2.2.4 Testing

Following the successful wireline logging operations a balanced cement plug was set from 5080 m to 4858 m. A 8 ½" bit and a 9 5/8" casing scraper was run and the cement plug was tagged at 4845m and was dressed down to 4900m. A 12 ¼" underreamer was run in the hole and underreaming performed from 4869 to 4894m. Pumped slug as foundation for cement prior to pulling out. Correlation and caliper log was performed on wireline. 7" liner hanger failed at the first attempt. Modified running tool by increasing the number of ports in the mandrel above wiper plug. Sat hanger and cemented liner while rotating. Sat packer but had no positive indications that packer sat. Performed a 6" bit run to drill out the shoe track and cement, after which a cement bond log was run to check the zone isolation. Well was then displaced to 1.30SG Calcium Chloride brine. Production packer was installed at 4864 m on wireline. Test string was run to 4864 and the tubing displaced to diesel.

The well test 1 included clean-up flow, clean-up build-up multi-rate flow and final built-up.

The well was killed by bullheading the formation fluid. A high-vis pill was used to prevent losses during the minifrac test, but this deteriorated due to the temperature. An OBM pill was pumped instead and the minifrac performed successfully. After pulling the tubing sandbailer was run. After few unsuccessful attempts, could not pass the liner lap, the sandbailer was modified and samples were taken from the bottom. A cement retainer was placed at 4800m and cement was squeezed in the formation. Attempts to pressure test the retainer failed and an additional bridge plug was run on wireline and set at 4790m.

Preparations for DST 2 started by running the production packer. It was decided to delete the gauge ring run. The packer got stuck at the top of the 7" liner. An overshot run was made without success after which a mill and catcher was run in and the fish was successfully retrieved. A clean-up run with mill, scraper, junkbasket and gaugering was performed. Production packer for DST 2 was installed at 4636m. The test string was run. 31/2" test tubing was used on this test while on test 1 5 " tubing was used. This required additional time to laydown the 5" tubing and make up the 3 ½". Tubing was displaced to diesel and well perforated. The well test included clean-up flow, clean-up build-up multi-rate flow and final built-up.

5.5 Fluid sampling and evaluation

The well was drilled with oil based mud. The MDT fluid samples were taken using the Pump-Out module in combination with the Optical Fluid Analyser to limit contamination of mud filtrate. The contamination level of oil based mud in the flashed condensate was measured on site by gel permeation chromatography.

A total of seven fluid samples were acquired in 6406/2-4SR. Two fluid samples were taken in 4701 m MDRKB, four samples were taken in (4945.2 and 4881.0 m MDRKB). One water sample was acquired at (4835 m MDRKB).

The fluid analyses were performed at the Oilphase GECO laboratory in Stavanger and by Saga's internal laboratory. All samples were contaminated by oil based mud. The contamination level obtained offshore was confirmed by fingerprinting, Table 5-3. The composition of the base oil in the samples were assumed equal to the mud filtrate returned from the sampling depth. The composition of the filtrate were analysed and used to derive a corrected sample composition. Table 5-7 to Table 5-9.

Table 5-3 Contamination level of base oil in flashed condensate from MDT samples

Sample	Depth m MDRKB	Weight-% OBM
1.02	4701	45.6
1.04	4881	71.3
1.07	4945.2	24.9

Table 5-4 MDT wellsite worksheet

FORMATION TESTER WELLSITE WORKSHEET - SAGA PETROLEUM ASA

WELL:	6406/2-4SR	RUN/TOOLSTRING:	1A MDT	WITNESS:	Ø.Clausen/T.Elseth
RIG:	DSB	PRESSURE UNITS:	BAR	DATE:	25-des-98
KB:	23 m	MUD WEIGHT (SG):	1,44 g/cm3		

TEST NO.	START TIME hh:mm	DEPTH MD RKB	MD-TVD MSL	DEPTH TVD RKB	DEPTH TVD MSL	IN. HYDROST. PRESSURE EMW	IN. HYDROST. PRESSURE HP	FORMATION PRESSURE EMW	FORMATION PRESSURE HP	FIN. HYDROST. PRESSURE EMW	FIN. HYDROST. PRESSURE HP	TEMP AFTER deg. C	MOB. INDEX mD/cP	COMMENTS
1	23:09	4643,0	113,8	4552,2	4529,2	1,455	650,70			1,455	650,72	156,1		Tight, abandon, 2.0 cc
2	23:20	4680,3	114,9	4588,4	4565,4	1,455	655,95			1,454	655,45	156,5		Tight, abandon, 2.9 cc
3	23:40	4686,5	115,1	4594,4	4571,4	1,454	656,37			1,454	656,20	157,6	1,2	Supercharged, 2.4 cc
4	00:13	4696,7	115,4	4604,3	4581,3	1,455	658,01	1,139	515,390	1,453	657,53	158,5	4,3	Supercharged, 20 cc
5	00:30	4701,0	115,5	4608,5	4585,5	1,453	658,07	1,137	515,024	1,452	657,47	159,0	9,4	Good test, 20 cc. Pumped 8 l, sampled 2 x 450 cc (1.01, 1.02)
6	02:45	4835,5	119,9	4738,6	4715,6	1,451	675,49			1,450	675,16	161,2		Tight, abandon, 3.8 cc
7	03:00	4840,5	120,1	4743,4	4720,4	1,450	675,89			1,450	675,56	161,8	1,4	Supercharged, 4.8 cc
8	03:20	4881,0	121,7	4782,3	4759,3	1,451	681,74	1,110	521,533	1,450	681,41	162,6	52,2	Good test, 20 cc
9	03:30	4888,5	122,0	4789,5	4766,5	1,450	682,49	1,108	521,770	1,450	682,27	163,1	985,0	Good test, 20 cc
10	03:40	4893,2	122,2	4794,0	4771,0	1,450	682,86	1,108	521,900	1,449	682,69	163,5	342,7	Good test, 20 cc
11	03:50	4897,7	122,4	4798,3	4775,3	1,450	683,37	1,107	522,083	1,449	683,29	163,8	319,5	Good test, 20 cc
12	04:00	4902,5	122,6	4802,9	4779,9	1,450	683,97	1,106	522,213	1,449	683,79	163,9	730,0	Good test, 20 cc
13	04:12	4917,0	123,2	4816,8	4793,8	1,450	686,07	1,104	522,688	1,449	685,86	164,1	859,4	Good test, 20 cc
14	04:25	4922,0	123,4	4821,6	4798,6	1,450	686,66	1,103	522,874	1,449	686,57	164,4	454,5	Good test, 20 cc
15	04:32	4928,6	123,7	4827,9	4804,9	1,450	687,55	1,102	523,042	1,449	687,37	164,5	612,8	Good test, 20 cc
16	04:45	4937,0	124,1	4835,9	4812,9	1,450	688,71	1,101	523,354	1,449	688,54	164,8	98,2	Good test, 20 cc
17	04:55	4945,2	124,5	4843,7	4820,7	1,450	689,88	1,100	523,617	1,449	689,63	165,0	1290,4	Good test, 20 cc.
18	05:18	4974,8	126,0	4871,8	4848,8	1,450	694,07			1,450	693,90	165,0		Tight, abandon, 5.0 cc
19	05:35	4987,8	126,7	4884,1	4861,1	1,450	695,83			1,450	695,69	165,1		Tight, abandon, 5.2 cc
20	05:50	4881,0	121,7	4782,3	4759,3	1,448	680,43	1,109	521,507	1,447	679,98	165,1	26,8	Good test, 20 cc. Pumped 19 l, sampled 2 x 450 cc (1.03, 1.04)
21	08:30	4945,2	124,5	4843,7	4820,7	1,449	689,47	1,100	523,607	1,446	688,29	164,9	981,4	Good test, 20 cc. Pump failed, lost seal while attempting to preflush prior to sampling

Table 5-5 MDT wellsite worksheet

FORMATION TESTER WELLSITE WORKSHEET - SAGA PETROLEUM ASA

WELL:	6406/2-4SR	RUN/TOOLSTRING:	1B MDT	WITNESS:	T.Elseth/Ø.Clausen
RIG:	DSB	PRESSURE UNITS:	BAR	DATE:	27-des-98
KB:	23 m	MUD WEIGHT (SG):	1,44 g/cm3		

TEST NO.	START TIME hh:mm	DEPTH MD RKB	MD-TVD MSL	DEPTH TVD RKB	DEPTH TVD MSL	IN. HYDROST. PRESSURE EMW	IN. HYDROST. PRESSURE HP	FORMATION PRESSURE EMW	FORMATION PRESSURE HP	FIN. HYDROST. PRESSURE EMW	FIN. HYDROST. PRESSURE HP	TEMP AFTER deg. C	MOB. INDEX mD/cP	COMMENTS
1	02:23	4945,2	124,5	4843,7	4820,7	1,442	686,27	1,100	523,607	1,443	686,47	162,3	443,1	Good test, 20 cc. Pumped 44 l, sampled 1 + 1 gal. (1.05, 1.07)
2	05:35	4672,7	114,7	4581,0	4558,0	1,442	649,10					165,5		Lost seal, tool failure - POOH

Table 5-6 MDT wellsite worksheet

FORMATION TESTER WELLSITE WORKSHEET - SAGA PETROLEUM ASA

WELL:	6406/2-4SR	RUN/TOOLSTRING:	1C MDT	WITNESS:	T.Elseth/Ø.Clausen
RIG:	DSB	PRESSURE UNITS:	BAR	DATE:	27-des-98
KB:	23 m	MUD WEIGHT (SG):	1,44 g/cm3		

TEST NO.	START TIME hh:mm	DEPTH MD RKB		MD-TVD MSL	DEPTH TVD RKB	DEPTH TVD MSL	IN. HYDROST. PRESSURE EMW	IN. HYDROST. PRESSURE HP	FORMATION PRESSURE EMW	FORMATION PRESSURE HP	FIN. HYDROST. PRESSURE EMW	FIN. HYDROST. PRESSURE HP	TEMP AFTER deg. C	MOB. INDEX mD/cP	COMMENTS
1	13:49	4701,2		115,5	4608,7	4585,7	1,440	651,90			1,439	651,76	154,0		Tight, abandon
2	14:00	4701,0		115,5	4608,5	4585,5	1,439	651,71			1,439	651,70	154,0		Tight, abandon, 2.3 cc
3	14:16	4701,1		115,5	4608,6	4585,6	1,440	652,00			1,439	651,80	154,0		Tight, abandon, 2.8 cc
4	14:48	4701,0		115,5	4608,5	4585,5	1,439	651,60					155,0		Tight, abandon
5	15:00	4881,0		121,7	4782,3	4759,3	1,440	676,68	1,110	521,568	1,440	676,37	159,0	125,6	Good test, 20cc, done to verify probe integrity.
6	15:20	4702,0		115,5	4609,5	4586,5	1,439	651,60	1,137	515,022			160,0	46,2	Good test, 20cc. Pumped 40 l, sampled 1 + 1 gal (1.08, 1.09)
7	18:55	4672,7		114,7	4581,0	4558,0	1,438	647,13			1,438	647,18	161,0		Lost seal
8	19:05	4683,5		115,0	4591,5	4568,5	1,438	648,93			1,438	648,77	160,8		Supercharged, 4.3 cc
9	19:15	4686,5		115,1	4594,4	4571,4	1,438	649,17	1,141	515,097	1,437	648,83	160,5	5,0	Supercharged, 4.8 cc
10	19:35	4689,5		115,2	4597,3	4574,3	1,438	649,40	1,141	515,553	1,437	649,23	160,5	4,3	Supercharged, 4.2 cc
11	19:50	4691,2		115,2	4599,0	4576,0	1,438	649,57	1,140	515,353	1,437	649,43	160,7	4,8	Supercharged, 4.2 cc
12	20:10	4696,6		115,4	4604,2	4581,2	1,438	650,40	1,139	515,495	1,437	650,17	161,0	1,5	Supercharged, 4.1 cc
13	20:37	4762,2		117,4	4667,8	4644,8	1,438	659,45	1,171	537,408	1,437	659,01	161,9	0,2	Supercharged, 3.9 cc
14	21:03	4835,0		119,9	4738,1	4715,1	1,438	669,36	1,202	559,505	1,436	668,46	163,8	6,3	Good test, 20 cc. Pumped 13 l, sampled 2 3/4 gal. (1.10)
15	23:40	4837,0		120,0	4740,0	4717,0	1,436	668,78	1,200	559,066	1,436	668,74	166,3	11,9	Good test, 20 cc
16	23:50	4838,0		120,0	4741,0	4718,0	1,436	668,92	1,201	559,722	1,436	668,85	166,0	3,8	Supercharged, 4.3 cc
17	00:00	4840,6		120,1	4743,5	4720,5	1,436	669,28	1,205	561,684	1,436	669,18	165,8	0,7	Supercharged, 3.1 cc
18	00:25	4987,8		126,7	4884,1	4861,1	1,440	691,00			1,440	690,76	167,4		Tight, abandon, 3.4 cc
19	00:40	4974,9		126,0	4871,9	4848,9	1,438	688,37			1,439	688,60	168,3		No seal, 3 attempts
20	01:00	5008,0		127,8	4903,2	4880,2	1,443	694,88			1,442	694,64	169,6		No seal, 3 attempts
21	01:45	4644,8		113,9	4553,9	4530,9	1,435	641,90			1,435	642,03	163,8		Tight, abandon, 4.4 cc
22	02:05	4648,0		114,0	4557,0	4534,0	1,435	642,57			1,435	642,45	162,2		Tight, abandon, 2.8 cc
23	02:20	4619,5		113,1	4529,4	4506,4	1,434	638,10			1,435	638,70	161,4		Tight, abandon, 3.0 cc

5.7 Production testing

5.8 Production test no. 1 (4874 - 4904 m MD RKB)

5.8.1 Operations

The interval 4874 - 4904 m MDRKB (4753 - 4781.5 mTVDMSL) was tested with the barefoot concept (production packer in the casing and the tested interval open). The well was opened for a clean-up flow through a 6.35 mm adjustable choke. Gas arrived to the surface after two hours flow. The choke size was increased in steps and the final choke size was 11.1 mm fixed choke. After approximately 12 hours flow the well was shut in for an approximately 12 hours long pressure build-up.

The well was opened for the multirate flow on a 6.35 mm fixed choke. After 12 hours the choke was increased to a 7.9 mm fixed, which was kept for 7.5 hours. The last production rate (9.5 mm fixed choke) had a duration of 9.5 hours. The multirate flow was planned to be 48 hours but due to the worsening weather conditions the flow had to be stopped after 29 hours. The main build-up had a duration of approximately 21 hours. The duration of the different periods are shown in Table 5.13

After the main build-up a mini-frac test was performed. The well was finally killed with oil based mud being pumped into the formation. The main results are shown graphically in Figure 5.4

Period	Choke sizes (mm)	Duration (hours)
Clean-up flow		
FL1	6.35, adjustable	1.25
FL1	9.53, adjustable	0.95
FL1	9.53, fixed	1.63
FL1	11.11, adjustable	0.20
FL1	11.11, fixed	7.98
Clean-up build-up, BU1		11.82
Main flow		
FL2	6.35, fixed	12.03
FL3	7.94, fixed	7.75
FL4	9.53, fixed	9.10
Main flow build-up, BU2		20.77

Table 5.13 Summary of flow and build-up periods DST 1.

Summary of production results (data from end of the period) (Table 5.14).

Period	WHP (bar)	WHT (deg C)	BHP* (bar)	BHT* (deg C)	Q_{gas} (Sm^3/d)	Q_{cond} (Sm^3/d)	PI_{gas} ($Sm^3/d/bar$)
FL2	235.9	10.8	387.2	168.9	158000	60	1164
FL3	214.6	17.0	355.1	168.6	194000	73	1155
FL4	187.6	16.4	314.7	167.8	237000	93	1138

*) WTSR 867 at 4851.5 mMDRKB

Table 5.14 Summary of production results DST 1.

5.8.2 Fluid sampling and analysis

Gas analysis: On-site analysis indicated 6% CO_2 and 29 ppm H_2S.

Water analysis: The chloride content of the condensed water from the gas phase in the last multirate flow varied between 500 and 2000 mg/l.

Reservoir fluid: The well produced gas-condensate. The average separator GOR during the last flow rate (9.53 mm fixed choke) was 3019 Sm^3/Sm^3 (at separator conditions of 35 deg C and 35 bar).

The following PVT samples (Table 5.15) were collected from the separator:

Date	Time	Set no.
11.01.99	06:10 – 06:40	1
11.01.99	06:50 – 07:20	2
12.01.99	04:00 – 04:30	3
12.01.99	04:45 – 05:15	4
12.01.99	11:50 – 12:20	5
12.01.99	12:35 – 13:05	6
12.01.99	21:15 – 21:45	7

Table 5.15 PVT samples DST 1.

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

The following other samples were taken:

1 gas bottle for geochemistry (0.15 ltr.)
1 oil bottle for geochemistry (0.5 ltr.)
2 condensate samples for SCAL/TBP (each 20 ltr.)
8 stabilised condensate samples (each 18 ltr.)

5.8.3 Data acquisition

Flowrate and pressure:
All surface pressure and flowrate measurements were recorded electronically with the Schlumberger CAS system.

Bottomhole pressure:
Eight electronic pressure gauges were run. Seven out of these eight worked well. Figure 5.4 shows the bottomhole pressure during the test.

Bottomhole temperature:
The bottomhole temperature was recorded with the seven pressure gauges that worked. Figure 5.4 shows the bottomhole temperature during the test.

5.9 Production test no. 2 (4684 – 4704 mMD)

5.9.1 Operations

The interval 4684 – 4704 mMDRKB (4569 - 4588.5 mTVDMSL) was perforated on January 26, 1999 against a closed choke manifold. Diesel in the tubing allowed approximately 58 bars underbalance during perforation. The perforation guns were Sclumberger 3.5 inch, four shots per foot, 37 gram HNS per charge TCP guns. Immediately after a positive indication of the guns having fired was received at the surface (WHP increased to 103 bar), the well was opened on a 6.35 mm adjustable choke. After about 45 minutes, gas and brine/mud arrived at surface. After 4.12 hours the choke was increased to 7.94 mm. In the Test Program it was planned for an 8-12 hours build-up before start on the main flow, but due to low productivity it was decided to have the clean up and the main flow in one flow period.

After about 25 hour flow the well was shut in at the choke manifold due to icing in the flowhead. The ice plug was formed due to low well head temperature. The cause of the low well head temperature is the low rate, which cannot transport any considerable amount of heat from the formation. In addition, in a gas well with large drawdown thermodynamic effects makes thing even worse due to the Joule-Thomson effect. After 18 minutes the well was reopened on a 7.94 mm choke. The choke was kept in this position for the next 22 hours and then shut-in at the PCT valve for a 48 hours build-up.

The killing procedure was started by circulation of 11 m^3 hi-visc followed by brine into the tubing. The PCT valve was opened and mini frac test, run by bullheading the tubing contents into the formation, was made before the well was killed. Main results are shown graphically in Figure 5.5.

Period	Choke sizes (mm)	Duration (hours)
Cleanup/main flow:		
FL1	6.35 adj. Choke	3.3
FL1	6.35 fixed choke	0.42
FL1	7.94 adj. Choke	1.17
FL1	7.94 fixed choke	43.18
Build-up, BU1		48
Mini frac test, MFT1		1.35
Mini frac test, MFT2		1
Mini frac test, MFT3		0.33

Table 5.16 Flow and build-up periods DST 2

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

Period	WHP (bar)	WHT (deg C)	BHP* (bar)	BHT* (deg C)	Q_{gas} (Sm^3/d)	Q_{cond} (Sm^3/d)	PI_{gas} ($Sm^3/d/bar$)
FL1	58.4	4	128.8	149.8	42855	18.1	111

*) WTQR 807 at 4668.56 mMDRKB

Table 5.17 Summary of production results DST 2

5.9.2 Fluid sampling and analysis

Gas analysis: On-site analysis indicated 5% CO_2 and 14 ppm H_2S.

Water analysis: The chloride content of the condensed water from the gas phase was 200 mg/l at the end of the flow period.

Reservoir fluid: The well produced gas-condensate. The average separator GOR at the end of the flow period (7.94 mm fixed choke) was 2548 Sm^3/Sm^3 (at separator conditions of 35 deg. C and 35 bar).

The following PVT samples (Table 5.18) were collected from the separator:

Data	Time	Set no.
27.01.99	03:10 –03:40	1
27.01.99	03:55 – 04:25	2
27.01.99	14:25 – 14:55	3

Table 5.18 PVT samples DST 2.

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

The following other samples were taken:

2 gas bottles for feochemistry (0.15 ltr.)
2 oil bottle for geochemistry (0.5 ltr.)
2 condensate samples for SCAL/TBP (each 20 ltr.)
8 stabilized condensate samples (each 18 ltr.)

5.9.3 Data acquisition

Flowrate and pressure:
All surface pressure and flowrate measurements were recorded electronically with the Schlumberger CAS system.

Bottomhole pressure:
Eight electronic pressure gauges were run. All of them worked well. Figure 5.5 shows the bottomhole pressure during the test.

Bottomhole temperature:
The bottomhole temperature was recorded with the eight pressure gauges that were run. Figure 5.5 shows the bottomhole temperature during the test.

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf /Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
970405	T&A					/		/					WATER BASED
981107	PSPUD					/		/					OIL BASED
981108	PSPUD					/		/					OIL BASED
981109	PSPUD					/		/					OIL BASED
981110	NA					/		/					OIL BASED
981111	NA					/		/					OIL BASED
981112	NA					/		/					OIL BASED
981113	8 1/2"	4546.0	1.74	43.0	11.0	8/17		/		107873	.8	28.0	OIL BASED
981114	8 1/2"	4546.0	1.35	23.0	9.0	8/17		/		89145	.5	17.0	OIL BASED
981115	8 1/2"	4546.0	1.35	26.0	13.0	13/20		/		91745	.5	17.5	OIL BASED
981116	8 1/2"	4620.0	1.35	26.0	13.0	12/23		/		96930	.5	17.5	OIL BASED
981117	8 1/2"	4629.0	1.35	26.0	13.0	12/23		/		96930	.3	17.5	OIL BASED
981118	8 1/2"	4663.0	1.38	27.0	14.0	13/23		/		110228	.3	17.0	OIL BASED
981119	8 1/2"	4672.0	1.44	34.0	15.0	15/29		/		107597	.3	20.0	OIL BASED
981120	8 1/2"	4680.0	1.44	31.0	13.0	14/26		/		104960	.3	20.0	OIL BASED
981121	8 1/2"	4680.0	1.44	36.0	14.0	17/30		/		99453	.3	19.5	OIL BASED
981122	8 1/2"	4680.0	1.44	36.0	14.0	17/30		/		99453	.3	19.5	OIL BASED
981123	8 1/2"	4680.0	1.44	34.0	17.0	15/33		/		96930	.3	19.0	OIL BASED
981124	8 1/2"	4688.0	1.44	35.0	17.0	15/32		/		94625	.3	19.0	OIL BASED
981125	8 1/2"	4688.0	1.44	39.0	16.0	15/33		/		92298	.3	19.0	OIL BASED
981126	8 1/2"	4688.0	1.44	39.0	15.0	15/32		/		92298	.3	19.0	OIL BASED
981127	8 1/2"	4692.0	1.44	37.0	13.0	13/25		/		87566		19.5	OIL BASED
981128	8 1/2"	4719.0	1.44	40.0	15.0	12/31		/		103981		20.0	OIL BASED
981129	8 1/2"	4722.0	1.44	39.0	19.0	12/30		/		113609		19.5	OIL BASED
981130	8 1/2"	4762.0	1.44	39.0	15.0	12/30		/		111223	.8	19.5	OIL BASED
981201	8 1/2"	4803.0	1.44	40.0	15.0	11/29		/		106232	.8	20.0	OIL BASED
981202	8 1/2"	4818.5	1.44	39.0	15.0	12/28		/		106200		19.5	OIL BASED

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf /Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
981203	8 1/2"	4838.5	1.44	40.0	16.0	11/26		/		106200		19.5	OIL BASED
981204	8 1/2"	4857.0	1.44	39.0	14.0	11/24		/		110900	.5	20.0	OIL BASED
981205	8 1/2"	4898.5	1.44	36.0	15.0	10/26		/		119000	.7	19.0	OIL BASED
981206	8 1/2"	4935.0	1.44	42.0	18.0	12/27		/		119000	.8	19.0	OIL BASED
981207	8 1/2"	4970.0	1.44	40.0	15.0	11/24		/		119000	.8	19.5	OIL BASED
981208	8 1/2"	4994.0	1.44	41.0	15.0	11/24		/		119000	.8	19.5	OIL BASED
981209	8 1/2"	4994.0	1.44	36.0	14.0	10/22		/		117000	.9	19.5	OIL BASED
981210	8 1/2"	5046.5	1.44	36.0	14.0	10/22		/		117000	.9	19.5	OIL BASED
981211	8 1/2"	5046.5	1.44	37.0	15.0	11/23		/		117000	.9	19.5	OIL BASED
981212	8 1/2"	5067.0	1.44	42.0	15.0	11/25		/		99000	.6	20.0	OIL BASED
981213	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981214	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981215	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981216	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981217	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981218	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981219	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981220	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981221	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981222	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		111000	.6	20.5	OIL BASED
981223	8 1/2"	5080.0	1.44	43.0	16.0	10/25		/		110909	.6	20.5	OIL BASED
981224	8 1/2"	5080.0	1.44	44.0	17.0	9/25		/		108322	.6	19.5	OIL BASED
981225	8 1/2"	5080.0	1.44	42.0	16.0	9/23		/		110909	.6	20.0	OIL BASED
981226	8 1/2"	5080.0	1.44	42.0	16.0	9/23		/		110909	.6	20.0	OIL BASED
981227	8 1/2"	5080.0	1.44	42.0	16.0	9/23		/		110909	.6	20.0	OIL BASED
981228	8 1/2"	5080.0	1.44	42.0	16.0	9/22		/		110909	.6	20.0	OIL BASED
981229	DST#1	5080.0	1.44	43.0	13.0	7/19		/		110909	.6	20.0	OIL BASED

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf /Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
981230	DST#1	5080.0	1.44	43.0	11.0	7/19		/		68334	.6	21.5	OIL BASED
981231	DST#1	5080.0	1.44	38.0	10.0	7/18		/		78123	.6	20.0	OIL BASED
990101	DST#1	5080.0	1.44	40.0	11.0	7/17		/		78123		20.0	OIL BASED
990102	DST#1	4897.5	1.44	40.0	12.0	8/17		/		78123		20.0	OIL BASED
990103	DST#1	4897.5	1.44	40.0	11.0	6/19		/		78123		20.0	OIL BASED
990104	DST#1	4897.5	1.44	38.0	9.0	6/18		/		78123		20.0	OIL BASED
990105	DST#1	4897.5	1.44	38.0	9.0	6/18		/		78123		20.0	OIL BASED
990106	DST#1	4897.5	1.30			/		/					BRINE
990107	DST#1	4897.5	1.30			/		/					BRINE
990108	DST#1	4897.5	1.30			/		/					BRINE
990109	DST#1	4897.5	1.30			/		/	****	250000			BRINE
990110	DST#1	4897.5	1.30			/		/	****	250000			BRINE
990111	DST#1	4897.5	1.30			/		/	****	250000			BRINE
990112	DST#1	4897.5	1.30			/		/	****	250000			BRINE
990113	DST#1	4897.5	1.30			/		/	****	250000			BRINE
990114	DST#1	4897.5	1.30			/		/	****	250000			BRINE
990115	DST#1	4897.5	1.30			/		/	****	250000			BRINE
990116	DST#1	4897.5	1.30			/		/	****	250000			BRINE
990117	DST#1	4897.5	1.30			/		/	****	250000			BRINE
990118	DST#1	4684.0	1.25			/		/	****	250000			BRINE
990119	DST#2	4684.0	1.25			/		/	****	250000			BRINE
990120	DST#2	4684.0	1.25	17.0	25.0	6/12		/					BRINE
990121	DST#2	4684.0	1.30	17.0	25.0	6/12		/					BRINE
990122	DST#2	4684.0	1.25	17.0	25.0	6/12		/					BRINE
990123	DST#2	4684.0	1.25	17.0	25.0	6/12		/					BRINE
990124	DST#2	4684.0	1.25	17.0	25.0	6/12		/					BRINE
990125	DST#2	4684.0	1.25	17.0	25.0	6/12		/					BRINE

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf /Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
990126	DST#2	4684.0	1.25	17.0	25.0	6/12		/					BRINE
990127	DST#2	4684.0	1.25			/		/					BRINE
990128	DST#2	4684.0	1.25			/		/					BRINE
990129	DST#2	4684.0	1.25			/		/					BRINE
990130	DST#2	4684.0	1.25			/		/					BRINE
990131	DST#2	4684.0	1.25			/		/					BRINE
990201	DST#2	4684.0	1.25			/		/					BRINE
990202	DST#2	4684.0	1.25			/		/					BRINE
990203	DST#2	4684.0	1.25			/		/					BRINE
990204	DST#2	4684.0	1.25			/		/					BRINE
990205	DST#2		1.25	19.0	32.0	10/15		/					BRINE
990206	DST#2		1.74	19.0	32.0	10/15		/					BRINE
990207	DST#2		1.74	19.0	32.0	10/15		/					BRINE
990208	DST#2		1.74	19.0	32.0	10/15		/					BRINE
990209	P&A		1.74	19.0	32.0	10/15		/					BRINE
990210	P&A	2260.0	1.57	16.0	29.0	8/12		/					BRINE
990211	P&A		1.57	18.0	37.0	10/20		/					BRINE
990212	P&A					/		/					BRINE
990213	P&A					/		/					BRINE
990214	P&A					/		/					BRINE
990217	P&A					/		/					BRINE

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IFE/KR/F-99/047

DATAREPORT ON STABLE ISOTOPES, GAS
SAMPLE FROM WELL 6406/2-4SR

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Availability
In Confidence

Report type
IFE/KR/F-99/047

Date
1999-03-19

Report title
DATAREPORT ON STABLE ISOTOPES, GAS SAMPLE FROM WELL 6406/2-4SR
(ref. IFE no 2.3.029.99)

Date of last revision

Client
Saga Petroleum ASA

Revision number

Client reference

Number of pages
5

Number of issues
15

Summary

One gas sample from well 6406/2-4SR, test 1 is analysed for gas and isotopic composition.

The work is done in accordance with «The Norwegian Industry Guide to Organic Geochemical Analyses», third edition 1993.

Distribution

Saga (8)
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Reviewed by	Harald Johansen	1999-03-19	Harald Johansen
Approved by	Bjørg Andresen	1999-03-19	Bjørg Andresen

1 Introduction

One gas sample from well 6406/2-4SR, test 1 is analysed for gas and isotopic composition.

On the sample C_1 - C_5 and CO_2 are quantified and the $\delta^{13}C$ value is measured on methane, ethane, propane, the butanes and CO_2. In addition the δD value is measured on methane.

2 Analytical procedures

Aliquots of 0.2 ml are sampled with a syringe for analysis on a Poraplot Q column connected with flame ionisation (FID) and thermal conductivity (TCD) detectors. The detection limit for the hydrocarbon gas components is 0.01 µl/ml and for H_2S and for CO_2 0.2 µl/ml.

Two different approaches are used for the isotopic determination. For the isotope analysis of methane and carbon dioxide 5-10 ml of the gas is sampled with a syringe and then separated into the different gas components by a Carlo Erba 4200 gas chromatograph. Methane is oxidised in a CuO-oven. The combustion products CO_2 and H_2O are frozen into collection vessels and separated. Carbon dioxide is collected directly after the chromatographic separation.

The combustion water is reduced with zinc metal in a sealed quarts tube to prepare hydrogen for isotopic analysis. The isotopic measurements are performed on a VG Optima and a Finnigan Delta mass spectrometer.

For the carbon isotopic determination of the wet gas components aliquots are sampled with a syringe and analysed on a VG Isochrom connected on line to a VG Optima Mass spectrometer. A HP 5890 II with a Poraplot Q column is used for the separation and helium is used as a carrier gas. The injections are performed in splitless mode.

Both analytical methods are tested with the same laboratory gas mixture. Based on repeated analysis of a the gas mixture, the reproducibility in the $\delta^{13}C$ value is better than 0.5‰ PDB in both methods. The reproducibility in the δD value is likewise better than 10‰.

3 Results

The normalised volume composition of the gas sample is shown in Table 1. No H_2S is detected in the sample. The stable isotope composition is shown in Table 2.

The molecular composition related to the carbon isotope variation in methane from the sample are plotted in Figure 1 (Schoell, 1983), the carbon and hydrogen variation in methane are plotted in Figure 2 (Schoell, 1983) and the carbon isotope variation in ethane related to the carbon isotope variation in methane in Figure 3 (Schoell, 1983).

Table 1 Volume composition of a gas sample (normalised values) from well 6406/2-4SR

Sample	IFE no GEO	C_1 %	C_2 %	C_3 %	iC_4 %	nC_4 %	iC_5 %	nC_5 %	CO_2 %	ΣC_1- C_5 %	Wet-ness	iC_4/ nC_4/
6406/2-4SR, Test 1	990599	70.8	12.0	5.7	0.95	1.8	0.47	0.50	7.9	92.1	0.23	0.54

Table 2 Isotopic composition of a gas sample from well 6406/2-4SR

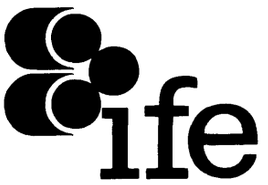
Sample	IFE no GEO	C_1 $\delta^{13}C$ ‰ PDB	C_1 δ D ‰ SMOW	C_2 $\delta^{13}C$ ‰ PDB	C_3 $\delta^{13}C$ ‰ PDB	iC_4 $\delta^{13}C$ ‰ PDB	nC_4 $\delta^{13}C$ ‰ PDB	CO_2 $\delta^{13}C$ ‰ PDB	CO_2 $\delta^{18}O$ ‰ PDB
6406/2-4SR, Test 1	990599	-44.3	-241	-30.6	-27.8	-28.8	-26.1	-10.5	-11.7

4 Literature

Schoell, M. (1983). Genetic characterisation of natural gases. *The American Association of Petroleum Geologists Bulletin*, **67**,2225-2238.

L-876

3



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BA99-656-1

IFE/KR/F-99/045

Vitrinite Reflectance Well 6406/2-4SR
Offshore Norway
(IFE no. 2.3.060.99)

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Availability
In confidence

Report type
F

Report number
IFE/KR/F-99/045

Date
1999-03-17

Report title
Vitrinite Reflectance Well 6406/2-4SR Offshore Norway
(IFE project no. 2.3.060.99)

Date of last revision

Client
Saga Petroleum ASA

Revision number

Client reference
Sven Hvoslef

Number of pages

Number of issues
9

Summary

Distribution

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Approved by	Harald Johansen	1999-03-17	Harald Johansen

1 Introduction

This report gives the result of routine vitrinite reflectance analyses of 10 samples from well 6406/2-4SR offshore Norway.

2 Material

The material was provided from the client as 10 cuttings samples.
Information on stratigraphy in well 6406/2-4SR was not provided from the client.

3 Analytical techniques

3.1 Preparation

The cuttings samples were treated with hydrochloric and hydrofluoric acid prior to further preparation. The aim was to avoid soft and expanding mineral phases in order to ensure good polishing quality. The sample material resulting from the acid treatment was embedded in an epoxy resin to make briquettes, ground flat and polished using 0.25 micron diamond paste and magnesium oxide as the two final steps.

3.2 Analysis

The analytical equipment being used was a Zeiss MPM 03 photometer microscope equipped with an Epiplan-Neofluar 40/0.90 oil objective. The sensitive measuring spot was kept constant for all measurements at about 2.5 micron in diameter. The measurements were made through a green band pass filter (546 nm) and in oil immersion (refractive index 1.515 at 18°C). The readings were made without a polarizer and using a stationary stage. This procedure is called measurement of random reflectance (%Rm). The photometer is calibrated daily against a standard of known reflectance (%Rm= 0.588) and routinely (daily) checked against two other standards of significant different reflectances (%Rm=0.879 and 1.696). A deviation from these values of less than ±0.01 and ±0.02 respectively is considered as acceptable. The calibration is routinely checked

during the course of measurements at least every hour, and a deviation of less than ±0.005 is considered as acceptable.

For each sample at least 20 points were measured if possible, and quality ratings are given to various important aspects which may affect the measurements. These aspects are abundance of vitrinite, uncertainties in the identification of indigenous vitrinite, type of vitrinite, particle size, particle surface quality and abundance of pyrite.

3.3 Presentation of results

The raw data from the measurements are presented in appendix for each sample both as tabulated data and histograms. A true vitrinite population is selected among the readings based on observations made during the measurements, and arithmetic mean values and standard deviation are calculated for this population and other populations. A quality rating is given to the true population. The results are listed in table 1. Figure 1 shows a vitrinite reflectance versus depth plot.

4 Results

Several samples were poor in vitrinite and had low quality surfaces. Though, it has been possible to establish a fairly reliable vitrinite reflectance towards depth trend for well 6406/2-4SR.

Table 1. Vitrinite reflectance data table well 6406/2-4SR

Analysis type:	Vitrinite reflectance
Well:	6406/2-4SR
Number of samples:	10
Time period for analysis:	mar-99
Analysis performed by:	Kristine Aasgaard, Institutt for energiteknikk
Analysis ordered by:	Geolab Nor/Saga

IFE sample code	Depth (mRKB)	Sample type	Lithology	Vitr. refl. (%Rm)	Stand. dev.	Number of readings	Sample description	Sample quality	Sample prep.
990623	4548	DC	sst	0.81	0.05	15	-±o--o	P	HF
990624	4557	DC	clyst	0.99	0.08	10	-oo--o	P	HF
990625	4593	DC	clyst	1.13	0.09	23	ooo--+	M	HF
990626	4611	DC	clyst	1.16	0.14	23	ooo-o+	M	HF
990627	4665	DC	clyst/sst	1.05	0.16	10	-oo--o	P	HF
990628	4782	DC	clyst/sst	1.12	0.08	19	ooo--+	P	HF
990629	4809	DC	sst/clyst	1.16	0.11	12	-ooo-+	M/P	HF
990630	4998	DC	sst/clyst	1.30	0.15	12	-oo--+	P	HF
990631	5061	DC	clyst/sst	1.21	0.1	13	-oo--+	M	HF
990632	5079	DC	sst/clyst	1.20	0.09	20	ooo--o	M	HF

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IFE/KR/F-99/051

DATAREPORT ON STABLE ISOTOPES, GAS SAMPLES FROM WELL 6406/2-4 SR

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Availability
In Confidence

Report type
IFE/KR/F-99/051

Date
1999-03-26

Report title
DATAREPORT ON STABLE ISOTOPES, GAS SAMPLES FROM WELL 6406/2-4 SR
(ref. IFE no 2.3.049.99)

Date of last revision

Client
Saga

Revision number

Client reference
Leif Husvik

Number of pages
5

Number of issues
15

Summary

Two gas samples from well 6406/2-4 SR, Test 2 FB 02BZ0034, 27.1.99 P.304 sample no 2.09 and Test 2 FB02BZ0033, 27.1.99 PT.305 sample no 2.10 are analysed for gas and isotopic composition.

The work is done in accordance with «The Norwegian Industry Guide to Organic Geochemical Analyses», third edition 1993.

Distribution

Saga (8)
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Johansen, H.
Johansen, I.
Sieglé, S.
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Reviewed by	Harald Johansen	1999-03-26	Harald Johansen
Approved by	Bjørg Andresen	1999-03-26	Bjørg Andresen

1 Introduction

Two gas samples from well 6406/2-4 SR, Test 2 FB 02BZ0034, 27.1.99 P.304 sample no 2.09 and Test 2 FB02BZ0033, 27.1.99 PT.305 sample no 2.10 are analysed for gas and isotopic composition.

On the samples C_1 - C_5 and CO_2 are quantified. The $\delta^{13}C$ value is measured on methane, ethane, propane, the butanes and CO_2. In addition the δD value is measured on methane.

2 Analytical procedures

Aliquots of 0.2 ml are sampled with a syringe for analysis on a Poraplot Q column connected with flame ionisation (FID) and thermal conductivity (TCD) detectors. The detection limit for the hydrocarbon gas components is 0.01 µl/ml, for CO_2 0.2 µl/ml.

For the isotope analysis 5-10 ml of the gas is sampled with a syringe and then separated into the different gas components by a Carlo Erba 4200 gas chromatograph. The hydrocarbon gas components are oxidised in separate CuO-ovens in order to prevent cross contamination. The combustion products CO_2 and H_2O are frozen into collection vessels and separated.

The combustion water is reduced with zinc metal in sealed quarts tubes to prepare hydrogen for isotopic analysis. The isotopic measurements are performed on a Finnigan MAT 251 and a Finnigan Delta mass spectrometer.

IFEs value on NBS 22 is -29.77 ± .06‰ PDB.

The uncertainty in the $\delta\ ^{13}C$ value is estimated to be ± 0.3‰ PDB and includes all the different analytical steps. The estimate is based on repeated analysis of a laboratory standard gas mixture. The uncertainty in the δD value is likewise estimated to be ± 10‰.

3 Results

The normalised volume composition of the gas samples is shown in Table 1. The stable isotope composition is shown in Table 2.

The molecular composition related to the carbon isotope variations in methane from the samples are plotted in Figure 1 (Schoell, 1983), the carbon and hydrogen variations in methane are plotted in Figure 2 (Schoell, 1983) and the carbon isotope variation in ethane related to the carbon isotope variations in methane in Figure 3 (Schoell, 1983).

Table 1 Volume composition of gas samples (normalised values) from well 6406/2-4SR

Sample	IFE no GEO	C_1 %	C_2 %	C_3 %	iC_4 %	nC_4 %	iC_5 %	nC_5 %	CO_2 %	ΣC_1- C_5 %	Wet-ness	iC_4/ nC_4
Test 2 FB02B20033, sample no 2.09	990636	76.5	10.4	4.5	0.60	1.3	0.44	0.47	5.8	94.2	0.19	0.48
Test 2 FB02B20033, sample no 2.10	990637	65.8	12.8	7.4	1.4	3.4	1.4	1.6	6.2	93.8	0.30	0.42

Table 2 Isotopic composition of gas samples from well 6406/2-4SR

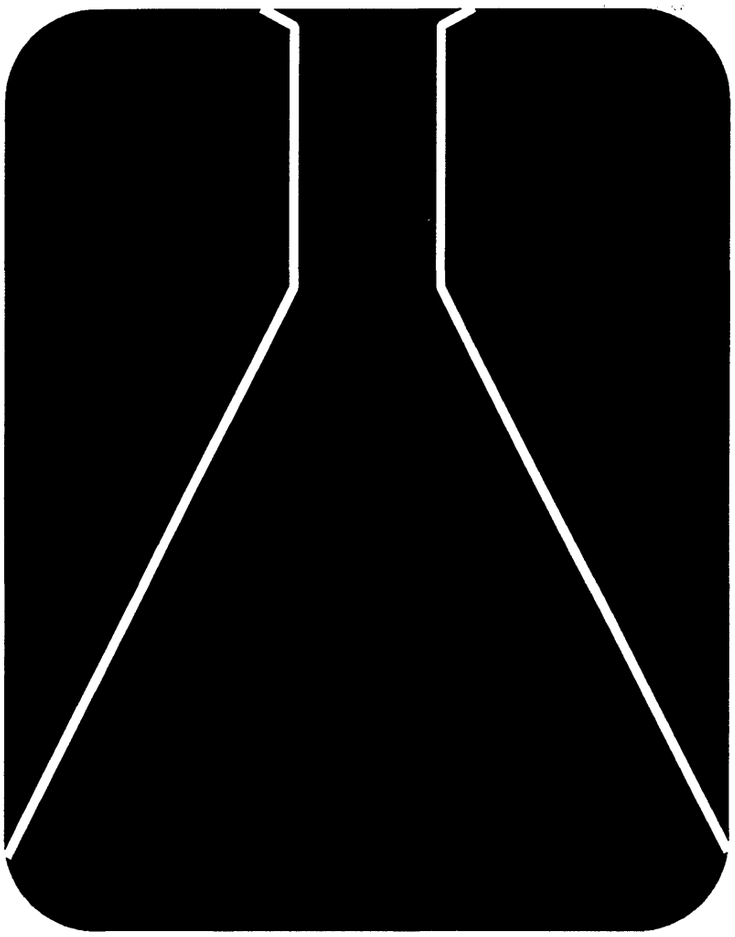
Sample	IFE no GEO	C_1 $\delta^{13}C$ ‰ PDB	C_1 δ D ‰ SMOW	C_2 $\delta^{13}C$ ‰ PDB	C_3 $\delta^{13}C$ ‰ PDB	iC_4 $\delta^{13}C$ ‰ PDB	nC_4 $\delta^{13}C$ ‰ PDB	CO_2 $\delta^{13}C$ ‰ PDB	CO_2 $\delta^{18}O$ ‰ PDB
Test 2 FB02B20033, sample no 2.09	990636	-43.6	-263	-30.6	-28.1	-25.8	-27.7	-7.5	-10.9
Test 2 FB02B20033, sample no 2.10	990637	-43.6	-213	-30.6	-28.2	-25.8	-27.4	-8.0	-11.9

4 Literature

Schoell, M. (1983). Genetic characterisation of natural gases. *The American Association of Petroleum Geologists Bulletin*, **67**,2225-2238.

GEOCHEMICAL DATA REPORT
Well NOCS 6406/2-4SR

B199-1628-1



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GEOCHEMICAL DATA REPORT

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TITLE

Data Report for Geochemical Analyses, Well NOCS 6406/2-4SR

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GEOLAB PROJECT NO.	DATE
62478	July 6th 1999
PROJECT MANAGER	QA RESPONSIBLE
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REPORT NO./FILE	FRONT PAGES
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* See Table 4b

** Only sample handling performed by Geolab Nor, all analysis invoicing and datatransfer between Saga and IFE

Table 1a: C1 to C7 hydrocarbons in HEADSPACE gas
(µl gas/kg rock)

GEOLAB NOR

Project: NOCS 6406/2-4SR
Well: NOCS 6406/2-4SR
Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4 / nC4
4548.00	3810	465	121	12	16	18	4424	614	13.9	0.75
4557.00	1490	702	320	33	45	70	2589	1099	42.5	0.74
4566.00	1165	1163	646	71	90	59	3134	1970	62.8	0.79
4575.00	1774	795	313	29	36	25	2946	1172	39.8	0.80
4584.00	1908	877	351	32	43	41	3211	1303	40.6	0.74
4593.00	4429	1042	353	27	36	44	5887	1458	24.8	0.74
4602.00	4738	1603	604	40	64	49	7050	2311	32.8	0.63
4611.00	17	9	21	2	6	9	54	37	68.6	0.27
4638.00	3114	652	159	10	13	12	3949	835	21.1	0.75
4647.00	553	147	47	3	5	23	756	202	26.8	0.68
4656.00	334	115	41	2	4	5	496	162	32.7	0.55
4665.00	779	167	66	5	10	7	1027	248	24.2	0.56
4674.00	5087	1242	346	26	33	22	6733	1646	24.5	0.78
4683.00	1752	364	95	7	11	18	2228	477	21.4	0.70
4692.00	1085	968	334	16	32	14	2435	1350	55.4	0.52
4701.00	1584	117	37	2	5	6	1745	162	9.3	0.45
4710.00	601	89	35	4	8	21	737	136	18.4	0.46
4728.00	2035	421	167	18	29	68	2671	635	23.8	0.61
4737.00	1341	198	68	6	10	19	1622	281	17.3	0.59
4746.00	1010	163	47	4	7	11	1232	221	18.0	0.58
4755.00	1305	231	73	6	12	22	1626	321	19.7	0.49
4764.00	1736	273	85	10	13	48	2117	381	18.0	0.76
4773.00	4195	570	152	15	21	21	4953	758	15.3	0.75
4782.00	3930	545	152	15	24	20	4665	735	15.8	0.62
4800.00	1131	245	73	7	11	23	1467	336	22.9	0.59
4809.00	531	159	56	6	10	48	763	232	30.4	0.57
4827.00	853	192	70	7	12	23	1135	282	24.8	0.55

Table 1a: C1 to C7 hydrocarbons in HEADSPACE gas
(µl gas/kg rock)

GEOLAB NOR

Project: NOCS 6406/2-4SR
Well: NOCS 6406/2-4SR
Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4/nC4
4836.00	3700	723	212	18	33	34	4685	986	21.0	0.55
4845.00	815	186	78	10	18	51	1108	293	26.4	0.57
4854.00	2705	405	117	13	18	39	3258	553	17.0	0.69
4863.00	3348	390	89	10	13	18	3850	502	13.0	0.76
4872.00	15905	1884	393	35	46	36	18263	2358	12.9	0.78
4881.00	15835	1766	408	41	53	52	18102	2268	12.5	0.78
4890.00	1462	217	66	8	11	46	1765	303	17.2	0.69
4899.00	1394	205	63	6	9	11	1678	284	16.9	0.69
4908.00	1380	228	75	8	12	14	1703	323	18.9	0.67
4917.00	9607	1655	519	61	75	64	11918	2311	19.4	0.81
4926.00	587	172	97	16	23	55	895	308	34.4	0.70
4935.00	9383	1505	442	48	60	52	11438	2055	18.0	0.80
4944.00	6801	1286	389	41	52	35	8568	1767	20.6	0.79
4953.00	547	110	46	6	9	14	718	171	23.9	0.68
4962.00	912	261	138	23	34	104	1368	456	33.3	0.69
4971.00	1214	368	166	22	34	41	1803	589	32.7	0.67
4998.00	503	122	46	7	10	14	689	186	27.0	0.65
5007.00	962	213	82	11	18	42	1287	325	25.3	0.61
5016.00	601	104	33	4	8	33	749	148	19.8	0.58
5034.00	1211	146	33	3	5	12	1397	186	13.3	0.64
5043.00	2681	374	79	8	11	20	3152	471	14.9	0.72
5052.00	719	169	74	5	9	19	976	257	26.3	0.59
5061.00	2463	417	105	10	15	72	3011	548	18.2	0.66
5070.00	1399	270	68	5	9	27	1750	352	20.1	0.60
5079.00	426	183	60	4	7	10	679	253	37.3	0.59

Table 1b: C1 to C7 hydrocarbons in CUTTINGS gas
(µl gas/kg rock)

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Project: NOCS 6406/2-4SR
Well: NOCS 6406/2-4SR
Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4/nC4
4548.00	32	13	5	1	1	3	51	20	38.3	0.51
4557.00	103	28	63	12	22	31	229	125	54.8	0.55
4566.00	108	83	180	35	63	61	469	361	77.1	0.56
4575.00	105	146	235	40	64	65	590	485	82.3	0.62
4584.00	131	104	142	24	35	48	437	305	70.0	0.68
4593.00	109	192	144	23	28	40	495	387	78.1	0.80
4602.00	103	174	149	26	35	49	488	384	78.8	0.74
4611.00	98	133	107	18	27	37	382	284	74.3	0.66
4638.00	420	786	596	105	144	184	2050	1630	79.5	0.73
4647.00	400	536	375	55	85	82	1451	1051	72.4	0.65
4656.00	132	17	10	2	3	9	162	31	18.9	0.62
4665.00	264	30	12	2	4	15	312	48	15.3	0.58
4674.00	362	770	687	131	203	310	2152	1790	83.2	0.65
4683.00	352	758	782	175	262	455	2329	1977	84.9	0.67
4692.00	348	272	292	61	98	177	1071	723	67.5	0.62
4701.00	3881	89	9	1	1	28	3981	100	2.5	0.75
4710.00	1448	47	8	1	2	16	1506	58	3.9	0.61
4728.00	827	49	13	3	4	7	895	68	7.6	0.68
4737.00	1113	42	7	1	2	16	1165	52	4.5	0.59
4746.00	1672	82	14	2	5	19	1775	103	5.8	0.40
4755.00	2258	110	24	3	5	15	2400	142	5.9	0.60
4764.00	614	40	26	5	8	16	694	80	11.5	0.63
4773.00	330	21	6	1	1	12	360	30	8.4	0.67
4782.00	443	32	11	2	3	9	490	47	9.7	0.61
4800.00	270	16	10	1	2	7	299	30	9.9	0.64
4809.00	431	45	12	1	2	8	491	60	12.3	0.56
4827.00	560	35	8	1	2	9	606	46	7.6	0.63

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Table 1b: C1 to C7 hydrocarbons in CUTTINGS gas
(µl gas/kg rock)

Project: NOCS 6406/2-4SR
Well: NOCS 6406/2-4SR
Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wetness	iC4/nC4
4836.00	537	40	13	2	4	22	596	60	10.0	0.52
4845.00	241	16	5	1	1	6	264	23	8.8	0.67
4854.00	249	22	6	1	1	4	280	31	10.9	0.65
4863.00	194	23	7	1	1	7	227	33	14.4	0.79
4872.00	273	28	15	2	3	7	320	47	14.7	0.64
4881.00	413	34	12	2	2	5	463	50	10.8	0.68
4890.00	356	40	8	1	1	7	406	50	12.4	0.63
4899.00	395	33	10	1	2	7	442	47	10.6	0.66
4908.00	323	24	5	1	1	8	355	32	8.9	0.69
4917.00	270	26	9	1	2	5	308	38	12.4	0.86
4926.00	364	32	9	1	2	6	407	44	10.7	0.70
4935.00	167	20	13	2	4	3	206	39	19.1	0.65
4944.00	121	13	6	1	2	4	144	22	15.6	0.71
4953.00	58	6	2	1	1	10	67	9	14.0	0.90
4962.00	45	4	2	1	1	6	52	7	13.4	1.19
4971.00	103	14	5	1	2	6	124	21	17.2	0.77
4998.00	138	16	6	1	2	15	163	25	15.2	0.64
5007.00	234	22	7	2	2	8	267	33	12.4	0.68
5016.00	205	21	5	1	1	9	234	29	12.4	0.92
5034.00	452	41	7	1	1	6	501	49	9.8	0.59
5043.00	606	52	9	1	1	7	669	63	9.5	0.66
5052.00	1261	112	23	3	4	11	1403	142	10.1	0.65
5061.00	2514	148	23	2	3	10	2690	176	6.6	0.67
5070.00	3064	226	33	2	4	14	3329	265	8.0	0.61
5079.00	1856	157	31	3	5	16	2052	196	9.5	0.62

Table 1c: C1 to C7 hydrocarbons in HEADSPACE and CUTTINGS gas GEOLAB NOR
(µl gas/kg rock)

Project: NOCS 6406/2-4SR
Well: NOCS 6406/2-4SR
Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4/nC4
4548.00	3841	478	126	13	17	21	4475	634	14.2	0.74
4557.00	1594	730	383	45	66	100	2818	1225	43.5	0.68
4566.00	1272	1246	826	106	153	120	3603	2331	64.7	0.70
4575.00	1878	941	548	68	100	90	3536	1657	46.9	0.68
4584.00	2039	982	494	56	78	89	3648	1609	44.1	0.72
4593.00	4538	1234	497	49	64	84	6382	1844	28.9	0.76
4602.00	4842	1777	753	67	99	98	7537	2696	35.8	0.67
4611.00	115	142	128	19	32	46	436	321	73.6	0.59
4638.00	3533	1438	756	115	157	196	5999	2465	41.1	0.73
4647.00	953	683	422	58	90	105	2207	1253	56.8	0.65
4656.00	466	132	50	4	7	15	659	193	29.3	0.58
4665.00	1043	198	78	7	13	23	1339	296	22.1	0.56
4674.00	5448	2012	1033	156	236	332	8885	3436	38.7	0.66
4683.00	2104	1122	877	182	273	473	4558	2454	53.8	0.67
4692.00	1433	1240	626	78	130	190	3506	2073	59.1	0.60
4701.00	5464	206	45	4	7	33	5726	262	4.6	0.52
4710.00	2049	136	43	5	10	37	2243	194	8.7	0.49
4728.00	2863	470	180	21	33	75	3566	703	19.7	0.62
4737.00	2454	239	75	7	12	35	2787	333	12.0	0.59
4746.00	2682	245	62	6	12	30	3007	325	10.8	0.51
4755.00	3563	340	97	9	17	38	4026	463	11.5	0.53
4764.00	2350	314	112	15	21	64	2811	462	16.4	0.71
4773.00	4525	591	158	16	22	33	5313	788	14.8	0.75
4782.00	4373	576	163	17	27	29	5155	782	15.2	0.62
4800.00	1400	262	82	8	13	30	1766	366	20.7	0.60
4809.00	962	204	68	7	13	56	1254	292	23.3	0.57
4827.00	1413	227	78	8	14	32	1741	327	18.8	0.56

Table 1c: C1 to C7 hydrocarbons in HEADSPACE and CUTTINGS gas (µl gas/kg rock)

GEOLAB NOR

Project: NOCS 6406/2-4SR
Well: NOCS 6406/2-4SR
Depth unit of measure: m * Indicated values in ml gas/kg rock

Depth	C1	C2	C3	iC4	nC4	C5+	sum C1-C4	sum C2-C4	%wet ness	iC4/nC4
4836.00	4236	762	225	21	38	56	5282	1046	19.8	0.54
4845.00	1056	202	83	11	20	56	1372	316	23.0	0.58
4854.00	2954	427	123	13	20	42	3538	584	16.5	0.68
4863.00	3542	413	96	11	14	25	4077	535	13.1	0.76
4872.00	16179	1912	408	37	48	43	18584	2405	12.9	0.77
4881.00	16248	1800	420	43	55	57	18566	2318	12.5	0.77
4890.00	1818	258	74	9	12	53	2171	353	16.3	0.68
4899.00	1790	239	73	8	11	18	2121	331	15.6	0.68
4908.00	1703	252	80	9	13	22	2057	354	17.2	0.67
4917.00	9877	1681	529	63	77	70	12226	2349	19.2	0.81
4926.00	951	204	106	17	24	61	1302	352	27.0	0.70
4935.00	9550	1525	455	50	63	54	11644	2094	18.0	0.79
4944.00	6922	1298	395	42	54	38	8712	1790	20.5	0.78
4953.00	605	116	48	7	10	24	786	181	23.0	0.70
4962.00	957	265	139	24	35	110	1419	463	32.6	0.70
4971.00	1317	381	171	24	35	47	1927	611	31.7	0.67
4998.00	641	138	52	8	12	29	852	211	24.7	0.65
5007.00	1196	235	90	13	21	50	1554	358	23.1	0.62
5016.00	806	125	38	6	9	43	983	177	18.0	0.63
5034.00	1663	186	40	4	6	18	1898	236	12.4	0.63
5043.00	3287	425	88	9	12	27	3821	534	14.0	0.71
5052.00	1980	281	97	8	13	30	2379	399	16.8	0.61
5061.00	4977	565	128	12	18	82	5701	724	12.7	0.66
5070.00	4462	496	101	8	12	41	5079	617	12.1	0.60
5079.00	2282	340	91	7	11	26	2732	449	16.4	0.60