hole Samples

Sampling/Scanning Summary

Client:	Hydro ASA
Field:	Stetind
Well:	6605/8-1

Rig:	TO Leader
Date:	01.okt.05
Run:	3A

Sample	DLIS file	MD (m)	Formation	Fluid	P(form) (Bar)	P(hyd) (Bar)	Mobility (MD/CP)	Cleanup (L/mns)	Temp(form) (DegC)
[1]	69,70,71	4230.2	Lysing	Water	613,30	664,00	-	1500/1250	146,0

Details

	Open ETIM	Sample Chamber	Chamber Slot	Chamber- Serial(s)	Temp (degC)	Drawdown Pressure (bar)	Max.Shut-in Pressure (bar)	Resistivity (ohm*m)	LFA GOR (m3/m3)	CFA GOR (m3/m3)	Opening Pressure (bar)
[1a]	10638	MRMS1	MPSR-1	#73	145,3	59	883	0,015	n/a	n/a	
[1b]	42465	MRMS1	MPSR-6	#1043	145,6	50	885	0,018	n/a	n/a	
[1c]	74753	MRMS1	MPSR-4	#928	145,9	51	883	0,024	n/a	n/a	

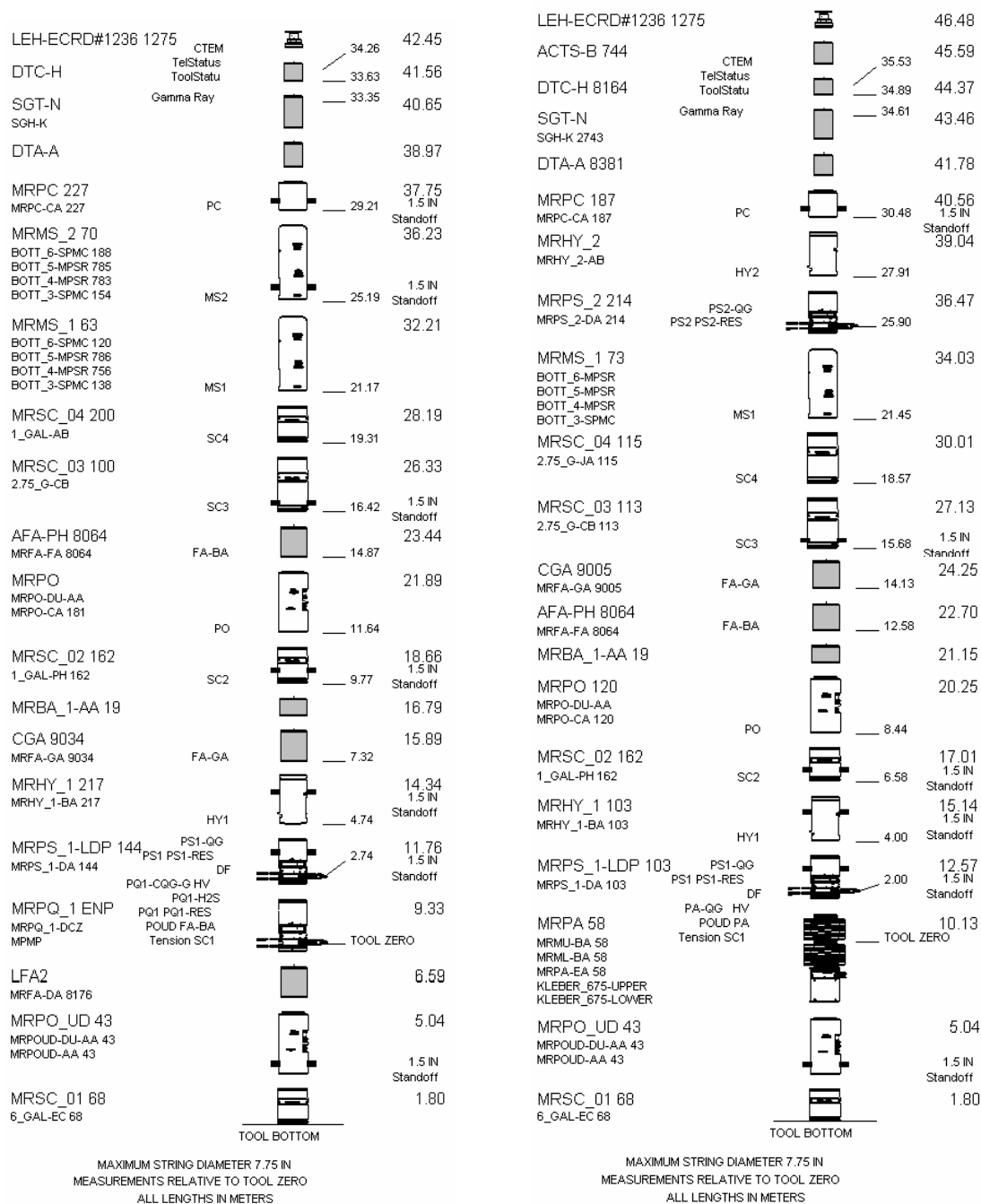
Chamber	Volume	#Strokes	MPSR Bottle#	Dead Volume
SPMC (Oilphase)	250 cc	0,43	3	7,2 cc
MPSR (Standard)	450 cc	0,77	2	10,2 cc
MRSC-GA (1g)	3,785 L	6,5	6	10,3 cc
MRSC-JA (2.75g)	0,41 L	17,8	1	11,1 cc
MRSC-EC (6g)	22,71 L	38,8	5	12 cc
MRSC-ED (18g)	68,14 L	116,5	4	12,5 cc

13.2.3 Curve Mnemonics for the MDT Channels

Curve mnemonics	Explanation	Units
BSG2	MRPS 2 Strain Gauge Pressure	Bar
BQT2	MRPS 2 Quartz Gauge Temperature	DegC
BQP2	MRPS 2 Quartz Gauge Pressure	Bar
B2TR	MRPS 2 Resistivity Cell Temperature	DegC
B2TV	MRPS 2 Strain Gauge Temperature	DegC
BFR2	MRPS 2 Flowline Fluid Resistivity	Ohm
PASG	MRPA Strain Gauge Pressure	Bar
PAQT	MRPA Quartz Gauge Temperature	DegC
PAQP	MRPA Quartz Gauge Pressure	Bar
PATV	MRPA Strain Gauge Temperature	DegC
FAOD [0..9]	Fluid Analyzer Optical Density Data [ch. 0..9]	Unitless
Water frac. (WATF)	Water Fraction	Unitless
Oil frac. (OILF)	Oil Fraction	Unitless
GASD[1..5]	Gas Detector Normalized Data [ch. 1..5]	Unitless

13.2.4 MDT Tool-strings

MDT logging string 2B (left) and 2C (right).





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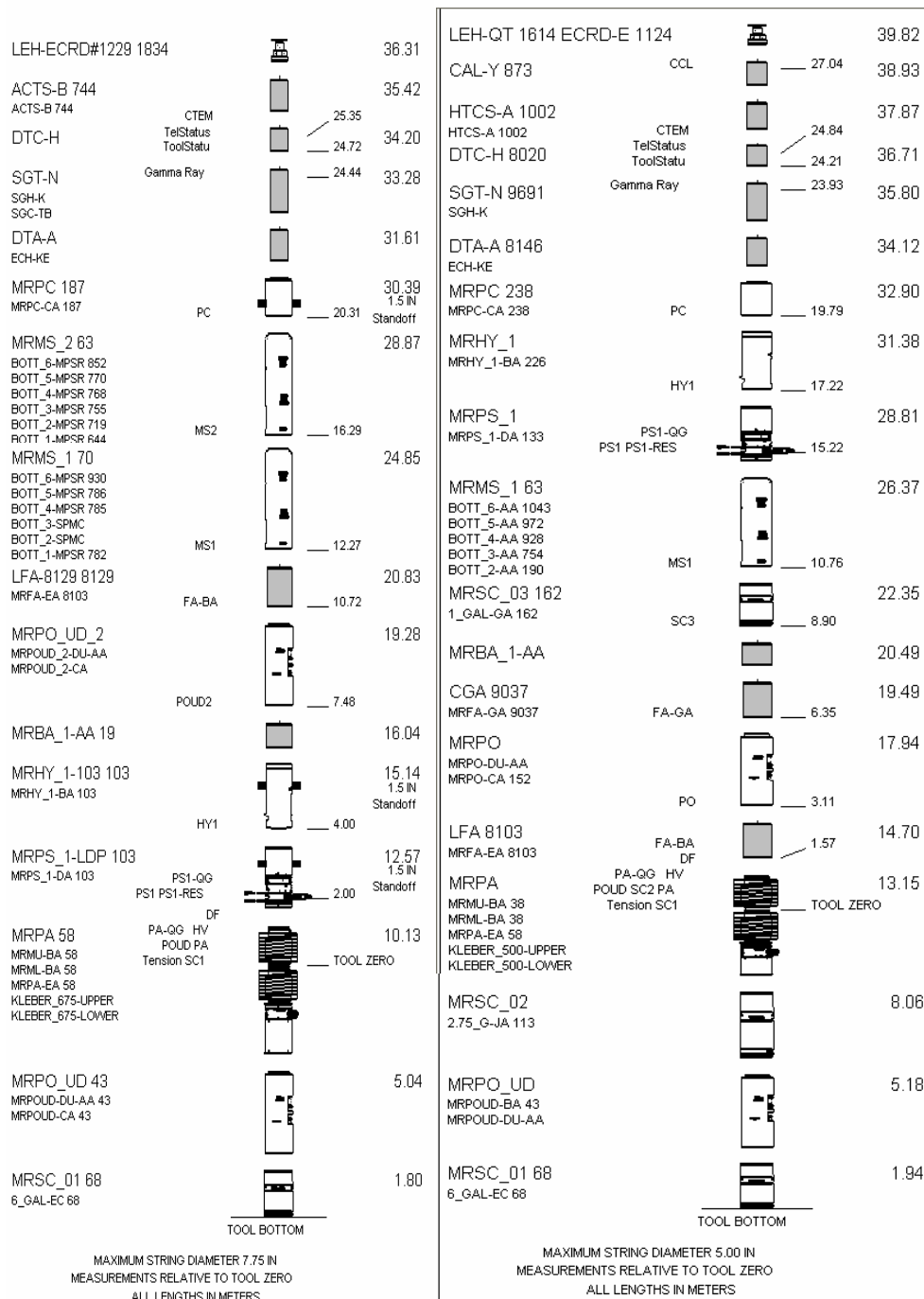
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MDT tool sketch of logging string 2D (left) and 2E (right) cased hole



13.3 Petrotech/ Oilphase sample list (MDT)

Sample no	Date Sampled	Chamber no.	Bottle no.	Depth m MD RKB	Comments
1.01	29.08.05	MPSR 036	4499-EA	4 231.4	Pressurised sample
1.02	29.08.05	MPSR 783	7007-MA	4 231.4	Pressurised sample
1.03	29.08.05	MPSR 756	5661-EA	4 231.4	Dead water
1.04	02.09.05	5 l plastic	na	4 209.4	Dead water
1.05	09.02.05	MPSR 694	na	4 209.4	Pressurised sample
1.06	02.09.05	SPMC 136	1561-EA	4 209.4	Pressurised sample
1.07	02.09.05	MPSR 974	TS 83803	4 209.4	Pressurised sample
1.08	03.09.05	MPSR 801	TS 83303	4 211.4	Pressurised sample
1.09	03.09.05	SPMC 188	9803-MA	4 211.4	Pressurised sample
1.10	07.09.05	MPSR 768	4469-EA	4 253.0	Pressurised sample
1.11	07.09.05	MPSR 930	6992-MA	4 253.0	Pressurised sample
1.12	01.10.05	MPSR 73	TS-85603	4 230.2	Pressurised sample
1.13	01.10.05	MPSR 1043	TS 83605	4 230.2	Pressurised sample
1.14	01.10.05	MPSR 928	PT 2130	4 230.2	Pressurised sample

13.4 Summary of Main Test Production data

Date	Time	BHP Bar	BHT Deg C	WHP Bar	WHT Deg C	Gas Rate Sm ³	SepP Bar	SepT Deg C
210905	18:00	102.1	117.8	27.6	6.4	122732	13.3	9.0
	19:00	105.2	117.9	28.0	6.4	126195	13.6	9.3
	20:00	102.2	117.4	27.6	7.2	125379	13.4	9.6
	21:00	101.5	117.4	27.4	7.2	127079	13.2	9.8
	22:00	100.1	117.3	27.1	7.3	125471	13.0	10.0
	23:00	99.0	117.3	26.7	7.3	123599	12.9	10.3
220905	00:00	97.5	117.1	26.3	7.3	121982	12.7	10.5
	01:00	96.1	116.9	26.0	7.4	121079	12.6	10.4
	01:55	95.5	116.8	25.9	7.3	119718	12.5	10.4
	03:00	93.9	116.6	23.3	7.2	115150	9.6	10.1
	04:00	93.5	116.6	23.1	7.2	114403	9.6	10.2
	05:00	93.7	116.7	22.9	7.3	113232	9.5	10.4
	06:00	92.5	116.6	22.7	7.3	111224	9.3	10.7
	07:00	91.8	116.5	22.5	7.2	110874	9.2	10.2
	08:00	91.3	116.4	22.2	7.3	109248	9.1	9.8
	09:00	90.6	116.3	21.8	7.6	108019	8.9	10.1
	10:00	90.0	116.2	21.6	7.8	106468	8.9	10.4
	11:00	89.4	116.1	21.4	7.9	104935	8.7	11.5
	12:00	88.8	116.0	21.0	8.1	103613	8.7	12.9
	13:00	88.3	115.9	21.0	8.3	102048	9.3	14.4
	14:00	87.8	115.9	21.0	8.4	100672	9.2	11.2
	15:00	88.7	116.1	23.8	8.9	102690	9.1	11.8
	16:05	87.8	116.0	24.0	9.2	102641	11.0	12.2
	17:00	88.0	116.1	24.2	9.1	101973	10.9	12.3
	18:00	87.5	116.0	24.1	9.1	101074	10.8	12.3
	19:00	86.9	115.9	23.9	9.0	100314	10.7	12.1
	20:00	86.4	115.9	23.4	8.9	99401	10.6	11.9
	21:00	86.0	115.9	23.4	8.8	98046	10.8	17.1
	22:00	85.5	115.8	23.3	8.9	97607	10.7	16.2
	23:00	84.9	115.8	23.0	9.0	96519	10.6	16.4
230905	00:00	84.5	115.7	23.1	9.1	95380	10.5	15.1

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Sample no.	Petrotech bottle no.	Date	Time	Flow period	Sampling point	Sample type	Volume	Bottle press. Barg	Comments
2	5309-A	21.09.2005	20:30	Main	Test sep	Gas	20 liter	12	PVT gas
3		22.09.2005	00:15	Main	Test sep	Water	1 liter	0	Plastic bottle
4		22.09.2005	03:00	Main	Test sep	Water	1 liter	0	Plastic bottle
5	5304-A	22.09.2005	03:45	Main	Test sep	Gas	20 liter	8.1	PVT gas
6	A-1804	22.09.2005	04:00	Main	Test sep	Gas	20 liter	8.1	PVT gas
7		22.09.2005	06:00	Main	Test sep	Water	1 liter	0	Plastic bottle
8		22.09.2005	14:40	Main	Test sep	Water	1 liter	0	Plastic bottle
9		22.09.2005	14:40	Main	Test sep	Water	1 liter	0	Plastic bottle
10		22.09.2005	14:50	Main	Cal.tank	Cond./ water	1 liter	0	Emulsion w/ some cond.
11		22.09.2005	14:50	Main	Cal.tank	Cond./ water	1 liter	0	Emulsion w/ some cond.
12		22.09.2005	15:15	Main	DS choke	Cond./ water	1 liter	0	Ca. 10% condensate
13	A-2134	22.09.2005	20:00	Main	Test sep	Gas	20 liter	10.2	PVT Gas
14		22.09.2005	20:00	Main	Test sep	Water	0.5 liter	0	Al bottle
15		22.09.2005	20:00	Main	Test sep	Water	0.5 liter	0	Al bottle
16		22.09.2005	20:00	Main	Test sep	Water	1 liter	0	Plastic bottle
17		22.09.2005	20:00	Main	Test sep	Water	1 liter	0	Plastic bottle
18		22.09.2005	20:00	Main	Test sep	Water	1 liter	0	Plastic bottle
19		22.09.2005	20:00	Main	Test sep	Water	1 liter	0	Plastic bottle
20		22.09.2005	20:00	Main	Test sep	Water	1 liter	0	Plastic bottle
21		22.09.2005	20:00	Main	Test sep	Bacteria kit			GAB
22		22.09.2005	20:00	Main	Test sep	Bacteria kit			SRB
23	275-A	22.09.2005	20:20	Main	Test sep	Gas	20 liter	9.6	PVT gas
24	PT-501	22.09.2005	21:00	Main	Test sep	Gas	500cc	9.6	Geochem
25	PT-324	22.09.2005	21:00	Main	Test sep	Gas	150cc	9.6	Geochem
26		22.09.2005	21:00	Main	Test sep	Gas	150cc	9.6	Geochem
27	A-1671	22.09.2005	21:05	Main	Minilab	Gas	20 liter	24.5	Minilab PVT gas
28	A-2127	22.09.2005	21:45	Main	Minilab	Gas	20 liter	24.5	Minilab PVT gas
29	A-2445	22.09.2005	22:20	Main	Test sep	Gas	20 liter	9.4	PVT gas
30	A-1652	22.09.2005	22:40	Main	Test sep	Gas	20 liter	9.4	PVT gas
31		22.09.2005	20:00-23:00	Main	DS choke	Condensate	0.5 liter		Al bottle
32		22.09.2005	20:00-23:00	Main	DS choke	Condensate	0.5 liter		Al bottle
33		22.09.2005	23:30	Main	Test sep	Bacteria kit			GAB
34		22.09.2005	23:30	Main	Test sep	Bacteria kit			SRB
35		22.09.2005	23:30	Main	Test sep	Water	1 liter	0	Plastic bottle
36		22.09.2005	23:30	Main	Test sep	Water	1 liter	0	Plastic bottle
37		22.09.2005	23:30	Main	Test sep	Water	1 liter	0	Plastic bottle
38		22.09.2005	23:30	Main	Test sep	Water	1 liter	0	Plastic bottle
39		22.09.2005	23:30	Main	Test sep	Water	1 liter	0	Plastic bottle
40		22.09.2005	23:00	Main	Test sep	Condensate	1 liter	0	Test sep oil line
41		22.09.2005	02:30	Main	Test sep	Condensate	1 liter	0	Test sep sight glass
42		22.09.2005	02:30	Main	Test sep	Condensate	0.5 liter	0	Test sep oil line. al bottle
43		23.09.2005	10:00	Build Up	Test sep	Condensate	5 liter	0	5 l drum
44		23.09.2005	10:00	Build Up	Test sep	Condensate	5 liter	0	5 l drum
45		23.09.2005	10:00	Build Up	Test sep	Condensate	10 liter	0	10 l drum
46		23.09.2005	10:00	Build Up	Test sep	Condensate	10 liter	0	10 l drum
47		23.09.2005	10:00	Build Up	Test sep	Condensate	200 liter	0	200 l drum
48		23.09.2005	10:00	Build Up	Test sep	Condensate	20 liter	0	200 l drum
49		23.09.2005	10:00	Build Up	Test sep	Condensate	0.25 liter	0	Glass bottle

13.6 Gas Trace Element Analysis (Ref./8/)

Date	Time	Gas Gravity Sg Air =1	H ₂ S (ppmv)	CO ₂ (vol %)	Radon Bq/m3	Mercury µg/m ₃
21.09.2005	16:15		>0.2	6.0		
	16:40		3.0	6.0		
	17:15		3.8	6.0		
	17:30	0.660				
	17:35				100.9	
	17:45				105.5	
	17:50	0.620				
	18:15		3.4	6.2		
	18:50					0.140
	19:05	0.625				
	19:15		4.0	6.0		
	20:10	0.627				
	20:20		4.5	5.0		
	21:25		4.0	5.5		
	22:00	0.627				
	22:15		4.5	5.5		
	23:00					0.414
	23:35		4.2	6.5		
22.09.2006	00:20	0.625	4.5	6.5		
	01:30		4.5	6.5		
	02:00				97.1	
	02:00				100.1	
	02:30	0.629	4.5	7.0		
	03:30		4.5	7.0		
	04:30		4.5	6.5		1.14
	05:00	0.627				
	05:35		5.0	7.0		
	06:45		5.0	7.0		
	08:00	0.621				
	09:00					0.93
	10:00	0.621	5.0	6.0		
	12:10	0.621	4.5	6.0		0.44
	14:00	0.621	4.5	6.0		
	17:20		5.0	6.5		
	18:20	0.621				2.97

13.7 Oil Trace Element Analysis (Ref./8/)

Date	Time	Density (g/cm ³)	Temp (°C)	Density* (g/cm ³)	Temp (°C)	Sample Point
21.09.2005	19:45	0.826	18.7	0.829	15	DS Choke
	20:15	0.832	19.2	0.835	15	DS Choke
	23:00	0.835	19.3	0.838	15	DS Choke
	23:45	0.829	20.3	0.833	15	DS Choke
22.09.2005	01:00	0.833	20.4	0.837	15	DS Choke
	02:00	0.830	20.3	0.834	15	DS Choke
	03:00	0.834	18.7	0.837	15	DS Choke
	04:00	0.834	17.7	0.836	15	DS Choke
	05:00	0.835	18.6	0.838	15	DS Choke
	06:00	0.834	20.9	0.838	15	DS Choke
	07:00	0.832	20.3	0.836	15	DS Choke
	08:00	0.835	19.0	0.838	15	DS Choke
	09:00	0.836	19.0	0.839	15	DS Choke
	11:00	0.835	17.4	0.837	15	DS Choke
	11:05	0.871	17.5	0.873	15	Sep.oil
	14:00	0.837	19.2	0.840	15	DS Choke
	16:00	0.849	21.0	0.853	15	Minilab
	18:30	0.839	17.0	0.840	15	DS Choke
	19:00	0.834	20.1	0.838	15	DS Choke
	20:00	0.835	18.1	0.837	15	DS Choke
	21:00	0.838	17.6	0.840	15	DS Choke
	23:00	0.837	17.8	0.839	15	DS Choke

*Density at 15 °C is calculated.

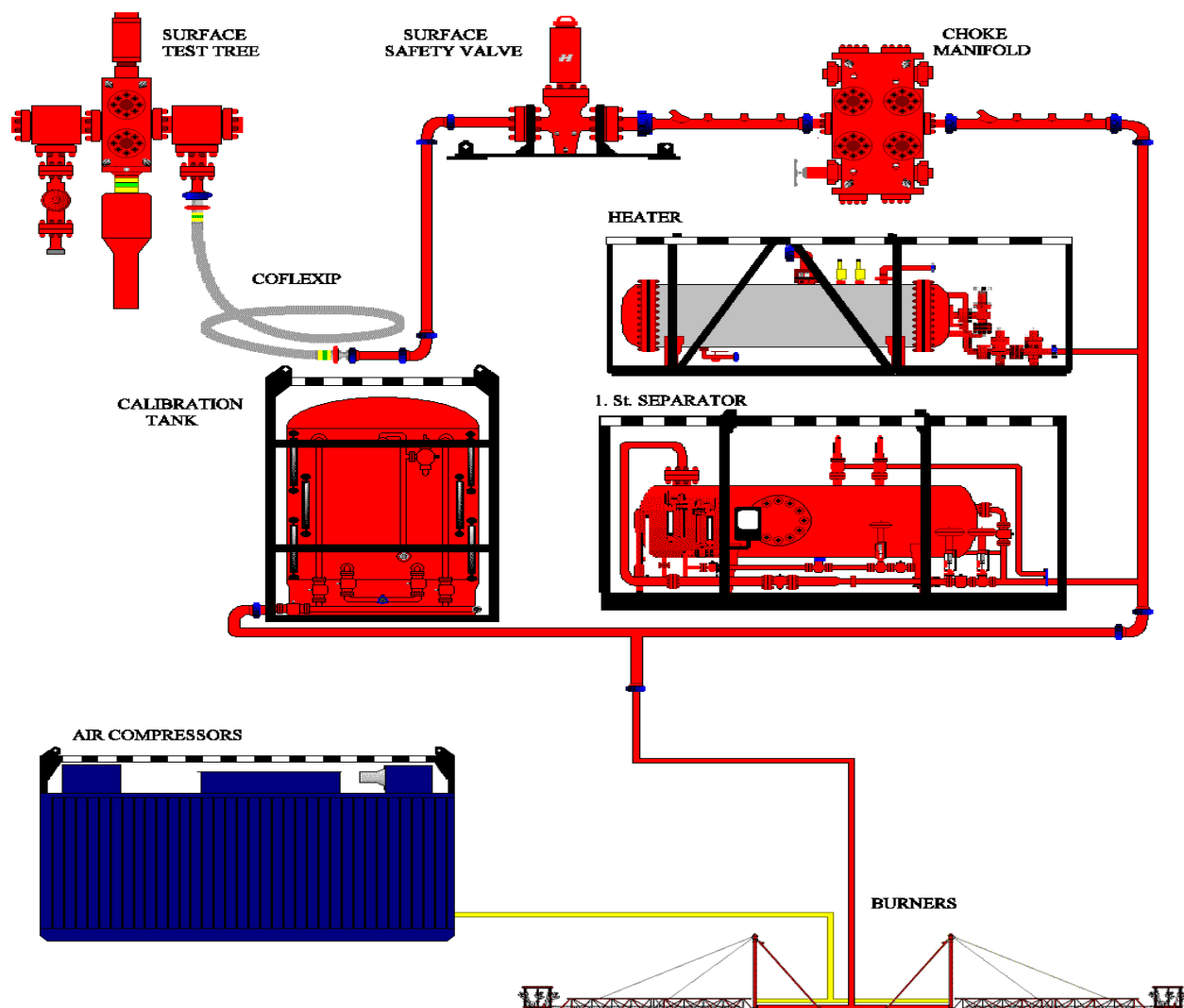
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MINI-LAB SAMPLING		CGR	CGR	CGR	CGR	CGR	CGR	CGR	CGR
Test no.		1	2	3	4	5	6	7	8
Date		21.09.05	21.09.05	22.09.05	22.09.05	22.09.06	22.09.06	22.09.06	22.09.06
Time		21:40	23:00	02:46	05:28	08:05	14:40	16:45	23:33
Flow Period		Main	Main	Main	Main	Main	Main	Main	Main
Choke Size		68	68	70	70	70	70	70	70
Probe Position		1 80%	1 80%	3 115%	3 115%	3 115%	3 115%	3 115%	3 115%
Gas Rate	Sm3/d	126000.0	125000.0	116000.0	112000.0	109700.0	109700.0	102700.0	94500.0
Condensate rate	Sm3/d	0.19	0.37	0.64	0.54	0.50	0.36	0.53	0.52
GOR @ stab cond	Sm3/m3	506840	252909	210969	237254	217647	379198	237562	240699
CGR @ stab cond	bbls/10-6 Scf	0.35	0.70	0.84	0.75	0.82	0.47	0.75	0.74



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13.8 Diagram of surface equipment





13.9

Diagram of the teststring run in well 6605/8-1



**13.10 Sequence of Events****13.10.1 8 ½" Open Hole MDT Logging**

The sequence of events (SOE) is based upon the sequence reported in the logging operational summary by Schlumberger, Hydro Wellsite Geologist and drilling reports. The SOE includes all TD-logging (8 ½" open hole) operations.

Note: The MDT logruns in the heading in SOE are incorrect, while correct no. are given in left column.

Schlumberger									
Company:		Hydro							
Well:		6605/8-1							
Field:		Stetind							
Rig:		Transocean Leader				Country: Norway			
Rig: Transocean Leader Field: Stetind Location: North Sea Well: 6605/8-1 Company: Hydro		MDT-GR-ACTS-ECRD MDT Sampling Quick Probe 28-Aug-2005							
		North Sea Norwegian Sector UTM: 7364907.6N, 346941.0E				Elev.: K.B. 23.5 m G.L. -838 m D.F. 23.5 m			
		Permanent Datum: MSL Log Measured From: DF Drilling Measured From: DF				Elev.: 0 m 23.5 m above Perm. Datum			
		Country: Norway		Max. Well Deviation 10.4 deg		Longitude 66 21'51.93" N		Latitude 05 34'39.23" E	
Logging Date		28-Aug-2005							
Run Number		2B							
Depth Driller		4513 m							
Schlumberger Depth		4514.5 m							
Bottom Log Interval		4231.4 m							
Top Log Interval		4231.4 m							
Casing Driller Size @ Depth		9.625 in @ 4100 m							
Casing Schlumberger		4095.5 m							
Bit Size		8.500 in							
Type Fluid In Hole		Glydriil DW							
MUD	Density	Viscosity	1.6 g/cm3						
	Fluid Loss	PH	1.4 cm3		7.6				
	Source Of Sample		Flowline						
	RM @ Measured Temperature		0.100 ohm.m @ 18 degC						
RMF @ Measured Temperature		0.069 ohm.m @ 18 degC							
RMC @ Measured Temperature		0.185 ohm.m @ 18 degC							
Source RMF		RMC	Press		Press				
RM @ MRT		RMF @ MRT	0.024 @ 141		0.017 @ 141				
Maximum Recorded Temperatures		141 degC		141		141			
Circulation Stopped		Time	24-Aug-2005		21:20				
Logger On Bottom		Time	29-Aug-2005		23:35				
Unit Number		Location		3819		NOBO			
Recorded By		D.Swan / S.Paweenawat/A. Arias							
Witnessed By		Magne Tillung / Finn Johansen							



Log run:	1A: PEX-HRLA-ECS-DSI 2A: MDT-GR 2B: MDT-GR (4SPMC-8MPSR-1x2¾SC-1x1SC) 1A: VSP (zero offset) 2C: MDT-GR (6SPMC-6MPSR-1x2¾SC-1x1SC-1x1SC w/Dye) 1A: MRCT 1A: FMI 2D: MDT-GR (2SPMC-4MPSR-2x2¾SC-1x1SC w/Dye) 1B: MRCT 2E: MDT-GR (2SPMC-10MPSR-1x2¾SC-1x1SC) 1C: MSCT		Hole diameter:	8 ½"
Date:	Time (start)	Operation:	Downtime:	
25.08.2005 2B PEX	11:30	Held pre job meeting, rigged up wireline cable, sheaves and heave compensating wire		
	12:45	Begin rigging up and function test PEX-HRLA-ECS-DSI		
	15:00	At surface notice that ECS is giving detector errors		
	15:45	ECS and LDSC swapped with back up tools. Power up tool again and check		
	16:00	Held pre-job meeting and installed radioactive sources		
	16:20	Rig up, length measurement at surface made - 103.5m. Tool stopped at 250m, asked drill floor to turn on compensator		
	16:25	Problems with compensator alignment, drill crew working on it		
	16:45	Compensator alignment fixed, reset depth, running in hole		
	18:55	Begin log down (file #53) from 3900m		
	19:35	Begin log up (file #56) from TD		
	20:13	Reach casing shoe 4099m MD. Stop logging		
	20:15	Simulate depth log at 4063m to check compensating system		
	20:35	Go down to 4295m for repeat section (file#58)		
	20:55	Stop log and go down for repeat section again (file#61). Playback repeat log (file#62)		
	21:25	Decide to go down to TD to repeat the main log		
	21:40	Start main log (file#63)		
	22:30	Reach casing shoe caliper read in casing = 8.36inch. Caliper offset = 0.802521 + 0.175 = 0.977521 inch		
	22:40	Start DSI in casing from 4120m to top of cement ~3687m		
	23:40	Finish DSI in casing. Start POOH		
26.08.2005	01:50	Tool arrive at surface		
	02:00	Rigged down and laid out PEX-HRLA-ECS-DSI. held pre job meeting prior to remove radioactive sources		
	02:30	Finish rigging down wireline		
	03:30	Rigged down wireline cable, sheaves and heave compensating wire. Temperature from thermometers in LEH = 128.128.128 degC	0.5 hrs	
26.08.2005 2A MDT	17:15	Start rigging MDT basic string for taking pressure points only		
	17:45	Picking up tools		
	18:10	Zero tool		
	18:25	Run in hole		
	19:15	Stop and do pickup at 1650m, 2800 lbs up tension, 1400 lbs down tension, head tension down is 475 lbs		



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Date:	Time (start)	Operation:	Downtime:	
	20:30	At casing shoe, tool hung up at 4197m while going down		
	20:45	At 4270m MD, prepare for correlation log (file #82)		
	21:15	Waiting for tool to stabilize wrt. temperature		
	21:20	Attempted pressure sampling at 4252.7m to 4252m, tight formation		
	21:50	Lost communication with MDT tool when doing pressure test #3 at 4246.8m, pulled inside 9 5/8" shoe for troubleshooting		
		Telemetry lost when power up 50V. Problem found in insulation of trolex plug or collector.		
	22:05	Inside casing, continue troubleshooting. No surface failure. Try to clean up collector cable		
	23:30	Try to power up tool again at casing shoe, still getting CRC's		
	23:40	Start POOH. Communication OK when close to surface.		
27.08.2005	02:05	Start rigging down		
	02:30	Finished rigging down.		
	03:20	Start lifting tools to catwalk	2.0 hrs	
27.08.2005 2B MDT	03:20	Start rigging up new MDT-string, now also including 12 PVT chambers (6 x 250 cc + 6 x 450 cc) and two low shock sampling chambers (1 and 2 3/4" gallon)		
	05:40	Finished rigging up		
	05:45	Checking tool at surface include calibration of LFA/CFA and Gamma-ray		
	06:20	Zero tool. start RIH		
	06:30	Finished turning on compensator.		
	08:00	At 2700m. Problems with telemetry. Intermittent breaks in communication. Probably faulty rope socket. Pull out to build new rope socket on cable end.		
	09:20	At surface. Cut 100m cable and start building new rope socket and change head		
	11:50	Rope socket and head checked - OK		
	12:15	Connect cable to tool. Waiting on top drive maintenance		
	12:25	Run in hole		
	12:35	Compensator on		
	13:05	Intermittent telemetry problems from 1000m		
	14:00	Function test probe at 3000m. works OK. Telemetry problems continue and appear to increase with depth.		
	14:20	At 3960m, tool powers down.		



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Date:	Time (start)	Operation:	Downtime:	
	14:35	Troubleshooting, tool seems to be powered up OK and a function test gives acceptable results. Still a lot of noise, but essential data reads OK. Test for GR readings. OK.		
	15:00	Run into open hole to do pre-tests.		
	15:10	Log up from 4300m for correlation (file #106). Correct for 6m deep.		
	15:20	Second correlation pass from 4300m (file #107), 0.5m shallow. Telemetry noise is decreasing.		
	15:35	First pre-test at 4246.8m (file #108). Problems to set probe properly, reset. Very slow build up, possibly supercharged		
	17:40	Tool shuts down at 4239m. Power tool up again, seems to work 100%. Continue pre-tests from 4238.5m		
	18:10	Tool shuts down at pre-test depth # 8 @ 4237.5m (file #177). Shut down data system. A complete reboot of the tool gives no response.		
	18:20	Pull out from 4250m and into casing shoe. RIH to 4230.0m to verify formation pressure of 1.52sg. At 4230.0m doing correlation pass. Pull up to next depth at 4209.1m.		
	20:00	At 4209.1m, unable to power up MDT. Pulling into shoe to troubleshoot		
	20:05	No go. Pulling out of hole.		
		Tool working at 1500m. Continue to POOH		
	22:50	On surface. Start trouble shoot with another set of TCC-GR-MRPC.		
28.08.2005	00:15	Failure reproduce		
	01:15	Start lifting FMI to drillfloor and check FMI on drillfloor, ok		
	01:45	Start disconnecting FMI and MDT		
	02:15	Finished rigging down MDT	33.5 hrs	
28.08.2005 2A VSP	02:15	Prepare for seismic run		
	03:50	Rig up VSP tool with four satellites for zero offset VSP		
	04:30	Zero Tool		
	04:35	Run in hole with VSP tool, tie in to reference log		
	07:50	Correlating		
	08:30	Log zero offset VSP in interval 4510m to 2710m		
	11:10	Survey complete. POOH with VSP from 2710m		
	12:13	VSP string at surface. start to rig down		
	13:30	Finnish rigging VSP down		



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Date:	Time (start)	Operation:	Downtime:	
28.08.2005 2B MDT	13:30	Start rigging up for run 2B MDT-GR w/sample bottles. Short in line #2 in logging head. Change to new logging head and install new collector.		
	15:00	Connect logging head.		
	15:10	Connect sampling string from last run. Tool works with CRC error (TCC). Test by PO against closed valve creating 2 amp load on PC.		
	15:30	Swap to DTC. Tool works fine in T5 mode. Test by running PO against closed valve creating 2 amp load on PC		
	16:56	Swap SPMC in MS-63 slot 6. NC valve released due to previous tool failure.		
	17:30	RIH		
	17:40	Activate compensator		
	17:50	Compensator on. RIH doing pick ups every 1000m		
	19:35	Start correlation log #132 from 4300m. correct by +0.5m		
	19:40	New correlation log #133 from 4300m. correct again by +0.5m and RIH. Tie in to reference log		
	20:30	Start pre-test #10 @ 4232.3m		
	22:50	Take pre-test #22 @ 4209.1m. Attempt with a drawdown volume of 10cc. but only 2.5cc achieved. Pump 1 stroke 480cc. Good test.		
29.08.2005	00:20	Move to pre-test #31 @4191.7m		
	00:41	Finished with the prioritized pressure points		
	00:45	Go down to 4290m. start new correlation log (file#144). correct by +1m		
	00:50	Start correlation log from 4290m (file#145). On depth.		
	01:00	Start pre-test @4237.5m		
	02:45	Go down to 4290m. start new correlation log (file#153). correct by +0.2m.		
	03:10	Start pre-test @4217.1m		
	05:00	No seal at @ 4194.5m. 5 pre-test depths from top Lysing. Probable leak of hydraulic oil for the standard probe. To avoid risk of loosing all chances of taking a fluid sample it is decided to go for a sample at 4231.4m (mobility 11.2md/cp) with the Guard probe. Confirmed with Hydro Petrophysicist.		
	05:30	RIH to do correlation pass.		
	05:50	Start correlation log (file #167) from 4300m. correcting depth with +0.3m.		
	06:00	Start correlation log (file #169) from 4290m. On depth.		
	06:10	At first sampling depth 4231.4m		



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Date:	Time (start)	Operation:	Downtime:	
30.08.2005	06:15	Set guard probe and take a pre-test.		
	06:45	Start pumping to clean up formation. Water/filtrate seen from start. both on LFA and CFA. Resistivity reading between 0.01 and 0.02 ohm*m.		
	08:10	Pumped 38 litres, res. is increasing > 0.1 ohm*m		
	08:40	Pumped 53 litres, res. is 0.15 ohm*m and increasing. No gas flags are seen on log.		
	09:55	Do pH injection tests		
	10:10	Pumped 97L , a few oil flags on the CFA. Res. reading 0.4 ohm*m		
	10:50	Lost seal, stop pump. Try re-setting the probe. No seal.		
	11:00	Retract probe. Set probe at 4231.4m, no seal.		
	11:05	Reset probe at same depth. seal OK.		
	11:15	Start pumping again. Only one pump started.		
	11:55	Split flow in the guard probe. Focus on the probe flow.		
	12:08	Starting to get some gas flags from AFA		
	13:30	Fill 2x450cc bottles, water samples. First bottle MPSR 55 either did not open, or was already triggered (rapid pressure build-up). Second bottle MPSR 36 appears OK.		
	13:45	MPSR 36 sealed. Continue pumping.		
	15:02	Pump stopped. Restart. Lost seal on outer packer on Guard probe, seal effective only towards inner probe.		
	15:15	Take a new water sample. 450cc. MPSR 783. Continue pumping, waiting for decision from town		
	15:30	Stop station log file #171. WFTI memory full. Start station log file #172.		
	16:45	Take water sample, start filling 450cc bottle MPSR 756		
	16:52	Close bottle		
	17:00	Do pH injection test, baseline 10 sec - injecting dye 30 sec.		
	17:10	Retract probe. Try to let tool drop down, no go. Pull up with 6000lbs on logging head. 12000lbs on cable, tool stuck.		
	17:40	Set both probes to centre tool.		
	17:45	Pull to 3000lbs.		
	17:47	Retract probes. pull to 12000 lbs, working tool up and down.		
	22:00	Decide to fish the tool string		
	23:30	Release the electrical weak point (ECDR) and start POOH with cable.		
30.08.2005	01:20	On surface with cable.		
	01:30	Finished rig down.		
Total Formation fluid pumped to the well on this run: 100L				



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Date:	Time (start)	Operation:	Downtime:	
30.08.2005 Fishing MDT	01:30	Make up 7" overshoot with 2 5/16" ID spiral grapple, one single 5" S-135 drill pipe and one 8 1/2" string stabilizer		
	02:30	Ran in hole with 7" fishing assembly on 5" S-135 drill pipe from 11m to 737m		
	04:30	Repair failure on hydraulic steering system for iron rough neck spinner tong		
	05:00	Continue running in hole from 737m to 4174m with 7" fishing assembly		
	12:00	Circulate bottoms up. 2000 l/min. condition mud		
	14:30	Establish slow circulation rate 200 l/min / 35 bar, run in hole carefully, engage fish at 4196m, observe 2 bar pressure increase and 5-10 ton down weight. Make several attempts to work fish before it came free, max overpull 50 ton, max down weight 10 ton.		
	16:00	Pump slug and start to pull fish out of the hole, flow check well for 15 min at shoe and before entering BOP with fish. well stable.		
31.08.2005	00:30	Held pre job meeting, pulled and secured fish in rotary. released fish, installed wireline cable to fish, function tested MDT tool. Ok, rigged down and laid out MDT. Observed filter on single probe fractured, worn single probe and inner guard probe packers. MDT else apparently ok.		
	04:00	Perform Wiper Trip. Circulated out any Formation-fluid pumped to the hole.		
01.09.2005 MRCT	05:20	Picking up MRCT from deck		
	05:30	Rigging up sheeve wheels.		
	05:50	Pre-job meeting at drillfloor.		
	06:00	Starting to rig up coring tool.		
	06:20	Adjusting compensator line, was on wrong side of upper sheeve.		
	06:45	Tool testing. Toolweight in air 1200 lbs		
	07:00	Connecting core catcher unit. calibrating GR and zero bit at DF.		
	07:30	RIH		
	07:35	Activating wave compensator.		
	10:00	Starting to correlate up from 4485m. 1.5 m deep (file #189)		
	10:35	On depth (file #191)		



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Date:	Time (start)	Operation:	Downtime:	
	10:37	Starting to cut core one at 4438.5 m. Cutting a bit unstable. but bit is penetrating. Suddenly it's not possible to rotate out the bit in coring mode. Rotates out manually, not possible to core in manual mode.Troubleshooting, no go.		
	12:00	Moving to core no 2.		
	12:20	Swapping to a older version software		
	12:55	Starting to cut core no 2. Still not able to rotate out the coring motor. After further troubleshooting the 50 V was shutting down when coring motor was started.		
	13:20	Not able to fix problem, decided to POOH.		
	15:30	Back at surface. starting to troubleshooting.		
	15:45	Problem reproducing at surface. 50 V shutdown when starting coring motor. The rotating problem not reproduced since the 50 V is shutting down.		
	17:55	MRCT rigged down.		
01.09.2005 2A FMI	17:58	Start rig up of FMI		
	18:30	Finish rig up FMI.		
	18:50	RIH FMI		
	20:38	Start logging up for repeat section @4260m to TD 4513m (file #209).		
	21:13	At TD. Start Main Log from 4513m to 4100m (File #211).		
	22:45	At the shoe. Calipers hanging on the shoe.		
	22:55	Pass the shoe. Caliper check. C1=8.4in. C2=8.5. POOH.		
02:09.2005	01:00	Tools at surface. Start rigging down FMI		
	01:30	FMI rigged down. prepare for next WL run.		
02.09.2005 2C MDT	02:30	Rig up Dual Packer MDT with 6 PVT chambers (2 x 250 cc + 4 x 450 cc) and two low shock chambers (1 and 2 ¾ gallon). check tool. ok		
	06:15	Start running in hole		
	08:20	Setting MRPA Auto Deflate valve at 4000 m.		
	08:50	Running into open hole.		
	09:00	At 4385m. Start up-log for correlation. 2m deep		
	09:30	Second correlation pass from 4308m. 0.5 m shallow.		
	09:35	Slightly tight around 4236m.		
	09:45	Third correlation pass from 4310m (file #221). On depth.		
	09:55	At 4211m. Start first pre-test. Supercharged, build up to above expected PP, then drops down again more than one bar (from 616.362 bar to 614.725 bar)		



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Date:	Time (start)	Operation:	Downtime:	
	11:20	Tried several pre-tests around 4211-4209m, all tight/supercharged or lost seal. Increase drawdown rate to 40 cc/min.		
	11:50	No good points in this zone 4208-4211m, pull up to 4191-4192m.		
	12:05	Pre-test at 4191.8m		
	12:50	No good pre-tests in upper zone. go down to 4275m to do correlation log (file #232).		
	13:50	Start correlation log from 4275m (file #234). On depth.		
	14:15	At 4195.5m. Pre-test.		
	15:00	Move to 4208.1m.		
	15:15	Got a good test at 4209.4m. Did a repeat 2x10cc drawdown, formation pressure stabilized at same level.		
	15:30	Do a pump-out cycle, 485 cc. Rate 300 rpm		
	16:20	Formation pressure back at same level as previous pre-tests.		
	16:30	Start second pump-out cycle, with CFA and AFA active. Drawdown on pump is approx. 50 bar at 300 rpm (lowest rate). Start to cleanup before sampling (file #240).		
	17:35	Inject pH dye for 23 sec. pH reads approx 3.8		
	18:00	Increase pump rate to 400 rpm and 578 bar, 35 bar drawdown		
	18:18	Increase to 500 rpm. 45 bar drawdown. More and more oil and gas flags seen on CGA Station log.		
	18:25	Looks like the formation is cleaning up, water flags decrease and oil gas flags increase on CGA and AFA. Increase to 600 rpm. 55 bar drawdown		
	18:55	Increase to 700 rpm, drawdown 63 bar		
	19:05	In discussion with town decided to take a 2¾-gallon chamber. MRSC 113, to secure a sample with potential HC.		
	19:10	Start sampling 2¾-gallon chamber. Res. 0.15ohm*m		
	19:45	Chamber filled (after 195min total pumping). Continue cleanup at the same rate 700rpm.		
	20:30	Pumped 64L to the well and 10L to the gallon chamber.		
	20:45	Start sampling 1x450cc bottle #1 MPSR 694. @ 700rpm		
	20:50	Chamber filled.		
	20:55	Continue pumping for pH test. Inject pH dye.		
	21:55	Reduced to @ 300rpm. Res. drops 0.03ohm*m.		
	22:10	Increased to @ 700rpm. To check res. going up to previous value. Res. increased back to 0.15ohm*m.		



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Date:	Time (start)	Operation:	Downtime:	
03.09.2005	22:12	Reduced again to @ 300rpm. Res. drops 0.03ohm*m.		
	22:35	Start sampling 1x250cc bottle #2 SPMC 136. @ 300rpm		
	22:38	Chamber filled. (Temp. 138 deg C. Press 612.2bar)		
	22:54	Start sampling 1x450cc bottle #6 MPSR 974. @ 300rpm.		
	23:01	Chamber filled. (Temp. 138 deg C. Press 612.2bar).		
	23:05	Start Transient test. Pump as fast we can. 700rpm for 10min, shut in and observe pressure response approx 1hr.		
		@ Midnight. Total volume pumped to the well is approx 70L. mostly filtrate. The rest to the chambers. For the record.		
	23:15	Shut in and stop pump. Start @ 24490.2sec.		
	00:20	Minitest finished		
	00:30	Software crash...		
	00:55	Retracting tool manually.		
	01:05	Try to pull but tool stuck. Working on it.		
	02:50	Prepare to set dual packer module.		
	03:50	Dual packer module set over interval 4210.85–4211.86m. 40.3bars inflate pressure.		
	03:54	Set observation probe at 4209.5m for vertical interference test.		
	04:12	Pre-test through probe. Mobility 3.6 md/cp		
	04:35	Draw down packer interval		
	04:50	Draw down packer interval second time		
	05:30	Build up for pressure. Very slow, to tight. 611.800bar after 40min and keep stabilizing. Stop minitest. (Would take 1hr or more to complete)		
	05:35	Clean up packer interval and try to move formation fluid. Look for reaction / pressure drop from the observation probe. No reaction.		
	05:55	Pumped 25L (18L in packer vol+7L formation) Stop pumpout in order to change 50V system, but it cured itself....if not pumping higher than 1600rpm		
	06:00	Continue clean up		
	07:00	Pumped 60L formation/filtrate to the well. (For the record. tot 130L.)		
	08:00	Reduce pump rate from 1500 to 1200 rpm		
	08:20	Increase rate from 1200 to 1500 rpm on pump. Pump is showing some sealing problems, strokes work only in one direction!		
	08:40	Pump seems be to OK again. 15 bar drawdown.		
	08:40	Start sampling 1x450cc bottle #5 MPSR 801. @ 1500rpm		



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Date:	Time (start)	Operation:	Downtime:	
	08:42	Finished sampling bottle #5. Reduce pump rate gradually from 1500rpm to 1200 to 600rpm (8 bar DD) to 400rpm (4 bar DD)		
	09:00	Continue clean up before sampling into SPMC bottle.		
	09:35	Start sampling 1x250cc bottle #3 SPMC 188. @ 400rpm.		
	09:45	Finished sampling. Increase pump rate to 1000 to 1500rpm.		
	10:25	Shut in at packer for mini-test		
	11:50	Decide to stop minitest . PS2 (packer) shows 611.548 bars. PS1 (probe) pressure 612.110 bars. Not fully stable pressures, fluctuates up and down within ca 0.05 bars.		
	11:55	Retract probe observation probe (PS1)		
	12:00	Deflate packers, opening lower SC seal valve and putting pumps in down mode. Tool drops free when running out cable! Pull into shoe and waiting for decision from "town".		
	12:30	Project decides to go for sampling in the 4191-4192m area. Run in hole for correlation log		
	12:35	Correlate GR up from 4245m (file #247).		
	12:40	At 4191.6m, preparing to set packers.		
	12:55	Setting dual packer module, inflates to 46 bars - OK. When shutting off pump, the pressure bleeds off. Problems with the inflate valve, elements are not holding inflate pressure when lower MS seal valve is open. Troubleshooting.		
	13:45	Problem solved, difficulties in closing inflate valve.		
	13:55	Start pumping (file #248) at 500rpm up to 900 rpm, total 2425 cc		
	14:07	Stop build-up, tight formation and slow build-up. Start cleaning up. Start with 300rpm. 80 bar drawdown.		
	14:44	Still pumping at 300rpm, drawdown has gradually increasing. now 127 bars below reservoir pressure.		
	14:45	Stop pumping. Probably just creating a vacuum in the annulus between the packers, with very little fluid drawn into well bore. Pressure recorded with PS2 is 485.5 bars. Pumped 4.4 litres. Pressure differential across packer and mud column close to packer limitation.		
	15:30	Slow and steady increase in shut in pressure, up to 563 bars, but still 50 bars below formation pressure. Start pumping a few strokes.		
	15:35	Suddenly packers lose internal pressure and seal. Stop pumping. Troubleshoot, unable to inflate packers.		
	15:50	Attempt to re-inflate packers, inflate pressure increase. 17 litres pumped, no increase in inflate pressure.		



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Log run:	1A: PEX-HRLA-ECS-DSI 2A: MDT-GR 2B: MDT-GR (4SPMC-8MPSR-1x2¾SC-1x1SC) 1A: VSP (zero offset) 2C: MDT-GR (6SPMC-6MPSR-1x2¾SC-1x1SC-1x1SC w/Dye) 1A: MRCT 1A: FMI 2D: MDT-GR (2SPMC-4MPSR-2x2¾SC-1x1SC w/Dye) 1B: MRCT 2E: MDT-GR (2SPMC-10MPSR-1x2¾SC-1x1SC) 1C: MSCT		Hole diameter:	8 ½"
Date:	Time (start)	Operation:	Downtime:	
	16:10	Recheck all valves, attempt to re-inflate packers again. same result		
	16:20	No success with packers, decide to pull out of hole with dual packer MDT from 4191.6m to surface.		
	18:30	On surface. Start rig down MDT, observed upper dual packer ruptured.		
	22:00	Finished rig down of MDT. Upper packer ruptured most likely due to high gas content and high temperature. 139+ deg C recorded.		
Total pumped Formation fluid to the well on this run: 290L				
03.09.2005 MRCT	22:00	Prepared for rig up of MRCT.		
	01:30	Rigged up MRCT. 50 cores. checked tool, ok		
04.09.2005	02:00	Setting up computer and testing of tools		
	03:00	Run in hole with MRCT from surface to 4000m, check tool at 2000m ok, check tool at 4000m, tool failure		
	05:00	Troubleshoot MRCT failure, not able to fully retract coring unit. no success.		
	05:20	POOH, to investigate and run back with the first tool ENP0.		
	07:00	At surface for troubleshooting.		
	07:30	Rigging down corecatcher and coring unit.		
	07:40	Preparing markers and coring tool from first run.		
	07:45	Rigging up tools.		
	08:05	Operational check of tool.		
	08:20	Software hangs up and SEC is not communicating.		
	09:00	Tool tested, works fine.		
	09:05	Not able to move winch after restarting WAFE and computers.		
	09:15	It is not possible to replace the brake. It looks like we are missing a electrical signal from the unit.		
	10:05	Connecting core catcher unit.		
	10:15	Power up tools again, tool is not token passing "stopping" below MRPC.		
10:35	Measure token out voltage at bottom of MRPC, good. Carry cartridge to doghouse to troubleshooting. Some bad (intermittent) continuity found on wires to little board. Contact problem fixed.			
13:45	Connecting the cartridge again, the tool is powering up normally. The tool has still some problems to respond on commands. Bit 9 on CT word is going on and off, could be a little board problem.			



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Date:	Time (start)	Operation:		Downtime:
	21:00	Unable to repair. Rig down wireline equipment.		
05.09.2005 Perform Wiper Trip. Circulated out any formation fluid pumped into the hole.				
05.09.2005 2D MDT	22:30	Held pre job meeting, rigged up wireline sheaves and compensator line		
	23:00	rig up dual packer MDT dressed with 2 x 250 cc SPMC. 10 x 450 cc MPSR and 2 x 2 3/4" gallon sample chambers		
06.09.2005	02:00	Finished rig up. Start checking tool.		
	02:15	Found poor connection on the lower Sample Chamber. Changed out with 1 gallon SC-2. Problems when power up 50V to the tool. Tripping down after 10min. Change MRTM and MRPP. Same results. Troubleshoot. Removed CFA and the two MRSC's.		
	08:15	CFA and MPRC's removed. Still problems with 50V at lower pump module, start to test 50V from top of tool. After testing all components, tool ok even at lower pump module		
	09:40	Zero tool. RIH with dual packer MDT dressed with 2 x 250 cc SPMC. 10 x 450 cc MPSR		
	09:50	Activating heave compensator and setting Auto Deflate Valve at 100m.		
	10:00	Continue RIH to 4057m		
	11:40	At 4050m. stop due to problems with high current on tool. – 15V -> -22.4V. 50V -> 114V temp 109 deg C. Possible leak of current within tool. Shut down all systems and restart.		
	13:00	Pull out of hole after troubleshooting. Tool is token passing fine. But 50 V cannot be put on tool.		
	14:50	On surface. Start testing MDT module		
	15:00	Continue troubleshooting MDT.		
	20:30	Found problem source in the LFA. Problem found on LFA-8129. UH 1.2.5.6 pins look burned. Change to LFA-8103. Changed with backup.		
	21:15	Checking tools, ok		
	21:30	RIH with dual packer MDT from surface to 4300m		
	23:45	At TD start correlating.		
	07.09.2005	23:50	@ 4300 Start correlation pass 4300-4230m (1m shallow)	
00:05		@ 4310 Start correlation pass 2. On depth. RIH		
00:20		On depth. RIH and pull up for pre-test		



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Date:	Time (start)	Operation:	Downtime:	
	00:27	@ 4253.5 Start pre-test 1. Mobility 2.1 md/cp and formation pressure 1.52+ in 700sec. (program says mobility >4 in max 500sec). Pull up in 30cm steps trying again for "numerous attempts" in the interval 4253.5-4252.0m. 8 tests at 5 stations, no success.		
	02:40	@4252.3m. Tight/Supercharged above 4253.2m. Drop down to 4253.7m to try again and possibly sample through the probe.		
	02:45	Correlation confirmation pass		
	02:50	@4253.7m.		
	03:15	@4253.4m. Mobility 2.1.		
	03:55	Attempt to pump/scan through the probe @4253.4m. 130bar draw down. Too much stress for the probe-packer. Abort scanning and move up to next sand. Save the dual packers until after the press/mobility evaluation of sand completed.		
	04:15	Abort scanning. Drop down to 4300m for correlation pass.		
	04:20	Finished correlation pass. Drop down to confirm correction when pulling up to next sand at 4246m.		
	04:35	@ 4246m Start pre-tests with 30cm intervals		
	05:50	@ 4245m. Done 3 pre-tests. Tight all the way up to 4245m. (See also MDT run 2B with pre-tests in same sand.) Move to depth 4246.2m for confirmation/repeat of pre-test from MDT run 2B (sand with mobility of 2.1cp/md was found earlier).		
	06:00	Correlation pass. (Hang up on something and stretched the log)		
	07:40	Decide to go for sampling with dual packer module at 4353.5m. Start correlation log (file #313).		
	07:50	At 4253.5m and set packers (file #315). No seal obtained possibly due to an asymmetric hole.		
	09:00	Move up to 4253.0m and set packers. Seal ok. Start log file #316. Start cleanup.		
	10:45	Pumped clogged. Start flushing through it.		
	11:25	Pump clean.		
	12:50	Fill 1x450cc bottle #4. MPSR 768. Continue pumping.		
	15:30	Fill 1x450cc bottle #6. MPSR 930.		
	15:40	Packer elements burst. lost seal. Try to establish new seal.		
	16:00	Packer element test. Elements confirmed burst.		
	17:00	Pre-test taken with probe at 4253.0m. Formation pressure recorded only 597.0 bars, possibly due to drawdown during cleanup and sampling.		
	17:30	Continue with pre-tests.		



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Date:	Time (start)	Operation:		Downtime:
	21:00	Pull out of hole.		
	22:45	Tools at surface.		
08.09.2005	00:35	MDT tools rigged down.		
Total formation fluid pumped to wellbore on this run: 66 ltr				
08.09.2005 2A MSCT	01:00	Rig up the MSCT logging tool. Check the MSCT logging tool, ok. MSCT dressed for 50 ea sidewall cores		
	01:35	Rigging up tools. Mechanical weak point rating 6700-7300 lbs. Max safe pull on weak point 5025 lbs.		
	02:20	Connecting corecatcher unit.		
	02:30	Zero tool at bit. Toolweight in air 900 lbs		
	02:40	Activating wave compensator. Tool weight in mud 700 lbs. depth adjusted 7.8 m.		
	02:45	RIH from surface to 4275 m. Make 3 correlation passes to come on depth.		
	05:00	Starting to cut core no. 1		
	08:20	Core 34 stuck between coring motor and lower block. Coring motor is not starting and rotates out. Working with the tool to overcome problem.		
	08:45	Tool working properly again. Core 34 properly lost/crushed.		
	10:05	Correlating for core 39 at 4438.5 m (file #353). on depth		
	12:00	Low oil warning came on at core 47. The only option is to pull out of hole.		
	12:05	Pull out of the hole with the MSCT log.		
	16:45	Tool at surface. Starting to rig down tools and sheave wheels.		
	18:30	Rig down completed		

13.10.2 Production test operations

Date	Time	Sequence of Events
15-sep-05	07:00:00	**** STETIND 6605/8-1 ****
15-sep-05	07:37:00	Start Spartek gauge 20429
15-sep-05	07:40:00	Start Spartek gauge 20398
15-sep-05	07:45:00	Start Spartek gauge 20397
15-sep-05	07:48:00	Start Spartek gauge 20356
15-sep-05	08:31:00	Start Spartek gauge 20396
15-sep-05	08:33:00	Start Spartek gauge 20406
15-sep-05	08:36:00	Start Spartek gauge 77289
15-sep-05	08:39:00	Start Spartek gauge 77415
15-sep-05	12:50:00	Start to RIH with TCP guns
15-sep-05	13:55:00	RIH with DST tools
15-sep-05	14:40:00	RIH Gauges
15-sep-05	15:05:00	RIH LPR-N Tester Valve
15-sep-05	20:55:00	Finish RIH BHA, start RIH 3 joints of 3.5" TBG
15-sep-05	22:00:00	Start P/T BHA against TST. Pump 159 litres. 620 Bar
16-sep-05	08:58:00	Prepare to P/T TBG half way. No need to reverse circulate
16-sep-05	08:58:00	because well U-Tube at 200 l/min
16-sep-05	09:05:00	Start P/T tubing against TST.620 Bar
16-sep-05	09:44:00	Good test. Continue RIH 3.5" TBG
17-sep-05	04:50:00	Pick up dummy hanger from pipe deck
17-sep-05	06:00:00	RIH with dummy hanger
17-sep-05	06:20:00	Paint single rotary
17-sep-05	08:50:00	TCP guns enter liner
17-sep-05	09:00:00	Rig up chemical injection hoses from test area to drillfloor
17-sep-05	09:19:00	Champ packer enter 7" liner
17-sep-05	13:45:00	Land fluted hanger in wear bushing
17-sep-05	13:50:00	Start RIH W/L for correlation
17-sep-05	16:00:00	W/L OOH
17-sep-05	23:30:00	Dummy hanger OOH
18-sep-05	03:40:00	Start P/T BHA against TST. Pump 222 litres . 620 Bar
18-sep-05	04:20:00	Good test.Continue run Subsea Test Tree
18-sep-05	05:00:00	Subsea control panel up on drillfloor
18-sep-05	05:30:00	P.U SSTT
18-sep-05	05:35:00	Control panel test/purge
18-sep-05	06:20:00	Istall new share
18-sep-05	06:40:00	P.U RV
18-sep-05	07:00:00	RV torqued
18-sep-05	07:45:00	Test unlatch (30 sec)
18-sep-05	08:00:00	Relatch
18-sep-05	08:30:00	Test control + balance
18-sep-05	09:00:00	Open SSTT and SSRV. Check for leaks
18-sep-05	09:30:00	Through rotary with SSTT and SSRV
18-sep-05	10:33:00	Pressure test string to 620 bar
18-sep-05	10:48:00	Close SSTT for inflow test
18-sep-05	11:05:00	Good test
18-sep-05	11:20:00	Start RIH

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18-sep-05	13:15:00	After many attempts we were able to RIH due to Calcium Bromide
18-sep-05	13:15:00	cushion excessive overflow on to drillfloor
18-sep-05	13:30:00	Stop + rethink strategy
18-sep-05	15:00:00	Close SSTT. leave SSRV open
18-sep-05	15:50:00	Start RIH
18-sep-05	17:30:00	Stop and fill up string
18-sep-05	17:45:00	Rig up + pump through SSTT to check pressure below SSTT
18-sep-05	18:00:00	Open SSTT and bleed off pressure (100 bar) to zero
18-sep-05	19:00:00	Commence RIH
18-sep-05	21:00:00	Pump to equalize pressure below SSTT. 100 Bar
18-sep-05	21:15:00	Open SSTT to bleed down pressure in string
18-sep-05	21:18:00	Close SSTT. Continue RIH
19-sep-05	01:30:00	Run through liner PBR with TCP Guns
19-sep-05	03:45:00	Run through liner PBR with Champ Packer
19-sep-05	06:00:00	Stab on SSRV + pressure test open/close + check inj. Line
19-sep-05	07:40:00	SSLV through rotary
19-sep-05	07:45:00	Fill string
19-sep-05	07:48:00	Open SSLV. Level in string blew out due to pressure trapped below
19-sep-05	07:48:00	SSLV. SSLV proved open
19-sep-05	08:00:00	Change of plan. Due to bad weather we POOH SSLV and lay it out
19-sep-05	08:42:00	SSLV laid out on deck
19-sep-05	09:40:00	Equalize SSTT (240 bar). Open SSTT and bleed to zero
19-sep-05	09:50:00	X-over to drill pipe
19-sep-05	10:05:00	Land in wear bushing. 10-15 ton overpull
19-sep-05	10:15:00	Added 20 litres of Oceanic Fluid to control panel reservoir
19-sep-05	10:55:00	Secure SSTT umbilical to drill pipe. Support hose with a gooseneck
19-sep-05	11:00:00	WOW
19-sep-05	19:00:00	Checked control panel C = 3000 B = 600 Hose OK
19-sep-05	20:00:00	Checked control panel C = 3000 B = 600 Hose OK
19-sep-05	20:30:00	Filled 20 l Oceanic fluid on Subsea Control Panel
20-sep-05	07:30:00	Stab on SSLV and make up control line connections and chemical inj. Line
20-sep-05	07:30:00	SSLV in closed position through rotary
20-sep-05	07:50:00	Fill above SSLV with Brine
20-sep-05	08:00:00	Open SSLV
20-sep-05	08:15:00	RIH one single
20-sep-05	08:15:00	Make up test sub to string
20-sep-05	08:25:00	Equalize and open SSTT
20-sep-05	08:30:00	Pressure test string to 620 bar
20-sep-05	08:35:00	Test SSLV chem.inj. line
20-sep-05	08:48:00	Close SSLV for inflo test
20-sep-05	09:06:00	Inflo test ok.Open SSLV
20-sep-05	09:18:00	Close SSLV to prevent overflow. Rig down test sub from tbg string
20-sep-05	09:30:00	Prepare floor to pick up STT
20-sep-05	11:00:00	Change to long bailes
20-sep-05	12:15:00	Pick up STT
20-sep-05	12:30:00	Make up Coflexip hoses to STT
20-sep-05	16:55:00	Stab flowhead on to string
20-sep-05	18:15:00	Land Subsea in BOP up weight 125 ton. Down weight 120 ton
20-sep-05	18:25:00	Compensator on and Subsea landed in BOP
20-sep-05	18:58:00	Close Lower Master Valve
20-sep-05	18:59:00	Close Kill Valve



Date	Time	Sequence of Events
20-sep-05	19:00:00	Start pressure test # 1
20-sep-05	19:59:00	Close Wing Valve and open Kill Valve
20-sep-05	20:01:00	Start pressure test # 2
20-sep-05	20:24:00	Close SSV
20-sep-05	20:25:00	Close SSLV
20-sep-05	20:26:00	Open Lower Master Valve
20-sep-05	20:29:00	Close Swab Valve open Needle Valve
20-sep-05	20:41:00	Open Wing Valve
20-sep-05	20:43:00	Start pressure test # 3
20-sep-05	21:05:00	Bleed off pressure to 2-3 bar
20-sep-05	21:07:00	Open SSLV
20-sep-05	21:10:00	Close middle pipe ram. 116 litres pumped
20-sep-05	21:19:00	Close Choke open SSV
20-sep-05	21:21:00	Kill line Check Valve in Unlock position
20-sep-05	21:33:00	Start pressure test # 4
20-sep-05	21:52:00	Test ok. Bleed off to 50 bar. Inflow test Check Valve.
20-sep-05	22:05:00	Open Choke bleed off to zero
20-sep-05	22:30:00	Toolbox talk prior setting Champ Packer
20-sep-05	22:40:00	Make up Lubricator hose to pipe
20-sep-05	23:05:00	Subsea landed. hold 80-85 ton on W.I.R
20-sep-05	23:10:00	Commence rig up W/L for Correlation run # 2
21-sep-05	01:50:00	RIH with W/L to correlate
21-sep-05	02:10:00	Perform PSD 1 test. SSV close Wing Valve close
21-sep-05	02:19:00	Open Wing Valve
21-sep-05	02:26:00	Open SSV
21-sep-05	02:35:00	Perform PSD 2 test.
21-sep-05	02:39:00	PSD system reset
21-sep-05	03:55:00	W/L OOH. Close Swab Valve. Top shot = 4184 m
21-sep-05	04:00:00	RA marker 7" liner = 4124 m. RA marker test string = 4096.5 m
21-sep-05	04:22:00	Start test Champ Packer. 35 Bar
21-sep-05	04:39:00	Test ok. Bleed off pressure to zero.
21-sep-05	04:58:00	Close Choke.
21-sep-05	05:12:00	Start cycle OMNI
21-sep-05	05:35:00	OMNI in circulating position
21-sep-05	05:49:00	Start displace tbg to Glycol/water 60/40 17.4 m3
21-sep-05	08:30:00	Isolate reelpack air supply from control panel air supply
21-sep-05	08:30:00	for independent operation
21-sep-05	08:40:00	Run a remote SSTT control line bleed off point to
21-sep-05	08:40:00	outside back door
21-sep-05	08:55:00	Start cycle OMNI from circ. to welltest position
21-sep-05	09:06:00	Pressure up separator to 10 bar with nitrogen
21-sep-05	09:15:00	Turn off reelpack air supply and connect SSTT chemical
21-sep-05	09:15:00	injection hose to reelpack
21-sep-05	09:17:00	Stop charging separator
21-sep-05	09:17:00	Separator in bypass for initial flow
21-sep-05	09:30:00	OMNI in welltest position
21-sep-05	12:35:00	Start pressure up to 500 bar to fire guns
21-sep-05	12:41:00	500 bar at choke
21-sep-05	12:42:00	Bleed off pressure at choke to 80 bar
21-sep-05	12:42:00	Close kill valve
21-sep-05	12:43:00	Close choke

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21-sep-05	12:45:00	Good indication of guns fire. Perforate from 4184 to 4211.5 m
21-sep-05	12:46:00	***** INITIAL FLOW *****
21-sep-05	12:46:00	Open well on 16/64" adjustable choke
21-sep-05	12:46:00	Start level in cal tank = 1.05 m3
21-sep-05	12:46:00	Increase adjustable choke to 32/64"
21-sep-05	12:46:00	Increase adjustable choke to 100/64"
21-sep-05	13:00:00	Calibration tank level = 2.35 m3
21-sep-05	13:06:00	Bleed off annulus to zero. close LPRN
21-sep-05	13:06:00	Calibration tank level = 2.80 m3
21-sep-05	13:06:00	Close in well at choke manifold. start 2 hrs initial buildup
21-sep-05	15:00:00	Pump up annulus to open LPRN
21-sep-05	15:00:00	Seabed temp = -0.62 DegC
21-sep-05	15:03:00	***** MAIN FLOW *****
21-sep-05	15:03:00	Open well on 16/64" adjustable choke
21-sep-05	15:05:00	Increase adjustable choke to 32/64"
21-sep-05	15:15:00	Calibration tank level = 4.30 m3
21-sep-05	15:20:00	Calibration tank level = 5.00 m3
21-sep-05	15:34:00	Light pilot on port side burner boom
21-sep-05	15:35:00	Start methanol injection at SSTT 3.7 l/min
21-sep-05	15:36:00	Start glycol injection at U/S Choke and SSLV 3.7 l/min
21-sep-05	15:38:00	Line up well through separator
21-sep-05	15:42:00	Open water outlet on separator to calibration tank
21-sep-05	15:46:00	Adjust heater choke to 32/64" and open adj. Choke fully on C.M.
21-sep-05	15:57:00	Gas on port burner boom
21-sep-05	16:00:00	BOP temp = 0.16 DegC
21-sep-05	16:00:00	Close water outlet on separator
21-sep-05	16:02:00	Increase heater adjustable choke to 36/64"
21-sep-05	16:04:00	Open water outlet on separator to calibration tank
21-sep-05	16:05:00	Increase heater adjustable choke to 40/64"
21-sep-05	16:10:00	Increase heater adjustable choke to 44/64"
21-sep-05	16:14:00	Close water outlet on separator
21-sep-05	16:17:00	Lower 2" orifice plate in to service
21-sep-05	16:22:00	Lift 2" orifice plate out of service
21-sep-05	16:23:00	Increase heater adjustable choke to 52/64"
21-sep-05	16:29:00	Increase heater adjustable choke to 60/64"
21-sep-05	16:31:00	Lower 2" orifice plate in to service
21-sep-05	16:35:00	Lift 2" orifice plate out of service
21-sep-05	16:35:00	Open water outlet on separator to calibration tank
21-sep-05	16:38:00	Close water outlet on separator
21-sep-05	16:39:00	Lower 1.5" orifice plate in to service
21-sep-05	16:40:00	H2S = 3.0 ppm
21-sep-05	16:40:00	CO2 = 6 %
21-sep-05	16:40:00	Bottoms up
21-sep-05	17:00:00	BOP temp = -2.06 DegC
21-sep-05	17:03:00	Lift 1.5" orifice plate out of service
21-sep-05	17:04:00	Increase heater adjustable choke to 64/64"
21-sep-05	17:04:00	Lower 1.5" orifice plate in to service
21-sep-05	17:06:00	Open water outlet on separator to calibration tank
21-sep-05	17:07:00	Close water outlet on separator
21-sep-05	17:12:00	Lift 1.5" orifice plate out of service
21-sep-05	17:13:00	Start decrease separator pressure

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21-sep-05	17:15:00	H2S = 3.8 ppm
21-sep-05	17:15:00	CO2 = 6 %
21-sep-05	17:20:00	Increase heater adjustable choke to 68/64"
21-sep-05	17:24:00	Lower 1.875" orifice plate in to service
21-sep-05	17:24:00	Stop injecting glycol U/S choke
21-sep-05	17:30:00	Gas SG = 0.660
21-sep-05	17:33:00	Adjust steam supply to 130 to increase HOT
21-sep-05	17:35:00	Adjust steam supply to 120 to decrease HOT
21-sep-05	17:38:00	Open water outlet on separator to calibration tank
21-sep-05	17:40:00	Close water outlet on separator
21-sep-05	17:45:00	Adjust Gas SG in Scan to 0.66
21-sep-05	17:50:00	Gas SG = 0.620
21-sep-05	18:00:00	BOP temp = 0.09 DegC
21-sep-05	18:15:00	H2S = 3.4 ppm
21-sep-05	18:15:00	CO2 = 6.2 %
21-sep-05	18:17:00	Open water outlet on separator to calibration tank
21-sep-05	18:19:00	Close water outlet on separator
21-sep-05	18:26:00	Switch off jet gas
21-sep-05	18:36:00	Stop injecting methanol at SSTT
21-sep-05	18:38:00	Start MEG injection at SSTT 3.7 l/min
21-sep-05	19:00:00	BOP temp = 0.23 DegC
21-sep-05	19:00:00	Open water outlet on separator to calibration tank
21-sep-05	19:02:00	Close water outlet on separator
21-sep-05	19:05:00	Gas SG = 0.625
21-sep-05	19:15:00	H2S = 4.0 ppm
21-sep-05	19:15:00	CO2 = 6.0 %
21-sep-05	19:16:00	Bleed off annulus from 117 to 112 bar
21-sep-05	19:45:00	Corr. Condensate SG 0.829
21-sep-05	19:39:00	Reduce pumprate on Meg inj. at SSLV 1.5 l/min
21-sep-05	19:30:00	CO2 = 6 %
21-sep-05	20:00:00	BOP temp = 0.83 DegC
21-sep-05	20:10:00	Gas SG = 0.627
21-sep-05	20:15:00	BS&W = 99.8 % Water. Chloride 29000 mg/l 0.2% Solids
21-sep-05	20:15:00	Water Density 1.088 @ 11.8 DegC
21-sep-05	20:15:00	Corr. Condensate SG 0.835
21-sep-05	20:20:00	H2S = 4.5 ppm
21-sep-05	20:20:00	CO2 = 5 %
21-sep-05	20:20:00	Gas SG = 0.627
21-sep-05	20:30:00	BS&W = 99.8 % Water. Chloride 29000 mg/l 0.2% Solids
21-sep-05	20:36:00	Reduce pumprate on Meg inj. at SSLV
21-sep-05	20:47:00	Bleed off annulus from 117 to 106 bar
21-sep-05	21:00:00	BOP temp = 2.38 DegC
21-sep-05	21:00:00	BS&W = 99.9 % Water. Chloride 29000 mg/l 0.1% Solids
21-sep-05	21:10:00	Gas SG = 0.627
21-sep-05	21:25:00	H2S = 4 ppm
21-sep-05	21:25:00	CO2 = 5.5 %
21-sep-05	21:30:00	BS&W = 99.9 % Water 0.1% Solids
21-sep-05	22:00:00	BS&W = 15% Cond.. 85% Water. Salinity 25000 mg/l 0.7% MEG
21-sep-05	22:00:00	BOP temp = 0.96 DegC
21-sep-05	22:00:00	Gas SG = 0.627
21-sep-05	22:01:00	Bleed off annulus from 118 to 110 bar



Date	Time	Sequence of Events
21-sep-05	22:19:00	H2S = 4.5 ppm
21-sep-05	22:19:00	CO2 = 5.5 %
21-sep-05	22:19:00	Gas SG = 0.627
21-sep-05	22:30:00	Petrotech BS&W = 8% Meg(??) 92% Water
21-sep-05	22:46:00	Bleed off annulus pressure from 117 to 111 bar
21-sep-05	22:48:00	Stop MEG injection at SSLV
21-sep-05	23:00:00	BS&W = 100 % Water. Chloride 20000 mg/l
21-sep-05	23:00:00	Water Density 1.066 @ 11.2 DegC
21-sep-05	23:00:00	Corr. Condensate SG 0.838
21-sep-05	23:00:00	BOP temp = 2.31 DegC
21-sep-05	23:35:00	H2S = 4.2 ppm
21-sep-05	23:35:00	CO2 = 6.5 %
21-sep-05	23:38:00	Bleed off annulus from 118 to 110 bar
21-sep-05	23:45:00	Corr. Condensate SG 0.833
21-sep-05	00:00:00	BS&W = 12% Condensate. 88% Water. Chloride 19000 mg/l
21-sep-05	00:00:00	Water Density 1.064 @ 14.7 DegC
22-sep-05	00:00:00	BOP temp = 0.56 DegC
22-sep-05	00:00:00	Petrotech BS&W = Producing 100 to 200 liters condensate per day
22-sep-05	00:16:00	Open water outlet on separator to calibration tank
22-sep-05	00:20:00	Gas SG = 0.625
22-sep-05	00:23:00	Close water outlet on separator
22-sep-05	00:30:00	BS&W = 12% Condensate. 88% Water.
22-sep-05	00:36:00	H2S = 4.5 ppm
22-sep-05	00:36:00	CO2 = 6.5 %
22-sep-05	00:36:00	Gas SG = 0.625
22-sep-05	00:52:00	Bleed off annulus from 119.8 to 111 bar
22-sep-05	01:00:00	BOP temp = 1.97 DegC
22-sep-05	01:00:00	BS&W = 12% Condensate. 88% Water. Chloride 17000 mg/l
22-sep-05	01:00:00	Water Density 1.066 @ 9.8 DegC
22-sep-05	01:00:00	Corr. Condensate SG 0.837
22-sep-05	01:11:00	Divert flow from port to starboard burner
22-sep-05	01:30:00	Drain scubbers in Daniels box
22-sep-05	01:30:00	H2S = 4.5 ppm
22-sep-05	01:30:00	CO2 = 6.5 %
22-sep-05	01:48:00	Start MEG inj at SSLV
22-sep-05	01:57:00	Lift orifice plate
22-sep-05	01:59:00	Reduce separator pressure from 12 to 7 bar
22-sep-05	02:00:00	BS&W = 12% Condensate. 88% Water. Chloride 14000 mg/l
22-sep-05	02:00:00	Water Density 1.079 @ 14.2 DegC
22-sep-05	02:00:00	Corr. Condensate SG 0.834
22-sep-05	02:00:00	BOP temp = 1.64 DegC
22-sep-05	02:02:00	Increase heater adjustable choke to 70/64"
22-sep-05	02:05:00	Lower 1.875" orifice plate in to service
22-sep-05	02:12:00	Bleed off annulus from 118 to 110 bar
22-sep-05	02:14:00	Open water outlet on separator to calibration tank
22-sep-05	02:15:00	Close water outlet on separator
22-sep-05	02:30:00	BS&W = 11% Condensate. 89% Water. Chloride 14000 mg/l
22-sep-05	02:30:00	Gas SG = 0.629
22-sep-05	02:30:00	H2S = 4.5 ppm
22-sep-05	02:30:00	CO2 = 7.0 %
22-sep-05	02:46:00	Stop MEG inj at SSLV



Date	Time	Sequence of Events
22-sep-05	03:00:00	BS&W = 11% Condensate. 89% Water. Chloride 17000 mg/l
22-sep-05	03:00:00	Water Density 1.065 @ 9.9 DegC
22-sep-05	03:00:00	Corr. Condensate SG 0.837
22-sep-05	03:00:00	BOP temp = 0.43 DegC
22-sep-05	03:07:00	Producing approx 12 M3/Day Water. Calibration tank measurement
22-sep-05	03:30:00	BS&W = 12% Condensate. 88% Water
22-sep-05	03:30:00	H2S = 4.5 ppm
22-sep-05	03:30:00	CO2 = 7.0 %
22-sep-05	03:39:00	Bleed off annulus from 117 to 111 bar
22-sep-05	04:00:00	BS&W = 12% Condensate. 88% Water. Chloride 16000 mg/l
22-sep-05	04:00:00	MI estimate 12% Condensate. 88% Water. Chloride 18000mg/l
22-sep-05	04:00:00	Water Density 1.064 @ 10.5 DegC
22-sep-05	04:00:00	Corr. Condensate SG 0.836
22-sep-05	04:00:00	BOP temp = 2.51 DegC
22-sep-05	04:02:00	Open water outlet on separator to calibration tank
22-sep-05	04:06:00	Close water outlet on separator
22-sep-05	04:30:00	BS&W = 12% Condensate. 88% Water
22-sep-05	04:30:00	H2S = 4.5 ppm
22-sep-05	04:30:00	CO2 = 6.5 %
22-sep-05	04:30:00	Mercury concentration = 1.14
22-sep-05	04:43:00	Petrotech estimate GCR 200000 SM3/SM3 Cond. rate 0.6 M3/Day
22-sep-05	05:00:00	Corr. Condensate SG 0.838
22-sep-05	05:00:00	BS&W = 12% Condensate 88% Water
22-sep-05	05:00:00	Water Density 1.063 @ 11.1 DegC
22-sep-05	05:00:00	BOP temp = 2.58 DegC
22-sep-05	05:30:00	BS&W = 12% Condensate. 88% Water
22-sep-05	05:30:00	H2S = 5 ppm
22-sep-05	05:30:00	CO2 = 7 %
22-sep-05	05:52:00	Bleed off annulus from 116 to 110 bar
22-sep-05	05:54:00	Open water outlet on separator to calibration tank
22-sep-05	05:58:00	Close water outlet on separator
22-sep-05	06:00:00	Corr. Condensate SG 0.838
22-sep-05	06:00:00	Chloride = 16000 mg/l
22-sep-05	06:00:00	BS&W = 12% Condensate. 88% Water
22-sep-05	06:00:00	BOP temp = 2.78 DegC
22-sep-05	06:30:00	BS&W = 12% Condensate. 88% Water
22-sep-05	06:45:00	H2S = 5 ppm
22-sep-05	06:45:00	CO2 = 7 %
22-sep-05	07:00:00	Corr. Condensate SG 0.836
22-sep-05	07:00:00	Water Density 1.060 @ 16.4 DegC
22-sep-05	07:00:00	Chloride = 15000 mg/l
22-sep-05	07:00:00	BS&W = 12% Condensate 88% Water
22-sep-05	07:00:00	BOP temp = 2.44 DegC
22-sep-05	07:30:00	BS&W = 12% Condensate. 88% Water
22-sep-05	07:33:00	Open water outlet on separator to calibration tank
22-sep-05	07:34:00	Close water outlet on separator
22-sep-05	08:00:00	Corr. Condensate SG 0.838
22-sep-05	08:00:00	Water Density 1.046 @ 13 DegC
22-sep-05	08:00:00	Chloride = 15000 mg/l
22-sep-05	08:00:00	BS&W = 13% Condensate. 87% Water
22-sep-05	08:00:00	BOP temp = 4.19 DegC

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22-sep-05	08:00:00	Gas SG = 0.621
22-sep-05	08:35:00	BS&W = 12% Condensate. 88% Water
22-sep-05	09:00:00	Corr. Condensate SG 0.839
22-sep-05	09:00:00	Water Density 1.059 @ 14 DegC
22-sep-05	09:00:00	Chloride = 14000 mg/l
22-sep-05	09:00:00	BS&W = 12% Condensate. 88% Water
22-sep-05	09:00:00	Mercury concentration = 0.93
22-sep-05	09:00:00	BOP temp = 4.05 DegC
22-sep-05	09:30:00	BS&W = 12% Condensate. 88% Water
22-sep-05	10:00:00	BS&W = 12% Condensate. 88% Water
22-sep-05	10:00:00	BOP temp = 3.25 DegC
22-sep-05	10:00:00	H2S = 5 ppm
22-sep-05	10:00:00	CO2 = 6 %
22-sep-05	10:00:00	Gas SG = 0.621
22-sep-05	10:30:00	BS&W = 12% Condensate. 88% Water
22-sep-05	10:53:00	Open oil bypass valve to ignite burners
22-sep-05	11:00:00	Corr. Condensate SG 0.837
22-sep-05	11:00:00	Water Density 1.056 @ 14 DegC
22-sep-05	11:00:00	Chloride = 12000 mg/l
22-sep-05	11:00:00	BS&W = 12% Condensate 88% Water
22-sep-05	11:00:00	BOP temp = 2.37 DegC
22-sep-05	11:01:00	Open oil bypass valve to ignite burners
22-sep-05	12:00:00	BOP temp = 1.7 DegC
22-sep-05	12:06:00	Open water outlet on separator to calibration tank
22-sep-05	12:07:00	Close water outlet on separator
22-sep-05	12:10:00	Mercury concentration = 0.44
22-sep-05	12:10:00	H2S = 4.5 ppm
22-sep-05	12:10:00	CO2 = 6 %
22-sep-05	12:10:00	Gas SG = 0.621
22-sep-05	12:14:00	Open water outlet on separator to calibration tank
22-sep-05	12:16:00	Close water outlet on separator
22-sep-05	12:16:00	Open oil bypass valve to ignite burners
22-sep-05	12:19:00	Calibration tank level = 9.3 m3
22-sep-05	12:42:00	Dump from oil compartment on separator to calibration tank
22-sep-05	12:43:00	Stop dumping from oil compartment on separator to calibration tank
22-sep-05	12:46:00	Open water outlet on separator to calibration tank
22-sep-05	12:50:00	Close water outlet on separator
22-sep-05	12:51:00	Oil compartment empty SG = 0.92
22-sep-05	13:00:00	BOP temp = 2.31 DegC
22-sep-05	13:35:00	Open water outlet on separator to calibration tank
22-sep-05	13:37:00	Close water outlet on separator
22-sep-05	13:40:00	Calibration tank level = 10.6 m3
22-sep-05	13:55:00	Open oil bypass valve to ignite burners
22-sep-05	14:00:00	Corr. Condensate SG 0.840
22-sep-05	14:00:00	Water Density 1.054 @ 16 DegC
22-sep-05	14:00:00	Chloride = 11000 mg/l
22-sep-05	14:00:00	H2S = 4.5 ppm
22-sep-05	14:00:00	CO2 = 6 %
22-sep-05	14:00:00	Gas SG = 0.621
22-sep-05	14:00:00	BOP temp = 2.51 DegC
22-sep-05	14:11:00	Open oil bypass valve to ignite burners

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22-sep-05	14:19:00	Open and close oil bypass several time to ignite gas on burner
22-sep-05	14:25:00	Lift 1.875" orifice plate
22-sep-05	14:25:00	Decrease heater adjustable choke to 64/64"
22-sep-05	14:26:00	Lower 1.875" orifice plate
22-sep-05	14:37:00	Open oil bypass valve to ignite burners
22-sep-05	14:50:00	Open water outlet on separator to calibration tank
22-sep-05	14:51:00	Close water outlet on separator
22-sep-05	14:54:00	Calibration tank level = 11.2 m3
22-sep-05	15:00:00	BOP temp = 1.77 DegC
22-sep-05	15:10:00	Adjust separator pressure to ignite burner
22-sep-05	15:20:00	Lift 1.875" orifice plate
22-sep-05	15:26:00	Lower 1.75" orifice plate
22-sep-05	15:35:00	Outlet valve on glycol tank shuts in
22-sep-05	15:40:00	Re-start injecting glycol
22-sep-05	16:00:00	Corr. Condensate SG 0.853
22-sep-05	16:00:00	Water Density 1.068 @ 19.4 DegC
22-sep-05	16:00:00	Chloride = 18000 mg/l
22-sep-05	16:00:00	BOP temp = -0.31 DegC
22-sep-05	16:00:00	Corr. Condensate SG 0.853
22-sep-05	16:10:00	Start pump out of calibration tank to slop tank
22-sep-05	16:11:00	Open water outlet on separator to calibration tank
22-sep-05	16:12:00	Close water outlet on separator
22-sep-05	16:52:00	Stop pumping out of calibration tank
22-sep-05	17:00:00	BOP temp = 2.37 DegC
22-sep-05	17:12:00	Calibration tank level = 3.6 m3
22-sep-05	17:12:00	Open water outlet on separator to calibration tank
22-sep-05	17:14:00	Close water outlet on separator
22-sep-05	17:18:00	Calibration tank level = 4.15 m3
22-sep-05	17:20:00	H2S = 5 ppm
22-sep-05	17:20:00	CO2 = 6.5 %
22-sep-05	18:00:00	BOP temp = 1.50 DegC
22-sep-05	18:15:00	Fluid from well is getting cleaner
22-sep-05	18:20:00	Gas SG = 0.621
22-sep-05	18:30:00	Corr. Condensate SG 0.840
22-sep-05	19:00:00	Calibration tank level = 4.2 m3
22-sep-05	19:00:00	BS&W = 12% Condensate 88% Water. Chloride 8000 mg/l
22-sep-05	19:00:00	Drain scubbers in Daniels box
22-sep-05	19:00:00	Water Density 1.065 @ 17.0 DegC
22-sep-05	19:00:00	BOP temp = 2.04 DegC
22-sep-05	19:00:00	Corr. Condensate SG 0.838
22-sep-05	19:30:00	BS&W = 12% Condensate 88% Water
22-sep-05	19:58:00	Divert flow from starboard to port burner
22-sep-05	20:00:00	BS&W = 10% Condensate. 90% Water. Chloride 8000 mg/l
22-sep-05	20:00:00	Water Density 1.057 @ 19.5 DegC
22-sep-05	20:00:00	BOP temp = 1.90 DegC
22-sep-05	20:00:00	Corr. Condensate SG 0.837
22-sep-05	20:30:00	BS&W = 10% Condensate 90% Water
22-sep-05	20:56:00	Open water outlet on separator to calibration tank
22-sep-05	20:58:00	Close water outlet on separator
22-sep-05	21:00:00	Calibration tank level = 4.65 m3
22-sep-05	21:00:00	BS&W = 10% Condensate. 90% Water. Chloride 7000 mg/l

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22-sep-05	21:00:00	BOP temp = 3.11 DegC
22-sep-05	21:00:00	Corr. Condensate SG 0.840
22-sep-05	21:30:00	BS&W = 10% Condensate 90% Water
22-sep-05	22:00:00	BOP temp = 3.00 DegC
22-sep-05	22:02:00	Open water outlet on separator to calibration tank
22-sep-05	22:05:00	Close water outlet on separator
22-sep-05	22:07:00	Calibration tank level = 5.50 m3
22-sep-05	22:30:00	BS&W = 10% Condensate 90% Water
22-sep-05	23:00:00	BS&W = 10% Condensate. 90% Water. Chloride 7000 mg/l
22-sep-05	23:00:00	Water Density 1.061 @ 14.6 DegC
22-sep-05	23:00:00	BOP temp = 1.50 DegC
22-sep-05	23:00:00	Corr. Condensate SG 0.839
22-sep-05	23:30:00	BS&W = 10% Condensate 90% Water
22-sep-05	23:55:00	Start MEG injection at SSLV 3.7 l/min
22-sep-05	23:55:00	Increase Annulus pressure from 115 to 126 bar
23-sep-05	00:00:00	Lift orifice plate
23-sep-05	00:00:00	BS&W = 10% Condensate 90% Water
23-sep-05	00:00:00	BOP temp = 2.40 DegC
23-sep-05	00:07:00	Bleed off Annulus pressure to close LPR-N
23-sep-05	00:09:00	Close in well at LPR-N
23-sep-05	00:10:00	***** MAIN BUILD UP *****
23-sep-05	00:10:00	Close choke manifold
23-sep-05	01:00:00	Stop Meg injection at SSTT and SSLV
23-sep-05	01:00:00	BOP temp = 1.90 DegC
23-sep-05	02:00:00	BOP temp = 2.90 DegC
23-sep-05	02:03:00	Disconnect chemical injection hoses from SSTT reel
23-sep-05	02:35:00	Close SSTT
23-sep-05	02:45:00	Start Meg injection at SSLV and Upstream choke manifold
23-sep-05	02:53:00	Open choke bleed off from 189 to 140 bar
23-sep-05	02:57:00	Close choke
23-sep-05	03:00:00	Stop Meg injection at SSLV and Upstream choke manifold
23-sep-05	03:00:00	BOP temp = 1.90 DegC
23-sep-05	04:15:00	Start Meg injection at SSLV and Upstream choke manifold
23-sep-05	04:29:00	Open Choke bleed off pressure to zero
23-sep-05	05:03:00	Stop MEG injection Upstream choke manifold
23-sep-05	05:12:00	Zero bar at choke. Choke open
23-sep-05	05:12:00	Stop MEG injection at SSLV
23-sep-05	05:22:00	Open kill valve
23-sep-05	05:23:00	Cementer start pump brine down tbq.
23-sep-05	05:36:00	Close choke manifold
23-sep-05	05:55:00	Cementer stop pump brine.
23-sep-05	06:15:00	Cementer start pump brine.
23-sep-05	06:23:00	Cementer stop pump brine.
23-sep-05	06:27:00	Cementer pressure up to 50 bar
23-sep-05	06:31:00	Close kill valve.
23-sep-05	06:34:00	Cementer bleed off to zero.
23-sep-05	07:12:00	Start open kill valve
23-sep-05	07:16:00	Kill valve open
23-sep-05	07:28:00	Start puming up on WHP to 100 bar to equalize SSTT
23-sep-05	07:38:00	Increase wellhead pressure from 100 to 200 bar
23-sep-05	07:48:00	Close kill valve

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23-sep-05	07:54:00	Start bleed off to 100 bar on WHP
23-sep-05	08:03:00	Start 30 min inflow test of SSTT Start = 103.46 bar
23-sep-05	08:33:00	Stop inflow test Stop = 106.13 bar. Differential = 2.67 bar
23-sep-05	08:35:00	Start bleed off to zero
23-sep-05	08:50:00	0 bar on WHP. Choke closed
23-sep-05	09:21:00	Start pumping high viscose pill down at BOP
23-sep-05	10:06:00	Start dumping rest of fluid from separator to calibration tank
23-sep-05	10:25:00	Stop dumping to calibration tank
23-sep-05	12:00:00	Open kill valve
23-sep-05	12:01:00	Pump up to 12 bar at choke with cement unit
23-sep-05	12:08:00	Lock kill valve flapper valve in open position
23-sep-05	12:09:00	Open choke
23-sep-05	12:10:00	Start flush string with cement unit
23-sep-05	12:11:00	Fluid return at choke
23-sep-05	12:14:00	Close choke. 60 bar at choke
23-sep-05	12:15:00	Bleed off to 10 bar at choke
23-sep-05	12:18:00	10 bar at choke
23-sep-05	12:19:00	Start pumping up with cement unit to 345 bar to equalize over SSTT
23-sep-05	12:20:00	345 bar at choke. but no reaction at SSTT
23-sep-05	12:26:00	Bleed off pressure on cement unit to 10 bar
23-sep-05	12:28:00	Isolate manual chart recorder on choke
23-sep-05	12:29:00	Start pumping up with cement unit to 500 bar to equalize over SSTT
23-sep-05	12:30:00	500 bar at choke. but no reaction at SSTT
23-sep-05	12:34:00	Increase pressure to 600 bar
23-sep-05	12:35:00	600 bar at choke. but no reaction at SSTT
23-sep-05	12:37:00	Bleed off pressure on cement unit to 10 bar
23-sep-05	12:54:00	Cementer bleed off to 0 bar
23-sep-05	13:03:00	Start pumping up with cement unit to equalize over SSTT
23-sep-05	13:05:00	Pumping through SSTT
23-sep-05	13:07:00	Bleed off to 8 bar at choke
23-sep-05	13:10:00	Start 30 min inflow test of SSTT Start = 8.29 bar
23-sep-05	13:40:00	Stop inflow test Stop = 30.8 bar. Differential = 22.51 bar
23-sep-05	13:51:00	Bleed off fast to 10 bar at choke
23-sep-05	13:52:00	Start a new inflow test of SSTT
23-sep-05	14:23:00	Pressure up to 120 bar at choke
23-sep-05	14:26:00	Bleed off fast to 10 bar at choke
23-sep-05	14:27:00	Start 30 min inflow test of SSTT Start = 10.45 bar
23-sep-05	14:57:00	Stop inflow test Stop = 22.55 bar. Differential = 12.1 bar
23-sep-05	15:50:00	Bleed off pressure at choke to 0 bar
23-sep-05	16:10:00	Unlatch SSTT
23-sep-05	16:50:00	Calibration tank level = 12.9 m3
23-sep-05	17:00:00	Start rig down STT
23-sep-05	19:45:00	STT on deck
23-sep-05	20:37:00	Close SSLV
23-sep-05	21:15:00	Open SSLV
23-sep-05	22:00:00	Close SSLV
23-sep-05	22:30:00	Start displace riser to seawater
24-sep-05	00:00:00	SSLV OOH
25-sep-05	10:01:00	Start pressure test injection line for fracjob
25-sep-05	10:20:00	Start pumping slop to boat
25-sep-05	10:22:00	Leak. bleed off pressure on cement unit



Date	Time	Sequence of Events
25-sep-05	10:28:00	Start pressure test injection line for fracjob
25-sep-05	10:33:00	Leak. bleed off pressure on cement unit
25-sep-05	10:53:00	Start pressure test injection line for fracjob
25-sep-05	11:00:00	Bleed off pressure on cement unit
25-sep-05	11:22:00	Start pressure test injection line for fracjob
25-sep-05	11:34:00	Bleed off pressure on cement unit
25-sep-05	20:20:00	Relatch SSTT
25-sep-05	20:35:00	Pump down tbg to equalize SSTT
25-sep-05	20:46:00	Open SSTT
25-sep-05	20:48:00	Pressure up tbg to 345 bar against LPR-N
25-sep-05	21:25:00	Good test.Bleed off pressure to zero
25-sep-05	21:31:00	Start 1 sec sampling
25-sep-05	21:50:00	Open LPR-N
25-sep-05	21:57:00	***** MINI FRAC *****
25-sep-05	21:57:00	Start Minifrac Cycle 1
25-sep-05	21:57:00	Increase rate to 0.075 m3/min.(approx 10 mins once stabilized)
25-sep-05	21:57:00	Propagation pressure 2.07 sg.
25-sep-05	22:50:00	Stop pumping.Close cement shutin valve
25-sep-05	22:50:00	Volume pumped 2.69 m3
25-sep-05	22:59:00	Open valve bleed off to 5 bar.
25-sep-05	23:02:00	Close cement shutin valve
25-sep-05	23:02:00	Volume return 0.16 m3. Formation supercharged? Pressure build up
25-sep-05	23:14:00	Start Minifrac Cycle 2
25-sep-05	23:14:00	Pumrate 0.1 m3/min
25-sep-05	23:30:00	Stop pumping.Close cement shutin valve
25-sep-05	23:30:00	Volume pumped 1.4 m3
25-sep-05	23:36:00	Open valve bleed off to 5 bar.
25-sep-05	23:39:00	Close cement shutin valve
25-sep-05	23:39:00	Volume return 0.34 m3. Formation supercharged? Pressure build up
25-sep-05	23:47:00	Start Minifrac Cycle 3
25-sep-05	23:47:00	Pumrate 0.159 m3/min
25-sep-05	23:52:00	Stop pumping.Close cement shutin valve
25-sep-05	23:52:00	Volume pumped 0.75 m3
25-sep-05	23:58:00	Open valve bleed off to 5 bar.
25-sep-05	23:59:00	Close cement shutin valve
25-sep-05	23:59:00	Volume return 0.24 m3 Formation supercharged? Pressure build up
26-sep-05	00:05:00	Start Minifrac Cycle 4
26-sep-05	00:05:00	Pumrate 0.4 m3/min for 5 min
26-sep-05	00:11:00	Stop pumping.Close cement shutin valve
26-sep-05	00:11:00	Volume pumped 1.9 m3
26-sep-05	00:19:00	Open valve bleed off to 0 bar
26-sep-05	00:19:00	Volume return 0.32 m3. Formation supercharged? Pressure build up
26-sep-05	00:20:00	Flowcheck
26-sep-05	01:00:00	Pressure 66 bar . Bleed off pressure to zero
26-sep-05	01:15:00	Pressure zero
26-sep-05	01:22:00	Pump up Annulus to shear RDSV
26-sep-05	01:26:00	RDSV shear at 278 bar
26-sep-05	01:28:00	Start 10 sec sampling
26-sep-05	02:00:00	Start displace well to kill mud.Down tbg
26-sep-05	05:00:00	Stop displace. H2S in shaker room. 26 ppm.
26-sep-05	06:40:00	Continue displace well to kill mud.Down tbg.

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Date	Time	Sequence of Events
26-sep-05	18:45:00	Finish circulating and weighing up mud
26-sep-05	18:45:00	Line up to circulate riser to mud
26-sep-05	19:05:00	Start circulate riser to mud
26-sep-05	22:20:00	122 bar at Annulus. Build up since 15:00:00
26-sep-05	22:20:00	Line up to bleed off pressure
26-sep-05	22:30:00	Bleed off pressure in Annulus and tbg.
26-sep-05	22:35:00	Flowcheck
26-sep-05	23:05:00	Start circulate down tbg
27-sep-05	02:40:00	Stop circulating.Flowcheck
27-sep-05	03:05:00	Cementer pump 4 m3 seawater down choke line
27-sep-05	03:45:00	Flowcheck
27-sep-05	03:50:00	Open MPR. Unseat Champ Packer
27-sep-05	04:10:00	Re land string in BOP
27-sep-05	04:15:00	Bullhead 1-2 m3 kill mud down annulus. Annulus P.up to 240 bar
27-sep-05	04:25:00	Line up to circulate 1.5 time annulus down tbg up choke
27-sep-05	04:43:00	Start circulate down tbg. Approx 150 m3
28-sep-05	01:00:00	Retainer valve OOH
28-sep-05	02:00:00	SSTT OOH
28-sep-05	02:30:00	Continue POOH with test string
28-sep-05	19:30:00	Slip Joint at rotary
28-sep-05	19:40:00	Toolbox talk prior to landing string
28-sep-05	20:55:00	Slip Joints OOH
28-sep-05	23:35:00	OMNI at rotary
29-sep-05	00:10:00	LPR-N at rotary
29-sep-05	01:00:00	Gauges OOH
29-sep-05	02:30:00	OOH with packer and shock absorber
29-sep-05	02:45:00	Stop Spartek gauge 20406. Data OK
29-sep-05	02:48:00	Stop Spartek gauge 20396. Data OK
29-sep-05	04:02:00	Stop Spartek gauge 20397. Data OK
29-sep-05	04:15:00	Stop Spartek gauge 20356. Data OK
29-sep-05	04:23:00	Stop Spartek gauge 20398. Data OK
29-sep-05	04:31:00	Stop Spartek gauge 20429. Data OK
29-sep-05	04:38:00	Stop Spartek gauge 77415. Data OK
29-sep-05	04:48:00	Stop Spartek gauge 77289. Data OK



13.10.3 Cased Hole MDT Logging

The sequence of events (SOE) is based upon the sequence reported in the logging operational summary by Schlumberger and Norsk Hydro drilling reports. The SOE includes all cased hole logging operations. Note that the MDT logruns in the heading of the SOE are incorrect while correct no. are given in left column. Between end of the production test and start of the cased hole MDT, a BOP test was performed.

Schlumberger							
Company:		Hydro ASA					
Well:		6605/8-1					
Field:		Stetind					
Rig:		Transocean Leader				Country: Norway	
Transocean Leader Stetind North Sea 6605/8-1 Hydro ASA	MDT-GR-ACTS MDT Sampling in Cased Hole 1:200						
	North Sea Norwegian Sector UTM: 7364907.6N, 346941.0E					Elev.: K.B. 23.5 m G.L. -838 m D.F. 23.5 m	
	Permanent Datum: <u>MSL</u> Log Measured From: <u>DF</u> Drilling Measured From: <u>DF</u>					Elev.: <u>0 m</u> 23.5 m above Perm. Datum	
	Country: Norway		Max. Well Deviation 10.4 deg		Longitude 66 21'51.93" N		Latitude 05 34'39.23" E
Logging Date		30-Sep-2005					
Run Number		2E					
Depth Driller		4513 m					
Schlumberger Depth		4513 m					
Bottom Log Interval		4230.2 m					
Top Log Interval		4230.2 m					
Casing Fluid Type		Glydril DW					
Salinity		117250 ppm					
Density		1.62 g/cm3					
Fluid Level		2 m					
BIT/CASING/TUBING STRING							
Bit Size		8.500 in					
From		4100 m					
To		4513 m					
Casing/Tubing Size		7.000 in					
Weight		32 lbm/ft					
Grade		P110					
From		4040 m					
To		4512 m					
Maximum Recorded Temperatures		150 degC		150			
Logger On Bottom		Time		2-Oct-2005		14:00	
Unit Number		Location		3819		NOBO	
Recorded By		A. Arias/ G. Sibbald/ L. Myrvol					
Witnessed By		Harald, Geir					

Log run:	3A: MDT-GR (6MPSR-1x2¾SC-1x1SC-)		Hole diameter:	8 ½"
Date:	Time (start)	Operation:	Downtime:	
29.09.2005 1A USIT-CBL	22:30	Start rigging up sheaves.		
	22:45	Safety meeting.		
	23:00	Start rigging up USIT-CBL		
	23:45	RIH with USIT-CBL.		
30.09.2005	02:55	Take downlog. file #25.		
	03:35	Logged USIT/CBL log from 4400 m to 4020 m, file #26. Good cement from 4400 m to 4156 m. Top of cement recorded at 4156 m.		
	05:30	Perform repeat section.		
	05:40	USIT log failure. USIT will not power up. Troubleshooting.		
	05:50	USIT working ok, start repeat from 4260m.		
	06:08	POOH		
	08:30	Tools at surface. Start rigging down USIT-CBL log. Temperature on the head 150 degC.		
	09:30	Finish rigging down USIT-CBL. Prepare for perforation run.		
30.09.2005 1A Perf.-run	10:00	Waiting for crane, helicopter arriving site.		
	10:30	Guns and PGGT ready on drillfloor.		
	11:00	Continue with last preparation for perforation run. Shut down unit.		
	11:45	RIH. tool weight on surface 600lbs. in mud 350lbs.		
	12:25	Perforation tool at 920m. Power up unit.		
	13:43	Start correlation log, file #51.		
	14:08	On depth. file #53.		
	14:24	Perforate interval 4230-4230.55m (in 1.62 mud). The gun was loaded with 5 shots per foot.		
	14:31	Log over perforated interval. no clear indication of perforated zone.		
	14:45	POOH		
	15:45	At 930m. Shut down unit.		
	16:30	Perforation gun at surface. All shots fired. Start rigging down perforation equipment.		
	17:00	Gun rigged down.		
30.09.2005 2E MDT	17:05	Start preparation for MDT-run.		
	20:00	Finished rigging up MDT-tool. Test same. ok. RIH.		
01.10.2005	00:00	Inflatable packer at 4230.2m, set packer over perforated interval 4230-4230.55m.		
	01:00	Take drawdown with 2 stroke and buildup for formation pressure (large pretest).		
	03:00	Take first sample MPSR #073 . Resistivity 0.015ohm*m.		
	03:40	Re-inflate packers to 30 bar. 125.6 litres pumped.		
	05:19	Re-inflate packers to 30 bar. 219.2 litres pumped.		



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Log run:	3A: MDT-GR (6MPSR-1x2¾SC-1x1SC-)		Hole diameter:	8 ½"
Date:	Time (start)	Operation:	Downtime:	
	05:57	Re-inflate packers to 37 bar. 258 litres pumped.		
	07:10	Re-inflate packers to 37 bar. 328.6 litres pumped.		
	07:40	Re-inflate packers to 38 bar. 353.3 litres pumped.		
	08:25	WFTI memory full. New station log started. file #70.		
	09:00	Re-inflate packers to 40 bar. 445 litres pumped.		
	10:40	Re-inflate packers to 36 bar. 543.9 litres pumped.		
	11:45	Take second sample MPSR #1043 . Resistivity 0.018 ohm*m.		
	12:05	Re-inflate packers to 43 bar. 637 litres pumped.		
	12:55	Re-inflate packers to 40 bar. 683 litres pumped.		
	13:20	Re-inflate packers to 40 bar. 720 litres pumped.		
	13:40	Switch to constant power. More current in motor. go back to constant speed.		
	14:00	Re-inflate packers to 42 bar.		
	14:45	Re-inflate packers to 35 bar. 902 litres pumped.		
	16:50	WFTI memory full. Start new station log. file #71		
	18:00	Re-inflate packers to 20 bar.		
	19:00	Re-inflate packers to 30 bar. 1647 litres pumped.		
	20:00	Re-inflate packers to 57 bar. 1712 litres pumped.		
	20:45	Take third sample MPSR #928 . Resistivity 0.024 ohm*m.		
	21:00	Re-inflate packers to 50 bar. 1782 litres pumped.		
02.10.2005	00:45	Re-inflate packers to 35 bar. 2103 litres pumped.		
	00:46	WFTI memory full. start new station log. file #72		
	03:00	Re-inflate packers to 40 bar. 2286.6 litres pumped.		
	04:35	Plugged filter inlet or formation. Stop pump after 2419.4 litres.		
	06:20	Deflate elements and attempted to pull string free without any success.		
	07:25	Pull to 9700lbs. - no go. Started to work tool string to get free without any success.		
	13:00	Try to take one more sample. but bottle not filling.		
	14:00	Release ECRD and pull out of hole with the wireline.		
	15:20	ECRD at surface. Start rigging down sheaves.		
	18:00	Finish rigging down wireline equipment. Prepare for fishing operation.		
03.10.2005	03:00	RIH with modified grapple assembly.		
	18:00	Wash down at 800 lpm and engage the fish. Attempt to push fish down without any success. Pull fish free with 55 tons overpull. Pull back to 4187 m with 10 tons drag.		
	19:00	Flow checked the well on trip tank. well static.		
	19:30	Pulled out of hole with the fish on 5" drill pipe		
04.10.2005	08:00	Secure the fish in the rotary and brake out the overshot from the fish. Brake out and lay down the MDT tool string. No parts missing from the MDT tool string.		
	10:00	Finish rigging down fish equipment and MDT.		