5.3 Formation Pressure Measurements and Fluid Samples

A Formation Multi-Tester (FMT) tool with a QuartzDyne pressure gauge was used for the formation pressure measurements in 6406/2-2. A total of 7 separate runs were performed with the FMT. The FMT wellsite worksheets are presented in Tables 5.4 - 5.10. All samples are considerably contaminated of oilbased mud. So there are no reasonable compositions to report. A composite plot of the pressure measurements are presented in Figure 5.1.

SAGA PETROLEUM a.s.

PAGE: 1 OF 1

WELL: 6406/2-2 | Γ WELLSITE WORKSHEET | WITN :D BY: K. GRAN

PRESSURE UNITS: BAR | HIG: ROSS RIG | DATE: 10.01.1996

RKB = 24 m

RUN #: 2A	DEPTH MD	DEPTH TVD	IN. HYDROST. PRESSURE		FORMATION PRESSURE		FIN. HYDROST. PRESSURE		TEMP	MOB. INDEX	PP G/CC	REMARKS
TEST #	RKB	RKB	SG	HP	SG	HP	SG	HP	degC		EMW	
1	3452,2		1,63	553,00		-	1,63	553,0	104,8			No seal
2	3454,0		1,63	553,00		-	1,63	553,4	107,1			No seal
3	3456,0		1,63	553,10		-	1,63	553,1	107,8			No seal
4	3457,5		1,63	553,10		-	1,63	553,3	108,3			No seal
5	3484,0		1,63	557,20		-	1,63	557,2	109,0			No seal
6	3486,0		1,63	557,60		-	1,63	557,6	109,3			No seal
7	3494,0		1,63	558,60		-	1,63	558,4	111,3			Tight, abandon test after 20 mins.
8	3498,5		1,63	559,40		-						No seal
9	3501,8		1,63	559,90		-	1,63	559,7	111,7			Tight, abandon test after 7.5 mins.
10	3506,0		1,63	560,50		-	1,63	560,4	112,1			Tight, abandon test after 10 mins.
11	3509,6		1,63	561,00		-	1,63	561,0	112,4			Tight, abandon test after 10 mins.
12	3524,2		1,63	563,38		-	1,63	563,3	112,8			Tight, abandon test after 20 mins.
13	3530,7		1,63	564,40		-						No seal
14	4177,5		1,62	665,28		-	1,62	664,8	128,4			Tight, abandon test after 15 mins.
15	4183,5		1,62	665,92		-	1,62	665,7	129,4			Tight, abandon test
16	4190,2		1,62	666,90		-			129,8			No seal
17	4208,2		1,62	669,66		-	1,62	669,5	130,4			Tight, abandon test
18	3524,3		1,63	563,13		-	1,63	563,4	122,8			Tight, abandon test
19	3524,4		1,63	563,41		-	1,63	563,4	120,6			Tight, abandon test

Note: All measurement positions indicating some permeability were attempted several times, in order to determine pressure. Due to very tight formations none of the measurements were able to reproduce pressure buildup and were subsequently abandoned as none-permeable.

Table 5.4

					SAGA PETROLEUM a.s.					PAGE:	1 OF 1	
WELL:	6406/2-2				FMT WELLSITE WORKSHEET					WITNESSED BY:		B. PEDERSEN
PRESSURE UNITS:		BAR			RIG:	ROSS RIG				DATE:		24.01.1996
					RKB = 24 m							
RUN #:	DEPTH	DEPTH	IN. HYDROST.		FORMATION		FIN. HYDROST.		TEMP	MOB.	PP	REMARKS
3B	MD	TVD	PRESSURE		PRESSURE		PRESSURE			INDEX	G/CC	
TEST #	RKB	RKB	SG	HP	SG	HP	SG	HP	degC	mD	EMW	
1	4482,0	4480,7	1,34	587,3			1,34	587,2				No seal
2	4481,5	4480,2	1,34	587,1			1,34	587,0				No seal
3	4485,5	4484,2	1,34	587,5			1,34	587,6				No seal
4	4491,5	4490,2	1,34	588,3			1,34	588,3				No seal
5	4504,0	4502,7	1,34	590,0			1,34	590,0				No seal
6	4625,0	4623,7	1,34	607,1			1,34	606,6		0,2		Tight, abandon test
7	4631,0	4629,7	1,34	607,1			1,34	607,1		0,1		Tight, abandon test
8	4633,5	4632,2	1,34	607,0			1,34	607,2		0,3		Tight, abandon test
9	4654,5	4653,2	1,33	609,6		520,3	1,34	609,8		227,5	1,14	
10	4658,5	4657,2	1,33	609,9			1,33	609,8		0,1		Tight, abandon test
11	4663,5	4662,2	1,33	610,0		517,8	1,33	610,1		1,4	1,13	
12	4670,2	4668,9	1,33	610,7		518,1	1,33	610,9		14,9	1,13	
13	4691,5	4690,2	1,33	613,8		518,9	1,33	613,8		76,4	1,12	
14	4698,0	4696,7	1,33	614,4		519,1	1,33	614,5		44,9	1,12	
15	4701,5	4700,2	1,33	614,8		519,2	1,33	614,7			1,12	
16	4705,0	4703,7	1,33	614,8		519,4	1,33	615,8		11,0	1,12	
17	4708,5	4707,2	1,33	615,1		519,6	1,33	615,2		161,2	1,12	
18	4719,0	4717,7	1,33	616,6		519,8	1,33	616,6	155,6	49,6	1,12	
19	4721,0	4719,7	1,33	616,6		520,0	1,33	616,7		51,6	1,12	
20	4723,5	4722,2	1,33	616,8		520,1	1,33	616,9	156,4	53,7	1,12	
21	4731,5	4730,2	1,33	617,8		520,6	1,33	618,0		0,8	1,12	
22	4739,5	4738,2	1,33	618,8		520,5	1,33	620,1		3,9	1,12	
23	4741,5	4740,2	1,33	618,8		520,6	1,33	618,9		2,4	1,12	
24	4719,0	4717,7	1,33	616,0		519,8	1,33	616,0		52,6	1,12	Sample
26												
27												
				NOTE: Permeability estimates assume viscosity of 0.25 cp.								

Table 5.5

FMT RUN 4C

					SAGA PETROLEUM a.s.					PAGE:	1 OF 1	
WELL:	6406/2-2				FMT WELLSITE WORKSHEET					WITNESSED BY:		B. PEDERSEN/K. GRAN
PRESSURE UNITS:		BARA			RIG:	ROSS RIG				DATE:		26.01.1996
					RKB = 24 m							
RUN #:	DEPTH	DEPTH	IN. HYDROST.		FORMATION		FIN. HYDROST.		TEMP	MOB.	PP	REMARKS
4C	MD	TVD	PRESSURE		PRESSURE		PRESSURE			INDEX	G/CC	
TEST #	RKB	RKB	SG	HP	SG	HP	SG	HP	degC	mD	EMW	
1	4485,5	4484,2	1,31	574,8			1,31	574,8	143,0			No seal
2	4491,0	4489,7	1,31	575,5					143,8			No seal
3	4495,2	4493,9	1,31	575,8					144,5			No seal
4	4503,5	4502,2	1,31	576,9					145,0			No seal
5	4546,0	4544,7	1,31	582,7					145,8			No seal
6	4625,2	4623,9	1,31	593,0			1,31	592,9	149,0	0,2		Tight, abandon test
7	4625,0	4623,7	1,31	592,9					149,7	0,2		Tight, abandon test
8	4654,2	4652,9	1,31	596,7		521,5	1,31	596,2	151,2		1,14	Sample
9												
10												

Table 5.6

					SAGA PETROLEUM a.s.					PAGE:	1 OF 1	
WELL:	6406/2-2				FMT WELLSITE WORKSHEET					WITNESSED BY:		K. GRAN
PRESSURE UNITS:		BARA			RIG:	ROSS RIG				DATE:		03.02.1996
					RKB = 24 m							
RUN #:	DEPTH	DEPTH	IN. HYDROST.		FORMATION		FIN. HYDROST.		TEMP	MOB.	PP	REMARKS
5D	MD	TVD	PRESSURE		PRESSURE		PRESSURE			INDEX	G/CC	
TEST #	RKB	RKB	SG	HP	SG	HP	SG	HP	degC	mD	EMW	
1	4873,8	4872,1	1,32	632,2		528,4	1,32	632,5	150,5	1,4	1,10	Supercharged ??
2	4878,5	4876,6				-			153,9	-		No seal
3	4878,7	4876,9	1,32	633,0		-	1,32	632,9	155,0	-		No seal
4	4883,5	4881,7	1,32	633,3		525,6	1,32	633,3	155,8	0,6	1,09	
5	4888,0	4886,2	1,32	633,4		525,9	1,32	633,5	157,0	0,7	1,09	
6	4891,5	4889,6	1,32	633,5		-	1,32	633,6	157,8			Tight, abandon test
7	4896,0	4894,0	1,32	633,7		526,2	1,32	633,8	158,6	0,7	1,09	
8	4901,0	4899,0	1,32	634,1		-	1,32	634,1	159,2			Tight, abandon test
9	4907,5	4905,4	1,32	634,9		526,6	1,32	634,9	159,5	0,8	1,09	
10	4911,3	4909,1	1,32	635,4		526,2	1,32	635,6	160,0	1,0	1,09	
11	4913,5	4911,3	1,32	635,6		-	1,32	635,9	160,1	0,1		Tight, abandon test
12	4916,0	4913,8	1,32	636,0		526,2	1,32	636,1	160,4	0,7	1,09	
13	4922,0	4919,6	1,32	636,7		526,4	1,32	636,9		0,5	1,09	
14	4926,5	4924,1	1,32	637,3		526,6	1,32	637,6	161,4	1,0	1,09	
15	4944,4	4941,8	1,32	639,8		527,8	1,32	639,6	161,5		1,09	Tight ?
16	4946,5	4943,8	1,32	639,6		529,0	1,32	639,8	161,9	0,6	1,09	
17	4945,5	4942,9	1,32	639,5		528,9	1,32	639,9	162,0	0,6	1,09	
18	4949,8	4947,1	1,32	640,3		531,7	1,32	640,4	162,4		1,09	Supercharged ?
19	4983,4	4980,0	1,32	645,3		533,1	1,32	645,4	162,7	0,6	1,09	
20	4987,0	4983,6	1,32	645,3		533,1	1,32	645,3	162,9	1,8	1,09	
21	4989,0	4985,9	1,32	645,0		-	1,32	645,0	163,4			Tight, abandon test
22	5002,3	4998,6	1,32	646,8		536,2	1,32	646,7	163,6	0,5	1,09	
23	5004,5	5000,7	1,32	646,6		535,8	1,32	646,6	163,8	1,2	1,09	
24	5005,5	5001,8	1,32	646,6		536,3	1,32	646,8	164,2	1,0	1,09	
25	5027,4	5023,1	1,32	650,2		-	1,32	650,2	164,5			Tight, abandon test
26	5055,5	5050,5	1,32	654,1		551,1	1,32	653,7	164,9		1,11	Supercharged ??
27	5057,0	5052,0	1,32	653,4		-	1,32	653,3	165,1			Tight, abandon test

Table 5.7

FMT RUN 5D

28	5073,5	5068,0	1,32	655,5		-	1,32	655,2	165,8			Supercharged ??
29	5075,0	5069,5	1,32	654,8		-	1,32	656,4	166,5			Supercharged ??
30	5086,0	5080,1				-	1,32	656,4	167,2			Supercharged ??
31	5117,5	5110,7	1,32	662,3		-	1,32	662,1	167,5			Tight, abandon test
32	4887,9	4886,0	1,32	632,4		525,7					1,09	Sampling failed
33												

Table 5.7

					SAGA PETROLEUM a.s.					PAGE:	1 OF 1	
WELL:	6406/2-2				FMT WELLSITE WORKSHEET					WITNESSED BY:		K. GRAN
PRESSURE UNITS:		BARA			RIG:	ROSS RIG				DATE:		04.02.1996
					RKB = 24 m							
RUN #:	DEPTH	DEPTH	IN. HYDROST.		FORMATION		FIN. HYDROST.		TEMP	MOB.	PP	REMARKS
5E	MD	TVD	PRESSURE		PRESSURE		PRESSURE			INDEX	G/CC	
TEST #	RKB	RKB	SG	HP	SG	HP	SG	HP	degC	mD	EMW	
1	4876,5	4874,8	1,32	633,1		525,4	1,32	632,7	156,5	0,5	1,10	OK ? Supercharged ??
2	4887,8	4886,0	1,32	634,1		523,7	1,32	633,9	159,4	1,1	1,09	
3	4899,0	4897,0	1,32	635,2		524,5	1,32	635,0	160,6	0,6	1,09	
4	4903,5	4901,4	1,32	635,4		525,0	1,32	635,1	161,5	0,6	1,09	
5	4905,0	4902,9	1,32	635,0		-	1,32	634,6	162,0			Tight, abandon test
6	4910,0	4907,9	1,32	635,8		524,4	1,32	635,1	162,5		1,09	
7	4912,0	4909,8	1,32	635,5		524,5	1,32	634,9	163,0	1,9	1,09	
8	4915,8	4913,6	1,32	636,2		524,5	1,32	635,8	163,7	0,7	1,08	
9	4919,0	4916,7	1,32	636,1		524,8	1,32	635,7	163,7	0,9	1,08	
10	4985,0	4981,6	1,32	643,4		531,8	1,32	643,6	165,0	2,6	1,09	
11	4987,5	4984,1	1,32	644,4		531,6	1,32	643,8	165,7	1,2	1,08	
12	5003,0	4999,3	1,32	646,9		535,0	1,32	645,9	166,3		1,09	
13	5022,7	5018,5	1,32	649,7		-	1,32	648,2	167,0			Tight, abandon test
14	4888,0	4886,1				524,5					1,09	Sample
15												
16												

Table 5.8

SAGA PETROLEUM a.s.

WELL: 6406/2-2

PRESSURE UNITS: BARA

FMT WELLSITE WORKSHEET

RIG: ROSS RIG

RKB = 22 m

PAGE: 1 OF 1

WITNESSED BY: K. GRAN/G. SMAASKJÆR

DATE: 15.02.1996

RUN #: 6F	DEPTH MD	DEPTH TVD	IN. HYDROST. PRESSURE		FORMATION PRESSURE		FIN. HYDROST. PRESSURE		TEMP	MOB. INDEX	PP G/CC	REMARKS
TEST #	RKB	RKB	SG	HP	SG	HP	SG	HP	degC	mD	EMW	
1	4877,0	4875,3	1,31	625,1			1,30	624,3	153,2			Tight, abandon
2	4888,0	4886,2	1,30	625,6	1,10	525,3	1,30	625,6	154,7		1,09	
3	4895,0	4893,1	1,30	625,5	1,09	525,6	1,30	626,5	155,5	8,0	1,09	
4	4903,5	4901,4	1,30	627,3	1,09	525,9	1,30	627,4	156,8	10,7	1,09	
5	4905,0	4902,9	1,30	627,7					156,4			Tight, abandon
6	4912,0	4909,8	1,30	628,4	1,09	526,1	1,30	628,5	157,3	3,6	1,09	
7	4916,0	4913,8	1,30	628,8	1,09	526,3	1,30	628,8	157,8	4,4	1,09	
8	4919,0	4916,7	1,30	629,0	1,09	526,4	1,30	627,1	158,2	6,8	1,09	Sample
9	4946,5	4943,9	1,30	632,7	1,09	528,7	1,30	632,8	160,8	14,9	1,09	
10	4987,0	4983,6	1,31	638,3	1,09	532,9	1,31	638,3	160,8	8,5	1,09	
11	4917,7	4915,5	1,30	627,8	1,09	526,1	1,30	627,8	160,9		1,09	
12	4902,2	4900,2	1,30	626,3	1,09	525,8	1,30	626,7	160,8		1,09	
13	5002,5	4998,8	1,30	639,6	1,09	536,0			160,8		1,09	
14	5139,5	5131,4	1,30	655,3					162,0			Tight, abandon
15	5149,0	5140,5	1,30	657,1								Tight, abandon
16	5148,0	5139,6	1,30	656,4	1,08	545,2	1,30	656,1	163,0	4,3	1,08	
17	5203,0	5192,7	1,30	664,4	1,08	548,2	1,30	664,1	164,0		1,07	
18	5210,5	5199,9	1,30	665,1	1,08	548,9	1,30	665,0	164,2		1,07	
19	5227,0	5215,9	1,30	667,4	1,08	550,4	1,30	667,2	164,6		1,07	
20	5243,0	5231,3	1,30	669,6					165,0			Tight, abandon
21	5290,0	5276,8	1,30	673,4					166,3			Tight, abandon
22	5290,5	5277,3	1,30	673,6					165,7			Tight, abandon
23	5329,0	5314,5	1,30	680,4	1,08	564,1	1,30	678,5	167,0	1,6	1,08	Tight, supercharged ?
24	5338,0	5323,3	1,30	680,5					168,9			Tight, abandon
25												
26												

Table 5.9

SAGA PETROLEUM a.s.
FMT WELLSITE WORKSHEET

WELL: 6406/2-2
PRESSURE UNITS: BARA

RIG: ROSS RIG
RKB = 24 m

PAGE: 1 OF 1
WITNESSED BY: K. GRAN/G. SMAASKJÆR
DATE: 15.02.1996

RUN #: 6G	DEPTH MD	DEPTH TVD	IN. HYDROST. PRESSURE		FORMATION PRESSURE		FIN. HYDROST. PRESSURE		TEMP	MOB. INDEX	PP G/CC	REMARKS
TEST #	RKB	RKB	SG	HP	SG	HP	SG	HP	degC	mD	EMW	
1	4946,5	4943,9	1,30	632,0	1,09	529,1	1,30	632,0	155,9	3,0	1,09	Normal pretest
2	4946,0	4943,4	1,30	631,6	1,09	529,0	1,30	631,3	157,6	25,0	1,09	Sample point
3	4949,5	4947,0	1,30	631,4								Partially plugged tool
4	4949,0	4946,5	1,30	631,1								Partially plugged tool
5	4919,0	4916,7	1,31	630,6								Partially plugged tool
6												
7												

Table 5.10

5.4 Well testing

5.4.1 Production test no. 1 (4868 - 4927 mRKB)

5.4.1.1 Operations

The interval 4868 to 4927 mRKB (4842.2 to 4900.3 mTVDMSL) was perforated on February 26, 1996 against a closed choke manifold. Diesel in the tubing allowed approximately 70 bar underbalance during perforation. The perforation guns were Schlumberger 3-1/2 inch, four shots per foot, 34 gram HNS per charge TCP guns. Once a positive indication of the guns having fired was received at the surface (WHP increased to 106 bar), the well was opened on a 32/64ths choke and increased to 48/64ths choke. After 40 minutes, gas arrived at surface and the well was shut-in for 20 minutes due to high pressure at separator inlet. The well was then opened again on a 12/64ths choke and increased slowly to 48/64ths. After 52 minutes the well was shut-in at the PCT valve for an initial four hour buildup.

The well was opened on a 24/64ths choke and increased stepwise to 48/64ths for a high rate clean-up. After four hours production at high rate, the choke was reduced to 28/64ths to start a three rate main flow. After 30 minutes, however, the choke was increased to 36/64ths for rate one (since there was no measurable condensate rate at the first choke size). This rate was kept 15 hours, after which the well was shut-in (at the PCT) and preparations were made to disconnect due to bad weather. After 3.5 hours, however, the weather forecast allowed the test to continue and rate two was started at 48/64ths. After about four hours the well was shut-in again (at the PCT) because there was a leak in the oil line at burner boom. Rate two was restarted 1.2 hours later and was kept 19.5 hours. At this time the well was shut-in (at the PCT) for main buildup due to bad weather. During the time of waiting on weather, the landing string was pulled to repair suspected leaks in control line. A fishing operation for a gauge originally attached to the EZ tree was also executed.

After about 4.5 days with well shut-in, the operation continued with a short clean-up, preparations for running production logging tool and bottom hole sampling. PL logging was planed as an attempt to find an answer to the poor productivity of the zone. About 55 hours was spent trying to activate the gun-release sub (both with well shut-in and flowing at a small rate) and taking bottom hole samples. All attempts made to drop the TCP guns failed and the PL logging was therefore canceled. One run with 3 bottom hole samplers were made and one sample was obtained (two samplers failed to activate).

The killing procedure was started by circulating kill pill (SG 1.28) and brine into the tubing. The PCT was opened and a breakdown test, run by bullheading the tubing contents into the formation, was made before the well was killed.

Main results are shown graphically in Figure 5.2.

Flow- and buildup periods:

Period	Event	Duration (hr)
FL1	Initial flow	1.53
BU1	Initial buildup	4.25
FL2	Main flow cleanup (48/64" choke)	4.623
FL3	Main flow (36/64" choke)	15.619
BU2	Buildup while waiting on weather	3.338
FL4	Main flow (48/64" choke)	4.245
BU3	Buildup due to leak in oil line	1.142
FL5	Main flow (48/64" choke)	19.684
BU4	Main buildup, WOW and fishing	108.00
BHS	Bottom hole sampling and attempt to drop TCP guns for PL logging	54.53
FBT	Formation breakdown test	1

Summary of production results (data from end of period):

Period	WHP (bar)	WHT (degC)	BHP (bar)	BHT (degC)	Q_{GAS} (Sm^3/d)	$Q_{COND.}$ (Sm^3/d)	PI_{GAS} ($Sm^3/d/bar$)
FL3	86.1	12.0	159.8	160.0	223 000	91	615
FL5	50.7	13.2	110.0	154.5	221 000	81	536

* WTQR729 at 4804.2 mRKB

5.4.1.2 Fluid Sampling and Analysis

Gas Analysis: On-site analysis indicated 6 % CO_2 and 26 ppm H_2S. Four gas samples for geochemical analysis were collected.

Water analysis: The water cut was approx. 10 % during test no. 1. (As glycol and methanol were injected at subsea test tree and the lubricator for hydrate prevention, the water cut is inclusive glycol and methanol). Chloride content of approx. 2200 ppm was measured on-site during the flow.

Reservoir Fluid: The well produced gas-condensate. The average separator GORs (In brackets: GORs measured using the Wellhead Split Stream Sampling technique) were, 2397 Sm^3/Sm^3 (2402 Sm^3/Sm^3) during the 36/64" choke period and 2827 Sm^3/Sm^3 (2857 Sm^3/Sm^3) during the 48/64" choke period (All GORs refer to reference separator conditions of 13 bar and 40 degC).

The following PVT samples were collected:

Date	Time	Set no.	Sample point
270296	07:00	1	Test Separator
270296	07:40	2	Test Separator
270296	07:16	3	Mini Lab (lost)
270296	20:25	4	Test Separator
270296	21:05	5	Test Separator
280296	04:28	6	Test Separator
270296	20:19	7	Mini Lab

Each PVT set consists of 0.6 ltr. condensate and 20 ltr. gas pressurized bottles.

The following other samples were taken:

4 gas samples for geochemistry (each 0.5 ltr)
1 gas sample for helium (0.5 ltr.)
2 condensate samples for SCAL/TBP (each 20 ltr)
9 condensate samples (each 1 ltr)
21 water samples (each 1 ltr.)
14 condensate samples, dead oil (each 10 ltr)
2 sets of recombination gas/condensate samples (mini-lab)

5.4.2 Production test no. 2 (4714.5 - 4745.6 mRKB)

5.4.2.1 Operations

The interval 4714.5 - 4745.6 mRKB (4689.2 to 4720.3 mTVD) was perforated on March 14, 1996 against a closed choke manifold. Diesel in the tubing allowed approximately 55 bars underbalance during perforation. The perforation guns were Schlumberger 3-1/2 inch, four shots per foot, 34 gram HNS per charge TCP guns. A direct response in WHP was noted after perforation (WHP increased to 86 bars). Immediately after perforation, however, the methanol injection pump failed and had to be replaced. Almost one hour after perforation, the well was opened on a 20/64ths choke and increased in steps to 28/64ths. After about one hour, brine and gas arrived at surface and the choke was reduced to 24/64ths. When flowing continuous gas the choke was increased in steps to 32/64ths and flowed for 20 minutes before the well was shut-in on the choke manifold and the PCT-valve due to a leak in the test room. While making up new piping, a 7 hours initial buildup was conducted.

Production was then started again through a 20/64ths choke and increased stepwise to a 44/64ths, at which it was flowing for about 2 hours. At this time, the choke was reduced to a 24/64ths and the three rate main flow was started. The two first rates (24/64" and 32/64" chokes) were kept about 12 hours each. The last rate (40/64" choke) was kept 4 days. The well was then shut-in at the PCT valve for a 36 hours main buildup.

After the main buildup, a maximum flow test was conducted. The well was opened on a 12/64ths choke and increased to a 68/64ths (60/64" fixed and 32/64" adjustable) choke. The well was flowing on max. rate for 45 minutes, before it was shut-in at the PCT.

The killing procedure was started by circulating kill pill (SG 1.28) and brine into the tubing. The PCT was opened and a breakdown test, run by bullheading the tubing contents into the formation, was made before the well was killed.

Main results are shown graphically in Figure 5.3.

Flow- and buildup periods:

Period	Event	Duration (hr)
FL1	Initial flow	1.76
BU1	Initial buildup	6.85
FL2	High rate cleanup (44/64" max. choke)	5.70
FL3	Main flow (24/64" choke)	12.43
FL4	Main flow (32/64" choke)	12.80
FL5	Main flow (40/64" choke)	97.02
BU3	Main buildup	36.01
FL6	Max. flow test (68/64" max. choke)	2.87
FBT	Formation breakdown test	1

Summary of production results (data from end of period):

Period	WHP (bar)	WHT (degC)	BHP* (bar)	BHT* (degC)	Q_{GAS} (Sm^3/d)	$Q_{COND.}$ (Sm^3/d)	PI_{GAS} ($Sm^3/d/bar$)
FL3	302.2	29.7	455.9	168.7	338 000	176	6090
FL4	266.7	40.4	423.4	168.7	516 000	264	5860
FL5	185.9	33.4	326.0	167.2	611 000	282	3300
FL6	133.3	43.2	348.6	167.0	1021000	557	6270

* WTQR729 at 4591.2 mRKB

5.4.2.2 Fluid Sampling and Analysis

Gas Analysis: On-site analysis indicated 5.5 % CO_2 and 23 ppm H_2S. Gas samples for geochemical analysis were collected.

Water analysis: A water cut of approx. 5.5 % and chloride content of about 100 ppm was measured on-site during the flow.

Reservoir Fluid: The well produced gas-condensate. The average separator GORs (In brackets: GORs measured using the Wellhead Split Stream Sampling technique) were; 1917 Sm^3/Sm^3 (1953 Sm^3/Sm^3) during the 24/64" choke period; 1953 Sm^3/Sm^3 (1960 Sm^3/Sm^3) during the 32/64" choke period; 2050 Sm^3/Sm^3 (2155 Sm^3/Sm^3) during the 40/64" choke period (All GORs refer to reference separator conditions of about 41.5 bar and 30 degC).

The following PVT samples were collected:

Date	Time	Set no.	Sample point
15.03.96	06:30	PVT set no.1	Test separator
15.03.96	07:15	PVT set no.2	Test separator
15.03.96	08:00	PVT set no.3	Test separator
15.03.96	09:30	PVT set no.4	Mini-lab
15.03.96	18:50	PVT set no.5	Test separator
15.03.96	20:35	PVT set no.6	Test separator
15.03.96	22:58	PVT set no.7	Mini-lab
16.03.96	10:50	PVT set no.8	Mini-lab
16.03.96	14:10	PVT set no.9	Test separator

All PVT sets consists of 0.5 ltr. condensate and 20 ltr. gas pressurized bottles.

The following other samples were taken:

3 gas samples for geochemistry (each 0.5 ltr.)
3 condensate samples for geochemistry (each 0.5 ltr.)
1 gas sample for helium (0.5 ltr.)
2 condensate samples for SCAL/TBP (each 20 ltr.)
16 water samples (each 1 ltr.)
10 condensate samples (each 1 ltr.)

14 condensate samples, dead oil (each 10 ltr.)
6 sets of recombination gas/condensate samples (mini-lab)
4 set isokinetic samples

6.2 Mud Data

6.2.1 Mud Properties, Daily Report

Table 6.2.1 lists the daily reported mud properties (4 pages).

6.2.2 Mud Materials Used

The mud material consumption is shown in Table 6.2.2 (1 page).

Well: 6406/2-2

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf /Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
951211	PSPUD	296.0				/		/					WATER BASED
951212	36"	386.5	1.03			/		/					WATER BASED
951213	9 7/8"	470.0	1.20	10.0	42.5	/	11.5	/					WATER BASED
951214	9 7/8"	1094.0	1.20	10.0	23.0	/	11.5	/					WATER BASED
951215	9 7/8"	1272.0	1.20	10.0	23.0	/	11.5	/					WATER BASED
951216	9 7/8"	1272.0	1.20	10.0	23.0	/	11.5	/					WATER BASED
951217	9 7/8"	1272.0	1.20	10.0	23.0	/	11.5	/					WATER BASED
951218	24"	1272.0	1.25	10.0	23.0	/	11.5	/					WATER BASED
951219	24"	1272.0	1.25	10.0	23.0	/	11.5	/					WATER BASED
951220	24"	1272.0	1.25	10.0	23.0	/	11.5	/					WATER BASED
951221	17 1/2"	1272.0	1.25	10.0	23.0	/	11.5	/					WATER BASED
951222	17 1/2"	1489.0	1.30	26.0	17.0	4/5	9.4	.0/1.4	72	85000	.9	16.4	KCl MUD
951223	17 1/2"	2122.0	1.48	32.0	20.0	4/6	8.1	.0/.6	240	84000	1.2	19.2	KCl MUD
951224	17 1/2"	2598.0	1.65	46.0	27.0	5/10	8.1	/.6	480	84000	2.2	25.8	KCl MUD
951225	17 1/2"	2654.0	1.65	46.0	30.0	5/11	8.1	/.6	480	85000	2.2	26.2	KCl MUD
951226	17 1/2"	2858.0	1.65	41.0	38.0	4/11	8.1	/.5	360	84000	1.5	26.8	KCl MUD
951227	17 1/2"	2858.0	1.67	35.0	38.0	4/10	8.2	/.6	400	71000	1.2	26.2	KCl MUD
951228	17 1/2"	2858.0	1.67	36.0	40.0	4/9	8.1	/.6	420	74000	1.2	26.2	KCl MUD
951229	12 1/4"	2858.0	1.67	33.0	40.0	4/8	8.7	.1/1.1	600	71000	1.0	26.2	KCl MUD
951230	12 1/4"	2858.0	1.56	49.0	17.0	10/24		/		103000		23.5	OIL BASED
951231	12 1/4"	3204.0	1.55	44.0	16.0	9/16		/		102000	1.0	24.0	OIL BASED
960101	12 1/4"	3450.0	1.55	45.0	18.0	11/30		/		100000	1.0	24.5	OIL BASED
960102	12 1/4"	3539.0	1.57	50.0	19.0	13/31		/		91000	.8	25.0	OIL BASED
960103	12 1/4"	3840.0	1.57	54.0	22.0	15/34		/		91000	.5	24.0	OIL BASED
960104	12 1/4"	4157.0	1.59	50.0	20.0	15/31		/		85000	1.0	24.0	OIL BASED
960105	12 1/4"	4215.0	1.63	55.0	23.0	15/33		/		88000	1.0	25.0	OIL BASED
960106	12 1/4"	4215.0	1.63	51.0	22.0	16/33		/		99000	.8	25.8	OIL BASED

Well: 6406/2-2

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf /Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
960107	12 1/4"		1.63	47.0	22.0	15/30		/		102000	.7	26.5	OIL BASED
960108	12 1/4"	4450.0	1.63	46.0	23.0	16/29		/		101000	.8	26.2	OIL BASED
960109	12 1/4"	4474.0	1.63	43.0	18.0	14/29		/		101000	.8	26.2	OIL BASED
960110	12 1/4"	4474.0	1.63	43.0	18.0	14/29				101000	.8	26.2	OIL BASED
960111	12 1/4"	4474.0	1.63	43.0	18.0	14/29		/		101000	.8	26.2	OIL BASED
960112	12 1/4"	4474.0	1.65	43.0	18.0	14/29		/		101000	.8	26.2	OIL BASED
960113	12 1/4"	4474.0	1.65	47.0	12.0	14/28		/		84000	.4	26.0	OIL BASED
960114	8 1/2"	4474.0	1.65	47.0	24.0	14/28		/		84000	.4	26.0	OIL BASED
960115	8 1/2"	4486.0	1.35	29.0	12.0	10/20		/		86000	.3	17.5	OIL BASED
960116	8 1/2"	4486.0	1.35	28.0	13.0	10/20		/		99000	.3	19.0	OIL BASED
960117	8 1/2"	4589.0	1.35	32.0	17.0	14/23		/		102000	.3	17.5	OIL BASED
960118	8 1/2"	4626.0	1.35	30.0	16.0	12/25		/		102000	.3	17.7	OIL BASED
960119	8 1/2"	4648.0	1.35	30.0	16.0	13/25		/		96000	.3	18.0	OIL BASED
960120	8 1/2"	4685.0	1.35	32.0	16.0	10/27		/		108	.2	18.0	OIL BASED
960121	8 1/2"	4759.0	1.35	33.0	17.0	13/27		/		102000	.3	18.0	OIL BASED
960122	8 1/2"	4828.0	1.35	31.0	16.0	11/28		/		108000	.3	17.8	OIL BASED
960123	8 1/2"	4848.0	1.35	33.0	17.0	13/31		/		108000	.3	17.5	OIL BASED
960124	8 1/2"	4848.0	1.35	32.0	17.0	12/29		/		108000	.3	17.5	OIL BASED
960125	8 1/2"	4868.0	1.32	32.0	21.0	13/33		/		108000	.3	16.6	OIL BASED
960126	8 1/2"	4868.0	1.32	30.0	24.0	13/36		/		111000	.3	16.6	OIL BASED
960127	8 1/2"	4868.0	1.33	34.0	19.0	12/37		/		102000	.3	17.5	OIL BASED
960128	8 1/2"	4942.0	1.32	35.0	20.0	14/38		/		111000	.6	16.8	OIL BASED
960129	8 1/2"	4979.5	1.32	30.0	20.0	10/30		/		111000	.5	17.0	OIL BASED
960130	8 1/2"	5016.5	1.32	35.0	21.0	14/33		/		99000	.5	17.0	OIL BASED
960131	8 1/2"	5054.0	1.32	31.0	21.0	14/33		/		99000	.5	17.2	OIL BASED
960201	8 1/2"	5054.0	1.32	34.0	17.0	14/33		/		103000	.5	17.4	OIL BASED
960202	8 1/2"	5129.0	1.32	37.0	21.0	14/34		/		118000	.5	17.2	OIL BASED

Well: 6406/2-2

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf /Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
960203	8 1/2"	5129.0	1.32	37.0	21.0	14/34		/		118000	.5	17.2	OIL BASED
960204	8 1/2"	5129.0	1.32	37.0	21.0	14/34		/		118000	.5	17.2	OIL BASED
960205	8 1/2"	5182.0	1.32	37.0	22.0	18/46		/		108000	.5	17.0	OIL BASED
960206	8 1/2"	5236.0	1.32	38.0	24.0	16/40		/		108000	.5	17.0	OIL BASED
960207	8 1/2"	5248.0	1.32	40.0	24.0	16/41		/		111000	.5	17.5	OIL BASED
960208	8 1/2"	5292.0	1.32	44.0	26.0	14/49		/		120000	.8	17.7	OIL BASED
960209	8 1/2"	5336.0	1.32	39.0	22.0	12/43		/		127000	.7	17.5	OIL BASED
960210	8 1/2"	5367.0	1.32	38.0	21.0	10/34		/		129000	.5	17.7	OIL BASED
960211	8 1/2"	5367.0	1.32	39.0	22.0	12/40		/		127000	.5	17.7	OIL BASED
960212	8 1/2"	5367.0	1.32	40.0	21.0	12/40		/		117000	.5	17.7	OIL BASED
960213	8 1/2"	5367.0	1.32	40.0	23.0	10/39		/		117000	.5	17.7	OIL BASED
960214	8 1/2"	5367.0	1.32	39.0	23.0	11/38		/	****	117000	.5	17.7	OIL BASED
960215	8 1/2"	5367.0	1.32	39.0	21.0	10/38		/	****	117000		17.7	OIL BASED
960216	8 1/2"	5367.0	1.32	39.0	21.0	10/38		/	****	117000		17.7	OIL BASED
960217	8 1/2"	5367.0	1.32	39.0	17.0	10/36		/	****	117000		17.7	OIL BASED
960218	DST#1	5367.0	1.32	39.0	18.0	10/36		/	****	117000		17.7	OIL BASED
960219	DST#1	5367.0	1.32	37.0	18.0	8/33		/	****	96000		17.4	OIL BASED
960220	DST#1		1.28			/		/					BRINE
960221	DST#1		1.28			/		/					BRINE
960222	DST#1		1.28			/		/					BRINE
960223	DST#1		1.28			/		/					BRINE
960224	DST#1		1.28			/		/					BRINE
960225	DST#1		1.28			/		/					BRINE
960226	DST#1		1.28			/		/					BRINE
960227	DST#1		1.28			/		/					BRINE
960228	DST#1		1.28			/		/					BRINE
960229	DST#1		1.28			/		/					BRINE

Well: 6406/2-2

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf /Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
960303	DST#1		1.28			/		/					BRINE
960304	DST#1		1.28			/		/					BRINE
960305	DST#1		1.28			/		/					BRINE
960306	DST#1		1.28			/		/					BRINE
960307	DST#1		1.28			/		/					BRINE
960308	DST#1		1.28			/		/					BRINE
960309	DST#2		1.28			/		/					BRINE
960310	DST#2		1.28			/		/					BRINE
960311	DST#2		1.28			/		/					BRINE
960312	DST#2		1.28			/		/					BRINE
960313	DST#2		1.28			/		/					BRINE
960314	DST#2		1.28			/		/					BRINE
960315	DST#2		1.28			/		/					BRINE
960316	DST#2		1.28			/		/					BRINE
960317	DST#2		1.28			/		/					BRINE
960318	DST#2		1.28			/		/					BRINE
960319	DST#2		1.28			/		/					BRINE
960320	DST#2		1.28			/		/					BRINE
960321	DST#2		1.28			/		/					BRINE
960322	DST#2		1.28			/		/					BRINE
960323	DST#2		1.28			/		/					BRINE
960324	P&A		1.28			/		/					BRINE
960325	P&A		1.28			/		/					BRINE

Materials	Unit	36" Hole	24" Hole	17 1/2" Hole	12 1/4" Hole	8 1/2" Hole	Test	Total
					Well : 6406/2-2			
Anco 208	ltr	-	-	33100	-	-	-	33100
Anco Defoamer WB	kg	-	-	-	-	-	220	220
Ancocide	kg	-	-	175	-	-	-	175
Barite	MT	0	65	771	369	82	35	1322
Bentonite	MT	14	97	0,6	0,525	-	2,075	114,2
Citric Acid	kg	-	-	200	-	-	-	200
KCl - brine	M3	-	-	773	-	-	-	773
KD-40	ltr	-	-	-	-	-	400	400
Lime	kg	40	520	50	2190	11040	120	13960
Rodopol 23P	kg	-	-	3400	-	-	425	3825
Soda Ash	kg	75	475	1750	50	-	300	2650
Thermopol	kg	-	-	-	-	-	275	275
Lampac LV	kg	-	-	15000	-	-	-	15000
Sodium Bicarbonate	kg	-	-	200	-	-	-	200
$CaCl_2$	kg	-	-	-	5000	8850	-	13850
Ancovert vis	kg	-	-	-	4000	5775	-	9775
Ancovert P	kg	-	-	-	10840	11800	-	22640
Ancovert S	kg	-	-	-	4020	4650	-	8670
Ancovert F	kg	-	-	-	1170	13430	-	14600
Baseoil	m_3	-	-	-	184	240	22	446
$CaCl_2$ brine	m_3	-	-	-	-	-	355	355
$CaCl_2$ powder	kg						27100	27100
RX 16/1	l	-	-	-	-	-	1664	1664
RX 25/3	l	-	-	-	-	-	1664	1664
Ancotherm DL	kg	-	-	-			100	100
Nutplug F	kg	-	-	-			75	75
Nutplug C	kg	-	-				50	50
Mica F	kg	-					200	200

Table 14 List over the mud materials used in Well 6406/2-2

L-825

3

Saga Petroleum

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Title

Geochemical Evaluation Well 6406/2-2

Author(s)

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Prepared	VBP				
Reviewed	NM	AIE			
Approved	ToH	KMB			

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1 Introduction

The purpose of this report is to present the geochemical evaluation of the results from well 6406/2-2. The well was spudded December 12th 1995.

The well was drilled using Anco 2000 mud system in the 17 1/2'' hole (1252- 2849 mRKB) and Anco Vert oil-base mud system below the 13 3/8" casing point (2849- 5367mRKB TD). Both the Anco 2000 and Anco Vert oil-base mud system affect the geochemical results and the interpretation of the reported data must be handled with caution.

The analyses have been carried out by Saga Petroleum (Appendix I-III), Geolab Nor (Appendix V), and IFE (Appendix IV).
The results from the different companies have been gathered in Tables 1 to 14 and shown in Figures 1 to 13.

The analytical work has in the main been performed in accordance with the guidelines given in "The Norwegian Guide to Organic Geochemical Analyses (1993)". The GC ratios of the aromatic fractions and the GCMS parameters have only been tabulated for few samples due to contamination and extremely low amounts / lack of biomarkers.

The samples were analysed in according to the analytical program shown in Table 1.

The lithostratigraphic subdivisions of well 6406/2-2 are listed in Table 2.

Analysis Count

Country	Wellname	Analysis	Sample Type	Count	
NOR	6406/2-2				
		Aromatic Biomarkers	COND	2	
					2
		Aromatic GC	CCP	2	
			COND	2	
			SWC	2	
					6
		Fraction Isotopes	CCP	8	
			COND	4	
			CUT	4	
			OIL	1	
			SWC	3	
					20
		Headspace & Occluded Gas GC	CUT	129	
					129
		MPLC/Iatroscan	CCP	167	
			COND	4	
			CUT	14	
			OIL	1	
			SWC	3	
					189
		Phenanthrenes	COND	2	
					2
		Rock-Eval	CCP	36	
			CUT	78	
			SWC	22	
					136
		Saturated Biomarkers	COND	2	
			CUT	4	
					6
		Saturated GC	CCP	9	
			COND	4	
			CUT	4	
			OIL	1	
			SWC	5	
					23
		Total Isotopes	CUT	9	

Table 2 Analysis Count

Analysis Count

Country	Wellname	Analysis	Sample Type	Count	
NOR	6406/2-2				
		Total Isotopes	GAS	6	
					15
		Vitrinite Reflectance	CCP	6	
			CUT	33	
			SWC	14	
					53

Table 2 Analysis Count

Detailed Data summarised by Well

NOR:6406/2-2

End Depth m (IRKB)	Type	Lithology	VRo(1) (%)	SD (%)	Pop'n	VRo(2) (%)	SD (%)	Pop'n	Name
1280.00	CUT	CLST/SST	0.32	0.04	23				IFE
1380.00	CUT	CLST/SST	0.29	0.05	24				IFE
1480.00	CUT	CLST/SST	0.28	0.05	23				IFE
1580.00	CUT	CLST/SST	0.3	0.05	27				IFE
1680.00	CUT	CLST	0.34	0.05	20				IFE
1790.00	CUT	CLST	0.28	0.04	20				IFE
1880.00	CUT	CLST	0.3	0.03	22				IFE
1990.00	CUT	CLST	0.33	0.03	21				IFE
2080.00	CUT	CLST	0.31	0.03	15				IFE
2180.00	CUT	CLST	0.32	0.04	14				IFE
2280.00	CUT	CLST	0.43	0.05	13				IFE
2380.00	CUT	CLST	0.37	0.05	21				IFE
2480.00	CUT	CLST	0.45	0.07	11				IFE
2580.00	CUT	CLST	0.49	0.06	17				IFE
2680.00	CUT	CLST	0.47	0.04	23				IFE
2780.00	CUT	CLST/SLTST	0.5	0.07	25				IFE
2880.00	CUT	CLST/SLTST	0.55	0.06	17				IFE
2980.00	CUT	CLST/SLTST	0.57	0.05	20				IFE
3080.00	CUT	CLST/SLTST	0.58	0.05	20				IFE
3100.00	SWC	CLST/SLTST	0.64	0.07	13				IFE
3180.00	CUT	CLST/SLTST	0.65	0.07	22				IFE
3247.00	SWC	CLST/SLTST	0.72	0.06	19				IFE
3280.00	CUT	CLST/SLTST	0.7	0.05	14				IFE
3380.00	CUT	CLST/SLTST	0.73	0.05	20				IFE
3397.00	SWC	CLST/SLTST	0.83	0.07	13				IFE

Detailed Data summarised by Well

NOR:6406/2-2

End Depth m (IRKB)	Type	Lithology	VRo(1) (%)	SD (%)	Pop'n	VRo(2) (%)	SD (%)	Pop'n	Name
3442.00	SWC	CLST	0.71	0.05	9				IFE
3462.00	SWC	CLST/SLTST	0.83	0.06	19				IFE
3480.00	CUT	CLST/SLTST	0.77	0.08	27				IFE
3514.00	SWC	CLST/SLTST	0.77	0.06	11				IFE
3580.00	CUT	CLST/SLTST	0.85	0.08	12				IFE
3610.00	SWC	CLST/SLTST	0.76	0.07	3				IFE
3680.00	CUT	CLST/SLTST	0.75	0.07	22				IFE
3700.00	SWC	CLST/SLTST	0.84	0.07	9				IFE
3780.00	CUT	CLST/SLTST	0.7	0.02	4				IFE
3847.00	SWC	CLST/SLTST	0.9	0.05	12				IFE
3880.00	CUT	CLST/SLTST	0.97	0.07	19				IFE
3980.00	CUT	CLST/SLTST	0.98	0.08	20				IFE
4047.00	SWC	CLST/SLTST	0.92	0.08	14				IFE
4080.00	CUT	CLST	1.02	0.08	21				IFE
4180.00	CUT	CLST	1.03	0.08	25				IFE
4195.00	SWC	CLST	1.23	0.05	13				IFE
4280.00	CUT	CLST	0.93	0.05	8				IFE
4354.00	SWC	CLST	1.07	0.10	26				IFE
4380.00	CUT	CLST	1.15	0.11	30				IFE
4385.00	SWC	CLST	1.04	0.11	26				IFE
4425.00	SWC	CLST	1.11	0.09	20				IFE
4450.00	CUT	CLST	1.25	0.10	28				IFE
4749.50	CCP	SST/SLTS	1.03	0.05	20				IFE
4935.00	CCP	CLST	1.76	0.10	23				IFE
4969.20	CCP	CLST/SST	1.72	0.12	21	1.27	0.07	4	IFE