

PHILLIPS PETROLEUM COMPANY NORWAY.

WELL TESTING.

ON

N.W. TOR - WELL NO. 2/4-10.

FROM: 20th November, 1973.
TO: 13th December, 1973.

ONBOARD 'ZAPATA EXPLORER'

CHIEF OF BASE.

J. H. Self

CHIEF OPERATOR.

J.F. SMITH.

J.F. Smith

- 1 - Outline and main results
- 2 - Sequence of events
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- 4 - Gas flow rate calculations
- 5 - Oil flow rate calculations
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- 7 - Bottom hole pressure chart readings
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- 9 - Well fluids sampling
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N.B. - Only the chapters marked with a cross appear in this report.

- 1 1 – Object
- 1 2 – Description of operations
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- 1 5 – Main results

N.B. – Only the subjects marked with a cross appear in this chapter.

OBJECT.

The object of the operation was to carry out flow tests on Well No. 2/4-10, at the following perforated intervals:-

<u>TEST 1.</u>	10840' - 10900'	-	60'
<u>TEST 2.</u>	10840' - 10855'	-	15'
<u>TEST 3.</u>	ABORTED.		
<u>TEST 4.</u>	10680' - 10765'	-	85'
<u>TEST 5.</u>	10680' - 10765'	-	85'
<u>TEST 6.</u>	10440' - 10510'	-	70'

All intervals were perforated with 4 shots per foot, except for Test 5 which was re-perforated, giving 8 shots per foot.

DESCRIPTION.

TEST NO.1.

After perforating, the B.J. test-string was run in the hole. With the packer at depth the test-string was displaced with drill water and the packer set.

The following test procedure was then carried out:-

Flow Period 1.

Well opened to the test-tank for a period of 15 minutes duration.

Shut in Period 1.

Well shut in at floor manifold for a period of 2hours duration.

Flow Period 2.

Well reopened to test tank. After recovering the remainder of the water cushion the flow of oil and water was diverted to the burner. Total flowing time 14 hours 49 minutes.

Shut in Period 2.

Well shut in at floor manifold for a period of 8 hours duration.

Acid Stimulation programme followed by a three hour contact period.

Flow Period 3.

Well opened to overboard flare-line, followed by clean-up to burner and flare-line. The flow was then diverted through the test Separator for a period of 8 hours duration at a final rate of 5400 B.F.P.D.

Shut in Period 3.

Well shut in at floor manifold for a period of 8 hours duration.

Flow Period 4.

Well flowed through test Separator for 6 hours at a final rate of 1200 B.F.P.D.

Shut in Period 4.

Well shut in a floor manifold for 8 hours.

Flow Period 5.

Well flowed through test Separator for approx 3 hours at a final rate of 2700 B.F.P.D.

This flow was curtailed prematurely due to high seas.

Shut in Period No.5.

Well shut in at floor manifold for 34 hours (during prevailing storm).

At this stage it was decided to terminate Test 1., so the well was killed.

Before proceeding with the next test the interval was squeezed with cement and drilled out to a depth of 10,865'.

TEST NO.2.

After perforating the B.J. test-string was run. With the packer at depth the string was displaced with drill water and the packer set. The following test procedure was then carried out:-

Flow Period 1.

Well opened to the test-tank. After approx 3.1/2 hours it was decided to proceed with the stimulation due to the diminishing cushion recovery rate.

Acid stimulation programme followed by 3 hour contact period.

Flow Period 2.

Well opened to overboard flare-line, followed by clean-up to burner and flare-line.

The flow was then diverted through the Separator for a period of 3 hours, flowing at a final rate of 2560 B.F.P.D.

At this stage the test was terminated.

Before proceeding with the next test this interval was plugged back and squeezed with cement.

TEST NO.3.

This was an aborted run due to the fact that the packer would not pass down the 7" casing.

TEST NO.4.

With the interval already perforated from the last test the B.J. test string, but with a Halliburton RTTS packer, was run in the hole. With the packer at depth the string was displaced with drill-water and the packer set. The following test procedure was then carried out:-

Flow Period No.1.

Well opened to test-tank for a period of 15 minutes duration.

Shut in Period 1.

Well shut in at floor manifold for 2 hours.

Flow Period 2.

Well opened to test-tank for 25 minutes. Due to the poor recovery rate it was decided to try and break-down the formation.

Unsuccessful attempts were made to break the formation. First by

pumping the treated water cushion and then by spotting acid to the circulating ports at the top of the packer.

After reverse circulating the test-string was pulled out of the hole.

TEST NO.5.

An open ended B.J. test string was run in the hole without recorders or perforated tail pipe. With the packer at depth, acid was displaced across the perforations and the packer set. The formation was then broken down and the acid-flush completed.

Shut in period 1.

Acid contact period for 30 minutes duration.

Flow period 1.

Well opened to test-tank, to recover sea-water cushion, for a period of 2 hours 5 minutes duration.

Shut in period 2.

Well shut in at floor manifold for 1 hour.

Flow Period 2.

Well opened to test tank for 9 hours. Due to diminishing cushion recovery rate the test was terminated at this stage and the well killed.

BEFORE proceeding with the next test a wire-line bridge-plug was run to 10,620'.

TEST NO.6.

After perforating the B.J. test-string was run in the hole. With the packer at depth the test string was displaced with drill-water and the packer set. The following test procedure was then carried out:-

Flow Period 1.

Well opened to the test-tank for a period of 15 minutes duration.

Shut In Period 1.

Well shut in at floor manifold for 2 hours.

Flow Period 2.

Well opened to test-tank, after a flowing period of some 7 hours it was decided to acidize due to the poor water-cushion recovery rate.

ACID STIMULATION PROGRAMME FOLLOWED BY
2 HOUR CONTACT PERIOD.

Flow Period 3.

Well opened to the overboard flare-line. After acid-gas had reached surface the water flow-rate progressively decreased. During a flowing time of some 30 hours the flow was periodically switched to the test-tank to measure the flow-rate, also samples were collected from the floor manifold for analysis by the mud engineer.

At the end of the test the packer was released and the test-string reverse-circulated, during which time sample kits were collected (see data sheets).

End of tests.

Symbol : 1102 GD 00

FLOPETROL
NORTH SEA

Base : _____
Month - Year : NOV 73

Customer : PHILLIPS PETROLEUM Well : 2/4-10
Service order N^o : - Zone tested : DANIAN
Field : N.W. TOR. Perforations from : 10840'
to : 10900'

**SEQUENCE OF
EVENTS**

Date	Time	Operations	TEST NO.1.
21/11/73			
		Test string at depth.	
		Pressure tested surface lines and valves.	
	08.30	Test string displaced with drill water (78 Bbls).	
	09.00	Packer set at 10756' RKB.	
	09.06	Well opened to test tank - FLOW PERIOD 1.	
	09.21	Well shut in - SHUT IN PERIOD 1.	
	11.21	Well opened to test tank - FLOW PERIOD 2.	
	17.00	Mud and gas at surface, switched to overboard flare line.	
	17.20	Oil with mud at surface.	
	18.00	Flowing oil and water to burner. WHP. 0	
22/11/73			
	00.05	'T' kit and jerry can, taken from floor manifold.	
	00.10	Well shut in - SHUT IN PERIOD 2.	
	08.00	Commenced acidisation programme.	
	13.00	Acidisation complete.	
	-	Surface pressure recorded during during contact period.	
		FLOW PERIOD 3.	
	16.30	Well opened to overboard flare-line, 32/64" choke.	
	16.32	Flowing on 1" choke.	
	16.40	Oil and water with acid gas at surface.	
	16.41	Reduced choke to 48/64", switched to Burner.	
	16.45	Flowing oil and water to Burner and flare line.	
	17.05	Increased choke size to 1"	
		Continued collecting samples from Manifold for analysis.	
	20.15	Choked to 16/64" and switched to Separator.	
	20.20	Increased choke to 32/64"	
	20.30	Reduced choke to 24/64" - Separator flooding. Insufficient gas flow.	
REMARKS			Chief Operator J.F.SMITH.

Symbol : 1102 GD 02

FLOPETROL

Base : NORTH SEA
 Month - Year : NOV. 1973

Customer : PHILLIPS PETROLEUM Well : 2/4-10
 Service order N^o : - Zone tested : DANIAN
 Field : N.W. TOR. Perforations from : 10840'
 to : 10900'

SEQUENCE OF EVENTS

Date	Time	Operations
22/11/73		D.S.T. NO.1.
	21.00	Level control established - commenced reading.
23/11/73		
	01.00	Collected 'F' kit and Jerry Can from Separator.
	04.15	Well shut in - <u>SHUT IN PERIOD 3.</u>
	12.15	Opened well on 12/64" choke.
	12.16	Shut in leak on Manifold.
	12.30	Opened well on 12/64" choke.
	12.34	Shut in - leak on Manifold.
	13.07	Opened well on 12/64" choke - <u>FLOW PERIOD 4.</u>
	15.45	Reduced choke size to 10/64"
	18.15	Collected core-lab oil and gas samples.
	19.15	Shut in well - <u>SHUT IN PERIOD 4.</u>
24/11/73		
	03.15	Opened well on 44/64" choke to clean up.
	03.50	Choked to 16/64" Switched through Separator.
		<u>FLOW PERIOD 5.</u>
	04.30	Choked to 15/64" choke.
	06.04	Well shut in due to high Seas.
		<u>SHUT IN PERIOD 5.</u>
25/11/73		
		Well remained shut in due to high seas (Shut in Period 5 continued).
	16.30	Well killed.
		<u>END OF TEST NO.1.</u>

REMARKS

Chief Operator
 J. F. SMITH.

FLOPETROLBase: NORTH SEA
Month - Year: NOV. 1973.Customer: PHILLIPS PETROLEUM Well: 2/4-10
Service order N°: - Zone tested: DANIAN
Field: N.W. TOR Perforations from: 10840'
to: 10855'**SEQUENCE OF
EVENTS**

Date	Time	Operations	<u>TEST NO. 2.</u>
<u>29/11/73</u>			
		Test string at Depth.	
		Pressure tested surface lines and valves.	
	02.30	Displaced test string with drill water (78 Bbls).	
	03.00	Packer set at 10750' RKB.	
	03.05	Opened to tank - loss of mud in annulus.	
	03.06	Shut in and reset Packer.	
	03.10	Opened to tank - loss of mud in annulus.	
	03.11	Shut in and reset Packer.	
	03.12	Opened well to test tank. FLOW PERIOD 1.	
		Poor recovery rate.	
	06.45	Well shut in for acidisation.	
	09.10	Acidisation complete, commence 3 hour contact period.	
	12.10	Well opened to test tank. FLOW PERIOD 2.	
	12.12	Switched to overboard flare-line, 1" choke.	
	12.25	Oil traces at surface, flow to Burner and flare.	
	12.30	Bypass choke - flowing on 2" line (effective 1.5") Flowing oil and water - 30% oil.	
	15.35	Choked back and switched through Separator.	
	15.50	Flowing on 1" choke.	
	16.00	Commenced flow readings.	
	18.00	Collected 'T' kit from Separator.	
	18.30	Well shut in. Well killed.	
		<u>END OF TEST 2.</u>	

REMARKS

Chief Operator
J.F. SMITH.

FLOPETROLBase : NORTH SEA
Month - Year DEC 1973Customer : PHILLIPS PETROLEUM Well : 2/4-10
Service order N^o : - Zone tested : DANIAN
Field : N.W. TOR Perforations from 10680'
to 10765'**SEQUENCE OF
EVENTS**

Date	Time	Operations
		<u>TEST NO.4.</u>
<u>2/12/73</u>		
	22.00	Test string at depth.
	22.30	Pressure tested surface lines.
	22.50	Commenced displacing test string with drill water.
	23.20	Leak at tubing 'X'-over.
	23.30	Reversed out cushion - changed out 'X'-over.
<u>3/12/73</u>		
	00.50	Displaced test string.
	13.10	Leak at 'X'-over.
		Reversed out cushion and changed 'X'-over.
	02.45	Displaced test string with drill water.
	03.10	Finished displacing.
	03.16	Packer set.
	03.20	Opened well to test tank. FLOW PERIOD 1.
	03.35	Shut in Well. SHUT IN PERIOD 1.
	05.35	Opened well to test tank - FLOW PERIOD 2.
	06.00	Shut in well and attempted to break down formation with first 20 bbls of treated water cushion - unsuccessful at 7000 psi T.H.P.
	07.00	Reversed out cushion and spotted 24 Bbls of acid to circulating port at top of packer, chased with sea water.
		Attempted to break down formation, unsuccessful at 7500 psi T.H.P.
		Reversed out.
		END OF TEST NO.4.

REMARKS

Chief Operator
J.F. SMITH.

FLOPETROLBase : NORTH SEA
Month - Year DEC 1973Customer : PHILLIPS PETROLEUM Well : 2/4-10
Service order N^o : _____ Zone tested : DANIAN
Field : N.W.TOR. Perforations from : 10680'
to : 10765'**SEQUENCE OF
EVENTS**

Date	Time	Operations <u>TEST NO.5.</u>
4/12/73		
	15.00	Test string at depth.
	15.15	Reverse circulated mud.
	16.50	Pressure tested surface lines.
	17.00	Displaced and spotted 48 Bbls of acid across perforations chased with sea water.
	17.25	Set Packer.
	17.30	Commenced pumping (formation broke down at 5200 psi T.H.P.)
	18.00	Acid flush complete. Commenced 30 minute contact period -SHUT IN PERIOD 1.
	18.30	Opened well to test tank - FLOW PERIOD 1.
	20.35	Shut in well - SHUT IN PERIOD 2.
	21.36	Opened well to test tank - FLOW PERIOD 2.
<u>5/12/73</u>	06.44	Well shut in.
		Well killed.
		END OF TEST NO.5.

REMARKS

Chief Operator
J.F.Smith.

FLOPETROL

Base : NORTH SEA
 Month - Year : DEC 1973

Customer : PHILLIPS PETROLEUM Well : 2/4-10
 Service order N° : - Zone tested : Danian
 Field : N.W. TOR Perforations from : 10440'
 to : 10510'

SEQUENCE OF EVENTS

Date	Time	Operations
		TEST NO.6.
<u>11/12/73</u>		
	11.00	Test string at depth.
	11.45	Pressure tested surface lines.
	12.00	Displaced test-string with drill water - 78 bbls.
	12.55	Set Packer.
	13.01	Opened well to test tank - loss of mud in annulus.
	13.02	Shut in well.
	13.08	Reset packer.
	13.10	Opened well to test tank - FLOW PERIOD 1.
	13.25	Shut in well - Shut in Period 1.
	15.25	Opened well to tank - FLOW PERIOD 2.
	22.30	Well shut in for acidisation.
<u>12/12/73</u>		
	01.00	Acidisation complete, commenced 2 hour contact period.
	03.00	Opened well to overboard flare line, FLOW PERIOD 3.
	03.15	Flowing choke bypassed, effective 1.5"
	03.19	Acid gas at surface.
	03.30	Flowing water, rate decreasing.
		Continued flowing water, samples collected periodically for analysis by Mud Engineer.
		Flow diverted to test-tank periodically to measure flow rate.
<u>13/12/73</u>		
	09.00	Collected 'T' kit from floor Manifold.
	09.06	Shut in well. Released packer.
		Reverse circulated test string.
		Collected 'T' kit of reversed fluid.
		END OF TESTS.

REMARKS

Chief Operator
 J.F. SMITH.

SURFACE SAMPLES.

TEST NO.1.

FLOW PERIOD 2.

FROM FLOOR MANIFOLD:-

1 x 'T' KIT.
1 x JERRY CAN.

FLOW PERIOD 3.

FROM SEPARATOR:-

1 x 'F' KIT.
1 x JERRY CAN (OIL).

FLOW PERIOD 4.

FROM SEPARATOR:-

1 x CORE-LAB OIL BOTTLE.
1 x CORE-LAB GAS BOTTLE.

TEST NO.2.

FLOW PERIOD 2.

FROM SEPARATOR:-

1 x 'T' KIT.

TEST NO.6.

FLOW PERIOD 3.

FROM FLOOR MANIFOLD:-

1 x 'T' KIT.

REVERSE CIRCULATING.

1 x 'T' KIT.

All sampling data and identification was recorded on Phillips sampling sheets and presented to the Phillips Petroleum Representative onboard 'Zapata Explorer'