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BP NORWAY LIMITED U.A.

DRILLING COMPLETION REPORT

EXPLORATION WELL 2/7-22

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LOG NO 13

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Testing

Programme: A single production test was to be performed over the interval 4489 - 4496 m (identified from TD logs). Permanent production packer to be set in 7" liner close to 4 1/2" liner top. 3 1/2" tubing string with 4 1/2" landing string to be run.

The interval 4489 - 4496m was perforated with Schlumberger 2 7/8" HSD guns at 6 shots per foot. 15 gram charges were used with 60 degree phasing. Severe difficulty was encountered in getting the perforating guns down below 4450m. This was most likely a mud related problem. At this time the mud in the 4 1/2" liner had not been circulated for 3 days.

An Otis production packer was set at 4190m (drillers depth) on wireline after first running a 5.7" gauge ring and junk basket.

Problems were encountered with the Weatherford tubing tong when making the dummy run with the sub sea test tree. Firstly the tong had to be changed out due to a slipping back up. Later the dies in the power tong had to be changed out, again due to slippage.

The test string consisted of 3 1/2" 15.8 lb/ft PH6 tubing. Two grades were utilised; P105 and SM 95S with the P105 run at the bottom of the string. The landing string was 4 1/2" 24.6 lb/ft N80 PH4 tubing.

The test string was run without incident. It is worthy of note that no joints had to be laid out when running the string. Two representatives from Hydril were onboard the rig to oversee the running of the tubing.

The test string was pressure tested after making up one joint of 3 1/2" tubing, after running in to 1812m and to 3212m. The UTTV sheared at 3730m, somewhat deeper than anticipated. The string was filled every 6 joints prior to the UTTV shearing.

With the string just above the permanent packer an attempt was made to circulate through the string. A surface pressure of 2500 psi was reached with no circulation; an attempt was then made to reverse circulate again with no success. 140m of pipe were pulled out dry; when running in the string had been filling itself. It was concluded that one of the tester valves had closed. It was allowing fluid to pass with a low differential pressure across the valve when running and pulling the string but seated with a high applied pressure. A depth determination run was made using Schlumberger wireline. This confirmed that it was the Pressure Operated Tester Valve which had closed. The closing of the tester valve was most likely caused by the tool referencing itself incorrectly possibly as the tool was run into the 7" liner. Another possibility is that the incorrect referencing was caused by the high viscosity of the mud.

10 hours were lost due to a leaking flowhead kill valve. When this valve leaked during the pressure testing of the flowhead the valve was first re-greased to no avail. The gate was then changed out which again did not cure the problem. After replacing the seat the valve tested satisfactorily from both sides.

The initial plan had been to open the MCRV to circulate in the base oil cushion. However it was calculated that with the cushion in place, the difference in hydrostatic pressure would have been approx. 4250 psi. Coupled with the dynamic pressure losses associated with circulating it would not have been possible to reach the minimum required flowrate to close the MRCV (4.2 bbls/min). For this reason the test string was pulled out of the packer prior to circulating in the cushion. A total of 56 bbls of base oil were circulated into the string; the surface pressure afterwards was 4000 psi.

After stabbing back into the packer and landing out the SSTT the surface pressure was 5260 psi (due to stabbing into the seal assembly with a basically closed end string). The POTV was cycled to the lock open position and the string pressure bled down to 2510 psi and allowed to build back up against the choke for 4 1/2 hours.

The well was opened up at 0610 hours on 30 September. After initially flowing the well to the stock tank for 50 minutes the flow was diverted overboard. Stabilised flow was attained at 0930 hours. The stabilised flow period produced at a rate of 8 mmscfd gas, 1300 bpd condensate and 2100 bpd water through a 32/64" choke. Flowing wellhead pressure was 3400 psi. A new high pressure test standpipe had been fabricated prior to the test. Although the steel pipe used on this line were suitable for sour service, the welds were not. At the surface temperatures encountered (maximum of 208 deg F) the line was good for only 14 ppm H₂S. The well was shut in at 1650 hours when the H₂S in the produced gas reached 17 ppm. The well was shut in on the POTV and the string pressure bled off to 2500 psi; the POTV held pressure.

When flushing the surface lines to glycol treated water, the master valve failed. After completing the flushing of surface lines the well was left shut in with a surface pressure of 900 psi. The well was left shut in for 17 1/2 hours before well kill operations were commenced.

The first stage in the well kill operation was to bleed off the surface pressure and fill the test string with mud (59 bbls were required). The MCRV could not be cycled open so 48 bbls of formation fluids and 20 bbls of mud were bullheaded into the formation. Maximum required pressure was 2740 psi and the final pumping pressure was 2220 psi at 3/4 bpm. 15 bbls were returned on bleeding off the pressure.

On pulling out of the packer it was not possible to circulate. The string was stabbed back into the packer and the annulus pressured up to re open the POTV. On pulling out of the packer it was possible to circulate the long way but not to reverse circulate. The string was pulled back a further 1 metre with pressure on the annulus. Reverse circulation was then broken. Settled out mud solids were the most likely cause of not being able to reverse circulate; the solids would pack off with pressure applied to the annulus but would separate when pressure was applied from inside the pipe. A total of 235 bbls were reverse circulated. Maximum gas was 1.92% and the maximum H₂S concentration was 2 ppm (both after the poor boy degasser). Approx. 25 bbls of mud were lost downhole during reverse circulating.

On attempting to circulate conventionally it was found that there was no communication between the string and the annulus. After stabbing back into the packer two attempts were made to open the AORV to no avail. Pressures of up to 5200 psi were used; the AORV was set to open at 4500 psi. After pulling out of the packer it was possible to circulate (the POTV was now in the lock open position). After circulating 720 bbls the returns were taken through the choke line and poor boy degasser due to rising gas concentrations. Maximum gas seen was 5.6% with a maximum H₂S figure of 3 ppm.

No damaged tubing threads were identified when the test string was pulled. The POTV closed and the string started pulling wet on the way out of the hole (this was expected). A further attempt was made to open the MRCV to no avail. The annulus was pressured up to 1500 psi and the POTV opened. It is significant that when the test tools were pulled to surface the AORV was found to be open and the ports of the MRCV were blocked with mud solids.

PORE PRESSURE

2/7-22 RFT PRESSURE DATA SUMMARY

Run No	Test No	Depth mbrtld	Form.Press (psig)	Hydro.Press (psig)	Remarks
11B	1	4489.5	11,200	12,557	Good Test
	2	4494.0	11,201	12,571	Good Test
	3	4498.0	11,203	12,581	Good Test
	4	4504.0	11,211	12,599	Tight
	5	4512.5	-		Dry Test
	6	4511.5	11,219	12,620	Tight
	7	4526.0	11,240	12,663	Good Test
	8	4533.0	11,250	12,683	Good Test
	9	4547.0	11,272	12,725	Good Test
	10	4508.0	11,217	12,605	Good Test
	11	4516.0	11,228	12,633	Good Test
	12	4523.5	11,237	12,653	Good Test
	13	4639.5	-		Dry Test
	14	4632.0	-		Dry Test
	15	4633.0	-		Dry Test
12C	1	4479.0	-	12,501	Dry Test
	2	4483.5	11,633	12,514	Tight/Supercharged
	3	4485.5	-	12,517	Dry Test
	4	4489.5	11,198	12,529	Good Test
	5	4492.5	11,199	12,536	Good Test
	6	4494.0	11,199	12,541	Good Test+Sample
	7	4495.5	11,199	12,544	Good Test
	8	4498.0	11,203	12,552	Good Test
	9	4499.0	11,202	12,555	Good Test
	10	4639.0	-	12,950	Dry Test
	11	4664.0	-	13,021	Dry Test
	12	4680.5	11,715	13,066	Tight/Supercharged
	13	4692.0	11,748	13,097	Tight/Supercharged
	14	4726.5	11,874	13,203	Tight/Supercharged
12D	15	4547.0	11,276	12,710	Good Test+Sample

- STRAIN GAUGE USED

- HYSTERESIS EFFECTS

- ERROR BAR

- INITIAL RESERVOIR PRESSURE $P_i = 11,215$ PSIA at 4489 m BRT.

Wellhead

Drill-Quip Universal Wellhead system 15m

Mud

<u>Hole Size</u>	<u>Interval (m MD BRT)</u>	<u>Mud Type</u>	<u>Mud Weight (SG)</u>
9 7/8"	93 - 1100	Seawater and high viscosity slugs	1.05
36"	93 - 227	Seawater and high viscosity slugs	1.05
26"	227 - 1100	Seawater and high viscosity slugs	1.05
17 1/2"	1100 - 2978	Petrofree	1.50 - 1.70
12 1/4"	2978 - 4200	Petrofree	1.70 - 1.72
8 1/2"	4200 - 4293	Low Toxic OBM	1.72 - 1.97
5 7/8"	4293 - 4750	Low Toxic OBM	1.96

Perforations

Interval : 4489 - 4496 Number of Guns : 1 Type of Gun used : 3 3/8" HSD Perforations Gun

MATERIALS USED PER CASING INTERVAL

17 1/2" HOLE FOR 13 3/8" CASING

MATERIAL	UNIT	CONCENTRATION PPB	QUANTITY	UNIT COST USD	COST USD
Barite	MT	376.00	517	87.00	44,979.00
EZ-MUL NTF	190 kg	10.11	45	403.85	18,173.25
Lime	20 kg	1.77	104	5.60	582.40
CaCl2	25 kg	11.20	450	9.10	4,095.00
Duratone HT	50 lb	8.68	322	44.19	14,229.18
Geltone II	50 lb	1.85	76	39.89	3,031.64
RM 63	55 gal	0.66	6	816.00	4,896.00
OMC 42	55 gal	1.10	2	1,395.00	2,790.00
ESTER	bbl	0.62 bbl	1163	500.00	581,500.00
PETROFREE	bbl	-	2339	232.50	543,817.50
XCD POLYMER	25 kg	spacer	8	262.50	2,100.00
CAUSTIC	25 kg	spacer	2	14.50	29.00
SUB TOTAL					1,220,222.97
Back loaded to "Far Sailor" on 4 June 1990					
1151 bbl PETROFREE (USD 500.00 * 0.56 * 0.75 * 1151), USD 210.00					(241,710.00)
Salvaged for use in next interval					
2483 bbl PETROFREE (USD 500.00 * 0.56 * 0.75 * 2483), USD 210.00					(521,430.00)
TOTAL INTERVAL COST					457,082.97

12 1/4" HOLE FOR 9 5/8" CASING

MATERIAL	UNIT	CONCENTRATION PPB	QUANTITY	UNIT COST USD	COST USD
Barite	MT	327.40	151	87.00	13,137.00
EZ-MUL NTF	190 kg	11.31	37	403.85	14,942.45
Lime	20 kg	2.14	68	5.60	380.80
CaCl2	25 kg	8.60	40	9.10	364.00
Duratone II	50 lb	9.44	248	44.19	10,959.12
OMC 2	25 kg	0.72	22	313.15	6,889.00
OMC 42	55 gal	2.24	13	1,395.00	18,135.00
ESTER	bbl	0.60 bbl	761	500.00	380,500.00
PETROFREE	bbl	(500*0.56*0.75) *	2483	210.00	521,430.00
PETROFREE	bbl	(500*0.56*0.75) *	353	210.00	74,130.00
PETROFREE	bbl	(500*0.56*0.75) *	366	210.00	76,860.00
TOTAL					1,117,727.67

Spacer Displacement

XCD POLYMER	25 kg	1.1 ppb	10	262.50	2,625.00
Barite	MT	(Incl Dowell Spcr)	131	87.00	11,397.00
SPACER TOTAL					14,022.00
SECTION TOTAL					1,131,749.67

Less Backload For Credit

PETROFREE	bbl	(500*0.62*0,75)	62	232.50	(14,415.00)
PETROFREE	bbl	(500*0.60*0,75)	805	225.00	(181,125.00)
PETROFREE	bbl	(500*0.60*0,75)	120	225.00	(27,000.00)
PETROFREE	bbl	(500*0.58*0,75)	1272	217.50	(276,660.00)
BACKLOAD TOTAL CREDIT					(499,200.00)

Transfer to 8 1/2" OBM

PETROFREE	bbl	(500*0.60*0,75)	278	225.00	(62,550.00)
PETROFREE	bbl	(500*0.58*0,75)	86	217.50	(18,705.00)
TRANSFER TOTAL CREDIT					(81,255.00)
TOTAL INTERVAL COST					551,294.67

8 1/2" HOLE FOR 7" LINER, ENVIROMUL

MATERIAL	UNIT	CONCENTRATION PPB	QUANTITY	UNIT COST USD	COST USD
ENVIROMUL	bbl	Received	1923	74.55	143,359.65
PETROFREE	bbl	From 12 1/4"	278	225.00	62,550.00
PETROFREE	bbl	From 12 1/4"	86	217.50	18,705.00
BARITE	MT	456.00	257	87.00	22,359.00
XC PLYMER	25 kg	-	4	262.50	1,050.00
EZ-MUL NT	55 gal	3.39	8	316.63	2,533.04
INVERMUL NT	55 gal	11.03	10	261.48	2,614.80
LIME	20 kg	3.50	120	5.60	672.00
Duratone II	25 kg	16.78	68	44.19	3,004.92
OMC 2	50 kg	1.18	22	313.15	6,889.30
OMC 42	55 gal	2.31	11	1,395.00	15,345.00
OMC	55 gal	-	1	742.57	742.57
DRILLTREAT	55 gal	3.00	11	761.21	8,373.31
BENTONE 38	25 kg	2.36	1	119.09	119.09
BASE OIL	bbl	0.57 bbl	429	48.03	20,604.87
TOTAL					308,922.55
Less 1938 bbl ENVIROMUL @ USD 27.38 to 5 7/8" Hole Section					(53,062.44)
Less 928 bbl ENVIROMUL @ USD 29.78 to 5 7/8" Hole Section					(27,635.84)
TOTAL INTERVAL COST					228,224.27

5 7/8" HOLE FOR 4 1/2" LINER, ENVIROMUL

MATERIAL	UNIT	CONCENTRATION PPB	QUANTITY	UNIT COST USD	COST USD
ENVIROMUL	bbl	From 8 1/2"	1938	27.38	53,062.44
PETROFREE	bbl	From 8 1/2"	928	29.78	27,635.84
BARITE	MT	471.00	329	87.00	28,623.00
DRILL TREAT	55 gal	3.63	15	761.21	11,418.15
EZ-MUL NT	55 gal	5.55	17	316.63	5,382.71
INVERMUL NT	55 gal	8.65	10	261.48	2,614.80
LIME	20 kg	13.62	268	5.60	1,500.00
DURATONE HT	25 kg	11.59	51	44.19	2,253.69
Liquid Casing	25 lb	-	16	74.17	1186.72
BARACARB	25 kg	-	26	23.44	609.44
RM 63	55 gal	0.28	3	816.00	2,448.00
OMC 2	50 kg	0.87	2	313.15	626.30
XCD POLYMER	25 kg	-	3	262.50	787.50
CaCl2	25 kg	8.40	111	9.10	1,010.10
BENTONE 38	25 kg	2.93	42	119.09	5,001.78
BASE OIL	bbl	0.60 bbl	721	48.03	34,629.63
TOTAL					178,790.90
Less 1938 bbl ENVIROMUL @ USD 27.38 to 5 7/8" Hole Section					(53,062.44)
Less 928 bbl ENVIROMUL @ USD 29.78 to 5 7/8" Hole Section					(27,635.84)
26.07.90 Credit 557 bbls Backloaded @ USD 29.58					(16,476.06)
08.08.90 Credit 254 bbls Backloaded @ USD 29.78					(7,564.12)
08.08.90 Credit 113 bbls Backloaded @ USD 21.61					(2,441.93)
08.08.90 Credit 245 bbls Backloaded @ USD 26.42					(6,472.90)
Total Credit for Mud Backloaded					(32,955.01)
TOTAL					145,835.89
Less 2041 bbls Transferred to Testing Phase @ USD 25.94					(52,943.54)
TOTAL INTERVAL COST					92,892.35

TESTING / PLUG AND ABANDON, ENVIROMUL

MATERIAL	UNIT	CONCENTRATION PPB	QUANTITY	UNIT COST USD	COST USD
ENVIROMUL	bbbl		2041	25.94	52,943.54
BASE OIL	bbbl		195	48.03	9,365.85
DURATONE	25 kg		13	44.19	574.47
EZ-MUL NT	55 gal		1	316.63	316.63
BARITE	MT		60	87.00	5,220.00
XC POLYMER	25 kg		1	262.50	262.50
DRIL TREAT	55 gal		2	761.21	1,522.42
TOTAL					70,205.41
Less 521 bbbls ENVIROMUL Backloaded @ USD 26.42					(13,764.82)
Less 580 bbbls ENVIROMUL Backloaded @ USD 25.94					(15,045.20)
TOTAL INTERVAL COST					41,395.39