

6406/9-1
A/S NORSKE SHELL E & P
END OF WELL REPORT, ONYX SW

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B1.1 EXECUTIVE SUMMARY

6406/9-1 Executive Summary

Well 6406/9-1 was drilled as a vertical HPHT exploration well drilled by the semi-submersible rig Transocean Leader in 309m water depth. The well was spudded on the 15th June 2004 and achieved TD on February 06 2005. Well 6406/9-1 met all its geological objectives including geological cores, a full logging and sampling program was carried out at TD (5080 m MD). Two zones were DST tested in 6406/9-1 after completion of the success-case formation evaluation logging program.

6406/9-1 was drilled, tested and abandoned in 371 days time, for total cost (status end august 2005) 757 MM NOK. With planned 162 days and 430 MM NOK this is respectively 129% and time and 76% over initial approved budget + 15 days additional success case evaluation scope.

The well was characterized by the following events.

1. Difficult start up with cold stacked UK rig coming to PL255 licence out of Ølen (N) shipyard upgraded for 15 K HPHT operations and norwegian sector compliance. The unit was also resourced with additional new crew (65%). During first 2 months uptime was low (70%), significant time was lost due to rig equipment down time caused by combination of poor maintenance or operator error.
2. 36"/30" and 26"/20" sections executed trouble free. Experienced frequent stop/starts due to breakdown of rig equipment as mentioned above.
3. 17"x20" / 16" and 14.3/4"x17.1/2" / 14"x13.3/8" concentric hole opening sections were drilled with significant slower than anticipated on bottom progress, predominantly as result of reactive shales. Formation stability problems are also believed to have contribute to the 16" liner standing up high, necessitating a top liner cement squeeze repair. The e-line formation evaluation program in the lower concentric section was cancelled due to hole stability concerns.
4. The well was suspended at the 13.3/8" shoe due to strike (force majeure rate), caused by breakdown of negotiations between OFS labor union and drilling contractors association (Rederi Verbundet) . The strike resulted in total 126 days delay, including suspension, re-entry and WOW due to rescheduling the activity in winter weather. During strike additional crew was kept on board to progress maintenance backlog and carry out upgrade work to meet rig specification.
5. 12.1/4" / 10.3/4"x9.7/8" vertical section was drilled in two trips with a conventional packed, and a rotary steerable assembly. Gas bearing sands in Lange formation were penetrated. After evaluating section with e/line program, the one million pound production casing string was installed above top HPHT reservoir. Total were losses experienced during primary cementation. Drilled OBM cuttings were collected using a bulk transfer system from cutting ditch, to rig silo storage, to

vessel, saving in the area of HSE more than 1000 inboard and onboard crane lifts.

6. The HPHT reservoir was penetrated at 4415.5m. The reservoir pressure was measured in top reservoir with FPWD (formation pressure while drilling) allowing to trip out at coring point with a reduced mud weight. Drilling and coring on bottom progress was as expected top of 8.1/2" (4-5 m/hr), but tailed of deeper when running impreg bits to manage severe stick/slip. A total of 4 cores were cut across 3 reservoirs. Slower progress while tripping and longer flat times was due to combination of HPHT procedures restricting the operating envelop, and due to generic rig/crew efficiency. The offshore team demonstrated control in critical HPHT section, during what was one of the most hostile winters on Norway Haltenbanken in recent history.

7. A success case electric wireline logging program was performed consisting of an extended logging program, pressure sampling (RCI), mini-DST (RCI), sidewall coring and earth imager / VSP. Extra 15 days scope were added to total budget time to extend coring / logging program. That all essential data was collected is an outstanding achievement, since bottom hole temperature of the well 6406/9-1 was at or higher than the rating of the sensitive electronics in the logging tools. The mini DST data gathered with RCI assisted in making the drill stem test decision, in future this technology may replace one or more DST test.

8: The abandonment of well 6406/9-1 was carried out as per NORSOK standard with every hydrocarbon zone isolated with 2x barriers. Significant NPT was recorded when isolating the hydrocarbon zone in the Lange formation.

B1.2 WELL REVIEW SUMMARY

Well	6406/9-1 Onyx SW	Rig: Trans Ocean Leader
Date on location	07 June 2004	Planned TD 4988
Date Spudded	15 June 2004	Actual TD 5080
Date at TD	06 Feb 2005	Planned days to TD 74
Date Abandoned	02 Jun 2005	Actual days 371
Date off location	03 Jun 2005	

Cost Plan	72 MM USD	Cost/m Plan	15461 USD/m
Cost Actual	115 MM USD	Actual	24220 USD/m

Costs reported up to July 2005.

Plan includes additional amount for 15days success case logging as was carried out.

Planned Vs Actual Drilling Rates

Section	Planned Rate m/hr	Actual Rate m/hr
36"	12,83	5,31
26"	26,47	21,30
17" x 20"	22,13	12,64
14-3/4 x 17"	11,73	4,36
12-1/4"	11,64	10,28
8-1/2"	4,96	2,48

The 12-1/4" section includes both HPHT and Non HPHT drilling.

The 8-1/2" section includes TST pressure point sampling.

None Productive Time:

Description	Planned	Actual	Delta
NPT %	15	29,9	14,9

Description	Planned Days	Actual Days	NPT %
Drilling Ops	111	158	29,7
Testing Ops	51	72	29,2

NPT Phase Description	Rig Intake Days	Strike Days	Drilling Days	Well Test Days	TOTAL Days
NPT	14,89	123,20	10,71	16,74	165,54
WOW	1,5	2,8	21,16	1,96	27,42
Total NPT	16,39	126,00	31,87	18,70	192,96

NPT Phase Description	Rig Intake %	Strike %	Drilling %	Well Test %	TOTAL %
NPT	7,7	63,8	5,6	8,7	85,8
WOW	0,8	1,5	11,0	1,0	14,2
Total NPT	8,5	65,3	16,5	9,7	100,0



A/S Norske Shell E & P Well: 6406/9-1 Onyx SW

Principal Contractors:

Transocean, Schlumberger D&M, MI Fluids, Halliburton Cementing and Well Testing, Geoservices, Smith/Red Baron Fishing, Schlumberger Wireline, Oceaneering, Dril-Quip, ITM, Corpro, Petrotech PVT Analysis, Weatherford Casing Running Services, M-I Swaco Cuttings Handling

Table with well metadata including Last update, Well Type, Water Depth, Dwell Floor Elevation, Coordinates, UTM, Well Days, Temp Gradient, Reservoir Temp, Max Inclination, Max Pres Grad, Top Gam Frm, Wellhead Equipment.

Main well log table with columns for Well Schematics, Geometry, Stratigraphy, Mud, BOP Tests, Casing, Cement, and Formation Evaluation. Includes detailed data for various depth intervals and geological formations.

Geological target and tolerances table with columns for Target, Depth (TVBDF), Northing, Easting, Tolerance W, Tolerance E, Tolerance N.

Approved by: Administered by: EPE-T-WD..... EPE-T-WD.....

- Drilling Hazards: - Boulders (first 66m) - Unstable clays in the Kai, Brygge Fm, Rogaland group and uppermost Shetland - Differential sticking across the reservoir - HPHM reservoir - Hydrocarbons prognosed in 14 3/4" x 17", 12 1/4" and 8 1/2" sections

- BOP Stack: 10k Annular, 10k Annular, Connector, 15k BSR HTHP 350F, 15k VBR 250F, 15k 5" F HTHP 350F, 15k 5" F HTHP 350F

Control System: Electro/Hydraulic gen. 1



Preliminary Well Diagram - PI255 Onyx SW (draft-rev 0)

11.05.2004

Start date:	Well coordinates:	Well no:	6406/9-A Onyx SW
Spud date:	N 7148742 m E 394860 m	Licence no:	PL255
Reservoir penetrated:	Rig: Transocean Leader	Well type:	HPHT Exploration
Date abandoned:	DFE: 23.5 m	Reservoir:	Middle & Lower Jurassic
Drilling fluid (intermediate): Glydrill WBM (MI)	Water depth: 308 m	Res. pres:	830bar @ Top Garn. (P90)
Drilling fluid (reservoir): Paratherm (2.0 SIP 2.0) OBM (MI)	KOP (AHBDF): N/A	Res. temp:	172°C @ TD
Mud Weight: 1.94 SG	Max. Dev.: N/A	Date logged:	
Weight Material: Barite	Max. Dogleg:	Drillers TD:	

Wellhead Data				Casing Scheme										
Item	Rating	Notes (S/N)		Size (in)	Wt (lbs/ft)	Grade	Couplings	AHBDF (m)	TVBDF (m)	TTOC (m)	MW@sect. TD	Annular Fluid	Frm strenght (SG)	
													tvbdf (m)	min/exp/max
Dril-Quip SS-15	15000	Vetco H-4 profile		30	310	X-52	HD-90-HT / SL-60	407		Seabed	1,20	Cement		
30" LP Wellhead Housing	2000			20	133	N-80	Big Omega IS	1365		Seabed	1,20	Cement		
Permanent Guidebase	n/a			16	84	P-110	Dino Vam MS	2200		TOL	1,72	Cement	1365	1.62/1.72/1.82
18-3/4" Wellhead	15000			14	114	VM95SS	Vam Top SC80	1075	(cross-over)	2550		Glydrill (1.82)		
14" Hanger	15000			13-3/8	72	P-110	Vam Top	2850			1,82	Glydrill (1.82)	2200	1.82/1.86/1.97
10-3/4" Hanger	15000			10-3/4	101	VM110SS	Vam HP SC80	2610	(cross-over)	4055		SIP 2.0 (1.90)		
				9-7/8	66,9	VM125CY	Vam Top	4355			1,90	SIP 2.0 (1.90)	2860	1.90/1.97/2.10
				7"	35	P-110	Vam Top	4988,5		TOL	1,94	Cement	4365	2.10/2.15/2.20

Hole size in	Depth m ahbdf	Depth m tvbdf	Inc. (deg.)	Downhole Schematic	Description	Formation	Top Depth tvbdf	Completion Dimensions Min ID	Max OD
	329,5	329,5	0		TOP of Wellhead /Connector				
	331,5	331,5	0		Seabed	Seabed	331,5	See attached casing data	See attached casing data
36	407,0	407,0	0		30" conductor shoe (36" TD @ 417 m) Cmt to surface, Top job				
	417,0	417,0	0						
	1075,0	1075,0	0		14" x 13.375 cross-over (min 1000m /burst)	Top Kai	1253,5		
	1300,0	1300,0	0		Top of 16" liner (65m liner lap), 20" adaptor housing 17,375" ID				
26	1365,0	1365,0	0		20" casing shoe (26" TD @ 1375 m) Cmt to Surface				
	1375,0	1375,0	0						
	1900,0	1900,0	0		TOC, 16" Liner	Brygge Hordaland	1668,5		
17.5 x 20	2200,0	2200,0	0		16" liner shoe (17.5" pilot hole depth @ 2243 m)	Tare	2283,5		
	2243,0	2243,0	0		Rogaland				
	2550,0	2550,0	0	TOC 13,375"	Base Tertiary	2423,5			
14.5 x 17.5	2610,0	2610,0	0	10.75" x 9.875 cross-over (min 2500m/H2S)					
	2850,0	2850,0	0	13.375" casing shoe (14.75" pilot hole depth @ 2873m)	Shetland				
	2873,0	2873,0	0		Lysing/Lange	3168,5			
			0		SK 84 Marker	3353,5			
	4055,0	4055,0	0	TOC 9,875"	Cromer Knoll				
	4255,0	4255,0	0	Top of 7" liner (100m liner lap)	Base Cret.	4298,5			
12,25	4355,0	4355,0	0	9.875" casing shoe (12.25" TD @ 4365 m)	Melke	4328,5			
	4365,0	4365,0	0		Viking				
			0		Garn	4463,5			
			0		Fangst				
			0		Ile	4578,5			
			0		Ror/Tolte	4688,5			
			0		Båt				
8,50	4990	4990,0	0	7" liner shoe	Tilje	4813,5	8,5	8,5	
	5000	5000,0	0	TD (approx.)					

Coring Data			Logging Data			Directional & LWD Data		
Objectives	Interval	Recovery	Section	Service	Interval	Type	Details	Date
Coring services: Corpro			Wireline services: Schlumberger			Directional and LWD services: SchlumbergerD&M		
Notes:								

Drawn by: Bjørn K. Schmidt Checked by: Bjørn K. Schmidt Date: 25.02.2004

PL 255 Onyx SW Casing Data

Description	Size	in	Primary Pipe										Contingency Pipe			
			30in	30in	30in	20in	16in	14in	13.3/8in	10 3/4in	10.3/4in	9.875in	7in	7 5/8in	7in	4 1/2in
	Nominal Weight	ppf	310	310		133	84	114	72	101	101	66.9	35	39	38	15.1
	Grade	-	X-52	X-52	X-52	N-80	P-110	VM95SS (ex-ST95)	P-110	VM110SS	AC-110SS	VM125C Y	P-110	VM125CY	VM125CY	P 110
	Connection	-	SL-60	HD-90- HT pin x SL-60 pin	Butt weld top x HD-90- HT box	Big Omega IS	Dino Vam MS	Vam Top SC 80	VAM TOP	Vam HP SC80	NK HW-SL	Vam Top	Vam Top	Vam Top NC	Vam Top SC85	New Vam
	Type	-	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C
Physical	Wall Thickness	in	1	1	1.5	0.635	0.495	0.800	0.514	0.960	0.960	0.668	0.498	0.500	0.540	0.337
	ID Nominal	in	28	28	27	18.730	15,010	12,400	12.347	8,830	8.830	8,539	6.004	6,625	5,920	3.826
	ID Connection (If Semi-Flush)	in		26.47	26.47											
	Coupling OD	in			33,030	21,126	16,869	15,006	14.291	11,500	11,615	10,974	7,842	8,262	7,730	5,039
	Drift Diameter API	in				17.375*	14,822									3.701
	Drift Diameter Special	in				18,543		12,250	12,250	8,750	8,750	8,500	5,879	6,500	5,879	
	Make Up Loss	in	9.7		14,063	5,827	5,212	6,946	5,698	8,226	5,906	5,484	4,776	5,557	4,776	3,969
	Burst, Pipe Body	psi				4450	5960	9770	7610	17680	17680	15220	13700	14750	17360	14420
	Burst, Pipe Connection	psi				4450	5960	9770	7610	17680	17680	15220	13700	14750	17360	14420
	Collapse, Pipe Body	psi				1600	1480	7500	2880	17890	17890	12900	13030	12060	16750	14340
	Collapse, Pipe Connection	psi				1600	1480	7500	2880	10000	8500	12900	13030	6500	16750	14340
	Yield Strength, Pipe Body	kips	4738	4738		3090	2652	3150	2285	3248	3246	2415	1119	1399	1370	485
	Yield Strength, Connection	kips	2080	2080	4220	3090	2652	2512	2285	2598	2601	2415	1119	1399	1165	485
	Bending and Tensional Efficiency	%														
	Compression Efficiency (compression-int/compression-ext)	%				50/50	50/50	48/48	60/60	40/60	40/50	60/60	60/60	75/75	51/51	40/40
Make Up Torques	Minimum	ft.lb				23400	18450	27000	20850	45000	21600	20850	15050	16900	NA	6840
	Optimum	ft.lb				26000	21700	30000	23150	50000	27000	23150	16650	18800	21000	7590
	Maximum	ft.lb				28400	24950	33000	25450	55000	32400	25450	18250	20700	23050	8340
String weights (not incl. running string unless full bore)	In Air	lbs			93125	452477	244240		699101			1249623	84512			
	In Mud	lbs			84946	394548	190752		545998			959710	64065			
	Abandonment air	lbs					N/A		545342			743552	N/A			
	Abandonment seawater						N/A		473902			649146	N/A			

* NB: 20" casing has housing adaptor for 16" liner installed - min 20" housing adaptor ID =17.375in



Well Status Diagram - PI255 Onyx SW (Rev 1)

20.08.2004

Start date: 28.05.2004	Well coordinates: N 7148739.65 m E 394862.13 m	Well no: 6406/9-A Onyx SW	
Spud date: 15.06.2004	Rig: Transocean Leader	Licence no: PL255	
Reservoir penetrated:	DFE: 23.5 m	Well type: HPHT Exploration	
Date abandoned:	Water depth: 309 m	Reservoir: Middle & Lower Jurassic	
Drilling fluid (intermediate): Glydrill WBM (MI)	KOP (AHBDF): N/A	Res. pres:	
Drilling fluid (reservoir):	Max. Dev.: N/A	Res. temp:	
Mud Weight:	Max. Dogleg:	Date logged:	
Weight Material: Barite		Drillers TD:	

Wellhead Data				Casing Scheme									
Item	Rating	Notes (S/N)	Size (in)	Wt (lbs/ft)	Grade	Couplings	AHBDF (m)	TVBDF (m)	TTOC (m)	MW@sect. TD	Annular Fluid	Frm strenght (SG)	
												tvbdf (m)	min/exp/max
Dril-Quip SS-15	15000	Vetco H-4 profile	30	310	X-52	HD-90-HT / SL-60	404.5		Seabed	1,20	Cement		
30" LP Wellhead Housing	2000		20	133	N-80	Big Omega IS	1367.8		Seabed	1,20	Cement		
Permanent Guidebase	n/a		16	84	P-110	Dino Vam MS	2205		TOL	1,69	Cement	1365	1,89
18-3/4" Wellhead	15000		14	114	VM95SS	Vam Top SC80	1049.94	(cross-over)	2550	1,82	Glydrill (1.82)		
14" Hanger	15000		13-3/8	72	P-110	Vam Top	2779.64			1,82	Glydrill (1.82)		

Hole size in	Depth m ahbdf	Depth m tvbdf	Inc. (deg.)	Downhole Schematic	Description	Formation	Top Depth tvbdf	Completion Dimensions		
								Min ID	Max OD	
	328,45	328,45	0		Corrosion Cap installed (Corrosion inhibitor below) Well circulated to seawater from 330m Top of Wellhead /Connector					
	332,5	332,5	0		Seabed	Seabed	332,5		See attached casing data	See attached casing data
36	404,5	404,5	0		30" conductor shoe. Cmt to surface, Top job	Nordland				
	408,0	408,0	0							
	1049,94	1049,94	0		14" x 13.375 cross-over					
	1288,0	1288,0	0		Top of 16" liner (79,8m liner lap), 20" adaptor housing 17,375" ID (16" Liner Landed off 1,2m high :: Landing shoulder at 1289,2m)					
26	1367,8	1367,8	0		20" casing shoe. Cmt to Surface					
	1380,0	1380,0	0							
	1850,0	1850,0	0		TTOC Suspension Plug (Pressure tested to 110Bar)					
	1950,0	1950,0	0		BOC Suspension Plug (200m HiVis mud below Plug)					
	1900,0	1900,0	0		TTOC, 16" Liner	Brygge Hordaland	1656,5			
	2205,4	2205,4	0		16" liner shoe.					
(17.5 x) 20	2218,0	2218,0	0			Tare	2263			
17.5 x (20)	2248,0	2248,0	0		Bottom of Pilot Hole					
	2550,0	2550,0	0		TTOC 13,375"	Rogaland Base Tertiary	2406			
	2779,6	2779,6	0	13.375" casing shoe (Pressure tested 175Bar)						
(14.5 x) 17.5	2788,0	2788,0	0		Shetland					
14.5 (x 17.5)	2793,0	2793,0	0	Bottom of Pilot Hole						

Coring Data			Logging Data			Directional & LWD Data		
Objectives	Interval	Recovery	Section	Service	Interval	Type	Details	Date
						Anderdrift/GR	RES/CAL Interval 408 - 1380m	
						Anderdrift/GR	RES/CAL Interval 1381 - 2248m	
						Anderdrift/GR	RES/CAL Interval 2252 - 2293m	
						Anderdrift/GR	RES/CAL Interval 2293 - 2793m	
Coring services: Corpro			Wireline services: Schlumberger			Directional and LWD services: SchlumbergerD&M		
Notes:								

Drawn by: Bjørn K. Schmidt	Checked by: Paul Richardson/Trenton Hersch	Date: 20.08.2004
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Well Status Diagram - PI255 Onyx SW (Rev 1)

20.08.2004

Start date: 28.05.2004	Well coordinates: N 7148739.65 m	Well no: 6406/9-A Onyx SW	
Spud date: 15.06.2004	E 394862.13 m	Licence no: PL255	
Reservoir penetrated:	Rig: Transocean Leader	Well type: HPHT Exploration	
Date abandoned:	DFE: 23.5 m	Reservoir: Middle & Lower Jurassic	
Drilling fluid (intermediate): Glydrill WBM (MI)	Water depth: 309 m	Res. pres:	
Drilling fluid (reservoir):	KOP (AHBDF): N/A	Res. temp:	
Mud Weight:	Max. Dev.:	Date logged:	
Weight Material: Barite	Max. Dogleg:	Drillers TD:	

Wellhead Data				Casing Scheme									
Item	Rating	Notes (S/N)	Size (in)	Wt (lbs/ft)	Grade	Couplings	AHBDF (m)	TVBDF (m)	TTOC (m)	MW@sect. TD	Annular Fluid	Frm strenght (SG)	
												tvbdf (m)	min/exp/max
Dril-Quip SS-15	15000	Vetco H-4 profile	30	310	X-52	HD-90-HT / SL-60	404.5		Seabed	1,20	Cement		
30" LP Wellhead Housing	2000		20	133	N-80	Big Omega IS	1367.8		Seabed	1,20	Cement		
Permanent Guidebase	n/a		16	84	P-110	Dino Vam MS	2205		TOL	1,69	Cement	1365	1,89
18-3/4" Wellhead	15000		14	114	VM95SS	Vam Top SC80	1049.94	(cross-over)	2550	1,82	Glydrill (1.82)		
14" Hanger	15000		13-3/8	72	P-110	Vam Top	2779.64			1,82	Glydrill (1.82)		

Hole size in	Depth m ahbdf	Depth m tvbdf	Inc. (deg.)	Downhole Schematic	Description	Formation	Top Depth tvbdf	Completion Dimensions		
								Min ID	Max OD	
	328,45	328,45	0		Corrosion Cap installed (Corrosion inhibitor below) Well circulated to seawater from 330m Top of Wellhead /Connector Seabed	Seabed Nordland	332,5	See attached casing data	See attached casing data	
	332,5	332,5	0							
36	404,5	404,5	0		30" conductor shoe. Cmt to surface, Top job					
	408,0	408,0	0							
	1049,94	1049,94	0		14" x 13.375 cross-over					
	1288,0	1288,0	0		Top of 16" liner (79,8m liner lap), 20" adaptor housing 17,375" ID					
26	1367,8	1367,8	0		20" casing shoe. Cmt to Surface					
	1380,0	1380,0	0							
	1850,0	1850,0	0		TTOC Suspension Plug (Pressure tested to 110Bar)					
	1950,0	1950,0	0		BOC Suspension Plug (200m HiVis mud below Plug)					
	1900,0	1900,0	0		TTOC, 16" Liner	Brygge Hordaland	1656,5			
	2205,4	2205,4	0		16" liner shoe.					
(17.5 x) 20	2218,0	2218,0	0			Tare	2263			
17.5 x (20)	2248,0	2248,0	0		Bottom of Pilot Hole					
	2550,0	2550,0	0		TTOC 13,375"	Rogaland Base Tertiary	2406			
	2779,6	2779,6	0							
(14.5 x) 17.5	2788,0	2788,0	0	13.375" casing shoe (Pressure tested 175Bar)						
14.5 (x 17.5)	2793,0	2793,0	0	Bottom of Pilot Hole	Shetland					

Coring Data			Logging Data			Directional & LWD Data		
Objectives	Interval	Recovery	Section	Service	Interval	Type	Details	Date
						Anderdrift/GR	Interval 408 - 1380m	
						Anderdrift/GR	Interval 1381 - 2248m	
						Anderdrift/GR	Interval 2252 - 2293m	
						Anderdrift/GR	Interval 2293 - 2793m	
Coring services: Corpro			Wireline services: Schlumberger			Directional and LWD services: SchlumbergerD&M		
Notes:								

Drawn by: Bjørn K. Schmidt	Checked by: Paul Richardson/Trenton Hersch	Date: 20.08.2004
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PL 255 Onyx SW Casing Data

Description	Size	in	Primary Pipe										Contingency Pipe			
			30in	30in	30in	20in	16in	14in	13.3/8in	10 3/4in	10.3/4in	9.875in	7in	7 5/8in	7in	4 1/2in
	Nominal Weight	ppf	310	310		133	84	114	72	101	101	66.9	35	39	38	15.1
	Grade	-	X-52	X-52	X-52	N-80	P-110	VM95SS (ex-ST95)	P-110	VM110SS	AC-110SS	VM125C Y	P-110	VM125CY	VM125CY	P 110
	Connection	-	SL-60	HD-90- HT pin x SL-60 pin	Butt weld top x HD-90- HT box	Big Omega IS	Dino Vam MS	Vam Top SC 80	VAM TOP	Vam HP SC80	NK HW-SL	Vam Top	Vam Top	Vam Top NC	Vam Top SC85	New Vam
	Type	-	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C
Physical	Wall Thickness	in	1	1	1.5	0.635	0.495	0.800	0.514	0.960	0.960	0.668	0.498	0.500	0.540	0.337
	ID Nominal	in	28	28	27	18.730	15,010	12,400	12.347	8,830	8.830	8,539	6.004	6,625	5,920	3.826
	ID Connection (If Semi-Flush)	in		26.47	26.47											
	Coupling OD	in			33,030	21,126	16,869	15,006	14.291	11,500	11,615	10,974	7,842	8,262	7,730	5,039
	Drift Diameter API	in				17.375*	14,822									3.701
	Drift Diameter Special	in				18,543		12,250	12,250	8,750	8,750	8,500	5,879	6,500	5,879	
	Make Up Loss	in	9,7		14,063	5,827	5,212	6,946	5,698	8,226	5,906	5,484	4,776	5,557	4,776	3,969
	Burst, Pipe Body	psi				4450	5960	9770	7610	17680	17680	15220	13700	14750	17360	14420
	Burst, Pipe Connection	psi				4450	5960	9770	7610	17680	17680	15220	13700	14750	17360	14420
	Collapse, Pipe Body	psi				1600	1480	7500	2880	17890	17890	12900	13030	12060	16750	14340
	Collapse, Pipe Connection	psi				1600	1480	7500	2880	10000	8500	12900	13030	6500	16750	14340
	Yield Strength, Pipe Body	kips	4738	4738		3090	2652	3150	2285	3248	3246	2415	1119	1399	1370	485
	Yield Strength, Connection	kips	2080	2080	4220	3090	2652	2512	2285	2598	2601	2415	1119	1399	1165	485
	Bending and Tensional Efficiency	%														
	Compression Efficiency (compression-int/compression-ext)	%				50/50	50/50	48/48	60/60	40/60	40/50	60/60	60/60	75/75	51/51	40/40
Make Up Torques	Minimum	ft.lb				23400	18450	27000	20850	45000	21600	20850	15050	16900	NA	6840
	Optimum	ft.lb				26000	21700	30000	23150	50000	27000	23150	16650	18800	21000	7590
	Maximum	ft.lb				28400	24950	33000	25450	55000	32400	25450	18250	20700	23050	8340
String weights (not incl. running string unless full bore)	In Air	lbs			93125	452477	244240		699101			1249623	84512			
	In Mud	lbs			84946	394548	190752		545998			959710	64065			
	Abandonment air	lbs					N/A		545342			743552	N/A			
	Abandonment seawater						N/A		473902			649146	N/A			

* NB: 20" casing has housing adaptor for 16" liner installed - min 20" housing adaptor ID =17.375in

PL 255 Onyx SW Casing Data

Description	Size	in	Primary Pipe										Contingency Pipe			
			30in	30in	30in	20in	16in	14in	13.3/8in	10 3/4in	10.3/4in	9.875in	7in	7 5/8in	7in	4 1/2in
	Nominal Weight	ppf	310	310		133	84	114	72	101	101	66.9	35	39	38	15.1
	Grade	-	X-52	X-52	X-52	N-80	P-110	VM95SS (ex-ST95)	P-110	VM110SS	AC-110SS	VM125C Y	P-110	VM125CY	VM125CY	P 110
	Connection	-	SL-60	HD-90- HT pin x SL-60 pin	Butt weld top x HD-90- HT box	Big Omega IS	Dino Vam MS	Vam Top SC 80	VAM TOP	Vam HP SC80	NK HW-SL	Vam Top	Vam Top	Vam Top NC	Vam Top SC85	New Vam
	Type	-	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C	T&C
Physical	Wall Thickness	in	1	1	1.5	0.635	0.495	0.800	0.514	0.960	0.960	0.668	0.498	0.500	0.540	0.337
	ID Nominal	in	28	28	27	18.730	15,010	12,400	12.347	8,830	8.830	8,539	6.004	6,625	5,920	3.826
	ID Connection (If Semi-Flush)	in		26.47	26.47											
	Coupling OD	in			33,030	21,126	16,869	15,006	14.291	11,500	11,615	10,974	7,842	8,262	7,730	5,039
	Drift Diameter API	in				17.375*	14,822									3.701
	Drift Diameter Special	in				18,543		12,250	12,250	8,750	8,750	8,500	5,879	6,500	5,879	
	Make Up Loss	in	9.7		14,063	5,827	5,212	6,946	5,698	8,226	5,906	5,484	4,776	5,557	4,776	3,969
	Burst, Pipe Body	psi				4450	5960	9770	7610	17680	17680	15220	13700	14750	17360	14420
	Burst, Pipe Connection	psi				4450	5960	9770	7610	17680	17680	15220	13700	14750	17360	14420
	Collapse, Pipe Body	psi				1600	1480	7500	2880	17890	17890	12900	13030	12060	16750	14340
	Collapse, Pipe Connection	psi				1600	1480	7500	2880	10000	8500	12900	13030	6500	16750	14340
	Yield Strength, Pipe Body	kips	4738	4738		3090	2652	3150	2285	3248	3246	2415	1119	1399	1370	485
	Yield Strength, Connection	kips	2080	2080	4220	3090	2652	2512	2285	2598	2601	2415	1119	1399	1165	485
	Bending and Tensional Efficiency	%														
	Compression Efficiency (compression-int/compression-ext)	%				50/50	50/50	48/48	60/60	40/60	40/50	60/60	60/60	75/75	51/51	40/40
Make Up Torques	Minimum	ft.lb				23400	18450	27000	20850	45000	21600	20850	15050	16900	NA	6840
	Optimum	ft.lb				26000	21700	30000	23150	50000	27000	23150	16650	18800	21000	7590
	Maximum	ft.lb				28400	24950	33000	25450	55000	32400	25450	18250	20700	23050	8340
String weights (not incl. running string unless full bore)	In Air	lbs			93125	452477	244240		699101			1249623	84512			
	In Mud	lbs			84946	394548	190752		545998			959710	64065			
	Abandonment air	lbs					N/A		545342			743552	N/A			
	Abandonment seawater						N/A		473902			649146	N/A			

* NB: 20" casing has housing adaptor for 16" liner installed - min 20" housing adaptor ID =17.375in

GENERAL DATA

B1.5 Well Data

Rig: Transocean Leader
Well co-ordinates : 7148739.65m North
 394862.13 m East
 UTM Zone 32

Drilling:
Operations commenced: 28th May, 2004 (Rig away from quay and on contract)
Spud date (bit on bottom): 15 June 2004
Ended (at reaching TD): 03 June, 2005 (Rig outside 500m zone)

Total rig days 371 days
 (drilling, well test & abandonment)

B1.6 Depth References

DFE to Mean Sea Level (MSL): 23.5m.
Sea depth below MSL: 309m.

B1.7 Deviation Data

Maximum inclination: 7.05 deg at 5034.08m AHBDF.
Maximum dogleg: 0.78°/30m at 4854.2m AHBDF.
 See Appendix Borehole Survey Summary Report and Survey Listing for more details.

B1.8 Casing Data

Table of Pre Abandonment Casing Status

Size (inches)	Weight (lbs/ft)	Grade	Liner Hanger / X-Over Depth (if applicable) (mAHBDF)	Casing/liner shoe depth (mAHBDF)
30"	310	X-52		404.5
20"	133	N-80		1367.8
16" Liner	84	P-110	1288	2205
14"	114	VM-95SS	1049.9	
13.3/8"	72	N-80		2779.6
10-3/4"	101	AC-110SS	2582.9	
9.7/8"	53.5	P-110		4291
7"			4183	5081

Table of Post Abandonment Casing Status

Size (inches)	Weight (lbs/ft)	Grade	Liner Hanger / X-Over Depth (if applicable) (mAHBDF)	Casing/liner shoe depth (mAHBDF)
30"	310	X-52		404.5
20"	133	N-80		1367.8
16" Liner	84	P-110	1288	2205
13.3/8"	72	N-80		1338 - 2779.6 (cut)
9.7/8"	53.5	P-110		2827 – 4291 (cut)
7"			4183	5081

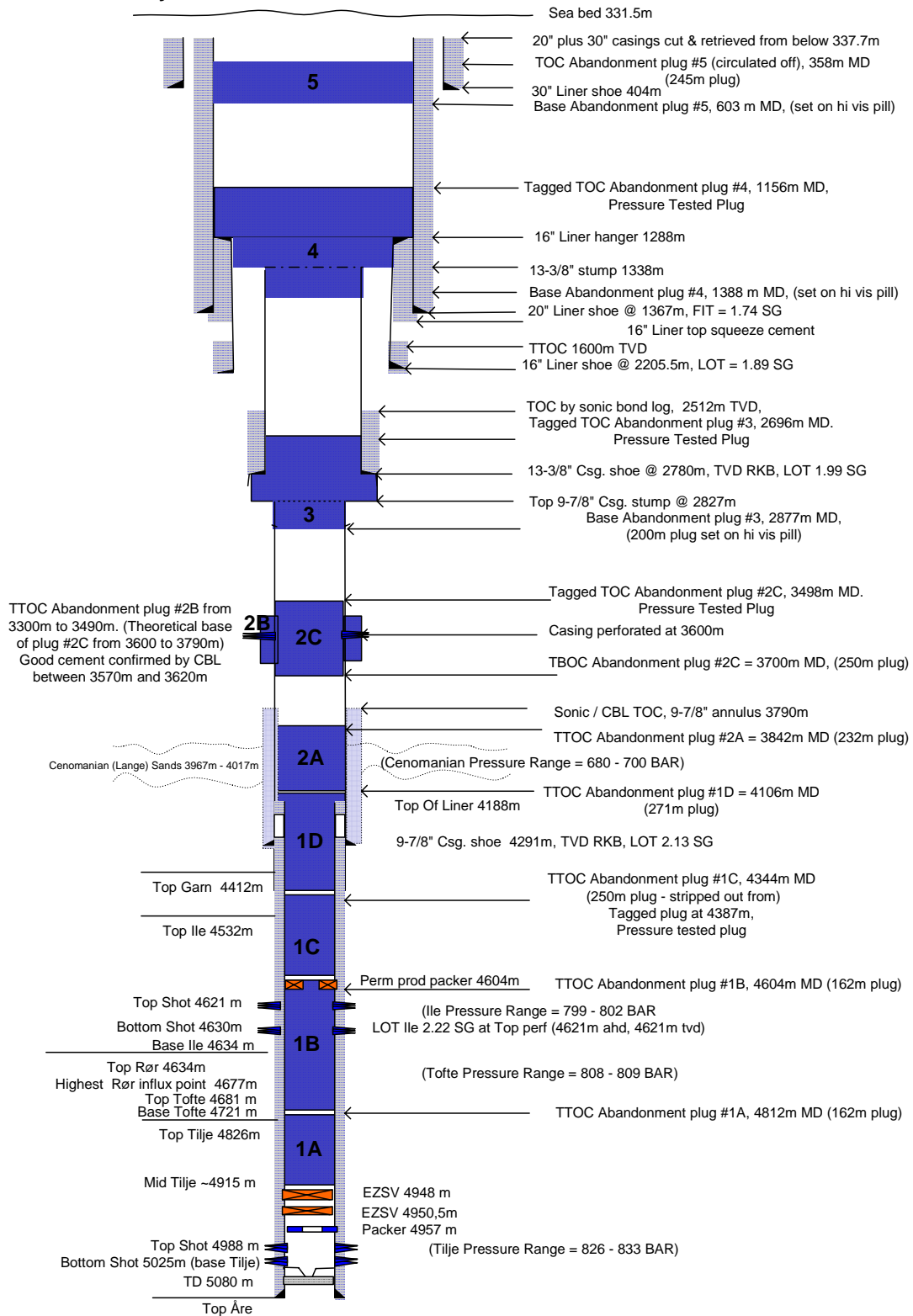
B1.9 Abandonment Data

Table of Post Abandonment Isolation Details

Formation(s)	Barrier Post Abandonment	
	Internal	Annulus
Lower Tilje.	2 bridge plugs (top plug pressure tested) and continuous column of cement from tested base to > 50m above Top Of Liner (TOL), 3rd plug set (#1C) tagged with 5 tons and pressure tested to 192 Bar at surface with 1.95SG mud in hole.	Primary Barrier: Liner cement, confirmed with CBL. Secondary Barrier: 9-7/8" casing shoe annulus cementation with 2.13SG FIT on shoe confirmed with sonic log and CBL.
Mid Tilje, Upper Tilje, Rør, Ile, Garn.	Continuous column of cement set from pressure tested EZSV to > 50m above TOL. Plug #1C tagged and pressure tested (third cement plug set, tagged with 5 tons and pressure tested to 192Bar at surface with 1.95SG mud in hole. Following the successful test on #1C there was no requirement to test plug #1D or #2A as they were set on a tested base inside a tested conduit.	Primary Barrier: Liner cement, confirmed with CBL. Secondary Barrier: 9-7/8" casing shoe annulus cementation with 2.13SG FIT on shoe confirmed with sonic log and CBL.
Cenomanian Lange Reservoir.	Primary Barrier: Cement from top of liner to > 50m above top of Cenomanian Reservoir, tagged and pressure tested. Secondary Barrier: 202m cement plug tagged with 5 tons and pressure tested to 99Bar at surface with 1.88SG mud in hole (plug set across 50m verified cement).	Primary Barrier: 9-7/8" casing shoe cementation with 2.13SG fit on shoe confirmed with Sonic log and CBL.
Formations in hole section below 13-3/8" casing shoe.	"T" plug set across shoe (50m inside 9-7/8" stump, 47m inside open hole below shoe and 84m inside 20" casing shoe). Plug tagged with 5 Tons and pressure tested to 99 Bar at surface with 1.88 SG mud in hole.	Primary Casing shoe annulus with 1.99SG EMG FIT on shoe.
Formations in hole section below 20" casing shoe & 16" liner shoe	"T" plug set across liner top (50m inside 13-3/8" stump, 50m inside 16" liner, 56m inside 20" casing), plug tagged with 5 Tons and pressure tested to 84 Bar at surface with 1.82sg mud in hole.	Primary 20" casing shoe annulus cementation with 1.74SG FIT at shoe.
Surface formations	251m cement plug set from 603m with top circulated off.	Primary 20" casing shoe annulus cementation with 1.74SG FIT at shoe.

Abandoned Well Schematic

Onyx SW Well Abandoned Status Post 2 Well Tests



B1.10 Cementation Data Summary

Primary	
Casing size:	30" Conductor
Type and density:	Class G + calcium chloride + NF-6 + SW, 1.95 SG
Top of cement:	Sea Bed
Casing size:	20" Surface
Type and density:	
Lead:	Class G + Econolite + HR-4L + NF-6 + SW, 1.56 SG
Tail:	Class G + FW, 1.92 SG
Top of cement:	Sea Bed
Liner size:	16" Drilling Liner
Type and density:	
Primary & Liner Top Squeeze:	Class G + CFR-5LE+ Halad-613L + NF-6 + FW, 1.92SG
Top of cement:	1907m AHBDF Primary Job
	Top of liner for liner top squeeze
Casing size:	14" x 13.3/8" Intermediate Casing
Type and density:	Class G + HR-4L + Halad-613L + NF-6 + FW, 1.95 SG
Top of cement:	2580m AHBDF (TOC determined by volume)
Casing size:	10.3/4" x 9.7/8" Production Casing
Type and density:	Class G + SSA-1 + Microsilica + CFR-3L + SCR-500L + Halad-413L + NF-6 + FW, 1.96 SG
Top of cement:	3590m AHBDF (Log interpretation)
Liner Size:	7" Production Liner
Type and density:	Class G +SSA-1 + Micromax + SA-541 + Microsilica + CFR-3L + SCR-500L + Halad-413L + NF-6 + FW, 2,05 SG
Top of Cement:	Top of liner at 4183m, confirmed and drilled down to TOL.
Abandonment	
	For identification of plugs please refer to Abandonment Schematic in section B1.5 above.
Plug:	1A, 1B, 1C and 1D
Type and density:	Class G +SSA-1 + Micromax + Microsilica + CFR-3L + SCR-500L + Halad-413L + NF-6 + FW, 2,05 SG
Top of Cement:	4106m AHBDF.
Plug:	2A, 2B (squeeze) and 2C
Type and density:	Class G +SSA-1 + Microsilica + CFR-3L + SCR-500L + Halad-413L + NF-6 + FW, 1,96 SG
Top of Cement:	3498m AHBDF, confirmed with tag of plug 2C.
Plug:	3
Type and density:	Class G +SSA-1 + CFR-3L + HR-5L + Halad-99LE+ + NF-6 + FW, 1,95 SG
Top of Cement:	2696m AHBDF, confirmed with tag.
Plug:	4
Type and density:	Class G + HR-5L + Halad-99LE + NF-6 + FW, 1,95 SG
Top of Cement:	1156m AHBDF, confirmed with tag.
Plug:	5
Type and density:	Slurry 1: Class G +SSA-1 + FW, 1,92 SG Slurry 2: Class G + FW, 1,92 SG
Top of Cement:	358 AHBDF.

B1.11 Mud Summary

36" conductor hole	Sea water/Bentonite sweeps as required 1.20 SG Hi-Vis mud left in hole for casing run
26" conductor hole	Sea water/Bentonite sweeps as required 1.30 SG Hi-Vis mud left in hole for casing run
20" intermediate hole	Glydril Waterbased Mud (1.55- 1.70 SG)
17-1/2" intermediate hole	Glydril Waterbased Mud (1.78- 1.82 SG)
12 1/4" intermediate hole	Paratherm Oilbased Mud (1.75 - 1.88 SG)
8 1/2" intermediate hole	Paratherm Oilbased Mud (1.89 - 1.95 SG)
Completion / P & A	SW / Paratherm / Glydril (1.03 – 1.89 SG)

The well was displaced to WBM before the 13 3/8" csg was cut and pulled.
See the Mud summary Report in section B.8.7 for more information.

B1.12 Contractor Data

Drilling contractor:	Transocean
Casing running:	Weatherford
Wellhead:	Dril-Quip
Wireline contractor:	Schlumberger / Baker Atlas (RCI)
Conductors:	Dril-Quip
Geology:	Cambrian
Turbines (not utilized):	Neyfor
Plug and Abandonment	Red Baron
ROV Services	Oceaneering
H ₂ S Services	Vesteknikk
Well Cleanout	SPS AFOS

Services	
Cement contractor:	Halliburton
MWD/LWD contractor:	Schlumberger
Mud chemical contractor:	MIDF
Mud logging contractor:	Geoservices
Fishing	Red Baron
Drilling Bits	Smith / Security DBS
Coring	Corpro
Testing	Halliburton

Rig Move & Anchor Handling Review Report

Onyx SW Exploration - Transocean Leader

Well 6406/9-1

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1.0 Executive Summary

1.1 Brief Outline of the Objective

The objectives were:

- i) To achieve a fast and smooth rig move to location
- ii) To achieve a safe and efficient anchor handling operation

Accomplishments:

- i) Due to one of the main engines being out of service, the rig move was estimated to take an additional 4 hrs. No incidents whilst on the move.
- ii) Anchor handling operations took 14 hrs, compared to an optimum 10 hrs, due to the malfunctioning of the #1 anchor winch counter and the #3 anchor winch hydraulic leak. Additionally, the #3 and #4 anchors motor failed during pre-tensioning, delaying the operation by 34.5 hrs

1.2 Time Breakdown

Operation	Target Time (days)	Budget Time (days)	Actual Time (days)	Productive Time (%)	Lost Time (%)	Down Time (%)
Rig move	2.00	2.85	2.39	93		7
Pre-spud & Anchor handling	1.3	1.54	2.88	43.5		56.5

1.3 Summary of Incidents, Down Time, Lost Time, and Associated Causes

1.3.1 Incidents

No reportable incidents.

1.3.2 Down Time (NPT)

Down Time Incident and Cause	Down Time (hrs)
Unable to pass pennant chain #1 to Olympic Hercules. Counter chain was not working, unable to repair	2.50
Stopped running anchor #3, stopped due to burst hydraulic hose	1.25
Stopped pre tensioning, due to due to motor failure on winch #4. Prepared for and repaired anchor winch #4	34.50
Eagle Lite malfunction	0.75

Total down time (NPT) for the section was 39hrs.

1.3.3 Lost Time (WOW, etc)

No reportable lost time.

1.3.4 Commissioning Time

Cause of Delay	Time (hrs)
Acceptance of completion test programme	126

1.4 Chemical Discharge

1.4.1 Mud

No accidental discharges of mud during the loading of mud onto the rig.

1.4.2 Cement

No cement on board the rig during the rig move and anchor handling.

1.4.3 Rig Chemicals

No incidents or spills during the rig move and anchor handling.

2.0 Highlights, Lowlights & Lessons Learned

2.1 Highlights

The rig was moved from the Klosterfjord to location at Onyx SW without incidents or accidents, at an average speed of 5.5 knots.

2.2 Lowlights

The repair of one of the main engines left only 3 engines working, causing a delay of approximately 4 hrs on the arrival time of the rig onto location.

Could not run anchor #1 as the chain counter was malfunctioning. Additionally, whilst running anchor #3, a hydraulic hose on the winch burst. This caused a delay of 4 hrs in the operation.

Whilst pre-tensioning, the #3 and #4 anchor motor failed. The decision was made to order a new motor from Kristiansund, and in the meantime, ballast down to survival draft in order to work the boats for bulk transfer. This caused a delay of 34.5 hrs.

The Eagle Lite malfunction caused a 0.75 hr downtime and further decrease in productivity levels when picking up the 5" V150 drill pipe.

See separate rig move report for details.

2.3 Lessons Learned

Refer to Lessons Learned database.

Section Review Report

Onyx SW Exploration - Transocean Leader

Well 6406/9-1

Drilling 12 ¼ " Hole

Logging 12 ¼" Hole

Running & Cementing 9 7/8" x 10 ¾" Casing

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1.0 Executive Summary

1.1 Brief Outline of the Objective

The section objectives were:

- a. No harm to people or the environment
- b. FIT limit test to 2.00 s.g.
- c. Drill the 12 ¼" section to TD and install the 9 7/8" x 10 ¾" casing in the competent Melke formation.
- d. Drill the section in maximum 2 runs. 1 x combined packed clean-up/drilling rotary assembly, 1 x dedicated drilling assembly (packed assembly, or alternatively a rotary steerable assembly). Select the proper bits, BHA and utilise drilling practices to minimise the risk of additional tripping.
- e. Efficiently initiate HPHT procedures in final phase of the OH section.
- f. Install and cement casing with full bore running string to provide adequate shoe strength for drilling the next high pressure section.

Accomplishments:

- a. No. Starting up after the 3month industrial conflict proved very challenging early on we experienced 1 NM and 2 FACs. Extra measures where taken and continuously improvement was seen during the section.
- b. Limit test to 1.99 s.g.
- c. Section TD 4,306m based on top Melke at 4,266m.
- d. As per plan.
- e. HPHT procedures initiated as per plan
- f. Installed and cemented casing. Shoe strength 2.13 sg

1.2 Time Breakdown

Operation	Target Time (days)	Budget Time (days)	Actual Time (days)	Productive Time (%)	Lost Time (%)	Down Time (%)
Re-entry	6.08	N/A	9.90	63.9	36.1	0.0
Drill 12¼" hole	7.33	12.83	16.31	55.6	41.2	3.2
Log 12 ¼" hole	0.92	1.31	1.21	96.6	0.0	3.4
Case & cement 12 ¼" hole	3.79	5.41	8.25	86.0	6.6	7.4

1.3 Summary of Incidents, Down Time, Lost Time, and Associated Causes

TO RUHs: 7641, 7650, 7644, 7648, 7670, 7686, 7669, 7671, 7674

NM: 1

FAC: 2

1.3.1 Incidents

7641: Riser Nut retainer swedge fell down to Drill Floor (NM)

Description:

The rig was running riser from the aft receiver. The 60 ft joint was being raised from horizontal to vertical, in preparation to make it up to the riser joint secured in the rotary table riser spider. The riser lifting nubbin hanging in the elevator was made up to the riser joint and the riser joint was lifted approximately 15m from the rig floor and at a 60 deg. angle. At this point, one of the riser nut retainer swedges (6.45kg) fell from the retaining pocket and landed approximately 1.5m from the rotary table.

Possible Consequences, reasons and actions:

NM. The weight of the nut and the height of fall was sufficient to have fatal consequences if anyone had been standing in its path. The retainer mechanism on all casing joints had been checked prior to lifting and was found to be ok. After the incident the remaining riser joint on deck was re-inspected finding several of the retaining mechanisms in an unsatisfactory state. By design the nut is held in its recess by a locking ring. Two plastic dowell pins secure this locking ring. The dowell had sheared on several of the joints including on the riser joint involved. An onshore investigation team travelled to the rig to find the root cause of the incident. Authorities (PSAN) informed.

7650: Shattered window in Drillers House

Description:

During BHA handling the protectors were stored next to the drillers cabin. As a member of the crew was removing the connector it was thrown towards the storage place. The protector accidentally hit the corner of the window of the drillers cabin. As a result the window shattered.

Possible Consequences, reasons and actions:

The force of the impact should not have been sufficient to break the window, and it is believed that it was weakened before of the incident. The window was not laminated causing it to disintegrate. The window was replaced with a certified safety glass type

7644: Riser string dropped down to Riser Spider Dogs

Description:

Main operation was deploying the BOP on Cameron RF marine riser. The BOP was at 289m depth as a five ft. riser pup joint was made up to the string. The hydraulic running tool was then made up to the five ft. pup joint. The test lift was performed and 253 tons held for one minute. The Driller then proceeded to open the riser spider prior to lowering the string. The riser Spider did not function and the running tool released from the pup joint allowing the string to drop down one inch onto the riser spider dogs.

Possible Consequences, reasons and actions:

The incident occurred over a shift change. By design the same hydraulic hoses are used to both operate the riser spider and riser running tool (to avoid them being operated at the same time) The shift going off had left the hydraulic hoses on the running tool (not as per procedure), and this was not communicated to the oncoming shift. The new driller on shift believed he was opening the spider. With the hydraulic hoses hooked up to the running tool this released instead, causing the riser to drop into the riser spider dogs. Stress analysis and MPI was conducted without revealing any damage to equipment.

7648: Finger injury on cellar deck (FAC). (Finger caught between riser joint)

Description:

When securing Mux Cables to the slip joint, a person put his left hand onto the hand rail on the working platform. Due to vessel movement the slip joint moved trapping his hand against the handrail and bruised left hand index finger.

Possible Consequences, reasons and actions:

Made safe, and stopped operations for an extraordinary meeting in the cinema. Discussed use of safety tools and held a discussion regarding the current incident rate, possible causes, and what was required to reverse the trend.

7660: Person crossing barriers with out permission

Description:

During lifting operations from the boat to the rig, an area on port box girder was barriered off. A person attempted to cross the barrier tape. He was told to go outside the barrier. After 5 minutes he showed up again and was for second time told to remain outside of the barriered off area.

Possible Consequences, reasons and actions:

The person attempted to cross a barrier 2 times in 5 minutes. Both times he told to stay out of the area. Informed all on dept. safety meetings and weekly safety meeting, the need to follow and respect the safety rules we have.

7668: Door on stb. crane fell off

Description:

During maintenance, the crane operator would clean the windows outside the crane operators cabin. He opened the door from the cabin to the platform around the cabin. The door was hard to open, and suddenly the door fell off. The door could have fallen into the sea.

Possible Consequences, reasons and actions:

Welder to weld on new hinges.

7669: Leftovers from coveralls in laundry

Description:

People do not empty their pockets on coveralls before they deliver it to the laundry. Tools, bolts, etc. is a big potential to cause damage to washing machines and tumble dryers if these enter into the machines. This must be brought up on safety meetings. Has been brought up before, but it seems that people have to be told this all the time. Change of attitude.

Possible Consequences, reasons and actions:

Make a poster to place above the tray for dirty coveralls that reminds people to empty their pockets before dropping the coveralls in the laundry. Inform all at safety meeting, general and departmental.

7671 : Use of jewellery on the rig

Description:

There is still some people that use jewellery onboard, especially wrist watches with metal straps. Transocean will provide the rig crew with watches that comply with with to our regulations.

Possible Consequences, reasons and actions:

Inform all at safety meetings about the rules we have for use of jewellery

7674: Squeezed finger during closing door (FAC).

Description:

Person was walking from compressor room towards sack store. Due to overpressure in compressor room, the person would close the door more gently, rather than letting it slam shut. He was holding on to the edge of the door, and squeezed left ring finger, as the door was closing. Person was holding his hand in the wrong place when closing the door. He was not using gloves, but this would possibly not make any difference in this situation.

Possible Consequences, reasons and actions:

Inform at safety meetings the need to keep body and hands away from doors when closing them.

7685: Possible leaking shearing device.

Description:

In handover from day shift, night shift was made aware of a possible leaking device, close to pit #2. One alternative would be a 13" butterfly valve, seated in the mud pump suction line. The valve isolates between mud pumping to string and shearing of pre-mix. No leak was observed during 20 minutes of shearing mud alone, indicating that the valve might be in order. When mud pump #3 was started to fill the drill string, a gain was noticed in pre-mix pit #2 (shear gun). Shearing was stopped, and the line-up was re-checked. Shearing was not re-started. The drill string was filled and pumps were stopped after setting tools/conditioning mud in the hole, without any valve being pin-pointed as leaking. The Transocean tour pusher decided to pressure test the 13" butterfly valve with a centrifugal pump. Geoservices mud loggers and Transocean driller were informed about the event taking place. The test was lined up from pit #2 to pressurise the main rig suction manifold against the 13" butterfly valve and suction valve pits #5, 6 and 7. Behind the isolation valve, suction valve from pit #3 was opened to verify a leak as quick as possible. The centrifugal pump was started and stopped several times during a period of 14 minutes, making adjustments to assure the test was as relevant as possible.

Results: There was no increase in pit #3 level.

Transocean personnel did not realise that a large amount of mud was going into pits #5, 6 and 7. The test was stopped due to warnings from Geoservices mud logger and no evidence of leaking valve. Later the same morning the MI mud engineer made the Transocean tour pusher aware of the amount of mud that was transferred to pits #5 and 6.

Possible Consequences, reasons and actions:

Memo to be issued to derrickmen informing them that no pressure testing is to take place against valves in mud pump room.

Loggers to be informed to ensure tight controls on pit levels to ensure leaks are identified earlier.

Changed out leaking valve #34 in mud pump room.

7689: Overflow of barite in the Hetland House.

Description:

Derrick man lined up to transfer barite into forward barite deck tank #8. On commencement of the transfer, barite was seen to be flowing out of aft barite deck tank #7 and into the Hetland mix house, despite the fact all valves to this tank were closed. Approximately 9 MT of barite was delivered onto the deck within the Hetland mix house. The transfer was shut down immediately, and the line up of the valve checked. All valves were found to be lined up correctly. After time was spent troubleshooting how barite had been released from deck tank #7, it was concluded that air had passed through the vent line from tank #8 to tank #7. It was also concluded that the vent line from the deck tanks to overboard was blocked. The isolation valve on deck tank #7 is not designed to hold more than 3 bar of pressure, and when this tank was charged above this pressure level, due to the blocked vent line, this was enough to discharge the barite through the valve.

Possible Consequences, reasons and actions:

Defective equipment. Lack of supervision/planning/guidance. Procedures not followed.

Unblocked the vent line, investigated deck isolating valve to determine if it was washed out or damaged.

Inform at drilling departmental safety meetings.

Ensure that the derrick man checks that the vent line is unblocked prior to transferring any bulk to the deck tanks.

Ensure that the vent line is blown clear after transferring any bulk to the deck tanks, and a pressure relief valve to vent hose to atmosphere to prevent it become pressurised.

7701: Incident with pressure discharge from Swaco

Description:

Incident with pressure discharge from Swaco during the night, whilst fluffing up tanks the system also pressurises the boat transfer line. The blanking cap/spill cap was not installed. Swaco never checked the line prior to pressuring up the tanks and a small amount of very dry cuttings was discharged.

Possible Consequences, reasons and actions:

The blanking cap/spill cap was not on. Swaco never checked the line.

Inadequate communication/warning system. Safety devices made inoperable. Lack of skill.

Inadequate control. Requirements/guidelines not followed.

Recommendation is to fit an isolating valve at the end of the discharge pipe next to their ISO tanks, to prevent them getting pressure into the transfer hose to the boat when fluffing the tanks.

1.3.2 Down Time (NPT)

Down Time Incident and Cause	Down Time (hrs)
Malfunction of base oil pump from leg tanks	1
Condition OBM	6
Hydraulic elevator malfunctioning	0.25
Failed air jet fittings on cuttings scroll trough	0.5
Loss of SPP	0.75

POOH to shoe for TDS maintenance	4.25
Pumped LCM to cure seepage losses	7.0
Incorrect tool zero	0.5
Bad spooling on WL drum	0.25
WL log parameter not activated	0.25
Hydraulic fault on PS30 slips. Changed out to Weatherford FMS	2.5
Malfunctioning casing tong	1.5
Malfunctioning casing tong	1.0
Malfunctioning casing tong	0.5
Hydraulic power lost to casing tong	4.0
Malfunctioning casing tong	0.5
Malfunctioning casing slips (PS-30)	2.0
Malfunctioning tong power scope	0.75
Break down of iron roughneck	1.0
Break down of hydraulic hose to DP elevator	0.5

Total down time (NPT) for the section was 35hrs

1.3.3 Lost Time (WOW, etc)

Lost Time Incident and Cause *sub events while still on suspension program end 21:30 06/11/2004 i.e. main NPT is Lost Time	Lost Time (hrs)
Dropped object: Riser connection nut fell to drillfloor*	2.25
Dropped riser*	7
FAC: Abrassed finger*	1.5
Leaking flow line seals on diverter*	3.25
Waiting on crane working pool boat*	1
Med-evac SAR helicopter (not work related)*	1
Broken hydraulic hose on upper racking arm*	0.5
WOW to work boat with OBM	13.5
Additional work scope due to suspension activities	15.75
Wait on weather	145.5
Wait on Eagle Lite gripper head	11.25
Waiting for crew change helicopter	0.5
Waiting for crew change helicopter	0.5
Waiting for crew change helicopter	0.5

Total lost time (NPT) for the section was 215.25hrs

1.4 Chemical Discharge

1.4.1 Mud

No discharges of OBM to sea.

Usage of the majority of the OBM chemicals was higher than planned due to the fact that the initial mud sent out to the rig was out of spec, and also due to the losses experienced during the section.

Chemical	Predicted usage (kg)	Actual usage (kg)	Exceed
Barite	383,000	758,067	97.9%
Bentone 42	5,109	567	N/A
Calcium chloride	2,660	11,176	320.2%
Ecotrol	10,698	0	N/A
EMI 595	17,508	14,279	N/A
EMI 603	3,990	9,419	136.1%
Lime	19,690	15,729	N/A
EMI 157	3,746	5,219	39.3%
Sipdrill 2.0	190,000	240,042	26.3%
VG Supreme	5,534	6,429	16.2%
Contingency chemicals			
MIX II Fine		580	
Mica Medium		426	
G-Seal Fine		709	
Calcium Carbonate F/M/C		681	

1.4.2 Cement

No discharges of cement and/or cement additives into the sea this section. Due to loss zones encountered the height of the cement column was more than doubled than original planned. The usage of

1.4.3 Rig Chemicals

Apart from BOP fluid and rig wash there was no discharge to sea during this section. Due to make up problems running the pre-doped casing string, API modified was required for successful make up. This dope was not included on the usage/discharge permit and was classed as a contingency chemical. Since in a OBM system no discharge resulted from its use.

2.0 Drilling Performance

2.1 Operational summary

During the strike a large amount of safety & operational critical maintenance had been carried out. One of the major lots of work being the upgrade of the Hetland House mixing system and the installation of a high rate mixer. This work extended into the start-up phase, with the upgrade of the automatic mixing PLC, installation of new mix pumps and installation of the high rate mixer still ongoing whilst preparing to run the BOP and drill out.

During the start-up phase all crews participated in a rig induction meeting, with most crews also taking part in a Shell start-up meeting.

The up-man phase was hampered by poor weather, giving an opportunity to use the time to complete BOP preparations and continue the work on the barite addition system, however, due to logistical reasons, essential equipment required for the installation of both the high rate mixer and the mix pumps did not arrive with the intended boat, hence delaying this work. Meanwhile, the rig inspected tubulars, picked up new 5" DP and 8" DCs and prepared to run the BOP. 8" DCs and 3 stands 5 7/8" HWDP were laid down for shipment to town and NS-2 inspection (Left sufficient 8" DC & 5 7/8" HWDP for fishing operations). The 5 7/8" DP threads were found to be in very good condition considering the time spent idle in the derrick. The bottom pin connections of each stand showed slight surface corrosion but could be relatively easily cleaned up. No joints were required to be laid out. A tubular inspector was on board during this period.

Whilst completing the BOP pressure & function tests, the ST lock bearing of the middle pipe rams was found completely fragmented, requiring this to be changed out. No spare bearings were on board, and the pool boat due to arrive that morning was diverted to the West Alpha on the Kristin field, which had a set of spares. The BOP function tests & acoustic shear ram test was completed without further issue. A total of 12.25 hrs was spent waiting on the BOP parts to arrive, and the consequential installation and function testing of the rams.

After 45.5 hours waiting on weather, the rig prepared to run the BOPs both on the drill floor and in the moonpool. With the riser double made up in the rotary (weather still too rough for skidding the BOP) it was discovered that the bearing previously obtained from the West Alpha was of an obsolete type and had to be changed out. All BOP operations were therefore suspended whilst waiting for a helicopter from Kristiansund to bring out a number of these bearings previously sourced from Aberdeen. This caused a waiting time of 4.75 hrs before BOP operations were again commenced.

Running of the riser was hampered by several hydraulic & mechanical problems. Although the riser spider had been overhauled, two of the dogs on the spider did not retract when releasing the lock. This was most likely due to the hydraulic pistons passing hydraulic fluid. Additionally, the "gripper" on the lower racking arm experienced a (hydraulic) malfunction, whereby a slight oil leak caused an inconvenience whilst running. It had no safety impact, however. Finally, the catwalk trolley did not retract when brought in all the way onto the drill floor, requiring it to be manually pushed out. When picking up a riser joint from vertical to horizontal a near miss incident occurred. One of the riser connector nuts weighing 6.45kg fell out of its recess at a height of approximately 15m down onto the drill floor. Luckily no personnel were injured, but the potentially outcome of the incident could have been fatal. The job was suspended and an investigation was carried out. A conference call was held, including the ECT representative on the way forward. As per procedures the PSAN (authorities) were informed about the incident. By design the nut is held in place with a lock ring secured by 2 Dowel pins. The lock ring was found on the left side of the aft catwalk trolley and the Dowel pins were sheared. On inspections of the remaining riser joints on deck, several Dowel pins were also found sheared. Subsequently all locking pins and Dowel pins were changed out. As a temporary mitigation measure it was decided to secure the individual nuts on the riser connections with a fibre rope. Prior to starting up the job again an information/safety meeting was held with the crew (time from start of incident to resumption of work was 2.25hrs). The work with running the riser resumed. When

installing the 5ft riser pup joint another incident occurred. In conjunction with a shift change the riser was dropped approximately 1inch. Several reasons allowed this to happen. The hydraulic hoses were left on the running tool by the off going shift (not as per procedure), and this was not communicated to the coming crew. The new driller on shift performed the pull test prior to lowering the riser. The riser was lifted out of the spider dogs. After the pull test the driller thought he was operating the spider to lower the string. As the hoses were still attached to the running tool, the running tool was subsequently released instead. This caused the riser to drop into the spider dogs. A TOFS was taken to investigate and inspect all associated equipment for damage. 7hrs down time was experienced before operations could resume. No damage to equipment was observed. Running riser was continued, 4.25hrs lost time were incurred to waiting on weather prior to picking up the slip joint. When the slip joint had been installed a crew member had a first aid case as his index finger was caught between the riser and the hand rail. He only experienced some bruises and abrasions. In light of this event and the number of previous events the rig took a time out for safety with all the crews on shift, trying to come to the root cause of these series of events taking place over such a short period of time. Operations were started up again by picking up the landing joint and the MUX lines, saddles, and hot line installed to the slip joint. The BOP was landed and confirmed with a 50T over pull. A good test on the wellhead connector to 34bar was performed. When activating the flow line seal on the diverter, fluid was observed passing. A burst hydraulic hose was found. 3.25hrs total was spent before the operations again restarted. The riser running equipment was rigged down, and BOP test tool made up and landed off in the wellhead. A successful BOP connector test performed. The BOP test tool was pulled and layed out. The HPHT drilling stand and kick single was picked up and made up on the drillfloor, and pressure tested to 34bar/827bar. Work commenced with making up a 12 1/4" packed rotary assy w/GR/D&I/Resistivity. The MWD was tested prior to making up the HDIS (Hydril Drop in Sub) between the 5 7/8" HWDP and 5 7/8" DP. The BHA was run in hole filling string every 500m to 1750m before circulation was initiated to wash down with 3000lpm to the suspension plug (theoretical at 1850m). TOC was tagged at 1845m. Choke drills were then carried out before starting to drill the suspension plug. The cement plug was drilled at approximately 25m/hr. Simultaneously the barite mixing capacity was tested. The upgraded Hetland house proved a mixing rate of 45mT/hr while the newly installed high rate mixer on pit 2 gave 50mT/hr. After drilling out the suspension plug the string was run in hole at restricted speed on 5 7/8" DP in case there should be some remaining cement in the well. When servicing the TDS a broken hydraulic hose was found on the upper racking arm. The hose was changed out causing 0.5hrs NPT. Handling gear was changed out and operations resumed by running in hole on 5" DP with restricted speed to 2619m. Pumps were switched on and the bit washed down to TOC at 2700m The well was circulated bottoms up and the mud found to be in good condition. A good pressure test of the casing was performed to 175bar on 1.75 sg mud. Choke drills were executed with the new crew on shift. Drilling of the shoe track went smoothly (Sharkbite installed) and float collar was observed at 2724m as per tally. At 2775m (4.6m above shoe) the cement was weight tested to 15mT. The well was circulated bottoms up 1.5 times whilst reciprocating and rotating the pipe. Preparations to displace the well to OBM were carried out (detailed OBM checklists), and pits cleaned. The remaining surface volume of WBM was dumped at the shakers. 13.5hrs WOW was experienced due to rough seas not permitting transfer of OBM from the supply vessel to the rig. As the OBM (being 1.75 s.g.) could not be stored in the column tanks (maximum weight 1.5 s.g.) a boat was required to displace the well to OBM. OBM was taken onboard discovering that the chloride levels did not meet minimum spec and the mud needed treatment prior to use. Some 6hrs NPT was spent to raise the calcium chloride concentration to an acceptable level. In addition the base oil transfer pump from the leg tanks malfunctioned and caused a 1hr delay. A stripping drill was carried out with OBM on 5" DP. The tool joints moved quite easily through the upper annular stripping in (20mT, 700psi on annular). An attempt was made to strip out of the hole. This proved very difficult with over pull of 40mT and is not recommended.

The remaining shoe track and 5m of new formation was drilled out and FIT test conducted with 1.75 sg OBM to EMW 1.99 (2780mrkb). Drilling of the 12 1/4" hole commenced with a packed rotary assy made up with a tri cone insert bit. The TCI bit was chosen for the need to drill the suspension plug as well as concern for bit balling in the rat hole which had been open to WBM

for 3 months. Prior to the suspension program the base line plan was to use a PDC bit to aim for a one run hole section. No indications of bit or BHA balling was seen when cleaning the rat hole. Initially the rotation speed was kept at around 120rpm giving 12m/hr. After some 100m the rpm was increased to 180rpm giving good response on ROP increasing it to 15-20m/hr. The BHA showed a slight building tendency and decision was made to reduce WOB from around 20-25mT to 15mT reducing the build tendency to acceptable levels, but compromising the ROP to 5-10m/hr. Simultaneously cuttings transfer from the ISO system onboard to the supply vessel was initiated. The transfer hose from the rig to the vessel clogged up and was disconnected from the vessel to remove the cuttings plug and reconnected. A total of 20mT cuttings had been transferred at approximately 1mT/hr. Due to rough weather, and weather forecast, the supply vessel returned to shore for supplies and offloading of the cuttings. The 12 ¼" hole was deepened to 3252m when decision to pull out of hole for a BHA change and WOW as 10m significant and 18m max waves were forecasted. The new rotary steerable BHA was made up and racked back in the derrick. When WOW to run back in hole with the new BHA, 15stds of 5" DP was picked up from pipe deck and made up. After an additional 19hrs WOW, weather was starting to come back down and it was considered safe to start running in hole to resume drilling. Drilling commenced from 3252m to 3543m. With the rotary steerable assembly in the hole, the inclination was dropped from 3.37deg back to vertical. The PDC proved good ROPs between 20-30m/hr. Reconfirming this section is best drilled with a PDC bit.

Since weather did not permit offloading of cuttings to the supply vessel, drilling was stopped and the BHA pulled to surface. The filled ISO tanks would need to be emptied, or replaced by cutting skips, prior to commence of work. Due to problems getting the ISO tank system to work, conventional skips were mobilised to Kristiansund. With the BHA at surface and no window to operate vessels for the few next days a BOP test was carried out to minimise downtime, as this was due the near future.

Following the BOP test the BHA (#11) was run to the shoe & circulation established to check the condition of the mud in the hole. During this period of circulation approximately 15 m³ OBM was transferred inadvertently between pits, causing minor deterioration of the mud properties. An RUH has been raised on this incident (see section 1.3.1). To minimise damage to casing, as well as minimising PowerDrive circulating hours, the PowerDrive was cycled to neutral position, i.e. not in rotating mode. A circulation test was conducted in another attempt to calibrate the Coriolis meter, the results were still unsatisfactory, and it was decided to rig down the sensors to investigate further.

At this point the weather conditions were again favourable for boat movements, and a number of cuttings skips were taken on board, enabling movement of cuttings from the ISO tanks to the skips. The boat was also able to transfer, hence barite, in preparation for weighing up the mud, was taken onboard, as well as other bulk. Following completion of barite bulking the cuttings hose was again hooked up and the cuttings movement tested from the ISO tanks to the boat. The results were encouraging, generating a rate of approximately 8 MT/hr. During this time the BHA was run to bottom. When enough capacity had been made available in the ISO tanks drilling again commenced, at a reduced rate (approx. 12 m/hr) to accommodate the cuttings movement capacity. As the cuttings handling capacity handled the ROP well, it was decided to set down maximum WOB (15 MT), which generated an ROP of approximately 15 – 20 m/hr, with cuttings handling no longer a limiting factor. Drilling was steady, with minor limestone stringers slowing ROP to 10 m/hr. Hole condition was good throughout, with only minor drag experienced.

Due to there being no protection hood installed on the lines from the ISO tanks to the skips, and the fit of the line to the inlet of the skips not being ideal, discharge to the skips caused the decks to become very messy.

Whilst weighting up the mud to 1.81 s.g. too much air pressure was used to clear a blocked vent line on one of the barite hoppers, caused by the surge tank having been loaded with more than 30 MT barite, whereby some of the barite started filling the vent line. As the valve end of the aft end of this surge tank does not hold pressure sufficiently, the increased air pressure caused the discharge of barite onto the decks. Whilst troubleshooting the failure – it turned out the valve was installed upside down – further barite was allowed to escape. A total of approx. 14 MT barite was spilt from the tank. The valve was repaired without implications to the drilling progress and

the area cleaned up. The majority of the barite was transferred to pit 5, whilst the remainder was cleaned up by Swaco. A picture of the situation is shown below.



A total of 4 attempts were made to bring the casing on board. The two first attempts had been hampered by weather restrictions on the supply vessels. The third attempt failed due to simultaneous boat operations and increasing weather trend, hence the pool boat was routed via the other installations prior to returning to the TO Leader. If possible, the casing should have been brought on board prior to start-up, however, this would most probably have been hampered by union requirements.

During this period of boat movements the Geoservices & MWD engineers were asked to leave their container, and the mudloggers moved to the Flair unit where there is a drilling parameter display and wet samples were taken for later cleaning/drying. As work was taking place in the Hetland House requiring the evacuation of the Flair unit no further monitoring could take place from here. During this time the MWD engineer was not able to check his surveys. The mud loggers were still able to take samples from the shakers by entering from the pump room, and monitoring took place from the company office. In the HPHT section it is essential to ensure that continuous monitoring can take place, and should lifting need to occur the time required should be optimised to ensure minimum time is required by the Geoservices and MWD engineers to evacuate the unit.

Drilling continued to 4,200m, at which point HPHT procedures were started (In addition; There was a chance of H₂S in the reservoir section. H₂S sensors and BA sets had been distributed around the rig, and all staff had received H₂S training prior to going in HPHT mode). At 3,967m sand/limestone layers were encountered, with an associated maximum gas peak of 45.7%. The nut on one of the Swaco air jet fittings failed and dropped into the cuttings scroll, causing 0.5 hrs downtime whilst waiting for the fitting to be temporarily secured for cuttings handling, and drilling, to continue. Background gas values steadied to less than 10% as drilling continued. As per the RSPs, hot work permits were pulled at levels above 10%.

Due to the weather forecasts being unfavourable it was decided to suspend drilling until the Edda Freya's ISO tanks could be emptied and further barite received to comply with PSA regulations/HPHT guidelines. A check trip was performed and the well circulated bottoms up above the sand stringers – maximum gas recorded 7%, indicating that the well was sufficiently overbalanced and in good condition. The string was pulled into the shoe & reciprocated/rotated whilst waiting on barite. During this time the crew were coached on HPHT & H₂S procedures.

Due to unreasonably tight 5" DP connections (VAM EIS) it was necessary to use the manual tongs while pulling out, with break-out torque values up to 90,000 ft.lbs necessary (recommended make-up torque of the VAM EIS connection is 45,226 ft.lbs) to break-out the connection prior to spinning it out with the Iron Roughneck. Due to the extra manual handling the operation took

longer than expected, however, more importantly, the extra exposure of the roughnecks from a safety point of view was considerable. The problem could be attributed to a combination of poor dope performance and the nature of the connection (double shouldered). The dope used up to this point in the well was Bestolife 3010 Plus, and inspection of the threads upon break-out showed that the dope provided little or no lubrication to the threads downhole, the dope coming out dry. Recommendation for future [OBM] sections is to use Jet Lube KOPR KOTE (this was on our discharge list as an approved chemical to use but not to discharge, hence only relevant in a closed in system, i.e. OBM). Jet Lube 21 is also on the discharge list, and could be considered as a replacement to Bestolife 3010 Plus on WBM sections. Jet Lube KOPR KOTE was order for the 8 1/2" section.

Whilst waiting for barite and cuttings disposal (Edda Freya) planned maintenance activities were carried out, as well as the repair of the knife valve on the barite surge tank. The 10 3/4" casing was finally brought on board from the Skandi Sotra. On arrival of the Edda Freya the cuttings hose was connected and a cuttings transfer test conducted prior to RIH. Attempts at transferring cuttings to the Edda Freya on the starboard side failed, believed at the time to be due to the lack of aeration on a 20m section of the cuttings hose. She was therefore transferred to the port side, and the drilling assembly was run in hole from the shoe. Transfer also failed on the port side, for which there are a number of possible reasons, or a combination of these. One is that the low temperature in the ISO tanks could be causing the cuttings "slurry" to become more viscous and hence more difficult to pump down to the boat. Another is the restriction offered to the cuttings upon arrival on the boat, where the line takes a sharp 90° bend immediately prior to an "R" valve. Due to the additional friction of the 90°elbow, cuttings flow is slowed down and the additional back-pressure causes the R valve to close ever so slightly, causing blockages on the boat. This physical condition was confirmed to occur several times during the transfer to the boat upon the following attempt made whilst tripping.

Slight losses were observed whilst running in hole to TD, total volume lost was 4.6 m³. No further losses were observed once circulation was initiated, indicating the losses were due to the gels in the mud and the effect of the cold mud in the riser. Hole condition was otherwise good, no drag was observed, and gas on bottoms up was 20.7%. A Coriolis circulation test was conducted, rendering consistent results, and the return flow was routed via the Coriolis meter whilst drilling. However, as the return flow read by the Coriolis sensor was up to 85% of its capacity, causing overflow across the bell nipple, it was decided to revert to the standard return flow sensor. Previous circulation tests had all given inclusive results, and the unit had been opened to check for any restrictions.

Due to the problems transferring cuttings to the boat, preparations were made to transfer cuttings to skips. During drilling cuttings were collected in the ISO tanks.

The 12 1/4" hole was drilled to section TD at 4,306m as per the HPHT procedures, 40m into the Melke formation. Top Melke occurred at 4,266m, 63.2m shallower than prognosed. No drag or losses were observed when drilling. Maximum inclination for the 12 1/4" section was 3.37°, decreasing to an inclination at TD of 0.30°.

As surge pressures during casing running would be excessive and likely cause major losses during casing running & cementing with the current mud rheology, it was decided to reduce the PV by 5 points (with a minimum Fann reading at 3 rpm of 10). Due to the reliance on the active system volumes for accurate volume control whilst pumping out of hole it was not possible to condition the mud system whilst pumping out of hole, hence the hole was circulated whilst conditioning the mud.

Whilst pumping out of hole as per HPHT procedures, the pop off valve on mud pump #3 failed (it leaked, but did not blow, as pop off pressure was set to 320 bar), most likely due to the combination of wear and the high pressure (300 bar). Additionally, the TDS pipe handler response was very slow, later found to be due to a sticky solenoid valve. This was resolved by lubricating the valve once in the shoe.

During this time the port crane broke down, caused by burnt slip rings on the auxiliary power supply. This caused a major delay in the casing handling operations, as this crane was required to move the 9 7/8" casing from the riser deck to the pipe deck for laying out. Additionally the starboard crane experienced a hydraulic hose failure – once this was again in operation, the

cuttings hose was connected to the Edda Freya, and an attempt was again made to discharge cuttings, as per above discussion. A rate of approx. 3 MT/hr was obtained.

Other equipment failures & malfunctions during this section:

- The Geoservices trip tank sensor (radar type) gave erratic results in the volume range 6 – 9 m³, and was changed out to a sonic type after wireline operations finished.
- Whilst preparing tools and cable the Schlumberger wireline crew experienced a repeated shut-down of their unit, caused by shared electric supply – the wireline unit shared a power breaker with the Swaco vacuum unit. As the winch was being run at the time of one of the power-downs, the drive chain broke, and a set of links to repair the chain, plus a new chain was brought out.
- Repeated mechanical failure of the cuttings scroll was experienced throughout the section. This is likely due to the wear of the trough liner, hence new liners were ordered.
- The rig degasser tripped on several occasions, when inspected it was discovered that its bottom was full of heavy mud. On consultation with the manufacturer modifications were made to the impeller to reduce the amount of mud entering the degasser, thereby avoiding these trips, but also reducing the amount of degassed mud.

The decision was made from town to relax the HPHT procedures for pulling out of hole, as per the exempt procedure (previous trips had already occurred at the interval above the HPHT section). The string was steadily pulled into the shoe, without observing any drag or losses. Once in the shoe, the TDS maintenance was conducted.

A check trip was conducted as per HPHT procedures. Circulated bottoms up on TD – maximum gas observed 14.6%. The borehole was in good condition, with no drag or overpulls observed. Slight seepage losses were however observed whilst running in hole, a total of 2.2 m³ mud was lost, at a rate of 200 – 300 lph. A 20.2 m³ LCM pill was therefore spotted at the expected loss zone prior to pulling out of hole.

Whilst preparing the LCM pill a slight, steady gain was observed on the trip tank, attributed to a “loss-gain” situation, as well as the change in tide. Total volume gained was 0.7 m³. Once the rate of gain had diminished, the LCM was spotted. A further 5.8 m³ were lost whilst pulling out of hole.

After the BHA had been laid out a stripping assembly consisting of bit, two float subs and a stand of 5 7/8” DP was made up and racked back in the derrick, as a contingency in case of well flow whilst logging.

Due to a favourable weather forecast for casing running it was decided to go ahead with the logging programme. See section 5 for further details.

The wear bushing was retrieved without incident and no major wear was observed. An index line measurement was taken to aid hanger landing. In preparation for the casing running, drill line was slipped and cut, the derrick inspection was completed and the drawworks brakes and travelling block safety devices were all checked.

See section 6 for details on the casing and cementing operations.

There was confusion regarding the manifesting of equipment coming on the dedicated boat – only items loaded onto the boat were manifested, without stating the roundtripped cargo. A deck plan of the boat was received, however, this did not tally up completely with what had previously been manifested; had the boat been checked in Kristiansund and the roundtripped cargo added to the manifest this could have been avoided. This should always be the common practice, both for outbound and return manifests. An RSP & a Shell procedure for third parties were developed to ensure adequate control of outbound and return cargo.

BHA # 9 12 ¼” Packed rotary assembly. Drilled from 2793m to 3252m

List of Components:

Item	Name	Vendor/Model	Serial #	OD (in)/ID (in)	Max OD (in)	Bottom/Top Connection	Length (m)	Cum. Length (m)
1	12 1/4 " Bit MX-C18 DX	Hughes Christensen	6027607	8.50/3.75	12.25	/7.63 Reg Pin	0.33	0.33
2	12 1/4" NB Stab w/ non-ported float valve	Odfjell	10211	8.00/2.81	12.25	6.63 Reg Pin/6.63 Reg Box	2.14	2.47
3	Pony Monel		28281	8.00/2.81	8.00	6.63 Reg Pin/6.63 Reg Box	2.59	5.06
4	12 1/4" NM Stabilizer		35905	8.00/2.81	12.25	6.63 Reg Pin/6.63 Reg Box	1.72	6.78
5	PowerPulse LF	Schlumberger	103	8.25/5.11	8.50	6.63 Reg Pin/6.63 FH Box	8.75	15.53
6	12 1/8" In line Stabilizer		NN	8.00/3.00	12.13	6.63 FH Pin/6.63 FH Box	1.53	17.06
7	ARC-8	Schlumberger	8029	8.25/2.81	9.10	6.63 FH Pin/6.63 Reg Box	6.12	23.18
8	12 1/8" NM Stabilizer		26122	8.00/2.81	12.13	6.63 Reg Pin/6.63 Reg Box	2.26	25.44
9	NM Float Sub non ported float valve		F'S 002	8.00/2.81	8.00	6.63 Reg Pin/6.63 Reg Box	0.83	26.27
10	8" NMDC		38167	8.13	8.13	6.63 Reg Pin/6.63 Reg Box	9.07	35.34
11	8" Anderdrift 0-2 1/2 deg probe /w Totco		ADB 865	8.03/2.81	8.03	6.63 Reg Pin/6.63 Reg Box	3.04	38.38
12	8X8" Collar (8 joints)			8.00/2.81	8.00	6.63 Reg Pin/6.63 Reg Box	72.55	110.93
13	Hydraulic Jar	HE	WHC 2207	8.00/3.00	8.00	6.63 Reg Pin/6.63 Reg Box	9.77	120.70
14	2X8" Collar (2 joints)			8.00/2.81	8.00	6.63 Reg Pin/6.63 Reg Box	17.88	138.58
15	Crossover		1244	8.00/2.81	8.00	6.63 Reg Pin/5.88 XT57 Box	1.22	139.80
16	5 7/8" HWDP (9 joints)			5.88/4.00	7.00	5.88 XT57 Pin/ 5.88 XT57 Box	84.24	224.04
17	Crossover			8.00/2.81	8.00	5.88 XT57 Pin/ 4.50 NC50 Box	1.23	225.27
18	HDIS Sub			6.75/2.81	6.75	4.50 NC50 Pin/ 4.50 NC50(IF) Box	0.64	225.91
19	Crossover			8.00/2.81	8.00	4.50 NC50 Pin/ 5.88 XT57 Box	1.14	227.05
20	5-7/8 " 26.40 DPS, 10% Wear (210 joints)			5.79/5.05	7.00	5.88 XT57 Pin/ 5.88 XT57 Box	2015.88	2242.93

BHA # 10 12 1/4" Rotary steerable assembly. Drilled from 3252m to 3543m

List of Components:

Item	Name	Vendor/Model	Serial #	OD (in)/ID (in)	Max OD	Bottom/Top	Length	Cum. Length
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					(in)	Connection	(m)	(m)
1	12 1/4" PDC MRS74PX	Smith	JT3201	8.50/3.75	12.250	/7.63 Reg Pin	0.26	0.26
2	PD 900 RSS	Schlumberger	CU369/ BU9011 1	9.25/3.00	11.80	7.63 Reg Box/ 7.63 Reg Box	4.68	4.68
3	12 1/16" NM Stab		3184	8.38/2.81	12.06	7.63 Reg Pin/ 6.63 Reg Box	1.88	6.56
4	PowerPulse LF	Schlumberger	103	8.25/5.11	8.50	6.63 Reg Pin/ 6.63 FH Box	8.27	14.83
5	ARC-8	Schlumberger	8029	8.25/2.81	9.10	6.63 FH Pin/ 6.63 Reg Box	6.12	20.95
6	NM Float Sub w/non-port		FS 003	8.00/2.81	8.00	6.63 Reg Pin/ 6.63 Reg Box	0.79	21.74
7	NM Stab 12 1/8"		26122	8.00/2.81	12.13	6.63 Reg Pin/ 6.63 Reg Box	2.26	24.00
8	NM Float Sub w/non-port		FS 002	8.00/2.81	8.00	6.63 Reg Pin/ 6.63 Reg Box	0.83	24.83
9	8" NM DC		38167	8.13/2.81	8.13	6.63 Reg Pin/ 6.63 Reg Box	9.07	33.90
10	Anderdrift 0-2 1/2 deg		ADB865	8.03/2.81	8.03	6.63 Reg Pin/ 6.63 Reg Box	3.04	36.94
11	Spiral Drill Collar			8.00/2.81	8.00	6.63 Reg Pin/ 6.63 Reg Box	72.55	109.49
12	Hydraulic Jar	Hydra-Jar	WHC 2207	8.00/3.00	8.00	6.63 Reg Pin/ 6.63 Reg Box	9.77	119.26
13	Spiral Drill Collar			8.00/2.81	8.00	6.63 Reg Pin/ 6.63 Reg Box	17.88	137.14
14	Crossover		WN XOS 1244	8.00/2.81	8.00	6.63 Reg Pin/ XT57 Box	1.22	138.36
15	HWDP 5 7/8"			5.88/4.00	7.00	XT57 Pin/ XT57 Box	84.24	222.60
16	Crossover		WN XOS 1288	8.00/2.81	8.00	XT57 Pin/ NC50 Box	1.23	223.83
17	HDIS Sub		IOT 21095	6.75/2.81	6.75	NC50 Pin/ NC50 Box	0.64	224.47
18	Crossover		XOS 1255	8.00/2.81	8.00	NC50 Pin/ XT57 Box	1.14	225.61
19	5 7/8" DP			5.79/5.05	7.00	XT57 Pin/ XT57Box	2014.8 8	2241.49

BHA # 11 12 1/4" Rotary steerable assembly. Drilled from 3543m to 4306m

List of Components:

Item	Name	Vendor/ Model	Serial #	OD (in)/ ID (in)	Max OD (in)	Bottom/ Top Connection	Length (m)	Cum. Length (m)
1	12 1/4" PDC MRS74PX	Smith	JT3201	8.50/3.75	12.250	/7.63 Reg Pin	0.26	0.26
2	PD 900 RSS	Schlumberger	CU369/ BU9011 1	9.25/3.00	11.80	7.63 Reg Box/ 7.63 Reg Box	4.68	4.68
3	12 1/16" NM Stab		3184	8.38/2.81	12.06	7.63 Reg Pin/ 6.63 Reg Box	1.88	6.56
4	PowerPulse LF	Schlumberger	103	8.25/5.11	8.50	6.63 Reg Pin/ 6.63 FH Box	8.27	14.83
5	ARC-8	Schlumberger	8029	8.25/2.81	9.10	6.63 FH Pin/ 6.63 Reg Box	6.12	20.95
6	NM Float Sub w/non-port		FS 003	8.00/2.81	8.00	6.63 Reg Pin/ 6.63 Reg Box	0.79	21.74
7	NM Stab 12 1/8"		26122	8.00/2.81	12.13	6.63 Reg Pin/ 6.63 Reg Box	2.26	24.00
8	NM Float Sub		FS 002	8.00/2.81	8.00	6.63 Reg Pin/ 6.63 Reg Pin/	0.83	24.83

	w/non-port					6.63 Reg Box		
9	8" NM DC		38167	8.13/2.81	8.13	6.63 Reg Pin/ 6.63 Reg Box	9.07	33.90
10	Anderdrift 0-2 1/2 deg		ADB865	8.03/2.81	8.03	6.63 Reg Pin/ 6.63 Reg Box	3.04	36.94
11	Spiral Drill Collar			8.00/2.81	8.00	6.63 Reg Pin/ 6.63 Reg Box	72.55	109.49
12	Hydraulic Jar	Hydra-Jar	WHC 2207	8.00/3.00	8.00	6.63 Reg Pin/ 6.63 Reg Box	9.77	119.26
13	Spiral Drill Collar			8.00/2.81	8.00	6.63 Reg Pin/ 6.63 Reg Box	17.88	137.14
14	Crossover		WN XOS 1244	8.00/2.81	8.00	6.63 Reg Pin/ XT57 Box	1.22	138.36
15	HWDP 5 7/8"			5.88/4.00	7.00	XT57 Pin/ XT57 Box	84.24	222.60
16	Crossover		WN XOS 1288	8.00/2.81	8.00	XT57 Pin/ NC50 Box	1.23	223.83
17	HDIS Sub		IOT 21095	6.75/2.81	6.75	NC50 Pin/ NC50 Box	0.64	224.47
18	Crossover		XOS 1255	8.00/2.81	8.00	NC50 Pin/ XT57 Box	1.14	225.61
19	5 7/8" DP			5.79/5.05	7.00	XT57 Pin/ XT57Box	2014.8 8	2241.49

2.2 Bit Performance

Bit No. 9

Nozzlos: #1 #2 #3 #4
19 19 19 16

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
12.250	Instert		447	Hughes	MX-C18 DX	6009606	1,027
<i>Features:</i>							
<i>Condition in:</i> New							
<i>Hydraulics:</i> w/ a MW of 1.75 sg at 2950lpm bit dP 54bar H.S.I 3.0							

Dull grading:		1-2-CT-H-E-I-LT-BHA						
	Date & Time	MD	Cumulative Run Hours					Total hrs
In:	11:00: 05/11	2793m	<i>Pump Hrs</i>	<i>Drill</i>	<i>Ream</i>	<i>Circ</i>	<i>Other</i>	
Out:	00:00: 12/11	3251m	83.5	48.0	0.0	35.5	73.5	157.00
ROP:		458.0m	in	48.0hrs	=	9.5	m/hr	
Cement/Shoetrack:							Size	Depth
			Drilled:	170m	Cmt Hours:	12.0hrs	13 3/8	2780m

The objective was to drill the section in one to two runs as vertically as possible. Due to the fact that the first run had an insert bit, it was unrealistic to drill the section in one run. The BHA was run in to the first CMT Plug at 1845m. Drilling commenced with a ROP of 20 m/hr to the bottom of the plug at 1940m. RIH to 2619m and washed down to the shoe. Tagged cement plug at 2700m Drilling commenced to 2775m. The Surface system and the well was then displaced to OBM. Drilling continued through the shoe and 5 meter new formation before performing a FIT. New formation was drilled with a WOB of 5-10Tons in the beginning and when stabs were into the 12 1/4" hole the WOB was increased to 15-20-22-25Tons in steps and with different RPM to get the best possible ROP and still maintain vertical hole. The packed BHA showed a building tendency and the WOB was cut back to try to keep the hole vertical. The ROP at the end was 6m/hr with a bit weight of 15 Tons and 180rpm. When the weather was picking up it was decided to POOH, the well was circulated clean and the BHA was laid out.

Bit No. 10

Nozzlos: #1 #2 #3 #4 #5 #6
16 16 16 16 16 16

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
12.250	-	PDC	M222	Smith	MR74PX	JT3201	1.178
<i>Features:</i>							
<i>Condition in:</i> New							
<i>Hydraulics:</i> w/ a MW of 1.78 sg at 2930pm bit dP 41bar H.S.I 2.3							

Dull grading:		0-1-WT-G-X-I-No-WC						
	Date & Time	MD	Cumulative Run Hours					Total hrs
In:	11:30: 13/11	3252m	<i>Pump Hrs</i>	<i>Drill</i>	<i>Ream</i>	<i>Circ</i>	<i>Other</i>	
Out:	11:30: 15/11	3543m	20.5	12.7	0.0	7.8	27.5	48.00
ROP:		291.0m	in	12.7hrs	=	22.9	m/hr	

Good run with no problems. At bottom PowerDrive was set to 40% low side to gently drop the inclination from just over three degrees back to vertical and maintain vertical hole. Maximum dog leg was 1.24 deg/30m. Reasonable penetration rates of 20m/hr were achieved with 10 to 12 T weight on bit and 160 to 180 rpm. The assembly was POOH at 3543m due a lack of cuttings handling capacity and worsening weather conditions.

Bit No. 11

Nozzlos: #1 16 #2 16 #3 16 #4 16 #5 16 #6 16

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
12.250	-	PDC	M222	Smith	MR74PX	JT3201	1.178
<i>Features:</i>	Double sealed roller bearing, aggressive tooth shaped inserts and carbide gage protection						
<i>Condition in:</i>	0-1-WT-G-X-IN-NO-WC						
<i>Hydraulics:</i>	w/ a MW of	1.83	sg	at	2800 lpm	bit dP =	39 bar H.S.I 2.1

Dull grading:		1-1-WT-A-X-IN-NO-TD						
	Date & Time	MD	Cumulative Run Hours					Total hrs
In:	09:15; 16/11	3543m	<i>Pump Hrs</i>	<i>Drill</i>	<i>Ream</i>	<i>Circ</i>	<i>Other</i>	
Out:	08:00; 25/11	4306m	100.1	50.2	0.0	49.9	114.7	214.75
	ROP:	763.0m	in	50.2 hrs	=	15.2	m/hr	

Good run with no problems directionally and drilling wise, apart from the extensive time spent WOW. The PowerDrive was set to 40% low side to maintain the inclination as close to vertical as possible. Maximum inclination was 0.48deg, and maximum dogleg was 0.52 deg/30m. Reasonable ROP's of 10 – 20 m/hr were achieved with 10 – 14 MT WOB and 160 rpm. Tools were inspected when laid out, all checked out fine visually. The bit was in good condition.

2.3 Drilling Parameters

BHA # 9

PARAMETERS: *Comments:*

	FLW (lpm)	SPP (bar)	RPM (string)	WOB (kdaN)	TRO (dN.m)	ROT	STRING WEIGHTS		Depth M
							UP	DN	
Min:	2900	258	60	8	6	150	152	152	2790
Max:	2950	269	180	25	12	150	154	150	3200

BHA # 10

PARAMETERS: *Comments:*

	FLW (lpm)	SPP (bar)	RPM (string)	WOB (kdaN)	TRO (dN.m)	ROT	STRING WEIGHTS		Depth M
							UP	DN	
Min:	2900	160	150	9	8	158	160	160	3270
Max:	2950	180	180	15	22	160	162	160	3500

BHA # 11 (RR of BHA #10 – WOW)

PARAMETERS: *Comments:*

	FLW (lpm)	SPP (bar)	RPM (string)	WOB (kdaN)	TRO (dN.m)	ROT	STRING WEIGHTS		Depth M
							UP	DN	
Min:	2550	275	120	7	11	163	164	162	3560
Max:	2900	305	180	14	20	173	174	174	4030

2.4 Equipment Failures

None

2.5 Conclusions and Recommendations

- Stripping operations have proved to be good with 5" DP and NC50 connections in OBM (Earlier an attempt to strip through the upper annular in WBM with 5 7/8" DP with XT57 connections proved very difficult).
- Difficulties breaking out 5 7/8" XT57 connections (Iron roughneck was calibrated and found ok. Over torqueing could have taken place down hole) with iron roughneck. Dope in use Bestolife 3010.

3.0 Drilling Fluids

3.1 Brief Overview of Mud System

Mud Type: Paratherm OBM

	Planned	Actual		
		Minimum	Maximum	Typical
Mud weight	1.82-1.90 s.g.	1.75	1.88	1.88
PV	< 50 cP	29	43	36
Yield point	16 – 26 lb/100 ft ²	17	29	21
3 rpm	8 – 13	9	14	12
10 sec. Gels	5 – 12	9	17	13
10 min. Gels	< 25	13	22	19
HPHT Fluid loss	2 – 4 cc/30 min	2.8	4.4	3.0
Activity	0.87 – 0.91	0.86	0.90	0.89
ES voltage	> 600 V	662	1150	980
Cl ⁻	100 – 125 mg/l	105	139	120
Filter cake	Med mer	1	1	1
LGS	< 180 kg/m ³	22	113	80
HGS		1067	1231	1180

To start the section 315 m³ of weighted Paratherm mud at 1.75 sg and 245 m³ of unweighted premix at 1.03 sg were taken on board the rig. The OWR and the salinity were out of specification on both shipments. Also the mud weight was 1.82 sg. The weight was adjusted in the pits with the addition of base oil to 1.75 sg before the displacement started.

To displace to Paratherm a 10 m³ freshwater spacer was pumped ahead of a viscous Paratherm spacer in order to thin down the Glydril mud in the wellbore. When the water spacer was identified at the shakers, circulation was stopped, and all the surface dump valves were closed and isolated. Stopping early guaranteed that there was no risk of dumping any interface mud overboard with the Glydril system.

Circulation was resumed and the water spacer was diverted to a slop pit. The interface between Paratherm and spacer was sent to slop, until an ES of 400 was seen in returns. The mud was then directed back to the active, and the system circulated for 30 minutes, while all areas on the rig were observed for leaks.

While stripping- and choke-drills were performed, 90 m³ premix was weighted up to 1.75 sg. This was used to fill up the shaker pits, increase the active volume, and have some reserve mud for drilling ahead. After the drills, circulation commenced and 8 MT of calcium chloride was added over 6 hours. This was done in order to have a salinity value compatible with the claystone formation.

The new high rate barite mixer in Pit#2 was used for weighting up reserve mud. A premix was then made up and bled slowly into the active to increase the OWR and improve the other properties. In order to maintain a 3-rpm reading of 12, after dropping to 8, VG Supreme was added directly to the active.

While WOW at 3254 m, a premix was made up and sheared in Pit#2. When drilling ahead, the system was treated with premix and direct addition of barite for mud weight maintenance.

The mud was weighted up in stages as follows:

From 1.75 sg to 1.78 sg at 3,543m.

From 1.78 sg to 1.81 sg from 3656 m.
From 1.81 sg to 1.83 sg from 3815 m.
From 1.83 sg to 1.85 sg from 3900 m.
From 1.85 sg to 1.88 sg from 3950 m.

The mud rheology increased while adding the barite to the system. The maximum 600-rpm reading was measured to 122, and the 3-rpm to 15. A water free premix with no viscosifier was added to the active system in order to bring the rheology down. Approaching the HTHP-mode depth at 4200 m, these same readings were recorded to 100 and 12.

After the 10 stand short trip and WOW, the hole was drilled to section TD at 4306 m. Back on bottom the system was treated with water- and viscosifier-free premix to reduce PV and low end readings. Prior to running the 10 3/4" – 9 7/8" casing the PV was reduced from 43 to 37 cP and the 3 RPM reading from 12 to 10.

After a trip to the casing shoe and prior to pumping out of hole, the well was circulated bottoms up and the mud treated with Lime. At 3500 m seepage losses were observed and a 21 m3 LCM pill was spotted. The pill contained 30 kg/m3 CaCO3, 50 kg/m3 G-Seal Fine, 30 kg/m3 Mica Medium and 40 kg/m3 MIX II Fine. Pulled out without further losses, and three wireline logging runs were performed without hole problems.

Rigged up and ran 9 7/8" x 10 3/4" casing. Started losing mud to the formation when entering the 14" casing. The casing was primarily filled with active mud, but some new weighted premix was also utilized. As no returns were seen during cement job, the cement was displaced with a blend of used and new mud. A total of 350 m3 mud was lost to the formation from start of running casing to the cement was displaced.

No adverse mud issues during this section. Properties were within limits. Rheology was reduced to facilitate a reduced loss rate during casing running.

3.2 Hole Cleaning

Hole condition was good throughout the section, with no adverse hole cleaning issues.

3.3 Solids Control Equipment

Instead of a conventional skip and ship, the rig had been fitted with a ISO tank system. The cuttings are collected under the sand traps, and blown into one of the 8 vertical silos installed on the starboard/aft deck. A dedicated supply vessel had been equipped with similar tanks to receive the OBM cuttings from the rig reducing number of lifts required and ease logistics.

The shakers were functioning as expected throughout the section, however, as the screen consumption was quite high, the repair kit stock diminished rapidly.

The performance of the ISO tank system was disappointing, with several line blockages and low transfer rates. Likely causes of this were the elbow bend at the boat; the temperature of the compressed air, and hence the temperature in the ISO tanks themselves; The ability to aerate the hose from the rig to the boat. The addition of water to clear the shakers was also mentioned as a potential culprit, however, unless the cuttings are made water-wet due to this addition, clogging due to the water is not too likely.

3.4 Drilling Fluids/Hole Cleaning Recommendations

- The OBM mud was pre-made onshore. On site it was found necessary to increase the CaCl₂ level to meet spec. This caused 6hrs NPT. Better QAQC of mud properties should be made onshore.
- Following the experience with the ISO tanks onboard the Leader it is important to gather all the learning and improve on operating practices and procedures. All recommendations made to the Leader team with regards to the cuttings handling from MI Swaco should be incorporated in future procedures if relevant.
- Friction/pressure losses in lines should be accounted for when designing the system – the line from the boat inlet to the ISO tanks on the boat has an elbow bend in it (90 deg), with an R-valve immediately after, caused a severe pressure drop. This resulted in several blockages.
- If a ISO tank cutting transfer system is to be used it is vital that a OBM/temperature study is performed to establish the effect of cutting storage and pumpability at ambient temperature. This could highlight the cutting storage heating requirements prior to cuttings transfer.

4.0 Surveying

4.1 General Discussion

SURVEY DATA: *Comments:*

VS Azimuth: 60.56

	MD	Inc	Azm	TVD	VS	N/-S	E/-W	Max DLS
First survey:	2877.04	0.77	98.02	2876.79	17.08	8.02	15.08	0.52
Last survey:	4293.42	0.30	351.50	4292.74	37.71	16.36	33.98	

4.2 Recommendations

The MWD & ARC tools worked without problem throughout the section and there are no specific improvement opportunities or requirements.

5.0 Electric Wireline Logging

5.1 General Discussion

A lengthy meeting prior to the job took place with both offshore & onshore Shell & Schlumberger representatives. The first run was tainted by three errors – incorrect tool zero, resulting in the toolstring being spudded at TD twice. This resulted in damage to the hole finder (see picture below). Bad spooling on the cable drum and a DSI sensor not having been activated during the main uplog, requiring re-start of the log. A fin was also lost down hole. Total downtime due to these errors was 59 minutes.



The calliper log showed an average hole size across the cement interval of 12.346", with minor washouts observed at the sand interval (max OD 13"). TOC outside the 13 3/8" casing was recorded as 2,510m. The difference between drilling and wireline depths was approx. 2m. The second wireline run proceeded without major incidents. A 5,000 lbs overpull was observed at 4,050m, potentially due to a ledge in the sand stringer interval (potentially where fin was lost). Trip tank levels were stable throughout the logging programme.

5.2 Recommendations

Improved procedures for setting tool zero and activating logging parameters.
Logging programme reviewed by offshore engineers/operators prior to pre-job meeting.

6.0 Casing and Cementing

6.1 General Discussion

In the end the casing was successfully installed and cemented in the well, though the operation was hampered by several breakdown of running equipment and troublesome make up. The dope in use might have been a contributing factor, and recommendations and precautions can be found in the text.

6.2 9 7/8" x 10 3/4" Casing Job

10 3/4" landing string

Nominal weight: 101 lbf
Grade: AC-110SS
Connection: NKHWSL
Nominal ID: 8.830"
Caliper ID: 8.886"
Drift diameter: 8.75"
Coupling OD: 11.50"
Make-up loss: 5.906"
Make-up torque: 27,000 lbft
Casing dope: API Modified

10 3/4" casing

Nominal weight: 101 lbf
Grade: VM110SS
Connection: Vam HP SC80
Nominal ID: 8.830"
Caliper ID: 8.886"
Drift diameter: 8.75"
Coupling OD: 11.47"
Make-up loss: 8.226"
Make-up torque: 50,000 lbft
Casing dope: Malleus STC-1

9 7/8" casing

Nominal weight: 66.9 lbf
Grade: Q-125
Connection: VAM TOP
Nominal ID: 8.539"
Caliper ID: 8.611"
Drift diameter: 8.5"
Coupling OD: 10.974"
Make-up loss: 5.484"
Make-up torque: 23,150 lbft
Casing dope: Malleus STC-1

The casing was brought on board and laid out as per plan. As only 184 joints of 10 3/4" casing had been brought on board initially, another 14 joints (already mobilized to KSU) were brought to the rig as back-up joints – this due to the requirement to place the 10 3/4" x 9 7/8" cross-over at a depth below 2,500m. Some of the pre-measured joints had no onshore joint numbers marked on them, and the 10 3/4" landing string and 9 7/8" casing had old lengths and numbers painted on, sometimes making it difficult to make out. In the future lengths should be painted on rather than sprayed, and they should be painted on both ends and 180° offset of each other to avoid confusion.

During rigging up for casing it was discovered that the 10 3/4" – 20" gripper head assembly for the Eagle-Lite was not on board the rig – a replacement was sourced from the West Alpha.

Following scrutiny of backload manifests and remaining rig equipment onboard it was discovered that the gripper head had been backloaded instead of a pipe spinner, incorrectly having been manifested as a pipe spinner. The gripper arm was found at the Transocean base in Kristiansund, and was mobilised on a Statoil helicopter. All in all this caused 11.25 hrs lost time.

Due to weather and boat movements equipment was brought onto the rig at nearly last minute, however, all third party casing running equipment was checked out and ready to run in time for the start of the job.

Initially experienced problems when making up the Vam Top connections, due to the connections shouldering out at high torques without proper make-up. Cleaned a few connections and re-applied Malleus STC-1 dope to check if the problem was due to "old" dope, however, this had no effect. An attempt at using API Modified instead of Malleus STC-1 gave good results, however, the problem was later attributed to the lack of greasing of the seal face, and hence only a thin layer of API Modified casing dope was applied to the bottom part of the pin, leaving the original Malleus STC-1 dope on. Apart from a galled thread, no further make-up problems were experienced. A total of 4 joints 9 7/8" casing were laid out, two as a result of damage due to the high shoulder, one due to seal damage from handling, and one due to a galled thread, as already mentioned.

Make-up was very slow, the limitation being the tong make-up speed and, especially, the stabbing of the joints with the Eagle-Lite. Movement of the Eagle Lite was very jerky and slow, mainly due to operator experience (strike). Due to the alignment of the elevator, the Eagle Lite had to be used to push the joint into the closing mechanism of the elevator, requiring additional time to run the casing. This was rectified by installing an elevator strap (hobble) to lift elevator more into horizontal.

Average running speed was 6 joints/hr, increasing to 9 joints/hr.

Losses were experienced almost immediately when running through the riser, initially at 200 litres/hr, up to 1,000 litres/hr at the end of the 9 7/8" casing running.

The casing handling gear was changed out to 10 3/4" and the FACTS tool was installed without issues. The 750 MT bails were installed without any problem (There had been some concern whether they were installed correctly during previous test installation). The bails had no clear marking illustrating the correct position for installing. For future jobs using 750T bails this should be properly marked from onshore. The 10 3/4" casing was run without any further make-up problems. Losses still occurred, again at approx. 1 m³/hr, increasing to 5 m³/hr as the 10 3/4" casing entered the 13 3/8" casing. Whilst stationary (making up new joints, filling pipe) slight gains were observed in the active, attributed to flowback from the formation.

Due to a failure of the automatic greasing system on the PS-30 slips, resulted slips locking open, the Weatherford 750T rotary mounted elevator was installed to enable continued running whilst repairing the PS30 slips. The slips were re-installed once repaired to reduce safety exposure. (Non-flush rotary mounted elevator vs. flush PS-30). To ensure that the slips would not again lock open (or closed), they were manually greased every 10 joints.

Experienced repeated problems with the Weatherford casing tong. Initially, a hydraulic fault caused difficulties closing the safety door, this was repaired after 1.5 hrs. As casing running continued, other hydraulic faults surfaced, until the tong experienced full hydraulic power loss. Later found to be sensor on door cutting out all power (safety feature). This fault may have been the cause of the two galled threads (box/pin, one connection). It was then changed out with the back-up tong, which turned out also to fail hydraulically, this time due to the telescopic arm continuing to push outwards whilst spinning/making up pipe. This was initially solved by removing the hydraulic hoses to the telescopic function whilst making up the joints. Whilst breaking circulation at the shoe the Weatherford engineers changed out a solenoid valve on the tong, which seems to have alleviated the problem slightly, although the functioning of the tong was still not optimal. Upon discussion with Weatherford onshore it was decided that there was

no point in sending out a mechanic, as the problem seemed to be a compatibility issue between the tong and the hydraulic power unit, which could not be solved offshore.

Circulation at the shoe was stopped almost immediately, due to no returns being obtained. Casing running resumed to hanger make up point. The pre-made up hanger and running tool was picked up and made up to the casing. After removing the PS-30 running hanger through table and re-installing PS-30 slips it was discovered that the closing function on PS-30 slips failed to operate properly. Hoses and nipling were changed out without success. The slips were replaced with a 750T rotary mounted elevator, and casing ran as plan without further difficulties. Using the non-flush elevator as slips would increase the stick up when making up the FACTS tool. The 2nd last joint was run down, and the rotary mounted 750T elevator was removed. Removed the skirt on the bail mounted elevator and landed it in the rotary. The 750T bails were released from the bail-mounted elevator now sitting in rotary. Bails were installed on the rotary mounted elevator and FACTS fill up assy removed. Due to height and troublesome threads, some difficulties were experienced making up the cement hose to the FACTS tool. After making up the cement hose a short pressure test was carried out, as breaking out the cement hose again after landing would have been very difficult. The cementing plugs were installed without significant difficulties and last joint was made up. Installed the cement plugs in last casing joint and landed casing applying pressure to compensator (Though the string was too heavy for full compensation prior to picking up some weight when landing). String weight when landing was 500mT. Weight was reduced to 110mT and index marks confirmed successful landing (9 7/8" shoe at 4291.02m). Total mud lost while running casing was 133m³.

6.2.1 High lights

- Ultra heavy casing successfully installed in the well
- Effective use of marginal weather condition with dedicated vessel to turn around equipment.

6.2.2 Low lights

- Inadequate marking of 750T bails. For future reference; ensure proper marking (i.e. up/down and inner/outer face), to avoid confusion.
- Multiple hydraulic tong failure.
- Malleus STC-1 did not perform as planned for casing dope.
- 10 3/4" pin end had to be cleaned on deck for inspection prior to running.
- Poor performance of PS-30 slips. Automatic greasing failed. Finally full failure.

6.3 9 7/8" x 10 3/4" Cement Job

To minimise the interface rheology between mud and spacer and still achieving water wetting of the surface areas of the cemented interval, a two-stage spacer design was chosen. The first stage spacer did not include SEM-8. In the second stage spacer SEM-8 was added to the initial spacer. As per HPHT procedures a batch mixer was used to prepare and QAQC the mix water (mix water was prepared +24hrs ahead in the mud pits for rheology development). A portable lab performed on-site analysis of the mix water, cement slurry and compressive strength development. Unfortunately the spacer was contaminated with approx. 2m³ OBM, due to a leaking valve in mud pits. The spacer properties were tested and found just within acceptable properties for use.

A toolbox talk was held prior to start of the cement operations and surface lines pressure tested successfully. 5m³ of first stage and 19.5m³ of second stage spacer was pumped using the rig pumps. The ball for the bottom wiper plug dropped and plug released with 81bar using the cement unit. 22.2m³ cement was pumped before ball for top plug was dropped and confirmed

sheared with 138bar. After displacing theoretical displacement volume and half a shoe track no bump was observed and displacing stopped as per plan. When analysing the data logs a clear pressure increase was seen when the bottom plug ruptured. Comparing volume pumped and casing capacity the pump efficiency was found to be lower than anticipated. After the cement job a piece of shaker screen was found in one of the mud pump discharge valves. This is believed to have happened towards the end of the cement job. Based on finding the cement inside the casing the theoretical top of cement outside the 9 7/8" casing was 3571m calculated from volumes (to be re-evaluated after WL logs). Floats were holding and annulus remained static. No returns were observed during the cement operation and total 210m³ was lost to the formation during cementation. Cement hose was removed and full bore running tool released. As the landing string was clear of the BOPs the blind/shear rams were closed to avoid any possible gas percolation through the cement while setting. The pressure increased and stabilized at 11bar under the rams from thermal expansion and/or breathing. Pressure was bled down and observed to be stable before rams were opened. A separate run with the mill and flush run was made to the wellhead to clean the sealing area before the seal assy was installed and tested ok. Some cuttings was observed over the shakers from the clean out run. The wear bushing was run and installed to prepare for drilling the 8 1/2" section.

In order to drill the 8 1/2" section the 5 7/8" tool joint give too small annular clearance (ECD) and was RIH and laid down to be replaced with 5" DP. Some problems were experienced breaking out the connection due to high torque. Manual rig tongs were required on a large amount of the connections. It is believed that this originates from the dope and not over torqued connections. The drill pipe dope in use was Bestolife 3010 ultra. Though this dope has proved to be suitable from previous experience it did not perform. In this instance the 5 7/8" DP connections in use were XT57. One possible reason for the dope not to perform as intended might be due to the extensive time the DP was sitting stationary in the derrick during the industrial dispute.

Spacer design ahead:

Volume of spacer: 25m³
 Pump rate: 1000lpm
 Weight: 1.92 s.g.
 Base fluid: Drill water

Additives: NF-6 as required
 Tuned spacer E+ 30kg/m³
 Halad-200L 12kg/m³
 Barite 1198kg/m³
 Musol 12kg/m³
 Sem-8 12kg/m³

The spacer was pumped using the rig pumps. The first 5 m³ were pumped without the addition of surfactant (SEM-8). The weight of this was 1.93 s.g. The final 0.5 m³ were used to chase the ball for the bottom wiper plug.

Primary slurry

Volume of slurry: 22.2 m³ ahead of top plug.
 Pump rate: 750 lpm
 Weight: 1.96 s.g.
 Slurry yield (G): 98.57 l/100kg
 Base fluid: Fresh water

Additives: SSA-1 35% bwoc
 Halad-413L 5.5 l/100kg
 Microsilica 8.0 l/100kg
 CFR-3L 1.4 l/100kg
 SCR-500L 2.8 l/100kg
 NF-6 0.10 l/100kg

The cement was displaced with 480 litres mix water to flush the cement line from the cement batch mixer and place cement behind the top plug as per recommendation for drill out. Then displaced with 1.88 s.g. mud using the rig pumps.

6.3.2 Highlights

- Steady cement weight obtained while mixing
- Confirmed tallies as casing tally and casing tally matched perfectly.

6.3.1 Lowlights

- No bump obtained. Calculated pump efficiency of 94% (based on pressure spike and volume pumped when rupturing bottom plug) but was not trusted as too low. Later a piece of shaker screen was found in mud pump discharge, which may explain the low efficiency (later, prior to drilling out the shoe track the plug were found on top of the float collar).
- Cement spacer was contaminated with 2m3 OBM prior to start of job and could have been a showstopper if spacer had not been within “spec”.

6.4 Casing and Cementing Recommendations

- 10 3/4” Double seal pin end not to be pre doped onshore.
- 9 7/8” Malleus STC-1 dope found to be “dried out” giving poor make up. Consider the use of Malleus STC-1. Though it should be taken into account that due to the industrial conflict, the actual time between preparation of the casing, and running of the casing was longer than normal. If the casing is stored with running dope over excessive period of time, re-doping should be considered.
- Slow make up initially. Increased speed of initial spin in make up.
- Dedicated vessel absolutely necessary to turn around the large amount equipment from the 12 1/2” section and 8 1/2” section in winter drilling to make full use of short weather windows. This saved days of NPT for this well.
- Remember to include contingency casing running dope in discharge permit.

Section Review Report

Onyx SW Exploration - Transocean Leader

Well 6406/9-1

Drilling 14 $\frac{3}{4}$ " x 17 $\frac{1}{2}$ " Hole
Running & Cementing 13 $\frac{3}{8}$ " x 14" Liner

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1.0 Executive Summary

1.1 Brief Outline of the Objective

The section objectives were:

- a. No harm to people or the environment
- b. FIT limit test to 1.90 s.g., 1.85 s.g. is minimum required
- c. Drill 17 1/2" over-gauge hole, confirm with memory calliper, pump OOH with open arms, and wireline calliper
- d. Obtain basic formation evaluation data (GR/resistivity)
- e. Field prove the Coriolis EKDS system
- f. Maintain a vertical trajectory, <2° inclination
- g. Section drilled to TD of 2,893m TVDRKB / 2,860m TVDRKB with AnderReamer in one run
- h. Spot a non-sagging mud in the 16" x 13 3/8" and 14" x 20" annulus
- i. Achieve a successful cementation of the 13 3/8" casing without trapping the 16" x 13 3/8" casing annulus
- j. Pressure test the 13 3/8" casing x 14" casing to 353 bar / 15 minutes on bump

Accomplishments:

- a. One first aid case. No harmful discharge to environment
- b. Achieved. Fit of 1.89 s.g. (Limit)
- c. Slightly under gauge hole in lime stone stringer was confirmed from memory calliper. Due to scope change and long-term suspension program, a separate clean out run was performed deepening the 14 3/4" x 17 1/2" shoulder, and simultaneously opening up the under gauge sections. No new calliper data was available over this section, but pumping out with AnderReamer arms open indicated a gauge hole. The wireline logging program was cancelled.
- d. Partly achieved. Basic formation evaluation data obtained from MWD, but not from wire line logging due to cancellation of wire line job.
- e. The Coriolis EKDS was not field tested adequately due too high flow rates on this section.
- f. Achieved. Max inclination over the section was 0,41°. Max DLS 0,33°/30m.
- g. Not achieved. First bit (PDC) balled up and was replaced with an insert tri-cone bit. Due to long-term suspension a third run was performed to deepen the 14 3/4" x 17 1/2" shoulder.
- h. Achieved. 1.82 s.g. Glydril non-sagging mud spotted in annulus.
- i. Achieved.
- j. Achieved. Due to plugs leaking the casing was tested successfully on hard cement to a revised 179bar/15min test.

1.2 Time Breakdown

Operation	Target Time (days)	Budget Time (days)	Actual Time (days)	Productive Time (%)	Lost Time (%)	Down Time (%)
Drill 14 3/4"x17 1/2" hole	2,75	4,41	10.5	6,33	1.5	
Evaluate 14 3/4"x17 1/2" hole	0,33	0,48	0			
Run and Cement 13 3/8" x 14" Casing	1,40	2.44	3.4	2.62		.625

1.3 Summary of Incidents, Down Time, Lost Time, and Associated Causes

1.3.1 Incidents

RUI 7438, 7440, 7441, 7442, 7448, 7460, 7462, 7471

One first aid case this section.

RUIs reported into the Synergy system:

7438: Oil leak on brake function in starboard crane

Description:

Crane operator was offloading cargo from boat, when he discovered that the speed on whip line was slowing down. He

Understood that it was the brake that was activated. There was also discovered some unexpected noise.

Possible Consequences, reasons and actions:

The crane was put in parking position, and mechanic was contacted.

Troubleshooting on the brake hydraulic circuit was taken place. It was found internal leak in intensifier for brake function for the whip line. The brake is "fail to safe". Intensifier was changed out with overhauled unit. The crane was test run, and found ok.

7440: Discharge of water based mud from trip tank

Description:

During the day shift, the floor men were washing down the shaker room. One spade from the ditch underneath the shakers leading to the overboard line was opened to allow the washing water (Salt water) to disperse. When the

Crew finished shift, this job was not completed and the spade was not fitted. This spade is normally removed when

Carrying out this task to prevent water going back into the active pit.

Possible Consequences, reasons and actions:

This caused a spill to sea of 11,7 m³ with water-based mud when the pumps was started to transfer the mud from trip tank into the flow line at the shaker. A full investigation took place.

7441: Broken bolt on slips during strip drill

Description:

Stripping through bop requires attachment of a safety valve and a grey valve to the drill string.

During the strip drill the safety valve did not pass through the PS 16, 5 7/8" DP slips and broke 1 of 4 cylinder bolts. Throat slips 8 1/4", OD safety valve 8 1/2".

Possible Consequences, reasons and actions:

No parts of the broken bolt fell in to the well. It is important to measure correct, and check that OD on tools are less than the ID in slips.

7442: Starboard crane stopped during lifting operation

Description:

During back loading to boat, the crane stopped as soon as the container landed on the boat, and the wire was slacking off. Alarm came on for hook position- upper/ lower, and jib- upper/ lower. Crane operator managed to lift the container off the boat with the boom, and swing it to the aft of the boat.

Possible Consequences, reasons and actions:

Electrician, mechanic and tech. section leader was called in to check it out and OIM informed. After the investigation, they found the "slack wire" micro switch on the whip line was activated. It was discovered that there was some sluggishness in the switch. The sluggishness in the switch resulted that the micro switch stalled. The "slack wire" switch was put back in position, and the crane worked as normal. These type of switches will be checked on both cranes.

7448: Hose snapped in agitator**Description:**

A chemical tank with glycol was rigged up with a Wilden pump to pump it from the area behind the "Hetland house" to pit #9. The hose was secured several places with ropes to prevent movement. However, the hose fell down between the floor in the pit room and the agitator in pit # 8 (~2" opening). Due to the length of the hose, it got caught in the agitator and snapped off.

Possible Consequences, reasons and actions:

The pump was stopped a.s.a.p. Old hose was disconnected and a new one rigged up. This hose was also secured, but was shorter and more suited for the task. This must be evaluated, and perform a plan for a risk free transfer of liquid from tanks on deck to pits

7460: Squeezed ring finger.**Description**

Operation at the time was BHA handling on the rig floor. The IP was removing a 6 5/8" double box sub from the sub rack at the driller's side of the rig floor. A tugger was attached to the installed lifting cap and another roughneck raised the sub off the retaining peg. As the IP was maneuvering the sub around the forward drill pipe set back area his left hand ring finger contacted a dowell peg used for storing shackles which is situated approximately 2 ft from the end of the sub rack. This resulted in a scrapped knuckle type abrasion on his finger. The IP went to the medic and had the finger cleaned and dressed and then returned to work.

Possible Consequences, reasons and actions:

The contact with the shackle peg was mild in nature, had the sub been heavier or moving faster there could have been a more serious injury.

1. Risk identification and positional awareness did not identify the potential pinch point between the sub and the peg.
2. The use of hands directly onto the sub itself rather than a piece of rope to control the sub exposed the hands to risk.
3. At the time of the occurrence there were a set of insert bowls in the vicinity and the intended load path was not clear.
4. A Time out for safety was held on the rig floor to re-enforce the requirement for risk assessment regarding pinch point awareness.
5. The Bowls were removed from the area.
6. The crew was advised to use small sections of rope to handle loads of this nature, which keeps their hands and fingers away from potential pinch points. Also the importance of keeping the housekeeping standards high at all times.
7. A one to one mentoring session was conducted with the IP at the work site.

7462: DC Power Failure, supply to the Drill Floor was lost.**Description**

At approximately 05.15 hours all DC power supply to the Drill Floor was lost. The VESDA "very early smoke detection apparatus" indicated a fault in the high voltage switch room, low voltage switch room and engine control room. The Night Barge Engineer mobilized Fire team no.1 to the scene to investigate, and informed the OIM. The Technical Section Leader and Chief Electrician were also informed. An initial inspection of these areas revealed no indication of a fire, but a faint burning smell was evident. This smell quickly disappeared and no indication of the source of the problem was initially found.

The Chief Electrician carried out further investigations and the following faults were found:

1. Two out of the three 100 amp fuses were found to have blown in No.1 600 volt switchboard and the corresponding fuses in No.2 600 volt switchboard had also blown.
2. The main isolating switch supplying 600 volts AC to all mud pump motor Field Regulators sustained electric arcing damage, Due to the fact that this isolating switch is common to both switch boards this resulted in a short circuit fault current in both 600 V switchboards. This resulted in the blowing of the fuses in both switchboards and the total power loss to the SCR system.

Possible Consequences, reasons and actions:

The main isolating switch supplies 600 volts AC to all mud pump motor Field Regulators. One phase cable became detached from the isolating switch, and contacted a second phase cable causing a short circuit and irreparable damage to the switch. The reason why this cable became detached due to a loose connection allowing the cable to release from the retaining screw on the switch. The second option is that there was a resistance build up in the cable and the securing connection melted and came free.

Description of equipment:

The system starts with the 6000 / 600 volt transformers in the high voltage switchgear room. 600 volt AC power is supplied to the three phase bus bars of switchboards 1 and 2 in the low voltage switch room. The 600 volt AC then goes to the isolating switch for all six of the mud pump DC motor fields. The available assignments of the mud pumps are present in both 1 and 2 switchboards. This is commonly known as the SCR assignment designation, and therefore allows system flexibility.

7471: Starboard Crane Cab window shattered when installing

Description

When installing front window on Starboard Crane cab, the window shattered. At the time the window cracked, it was lying on deck. The crew was preparing for sanding the corners with sand paper due to the size of the window was too big for the frame.

Possible Consequences, reasons and actions:

The reason that the glass broke, is do to the fact that it was triplex Glass, instead of laminated as we require for this purpose. The edges were not rounded, as we need. The windows are also ordered without any expanding clearance.

1.3.2 Down Time (NPT)

Down Time Incident and Cause	Down Time (hrs)
Repaired 16" liner seal	0,25
Circulate and condition cmt contaminated mud	5,25
Pump second slug	1
L/D 9 jts 5 7/8" HWDP	1
Suction problem with mud pump #3	1,5
Pumped and spotted KCL brine/Glydril pill to remedy bit balling	1,5
Round trip to change bit and clean BHA of balling	26
Additional trip to bottom to start pumping/reaming our of hole due to hole condition	3,75
Loss of DC power to rig floor, TDS and mud pumps	8,5
DP slips stuck due to gumbo	1
Replace switch gear SCR bay (DC power)	2,5
Additional well cleaning due to increased cuttings returns from below 16" shoe	8
Additional run to clean wellhead and BOP from clay	4,5
Shut down of power to drillers console (faulty purge air alarm system)	2
Rectified fault with Eaglelite control panel	0,5
Laid down 12 Rejected casing joints	5,25
System check to Weatherford computer	0,25
Problems finding shoulder when making up casing joint	0,5
Not possible to test casing on green cement due to leaking plugs	2

WOC to pressure test casing on hard cement	4,5
Down time related to suspension activities prior to force majeure situation 27.06.2004	48,75
Down time related to suspension activities after force majeure situation 00:30 hrs 27.06.2004	

Total down time (NPT) for the section was 128,5hrs (add force majeure).

1.3.3 Lost Time (WOW, etc)

Lost Time Incident and Cause	Lost Time (hrs)

No lost time during this section.

1.4 Chemical Discharge

1.4.1 Mud

DATA TO BE ADDED ON FINAL SECTION REPORT (AFTER DISPLACING EXISTING MUD IN HOLE TO OIL BASED MUD)

1.4.2 Cement

1.4.3 Rig Chemicals

2.0 Drilling Performance

2.1 Operational summary

Following the BOP test (covered by previous section review) a 14 3/4" clean-out BHA (BHA #5) was made up and run in hole on 5" DP. With the 5" DP still across the BOP a stripping drill was performed, however the string weight was too low to strip the tool joint through the annular. Reduction of annular closing pressure resulted in the annular leaking well pressure. The drill was aborted. A choke drill was also performed, however, this was also prematurely aborted as the mud properties were too viscous to gain reasonable results during the drill.

A circulation test was performed whilst running in hole to calibrate the Coriolis meter. The return volumes deviated from that expected at flow rates greater than 2,500lpm, with the surplus volume going to the drain tank rather than returning to the active system. This could potentially be due to the mud properties, hence the test was repeated whilst circulating and conditioning mud, at which point the mud properties were improved. The result then was 3,300lpm maximum, hence still too low/borderline for the flow rates expected in the next section and below.

Drilled hard cement from top of liner at 1,288m to 1,349m. Another choke drill was performed successfully whilst washing/reaming to the float collar, which was tagged at 2,192m. None, or very ratty cement was found in the shoe track. It was only required to wash down to the shoe at 2,205m. This could be due to the bottom plug not releasing at the correct moment – both plugs were drilled at this stage, confirmed by multi-coloured returns at the shakers. Should the bottom plug have been released by the top plug releasing and travelling down together, this would have caused the plugs to push mud ahead of it, effectively filling the shoe track with mud, pushing the cement ahead and through the shoe. Ratty cement was also found up to 3m below the shoe.

Conditioning mud to an even mud weight and improving properties took 4.25hrs due to the heavy cement contamination of the mud. A FIT was then conducted, with the result of 1.89 s.g. This was greater than the minimum requirement of 1.85 s.g. The decision was therefore made to pull the string and prepare to run the 14 3/4" drilling assembly. The HWDP in the string (not NS-2 inspected), as well as the 9 1/2" DCs and 9 1/2" jar, were laid down on the trip out.

The first 14 3/4" x 17 1/2" Drilling (BHA#6) c/w a PDC bit was made up and run in hole. When inside the 16" liner shoe the drill line was slipped and cut, choke and kill lines flushed, and derrick alarms tested. Prior to washing down to TD suction problems were experienced with one of the rig pumps and repaired. After washing down to 2245m the Anderreamer ball was dropped to activate the tool. New formation was then drilled from 2253m to 2285m. Initially ROP of 10 m/hr with approx. 10 tons WOB was achieved. At 2264m ROP started to slow down until drilling was stopped at 2285m. Parameters were indicating a bit balling problem, and a 6m³ (75% KCL brine/25% Glydрил) pill was spotted around bit and BHA. Every 5min the pill was displaced with 1m³ until the tot. 13,5m³ pill was removed from the bit. Drill off tests were performed and hole deepened to 2293m. No improvement was seen and BHA was pulled to surface while back reaming to the shoe. The bit and AnderReamer were found totally balled up with hard clay.

The BHA was cleaned, AnderReamer redressed, and bit changed out to an insert bit and run in hole. With BHA #7 inside the 16" shoe 5hrs were needed to condition the mud. The barite mixing capacity on the rig added to the access time needed to treat the mud. Inside the casing shoe the flow rate was increased to wash down at high flow rate. The string could not be moved up or down confirming the arms of the Anderreamer opened. The flow rate was reduced to allow washing down to 1m above bottom with the Anderreamer arms closed. The flow rate was increased to max possible and the last meter of open hole was reamed down to bottom at 2293m.

Drilling of the 14 3/4" x 17 1/2" hole commenced. Initially ROP was in the range of 10-15m/hr but constantly dropped and levelled out around 7m/hr. ECDs were in the range of 1.84-1.89sg and higher than expected. These observations combined with the down hole weigh indicator showing that most of the weight was distributed to the AnderReamer indicated balling on the AnderReamer. The drilling progress was steady but slow with minimum ROP around 3-4 m/hr. At 2516m a drilling break occurred and ROP increased to 10m/hr. A new drilling break at 2532m further increased the ROP to 15-20 m/hr. The ROP slowed down quickly to a steady 8-9 m/hr, until 2664m where ROP slowed down to a steady 1-2 m/hr. At 2674m a nut plug was pumped and circulated around the BHA to erode possible balling. The plug showed immediate effect and ROP increased to initial 15-20 m/hr before stabilizing at around 5-7 m/hr to 2719m. From 2719m to 2733m the ROP again slowed down to an average speed of 2-3m/hr. A new nut plug pill was prepared but ROP increased and levelled out at 5-6 m/hr so no need was seen to pump the pill. The remaining of the hole from 2733m was drilled with an average ROP of 5-6m/hr until section TD was called at 2793m. The well was circulated bottoms up prior to pumping a slug and started to pull out of hole. Wiped through tight spot at 2678m and 2661m bit depth with over pulls of 10mT. It was not possible to wipe through a tight spot from 2610m to 2601m with max 15mT over pull (16mT bellow jar). Decision was made to run back to bottom and pump out of hole back reaming the tight spots. When pumping to the shoe tight spots at 2601m - 2595m, 2590m - 2576m, and 2563m - 2550m were back reamed. Hole conditions were constantly improving as the BHA was pumped out of hole with occasional ~5mT over pulls. While reciprocating the pipe with the AnderReamer below the casing shoe the well was circulated bottoms up. All DC power was lost to the drill floor, TDS and mud pumps. No pipe movement with the draw works or circulating with mud pumps was possible. To prevent the BHA from packing off, mud was circulated using the cement unit, and pipe reciprocated with the compensator. After 6hrs power to the draw works was re-established and the BHA could be pulled through the 16" liner shoe while circulating with the cement unit. On the 3rd attempt the AnderReamer was pulled through the shoe. It was not possible to pull through the liner with out pumping (max 18mT over pull and swabbing with pumps off, and no drag while pumping). On surface the drill pipe tool joints were partly covered with clay and the drill pipe slips got stuck for one hour due to gumbo. After repairing the slips the pipe was continued to be pumped out of hole until the bit was above the 16" top of liner. Full power to the rig systems was then restored prior to pull the BHA to surface. At surface the BHA was found partly balled up with clays. No hydrocarbon bearing Springar sandstone was found in this well.

All jewellery was laid down and a simple assembly made up, comprising of a 14 3/4" RR mill tooth bit made up directly to the backup AnderReamer (cutter arms 5m behind the bit). The objective of this assembly was to deepen the 14 3/4" rat hole (for long term suspension) and clean the hole prior to wireline logging and running the 13 3/8" x 14" casing. The assembly was run in hole and AnderReamer activated below the shoe. On bottoms from the shoe, a large quantity of cuttings came over the shakers indicating that the hole was not circulated clean when pulling out after the power failure. The hole was reamed easily from 2222m to 2442m. From 2442m to 2449m indications of the string packing off were experienced (increased SPP and reduced rotating weight). The AnderReamer arms were closed by reducing the pump rate and sting worked over the interval. Reaming was commenced and tight spots were encountered at (bit depth) 2468m, 2495-2498m, 2525-2565m, 2570-2575m and 2630m-2655m. The interval 2655m -2767m was reamed easily. The 14 3/4" rat hole from the previous section was opened to 17 1/2" hole at the interval 2762m-2788m (14 3/4" hole TD at 2793m). The hole was circulated clean at TD and a viscous pill was pumped around. The well was proved overbalanced by a flow check before a 3 std check trip was performed. Ran back to bottom and spotted a hi-vis pill. No resistance was observed while pumping out of hole to the 16" liner shoe. At the shoe the well was circulated clean. An increase in cuttings were observed, and well circulated clean after running one stand in the hole. A hi-vis pill was pumped around prior to pulling the AnderReamer through the liner. A large amount of big cuttings were observed over the shakers and the assembly was again run down into open hole and well circulated clean. The assembly was pulled inside the shoe without pumping before pulling dry to surface. The assembly was found partly balled up. The wellhead wash tool and WBRT was run in hole and the nominal bore protector pulled. Due to substantial

amount of clay found above and inside the RT a second cleaning run to the wellhead and BOP was performed. The jetting tool was laid down and rigged up for the 13 3/8" casing job. A 55m four joint shoe track was made up tube locking the 6 first couplings. The 13 3/8" casing was then run in hole. 8 rejects were experienced due to either to tight tolerances or course run-out threads. 4 of the 14" casing joints were rejected due to galled threads. Possibly due to weather causing excess rig movement or wind force acting on the joints while stabbing. The casing was landed in the wellhead with good indications on firm land off (shoe at 2779,64m). No losses were experienced running the casing. Operations proceeded with cementation of the casing. The job went according to program (200m +50% theoretically putting TOC at 2480m) until the casing was to be pressure tested on bump. The plugs proved not to be holding, and casing could not be pressure tested on green cement. The operation commenced setting and testing the hanger seals successfully. A good pressure test of the casing was then performed on hard cement. Due to the labour dispute, the well was to be prepared for long-term suspension. A 100m-suspension plug was set from 1950m to 1850m to act as the second barrier. The riser was displaced to seawater and BOP pulled. A wellhead corrosion cap was run and corrosion inhibitor spotted to protect the wellhead.

BHA # 5 Clean out assy. Drilled 61m hard cement at liner lap, and 36m hard cement above float collar. Plugs and floats were drilled, but no hard cement was found in shoe track. Drilled 3m of hard cement bellow the shoe and 5m of new formation.

List of Components:

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	5053229	14 3/4"	3"		7 5/8" R P	0,33	0,33		
Bit sub	TOL 702	9 1/2"	3"	7 5/8" R B	7 5/8" R B	0,91	1,24		
DC-Spiral	6002	9 1/2"	3 1/4"	7 5/8" R P	7 5/8" R B	9,25	10,49		
DC-Spiral	6006	9 1/2"	3 1/4"	7 5/8" R P	7 5/8" R B	8,96	19,45		
DC-Spiral	6009	9 1/2"	3 1/4"	7 5/8" R P	7 5/8" R B	9,34	28,79		
DC-Spiral	6022	9 1/2"	3 1/4"	7 5/8" R P	7 5/8" R B	9,04	37,83		
DC-Spiral	6008	9 1/2"	3 1/4"	7 5/8" R P	7 5/8" R B	9,24	47,07		
Jar	2501	9 1/2"	3"	7 5/8" R P	7 5/8" R B	9,88	56,95		
DC-Spiral	6004	9 1/2"	3 1/4"	7 5/8" R P	7 5/8" R B	9,33	66,28		
DC-Spiral	6023	9 1/2"	3 1/4"	7 5/8" R P	7 5/8" R B	9,17	75,45		
DC-Spiral	6003	9 1/2"	3"	7 5/8" R P	7 5/8" R B	9,28	84,73		
X-over	WN X/O 1241	9 1/2"	3,060"	7 5/8" R P	XT 57 B	1,23	85,96		
HWDP		5 7/8"	4"	XT 57 P		84,20	170,16		

No motor was used in this BHA.

BHA # 6 Drilled 40m new formation from 2253m to 2293 m

List of Components:

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc. length	Comments	Stab Gauge Out
Bit	JT4471	14 3/4"	-	-	7 5/8 R P	0.40	0.40		
PowerDriveXtra900	40	9 1/4"	-	7 5/8 R B	6 5/8 R B	4.45	4.85	w/Ported float	
Stabiliser	90058	14 1/2"	3"	6 5/8 R P	6 5/8 FH B	1.76	6.61		
ARC9	8159	9 1/2"	-	6 5/8 FH P	6 5/8 FH B	5.68	12.29		
PowerPulse w/GR	MDC 024	9"	-	6 5/8 FH P	6 5/8 R B	8.77	21.06	16.29m to survey	
14 1/2" NM Stab	ODT-3897	9 1/2"	3"	6 5/8 R P	6 5/8 R B	2.46	23.52		
Anderdrift	ADB 883	8"	3"	6 5/8 R P	6 5/8 R B	3.09	26.61		
X/O	54923	8"-9 1/2"	3"	6 5/8 R P	7 5/8 R B	0.87	27.48		
Ander	RB 1712	12 1/8" - 9	3 1/2"	7 5/8 R P	7 5/8 R B	6.91	34.39		

Reamer		1/2"							
X/O	53324	8"-9 1/2"	3"	7 5/8 R P	6 5/8 R B	1.20	35.59		
DC-Spiral	Tol 5016	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,17	44,77		
DC-Spiral	Tol 4003	8"	2 13/14"	6 5/8" RP	6 5/8" RB	8,91	53,68		
DC-Spiral	Tol 5011	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,18	62,86		
DC-Spiral	Tol 5012	8"	2 13/14"	6 5/8" RP	6 5/8" RB	8,76	71,62		
DC-Spiral	Tol 5004	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,08	80,70		
DC-Spiral	Tol 5010	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,05	89,75		
DC-Spiral	Tol 5005	8"	2 13/14"	6 5/8" RP	6 5/8" RB	8,98	98,73		
DC-Spiral	Tol 5025	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,00	106,52		
Jar	WHC-2207	8 1/16"	3"	6 5/8" RP	6 5/8" RB	9,77	116,29		
DC-Spiral	Tol 5020	8"	2 7/8"	6 5/8" RP	6 5/8" RB	9,15	125,44		
DC-Spiral	Tol 5018	8"	2 7/8"	6 5/8" RP	6 5/8" RB	8,67	134,11		
DC-Spiral	Tol 5019	8"	2 7/8"	6 5/8" RP	6 5/8" RB	9,11	143,22		
X-over	WN XOS 1244	8,000	2 7/8"	6 5/8" RP	XT 57B	1,22	144,44		
HWDP		8,875	4"	XT 57P	XT 57B	84,44	228,88		

Steering BHA

BHA # 7 Drilled 500m new formation from 2293m to 2793m.

List of Components:

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit (MX-09)	5051677	14 3/4"	3"		7 5/8" R P	0,32	0,32		
PowerDriveXtra900	40	9 1/4"	-	7 5/8 R B	6 5/8 R B	4.45	4.77	w/Ported float	
Stabiliser	90058	14 1/2"	3"	6 5/8 R P	6 5/8 FH B	1.76	6.53		
ARC9	8159	9 1/2"	-	6 5/8 FH P	6 5/8 FH B	5.68	12.21		
PowerPulse w/GR	MDC 024	9"	-	6 5/8 FH P	6 5/8 R B	8.77	20,98	16.29m to survey	
14 1/2" NM Stab	ODT-3897	9 1/2"	3"	6 5/8 R P	6 5/8 R B	2.46	23.44		
Anderdrift	ADB 883	8"	3"	6 5/8 R P	6 5/8 R B	3.09	26.53		
X/O	54923	8"-9 1/2"	3"	6 5/8 R P	7 5/8 R B	0.87	27.40		
Ander Reamer	RB 1712	12 1/8" - 9 1/2"	3 1/2"	7 5/8 R P	7 5/8 R B	6.91	34.31		
X/O	53324	8"-9 1/2"	3"	7 5/8 R P	6 5/8 R B	1.20	35.51		
DC-Spiral	Tol 5016	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,17	44,69		
DC-Spiral	Tol 4003	8"	2 13/14"	6 5/8" RP	6 5/8" RB	8,91	53,60		
DC-Spiral	Tol 5011	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,18	62,78		
DC-Spiral	Tol 5012	8"	2 13/14"	6 5/8" RP	6 5/8" RB	8,76	71,54		
DC-Spiral	Tol 5004	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,08	80,62		
DC-Spiral	Tol 5010	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,05	89,67		
DC-Spiral	Tol 5005	8"	2 13/14"	6 5/8" RP	6 5/8" RB	8,98	98,65		
DC-Spiral	Tol 5025	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,00	106,46		
Jar	WHC-2207	8 1/16"	3"	6 5/8" RP	6 5/8" RB	9,77	116,21		
DC-Spiral	Tol 5020	8"	2 7/8"	6 5/8" RP	6 5/8" RB	9,15	125,36		
DC-Spiral	Tol 5018	8"	2 7/8"	6 5/8" RP	6 5/8" RB	8,67	134,03		
DC-Spiral	Tol 5019	8"	2 7/8"	6 5/8" RP	6 5/8" RB	9,11	143,14		
X-over	WN XOS 1244	8,000	2 7/8"	6 5/8" RP	XT 57B	1,22	144,36		
HWDP		8,875	4"	XT 57P	XT 57B	84,44	228,80		

Steering BHA

BHA # 8 14 3/4"x 17 1/2" Clean out assy. Reamed stringers in 17 1/2" hole and deepened 17 1/2" shoulder from 2762m to 2788m.

List of Components:

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit (MX-01)	5053229	14 3/4"	3"		7 5/8" R P	0,33	0,33	5RR1	
Bit sub	XOS 804	9"	3"	7 5/8 R B	7 5/8 R B	0,92	1,25		
Ander Reamer	RB 1710	12 1/8" - 9 1/2"	3 1/2"	7 5/8 R P	7 5/8 R B	6,98	8,23		
X/O	IOT 95688	8"	2 7/8"	7 5/8 R P	6 5/8 R B	1,14	9,37		
DC-Spiral	Tol 5016	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,17	18,54		
DC-Spiral	Tol 4003	8"	2 13/14"	6 5/8" RP	6 5/8" RB	8,91	27,45		
DC-Spiral	Tol 5011	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,18	36,63		
DC-Spiral	Tol 5012	8"	2 13/14"	6 5/8" RP	6 5/8" RB	8,76	45,39		
DC-Spiral	Tol 5004	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,08	54,47		
DC-Spiral	Tol 5010	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,05	63,52		
DC-Spiral	Tol 5005	8"	2 13/14"	6 5/8" RP	6 5/8" RB	8,98	72,50		
DC-Spiral	Tol 5025	8"	2 13/14"	6 5/8" RP	6 5/8" RB	9,00	81,50		
Jar	WHC-2207	8 1/16"	3"	6 5/8" RP	6 5/8" RB	9,77	91,27		
DC-Spiral	Tol 5020	8"	2 7/8"	6 5/8" RP	6 5/8" RB	9,15	100,42		
DC-Spiral	Tol 5018	8"	2 7/8"	6 5/8" RP	6 5/8" RB	8,67	109,09		
DC-Spiral	Tol 5019	8"	2 7/8"	6 5/8" RP	6 5/8" RB	9,11	118,20		
X-over	WN XOS 1244	8,000	2 7/8"	6 5/8" RP	XT 57B	1,22	119,42		
HWDP		8,875	4"	XT 57P	XT 57B	84,44	203,86		

2.2 Bit Performance

Bit No. 5

#1 #2 #3 #center

Nozzlos: 20/20/22/20

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
14,750	Rock		115	Hughes	MX-1	5053229	1,356
<i>Features:</i>							
<i>Condition in:</i> New							
<i>Hydraulics:</i>							

Dull Grading:		0-1-WT-H-E-I-BU-TD						
	Date & Time	MD	Cumulative Run Hours					
In:	19:45 10/07	1288m	Pump	Drill	Ream	Circ	Other	TOTAL
Out:	03:3013/07	2253						
	ROP	105m	in	14,75hrs	=	7,12m/hr	Size 16"	Depth 2205
	Cmt/shoetrack:							

Bit No. 6

#1 #2 #3 #4 #5 #6 AnderReamer

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
14 3/4"		PDC	M222	Smith	MRS74PX	JT4471	1,335
<i>Features:</i>							
<i>Condition in:</i> New							
<i>Hydraulics:</i> With MW 1,81 s.g. At 3600lpm Bit ΔP 45bar H.S.I 2,2							

Dull Grading:		0-0-BU-A-X-I-NO-PR						
	Date & Time	MD	Cumulative Run Hours					
In:	03:45 13/07	2253m	Pump	Drill	Ream	Circ	Other	TOTAL

Out:	01:00 15/07	2293m	17,6	6,2	0,0	11,4	27,6	45,25
	ROP:	40m	in	6,2hrs	=	6,5	m/hr	

Bit No. 7

Nozzlos: #1 #2 #3 #centre
 20 20 22 22

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
14 3/4"	Insert		435	BHC	MX-09	5051677	1,356
<i>Features:</i>							
<i>Condition in:</i> New							
<i>Hydraulics:</i> With MW 1,81 s.g. At 3600lpm Bit ΔP 45bar H.S.I. 2,2							

Dull Grading:		1-1-BU-A-F-I-NO-TD						
Date & Time	MD	Cumulative Run Hours						
		<i>Pump</i>	<i>Drill</i>	<i>Ream</i>	<i>Circ</i>	<i>Other</i>	<i>TOTAL</i>	
In: 02:00 15/07	2293m							
Out: 07:00 21/07	2793m	114	75,9	6,0	32,1	35	149	
	ROP:	500m	in	75,9hrs	=	6,6	m/hr	

Bit No. 5RR1

Nozzlos: #1 #2 #3 #center
 20 20 20 20

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
14,750	Rock		115	Hughes	MX-1	5053229	1,227
<i>Features:</i>							
<i>Condition in:</i> Used (Dull when pulled: 0-1-WT-H-E-I-BU-TD)							
<i>Hydraulics:</i>							

Dull Grading:		1-1-WT-A-E-I-NO-TD						
Date & Time	MD	Cumulative Run Hours						
		<i>Pump</i>	<i>Drill</i>	<i>Ream</i>	<i>Circ</i>	<i>Other</i>	<i>TOTAL</i>	
	ROP:	26	in	7,5hrs	=	3,47	m/hr	

2.3 Drilling Parameters

BHA #5:

PARAMETERS:	Comments:							
	FLW	SPP	RPM	WOB	TRQ	STRING WEIGHTS		
	(lpm)	(bar)	(string)	(MT)	(KN.m)	ROT (kdaN)	UP (kdaN)	DN (kdaN)
Min	3670	220	65	3	6			
Max	4070	310	125	16	11			

BHA #6:

PARAMETERS:	Comments:							
	FLW	SPP	RPM	WOB	TRQ	STRING WEIGHTS		
	(lpm)	(bar)	(string)	(MT)	(KdN.m)	ROT (kdaN)	UP (kdaN)	DN (kdaN)
Min	3600	280	50	4	9	130	131	129
Max	3950	290	135	17	13	130	131	129

BHA #7:

PARAMETERS:	Comments:							
	FLW	SPP	RPM	WOB	TRQ	STRING WEIGHTS		
	(lpm)	(bar)	(string)	(MT)	(KN.m)	ROT (kdaN)	UP (kdaN)	DN (kdaN)
Min	3340	290	100	15	11	130	131	129
Max	3580	300	175	25	18	130	132	127

BHA #8:

PARAMETERS:	Comments:							
	FLW	SPP	RPM	WOB	TRQ	STRING WEIGHTS		
	(lpm)	(bar)	(string)	(MT)	(KN.m)	ROT (kdaN)	UP (kdaN)	DN (kdaN)
Min	3770	296	100		15			
Max	3770	296	100		15			

2.4 Equipment Failures

- Suction problems on mud pump.
- Loss of DC power to rig floor, TDS and mud pumps.
- Shut down of power to drillers console (faulty purge air alarm system).
- Fault with Eaglelite control panel.

2.5 Conclusions and Recommendations

Conclusion:

A few fact might have contributed to the PDC bit balling up on the first 14 3/4" x 17 1/2" drilling BHA:

- Poor or minimum mud properties at start of drilling the 14 3/4" x 17 1/2" section due to the severe cement contamination when drilling the cement on the 16" liner lap and on top of shoe.
- Long exposure time of deep 17"x20" rat hole below 16" shoe. The 17" rat hole was 43m below the 16" casing shoe and exposed for 8.5 days.
- Due to various pump problems less than maximum flow rates was achieved.
- Individual Anderreamer arms and cutters are not cleaned by dedicated nozzles/mudflow

Recommendations:

- Ensure the mud properties are within specifications when clearing out the rat hole below the casing shoe. This is especially important when reactive shales are exposed.
- Prior to drilling the Tare in this area, mud properties and bit design need to be optimized to avoid balling.
- Avoid long rat holes. Rat hole should not be longer than absolutely required.
- Aim for maximum flow rate when drilling out rat holes.
- Consider having one dedicated nozzle for each under reamer arm to ensure cutters are constantly cleaned by a dedicated directed mud flow to prevent build up of cuttings on the cutters (build up of cuttings will increase the risk of balling up the under reamer).
- Pumping a medium size nut plug (150kg/m³) can clean up balled down hole tools.
- Prevent high ECD when drilling pilot holes.
- ROP can be lower than expected when running under reamer or bi-centre bits. It will (maybe) better to install nozzles for each under reamer arm to improve to improve cleaning of the cutters and prevent/reduce the chance of balling up the cutters.
- Down hole WOB and torque is a very useful tool when analyzing slow ROP, down hole problems etc.
- Use only 5 7/8" DP to drill this section. This might require a review on BOP configuration to facilitate DP landing and shearing capability.
- Use 9 1/2" DC instead of 8" DC to provide more weight. Design for BHA without changing connection types.
- Pumping a 35ppg nut plug pill seemed to be effective to clear balling of down hole tools and reduce ECD. At two occasions ROP was enhanced after pumping the pill.

3.0 Drilling Fluids

A total of 802 m³ Glydril mud was transferred in from the 20" section. The volume in the active and in most of the surface volume except column-tank was already contaminated with cement as described in the 20" section. The treatment for cement contamination was continued when 5m of new formation was drilled to 2253m. Left the mud in the hole at a pH in the range of 10-10.5. The mud system was very viscous due to flocculated formation clays, and the fact that a 23 m³ high viscosity pill was incorporated into the active system from below the cement-plug inside the 16" liner.

While tripping, a full pit of premix was built with straight KCl-brine and high concentration of Polypac ELV. No viscosifier was added. Treated active system with approximately 15% dilution of this premix. However, the addition took longer time than originally planned. Mud properties were therefore not within specifications for all parameters at start of drilling. Mud specifications was soon improved and within specifications, as a continuous treatment was performed. Treatment for cement contamination with Citric Acid and Sodium Bicarbonate was also continued. Specifications were met prior to experiencing severe bit balling problems. Extra Polypac ELV was added along with KCl-powder to increase inhibition properties.

As an attempt to dry out balled bit and BHA, a 25% by volume Glydril MC pill in pure KCl-brine was pumped as per M-I Swaco recommendations. A total of 13.5 m³ was pumped. No effect was seen from this action. Circulating the pill out of the hole, a minimum MW of 1.41 sg was observed and light mud was directed to fill up empty sand-traps. Reason for that was the limited mixing capacity for Barite, and thereby an attempt to minimize the amount required to bring the MW back to 1.81 sg into the well. Still the system could not cope with the reduced MW and a minimum MW of 1.72 going in was registered. It was however decided to POOH from 2292m even if MW was not evened out at 1.81 sg throughout the system.

Another weighted premix was prepared and added while circulating to condition mud prior to drilling ahead after bit trip. This dilution brought the KCl-content up above 150 kg/m³ and API fluid loss down to approximately 3 ml. In addition the glycol level had increased to approximately 6 vol% after incorporation of Glydril MC from the bit balling pill. The mud system had now greatly improved the inhibition properties and drilling was commenced.

In the early part of the section KCl-powder was added directly to the active at a typical rate of 2-3000 kg per 12 hr shift. The KCl-level was slowly increasing, by addition of premixes with pure brine, as agreed upon with onshore team. Also Polypac ELV was added at a slow rate in periods to maintain good clay encapsulation. The Glycol level was maintained at the high level of approximately 6 vol%. Citric Acid and Sodium Bicarbonate was added to reduce pH and Calcium to acceptable levels, as some cement was picked up by the mud system in the early phase of drilling.

Mud parameters were stable throughout the rest of the section. The level of LGS increased with the low ROP's, but did not effect the viscosity profile except for 10 min gels. The gels however never did exceed specifications. The shakers were run with finest screens possible to minimize fine solids build-up. Even running two shakers with 30 mesh top screens over 210 mesh bottom screens was no problem with the VSM-300 shakers. See comments under Solids Control section.

Started drilling with 1.81 SG and kept that weight for the entire section. At the end of section while wiper tripping and conditioning the hole the mud weight increased briefly to 1,84 SG but was reduced to 1,82 by addition of light premix.

3.1 Brief Overview of Mud System

Mud Type: Glydrill mud

	Unit	Planned	Actual
Density	s.g.	1.82	1.81
PV	cP	alap	43
YP	Pa	15 - 25	17
Gel 10 sec	Pa	>4	5
Gel 10 min	Pa	<25	15
Fann	3 rpm	12 - 16	12
API	ml	2 - 4	3.2
Cake	mm	<1	1
pH		7.5 - 8.5	8.5
KCl	kg/m ³	140 - 170	160
Glycol	%	3.5 - 5	6
Ca++	mg/l	<1000	400
MBT	kg/m ³	<60	40
LGS	kg/m ³	<200	75

3.2 Hole Cleaning

The Underreamer balled up due to poor cleaning from only two nozzles. This caused some of the low ROP and crushed the cuttings up to mush. During drilling the cuttings was just like paste, but well inhibited when they were taken apart.

3.3 Solids Control Equipment

Shakers were dressed with 10 mesh on top and 175 mesh on bottom at start off. Later changed to 20 mesh on two shakers, and 30 mesh on the other two. Only three shakers were utilized at the same time, giving a good opportunity to keep screens in good condition. As drilling was slow, 210 mesh screens were fitted on all four shakers. Even with these fine screens it was possible to run only two shakers. 175 mesh screens were also used in order to reduce screen wear and need for repairs.

3.4 Drilling Fluids/Hole Cleaning Recommendations

4.0 Surveying

4.1 General Discussion

SURVEY DATA: *Comments:* VS Azimuth: 0.00

	MD	Inc	Azm	TVD	VS	N/-S	E/-W	Max DLS
First survey:	2034,15	0,19	283,27	2033,91	7,59	7,59	15,47	0,38
Last survey:	2772,01	0,13	236,86	2771,77	8,11	8,11	14,36	

4.2 Recommendations

5.0 Casing and Cementing

5.1 General Discussion

5.2 13 3/8" x 14" Casing Job

13 3/8" Casing:

Nominal weight: 72 lbf
Grade: P-110
Connection: Vam Top
Nominal ID: 313,61mm
Drift diameter: 311,15mm
Coupling OD: 14,291"
Make-up loss: 14,47cm
Make-up torque: 23150lbs (FF=1,0)

14" Casing:

Nominal weight: 114 lbf
Grade: P-110
Connection: Vam Top SC80
Nominal ID: 314,96mm
Drift diameter: 311,15mm
Coupling OD: 15,006"
Make-up loss: 17,64cm
Make-up torque: 30000lbs (FF=1,0)

5.2.1 Highlights

Prior to running the 13 3/8" x 14" casing there were some concern about the exciting hole condition. The hole had been open to WBM for +-12 days and Tare formation below the 16" liner shoe had started to break down. Never the less the casing was run across the open hole without significant formation related problems. The string picked up some weight at one point but was easily wiped through. No fill was observed at bottom and circulation was not required. The hanger landed promptly in the wellhead indicating the casing was not standing up on bottom. No losses were experienced while running casing. Casing setting depth is 2779,64mRKB.

5.2.2 Lowlights

Excessive number of casing was rejected causing downtime and interrupting the workflow, as they needed to be laid down again on the pipe deck. 8 joint of 13 3/8" casing was rejected. The casing crew experienced problems with high shoulders or no shoulder. According to the Weatherford representatives and a VAM thread inspector present on the job this was caused by two possible reasons; tight tolerances i.e. large pins and small boxes, or course run-out threads. After crossing over to the 14" casing the weather picked up resulting in rig movement and increased wind pressure to the casing prior to stabbing. On to occasions the threads galled causing 4 rejected 14" casing job. As many of the rig crews onboard were new to the rig and unfamiliar with the rig tubular handling system. Added the make up problems the running speed of the casing was not to great. From start of rigging up till finishing clearing the drill floor of casing equipment, 2450m of 13 3/8" x 14" casing was installed in 57,75hrs including landing the hanger and setting the hanger seals. Actual running time of the casing itself was on average 4.6 joints/hr including rejects and problems making up the connections.

5.3 13 3/8 x 14" Cement Job

Spacer design ahead:

Volume of spacer: 18m3
Pump rate: 1000lpm
Weight: 1.88 s.g.
Base fluid: Drill water

Additives: NF-6 as required
Tuned spacer E+ 32kg/m3
Barite 1130kg/m3

Primary slurry

Volume of slurry: 23.53m3 ahead of top plug.
Excess: 50%
Pump rate: 800-900 lpm
Weight: 1.95 s.g.
Slurry yield (G): 72.92 l/100kg
Base fluid: Fresh water

Additives: HR-4L 1.6 l/100kg
Halad-613L 1.5 l/100kg
NF-6 0.10 l/100kg

Spacer design behind:

Volume of spacer: 2,86m3
Pump rate: 650lpm
Weight: 1.00 s.g.
Base fluid: Drill water

Additives: None

5.3.2 Highlights

The spacer ahead was pumped using the rig pumps. Mixing and pumping the cement went according to plan with good indications the bottom plug releasing, and positive shear of the top plug. The cement weight was even throughout the job and cement unit and cementers performed excellent. Due to the barrier requirement (long term suspension) a 55m shoe track was left in the well

5.3.1 Lowlights

The plug bumped with 70bar over FCP, but pressure could not be held. The casing could therefore not be tested on green cement. No surface lines proved to leak. Floats were holding and a good pressure test was obtained on hard cement indicating the plugs had not held pressure from above. 4,5hrs spend waiting on cement. The casing was tallied onshore. Lengths of joints were measured correctly, but several errors in the reported tally for the 13 3/8" casing existed.

5.3 13 3/8 x 14" Suspension plug

Spacer design ahead:

Volume of spacer: 7m3
Pump rate: 1000lpm
Weight: 1.88 s.g.
Base fluid: Drill water

Additives: NF-6 as required
Tuned spacer E+ 32kg/m3
Barite 1130kg/m3

Primary slurry

Volume of slurry: 7,83m3
Excess: 0%
Pump rate: 800-900 lpm
Weight: 1.95 s.g.
Slurry yield (G): 72.92 l/100kg
Base fluid: Fresh water

Additives:	HR-4L	1.6 l/100kg
	Halad-613L	1.5 l/100kg
	NF-6	0.10 l/100kg

Spacer design behind:

Volume of spacer:	1m ³
Pump rate:	1000lpm
Weight:	1.88 s.g.
Base fluid:	Drill water

Additives:	NF-6 as required	
	Tuned spacer E+	32kg/m ³
	Barite	1130kg/m ³

5.3.2 Highlights

The Suspension plug was set as pr. Program from 1950m to 1850,

5.3.1 Lowlights

None.

5.3 Casing and Cementing Recommendations

- The reason for plugs not holding pressure was not identified. But reference to offset data on the plug system should be revised to identify if this is a “common” problem or a “once off” occurrence.
- Better QA/QC of the onshore tally, both onshore and offshore.

Section Review Report

Onyx SW Exploration - Transocean Leader

Well 6406/9-1

Drilling 17x20" Hole
Running & Cementing 16" Liner

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1.0 Executive Summary

1.1 Brief Outline of the Objective

The section objectives were:

- a. No harm to people or the environment
- b. Drill 20" over-gauge hole, confirmed with memory calliper
- c. Obtain basic formation evaluation data (GR/resistivity)
- d. Maintain a vertical trajectory, <2° inclination
- e. Field prove the Coriolis EKDS system
- f. Section to be drilled to 2,241m TVD RKB / 2,210m TVD RKB
- g. Base case
 - i. Land 16" intermediate liner in 20" profile
 - ii. Cement with 300m cement column
- h. Establish the formation integrity (limit to 1.86 s.g.) at the 20" casing shoe and section TD. If criteria met [FIT=1.85 s.g. at the 20" casing shoe and 1.85 s.g. PWD dynamic (drilling circulation rate) FIT test with 1.81 s.g. mud at TD] the 16" intermediate liner would be omitted.
- i. Pressure test the 16" liner / seal assembly to 138 bar.

Accomplishments:

- a. Achieved, no incidents, no accidents, no near misses, no spills.
- b. QA/QC's calliper indicates 20" gauge hole to 2,114m
- c. No problems obtaining formation evaluation data
- d. Maximum inclination 0.82 degrees, maximum DLS 0.59 deg/30m.
- e. The Coriolis EKDS system was not used during this section
- f. Section was drilled to 2,248m TVD (17" hole), 2,216m TVD (20" hole)
- g. Unable to land 16" liner in 20" profile, liner cemented in place with a 200m (+50% excess) column of cement 1.2m above the landing profile. 40m equivalent cement pumped behind the top plug.
- h. Achieved an FIT of 1.73 s.g. at the 20" casing shoe, requiring the setting of a 16" intermediate liner
- i. 16" liner was pressure tested to 138 bar, however, seal assembly could not hold pressure as it was set in the 20" casing

1.2 Time Breakdown

Operation	Target Time (days)	Budget Time (days)	Actual Time (days)	Productive Time (%)	Lost Time (%)	Down Time (%)
Drill 17x20" hole	2.6	3.4	5.4	94.6	0.0	5.4
Run & cement 16" liner	1.5	2.0	3.9	57.1	0.0	42.9
Test BOP	N/A	N/A	1.4	33.3	0.0	66.7

1.3 Summary of Incidents, Down Time, Lost Time, and Associated Causes

1.3.1 Incidents

No reportable incidents or near misses during this section.

RUIs reported into the Synergi system:

More than 100 persons onboard

The crew change helicopter let off all passengers on the Transocean Leader and continued on to the Transocean Searcher empty to pick up a back-up VX gasket, before it returned to the Transocean Leader to pick up the departing passengers. This made the POB on the Transocean Leader temporarily 111.

Action: Make sure that Shell helibooking policy and Transocean /Norwegian regulations for safety onboard correspond.

Mixing/circulating mud in the pump room

Mix pump #3 was lined up to fill trip tank with seawater from pit #8, whilst mix pump #2 was lined up to pit #4. Derrickman observed a 5 m³ increase in the level of pit #4, investigation showed that this was seawater from pit #8. No leaks were found.

Action: The text in RSP42 has been changed to reinforce pit room routines. Inform all crew to check all line-ups, walk the line.

Slippery mat in cabin

Person slipped & almost fell backwards when stepping out from the bathroom onto the mat on the floor of the cabin as the floor was wet & the mat did not grip.

Action: Cabin floors to be dried before replacing the mats

Lighter found in coverall pocket

A butane lighter was found in a pocket of one of the coveralls handed in to the laundry, most likely brought onto the rig during the yard stay in Ølen. Lighters are not allowed on board due to the risk of ignition/explosion in tumble dryers & the risk of sparks outside.

Action: All pockets to be checked before handing in coverall to laundry. Crew to be informed on safety meetings.

Lack of suction from pit #5

Unable to get suction from pit #5 when lined up to pump spacer ahead of cement on 16" liner job. Spacer was transferred to pit #8 and pumped downhole. Also experienced varying pump pressure and low pump efficiency when displacing cement from drillfloor to casing shoe. Opened mud pump strainers and found them clogged with polymers. Strainers were cleaned and pumping continued successfully.

Action: Clean suction filters on mud pumps – to be brought up in safety meetings for all drilling & deck crew.

Lack of suction from pit#5

Incident as above. Following the incident, pit #5 was emptied and the suction valve and valve operation inspected. Valve was found to be malfunctioning, resulting in a closing action when attempting to pump fluid from the pit. Further investigations resulted in an unintentional transfer of 5 m³ mud from pit #3 to pit #5.

Action: Repair suction valve. Open strainers and clean them regularly. Check that mud is mixed in a manner that does not create long polymer chains (lumps). Bring this RUI up in safety meetings with all drill crews.

Unsafe installation of soap dispenser in galley

New soap dispenser for the dishwasher (230V) was connected between 440V and earth (ground). This is a shortcut to get 230V as 440V: V3 = about 240V, but this has great potential. If earthing on the dishwasher was poor, the whole housing of the dishwasher could get a potential of 440V, meaning that a person who was touching the dishwasher and ground (e.g. a sink) could sustain a serious injury. Soap dispenser has been reconnected to 230V circuit in dishwasher.

Action: All 3rd party electrical installations must be approved by the rig electrician.

1.3.2 Down Time (NPT)

Down Time Incident and Cause	Down Time (hrs)
Changed out Rhinoreamer	1.00
Washed/drilled out cement in 20" casing	2.25
Leaks during FIT	2.00
Change out of oil filter on TDS	0.50
Repairing mud pump #2	2.75
Repairing mud pump #1	0.75
Unable to land 16" liner in landing profile (including subsequent BOP test tool seating problems)	62.25
No suction on pit #5	0.50

Total down time (NPT) for the section was 72 hrs.

1.3.3 Lost Time (WOW, etc)

Lost Time Incident and Cause	Lost Time (hrs)

No lost time during this section.

1.4 Chemical Discharge

1.4.1 Mud

Less mud than planned was used & discharged on this section, as due to the efficiency of the shakers less dilution due to cuttings was required.

1.4.2 Cement

More NF-6 was used for the primary cement job due to the barrier requirement of an additional 40m of cement above the float collar, as well as the usage of NF-6 in the spacer does not appear to have been accounted for in the planned volumes.

As a liner lap squeeze had to be performed, more chemicals were used than planned during this section. Less retarder than planned was used, this could be attributed to the final recommended concentration of retarder being lower than that initially planned. Discharge values were calculated as maximum 3.5% of that pumped, although theoretically there should be no discharge to sea of cement slurry. Discharge values were within that of the discharge permit.

Chemical	Planned usage	Actual usage
Class G cement	44 MT	66 MT
CFR-5LE	257 kg	371 kg
HR-5L	670 kg	377 kg
Halad-613L	1,126 kg	996 kg

NF-6	42 kg	128 kg
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A total of 7 m³ Tuned Spacer E+/Glydril mud mixture had to be backloaded to shore as this was left pumpable in pits #5 & 8.

1.4.3 Rig Chemicals

Nothing to report.

2.0 Drilling Performance

2.1 Operational summary

Whilst preparing to pick up the BHA it was realised that the Rhinoreamer pre-made up in the assembly was of the “shear-pin” type, rather than the “drop-ball” type. The “drop-ball” type Rhinoreamer was preferred as this would render better control (i.e. the avoidance of accidental activation of the reamer inside casing) whilst pumping with the Rhinoreamer still in the casing. The “shear-pin” type therefore had to be changed out, requiring an hour unnecessary rig time. The BHA was made up without further issues and run in hole, filling pipe every 10 stands. A stripping drill was conducted whilst running in hole. A reasonably high amount of downweight was required to force the tooljoint through the annular, attributed to the well not having been circulated with the new mud for a great amount of time prior to the drill (cold mud). The 16” liner adaptor sub was tagged at approximately 1,290m, the string was then picked up and gently rotated/washed past the adaptor sub point. Cement was tagged at 1,300m. After a couple of meters of fairly soft cement, the cement hardened up considerably, requiring the remainder of the cement inside the casing to be drilled out. At 1,340m (approx. float collar depth) the hole was circulated clean of cement. A pressure test of the 20” casing to 138 bar confirmed good cement. The well was displaced to 1.55 s.g. Glydril mud whilst drilling shoe & cement. Washed down to 26” rathole TD at 1,380m & drilled 5m new formation. There were no indications of cement sheathing or cement blocks whilst drilling cement/formation.

Made three attempts to conduct an FIT with the 1.55 s.g. Glydril mud. Due to a line-up issue, or leaking valves in the choke manifold, large pressure loss were observed on the cement unit whilst pressuring up according to the programme. On the third attempt it was decided to isolate the choke manifold, thereby only pumping down the drill string, this time a solid test was obtained. The choke valve was subsequently pressure tested ok, hence it is not known what caused the problem. The desired FIT limit test result was 1.86 s.g., however, the actual result was only 1.73 s.g. Hence, according to the conditions of the programme, the 16” liner would have to be installed.

It was decided to activate the Rhinoreamer at the point where the Rhinoreamer would hit the 17” ledge, hence giving a good indication of positive action. A pressure peak was observed when the ball seated in the Rhinoreamer, and once drilling commenced a torque increase was observed indicating the reaming action of the Rhinoreamer. Several hard limestone stringers were observed whilst drilling the 17x20” hole, reducing the ROP from around 15 – 20 m/hr, to 0.5 – 3 m/hr. Pore pressure increased steadily during the section, from an initial 1.2 s.g. to 1.62 s.g. by TD (pore pressure values as indicated by the geologist’s Pore Pressure Prediction programme). Slightly increased torque from 1,740m whilst back-reaming on connections indicated the increase in pore pressure, no other indications, such as pressure cavings or increased gas readings, were observed until 1,770m, when small cavings started to appear on the shakers. Mud weight was increased to 1.58 s.g., and drilling continued with this mud weight until 1,920m when some more cavings were observed on the shakers, rendering an increase in the mud weight to 1.61 s.g. Weighting up of the mud then continued as per the prepared “weigh-up schedule”.

Experienced extensive problems with the mud pumps whilst drilling the hole. Throughout part of the section mud pump #3 was down due to an electrical problem with the motor, whilst mud pump #2 was down due to a washed out module (on discharge end), requiring replacement. The latter caused 2.75 hrs downtime due to the fact that, with pump #3 down, only one pump was available for service, and hence drilling had to stop whilst waiting for the pump to be repaired. Worked the pipe & circulated whilst waiting, removing a stand every hour to minimise erosion/washouts. As repairs on mud pump #3 were completed during this waiting period, drilling continued until 1,971m, when the gauge on the pulsation dampener on mud pump #1 failed, requiring replacement of the HP fitting and entire gauge assembly. This caused 0.75 hrs

downtime, during which time the well was circulated on mud pump #3 & string reciprocated as before.

At 2,000m a drilling break was observed, whereby the ROP increased from 15 m/hr to 40 m/hr, however the resulting flowcheck was negative. At 2,021m, the repairs on mud pump #2 were complete, and drilling continued to TD with all pumps online.

Mud was weighed up as per the planned weighing up schedule, and no cavings were observed on the shakers. At 2,114m the well had to be circulated clean, however, due to extensive cuttings coming over the shakers. Mud weight at TD was 1.70 s.g. No indications of poor hole cleaning (i.e. high ECD) were observed on the PWD sub, however, this had started to show erratic readings. See section 4 for further details.

Inclination was steady & averaging less than 0.5 degrees, maximum being 0.87 degrees.

During drilling the primary standpipe experienced a wash-out, hence the back-up standpipe had to be used, this limits the ability to use the riser booster line. The primary standpipe was repaired offline during cementing & BOP testing.

Throughout the drilling a small amount of gas bubbles were observed by the ROV, coming from 30"x20" wellhead annulus. The flow appeared to be steady, with a slight increasing trend, indicating the possibility of channelling in one of the cement columns (30" or 20").

At TD the well was circulated bottoms up. Steady amount of cuttings coming over the shakers, hole appeared to be in good condition. The maximum gas peak was 5.58%, believed to come from 2,244m (based on lag time). Whilst pulling out the string was rotated at 100 rpm & the well was circulated at 1,900 lpm, the former to ensure an even, average reading of the MWD calliper & the latter, as a back-up, to mechanically check the gauge of the hole with the Rhinoreamer. Pulling speed had to be restricted to 250m/hr to obtain reasonable MWD data.

At 1,737m and 1,497m, large amounts of cuttings were observed on the shakers. This could be an indication of potential washouts containing gelled mud & cuttings & scoured out by the bit/Rhinoreamer pulling/jetting past. Could not boost the riser due to the back-up standpipe being used to circulate the hole.

A 5 MT overpull test of the Rhinoreamer was conducted at the shoe, positive indication of Rhinoreamer functioning. No further overpull was observed whilst pulling past the shoe after stopping the pumps & resetting the Rhinoreamer to cutter arm retract mode. Pulled the remaining assembly out of the hole, gently passing the 16" liner adaptor sub to ensure no damage to the seals. The bit came out with minor wear and in gauge, the Rhinoreamer was also in very good condition, with only a couple of broken cutters indicating its work downhole.

The wear bushing was pulled using the multi purpose tool, with an SPS jetting sub assembly to wash the BOPs/wellhead area whilst running in hole. No washing was conducted with the wearbushing removed (risk of damaging seal/shoulder areas).

For liner running & cementing, see section 5.

Following the liner lap squeeze & dress-off run, preparations were made to test the BOP. It was not possible to land off the special BOP test tool (this is used when the bore protector is installed) in the wellhead, believed to be due to debris in the wellhead preventing the tool to seat. The tool was pulled to surface and inspected, large chunks of hard cement were found inside the tool. A jetting run with the SPS jetting sub was therefore performed and the special BOP test tool re-run. Again it was not possible to seat the tool. Pulled to surface and inspected the tool, the tool was now packed full of cement. It was decided to pull the nominal bore protector & test the BOP with the BOP test plug after jetting/washing the BOP & riser. The test plug landed off

in the wellhead without further issues & the BOP was tested as per programme. The large amounts of cement are likely from a sheath of cement formed at the inside of the 20" casing.

BHA # 3 Drilled from 1,380 m to section TD at 2,248 m

List of Components:

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	MJ 4610	17"	3.75"	N/A	7 5/8" R	0.42	0.42		
DH motor	A1125M3 436SP	11.88"	3"	7 5/8" R	7 5/8" R	8.84	8.86		
Float sub	FLX010	11.25"	3"	7 5/8" R	7 5/8" R	1.50	10.36		
ARC w/APWD	0401	10"	3"	7 5/8" R	7 5/8" R	6.13	16.49		
PowerPulse	487	9.5"	3"	7 5/8" R	7 5/8" R	8.42	24.91		
NM stab	35833	17"	3"	7 5/8" R	7 5/8" R	2.01	26.92		17"
Anderdrift	972	9.5"	3"	7 5/8" R	7 5/8" R	3.00	29.92		
Rhinoreamer	G84972	20"	3.935"	7 5/8" R	7 5/8" R	4.09	34.01		
NMDC	6543-2	9.5"	3"	7 5/8" R	7 5/8" R	7.71	41.72		
DC	6002	9.5"	3.25"	7 5/8" R	7 5/8" R	9.25	50.97	Spiral	
DC	6006	9.5"	3.25"	7 5/8" R	7 5/8" R	8.96	59.93	"	
DC	6009	9.5"	3.25"	7 5/8" R	7 5/8" R	9.34	69.27	"	
DC	6022	9.5"	3.25"	7 5/8" R	7 5/8" R	9.04	78.31	"	
DC	6008	9.5"	3.25"	7 5/8" R	7 5/8" R	9.34	87.55	"	
Jar	2501	9.5"	3"	7 5/8" R	7 5/8" R	9.88	97.43		
DC	6004	9.5"	3.25"	7 5/8" R	7 5/8" R	9.33	106.76	Spiral	
DC	6023	9.5"	3.25"	7 5/8" R	7 5/8" R	9.17	115.93	"	
DC	6003	9.5"	3.25"	7 5/8" R	7 5/8" R	9.28	125.21	"	
X/O	1241	9.5"	3.06"	XT 57	7 5/8" R	1.23	126.44		
HWDP		5.875"	4"	XT 57	XT 57	84.20	210.64		

Motor Spec:	Stab	Bend	Rotor Nozzle	rev/gal	Opt. ΔP	Stator	R/S gap	Bearing In /Out	Stab Out
A1125 M3436 SP	11 7/8"	Straight	No	0.115	25	100D	0.03m m	1mm/1 mm	17"

BHA # 4 Drilled cement from 1,275 m to 1,288 m (TOL)

List of Components:

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
17 1/2" bit	MM 4769	17 1/2"	3"	-	7 5/8" R	0.45	0.45		
Bit sub	TOL 702	9 1/2"	3"	7 5/8" R	7 5/8" R	0.91	1.36		
Spiral DC	6002	9 1/2"	3 1/4"	7 5/8" R	7 5/8" R	9.25	10.61		
Spiral DC	6006	9 1/2"	3 1/4"	7 5/8" R	7 5/8" R	8.96	19.57		
Spiral DC	6009	9 1/2"	3 1/4"	7 5/8" R	7 5/8" R	9.34	28.91		
Spiral DC	6022	9 1/2"	3 1/4"	7 5/8" R	7 5/8" R	9.04	37.95		
Spiral DC	6008	9 1/2"	3 1/4"	7 5/8" R	7 5/8" R	9.24	47.19		
Jar	2501	9 1/2"	3"	7 5/8" R	7 5/8" R	9.88	57.07		
Spiral DC	6004	9 1/2"	3 1/4"	7 5/8" R	7 5/8" R	9.33	66.40		
Spiral DC	6023	9 1/2"	3 1/4"	7 5/8" R	7 5/8" R	9.17	75.57		
Spiral DC	6003	9 1/2"	3 1/4"	7 5/8" R	7 5/8" R	9.28	84.85		
Cross over	WN X/O	9 1/2"	3.06"	7 5/8" R	XT 57	1.23	86.08		

	1241								
HWDP		5 7/8"	4"	XT 57	XT 57	84.20	170.28		

2.2 Bit Performance

Bit No. 3

Nozzles: #1 22 #2 22 #3 20 #center 18

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
17"	Insert	-	515M	Smith	20GM	MJ 4610	1.298
<i>Features:</i>	Double sealed roller bearing, aggressive tooth shaped inserts and carbide gauge protection						
<i>Condition in:</i>	New						
<i>Hydraulics:</i>	With a MW of	1.70 s.g.	at	4500 lpm	Bit DP=	82 bar	HSI = 1.4

Dull Grading:		1-1-NO-A-E-I-NO-TD						
	Date & Time	MD	Cumulative Run Hours					
In:	11:00 30/06	1,380m	<i>Pump</i>	<i>Drill</i>	<i>Ream</i>	<i>Circ</i>	<i>Other</i>	<i>TOTAL</i>
Out:	11:30 05/07	2,248m	84.0	47.6	5.0	31.4	41.3	125.25
	ROP:	868 m	in	47.6 hrs	=	18.2	m/hr	
	Rotary drilled:	868 m	in	47.6 hrs	18.2 m/hr	% Rotated:		100%
	Sliding	0 m	in	0.0 hrs		% Sliding:		0%
	Cmt/shoetrack:					Size	Depth	
		Yes	Drilled:	12 m	Cmt hrs:	0.7 hrs	20"	1,367.8 m

Bit No. 4

Nozzles: #1 24 #2 24 #3 24 #center 18

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
17 1/2"	Milled tooth	-	115M	Smith	MGSSQC	MM 4769	1.574
<i>Features:</i>							
<i>Condition in:</i>	New						
<i>Hydraulics:</i>	With a MW of	1.70 s.g.	at	4500 lpm	Bit DP=	81 bar	HSI = 3.4

Dull Grading:		1-1-WT-A-E-I-NO-TD						
	Date & Time	MD	Cumulative Run Hours					
In:	18:00 08/07	1,275m	<i>Pump</i>	<i>Drill</i>	<i>Ream</i>	<i>Circ</i>	<i>Other</i>	<i>TOTAL</i>
Out:	10:00 09/07	1,288m	4.3	1.2	0.0	0.0	10.5	16.0
	ROP:	13 m	in	1.2 hrs	=	10.8	m/hr	
	Rotary drilled:	13 m	in	1.2 hrs	10.8 m/hr	% Rotated:		100%
	Sliding	0 m	in	0.0 hrs		% Sliding:		0%
	Cmt/shoetrack:					Size	Depth	
		Yes	Drilled:	13 m	Cmt hrs:	1.2 hrs	16" liner lap	1,288m

2.3 Drilling Parameters

BHA #3:

PARAMETERS:	Comments:							
	FLW	SPP	RPM	WOB	TRQ	STRING WEIGHTS		
	(lpm)	(bar)	(string)	(MT)	(KN.m)	ROT (kdaN)	UP (kdaN)	DN (kdaN)
Min	3,600	130	30	0	9	103	108	98
Max	4,500	268	120	25	19	132	130	134

BHA #4:

PARAMETERS:	Comments:							
	FLW	SPP	RPM	WOB	TRQ	STRING WEIGHTS		
	(lpm)	(bar)	(string)	(MT)	(KN.m)	ROT (kdaN)	UP (kdaN)	DN (kdaN)
Min	4,460	185	65	5	7	Average		
Max	4,490	195	70	9	9.5	94	94	90

2.4 Equipment Failures

As mentioned in the Operational Summary:

- Consecutive mud pump failures.
- Mud supply system valve failures (ST-15 & pit#5).
- Standpipe washout.

2.5 Conclusions and Recommendations

Hole was in good condition, no excessive torque observed, no adverse pressure fluctuations.

Pulling out of hole time could potentially have been reduced by 2 – 3 hrs had there been no requirement to obtain a caliper log (LWD), resulting in a maximum pulling speed of 250 m/hr. It is recommended to back ream & pump out of hole to get a mechanical indication of hole gauge (Rhinoreamer) and to avoid a subsequent wiper trip prior to running casing. It is also recommended to limit pulling speed to 300 m/bottoms up whilst pumping out of hole to ensure sufficient hole cleaning.

Bit performance was good, and recommended to be run again with similar assemblies in this field. The use of pre-made up assemblies was very beneficial to the operation, despite the requirement to change out the Rhinoreamer, as this sped up the operation as well as avoiding a lot of manual handling both on the deck and the rig floor.

Always ensure that the whole circulating system is filled with uniform fluid, with no air present in the system. This could potentially have caused the problems with the FITs.

As the liner squeeze introduced additional contaminants (cement) to the well, a dedicated clean-out run prior to running the Special BOP Test Tool would be recommended. A large amount of cement was retrieved with the test tool, which, due to its large bore, acted as a junk basket. It could therefore not seat. Alternatively, the wear bushing/bore protector should be pulled and a BOP test plug used instead, as was finally done on this well.

3.0 Drilling Fluids

3.1 Brief Overview of Mud System

Mud Type: Glydrill mud

	Planned	Actual
Mud weight	1.5 – 1.7 s.g.	1.55 – 1.70 s.g.
PV	ALAP	19 – 35 cP
Yield point	15 – 25 Pa	10 – 24 Pa
3 RPM	10 – 15	7 – 15
10 sec. gels	> 4	4 – 15 lbs/100ft ²
10 min. gels	< 20	9 – 37 lbs/100ft ²
API water loss	2 – 4 ml	2.8 – 4.0 ml
Filter cake	< 1 mm	1 mm
pH	7.5 – 8.5	7.5 – 8.2
KCl	140 – 170 kg/m ³	137 – 148 kg/m ³
Glycol	3.5 – 5%	5.0 – 5.3%
Ca ²⁺	< 1000 mg/l	562 – 650 mg/l
MBT	< 60 kg/m ³	18 – 50 kg/m ³
LGS	< 200 kg/m ³	46.3 – 109.8 kg/m ³

The hole was displaced to 1.55 s.g. Glydril mud at 1,362m (i.e. ~5m above shoe). The mud was in good condition throughout the section. Treatment with citric acid & sodium bicarbonate was required for cement contamination whilst drilling the shoetrack. Although slow, the mud was weighed up as per schedule to 1.7 s.g. at TD.

Experienced problems transferring mud from one of the column tanks – ST-15 – to the pits. To obtain space for treatment of mud part of the Glydril mud was transferred to this column tank but could later not be retrieved. Investigation showed this was due to a failed solenoid valve (showed to be closed on the displays but was actually open). Whilst troubleshooting the problem, the mud was contaminated with some seawater, used to back flush the lines to clear potential blockages in the line. The valve was replaced and the mud transferred to the pits. Tests showed the properties of the mud to be sub-optimal but was treated and bled into the active system.

The chemical/bulk mixing system on the rig is very rudimentary, and several members of the rig crew have never used the system before. The addition of chemicals using the hopper system is reliant on the derrickman's judgement of mass volume, as the faulty gauges on the hoppers to indicate the amount of chemicals added to the system are not correctly calibrated. This results in a lack of control of mud properties, unless the derrickman is very experienced with the system. New valves are on order to enable calibration of the system. Although a steep learning curve, the crew are getting more experienced with the mud mixing system.

The addition of barite is very slow, and the augers have a tendency to block up. The cause of the latter is two-fold, attempting to add too much barite at any one time and the lack of purging of the lines (air purge switched off). Improvements on the barite addition systems will be made by installing different types of valves.

It is not possible to independently change out the chemical tanks due to a solid wall preventing access to two of the mixing stations. Hence to change out the tank on station #3 or #4, the tanks on stations #1, 2 and 3 have to be removed. This causes double handling and slows down the mud mixing process.

A Hetland engineer is planned to come to the rig next week to inspect/repair/re-calibrate the system. The engineer will be coming out next week, bed space pending.

The mud was heavily contaminated during the drilling out of the cement above top liner. High viscosity, high pH (11.0) and lower mud weight due to dilution (by fresh water spacer) resulted. Used up all the citric acid on board in an attempt to condition the mud, although properties improved it would not be possible to drill out the next section with the mud as is. These extreme parameters are not included in the table above.

3.2 Hole Cleaning

The following techniques were used to keep the hole clean:

- 1) String drags were monitored with the Driller's weight indicator.
- 2) Rheology was defined by a Funnel viscosity of 62 – 95 secs.
- 3) ECDs were in the range of 1 – 3 points above mud weight.

Observed a large amount of cuttings coming over the shakers at 2,114m, indicating deteriorating hole condition, however, no further indications were observed during the remainder of the drilling. Whilst pumping out of hole, cavings/cuttings were observed on the shakers at 1,732m and 1,497m, however, the amount of cuttings decreased as the well was circulated clean, indicating these were cuttings left in the hole following the bottoms up at TD.

3.3 Solids Control Equipment

There were no operational issues with the shakers during the section, apart from the inability to dump cuttings from the header box (sealed shut, most likely as a precautionary measure for OBM usage).

20 pieces 175 mesh screens were used during the section, of which only 5 had to be discarded. This is excellent performance considering the hole size and high flow rates used. The MI supplied shaker screen repair system (insert plugs) worked very well, being the main reason why only 5 screens had to be disposed of.

3.4 Drilling Fluids/Hole Cleaning Recommendations

The mud initially received on the rig was delivered with properties at the lower end of the specification, requiring additional treating on the rig. The mud should have been supplied with optimal parameters.

It could have been beneficial to use 210 mesh screens rather than 175 mesh screens during the drilling of this section, as these would have reduced the solids level in the mud (actual levels towards the upper spec). This would also have allowed the use of only 2 shakers (if required) without overloading the shakers, at a flowrate of 4,500 lpm.

Continue using the insert plug shaker screen repair system.

For the Hetland house overhead crane to reach all chemical mixing stations a recommendation would be to remove the solid wall along the starboard side of the Hetland house and instead install a removable curtain.

As the liner squeeze was not planned, the heavy cement contamination of the mud was not expected and hence not enough chemicals were on site to treat the mud. As a pre-emptive measure it would be recommended to ensure additional cement treatment chemicals are on site prior to running/cementing liners.

4.0 Surveying

4.1 General Discussion

SURVEY DATA: *Comments:* VS Azimuth: 0.00

	MD	Inc	Azm	TVD	VS	N/-S	E/-W	Max DLS
First survey:	1,432.61	0.74	349.76	1432.4	4.21	1.86	21.62	0.46
Last survey:	2,205.94	0.15	313.00	2205.70	7.92	5.57	17.00	

Interference from the BHA (Hi H value on Azimuth) caused several of the initial surveys to be rejected.

In the latter stages of the section the ECD results from the PWD sub were very erratic, ranging from 1.3 – 1.8 s.g. with a mud weight of 1.68 s.g. in the hole.

A new calliper MWD module was tried out whilst pulling out of the hole. The data from the module could not be converted from binary offshore, and had to be sent onshore for analysis. This is not very efficient, and the MWD engineers offshore should be capable of producing the log themselves.

4.2 Recommendations

Re-evaluate requirement to obtain electronic calliper measurement due to the additional rig time required.

Evaluate the robustness of the PWD sub, the readings obtained at the bottom end of the section were erratic and could not be relied upon.

It would be recommended to run resistivity log in the 26" hole section in the future to enable correlation with the resistivity log run in this section – as this was not done on this well, it was not possible to obtain a shale base line for pore pressure prediction.

5.0 Casing and Cementing

5.1 General Discussion

A new cement head was supplied by Halliburton during this section, as the previous (Peak) cement head used on the 20" cement job had to be sent back to shore following the problems on the cementation. Whilst loading the new (Halliburton) cement head it was found to be a very tight fit between the dart (5 – 5 1/2"), of a larger size than normal due to the use of 5 7/8" landing string, and the small sub installed above this new cement head. Installation of the dart damaged the dart to the point where it could not be used, and hence another cement head was ordered from shore. A Peak cement head (supposedly with a larger bore than the Halliburton cement head, however, as it turned out this was not much larger than the Halliburton head already on board) was sent out, however, it was specifically requested that the cement head be loaded onshore, which did not happen. Additionally, it was requested from offshore that two darts be supplied with the cement head, however, only one was supplied with the cement head, with the other arriving on the helicopter two days later, too late for the cement job. It was decided to load the Halliburton cement head, however, prior to doing the operation, the cement head was cleared of rust at both ends, and the loading pin was modified to cover a larger surface area of the dart, to give a more even pushing force. The top sub inner bore of the cement head was lubricated with engine oil, and the dart was soaked in hot water (to soften the rubber) prior to attempting to install the dart. The dart was installed without further problems.

5.2 16" Liner Job

Nominal weight:	84 lbf
Grade:	P-110
Connection:	Dino VAM NS
Nominal ID:	15.010"
Drift diameter:	14.822"
Coupling OD:	16.744"
Make-up loss:	5.212"
Make-up torque:	19,530 lbs (FF=0.9)

Made up the cement head to 1 stand of 5 7/8" DP & racked back same in derrick prior to rigging up Weatherford. Ran 16" liner as per programme until 913m, no losses were observed during the running of the liner inside casing. Picked up the hanger & continued running the 16" liner on 5 7/8" DP. Circulated landing string & liner contents at 20" shoe. Large cuttings observed coming over the shaker, maximum gas peak 3.1% on bottoms up. No losses were observed during the running of the liner in open hole, and no indications of hole problems were observed.

Stood up 2m too high, worked pipe with circulation & reciprocation, apparent progress made 1m. Lost 12 m³ mud whilst working pipe. Observed a maximum gas peak of 4.95% on bottoms up. After 2.75 hrs without making any progress the decision was made to cement liner in situ, 1.2m above landing profile.

5.2.1 Highlights

All Weatherford casing running equipment was function-tested offline on deck and worked very well during the casing running, no failures, no hydraulic leaks. Rig-up was done in a safe manner with Think plan & toolbox talk.

Apart from during the working of the pipe no losses were observed during the running of the liner & there were no indications of poor hole condition.

5.2.2 Lowlights

Could not land liner hanger in landing profile. This resulted in seal assembly being set inside 20" casing & hence could not provide a seal, thereby necessitating a cement squeeze repair of the liner lap. The reason for this inability to land could be attributed to either hole problems (undergauge hole/ledge) or the mechanical dimensions of the landing profile installed in 20" casing. The QA/QC'd calliper log indicates gauge hole to 2,114m, suggesting the problem is mechanical.

5.3 20" Cement Job

Primary slurry

Volume of slurry: 23.5m3 ahead of plug, 4.6 m3 behind plug
Excess: 0%
Pump rate: 900 lpm
Weight: 1.92 s.g.
Slurry yield: 75.16 l/100kg

Additives:	CFR-5L	0.5 l/100kg
	HR-5L	0.6 l/100kg
	Halad-613L	1.5 l/100kg
	NF-6	0.10 l/100kg

Squeeze slurry

Volume of slurry: 18.5 m3
Excess: 0%
Pump rate: 900 lpm
Weight: 1.92 s.g.
Slurry yield: 75.16 l/100kg

Additives:	CFR-5L	0.5 l/100kg
	HR-5L	0.4 l/100kg
	Halad-613L	1.5 l/100kg
	NF-6	0.10 l/100kg

Circulated & cemented casing as per programme. Experienced problems obtaining suction on pit #5 (initial spacer pit) and therefore had to transfer the spacer to another pit (pit #8). Inspection showed that the suction valve on pit #5 had washed out & hence the pump was sucking air. No losses were observed during cement job, and the plug was bumped with 100 bar. Pressure tested casing to 138 bar, no backflow was observed. Set seal assembly with good indications at surface. Attempted to pressure test the seal assembly as per programme, no go – suggesting the seal assembly was set against the 20" casing, creating a flow path past the seal. Established injectivity rate of 0.32 m3/min at 41 bar. Static pressure after injectivity test stabilised at 24 bar.

Released running tool without overpull and recovered running tool & seal assembly. Lead impression pins on seal assembly indicated proper seating of seal assembly on hanger and no wear was observed on seal, indicating that no debris was present on top of the hanger when attempting to set the seal assembly.

Set the nominal bore protector as per Dril-Quip procedures.

Ran in hole with 350m 5" cement stinger on 5 7/8" DP & performed squeeze repair on liner lap. Injected a total of 6.9 m3 1.92 s.g. slurry into liner lap. Waited on cement with 28 bar, static pressure.

Dressed off cement with 17 1/2" bit & pressure tested casing with 115 bar with 1.68 s.g. Glydril mud. Circulated clean, large chunks of cement seen coming over the shakers & the mud was heavily contaminated with cement.

Proceeded to test the BOP – see section 2.1.

5.3.2 Highlights

Cement job was performed without losses. Plug was bumped (rig pump efficiency achieved 97.5%). Casing pressure tested to 138 bar. Liner lap squeeze was successful on first attempt.

5.3.1 Lowlights

Problems loading the cement heads supplied, as detailed in section 5.1.

As suction could not be achieved on the spacer pit (due to a faulty suction valve) the spacer had to be transferred to another pit prior to pumping downhole. Inspected the suction end of the mud pumps as part of the investigation into this incident, found the strainers in the suction lines to all the pumps clogged with polymers. Strainers were cleaned.

Pump suction problems also caused difficulties during displacement of the cement after the primary cement job, complicating the tracking of number of strokes pumped versus volume.

Could not pressure test seal assembly due to the seal assembly being set in 20” casing.

5.3 Casing and Cementing Recommendations

The spare 20” casing joint w/landing profile and spare 16” liner hanger should be inspected onshore to evaluate dimensions of liner lap. This could possibly reveal the reason of landing 16” liner approx. 1.2m too high.

The 16” liner was run using a manual safety clamp, causing a delay in the operation and introducing additional manual handling risk. It is recommended to use slips with automatic safety clamp in the future.

More attention should have been given to the results of the calliper, even if the log supplied to offshore was not QA/QC'd (quick look). Although the problem with the liner hanger appears to be of a mechanical nature, it would still have been prudent to modify the plan with the apparent results.

A dedicated clean-out run to the landing sub inside 20” casing prior to running the liner may be beneficial to ensure that any debris inside the numerous landing/locking profiles inside would be removed. This was requested by Dril-Quip both onshore & offshore, however, it was decided to exclude this extra run at the time.

Shell & Dril-Quip onshore should evaluate whether the nominal bore protector will have to be pulled prior to running 16” liner on future wells. Although running the liner with the nominal bore protector installed poses the risk of damaging the seal assembly whilst running in and unlatching the bore protector when pulling out with the landing string/running tool, pulling the bore protector also has associated risks. Apart from the two extra runs to the wellhead (pulling and running), the running and potential working of the string past an unprotected hanger seal in the wellhead could compromise the sealing capabilities of later casing seal assemblies. Additionally, leaving the bore protector installed would reduce rig time.

Alternative liner hanger systems should be evaluated, e.g. non-profile hanger systems such as the Baker Oil Tools liner hanger to be used for the 7” production liner. This is the second time problems have been experienced landing out the 16” liner hanger, hence an alternative solution will have to be advised.

A total of 7 m³ pumpable volume Tuned Spacer E+ (mixed with mud due to 3 m³ mud accidentally being transferred to pit #5 whilst inspecting pit #5 suction valve wash out) was left in pits #5 & 8 following the pumping of the spacer ahead of the cement. In the future it is

advised to pump all spacer mixed (as it is weighted there is no hydrostatic head decrease), hence there will be no requirement to backload additional spacer. This had to be done in this case.

Check mud pumps suction line strainers prior to critical operations and replace/clean if necessary.

Section Review Report

Onyx SW Exploration - Transocean Leader

Well 6406/9-1

Drilling 26" Hole
Running & Cementing 20" Casing

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1.0 Executive Summary

1.1 Brief Outline of the Objective

The section objectives were:

- No harm to personnel or environment.
- Drill to section TD with one run
- Drill the section with the lowest possible inclination and dogleg.
- Provide an OH suitable to install 20" Casing.
- Install 20 " casing and lock the well head into the conductor housing.
- Cement the casing to surface.
- Pressure-test the casing to 138 bars on bump of the cementing plug.
- Obtain basic Formation Evaluation data (GR) through the drilled interval.
- Perform the planned operations in an efficient manner with due consideration for identified hazards and possible contingency activities.

Accomplishments:

- No harm to personnel. One hydraulic oil spill.
- Achieved.
- Maximum inclination 1.87 deg, maximum DLS 0.59 degrees/100ft.
- 20" casing installed without problems.
- As above.
- No cement returns observed to seabed.
- Good pressure test.
- Achieved.
- Achieved.

1.2 Time Breakdown

Operation	Target Time (days)	Budget Time (days)	Actual Time (days)	Productive Time (%)	Lost Time (%)	Down Time (%)
Drill 26" hole	1.5	2.3	6.5	50.4	0	49.6
Run & cement 20" casing	1.1	1.8	1.8	90.1	0	9.9
Run 18 ¾" BOP	0.97	1.4	3.4	78.8	1.2	20

1.3 Summary of Incidents, Down Time, Lost Time, and Associated Causes

1.3.1 Incidents

One reportable incident during this section.

Due to a burst hydraulic hose on the ROV unit, 4.5 litres of hydraulic oil was discharged to sea.

1.3.2 Down Time (NPT)

-

Down Time Incident and Cause	Down Time (hrs)
Replacement of failed anchor winch motor	103.25
Excess reaming due to unstable shale in Kay formation	5
Extra check trip due to unstable shale in Kay formation	1
Spotting of Glydril pill across Kay formation prior to run 20in casing (unplanned)	0.5
Break down of Eagle Light HTV machine	0.75
Pre tensioning of rigid lock down mechanism on wellhead	3.25
Failed BOP riser joint	9
Replacement of VX gasket	4.75
Helicopter delaying riser operations	1

Total down time (NPT) for the section was 128.5 hrs.

1.3.3 Lost Time (WOW, etc)

Lost Time Incident and Cause	Lost Time (hrs)
Helicopter delaying riser operations	1

Total lost time for this section was 1 hrs.

1.4 Chemical Discharge

1.4.1 Mud

Usage and discharge of mud did not exceed any limitations set for this section.

1.4.2 Cement

Used slightly more G cement and econolite than planned (17.2% more G cement, 5.2% more econolite discharged to sea). As far as total usage and discharge overall goes, no chemicals have yet exceeded the limits.

1.4.3 Rig Chemicals

Bestolife 3010 NM used on drill pipe and Bestolife 2010 NM Ultra for casing. Discharge within permit limitation.

2.0 Directional Drilling Performance

2.1 BHA Performance

BHA # 2 Drilled from 405.4 m to section TD at 1380 m in one run.

List of Components:

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	10534324	26"	-	-	7 5/8 R P	0.55	0.55		
Mud Motor	2032	11 1/4"	-	7 5/8 R B	7 5/8 R B	8.46	9.01	1.10m (0.13m)	25 3/4"
Float Sub	FLX11-005	9 1/2"	-	7 5/8 R P	7 5/8 R B	1.54	10.55		
25 3/4" NM Stab	35864	9 1/2"	3 1/16"	7 5/8 R P	7 5/8 R B	2.38	12.93	10.97m (0.82m)	25 3/4"
PowerPulse w/GR	MDC 487	9"	-	7 5/8 R P	7 5/8 R B	8.91	21.84	D&I @ 17.50m	
24" NM Stab	28325	9 1/2"	3 1/16"	7 5/8 R P	7 5/8 R B	2.14	23.98	22.09m (0.74m)	24"
9 1/2" Anderdrift	AD 983	9 1/2"	3"	7 5/8 R P	7 5/8 R B	2.99	26.97		
9 1/2" NMDC	64543-2	9 5/16"	3"	7 5/8 R P	7 5/8 R B	7.71	34.68		
5 x 9 1/2" DC				7 5/8 R P	7 5/8 R B	45.82	80.50		
Jar	2501	9 3/8"	3"	7 5/8 R P	7 5/8 R B	9.88	90.38		
3 x 9 1/2" DC				7 5/8 R P	7 5/8 R B	27.44	117.82		
X/O				7 5/8 R P	XT57 B	1.22	119.04		
9 x 5 7/8" HWD				XT57 P	XT57 B	84.20	203.24		
5 7/8" DP	To Surface			XT57 P	XT57 B		203.24		

Motor Spec:	Stab	Bend	Rotor Nozzle	rev/gal	Opt. ΔP	Stator	R/S gap	Bearing In /Out	Stab Out
A1125 SP	25 3/4" SWM	0.78	No	0.115	25	100D	0.03mm	2/2	25 3/4"

Ran in hole with assembly and tagged firm cement at 396m (8.5m inside shoe). Drilled out cement and 30" casing shoe with low flow rate/surface RPM and maximum weight on bit of 5 ton, in order to minimise shocks on the bottom hole assemblies. None were seen.

Started to drill new formation from 404.5m, with drilling parameters optimised to maintain hole angle as close to vertical as possible (100-120 RPM, 4500 lpm, 2-5 T SWOB). A slight build tendency of approximately 0.25 deg/30m was observed, following the azimuth from the previous section. At survey depth of 588m the inclination was above the required 1.5deg and a 10m low side slide was performed to arrest this tendency. Several small stringers was found at interval 642-667mMD. Most likely a sand streak (possibly pebbles) as low GR values also matched this interval. The stringers were drilled at an average ROP of 7 m/hr, with ROP in slow spots at 2.8 m/hr and WOB up to 12MT. The section was drilled to TD at 1380m MD with no further slides or stringers found (aprox. 5MT WOB), with the inclination staying at approximately one degree for the remainder of the run.

At section TD the hole was swept with hi-viscosity bentonite pills, in order to clean out the hole. Tight hole was observed at 1330m, while performing a 5 stand wiper trip, in the Kay formation

(shale). This section was reamed and the hole was filled with inhibitive mud (Glydriil) of 1.37 sg weight. Pulled out of hole with no further problems.

No damage or excessive wear was observed on any of the bottom hole assembly components and the bit had minimal cutting structure wear, as expected for this section, although one of the bearing seals had failed.

2.2 Torque and Drag Monitoring

The Power Plan system was used to monitor torque and drag.

Parameter	Cased Hole Friction Factors	Open Hole Friction Factors
Pick-up weight	N/A	N/A
Slack-off weight	N/A	N/A
Off bottom torque	N/A	N/A

2.3 Bit Performance

Bit No. 2

Nozzlos: #1 20 #2 18 #3 18 #center 16

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
26"	Insert	-	415M	Sec DBS	XT02DLC	10534324	1.000
Features:	Double sealed roller bearing, aggressive tooth shaped inserts and carbide gage protection.						
Condition in:	New						
Hydraulics:	With a MW of 1.03 SG at 4500 lpm bit ΔP 82 bar and H.S.I = 1.14						

Dull Grading:		0-1-WT-G-F-I-NO-TD						
	Date & Time	MD	Cumulative Run Hours					
In:			Pump	Drill	Ream	Circ	Other	TOTAL
Out:	01:30 25/06	1380m	50.7	34.6	5	11.1	0	71.50
	ROP:	972 m	in	34.6 hrs	=	28.1	m/hr	
	Rotary drilled:	962 m	in	34.1 hrs	28.3 m/hr	% Rotated:		99%
	Sliding	10 m	in	0.5 hrs	20.5 m/hr	% Sliding:		1%
	Cmt/shoetrack:						Size	Depth
		Yes	Drilled:	12 m	Cmt hrs:	0.9 hrs	30"	404.5 m

2.4 Drilling Parameters

PARAMETERS:	Comments:							
	FLW	SPP	RPM	WOB	TRQ	ROT	UP	DN
	(lpm)	(bar)	(string)	(kdaN)	(KN.m)	(kdaN)	(kdaN)	(kdaN)
Min(408m)	3800	110	45	1	6	78	78	78
Max(1320m)	4640	195	120	13	13	107	110	116

2.5 Equipment Failures

None.

2.6 Conclusions and Recommendations

The bit performed as expected. The directional driller recommends this type of bit for future 26" sections in this field with a similar BHA. Little problems were seen drilling the top part of this section. At 588m survey depth the inclination was above the required 1.5° and a 10m low side was performed. A stringer was found at interval 642-667mMD. Most likely a sand streak (possibly pebbles) as low GR values also matched this interval. The stringer was drilled at an average ROP of 7 m/hr, with ROP in slow spots at 2.8 m/hr. Due to reactive shale in the bottom of the hole (Kay formation) some 6.5hrs were spent on curing the hole. Measures to prevent or reduce this should be considered for next well, by minimising exposure time to seawater.

3.0 Drilling Fluids

3.1 Brief Overview of Mud System

Mud Type: Seawater / High viscosity sweeps

	Planned	Actual
Mud weight	1.03 s.g.	1.05 s.g.
3 RPM	N/A	N/A
Funnel viscosity	>100 secs (sweeps)	>100 secs (sweeps)
pH	9-10	9.2-9.8

Mud Type: Displacement mud

	Planned	Actual
Mud weight	1.2 s.g.	1.3 s.g.
PV		20 cP
Yield point		12
600 RPM		64
300 RPM		44
200 RPM		33
100 RPM		21
6 RPM		7
3 RPM	12-20	6
10 sec. gels		5
10 min. gels		10
Funnel viscosity	>60 secs	61
pH	9-10	8.5

Hivis pills were very thick rendering good hole cleaning. They were made using pure hydrated bentonite (i.e. fresh water only) rather than diluting with seawater, which resulted in a very much higher viscosity than that of a standard Hivis pill. At TD the hole was displaced to bentonite/CMC treated seawater, which allowed the formation of a good filter cake. A Glydril pill was spotted on bottom to aid hole stability for running 20" casing.

3.2 Hole Cleaning

The following techniques were used to keep the hole clean:

- 1) String drags were monitored with the Driller's weight indicator.
- 2) Rheology was defined by a Funnel viscosity of more than 100 secs.
- 3) 6 m³ hi-vis pills were pumped every 10m, and 8 m³ hi-vis pills every connection, or as required. A 30-m³ hi-vis sweep was pumped B/U at TD.

3.3 Solids Control Equipment

Returns to seabed, hence no solids control equipment was used in this section.

3.4 Drilling Fluids/Hole Cleaning Recommendations

A 45 m³ 1.37 s.g. Glydril pill was spotted at TD to prevent Kai shales from swelling. This should be incorporated in the programme on future wells.

4.0 Surveying

4.1 General Discussion

SURVEY DATA: *Comments:* VS Azimuth: 0.00

	MD	Inc	Azm	TVD	VS	N/-S	E/-W	Max DLS
First survey:	415.91	0.74	89.01	415.91	0.10	0.10	0.71	0.59
Last survey:	1361.37	1.13	55.98	1361.17	3.36	3.36	18.98	

Interference from the BHA (Hi H value on Azimuth)

4.2 Recommendations

None.

5.0 Casing and Cementing

5.1 General Discussion

Problems with locking down the wellhead and an alternatively performed cement job. The problem associated with the wellhead was solved, and objective achieved.

Depth of 16" liner adaptor sub is 1,291.08m (land-off point).

5.2 20" Casing Job

Nominal weight:	133 lbf
Grade:	N-80
Connection:	Big Omega IS
Nominal ID:	18.730"
Drift diameter:	18.542"
Coupling OD:	21"
Make-up loss:	5.82"
Make-up torque:	26,000 lbs

Prior to the job it was unclear to what torque the joints were to be made up to. In this case it was discovered in time to be straightened out off the critical path. But a valid learning point for all casing jobs in the future, is to check if the casing running company's values match up the official in house values and then agree up front in the planning phase. Weatherford rigged up to run casing 02:45 on the 26th June. Except for needing to change out an incorrect fitting on the leak off pipe between power unit and rig floor, the power scope and tong was rigged up and tested ok. The 3 shoe track joints were picked up and made up. On these joints some problems were experienced closing the tong. Either caused by slightly oversized OD joints or to tight dies. Problem was quickly resolved by removing 2 dies in secondary jaws.

The remaining 78 casing joints were run without rejects at a steady speed 10 jnts/hr. During the job 1,25 hrs NPT was experienced from break down of the eagle light and a scheduled crew change helicopter. The 7-ton hanger assembly was too heavy to be lifted in to the drillfloor from the front. To make room for the hanger to be lifted from the aft catwalk the tong had to be rigged down, for then to be rigged up again to make up the wellhead hanger extension connection. This is not to a difficult operation if it is prepared and talked through in advance (though bad weather conditions would increase the risk with hoses on the casing tong hanging up, or people caught in between moving objects). The manual elevator was planned for lifting the wellhead joint. Due to the bails not straddling over the ears of the manual elevator, it was needed to change to automatic elevators for this operation.

After making up the running tool to the wellhead, the casing was run on 5" landing string to seabed and landed off in the 30" wellhead housing with out problems. The wellhead in use is a rigid lock down type. These wellheads are to be pre tensioned and locked down to prevent them to disengage from the landing profile caused by thermal expansion once in production. Initially it was not possible to lock down the wellhead. After 2.25hrs the effort to try to lock down the wellhead was given up and decision made to proceed with the cement job. After the cement job a new attempt was performed to lock down the wellhead. This time no problem was experienced and the wellhead successfully pre loaded to 500,000lbs confirmed by a 50ton over pull.

5.3 20" Cement Job

Lead slurry

Volume of slurry:	200m3
Excess:	50%

Pump rate:	1200 lpm	
Weight:	1.56 s.g.	
Slurry yield:	129.60 l/100kg	
Additives:	Econolite	3.2 l/100kg
	HR-4L	0.6 l/100kg
	NF-6	0.10 l/100kg

Tail slurry

Volume of slurry:	20m3	
Excess:	50%	
Pump rate:	800 lpm	
Weight:	1.92 s.g.	
Slurry yield:	74.97 l/100kg	
Additives:	NF-6	0.10 l/100kg

Pumping and mixing of the cement went very well with steady cement density and no problems experienced in the bulk transfer system. After pumping the main and tail slurry the dart was released and displaced at 500lpm to the wiper plug. After pumping theoretical displacement volume plus 50% no indication of shear had been seen. The slurry was then displaced with the rig pumps to a theoretical 50% less the shoe track volume i.e. approx. 20m inside the shoe. No bump was observed thus no pressure test carried out. Pressure was released and surface line volume bled back to the cement unit. Floats held. Positive cement returns were observed at seabed. When retrieving the wellhead housing running tool it was discovered that the inner core of the wiper plug not had sheared and was still attached to the swivel/equalizing sub, though all the wiper fins had disappeared. It is suspected that the dart has ledged in the cement head, a piece of rubber was observed by close inspection offshore, however, final confirmation of the location of the dart will be given once the cement head is broken out onshore.

5.3 Casing and Cementing Recommendations

- Make up values for casing joints must be decided and agreed up front with the casing running company, as large variations can occur.
- If difficulties locking down wellheads of this type are experienced, the rig position must be checked immediately (also direction of current if such information are available) as they appear to be sensitive to misalignment.
- Don't pump till bump – would have resulted in wet shoe in this case

6.0 Running of BOP & riser

Stump test of the BOP had been conducted offline, hence there were no delays in rigging up to run the BOP & riser. This operation, given that most of the crew were new to the equipment, went very smoothly. After making up the riser double to the BOP, the BOP was run through the splash zone, and an initial test of the kill & choke lines to 500 & 12,000 psi was conducted. The test failed, and the BOP had to be landed back on the trolley. Broke out the riser double & attempted to test both joints without success. The damaged seals on both riser joints were replaced. The kill & choke lines on the BOP were also tested to 500 & 12,000 psi as a precaution, this was a good test. With the new seals installed on the riser joints, the riser double was again made up to the BOP & running commenced. The test of the kill & choke lines was repeated with the BOP just past the splash zone, this time the test was good. Continued running the BOP as per Transocean procedures, pressure testing the kill & choke lines at set intervals. Slip joint & landing joint were installed without problems. Several attempts were made to land the BOP on the wellhead without success. This can be attributed to the fact that the rig was maintaining position using thrusters only, with the anchor tensions being fairly slack. Hence the rig was moving along (surging) with the pulsing movement of the thrusters, making a steady position over the wellhead difficult to achieve. Additionally, the BOP nudged the wellhead on a few occasions, to the point where the ring joint had to be replaced. The thrusters were stopped to check the alignment of the rig compared with the wellhead, and the anchor chain tensions increased to ensure correct alignment. The BOP was landed on first attempt following this action. Conducted a 30 MT overpull test as per procedure, and proceeded to test the riser connector to 35 bar, positive test. Stroked out the slip joint inner barrel and laid down the landing joint. At this point the crewchange helicopter arrived, rendering the deck crew busy with helicopter traffic. Additionally, the helicopter had to make a detour to the Transocean Searcher to pick up an additional VX gasket to replace the gasket that had been installed on the wellhead. This resulted in a 2 hr delay in the operation. Following the installation of the diverter the riser equipment was laid down. The riser connector was again tested to 35 bar using the BOP test tool, good test.

Section Review Report

Onyx SW Exploration - Transocean Leader

Well 6406/9-1

**Drilling 36" Section
Running & Cementing 30" Conductor**

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1.0 Executive Summary

1.1 Brief Outline of the Objective

The section objectives were:

- 1) No harm to personnel or the environment.
- 2) Drill a 36" vertical hole to accommodate the 30" conductor. Maximum allowable DLS is 1.1 deg/30m. If inclinations over 1.5 deg are registered the hole shall be reamed until inclination drops within acceptable limits.
- 3) Run and cement the 30" conductor (with minimum inclination of the conductor housing) with returns to seabed to provide sufficient lateral and axial support from the cemented conductor. The cement job is to be topped up using the Titus system.
- 4) Perform the planned operations in an efficient manner with due consideration for identified hazards and possible contingency activities.
- 5) The conductor will be run to approx. 76m below seabed to get the conductor shoe below the prognosed bottom of boulders (the likely prognosed bottom of boulders depth is 66m with 69m being the deepest prognosis value).
- 6) Obtain basic Formation Evaluation data through the drilled section.

Accomplishments:

- 1) All section objectives met.

1.2 Time Breakdown

Operation	Target Time (days)	Budget Time (days)	Actual Time (days)	Productive Time (%)	Lost Time (%)	Down Time (%)
Drilling 36" hole	0.41	0.98	6.79	34.20	22.09	43.71
Running & cementing 30" conductor	1.84	0.88	1.18	89.38	0	10.62

1.3 Summary of Incidents, Down Time, Lost Time, and Associated Causes

1.3.1 Incidents

No reportable incidents. Approximately 5 ltr hydraulic oil was lost in total into the sea due to various hydraulic failures of the ROV when being employed in open waters.

1.3.2 Down Time (NPT)

Down Time Incident and Cause	Down Time (hrs)
SCR failure when assigning mud pumps for spud. Rig shut down for SCR repairs and preventative maintenance tasks	61.5
Investigation of pressure drop event – washing out of swivel/gasket	10
Due to the Eagle Lite malfunction the efficiency in picking up DP and HWDP was low	5.50
Leaking vent valve on 30" WWWH	1.25
Burst hydraulic hose on ROV unit	1.75

1.3.3 Lost Time (WOW, etc)

Lost Time Incident and Cause	Lost Time (hrs)
WOW to spud	36

1.4 Chemical Discharge

1.4.1 Mud

Total 297m³ mud was used on section, and discharged to sea. Comprising of 34.998MT Barite, 17.985MT Bentonite, 146kg CMC EHV and 219kg Soda Ash.

1.4.2 Cement

Returns were observed with ROV during primary and secondary cementation. Unknown amount of excess cement was discharge on seabed during main and top up cementation.

1.4.3 Rig Chemicals

10kg OK 2047 Super Rig-cleaner, and 0.5kg Bestolife 3010 Ultra.

2.0 Directional Drilling Performance

2.1 BHA Performance

The well was spudded under marginal weather conditions. The weather hit the rig from the side causing the rig to drift slightly off location. 5.75 hrs NPT was experienced reaming the hole to acceptable inclination and repositioning the rig above spud location. The highlight is that the conductor was installed on depth with correct stick up of 2 mtr above seabed and 0 deg bulls eye reading. Far more NPT would have been experienced if the decision to WOW had been called rather than to accept the fact that some reaming would be necessary to provide a good hole for conductor installation. To adjust to correct rig position for reaming, the survey MWD tool proved vital as correct skidding direction could be decided. The well was spudded using low flow rate to reduce the risk of cratering the top of the hole. Plugging of the pilot bit most likely occurred during a connection when the bit hit top of hole fill during rig heave. This bitballing reduced the ROP from 30m/hr using 2-3tons on bit to 2-5m/hr using 10-15tons on bit. The fill landing on the bottom could not be effectively cleaned out with the viscous sweeps, as the pilot bit nozzles were plugged. The fill then required re-drilling. It was decided not to pull the BHA, and this decision proved correct as more time would have been spent round tripping the BHA to clean the plugged nozzles. At 408m TD was called. Two viscous sweeps of 20m³ were pumped (with 50m³ SW spacer between the 2 viscous sweeps), and the well was displaced to 1.2 S.G. mud. The BHA was tripped to 10m below seabed, and a check trip to bottom was performed after a 15 min waiting period. No fill was observed (also when installing conductor) proving the hole cleaning strategy was effective. The BHA was pulled out of the hole without problems. The 17 1/2" bit (including bit nozzles) was found balled up when pulled to surface. No boulders and/or rough drilling conditions were encountered in this hole section.

List of Components:

Serial No	Size/OD	Component	ID	Con dn	Con up	Length	Acc length	Comments
MJ0273	17 1/2"	bit	3 7/8"		7 5/8" Reg	0.44	0.44	
RB60046	26" x 36"	Hole opener	2"	7 5/8" Reg	7 5/8" Reg	4.34	4.78	
RTS 41720	9 1/2"	Pony DC	3"	7 5/8" Reg	7 5/8" Reg	2.92	7.70	
	9"	PowerPulse	5.9"	7 5/8" Reg	7 5/8" Reg	8.91	16.61	
28325	24"	NM stabilizer	3"	7 5/8" Reg	7 5/8" Reg	2.14	18.75	
AD983	9 1/2"	Anderdrift	3"	7 5/8" Reg	7 5/8" Reg	2.99	21.74	
64543	9 1/2"	NMDC	3"	7 5/8" Reg	7 5/8" Reg	7.71	29.45	
-	9 1/2"	DC	3"	7 5/8" Reg	7 5/8" Reg	54.7	84.15	6 joints
XOS 1242	8"	X-over	3"	7 5/8" Reg	XT 57	1.22	85.37	
-	5 7/8"	HWDP	4"	XT 57	XT 57	84.20	169.57	9 joints

2.2 Torque and Drag Monitoring

Parameter	Cased Hole Friction Factors	Open Hole Friction Factors
Pick-up weight	None	None
Slack-off weight	None	None
Off bottom torque		7kNm

2.3 Bit Performance

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA
17 1/2"	√	-	435	Smith	10GMODPD	MJ0273	2,222
Features:							
Condition in:	Used, as new						
Hydraulics:	With a MW of	1.21 SG	at 405 m	4500 lpm	SPP	110 bar	

Dull Grading:	2-1-WT-M-E-I-BU-TD
----------------------	--------------------

	Date & Time	MD	Cumulative Run Hours					
In:	15/06/04 21:30	332,5	<i>Pump</i>	<i>Drill</i>	<i>Ream</i>	<i>Circ</i>	<i>Other</i>	<i>TOTAL</i>
Out:	17/06/04 07:15	408	24,5 hrs	19,25 hrs	5,25 hrs	3,25 hrs	6 hrs	33,75 hrs
	ROP:		In	19,25 hrs	=	3,92	m/hr	
	Drilled:	75,5 m	Rotated:	75,5 m	100 %	Oriented:	0 m	0 %

2.4 Drilling Parameters

PARAMETERS:	Comments:						
	FLW (lpm)	SPP (bar)	RPM (string)	WOB (kdaN)	TRQ (KN.m)	ROT (kdaN)	STRING WEIGHTS UP DN
Min:	1600	20	20	1	2	(kdaN)	(kdaN) (kdaN)
Max:	4500	115	115	10	20	-	72 72

2.5 Equipment Failures

The rubber gasket from between the swivel and the drive shaft on the TDS came out of position, landed on the Anderdrift and MWD screens inside the BHA and caused a steady pressure drop. A 10 hr roundtrip was needed to investigate the pressure drop and to remove the rubber gasket from the BHA. If the system had been flushed prior to making up the MWD tool rather than after, some time would have been saved not needing to recover the gasket from the MWD tool.

2.6 Conclusions and Recommendations

A pre-made up 17 1/2" x 26" x 30" hole opener assembly was sent out to the Transocean Leader, however it was not possible to check the serial numbers on the Smith 17 1/2" bit and 26" x 36" Red Baron hole opener. Diagrams and data sheets were sent out to the rig upon request. Data sheets on the pre-made up BHA assembly need to be sent out to the rig, before the BHA is picked up.

During the DWOP session the need to use marker buoys was rejected. After discussion on the rig it was decided to mobilise marker buoys. The marker buoys aided in locating the well position

(crater) and also was found to be a helpful tool to confirming the wellhead stick-up, as the exact length of the marker buoys was known. This lesson is also captured in lessons learned.

Under pre spud recommendations additional 9 1/2" DC and drilling Jar for the 26" section were not mentioned to be made up and needed to be made up at a later stage. Time could have been saved when this was included in the pre-spud preparations.

Always include MWD in spud assembly as this will allow/aid rig to be moved to reduce the hole angle (as was successfully done on this section).

3.0 Drilling Fluids

3.1 Brief Overview of Mud System

Mud Type: Seawater / high viscosity sweeps

	Planned	Actual
Mud weight	1.03	1.05
Funnel viscosity	>100 secs	>100 secs

Mud Type: Displacement mud

	Planned	Actual
Mud weight	1.2	1.2
3 RPM	12-20	20
Funnel viscosity	>60 secs	85
pH	9-10	9.5

The planned mud system was used with success, achieving the objectives. The pre job preparation was good. No problems were experienced preparing mix water, chemicals, sweeps etc. One lowlight was that the weight indicator was not calibrated properly, and manual weight measurement needed to be performed (no NPT). The problem is addressed with Transocean and calibration of the weight indicator will be performed prior to the next section.

3.2 Hole Cleaning

The viscous sweeps proved effective when drilling. two 8m³ pills/stand. The reaming observed after making a connection, was caused by the plugged nozzles as hole file could not be circulated/washed out of the pocket. The viscous sweeps was increased to two 16 m³ pills/stand. At section TD, a viscous sweep of two 20m³ was pumped (pumping 50m³ SW pill between), and the well was displaced to 1.2 S.G. mud. The BHA was tripped to 10m below seabed, and a check trip to bottom was performed. No fill was observed (also when installing conductor) proving the hole cleaning strategy was effective.

3.3 Solids Control Equipment

Returns to seabed, i.e. no solids control equipment was used for this section.

3.4 Drilling Fluids/Hole Cleaning Recommendations

Seepage was noticed from the closed 1 500 kg chemical container lids before shipment to the rig. A logistical delay was experienced while attempts were being made to rectify the problems. In future consideration should be given to the type of chemical that needs to be transported and the sealing abilities of the lids used on the containers used for transporting these chemicals

4.0 Surveying

4.1 General Discussion

The rig heave compensator proved very suitable to aid taking stationary surveys. Implementing the MWD survey tool in the BHA proved vital when spudding under marginal weather conditions, as rig skidding direction to correct for hole angle is possible.

SURVEY DATA:	<i>Comments:</i>			VS Azimuth: 0.000				
	MD	Inc	Azm	TVD	VS	N/-S	E/-W	Max DLS
First survey:	330.10	0.22	27.28	330.10	0.56	0.56	0.29	1.42
Last survey:	390.91	0.33	69.47	390.91	0.65	0.65	0.78	

4.2 Recommendations

Some difficulties were experienced calibrating the MWD tool on bottom. This was caused by the fact that the system pressures are low at shallow depths. To aid calibrating the MWD tool the pressure on the mud pump pulsation dampers can be reduced, improving the mud pulse given from the MWD tool transmitting to surface. This learning has been communicated to Transocean and Schlumberger.

Hole file (and irregular rotary torque) was only observed after reaming a hole section. Reaming is only recommended when there is a reason to ream. It is preferred to just wipe the hole drilled, without rotation. Rotation might cause hole instability.

5.0 Casing and Cementing

5.1 General Discussion

Objectives of installing and cementing the conductor within the design requirement where met. Conductor set at sufficient depth, cemented to surface with a bulls eye reading of 0 degrees.

5.2 30" Casing Job

The rig up for casing running performed well (bowl and slips) for running the conductor joints. Making up the conductor joints went according to plan, including the pin x pin x-over from the SL-60 to the more rigid HD-90-HT connector on the Wellhead Housing. A one-stand cement stinger was run. With the set up chosen, landing the WHH in the elevator, resulted in a high stick up on the rotary table. Installing the cement stinger using the false rotary became difficult (working in height and awkward handling of elevators increased potential of personal injury) and time consuming. It was suggested to use a wellhead clamp to land off the wellhead in the rotary instead of using the elevator. This will reduce the height of the stick-up and ease installing the cement stinger. Feedback from the wellhead operator suggest the operation then could have been performed in 0.5 hrs, instead of the 2 hrs spent on installing the cement stinger. Previously the rig also has good experience cementing conductors without using cement stinger. When running in with the conductor the vent valve on the WHH is left in the open position to allow the WHH to be filled with water and avoid collapse of the WHH. When filled, the vent valve is then closed using the ROV to allow backpressure to build up when pumping the cement. This valve was found to be leaking. The WHH needed to be tripped back into the moonpool to be replaced with the back up valve. When running back in a ROV failure occurred. A hydraulic hose burst, and the ROV had to be pulled to surface and the hose changed out, causing 1.75 hrs NPT. The hose was found to be weathered with cracked outer rubber layer and exposed/corroded metal armour underneath the rubber layer. The conductor was then ran to seabed and stabbed into the hole without rig positioning adjustment, and ran to bottom without difficulties (no hole fill was observed). The conductor was successfully landed on bottom with a 2m stick up and cemented in place with 0 degree reading on the bull's eye as per program.

Setting Depth:	404.5mbdf
Nominal weight:	310 lbf
Grade:	X-52
Connection:	SL-60 x HD-90HT
Nominal ID:	28"
Coupling OD:	32" (SL-60), 33" (HD-90HT)
Coupling ID:	27" (SL-60), 26.5" (HD-90HT)

5.3 30" Cement Job

The cement job went as per program, with a steady density and good indication on the cement sample. The bulk transfer system performed well with a high steady transfer rate for the duration of the job. It was decided to use a conventional cement stand, with a TIW valve and pump in sub. The initial plan was to use the cement head. If the cement head had been used, it was a concern with being able to clean the tool properly after the job. Also some time on redressing the tool for the 20" cement job, would need to be spent. The top up job using the Titus system was successful with returns observed at surface. Disconnecting the Titus hose and releasing the running tool using the passive heave compensator went according to plan without problems. Prior to pulling out the landing string was drifted. No cement rings were observed in the connection of the V150 landing string.

Deleted: .

As part of the pre-spud preparation the cement head was made up into the derrick. The tool design made it hard to identify the open/close position of the valves, this design improvement opportunity has been communicated to Peak/Halliburton.

Primary Cement Job

Volume of slurry: 47,1 m³
Excess: 200%
Pump rate: 800l/min
Weight: 1.95 s.g.
Slurry yield: 75.06 l/100kg

Additives: CaCl₂ 4.35 l/100kg
NF-6 0.10 l/100kg
Seawater 39.56 l/100kg

Top-up Job

Volume of slurry: 15 m³
Excess: 0%
Pump rate: 700l/min
Weight: 1.95 s.g.
Slurry yield: 75.06 l/100kg

Additives: CaCl₂ 4.35 l/100kg
NF-6 0.10 l/100kg
Seawater 39.56 l/100kg

5.4 Casing and Cementing Recommendations

- Provide a wellhead clamp when using an inner cement stinger, or omit using inner cement stinger.
- Double vent valves for the wellhead housing
- Drift the landing string prior to pulling out with the running tool, as drift can be recovered from the Titus dart.
- Ensure hydraulic hoses and fitting on ROV are in acceptable condition prior to use
- Clear indications for open and closed position on remote operated valves

Abandonment Review Report

Onyx SW Exploration - Transocean Leader

Well 6406/9-1

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1.0 Executive Summary

1.1 Brief Outline of the Objective

The objectives were:

- To successfully cut & retrieve 10 3/4" & 14" x 13 3/8" casings
- To obtain the required cement & mechanical barriers as per PSA/NPD requirements
- To successfully cut & retrieve 18 3/4" WH

Accomplishments:

- Successfully cut & retrieved 10 3/4" & 14" x 13 3/8" casings
- To obtain the required cement & mechanical barriers as per PSA/NPD requirements
- To successfully cut & retrieve 18 3/4" WH

1.2 Time Breakdown

Operation	Target Time (days)	Budget Time (days)	Actual Time (days)	Productive Time (%)	Lost Time (%)	Down Time (%)
<i>Test BOP</i>			0.85	85.4	0.0	14.6
Spot abandonment plugs # 1A – 1D	3.35	4.78	4.63	48.4	0.0	51.6
Spot abandonment plug # 2A	1.25	1.68	1.15	100.0	0.0	0.0
Set & test bridge plug	0.83	1.19	0.00	0.0	0.0	0.0
<i>Perforate 9 7/8" casing</i>			0.59	0.0	0.0	100.0
<i>Pump & squeeze abandonment plug # 2B</i>			0.99	0.0	0.0	100.0
<i>Clean-out run</i>			0.98	0.0	0.0	100.0
<i>CBL log</i>			0.27	0.0	0.0	100.0
<i>Spot abandonment plug # 2C</i>			1.95	9.1	0.0	90.9
Cut & retrieve 10 3/4" x 9 7/8" casing	0.50	0.71	5.23	64.5	0.3	35.2
Spot abandonment plug #3	1.08	1.54	2.11	99.0	0.0	1.0
Set & test bridge plug	0.58	0.83		Na		
Cut & retrieve 14" x 13 3/8" casing	0.75	1.07	1.21	86.4	0.0	13.6
Spot abandonment plug #4	0.50	0.71	1.40	100.0	0.0	0.0
Spot abandonment plug #5	0.63	0.89		Na		
Circulate well to seawater	0.17	0.24	0.47	95.6	0.0	4.4
Pull riser/BOP	0.75	1.07	1.59	72,6	27,4	0
Spot abandonment plug #5			0,54	100	0	0
Cut & retrieve 20" x 30" casing/WH	0.75	1.07	0,79	100	0	0
L/O extra tubulars from deck	0.13	0.18		Not reported-		
Demobilise equipment	1.00	1.43		Not reported-		
Deballast rig	0.25	0.36		Not reported-		
Pull anchors	1.25	1.78		Not reported-		

1.3 Summary of Incidents, Down Time, Lost Time, and Associated Causes

1.3.1 Incidents

Synergy number	Description	Possible consequence/cause	Required actions
8189	Leaking fuel pipe in engine room	Engine room is unmanned.	Consider installing a camera in engine room.

			Have engine room operator manning the engine room at all times.
8212	Smashed winchcab window with crane hook Incident occurred when working on anchor wire #3.	Boom position should have been over hook point before hook was released from sling. Hook should not be let go until it is above head height.	Further training of new personnel required.
8217	Hydraulic leak on #8 anchor windlass The approx. 2 litre spill was contained within the deck using spill kit.	Leak occurred through a corroded manual chance on valve body. The valve is no longer in use. Inadequate maintenance.	Removed hydraulic hoses from leaking valve. Put valve out of service. Change out all hydraulic hoses and steel pipe on all anchor windlasses
8223	Loose bolts on Eagle Lite 4 loose bolts discovered upon routine inspection	Bolts are difficult to access and not fit for wire-locking	Bolts to be secured by threadlock More frequent inspections Discuss alternative solutions with Maritime Hydraulics

1.3.2 Down Time (NPT)

Down Time Incident and Cause	Down Time (hrs)
07.05.05: Heavy backflow when running in hole cement stinger	0.50
07.05.05 – 08.05.05: Black-out due to water ingress from deck to switchboard #2	19.25
10.05.05 – 11.05.05: Round-trip due to drop in SPP	37.00
13.05.05 – 18.05.05: Additional workscope due to Lange sand	108.75
18.05.05 – 19.05.05: Unable to calibrate crown/floor saver	3.00
20.05.05: Unable to pull 10 3/4" casing hanger through BOPs	5.00

Total down time (NPT) for the section was 173,5 hrs.

1.3.3 Lost Time (WOW, etc)

No reportable lost time.

1.3.4 Commissioning Time

Cause of Delay	Time (hrs)
19.05.05: Waiting on crewchange helicopter whilst picking up landing string	0.50

1.4 Chemical Discharge

1.4.1 Mud

No accidental discharges of mud during the loading of mud onto the rig.

1.4.2 Cement

No cement on board the rig during the rig move and anchor handling.

1.4.3 Rig Chemicals

No incidents or spills during the rig move and anchor handling.

2.0 Sequence of events

Prior to commencing the setting of abandonment plugs as per the abandonment programme the BOP and surface equipment was pressure/function tested as per TO procedure.

The three cement plugs inside the 7" liner (plugs #1A – 1C) were spotted without major operational issues. Whilst running the cement stinger to the required depth, heavy backflow was observed from the well, due to the u-tubing effect caused by differences in fluid in the string and the annulus. The well was circulated to rectify the problem. No restrictions were observed whilst running stinger through production packer at 4,604m. When circulating bottoms up prior to spotting plug #1A, a maximum of 47% gas was observed. Whilst circulating the rig experienced a complete black-out (see incident report from Transocean for further details), and operations were halted for 19.25 hrs whilst restoring power. The plugs were then spotted in sequence as per programme.

Plugs generally pulled dry when picking up above them, indicating they were well under-balanced. Some spacer returns were observed at the shakers when circulating bottoms up above the plugs, these were diverted to slops if required.

Stripped out through liner lap to avoid squeezing away cement. When circulating B/U following plug #1C a 60 bar drop was observed in standpipe pressure. As the cause of this pressure loss was not known, the cement stinger was pulled out of hole and inspected, only to find the bottom of the stinger filled with the wiper balls pumped down following each cement job. The muleshoe had been modified by cutting off the pin connection at the bottom and pinching the bottom of the muleshoe in order for the muleshoe to provide a funnel guide for passing the liner lap. Due to the smaller ID of the bottom of the joint (see Fig. 1) the wiper balls could not pass, and hence collected at the bottom of the shoe. As no other causes of pressure loss could be identified, the drop in standpipe pressure was most probably caused by the wiper balls covering the circulating ports in the muleshoe. The balls would also act as pressure absorbers when compressed due to circulating pressure. The muleshoe was subsequently modified to obtain an approx. 15deg taper for tagging cement, and to assist in passing restrictions in the well bore.

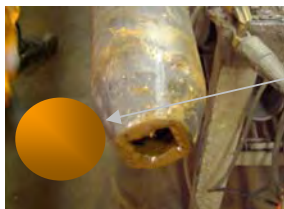


Fig. 1: Muleshoe

Approx. size of
sponge ball



Fig. 2: Modified muleshoe

Back on depth the previous cement plug (#1C) was tagged at 4,387m. T_{TOC} was 4,344m, i.e. the plug was tagged 43m deep. When circulating bottoms up above the plug, firm cement returns were observed. Again a drop in standpipe pressure was observed. Upon further investigation, it was realized that the drop was from a higher value than previously to that which was observed on the previous bottoms up. This is thought to have been caused by the muleshoe having entered the contaminated, softer cement above the solid cement plug, and thereby became partly plugged. The drop in standpipe pressure was observed as the cement plug was discharged from the bottom of the string. Following bottom sup the plug was pressure tested to 192 bar, 10 mins as per programme.

The plug #1D cementation across the liner lap proceeded as per programme.

The mud weight was reduced to 1.88 – 1.89 s.g. prior to spotting cement plug #2A across the Lange sands, which again proceeded without issues. To avoid depositing potential cement in BOP cavities and to avoid cement dropping out & spacer stringing out in the riser with subsequent major mud contamination the well was reverse circulated via the choke line. The cement stinger was then pulled out of hole.

Utilising the remaining Halliburton TCP equipment from the well test, the 9 7/8” casing was perforated from 3,595m to 3,600m in order to isolate the 12 1/4” x 9 7/8” annulus from the Cenomanian sands (NPD requirement). A maximum of 20.6% gas was observed on bottoms up following the casing punch. The balanced plug setting and subsequent squeeze job proceeded as per programme, with 7 m³ out of the 8 m³ pumped squeezed away with controllable surface pressures. Surface pressure readings at the time indicated that some cement was going up in the annulus, however, the WL CBL log conducted following the cement job showed that the cement had gone both up and down from the perforations. Additionally, only 50m good cement could be observed on the CBL read-out (planned cement squeeze length was 150m). Evidently some of the cement slurry had dropped down below the perforations prior to or during the squeeze. The height of the annular cement column was accepted by town as complying with regulations.

Prior to running the CBL log, however, a clean-out trip was performed with an 8 1/2” milled tooth bit and an SPS razor back clean-out tool. Due to the inclusion of a razor back tool, controlled reaming parameters were used, with a maximum WOB of 10 MT and maximum rotational rate of 60 rpm. Cement was observed in the following intervals: 3,630 - 3,650m; 3,673 - 3,676m and 3,772 - 3,773m. The latter two intervals were probably sheathes of cement from previous jobs. Another 8% gas was observed when circulating bottoms up at 3,816m.

The CBL logging run was performed efficiently and without any issues. No restrictions were observed pulling the wireline tools through the BOP.

Using the modified 2 7/8” muleshoe (with flat bottom edge in order to enable tagging with downweight) the cement stinger was again run in hole and a HiVis pill spotted below plug setting depth. When pulling out of the plug severe backflow was observed, due to the u-tubing effect caused by the HiVis pill. Plug #2C was then spotted as per programme. When reverse circulating bottoms up above the plug (circulation rate 1,190 lpm), slight losses were observed (total loss for circulation 2 m³, gone into perforations). The pump rate was therefore reduced to 565 lpm. Some of the losses (total of 600 litres) were returned on the subsequent flow check.

Due to the requirement to tag and pressure test cement plug #2C, the rig had to wait on cement until the Halliburton lab technician confirmed enough compressive strength. The 10 hrs was spent slipping and cutting drilling line and conducting planned maintenance on drawworks and TDS.

Plug #2C was tagged at 3,498m, 97m above perforations. The regulations stipulated a minimum of 50m cement column above the perforations, hence the TOC was acceptable. A pressure test of the plug to 140 bar as per programme confirmed its integrity.

Whenever the cement stinger was pulled out of hole the opportunity was taken to lay down drill pipe. Following the tag and pressure test of plug #2C the cement stinger was pulled out of hole, and hence some 5” DP was laid out. The mid-stand connections were found to be torqued up, and hence the rig tongs had to be used to break-out the connections. A THINK drill & TBT were conducted prior to the use of the rig tongs, as this operation is an internal non-conformance.

The 9 7/8” cutting assembly was then made up and run in hole. Heavy backflow was observed due to the u-tubing effect caused by stringing out of the heavy slug in the annulus. The 9 7/8” casing was cut at 2,827.3m as per Red Baron instructions. Clear indications of a successful cut

were observed, with torque dropping from ~11,000 kNm to 6,500 kNm and the standpipe pressure dropping from 177 bar to 90 bar. No pressure build-up was observed following the cut. When circulating bottoms up via the choke line, losses were observed to the formation, with a total loss volume of 15 m³. A maximum of 8% gas was observed. 5 m³ were returned on the subsequent flowcheck. The losses continued when circulating up the riser, although the loss rate decreased considerably. Due to the additional backpressure exerted by the annular restriction of the marine swivel, and potentially also the knife circulating ports, the decision was made to lift the marine swivel off the wellhead. This meant that the knives would be lifted out of the 9 7/8" cut, restricting flow, hence the circulating sub ball was dropped to open the larger ports above the cutter. Circulation then continued at a rate of 1,200 lpm with only very slight losses. Total volume lost throughout was 17 m³ (i.e. a net volume of 12 m³).

The cutting assembly was then pulled out of hole. No adverse wear was observed on the knives, although good indication of the cut could be seen across the knife lengths. The circulating sub was broken out for redress. The annular swivel assembly was racked back in the derrick, whilst the spear assembly was laid down.

The wear bushing and seal assembly were retrieved in two separate trips using the Dril-Quip Multi-Purpose Tool. Some wear was observed on the wear bushing, whilst the seal assembly came out of hole without any wear and with the lock ring in place. When pulling the seal assembly the annular was closed as a precaution should gas be present. No pressure build-up was observed, and no gas was recorded upon circulation.

The spear assembly with pack-off and 8" bumper sub was then run in hole and engaged the 10 3/4" casing. The casing was released from the wellhead without any overpull observed. When circulating (conventionally) to obtain even mud weight and also to remove any gas present a total of 70m³ mud was lost. Difficulties were experienced pulling the 10 3/4" casing hanger through the BOP, due to the hanger sliding into the BOP cavities (the assembly wedges to the side due to the high casing weight below). This was solved by closing the other annular in order to centralise the string.

With the 10 3/4" casing hanger above the BOP, the well was flowchecked and found to be gaining. There were no leak paths identified at surface, and by functioning each annular it was determined that the leak causing the gain in the trip tank was most likely caused by the spear pack-off. As from a well control perspective the casing could not be pulled until the well was stable, the 10 3/4" hanger was again landed in the wellhead and the lost volume bled back from the well in stages until dead, closing in well for 1 hr periods to monitor closed-in pressures. This operation took 13.75 hrs, and the total volume bled back was 60m³. Maximum gas observed during the bleed-back/shut-in period was 46.5%.

To circulate the well to even mud weight and to remove gas present in the mud, the well was reverse circulated at a slow rate (200 – 300 lpm). Slight losses were observed when reverse circulating, with mud weights trending between 1.54 – 1.87 s.g., and gas levels ranging from a maximum of 57.4% to a low of 7.4% at the end of the circulation.

Following a negative flowcheck, the 10 3/4" casing was again worked past the BOPs and the landing string was pulled out of hole. The casing spear was released as per Red Baron procedure. A number of issues were identified w.r.t. the Weatherford tong; when attempting to break out the 10 3/4" casing hanger the tong repeatedly went into "dumping mode" when the jaws bit on the casing – the day crew was mobilised to the rig floor to investigate, and as it turned out, the tong was set up in "make-up mode". In the meantime, rig tongs were used to break out the hanger. The hanger was in good condition, no major wear was observed from the repeated problems observed pulling past the BOPs. The remaining joints of 10 3/4" and 9 7/8" were pulled out of hole without major issues, apart from again having to mobilise the day crew onto the floor to coach the night crew on correct break-out procedures. No gains or losses were observed

throughout trip. Break out torque required to break casing connections varied between 40-60.000 ftlbs.

M/u and rih with 2 7/8" muleshoe on 3 1/2" – 5" DP cement stinger to 2990m, washed down through open hole between 13 3/8" csg and 9 7/8" casing stump without observing any resistance. Circulated btm-up at 2 m3/min without any losses. Spotted HiVis pill from 2990 – 2877m and set balanced cement plug #3 from 2877 – 2677m. POOH to 2571m, dropped two sponge balls and circulated btm-up at 2 m3/min – no losses observed throughout the cement job.

Laid down 120 jnts excess 5" Dp and HPHT kick single, adjusted space out on marine swivel in preparation of cutting 13 3/8" casing while waiting on cement. RIH to 2571 m and washed down to TOC at 2696m (84 m above 13 3/8" casing shoe). Weight tested cement with 5 mt, circulated btm-up with small amount of large and hard cement pieces observed at surface. P-tested cement plug #3 with 99 bar/15 min. POOH to 1820m while laying down excess pipe again. Deliverately left OBM behind in the lower part of the 13 3/8" casing to avoid waiting on 1.82 sg WBM. Circulated well to 1.82 sg WBM at 1820m. POOH to surface, laid down 45 joints 3 1/2" Dp. Found bottom part of 2 7/8" muleshoe plugged with hard cement with 2 sponge wiper trapped inside the muleshoe, deep enough to cause any circulating pressure increase.

M/u Red Baron 13 3/8" casing cutter and RIH. Unable to pass through wellhead with the 13 3/8" casing cutter. POOH and found one cutter arm open, with securing tap sliced open. Re-secured cutter arm in closed position with "Gray" tape and steel piano wire. (Total time lost 2 hrs) RIH to 1338 without any difficulty. Landed marine swivel in wellhead and closed well in on annular swivel. Cut casing in approximately 4 minutes with positive observations on surface (loss of torque and pump pressure). Circulated btm up, no gas observed. Flow checked well static, pooh and laid down annular and marine swivel and casing cutter. M/u Dril-Quip MPT, rih and engaged 14" hanger seal assembly through closed annular. Stripped up hanger seal assembly +/- 1.5 above landing point through closed annular, no pressure build up. Opened well and flow checked well static. POOH and laid down MPT and hanger seal assembly.

M/u Red Baron casing spear dressed for 14" 114# casing, stop plate, bumper sub and 6 x 6 1/2" DC's. RIH to wellhead and engaged 14" csg/csg hanger. Closed annular and worked casing hanger with max pull (420 mt MD) and rig heave until free. Circulated bottoms up through closed annular at 1.1 m3/min, no losses. Observed 4.7% max gas level which reduced to 0.4% after bottom up. Worked casing through BOP by operating annulars at reduce closing pressure to centralise casing string. Remove casing spear and racked back as a stand in the derrick. POOH and laid down 14" x 13 3/8" casing. Break out torque observed were mainly around the 30-35.000 ftlbs with a few coupling requiring upto 50.000 ftlbs break out torque compared to 30.000 m/u torque. Cleared all casing running equipment from drillfloor and broke down single with EDPHOT.

M/u and rih with 2 7/8" modified (closed ended) muleshoe on 408 m 3 1/2" cement stinger and 5" Dp cement stinger to 1502 m. Circulated 120% well content at m3/min and performed a LOT on the open annulus below the 16" liner shoe, formation strength obtained 1.88 sg EMW. Spotted 12 m3 Hi-Visc pill. POOH to 1388m and set abandonment plug #4 with 27.3 m3 1.95sg slurry and 15 m3 1.88sg water based spacer ahead. Pulled back to approx 100 m above TTOC, circulated clean and WOC while cleaning derrick in preparation of rig handover to next operator. Derrick cleaning was very slow and only approx. 15% of the derrick got cleaned. Washed down and tagged TOC at 1156m with 5 mt, p-tested plug #4 with 84 bar. Singled out excess 5" Dp to 753m where a 150 m 1.82sg HiVisc pill was spotted in preparation for plug #5. Continued to l/d excess DP to 603m. Circulated well to seawater and jetted/operated BOP to flush/clean cavities. Continued to l/d 5" Dp and 3 1/2" cement stinger. (Left 603m 5" Dp racked back in derrick to be used as cement stinger for plug #5)

Pulled marine riser and BOP until 5 1/2" riser handling tool was damaged when laying down the 2nd full joint marine riser. The spare 5" riser handling tool had to be re-certified before it could be used causing 10 1/2 hr down time. BOP and marine riser were recovered without any further incidents.

RIH with 2 7/8" muleshoe on 5" Dp cement stinger, stabbed into wellhead and rih to 603m. Set plug #5 from 603 to 358 m with remaining cement on board. Circulated clean at 358m with seawater, ROV observed good cement returns to seabed and visual confirmed number of joints pulled after circulating clean. L/d down all remaining 5" Dp and cement stand.

M/u Red Baron wellhead cutting and retrieving assembly, RIH and engaged wellhead (confirmed engagement with 15 mt overpull. Cut wellhead until positive indications of cut completed (motor stalled out and returns observed by ROV outside 30" conductor. Time to cut the wellhead (both the 20" casing and 30" conductor housing) was 8 hrs. Noticed by ROV observation that retrieving mechanism had dis-engaged from wellhead during cutting operations, re-engaged wellhead and pulled wellhead free with 50 mt overpull. Pulled wellhead to surface, laid down wellhead, cutting and retrieving assembly, V150 landing string and 6 1/2" DC's. Completed final seabed survey with ROV, seabed was found to be clean, no debris left behind.

Table 1.: Summary of cement plugs

Plug #	TBOC	TTOC	ATOC	Confirmed by	Pressure test
1A	4,938m	4,776m			
1B	4,766m	4,604m			
1C	4,594m	4,344m	4,387m	5 MT tag	192 bar
1D	4,377m	4,106m			
2A	4,096m	3,846m			
2B			3,570m – 3,620m	CBL log	
2C	3,700m	3,450m	3,498m	5 MT tag	140 bar
3	2,877m	2,677m	2,696m	5 MT tag	99 bar
4	1,388m	1,188m	1,156m	5 MT tag	84 bar
5	603m	358m	358m	Visual, returns	to seabed

3.0 Highlights, Lowlights & Lessons Learned

2.1 Highlights

No problems were observed throughout the cement jobs, with pressures behaving as expected and pipe pulling dry following the plug set. Objectives were achieved despite technical difficulties of setting small volume plugs at these depths and temperatures.

Good indications were observed during the squeeze job (plug #2B).

The 10 3/4" x 9 7/8" pulling job was conducted in a very smooth & efficient manner, the only downside potentially being the competence of the casing crew.

Stabilised well after loss/gain situation by controlled back flowing of volume lost into formation with identified leak path past pack-off at casing spear.

No time lost caused by waiting on WBM by leaving OBM in lower section of 13 3/8" casing. Excess 5" Dp singles were laid down while preparing sufficient surface volume 1.82 sg WBM with OBM in the hole above abandonment plug #3 from 2696 m to 1820 m. This reduced the volume WBM needed and increased the time to prepare the WBM, without causing down time for WO mud.

The "none sagging" 1.82sg mud spotted in the 20"/16" x 14"/13 3/8" annulus appeared to be in good and stable condition since the 13 3/8"x14" casing was cemented on 28 July 2005. Mud weight returned from the annulus fluctuated in weight between 1.77 – 1.83 sg. Unfortunately no spot samples (this was not requested as well) were taken to allow detailed analyses to be done on this no sagging mud after having gone through 10 months downhole exposure in a HPHT well.

Recovered all identified debris/items (3 x VX gaskets, transponder, wellhead measuring stick, grating, piece of handrail and blue pod cover) offline from seabed with ROV unit.

Introduction of the "SERPENT" project on TO Leader and in Shell Norway. This marine biology project was seen as very positive by a great number of staff on board. Should be allow on future Shell operation.

2.2 Lowlights

During the abandonment phase frequent amendments to the abandonment programmes were made, however, it was found difficult to follow the sequence of operations as more amendments were received. It would have been easier to include changes in the original amendment programme, i.e. issue a revision rather than an amendment, with changes clearly marked where applicable.

During the circulation prior to spotting plug #1A the rig experienced a complete blackout caused by water ingress through a hole in the deck in the well test area. This caused a short circuit of switchboard #1 and thereby a complete black-out. For lessons learned see separate TO report.

The 2 7/8" muleshoe had an elongated pin which would have functioned well as a guide and did not require any further modifications. Despite this fact the muleshoe was modified by cutting the pin and pinching the bottom of the joint to create a guide funnel. This ended up trapping the wiper balls as they were pumped down the string following each plug, eventually covering the circulation ports, causing a drop in standpipe pressure (circulating via a higher point in the stinger).

When reverse circulating bottoms up after spotting plug #2C, losses were observed as the flow rate selected was too high. It was believed that plug #2B had efficiently sealed off the perforations, and therefore no losses could be induced. This cannot be guaranteed. In future driller's instructions should state maximum circulating pressure (dictated by the LOT results at the previous casing shoe). The losses caused us to squeeze a further 2 m3 cement into the formation, with the top of plug #2C 48m deeper than theoretical. The result could have been worse given the annular height of a 2 m3 loss.

No casing protectors could be sourced for laying out either the 10 3/4" x 9 7/8" casing or the 14" x 13 3/8" casing. For future wells the protectors used when running the casing must be kept to avoid this occurrence due to the high cost of re-cutting damaged threads when laying down & backloading.

The 10 3/4" x 9 7/8" casing was retrieved using an ITCO spear with pack-off. A large amount of downtime was incurred due to the pack-off being designed for sealing in 9 5/8" casing – the ID of the 10 3/4" is 8.83" (nominal) compared with 8.681" for 47# 9 5/8", hence the pack-off was

observed to be leaking. Smith Red Baron could not provide pack-offs specifically designed for 10 3/4" casing, and hence this smaller size was used. Additionally to this the pack off will only hold pressure from the inside and not from the outside and therefore the well could not be reverse circulated with the pack off below the annular preventer. To avoid this the casing could have been retrieved using the Dril-Quip full bore CHSART. Apart from providing a positive seal, this would also have alleviated the use of a BX elevator in order to lay down the casing hanger, as the CHSART would have a DP pup installed above, allowing the use of the Varco 500T slip type elevators throughout the casing pulling operation.

Although 13 3/8" casing cutter knives were secured in the closed position with "Gray" tape the tool could not be run through the wellhead as the "Gray" tape got cut while running in. The casing cutter was pulled to surface and the knives were resecured in the closed position with steel piano wire and Gray tape.

Again the rig experienced difficulties properly executing equipment demobilisation due to the unpredictable vessel movement by Statoil Marine, changing agreed sailing plans and disrespecting "B" priorities called to so-called secure service of poolvessel to an installation. Again the "pool" proved to be an unreliable service provider to do business with. Pool performance is discussed after each project again and again with results. We are not receiving the service we pay for and it feels at times that a "Shell" operated rig is at sea to supply a service to the pool instead of receiving service from the pool.

2.3 Lessons Learned

Unable to break hanger with pup joint with BX elevator and pup too short to be handle with Eagle Light. Should have used longer pup below csg hanger or single joint pick up elevator to lay down joint.

Keep flow rates the same when setting cement plugs in sequence to monitor circulating pressure fluctuations. The cement stinger got partially plugged during consecutive plugs which increases circulating pressure and cement stinger was round tripped for washout when circulation pressure dropped back to original circulating pressure.

At the start of any drilling campaign the mudloggers have to be informed about comments to be added to mudlogging data recorded. Comments can not be erased once added.

A better engineered method should be developed to secure casing cutter knives in the closed position. Gray tape and steel piano wire are not really a proven way and securing it too much might cause a failure to open the knives when on casing cutting depth.

Leaving OBM in the lower part of the 13 3/8" casing allowed additional time to prepare the weighted WBM and prevented any waiting time (approx 6 hrs) on WBM preparation.

Standard pack offs on casing spears will only hold pressure from the inside. It is strongly preferred to have a positive seal in both direction to give increase flexibility in circulation option in landed position (straight or reverse circulation) and less risk of having a questionable seal in the string once the casing spear with casing hanger is pulled above the annular preventers.

Evaluate including a fishing jar in the BHA when rih with the casing spear to be able to jar hanger off its seat in the wellhead. Two hours were spend to free the 14" casing hanger from the wellhead. This could have likely reduce would we have been able to jar, normally one or two blows with the jar has shown to be very effective to free hangers from the wellhead.

Pulling the 14" hanger seal assembly proved its value. We would have most likely given up trying to free the 14" casing hanger earlier because of complications expected to come from the seal assembly preventing the casing hanger to come out of the wellhead with straight overpull.

Both the 10 3/4" and 14" casing hangers hung up in the cavities in the BOP. Both hangers were worked through the BOP centralising the casing strings by closing the annulars with reduced closing pressure. This proved much more effective than changing the rig position above the well location.

Again it showed that cutting the wellhead is a time depending operation where operators have to be patient as long as positive cutting actions are observed at surface. Cutting operations are best continued until positive surface observations are made that cut is completed.

Allowing next operator to load pre-spud materials on the rig before the rig comes off contract should be prevented in the future. Although the initial idea was that most could be done offline and using the same vessel to backload Shell equipment did have an impact on rig move preparations in general. This impact was increased by the relatively high number of new deck crew on board which made it impossible for the deck crew to support drillfloor activities and vessel handling simultaneously. (This was possible with different crews earlier on).

Several of the "long time on board" containers were found to be out of certification and a lot of equipment had to be repacked into other containers increasing the workload of the already busy deck crew. Certification of all "long time storage" containers on board to be checked up front allowing for timely recertification when needed.

B4. SAFETY AND ENVIRONMENT

HEALTH, SAFETY, WORKING ENVIRONMENT AND ENVIRONMENT

HSE-results for Transocean Leader this well under the directorship of Shell :

Status for Transocean Leader	GOAL IN HSE - PROGRAMS	RESULTS MAY 2004 TO MAY 2005
First Aid Treatment Case (FAC)	-	10
Medical Treatment Case (MTC)	-	1
Loss Time Incident (LTI/ SIC)	0	0
LTI Frequency	0,0	0
Total Recordable Incident Rate	< 7,0	3,0
Number of RUI	-	173
Number of Spill to Environment	0	3
Number of Near Hits	-	93
Number of Loss of Production	-	6
Number of Falling Objects	-	4
Falling Objects (Red/Yellow/Green)	-	1/2/1
No. of Critical / Serious RUI (red/yellow)	0/-	2/31
Risk Factor (All RUI)	-	11
Risk Factor (Personal injuries)	-	7
Sick leave (Short-term)	< 3 %	3,47 %
Sick leave (Long-term)	-	1,38 %
Sick leave (Total)	-	4,85%

We had no Lost Time Incidents during this campaign with Shell for anyone on the rig. We did, however, have one Medical Treatment Case where an electrician received a cut in a finger while working on a pump motor. We also had 10 First Aid Incidents.

Description of personal injuries

We had a total of 11 personal injuries during the campaign and these are described as follows in Synergi :

Lost Time Incident :

None

Medical Treatment Case :

RUI 068/7619 – 27.10.04 - Transocean - Risk factor : 10

Used a knife when de-isolating a connection on a pump motor, knife slipped and cut finger. Underlying causes: Access to the electric motor junction box was restricted due to the location of the equipment. Whilst cutting the electric insulation tape, the position of the injured person's finger was directly in front of the direction that the knife was being used.

First Aid Cases :

RUI 040/7460 – 21.07.04 - Transocean - Risk factor : 4

Operation at the time was BHA handling on the rig floor. The IP was removing a 6 5/8" double box sub from the sub rack at the driller's side of the rig floor. A tugger was attached to the installed lifting cap and another roughneck raised the sub off the retaining peg. As the IP was manoeuvring the sub around the forward drill pipe set back area his left hand ring finger contacted a Dowell peg used for storing shackles which is situated approximately 2 ft from the end of the sub rack. This resulted in a scrapped knuckle type abrasion on his finger. The IP went to the medic and had the finger cleaned and dressed and then returned to work.

RUI 044/7513 – 07.08.04 - Transocean - Risk factor : 15

The right hand side of the shaker header box "wheelie" dump valve would not open, although it was possible to turn it a couple of turns either way. I thought that while it looked to be damaged slightly, that it was maybe the weight of the cuttings sitting on it that was jamming it up. I cleared off all the cuttings from around the valve and then decided to try and operate the valve as it was not completely closed. As I put pressure on the valve handle, it snapped off causing me to strike my face on the top of the header box, causing me to cut the inside of my mouth.

RUI 069/7640 – 01.11.04 - Transocean - Risk factor : 4

Person working on aft riser deck and in the process of installing a double leg lifting bridle into the port crane main block hook. As the master link of the bridle was presented to the hook, the block moved slightly and the main block contacted the persons left hand.

RUI 072/7648 – 03.11.04 - Transocean - Risk factor : 2

When securing Mux Cables to Slip Joint, a person held his left hand onto the hand rail on the working platform. Due to pitch and roll Slip Joint moved and bruised left hand index finger.

RUI 079/7674 – 14.11.04 - Transocean - Risk factor : 3

Person was walking from compressor room towards sack store. Due to overpressure in compressor room, the person would close the door more gently, then just slam it. He was holding on the edge of the door, and pinched left ring finger, as the door was closing.

RUI 092/7774 – 23.12.04 - Transocean - Risk factor : 4

When offloading luggage from left sponson on the helicopter, lifted hatch in process of locking hatch in upright position, failed to engage locking mechanism. High wind blew down hatch, striking person on left of head.

RUI 002/7839 – 09.01.05 - Universal - Risk factor : 3

Taking provision, one person stepped on the edge off a 1,5 cm. high rubber mat and twisted the ankle.

RUI 033/7965 – 18.02.05 - Universal - Risk factor : 2

The IP was cleaning the shelves in the galley fridge. The shelves are retained in position by shelf supports. The shelves are removable and the supports are of steel construction, fixed in place, and traverse the full width of the fridge unit.

The IP was cleaning the support with a cloth. As the cloth was run along the length of the support the IP's finger tip came into direct contact with the top of the support and sustained a minor cut to the finger tip.

RUI 040/8018 – 13.03.05 - Shell - Risk factor : 2

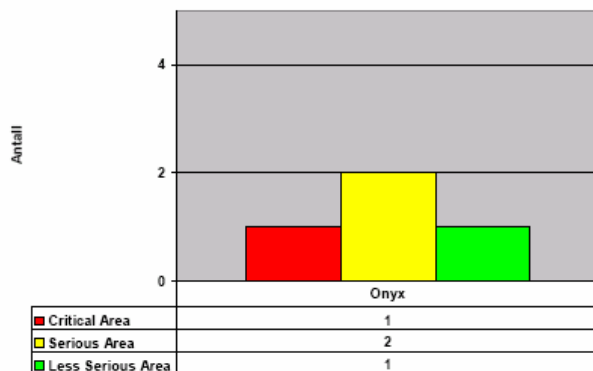
Substained a minor cut in left index finger when cutting bread using a bread knife. Finger was caught underneath bread knife blade.

RUI 073/8235 – 26.05.05 - Universal - Risk factor : 2

Person went out from bathroom and stepped down to the mat with right leg, the mat slipped and person fell, the left leg was hit by the threshold and caused a minor graze.

4. FALLING OBJECTS

There were no goals for falling objects this term. We had four falling objects, one in critical (red) area, two serious (yellow) and one in less serious (green) area.



We had four falling objects reported, described as follows in Synergi :

RUH 070/7641 – 02.11.04 - Risk factor : 150

The rig was running riser from the aft receiver. The 60 ft joint was being raised from the horizontal plane to the vertical plane in preparation for make up to the riser joint secured in the rotary table riser spider. The riser lifting nubbin was in the elevator and the riser joint was raised approximately 40 ft from the rig floor and at a 60 deg angle. At this juncture one of the riser nut retainer wedges fell from the retaining pocket and landed approximately four feet from the rotary table

RUH 071/7644 – 02.11.04 - Risk factor : 5

Main operation was deploying the BOP,s on Cameron RF marine riser. The BOP were at 289m depth. A five ft. riser pup joint was made up to the string and the hydraulic running tool was then made up to the five ft. pup joint. The test lift was taken and 253 tons held for one minute. This constituted a successful load test of the running tool to pup joint make up. The Driller then proceeded to open the riser spider prior to lowering the string. The riser Spider did not function and the running tool released from the pup joint allowing the string to drop down one inch onto the riser spider dogs.

RUH 024/7920 – 04.02.05 - Risk factor : 20

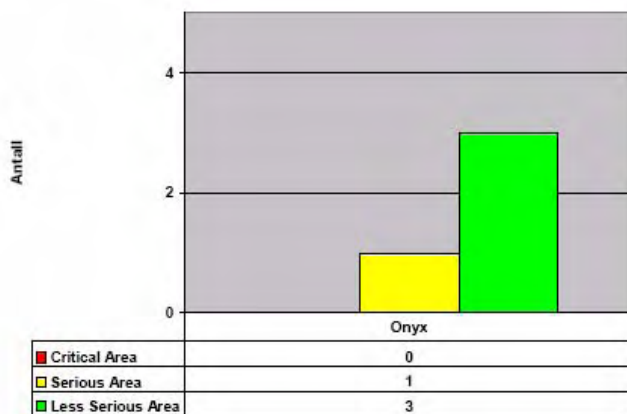
While picking up DP with "Eagle" and drifting them, the drift went out of the pipe and down on the catwalk due to bad protector.

RUH 051/8093 – 06.04.05 - Risk factor : 20

The rig was involved in recovering the LMRP to repair a failure of the Kill line kick out sub. The main activity on the floor at the time was laying down a 50 ft joint of marine riser fitted with buoyancy modules. The rig floor manipulator arm placed the box end in aft receiver trolley and the manipulator arm was retracted. The Traveling block was then lowered and the receiver trolley moved aft accordingly to take the riser joint from the vertical plane towards the horizontal plane. With the lifting nubbin at approximately a 45 degree angle and 12 meters from the rig floor, a floor man observed a segment of the riser buoyancy thrust washer fall from the area at the top of the buoyancy module. The damaged thrust washer segment weighing 3.7 KG landed on the aft starboard side of the riser spider approximately 0.7 m away from the spider and remained there. The riser joint was laid into the horizontal position on the aft receiver trolley and Vee block assembly. Stop Operations.

5. SPILL TO THE ENVIRONMENT

As the table below shows, we have not reached the goals we had set when it comes to spill to environment.



We had 3 spills to the environment during this campaign with Shell.

Chemical	May 28th, 2004 – June 4th, 2005	
	Total Incidents	Total volume (liter)
Water Based Mud	1	11700
Oil Based Mud	1	100
Dry oil base cuttings	1	90

Description incidents as follows:

RUH 036/7440 – 10.07.04 - Risk factor : 30

During the day shift, the shaker room was being washed down by the Floormen. One spade from the ditch underneath the shakers leading to the overboard line was opened to allow the washing water (Salt water) to disperse. When the crew finished shift, this job was not completed and the spade was not fitted. This spade is normally removed when carrying out this task to prevent water going back into the active pit. This caused a spill to sea of 11,7 m3 with water based mud when the pumps was started to transfer the mud from trip tank into the flow line at the shaker.

RUH 082/7701 – 23.11.04 - Risk factor : 2

Incident with pressure discharge with SWACO during the night, whilst fluffing up tanks and the system also pressurizes the boat transfer line. The blanking cap/spill cap was not on. SWACO never checked line prior to pressing up tanks and we ended up putting a small amount of very dry cuttings over the side. The spill to environment was app. 90 litres of dry oil base cuttings to the sea.

RUH 029/7946 – 13.02.05 - Risk factor : 15

100 liters oil based mud spilled into the sea due to a cracked and leaking booster hose on cellar deck.

A/S Norske Shell

Survey Report - Geographic

Company: EP Norske Shell	Date: 24/08/2005	Time: 12:59:49	Page: 1
Field: Onyx	Co-ordinate(NE) Reference: Site: Onyx, Grid North		
Site: Onyx	Vertical (TVD) Reference: SITE 23.5		
Well: 6406/9-1 Onyx South West	Section (VS) Reference: Well (0.00N,0.00E,72.21Azi)		
Wellpath: Hole 1 (Original hole)	Survey Calculation Method: Minimum Curvature	Db: Oracle	

Field: Onyx Norway	Map Zone: UTM Zone 32, North 6E to 12E
Map System: Universal Transverse Mercator	Coordinate System: Site Centre
Geo Datum: ED50 (International 1924)	Geomagnetic Model: bggm2003
Sys Datum: Mean Sea Level	

Site: Onyx 6406/9-1 Norway	Site Position:	Northing: 7148739.65 m	Latitude: 64 26 46.855 N	
From: Geographic		Easting: 394862.13 m	Longitude: 6 48 55.234 E	
Position Uncertainty: 0.00 m			North Reference: Grid	
Water Depth: 308.00 m			Grid Convergence: -1.97 deg	

Well: 6406/9-1 Onyx South West	Slot Name:
Well Position: +N/-S 0.00 m	Northing: 7148739.65 m
+E/-W 0.00 m	Easting: 394862.13 m
Position Uncertainty: 5.00 m	Latitude: 64 26 46.855 N
	Longitude: 6 48 55.234 E

Wellpath: Hole 1 (Original hole)	Drilled From: Surface
Current Datum: SITE	Tie-on Depth: 0.00 m
Magnetic Data: 17/06/2004	Above System Datum: Mean Sea Level
Field Strength: 51585 nT	Declination: -1.23 deg
Vertical Section: Depth From (TVD)	Mag Dip Angle: 75.23 deg
m	+N/-S
0.00	m
0.00	+E/-W
0.00	m
0.00	Direction
0.00	deg
0.00	72.21

Survey Program for Definitive Wellpath				Version: 1	
Date: 01/03/2005	Validated: No	Actual From	To	Survey	Tool Name
		m	m		
331.50	390.91			Survey #1 36" Hole Section (331.50-390.91)MWD	
415.91	1361.37			Survey #2 26" Hole Section (415.91-1361.37)MWD	
1432.61	2772.01			Survey #3 17x20" Hole Section (1432.61-2772.01)MWD	
2877.04	3210.26			Survey #4 12 1/4" Hole Section (2877.04-3210.26)MWD	
3267.33	3526.69			Survey #5 12 1/4" Hole Section (3267.33-3526.69)MWD	
3559.81	4293.42			Survey #6 12 1/4" Hole Section (3559.81-4293.42)MWD	
4320.66	4522.45			Survey #7 8 1/2" Hole Section (4320.66-4522.45)MWD	
4608.66	4665.88			Survey #9 8 1/2" Hole Section (4608.66-4665.88)MWD	
4701.64	4759.73			Survey #10 8 1/2" Hole Section (4701.64-4759.73)MWD	
4788.45	4854.17			Survey #11 8 1/2" Hole Section (4788.45-4854.17)MWD	
4884.15	5034.08			Survey #12 (4884.15-5064.25)	Unknown
5065.64	5065.64			Survey #13 8 1/2" Hole Section (5065.64-5065.64)MWD	Data failed/not subject to QA

Survey											
MD	Incl	Azim	TVD	+N/-S	+E/-W	Map	Map	<---- Latitude ---->		<--- Longitude --->	
m	deg	deg	m	m	m	Northing	Easting	Deg	Min	Sec	
331.50	0.00	0.00	331.50	0.00	0.00	7148739.65	394862.13	64	26	46.855 N	6 48 55.234 E
340.71	0.33	81.96	340.71	0.00	0.03	7148739.65	394862.16	64	26	46.855 N	6 48 55.236 E
349.73	0.71	75.51	349.73	0.02	0.11	7148739.67	394862.24	64	26	46.856 N	6 48 55.242 E
358.37	0.79	98.08	358.37	0.03	0.22	7148739.68	394862.35	64	26	46.856 N	6 48 55.250 E
368.21	0.43	107.35	368.21	0.01	0.32	7148739.66	394862.45	64	26	46.856 N	6 48 55.258 E
377.36	0.55	56.62	377.36	0.02	0.39	7148739.67	394862.52	64	26	46.856 N	6 48 55.263 E
390.91	0.33	69.51	390.91	0.07	0.48	7148739.72	394862.61	64	26	46.858 N	6 48 55.270 E
415.91	0.74	89.01	415.91	0.10	0.71	7148739.75	394862.84	64	26	46.859 N	6 48 55.287 E
444.63	0.79	76.73	444.62	0.15	1.09	7148739.80	394863.22	64	26	46.861 N	6 48 55.315 E
473.75	1.08	94.86	473.74	0.17	1.56	7148739.82	394863.69	64	26	46.862 N	6 48 55.350 E
502.73	1.14	94.66	502.71	0.12	2.11	7148739.77	394864.25	64	26	46.861 N	6 48 55.392 E
531.68	1.35	96.30	531.66	0.06	2.74	7148739.71	394864.87	64	26	46.860 N	6 48 55.439 E
560.60	1.33	96.96	560.57	-0.02	3.41	7148739.63	394865.55	64	26	46.858 N	6 48 55.489 E
588.68	1.87	93.13	588.64	-0.08	4.19	7148739.57	394866.33	64	26	46.857 N	6 48 55.548 E
617.64	1.52	87.95	617.59	-0.09	5.05	7148739.56	394867.18	64	26	46.858 N	6 48 55.612 E
645.90	1.46	93.07	645.84	-0.10	5.78	7148739.55	394867.92	64	26	46.858 N	6 48 55.666 E
674.96	1.56	84.54	674.89	-0.08	6.55	7148739.57	394868.68	64	26	46.860 N	6 48 55.723 E
703.82	1.37	72.41	703.74	0.06	7.27	7148739.71	394869.40	64	26	46.865 N	6 48 55.777 E

A/S Norske Shell

Survey Report - Geographic

Company: EP Norske Shell Field: Onyx Site: Onyx Well: 6406/9-1 Onyx South West Wellpath: Hole 1 (Original hole)	Date: 24/08/2005 Time: 12:59:49 Co-ordinate(NE) Reference: Site: Onyx, Grid North Vertical (TVD) Reference: SITE 23.5 Section (VS) Reference: Well (0.00N,0.00E,72.21Azi) Survey Calculation Method: Minimum Curvature Db: Oracle
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Survey

MD m	Incl deg	Azim deg	TVD m	+N/-S m	+E/-W m	Map Northing m	Map Easting m	<---- Latitude ---->		<--- Longitude --->					
								Deg	Min Sec	Deg	Min Sec				
732.21	1.44	74.82	732.12	0.26	7.93	7148739.91	394870.07	64	26	46.872	N	6	48	55.826	E
760.91	1.38	59.57	760.81	0.53	8.58	7148740.18	394870.71	64	26	46.882	N	6	48	55.874	E
790.38	1.33	73.08	790.27	0.80	9.21	7148740.45	394871.35	64	26	46.891	N	6	48	55.921	E
818.48	1.29	76.04	818.36	0.98	9.83	7148740.63	394871.97	64	26	46.898	N	6	48	55.966	E
847.23	1.28	76.70	847.11	1.13	10.46	7148740.78	394872.59	64	26	46.903	N	6	48	56.013	E
876.84	1.18	79.38	876.71	1.26	11.08	7148740.91	394873.21	64	26	46.908	N	6	48	56.059	E
905.58	1.19	81.96	905.44	1.36	11.67	7148741.01	394873.80	64	26	46.912	N	6	48	56.102	E
935.14	1.04	83.23	935.00	1.43	12.24	7148741.08	394874.37	64	26	46.915	N	6	48	56.145	E
962.67	1.06	86.68	962.52	1.48	12.74	7148741.13	394874.87	64	26	46.917	N	6	48	56.182	E
992.76	1.12	85.11	992.61	1.52	13.31	7148741.17	394875.44	64	26	46.919	N	6	48	56.225	E
1021.63	1.03	72.87	1021.47	1.62	13.84	7148741.27	394875.97	64	26	46.923	N	6	48	56.264	E
1049.58	1.10	85.13	1049.42	1.71	14.35	7148741.36	394876.48	64	26	46.926	N	6	48	56.302	E
1078.35	0.99	73.03	1078.18	1.81	14.86	7148741.46	394876.99	64	26	46.930	N	6	48	56.340	E
1135.93	0.89	79.52	1135.76	2.04	15.78	7148741.69	394877.91	64	26	46.938	N	6	48	56.408	E
1165.42	1.07	71.16	1165.24	2.17	16.26	7148741.82	394878.39	64	26	46.943	N	6	48	56.444	E
1192.91	0.74	73.75	1192.73	2.30	16.67	7148741.95	394878.81	64	26	46.948	N	6	48	56.474	E
1222.00	0.94	74.02	1221.82	2.42	17.08	7148742.07	394879.22	64	26	46.952	N	6	48	56.505	E
1250.68	0.97	74.33	1250.49	2.55	17.54	7148742.20	394879.68	64	26	46.957	N	6	48	56.539	E
1279.51	0.71	59.85	1279.32	2.70	17.93	7148742.35	394880.07	64	26	46.962	N	6	48	56.567	E
1307.99	0.90	56.71	1307.80	2.92	18.27	7148742.57	394880.41	64	26	46.970	N	6	48	56.592	E
1336.81	0.80	59.53	1336.61	3.14	18.64	7148742.79	394880.77	64	26	46.977	N	6	48	56.619	E
1361.37	1.13	55.98	1361.17	3.36	18.98	7148743.01	394881.12	64	26	46.985	N	6	48	56.644	E
1432.61	0.74	349.76	1432.40	4.21	19.48	7148743.86	394881.62	64	26	47.013	N	6	48	56.679	E
1457.52	0.82	351.73	1457.31	4.54	19.43	7148744.19	394881.56	64	26	47.023	N	6	48	56.675	E
1485.75	0.46	350.91	1485.54	4.86	19.38	7148744.51	394881.52	64	26	47.033	N	6	48	56.670	E
1513.40	0.78	340.07	1513.19	5.14	19.30	7148744.79	394881.44	64	26	47.043	N	6	48	56.663	E
1542.71	0.63	345.22	1542.49	5.49	19.19	7148745.14	394881.33	64	26	47.054	N	6	48	56.654	E
1571.26	0.46	325.94	1571.04	5.73	19.09	7148745.38	394881.22	64	26	47.061	N	6	48	56.646	E
1602.09	0.53	285.65	1601.87	5.87	18.88	7148745.52	394881.02	64	26	47.066	N	6	48	56.630	E
1657.64	0.46	311.67	1657.42	6.09	18.47	7148745.74	394880.60	64	26	47.072	N	6	48	56.599	E
1686.74	0.87	326.89	1686.52	6.35	18.26	7148746.00	394880.39	64	26	47.081	N	6	48	56.582	E
1744.63	0.69	290.77	1744.40	6.85	17.69	7148746.50	394879.83	64	26	47.096	N	6	48	56.539	E
1772.98	0.52	252.36	1772.75	6.87	17.41	7148746.52	394879.55	64	26	47.096	N	6	48	56.518	E
1801.68	0.46	280.81	1801.45	6.85	17.17	7148746.50	394879.31	64	26	47.095	N	6	48	56.500	E
1830.49	0.73	290.94	1830.26	6.94	16.89	7148746.59	394879.02	64	26	47.098	N	6	48	56.478	E
1859.02	0.59	285.08	1858.79	7.02	16.58	7148746.69	394878.71	64	26	47.101	N	6	48	56.455	E
1889.37	0.49	292.09	1889.13	7.13	16.31	7148746.78	394878.44	64	26	47.103	N	6	48	56.434	E
1974.51	0.40	306.90	1974.27	7.44	15.73	7148747.09	394877.87	64	26	47.113	N	6	48	56.391	E
2034.15	0.19	283.27	2033.91	7.59	15.47	7148747.24	394877.60	64	26	47.117	N	6	48	56.371	E
2061.83	0.23	262.37	2061.59	7.60	15.37	7148747.25	394877.50	64	26	47.117	N	6	48	56.363	E
2090.26	0.37	281.41	2090.02	7.61	15.22	7148747.26	394877.36	64	26	47.118	N	6	48	56.352	E
2118.86	0.21	353.39	2118.62	7.68	15.13	7148747.33	394877.26	64	26	47.120	N	6	48	56.345	E
2148.34	0.31	305.82	2148.10	7.78	15.06	7148747.43	394877.19	64	26	47.123	N	6	48	56.339	E
2205.94	0.15	313.00	2205.70	7.92	14.87	7148747.57	394877.01	64	26	47.127	N	6	48	56.325	E
2260.66	0.41	284.41	2260.42	8.02	14.63	7148747.67	394876.77	64	26	47.130	N	6	48	56.307	E
2289.03	0.33	235.71	2288.79	8.00	14.47	7148747.65	394876.60	64	26	47.129	N	6	48	56.295	E
2316.25	0.15	256.20	2316.01	7.94	14.37	7148747.59	394876.50	64	26	47.128	N	6	48	56.287	E
2346.53	0.06	97.00	2346.29	7.93	14.34	7148747.58	394876.48	64	26	47.127	N	6	48	56.286	E
2377.48	0.06	182.57	2377.24	7.91	14.36	7148747.56	394876.49	64	26	47.127	N	6	48	56.287	E
2405.04	0.06	109.20	2404.80	7.89	14.37	7148747.54	394876.51	64	26	47.126	N	6	48	56.288	E
2432.95	0.00	202.12	2432.71	7.89	14.39	7148747.54	394876.52	64	26	47.126	N	6	48	56.289	E
2462.59	0.04	43.64	2462.35	7.90	14.39	7148747.55	394876.53	64	26	47.126	N	6	48	56.289	E
2550.85	0.22	55.89	2550.61	8.01	14.55	7148747.66	394876.69	64	26	47.130	N	6	48	56.301	E
2579.77	0.12	350.82	2579.53	8.08	14.60	7148747.73	394876.73	64	26	47.132	N	6	48	56.304	E
2608.94	0.09	345.30	2608.70	8.13	14.59	7148747.78	394876.72	64	26	47.134	N	6	48	56.303	E
2666.91	0.04	103.64	2666.67	8.17	14.59	7148747.82	394876.73	64	26	47.135	N	6	48	56.304	E
2694.88	0.19	266.13	2694.64	8.16	14.56	7148747.81	394876.69	64	26	47.135	N	6	48	56.301	E

A/S Norske Shell

Survey Report - Geographic

Company: EP Norske Shell	Date: 24/08/2005	Time: 12:59:49	Page: 3
Field: Onyx	Co-ordinate(NE) Reference:	Site: Onyx, Grid North	
Site: Onyx	Vertical (TVD) Reference:	SITE 23.5	
Well: 6406/9-1 Onyx South West	Section (VS) Reference:	Well (0.00N,0.00E,72.21Azi)	
Wellpath: Hole 1 (Original hole)	Survey Calculation Method:	Minimum Curvature	Db: Oracle

Survey

MD m	Incl deg	Azim deg	TVD m	+N/-S m	+E/-W m	Map Northing m	Map Easting m	<---- Latitude ---->			<--- Longitude --->				
								Deg	Min	Sec	Deg	Min	Sec		
2723.60	0.14	244.73	2723.36	8.14	14.48	7148747.79	394876.61	64	26	47.134	N	6	48	56.295	E
2753.06	0.15	262.59	2752.82	8.12	14.41	7148747.77	394876.54	64	26	47.133	N	6	48	56.290	E
2772.01	0.13	236.86	2771.77	8.11	14.36	7148747.76	394876.50	64	26	47.133	N	6	48	56.287	E
2877.04	0.77	98.01	2876.79	7.94	14.96	7148747.59	394877.10	64	26	47.128	N	6	48	56.332	E
2977.71	1.82	79.54	2977.44	8.14	17.21	7148747.79	394879.34	64	26	47.137	N	6	48	56.499	E
3010.41	2.19	74.66	3010.12	8.40	18.32	7148748.05	394880.45	64	26	47.147	N	6	48	56.581	E
3039.94	2.37	70.68	3039.62	8.75	19.44	7148748.40	394881.57	64	26	47.159	N	6	48	56.664	E
3094.72	2.84	71.56	3094.35	9.56	21.79	7148749.21	394883.93	64	26	47.188	N	6	48	56.838	E
3151.15	3.19	70.98	3150.70	10.51	24.61	7148750.16	394886.74	64	26	47.222	N	6	48	57.046	E
3210.26	3.37	72.74	3209.71	11.56	27.82	7148751.21	394889.95	64	26	47.259	N	6	48	57.283	E
3267.33	2.88	62.72	3266.70	12.72	30.70	7148752.37	394892.83	64	26	47.300	N	6	48	57.495	E
3297.10	1.85	45.93	3296.44	13.39	31.71	7148753.04	394893.84	64	26	47.323	N	6	48	57.569	E
3326.88	1.29	29.82	3326.21	14.02	32.22	7148753.67	394894.35	64	26	47.343	N	6	48	57.606	E
3350.88	1.02	15.48	3350.21	14.46	32.41	7148754.11	394894.54	64	26	47.358	N	6	48	57.619	E
3379.44	0.49	5.67	3378.76	14.82	32.49	7148754.47	394894.62	64	26	47.370	N	6	48	57.624	E
3407.62	0.17	344.42	3406.94	14.99	32.49	7148754.64	394894.62	64	26	47.375	N	6	48	57.624	E
3440.70	0.12	226.47	3440.02	15.01	32.45	7148754.66	394894.58	64	26	47.376	N	6	48	57.621	E
3498.67	0.20	39.77	3497.99	15.04	32.47	7148754.69	394894.61	64	26	47.377	N	6	48	57.622	E
3526.69	0.31	2.54	3526.01	15.16	32.51	7148754.81	394894.64	64	26	47.381	N	6	48	57.625	E
3559.81	0.31	15.84	3559.13	15.33	32.54	7148754.98	394894.67	64	26	47.386	N	6	48	57.626	E
3588.77	0.12	339.71	3588.09	15.44	32.55	7148755.09	394894.68	64	26	47.390	N	6	48	57.627	E
3617.42	0.08	260.28	3616.74	15.46	32.52	7148755.11	394894.65	64	26	47.390	N	6	48	57.624	E
3645.72	0.13	252.48	3645.04	15.45	32.47	7148755.10	394894.60	64	26	47.390	N	6	48	57.621	E
3673.25	0.04	148.02	3672.57	15.43	32.44	7148755.08	394894.57	64	26	47.389	N	6	48	57.619	E
3701.88	0.15	104.61	3701.20	15.41	32.48	7148755.06	394894.62	64	26	47.389	N	6	48	57.622	E
3731.77	0.38	78.12	3731.09	15.42	32.62	7148755.07	394894.75	64	26	47.389	N	6	48	57.632	E
3759.73	0.48	55.57	3759.05	15.51	32.80	7148755.16	394894.94	64	26	47.392	N	6	48	57.646	E
3788.37	0.43	27.45	3787.69	15.67	32.95	7148755.32	394895.09	64	26	47.398	N	6	48	57.657	E
3816.52	0.38	318.25	3815.84	15.84	32.94	7148755.49	394895.07	64	26	47.403	N	6	48	57.655	E
3845.50	0.13	161.88	3844.82	15.88	32.89	7148755.53	394895.02	64	26	47.404	N	6	48	57.651	E
3906.80	0.33	43.84	3906.12	15.94	33.03	7148755.59	394895.16	64	26	47.406	N	6	48	57.662	E
3936.06	0.13	197.38	3935.38	15.97	33.08	7148755.62	394895.21	64	26	47.407	N	6	48	57.665	E
3963.47	0.37	91.42	3962.79	15.93	33.16	7148755.58	394895.29	64	26	47.406	N	6	48	57.671	E
3991.04	0.37	78.39	3990.36	15.95	33.33	7148755.60	394895.47	64	26	47.407	N	6	48	57.684	E
4019.69	0.27	68.27	4019.01	15.99	33.49	7148755.64	394895.62	64	26	47.409	N	6	48	57.696	E
4048.99	0.17	23.66	4048.31	16.06	33.57	7148755.71	394895.70	64	26	47.411	N	6	48	57.702	E
4077.34	0.19	281.87	4076.66	16.11	33.54	7148755.76	394895.67	64	26	47.412	N	6	48	57.699	E
4104.67	0.20	117.66	4103.99	16.10	33.54	7148755.75	394895.67	64	26	47.412	N	6	48	57.699	E
4136.14	0.31	27.66	4135.46	16.14	33.63	7148755.79	394895.76	64	26	47.414	N	6	48	57.706	E
4188.89	0.21	139.64	4188.21	16.20	33.75	7148755.85	394895.89	64	26	47.416	N	6	48	57.715	E
4223.92	0.09	68.82	4223.24	16.16	33.82	7148755.81	394895.95	64	26	47.414	N	6	48	57.720	E
4247.42	0.35	83.02	4246.74	16.17	33.91	7148755.82	394896.04	64	26	47.415	N	6	48	57.727	E
4276.76	0.31	358.29	4276.08	16.26	34.00	7148755.91	394896.13	64	26	47.418	N	6	48	57.733	E
4293.42	0.30	351.50	4292.74	16.35	33.99	7148756.00	394896.12	64	26	47.421	N	6	48	57.732	E
4320.66	0.77	1.33	4319.97	16.61	33.98	7148756.26	394896.12	64	26	47.429	N	6	48	57.731	E
4346.70	0.89	15.50	4346.01	16.98	34.04	7148756.63	394896.17	64	26	47.441	N	6	48	57.734	E
4385.72	1.06	34.35	4385.03	17.57	34.33	7148757.22	394896.46	64	26	47.460	N	6	48	57.754	E
4434.50	1.34	42.41	4433.80	18.36	34.96	7148758.01	394897.10	64	26	47.487	N	6	48	57.800	E
4492.18	1.50	55.85	4491.46	19.28	36.04	7148758.93	394898.18	64	26	47.518	N	6	48	57.878	E
4522.45	1.81	59.86	4521.72	19.74	36.79	7148759.39	394898.92	64	26	47.533	N	6	48	57.933	E
4575.89	2.34	66.06	4575.12	20.61	38.51	7148760.26	394900.65	64	26	47.563	N	6	48	58.059	E
4608.66	2.60	65.52	4607.86	21.19	39.80	7148760.84	394901.93	64	26	47.583	N	6	48	58.154	E
4638.12	2.66	66.48	4637.29	21.74	41.04	7148761.39	394903.17	64	26	47.602	N	6	48	58.245	E
4665.88	2.99	70.48	4665.01	22.24	42.31	7148761.89	394904.44	64	26	47.620	N	6	48	58.339	E
4701.64	3.15	71.55	4700.72	22.86	44.12	7148762.51	394906.25	64	26	47.642	N	6	48	58.473	E
4732.27	3.38	76.93	4731.30	23.33	45.80	7148762.98	394907.93	64	26	47.659	N	6	48	58.597	E
4759.73	3.74	79.80	4758.71	23.67	47.47	7148763.32	394909.60	64	26	47.672	N	6	48	58.721	E
4788.45	4.33	80.15	4787.36	24.02	49.46	7148763.67	394911.59	64	26	47.686	N	6	48	58.869	E

A/S Norske Shell

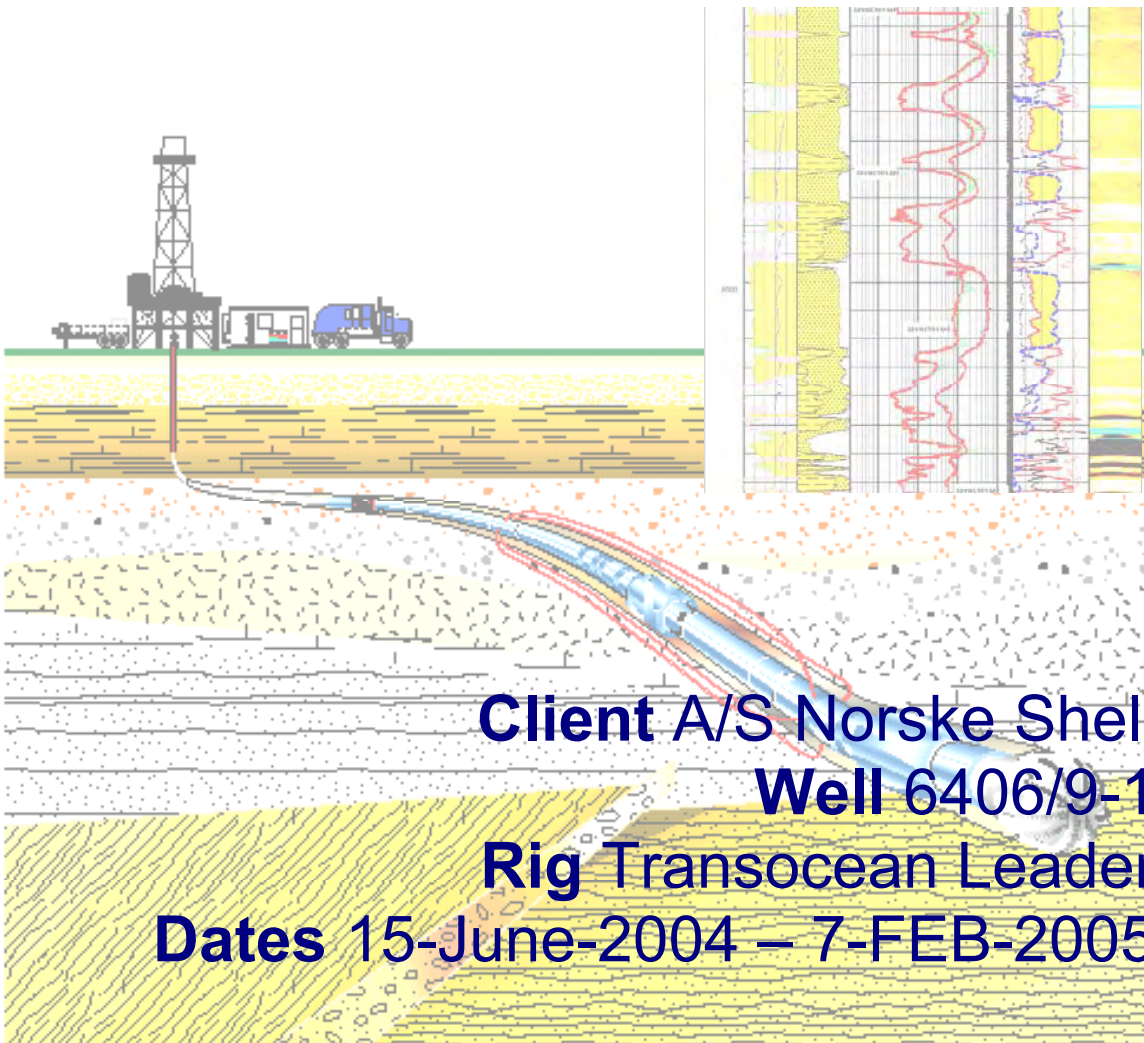
Survey Report - Geographic

Company: EP Norske Shell	Date: 24/08/2005	Time: 12:59:49	Page: 4
Field: Onyx	Co-ordinate(NE) Reference: Site: Onyx, Grid North		
Site: Onyx	Vertical (TVD) Reference: SITE 23.5		
Well: 6406/9-1 Onyx South West	Section (VS) Reference: Well (0.00N,0.00E,72.21Azi)		
Wellpath: Hole 1 (Original hole)	Survey Calculation Method: Minimum Curvature	Db: Oracle	

Survey

MD m	Incl deg	Azim deg	TVD m	+N/-S m	+E/-W m	Map Northing m	Map Easting m	<---- Latitude ---->			<--- Longitude --->		
								Deg	Min	Sec	Deg	Min	Sec
4815.74	4.74	82.11	4814.56	24.36	51.59	7148764.01	394913.72	64	26	47.699 N	6	48	59.027 E
4854.17	5.71	84.90	4852.83	24.74	55.07	7148764.39	394917.20	64	26	47.715 N	6	48	59.286 E
4884.15	5.94	83.69	4882.66	25.05	58.09	7148764.70	394920.23	64	26	47.728 N	6	48	59.511 E
4914.14	6.55	86.36	4912.47	25.33	61.34	7148764.98	394923.48	64	26	47.741 N	6	48	59.754 E
4944.16	6.41	86.10	4942.30	25.55	64.72	7148765.20	394926.86	64	26	47.752 N	6	49	0.006 E
4974.18	6.69	88.42	4972.12	25.71	68.14	7148765.36	394930.28	64	26	47.761 N	6	49	0.261 E
5004.21	6.91	90.51	5001.94	25.74	71.70	7148765.39	394933.83	64	26	47.766 N	6	49	0.526 E
5034.08	7.05	93.43	5031.59	25.62	75.33	7148765.27	394937.46	64	26	47.766 N	6	49	0.798 E
5065.64	6.61	93.89	5062.93	25.38	79.07	7148765.03	394941.20	64	26	47.762 N	6	49	1.078 E
5080.00	6.61	93.89	5077.19	25.27	80.72	7148764.92	394942.85	64	26	47.760 N	6	49	1.202 E

End of Well Report/Logs



Services provided by : Schlumberger Drilling & Measurements
Report compiled by : Transocean Leader D&M Crew
Date : 2-Mar-05
Report verified by : Roel Heusschen
Report approved by : Roel Heusschen

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1.0 Introduction

Company : A/S Norske Shell
Well : 6406/9-1
Field : Onyx South West
Area : Norwegian North Sea
Country : Norway
Rig : Transocean Leader
Drilling Contractor : Transocean Sedco Forex
Spud Date : 15th Jun 2004
TD Date : 7th February 2005
Total Depth : 5080.00 m MD
RKB-MSL : 23,5 m
MSL-Seabed : 309 m
RKB-Seabed : 332,5 m

2.0 Services Provided

2.1 MWD services

The Schlumberger Drilling & Measurements Wellsite Information System (WIS) provided the interface for Measurements While Drilling (MWD) and Logging While Drilling (LWD) data acquisition along with the real-time outputs needed for Directional Drilling. The software used was IDEAL 10_1a_15 and HSPM 9_0C_04.

PowerPulse MWD tools were used to collect data and transmit MWD and LWD information to the surface. The PowerPulse MWD is provided in appropriate sizes for the various well sections and offers a range of variables, telemetry options and data rates, which are configured in the field. On this operation the PowerPulse MWD tool provided all directional information including survey, continuous inclination and azimuth. In addition the tool provided temperature readings, shock indications for protection of the BHA and early warning of washouts by monitoring of turbine revolutions. To aid efficient drilling a stick-slip variable was measured and transmitted to the surface. Another function of the MWD tool was to provide electrical power to any logging tools in the string and it also has a self-diagnostic feature. The MWD tool was used to provide downhole weight on bit (DWOB) and downhole torque (DTOR) measurements in 36", 26" sections and oversized sections 17" x 20" - 14 3/4" x 17 1/2" .

The ARC LWD tool has the capability of providing phase and attenuation resistivity measurements at five depths of investigation at 2MHz and 400KHz frequencies, a total of twenty resistivity measurements, but in this well we will only provide the 2MHz Resistivity, 28 in. Spacing depth of investigation. These measurements are corrected for borehole size and mud parameters. In addition the tool measures natural gamma rays, which are borehole compensated and corrected for environmental factors. An Annular Pressure While Drilling (APWD) sensor provides ECD, ESD and annular temperature measurements. The tool has shock monitoring functions, contains a huge memory for all downhole data and has a self - diagnostic function. Power is taken from the MWD turbine but the tool also contains batteries for data collection during reaming without pumping. The tool is configured at the well site for the variables that are to be used and the rate at which data is to be collected.

Surface system:

Certain surface data were measured and recorded to aid the MWD service. This data included depth from a drawworks sensor, surface weight on bit from a hookload sensor, and pressure readings from two transducers. Other parameters such as rate of penetration are derived from these measurements.

Schlumberger **InterACT** Service was provided at all the time. The Interact service allowed the real time data to be published through the Internet and made it accessible to the town geologists and Drilling engineers.

Two Schlumberger Drilling & Measurements MWD engineers were on location at all times.

2.2 Schlumberger D&M Personnel

2.2.1 MWD Personnel

James Dorr
Paal Groenaas
Matthew Christopher Moran
Vadim Kim
Per Ulvedal
Eivind Hinna
Luis Castro
Frode Hjortland
Peter Munch
Steinar Inge Bidne
Jan Henrik Joergensen
Jan Erland
Maria Mora

2.2.2 DVD Personnel

Phil Matt

2.2.3 TST Personnel

Ole Jørstad
Francois Bernard

2.2.4 FSM / Project Manager

Roel Heusschen

2.2.5 DD Personnel

William Wallace

John Tait

Neil Caple

Laurie Scott

Bjorn T. Ribesen

Ronny Fossberg

Gudmund Aaker

Paul Winterbottom

Paul Nguyen

S. J. Hovland

3.0 Open Hole and Casing Record

3.1 Open Hole Record

Hole Size	Operation	Start Depth	TD
36 "	Drilling	331.5 m MD	408 m MD
26"	Drilling	408 m MD	1380 m MD
17"x20"	Drilling	1380 m MD	2248 m MD
14 ¾" x 17 ½"	Drilling	2248 m MD	2793 m MD
12 ¼"	Drilling	2793 m MD	4308 m MD
8 ½"	Drilling	4308 m MD	5080 m MD

3.2 Casing Record

Casing Size	Start Depth	TD
30"	331.5 m MD	404.5 m MD
20"	331.5 m MD	1367.8 m MD
16"	1288 m MD	2205.4 m MD
14"	328.5 m MD	1050.6 m MD
13 3/8"	1050.6 m MD	2779.6 m MD
10 3/4"	328.5 m MD	2582.85 m MD
9 7/8"	2582.85 m MD	4289 m MD

4.0 Drilling Objectives and Results

4.1 Directional drilling section summary

4.1.1 36" Directional Drilling Summary.

Observations

The same BHA was run in the hole and the well spudded, as per program. The 3rd survey, at 349m, showed an inclination of 1.8 deg. It was discovered that the rig had moved several meters from the original spud location, as the weather was marginal. The rig was moved and the section reamed to bring the angle below the required 1 deg.

At 375m, while making the connection, a large heave caused the drill pipe to come up and push the slips out. After the connection there was a 25 - 30 bar increase in pump pressure and drilling became very slow. Due to the low ROP and high WOB, up to 6 Tons, it was decided to survey every single. At 384m the survey showed 0.92 degrees inclination and the hole was reamed. At the same time the rig was repositioned over the hole from 2.5m to 0.5m away. These two factors gave an inclination of 0.43 degree. Drilling continued to 393m with 10 tons and 110 RPM where the inclination showed 0.55 degree. These drilling parameters were used to a TD of 408m and the final survey showed 0.33 deg inclination. After sweeping the hole clean the BHA was pumped out to 10m below seabed. Then run in the hole again. No hole fill was observed so the hole was filled with 1.20 sg. mud prior to pumping out slowly again. The assembly was racked back but the hole opener laid out. Three of the jets in the 17 1/2" bit were blocked, the bore of the Hole Opener was plugged and the bit was balled up. It was explained that bit was spudded w/o circulation during the period that a large heave caused the drillpipe to come out of slips.

Recommendations

Ensure rig position is held over original spud location after well has been spudded, to ensure hole is as vertical as possible.

Marginal weather caused blocking of nozzles, subsequent bit balling and low penetration rates. Should have waited several hours, for better weather, before spudding commenced.

4.1.2 26" Directional Drilling Summary.

Observations

Ran in hole with assembly and tagged cement at 396m. Drilled out cement and 30" casing shoe with low flow rate/surface RPM and maximum weight on bit of 5 ton, in order to minimize shocks on the bottom hole assemblies. None were seen.

Started to drill new formation from 408m, with drilling parameters optimised to maintain hole angle as close to vertical as possible (100-120 RPM, 4500lpm, 2-5 Ton SWOB). A slight build tendency of approximately 0.25 deg/30m was observed, following the azimuth from the previous section. At survey depth of 588m the inclination was above the required 1.5deg and a 10m low side slide was performed to arrest this tendency. The section was drilled to TD at 1380m MD, with no further slides required, with the inclination staying at approximately one degree for the remainder of the run. Weight on bit was kept to around 5 tonnes, however weights of up to 12 tonnes were required to break through several small stringers.

At section TD the hole was swept with hi-viscosity bentonite pills, in order to clean out the hole. Tight hole was observed at 1330m, while performing a 5 stand wiper trip, in the Kia formation (shale). This section was reamed and the hole was filled with inhibitive mud of 1.30 sg weight. Pulled out of hole with no further problems.

No damage or excessive wear was observed on any of the bottom hole assembly components and the bit had minimal wear, as expected for this section, although one of the bearing seals had failed.

Recommendations

An inhibitive mud system, not seawater, should be used for drilling the Kia formation.

4.1.3 17 x 20" Directional Drilling Summary.

Observations

The objective was to drill as vertically as possible, and this was achieved.

Cavings were observed continually throughout the run but never in amounts enough to cause concern.

There were several pump problems, especially with pump #3 which would trip out due to over heating. This resulted in drilling ahead at a maximum of 20 m/hr with a reduced flow rate of 3600lpm, which was not enough to clean the hole. When pump 3 was brought online again and 4500lpm was pumped at bottoms up, the header box was filled and huge amounts of material would blind the shakers.

After circulating the hole clean at TD back reaming out of hole commenced at 250 m/hr, 3500lpm and 60 rpm to obtain a caliper log from the ARC. At 1800 and 1420m the shaker house was again overrun.

At the shoe an over-pull test was performed to ensure the under reamer closed prior to pulling out of hole, test was successful.

Recommendations

Any reduction in mud pump flow while drilling led to significant hole cleaning problems. Drilling ahead with less than 4000lpm flow should be avoided.

The pendulum BHA performed as required and should be used again in future.

4.1.4 14 ¾” x 17 ½” Directional Drilling Summary

Observations

The objective was to drill section in one run as vertically as possible. Unfortunately due to bit-balling two runs were needed, but the well was drilled completely vertically never straying above an inclination of 0.33 degrees and finishing with an inclination of 0.13 degrees.

Once far enough into the open hole the AnderReamer ball was dropped to activate the under reaming arms. Drilling commenced with 3680 lpm, pump pressure of 303bar, and initial ROP 10m/hr with ca 10 tons on bit. At measured depth 2264m ROP started to slow down. Believed it to be a stringer at first and tried various parameters with the SWOB, rpm. Flow was never varied due to rig pump problems. After a while realized that this was not just a stringer and most likely balled up bit and/or bottom hole assembly. Kept on trying for a while and had sometimes a “drilling break” for a meter or so. Logs and cuttings showed proof of a formation change at 2263m with the Tare formation coming in 20m shallow.

During this run we had problems with high pump pressure, which was not anticipated as a problem, and lower flow for keeping bit/down-hole tools clean of formation. The mud was initially at a weight of 1.81 sg, but due to dilution and the rigs inability to weigh up mud fast enough the final mud weights were 1.79 in and 1.78 out. After finally spotting an anti balling pill made with brine/glycol drilling commenced with exactly the same ROP as before and it was decided to POOH at 2293m after drilling only 40m. The BHA was pulled out of hole for inspection, and it was completely balled up from bit to AnderReamer.

The PDC bit was replaced with an insert bit and the rest of the BHA ran back in hole taking precautions by washing down from inside the casing to avoid bit balling and plugging of nozzles if that could have been a cause for the high pump pressure encountered.

Drilling commenced with a ROP of 20 m/hr as per Shell procedure, but soon started to slow down. Throughout the run limestone stringers slowed the ROP down considerable and the general ROP had a gradual negative trend during the run as well. Several anti balling pills was spotted round the bit and BHA during the run, but possibly on 1 occasion could it be seen that it resulted in unballing BHA and improved ROP.

Pump pressure were unusual high compared to different hydraulics calculations. This resulted in a lower flow-rate than desired for the duration of the run.

As ROP had gradually slowed down to 4-5m/hr and no improvement could be seen by spotting anti balling pills, it was decided to set TD short of planned depth and POOH to run wireline and set casing. Indications of balling up the AnderReamer and most likely rest of BHA as well could be seen throughout the bitrun. Due to balling up, the AnderReamer took 15tons overpull going back into 16" liner shoe. Extra drag of 0-10tons was seen pulling BHA trough 16" liner. All BHA were found to be balled up upon inspection on surface. Some washing of the hard facing on the PowerDrive pads could also be seen.

4.1.5 12 1/4" Directional Drilling Summary

Observations

The objective was to drill section in one to two runs as vertically as possible. Due to the fact that the first run had an insert bit, the possibilities were therefore less realistic to active the first of the to alternatives.

The Packed Rotary BHA was run in to the first CMT Plug @1845. Drilling commenced with a ROP of 20 m/hr as per Shell procedure to the bottom of the plug at 1940m.

RIH /washed down to 2700m where the last CMT plug were, drilling commenced to 2793m.

The Surface system and the well was then displaced to OBM.

Drilling continued true the shoe and 5 meter new formation before FIT.

New formation was drilled with a WOB of 5-10Tons in the beginning and once far enough into the 12 1/4" hole the WOB was increased to 15-20-22-25Tons in steps and with different RPM to get the best possible ROP and still have an vertical hole!

After a while it was realized that this assembly was building angle and the WOB had to be cut back drastically to keep the assembly vertical. The ROP was at the end 6m/hr with a bit weight of 15 Tons. When the weather was picking up it was decided to POOH, the well was circulated clean and the BHA was laid out!

PowerDrive was run back in hole to obtain verticality.

Recommendations

Instead of having an Insert bit in the first assembly an PDC with the same configuration had been drilling Cement and formation much quicker with less weight and therefore less risk of getting an increased inclination in the hole!

In addition a higher flow would be preferred in the well this would make it easy to clean the well with a higher flow rate as high as possible and 5 ½" DP should be used to increase the strength of the drill string.

4.2 MWD/LWD Section Summary

4.2.1 36" Hole Section

This section was drilled in 3 runs. First two runs ended premature, first run due to rig maintenance and second run due to pressure loss in the drillstring while pumping. We POOH to check, but no errors found and the same BHA was run again.

The BHA included a 9" PowerPulse MWD tool for continuous D&I, stationary surveys, shocks, collar rpm, GammaRay, DWOB, DTOR and downhole temperature measurements.

This run was finished at 408m due to TD.

No MWD problems were experienced during drilling. The PowerPulse was programmed at 12 Hz frequency, QPSK at 3 bps. No considerable signal noise was interfering the data transmission.

4.2.2 26" Hole Section

This section was drilled in 1 run. The BHA included a 9" PowerPulse MWD tool for continuous D&I, stationary surveys, shocks, collar rpm, GammaRay, DWOB, DTOR and downhole temperature measurements.

This run was finished at 1380m due to TD.

No MWD problems were experienced during drilling. The PowerPulse was programmed at 12 Hz frequency, QPSK at 3 bps. No considerable signal noise was interfering the data transmission.

4.2.3 17 x 20" Hole Section.

This section was drilled in 1 run. The BHA included a 9" PowerPulse MWD tool for continuous D&I, stationary surveys, shocks, collar rpm, DWOB, DTOR and downhole temperature measurements. A 9"Vision resistivity tool (ARC9) was selected for real time 28" phase shift and attenuation resistivity measurements at 2MHz. In addition RT ECD measurement from APWD sensor was provided.

PCAL obtained to confirm hole opened to 20”.

This was a good run, and ended with a TD of 2248 mMD.

No MWD or LWD problems were experienced during the run. Good signals and real time connection between the two tools were present at all times. The PowerPulse was programmed at 12 Hz frequency, QPSK at 3 bps.

4.2.4 14 ¾” x 17 1/2” Hole Section.

This section was drilled in 2 runs. Both BHAs included a 9” PowerPulse MWD tool for continuous D&I, stationary surveys, shocks, collar rpm, DWOB, DTOR and downhole temperature measurements. A 9” Vision resistivity tool (ARC9) for real time 28” phase shift and attenuation resistivity measurements at 2MHz. In addition RT ECD measurement from APWD sensor was provided.

No MWD or LWD problems were experienced both runs. Good signals and real time connection between the ARC and MWD were present at all times. The PowerPulse was programmed at 12 Hz frequency, QPSK at 3 bps. Ended with a TD of 2793 m MD

PCAL obtained to confirm hole opened to 17 ½”.

4.2.5 12¼ ” Hole Section.

This section was drilled in 3 runs. All 3 BHA’s included 8¼” PowerPulse MWD tool (for continuous D&I, stationary surveys, shocks) and 8¼” Vision resistivity tool (ARC8) for real time 28” phase shift and attenuation resistivity measurements at 2MHz.

Gamma Ray and APWD (ECD and ESD) services were also provided for the duration of the section.

4.2.6 8 ½ ” Hole Section.

This section was drilled in seven runs all BHA's except for run 11 & 16 included 6 ¾" PowerPulse MWD tool (stationary surveys, shocks and real time data transmission) and 6 ¾" Vision Resistivity tool (ARC6) for real time 28" phase shift and attenuation resistivity measurements at 2MHz. In run 11 the TST tool was used to get formation pressure measurements along with ARC6 and PowerUp, which is a new version of the PowerPulse. For run 16 a PowerUp and a DVD tool was picked up. The DVD provided GR, 2MHZ Resistivities, APWD, Density and Neutron Porosity. The entire 8½" section was logged while running in hole to get Density and Neutron porosity. Due to DVD failure no Density and Neutron porosity log exist from 4874 to TD.

5.0 MWD Run Details

5.1 D & M Run # 1

BHA No. : 1
Hole size : 36"
Depth in : 331.5 m MD
Depth out : 331.5 m MD
Drilled : 0.0 m MD
MWD Tool No. : 379
MWD Collar No. : 487
Bit to Survey Depth : 12.36m
Pumping Hours : 0.3
Operating Hours : 0.3
% Operating : 100
Sensor Failure : No
SWOB : N/A
RPM : N/A
Flow Rate : 2500 lpm
Inclination : 0°

COMMENTS:

Included a PowerPulse MWD tool.

MWD tool setup to transmit data at 12 Hz, 3 bits per second.

No spud due to rig maintenance.

5.2 D & M Run # 2

BHA No. : 2
Hole size : 36"
Depth in : 331.5 m MD
Depth out : 331.5 m MD
Drilled : 0.0 m MD
MWD Tool No. : 379
MWD Collar No. : 487
Bit to Survey Depth : 12.36m
Pumping Hours : 7.0
Operating Hours : 7.0
% Operating : 100
Sensor Failure : No
SWOB : N/A
RPM : N/A
Flow Rate : 4000 lpm
Inclination : 0°

COMMENTS:

Included a PowerPulse MWD tool.

MWD tool was set-up to transmit data at 12 Hz, 3 bits per second.

No spud due to 30 bar pressure loss in drillstring. POOH to investigate, but no errors found and the same BHA was re-ran.

5.3 D & M Run # 3

BHA No. : 3
Hole size : 36"
Depth in : 331.5 m MD
Depth out : 408.0 m MD
Drilled : 76.5 m MD
MWD Tool No. : 379
MWD Collar No. : 487
Bit to Survey Depth : 12.36m
Pumping Hours : 7.0
Operating Hours : 7.0
% Operating : 100
Sensor Failure : No
SWOB : 0-10 Tons
RPM : 10-110
Flow Rate : 2400 - 4400 lpm
Inclination : 0° – 0.79°

COMMENTS:

Included a PowerPulse MWD tools.

MWD tool setup to transmit data at 12 Hz, 3 bits per second.

A good run, which ended on TD at 408 mMD.

5.4 D & M Run # 4

BHA No. : 4
Hole size : 26"
Depth in : 408.0 m MD
Depth out : 1380.0 m MD
Drilled : 76.5 m MD
MWD Tool No. : 379
MWD Collar No. : 487
Bit to Survey Depth : 17.50m
Pumping Hours : 50.7
Operating Hours : 50.7
% Operating : 100
Sensor Failure : No
SWOB : 0-10 Tons
RPM : 0-120
Flow Rate : 2268 - 5292 lpm
Inclination : 0.79° – 1.13°

COMMENTS:

The BHA included a PowerPulse MWD tool for directional data and Gamma Ray in real-time only.

The MWD tool was setup to transmit data at 12 Hz, 3 bits per second.

A good run, which ended on TD at 1380 mMD.

5.5 D & M Run # 5

BHA No.	: 5
Hole size	: 17" x 20"
Depth in	: 1380.0 m MD
Depth out	: 2248.0 m MD
Drilled	: 868.0 m MD
MWD Tool No.	: 379
MWD Collar No.	: 487
Bit to Survey Depth	: 18.23m
Pumping Hours	: 50.7
Operating Hours	: 50.7
% Operating	: 100
Sensor Failure	: No
SWOB	: 0-25 Tons
RPM	: 0-120
Flow Rate	: 3520 - 4307 lpm
Inclination	: 1.13° – 0.15°

COMMENTS:

We ran in the 17 x 20 in hole with a Pendulum Assembly including a Straight Motor, MWD PowerPulse and LWD ARC tool.

The objective of this run was drilled ahead holding an inclination less than 1 degree, calling TD at +/- 2241m MD.

We were demodulating with one Signal Pressure Transducer until 1964m MD where we got pump noise. At this point we started demodulating with two SPTs until the end of the run.

The MWD tool was set-up to transmit data at 12 Hz, 3 bits per second.

The objective of the run was achieved without any particularly problem calling TD at 2248 m MD.

5.6 D & M Run # 6

BHA No. : 6
Hole size : 14 ¾" x 17 ½"
Depth in : 2248.0 m MD
Depth out : 2293.0 m MD
Drilled : 45.0 m MD
MWD Tool No. : 378
MWD Collar No. : 024
Bit to Survey Depth : 16.29m
Pumping Hours : 17.62
Operating Hours : 17.62
% Operating : 100
Sensor Failure : No
SWOB : 0-15 Tons
RPM : 0-120
Flow Rate : 3600 - 3931 lpm
Inclination : 0.15° – 0.41°

COMMENTS:

We ran in the 14 ¾ x 17 ½ in hole with a rotary steerable assembly in order to drill through the Brygge and Tare formations and TD in the Shetland formation +/- 2893m MD.

We started without any problem but suddenly we got a dramatic decreased in the ROP from 40 m/h to 2 m/h. DWOB was almost zero at same time which gave us an indication that all the weight was at the Under Reamer. EVD started picking up to 1.86 sg with a mud weight average of 1.80 sg.

The decision was pump a pill until possible balling bit situation. After this pill was pumped the ROP didn't present any change and the client decided to POOH.

5.7 D & M Run # 7

BHA No. : 7
Hole size : 14 ¾" x 17 ½"
Depth in : 2293.0 m MD
Depth out : 2793.0 m MD
Drilled : 868.0 m MD
MWD Tool No. : 378
MWD Collar No. : 024
Bit to Survey Depth : 16.29m
Pumping Hours : 114
Operating Hours : 114
% Operating : 100
Sensor Failure : No
SWOB : 18-22 Tons
RPM : 110-170
Flow Rate : 3520 - 4307 lpm
Inclination : 1.13° – 0.15°

COMMENTS:

We ran in hole with a Rotary Steerable Assembly including a PowerDrive, MWD PowerPulse and LWD ARC tool.

The objective of this run was drilled ahead holding a low inclination until casing point. Good signals throughout the run, and no tool failures occurred.

The MWD tool was set-up to transmit data at 12 Hz, 3 bits per second.

The objective of the run was achieved without any particularly problem calling TD at 2793 m MD.

5.8 D & M Run # 8

BHA No.	: 8
Hole size	: 12 ¼"
Depth in	: 2793.0 m MD
Depth out	: 3252.0 m MD
Drilled	: 459.0 m MD
MWD Tool No.	: 978
MWD Collar No.	: 103
Bit to Survey Depth	: 11.28m
Pumping Hours	: 83.5
Operating Hours	: 83.5
% Operating	: 100
Sensor Failure	: No
SWOB	: 0-25 Tons
RPM	: 0-180
Flow Rate	: 2800 - 3000 lpm
Inclination	: 0.13° – 3.37°

COMMENTS:

We ran in hole with a Packed Rotary Assembly including MWD PowerPulse and LWD ARC tool.

The objective of this run was to drill out the cement plugs in the well, the float and casing shoe and then drill new formation until the Insert bit had to be pulled. It was also important that the inclination was as low as possible.

TD was called at 3252mMD when a BHA trip was done.

The MWD tool was set-up to transmit data at 12 Hz, 3 bits per second.

Good signals throughout the run.

5.9 D & M Run # 9

BHA No. : 9
Hole size : 12 ¼"
Depth in : 3252.0 m MD
Depth out : 3543.0 m MD
Drilled : 291.0 m MD
MWD Tool No. : 978
MWD Collar No. : 103
Bit to Survey Depth : 10.58m
Pumping Hours : 20.5
Operating Hours : 20.5
% Operating : 100
Sensor Failure : No
SWOB : 0-20 Tons
RPM : 0-180
Flow Rate : 2750 - 3000 lpm
Inclination : 0.31° – 2.88°

COMMENTS:

We ran in hole with a Rotary Steerable Assembly including PowerDrive, MWD PowerPulse and LWD ARC tool.

The objective of this run was to continue drilling the 12¼ in section to TD. The run had to be aborted at 3543mMD due to cutting storage filling up at surface, Weather conditions did not allow for the stand by boat to receive cuttings from the rig.

The MWD tool was set-up to transmit data at 12 Hz, 3 bits per second.

Good signals throughout the run.

5.10 D & M Run # 10

BHA No. : 10
Hole size : 12 ¼"
Depth in : 3543.0 m MD
Depth out : 4308.0 m MD
Drilled : 765.0 m MD
MWD Tool No. : 978
MWD Collar No. : 103
Bit to Survey Depth : 10.58m
Pumping Hours : 100.09
Operating Hours : 100.09
% Operating : 100
Sensor Failure : No
SWOB : 10-14 Tons
RPM : 0-160
Flow Rate : 2750 - 3000 lpm
Inclination : 0.04° – 0.48°

COMMENTS:

We ran in the hole with a Rotary Steerable Assembly. The objective of this run was to reach TD at +/-4306 m MD and hold the inclination at zero degrees, which was achieved without any particularly problems. The signal was very good all the time. This was a very good run for D&M.

The MWD tool was set-up to transmit data at 12 Hz, 3 bits per second.

Good signals throughout the run.

5.11 D & M Run #11

BHA No. : 11
Hole size : 8 1/2"
Depth in : 4308 m MD
Depth out : 4546 m MD
Drilled : 238
MWD Tool No. : 1413
MWD Collar No. : AE-FA21
Bit to Survey Depth : 23m
Pumping Hours : 104
Operating Hours : 104
% Operating : 100
Sensor Failure : No
SWOB : 10-17 Tons
RPM : 0-130
Flow Rate : 1600 –1800 lpm
Inclination : 0.77° – 1.81°

COMMENTS:

We ran in hole with a packed Rotary assembly including, MWD Power UP, TST tool and LWD ARC tool.

The objective of this run was to drill the first section of the 8.5 in section and to take pressure tests of the formation with the TST tool. TD was called at 4546 m MD due to core point.

The MWD tool was set-up to transmit data at QPSK 12 Hz, 6 bits per second.

Good signals throughout the run.

5.12 D & M Run #12

BHA No. : 12
Hole size : 8 ½ ”
Depth in : 4546 m MD
Depth out : 4591 m MD
Drilled : 30
MWD Tool No. : 91
MWD Collar No. : AB-159
Bit to Survey Depth : 14.14m
Pumping Hours : 23.23
Operating Hours : 23.23
% Operating : 100
Sensor Failure : No
SWOB : 10-20 Tons
RPM : 0-100
Flow Rate : 1500 –1700 lpm
Inclination : 1.81 ° – 2.34 °

COMMENTS:

We ran in hole with a packed Rotary assembly including, MWD Power Pulse, In Line Stabiliser and LWD ARC tool.

The objective of this run was to clean out the coring run from 4546m to 4561m MD and drill 30m of new formation looking for a clean sand in order to establish the second coring point.

The MWD tool was set-up to transmit data at QPSK 12 Hz, 3 bits per second and delayed surveys. We demodulate with two SPTs without any signal problems.

5.13 D & M Run #13

BHA No.	: 13
Hole size	: 8 ½ ”
Depth in	: 4591 m MD
Depth out	: 4684 m MD
Drilled	: 93
MWD Tool No.	: 91
MWD Collar No.	: AB-159
Bit to Survey Depth	: 13.80m
Pumping Hours	: 39.56
Operating Hours	: 39.56
% Operating	: 100
Sensor Failure	: No
SWOB	: 10-20 Tons
RPM	: 0-100
Flow Rate	: 1500 –1700 lpm
Inclination	: 2.34 ° – 2.99 °

COMMENTS:

We ran in hole with a Packed Hole assembly including Combo Tool, MWD Power Pulse, In Line Stabiliser and LWD ARC tool.

The objective of this run was to pick up the second core point at +/- 4684m MD. During this run we lost the communication with the ARC tool after waiting on weather for two days. We got intermittent communication while tripping in the hole, but prior to start drilling again the communication came back. While drilling we didn't have this problem anymore. We ended up with a very good RT data quality.

The MWD tool was set-up to transmit data at QPSK 12 Hz, 3 bits per second and delayed surveys. We demodulate with two SPTs without any signal problems.

5.14 D & M Run #14

BHA No. : 14
Hole size : 8 ½ ”
Depth in : 4684 m MD
Depth out : 4784
Drilled : 100
MWD Tool No. : 91
MWD Collar No. : AB-159
Bit to Survey Depth : 13.79
Pumping Hours : 46.9
Operating Hours : 46.9
% Operating : 100
Sensor Failure : No
SWOB : 10
RPM : 100
Flow Rate : 1700
Inclination : 2.99° –3.74°

COMMENTS:

We ran in hole with a Packed Hole assembly including Combo Tool, MWD Power Pulse, In Line Stabiliser and LWD ARC tool. Reamed previous cored section and drilled to next coring point.

5.15 D & M Run #15

BHA No. : 15
Hole size : 8 ½ ”
Depth in : 4813 m MD
Depth out : 4874
Drilled : 61
MWD Tool No. : 545
MWD Collar No. : AB-FA21
Bit to Survey Depth : 17.70
Pumping Hours : 30.5
Operating Hours : 30.5
% Operating : 100
Sensor Failure : Yes
SWOB : 13
RPM : 110
Flow Rate : 1700
Inclination : 3.74° –5.71°

COMMENTS:

We ran in hole with a Packed Hole assembly including, MWD Power Pulse, In Line Stabiliser and LWD ARC tool. Reamed the previously cored section and continued drilling 8½” hole. The IWOB sensor failed after drilling only 7m. High stick slip severity of 2-3 was seen throughout the run and the run was aborted due to this.

5.16 D & M Run #16

BHA No. : 16
Hole size : 8 ½ ”
Depth in : 4874 m MD
Depth out : 5063 m MD
Drilled : 189
MWD Tool No. : 015
MWD Collar No. : EG92
Bit to Survey Depth : 15.23
Pumping Hours : 111.54
Operating Hours : 21.36
% Operating : 19.15
Sensor Failure : Yes
SWOB : 12
RPM : 140
Flow Rate : 1700
Inclination : 5.71 °

COMMENTS:

We ran in hole with a Packed Hole assembly including DVD triple combo tool, MWD PowerUp, In Line Stabiliser. To give the client Density and Neutron porosity values from the 8½” section the section was reamed from the shoe and down. When the reaming was done and we were about to drill ahead the Neutron sensor failed. After drilling down to 4881m the pulser stopped working. Decided to drill ahead any way. Calling TD at 5063 m MD. No surveys were taken during this run.

5.17 D & M Run #17

BHA No. : 17
Hole size : 8 ½ ”
Depth in : 5063 m MD
Depth out : 5080 m MD
Drilled : 17
MWD Tool No. : 545
MWD Collar No. : AE-FA21
Bit to Survey Depth : 13.53
Pumping Hours : 26.6
Operating Hours : 26.6
% Operating : 100%
Sensor Failure : Yes
SWOB : 12
RPM : 168
Flow Rate : 1950
Inclination : 6.61 °

COMMENTS:

We ran in hole with a Packed Hole assembly including MWD PowerPulse, ARC tool and In Line Stabiliser. The objective was to ream down from 4874m MD to 5063m MD in order to log the section were the DVD tool failed and to drill down to a new TD at 5080m MD. After drilling down to 5073m MD all communication and real time data from the ARC tool failed, as it had no batteries loaded memory data was lost too. The decision was to drill ahead any way. Thought out the run there was a good signal from the PowerPulse.

6.0 Bottom Hole Assemblies



ROTARY BHA REPORT

RIG: T.O. Leader
 RUN No: 3
 MD In: 332.5m

Well Name: 6406/9-1
 BHA no: 3
 MD out: 408.0m

PHASE: 36"
 BIT No: 1rr3
 INTERVAL: 75.5m
 Job No: 04SCA042

OBJECTIVE:

General:	Drill 36" hole.
Inclination:	Vertical
Azimuth:	Vertical

1rr3	Bit	26"	36"					
Nozzles:	1 x 14, 3 x 18	6 x 12	6 x 12					
Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
17 1/2" 26"x36"HO	Insert		435	Smith	10GMODPD	NJ0273	0.896, 0.663, 0.663	
Features:	Able to drill soft, low compressive strength, abrasive formations.							
Condition in:	0-0-NO-A-E-I-NO-TD							
Hydraulics:	With a MW of Seawater		at	4500 lpm	bit dp =	16 bar	and H.S.I =	0.3
Dull Grading:	2-1-WT-M-E-I-BU-TD							
Selection Criteria:	Selected in town							
Performance:	As expected.							
Recommendations:	Yes							

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	NJ0273	17 1/2"	-	-	7 5/8 R P	0.44	0.44		
26" x 36" HoleOpener *	D60046	36"	-	7 5/8 R B	7 5/8 R B	4.34	4.78	2.20m to 36" Cutters	
9 1/2" Pony DC	41720C	9 1/2"	-	7 5/8 R P	7 5/8 R B	2.92	7.70		
PowerPulse w/GR	MDC 487	9"	-	7 5/8 R P	7 5/8 R B	8.91	16.61	D&I @ 12.36m	
24" NM Stab	28325	9 1/2"	3 1/16"	7 5/8 R P	7 5/8 R B	2.14	18.75	17.30m (0.32m)	24"
9 1/2" Anderdrift	AD 983	9 1/2"	3"	7 5/8 R P	7 5/8 R B	2.99	21.74		
9 1/2" NMDC	64543-2	9 5/16"	3"	7 5/8 R P	7 5/8 R B	7.71	29.45		
6 x 9 1/2" DC	-	9 1/2"	3"	7 5/8 R P	7 5/8 R B	54.70	84.15		
X/O	1242	7 1/4"	3"	7 5/8 R P	XT57 B	1.22	85.37		
9 x 5 7/8" HWDP	-	5 7/8"	4"	XT57 P	XT57 B	84.20	169.57		
5 7/8" DP	To Surface	5 7/8"	4 1/4"	XT57 P	XT57 B		169.57		
PD Spec.	Type	Stab	Min Flow (lpm)	Max Flow (lpm)	Required P drop	Float	Flex Collar	NB Inclination	Choke
-	-	-	-	-	-	Yes - Ported	-	-	-

OPERATIONS:

Date & Time	MD	Cumulative Run Hours	Pump	Drill	Ream	Circ	Other	TOTAL
17:00; 15/06	333m							
07:00; 17/06	408m	24.0	13.5	5.0	5.5	14.0	38.00	
ROP:	75.5m	in	13.5hrs	=	5.6	m/hr		

Cement/Shoetrack: Drilled: Cmt Hours: Size Depth

PARAMETERS:

FLW (lpm)	SPP (bar)	RPM (string)	WOB (ton)	TRQ (dNm)	ROT (ton)	UP (ton)	DN (ton)	Depth m
Min: 1000	3	10	1	8	73	71	75	373
Max: 4500	115	110	9	20				

SURVEY DATA:

MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS
First survey: 340.71	0.33	81.95	340.71	0.59	0.59	0.33	1.42
Last survey: 390.91	0.33	69.50	390.91	0.65	0.65	0.78	

FORMATION:

Age	Group	Formation	MD/TVD Top	Lithology

MUD:

Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (Pa)	Solids (%)	Sand (%)	Temp (°C)
Seawater w/ Pills	Water							

RESULTS:

The same BHA was run in the hole and the well spudded, as per program. The 3rd survey, at 349m, showed an inclination of 1.8 deg. It was discovered that the rig had moved several metres from the original spud location, as the weather was marginal. The rig was moved and the section reamed to bring the angle below the required 1 deg.

At 375m, while making the connection, a large heave caused the drill pipe to come up and push the slips out. After the connection there was a 25 - 30 bar increase in pump pressure and drilling became very slow. Due to the low ROP and high WOB, up to 6 Tons, it was decided to survey every single. At 384m the survey showed 0.92 degree inclination and the hole was reamed. At the same time the rig was repositioned over the hole from 2.5m to 0.5m away. These two factors gave an inclination of 0.43 degree. Drilling continued to 393m with 10 tons and 110 RPM where the inclination showed 0.55 degree. These drilling parameters were used to a TD of 408m and the final survey showed 0.33 degree inclination. After sweeping the hole clean the BHA was pumped out to 10m below seabed. Then run in the hole again. No hole fill was observed so the hole was filled with 1.20 sg mud prior to pumping out slowly again. The assembly was racked back but the hole opener laid out. Three of the jets in the 17 1/2" bit were blocked and bit was balled up.



ROTARY BHA REPORT

RIG: T.O. Leader
RUN No: 4
MD In: 408m

Well Name: 6406/9-1
BHA no: 4
MD out: 1380m

PHASE: 26"
BIT No: 2
INTERVAL: 972m
Job No: 04SCA042

OBJECTIVE:

General:	Drill 26" hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 2

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
26"	Insert	-	415M	Sec DBS	XT02DLC	10534324	1.000	-
Features: Double sealed roller bearing, aggressive tooth shaped inserts and carbide gage protection.								
Condition in: New								
Hydraulics: With a MW of 1.03 SG at 4500 lpm bit dp = 82 bar and H.S.I = 1.4								
Dull Grading: 0-1-WT-G-F-I-NO-TD (Provisional)								
Selection Criteria: Selected in town								
Performance: Good.								
Recommendations: Would run this bit again, with similar assemblies on this area of the field.								

BHA No. 4

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	10534324	26"	-	-	7 5/8 R P	0.55	0.55		
Mud Motor	2032	11 1/4"	-	7 5/8 R B	7 5/8 R B	8.46	9.01	1.10m (0.13m)	25 3/4"
Float Sub	FLX11-005	9 1/2"	-	7 5/8 R P	7 5/8 R B	1.54	10.55		
25 3/4" NM Stab	35864	9 1/2"	3 1/16"	7 5/8 R P	7 5/8 R B	2.38	12.93	10.97m (0.82m)	25 3/4"
PowerPulse w/GR	MDC 487	9"	-	7 5/8 R P	7 5/8 R B	8.91	21.84	D&I @ 17.50m	
24" NM Stab	28325	9 1/2"	3 1/16"	7 5/8 R P	7 5/8 R B	2.14	23.98	22.09m (0.74m)	24"
9 1/2" Anderdrift	AD 983	9 1/2"	3"	7 5/8 R P	7 5/8 R B	2.99	26.97		
9 1/2" NMDC	64543-2	9 5/16"	3"	7 5/8 R P	7 5/8 R B	7.71	34.68		
5 x 9 1/2" DC				7 5/8 R P	7 5/8 R B	45.82	80.50		
Jar	2501	9 3/8"	3"	7 5/8 R P	7 5/8 R B	9.88	90.38		
3 x 9 1/2" DC				7 5/8 R P	7 5/8 R B	27.44	117.82		
X/O				7 5/8 R P	XT57 B	1.22	119.04		
9 x 5 7/8" HWDP				XT57 P	XT57 B	84.20	203.24		
5 7/8" DP	To Surface			XT57 P	XT57 B		203.24		
Motor Spec:									
	Stab	Bend	Rotor Nozzle	rev/gal	Optimum dp	Stator	R/S gap	Bearing In /Out	Stab Out
A1125M3436SP	25 3/4" SWM	0.78	No	0.115	25	100D	0.03mm	2/2	25 3/4"

OPERATIONS:

Date & Time	MD	Cumulative Run Hours	Pump	Drill	Ream	Circ	Other	TOTAL	
02:00; 22/06	408m								
01:30; 25/06	1380m	50.7	34.6	5.0	11.1	20.8	71.50		
ROP:		972.0m	in	34.6hrs	=	28.1	m/hr		
Cement/Shoetrack: 30" casing shoe @ 405m. Tagged cement @ 396m.									
Drilled: 12m							Cmt Hours: 0.9hrs	Size: 30"	Depth: 405m (shoe)

PARAMETERS:

	FLW (lpm)	SPP (bar)	RPM (string)	WOB (ton)	TRQ (dN.m)	ROT (ton)	UP (ton)	DN (ton)	Depth (m)
Min:	3800	110	45	1	6	78	78	78	420
Max:	4640	195	120	13	13	107	110	116	1320

SURVEY DATA:

MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS
First survey:	415.91	0.74	89.01	415.91	0.10	0.10	0.71
Last survey:	1361.37	1.13	55.98	1361.17	3.36	3.36	18.98

FORMATION:

Age	Group	Formation	MD/TVD Top	Lithology
-	Nordland	Sea bed	332 m	Claystone w/ sandstone streaks.
-	Nordland	Kia	1254 m	Claystone w/ siltstone streaks.

MUD:

Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (Pa)	Solids (%)	Sand (%)	Temp (°C)
Seawater w/ sweeps	Water	1.03	-	-	-	-	-	19.5

RESULTS:

Ran in hole with assembly and tagged cement at 396m. Drilled out cement and 30" casing shoe with low flow rate/surface RPM and maximum weight on bit of 5 ton, in order to minimise shocks on the bottom hole assemblies. None were seen.

Started to drill new formation from 408m, with drilling parameters optimised to maintain hole angle as close to vertical as possible (100-120 RPM, 4500 lpm, 2-5 T SWOB). A slight build tendency of approximately 0.25 deg/30m was observed, following the azimuth from the previous section. At survey depth of 588m the inclination was above the required 1.5deg and a 10m lowside slide was performed to arrest this tendency. The section was drilled to TD at 1380m MD, with no further slides required, with the inclination staying at approximately one degree for the remainder of the run. Weight on bit was kept to around 5 tonnes, however weights of up to 12 tonnes were required to break through several small stringers.

At section TD the hole was swept with hi-viscosity bentonite pills, in order to clean out the hole. Tight hole was observed at 1330m, while performing a 5 stand wiper trip, in the Kia formation (shale). This section was reamed and the hole was filled with inhibitive mud of 1.30 sg weight. Pulled out of hole with no further problems.

No damage or excessive wear was observed on any of the bottom hole assembly components and the bit had minimal wear, as expected for this section, although one of the bearing seals had failed.



ROTARY BHA REPORT

RIG: T.O. Leader
RUN No: 5
MD In: 1080.0m

Well Name: 6406/9-1
BHA no: 5
MD out: 2248.0m

PHASE: 17/20"
BIT No: 3
INTERVAL: 972m
Job No: 04SCA042

OBJECTIVE:

General:	Drill 17" hole and underream to 20"
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 3

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
17"	Insert	-	515M	Smith	20GM	MJ4610	1.298	-
Features: Double sealed roller bearing, aggressive tooth shaped inserts and carbide gage protection.								
Condition in: New								
Hydraulics: With a MW of 1.70 SG at 4500 lpm bit dp = 82 bar and H.S.I = 1.4								
Dull Grading: 1-1-NO-A-E-0-NO-TD								
Selection Criteria: Selected in town								
Performance: Good.								
Recommendations: Would run this bit again, with similar assemblies on this area of the field.								

BHA No. 5

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	MJ4610	17"	3 3/4"	-	7 5/8 R P	0.42	0.42		
Mud Motor	2032	11 1/4"	-	7 5/8 R B	7 5/8 R B	8.44	8.86		
*Float Sub	FLX010	9 1/2"	3"	7 5/8 R P	7 5/8 R B	1.50	10.36		
ARC9	401	9 1/2"	-	7 5/8 R P	7 5/8 R B	6.13	16.49		
PowerPulse w/GR	MDC 487	9"	-	7 5/8 R P	7 5/8 R B	8.42	24.91	18.23m to survey	
17" NM Stab	35833	9 1/2"	3"	7 5/8 R P	7 5/8 R B	2.01	26.92		
9 1/2" Anderdrift	AD 972	9 1/2"	3"	7 5/8 R P	7 5/8 R B	3.00	29.92		
Rhino Reamer	G84972	9 1/2"	3.935"	7 5/8 R P	7 5/8 R B	4.09	34.01		
9 1/2" NMDC	64543-2	9 5/16"	3"	7 5/8 R P	7 5/8 R B	7.71	41.72		
5 x 9 1/2" DC	Tally	9 1/2"	3 1/4"	7 5/8 R P	7 5/8 R B	45.83	87.55		
Jar	2501	9 3/8"	3"	7 5/8 R P	7 5/8 R B	9.88	97.43		
3 x 9 1/2" DC	Tally	9 1/2"	3 1/4"	7 5/8 R P	7 5/8 R B	27.78	125.21		
X/O	WN X/O 1241	9 1/2"	3"	7 5/8 R P	XT57 B	1.23	126.44		
9 x 5 7/8" HWDP	Tally	5.875"	4"	XT57 P	XT57 B	84.20	210.64		
5 7/8" DP	To Surface	5.792"	4.25"	XT57 P	XT57 B	1.00	211.64		
Motor Spec:									
A1125M3436SP	Stab	Bend	Rotor Nozzle	rev/gal	Optimum dp	Stator	R/S gap	Bearing In /Out	Stab Out
	11 7/8"	0.00	No	0.115	25	100D	0.03mm	1mm/1mm	17"

OPERATIONS:

Date & Time	MD	Cumulative Run Hours	Pump	Drill	Ream	Circ	Other	TOTAL	
05:30; 30/06	1380m								
10:45; 05/07	2248m		84.0	47.6	5.0	31.4	41.3	125.25	
ROP:		868.0m	in 47.6hrs		= 18.2 m/hr				
Cement/Shoetrack: 20" casing shoe @ 1367.8m. Tagged cement @ 1341m.							Size	Depth	
Drilled: 12m Cmt Hours: 0.7hrs							20"	1367.8m (shoe)	

PARAMETERS:

FLW (lpm)	SPP (bar)	RPM (string)	WOB (ton)	TRQ (dN.m)	ROT (ton)	UP (ton)	DN (ton)	Depth (m)
Min: 3600	130	30	0	9	105	110	100	1391
Max: 4500	268	120	25	19	135	133	137	2230

SURVEY DATA:

MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS
First survey: 1432.61	0.74	349.76	1432.40	4.21	1.86	21.62	0.46
Last survey: 2205.94	0.15	313.00	2205.70	7.92	5.57	17.00	

FORMATION:

Age	Group	Formation	MD/TVD Top	Lithology
-	Nordland	Sea bed	332 m	Claystone w/ sandstone streaks.
-	Nordland	Kia	1254 m	Claystone w/ siltstone streaks.
-	Hordaland	Brygge	not identified	Claystone with Limestone stringers

MUD:

Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (Pa)	Solids (%)	Sand (%)	Temp (°C)
Glydri	WBM	1.70	82.00	33	38	26.5	0.25	44

RESULTS:

The objective was to drill as vertically as possible, this was achieved.

Cavings were observed continually throughout the run but never in amounts enough to cause concern.

There were several pump problems, especially with pump #3 which would trip out due to over heating. This resulted in drilling ahead at a maximum of 20 m/hr with a reduced flowrate of 3600 lpm which was not enough to clean the hole. When pump 3 was brought online again and 4500 lpm was pumped at bottoms up, the header box was filled and huge amounts of material would blind the shakers.

After circulating the hole clean at TD backreaming out of hole commenced at 250 m/hr, 3500 lpm and 60 rpm to obtain a caliper log from the ARC. At 1800 and 1420m the shaker house was again overun.

At the shoe an overpull test was performed to ensure the Underreamer closed prior to pulling out of hole, test was successful.



ROTARY BHA REPORT

RIG: T.O. Leader
RUN No: 7
MD In: 2293.0m

Well Name: 6406/9-1
BHA no: 8
MD out: 2793.0m

PHASE: 17"
BIT No: 6
INTERVAL: 500.0m
Job No: 04SCA042

OBJECTIVE:

General:	Drill 14 3/4" hole vertical and underream to 17 1/2"
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 6	#1	#2	#3	#4	#5	#6	<i>AnderReamer</i>	
Nozzles:	20	20	22	22	0	0	8	
Size	<i>Cone</i>	<i>Fixed cutter</i>	<i>IADC</i>	<i>Make</i>	<i>Type</i>	<i>Ser. No</i>	<i>TFA</i>	<i>Gauge length</i>
17"	insert		M222	Smith	MRS74PX	JT4471	1.356	3"
Features:	Double sealed roller bearing, aggressive tooth shaped inserts and carbide gage protection.							
Condition in:	New							
Hydraulics:	With a MW of 1.81 SG at 3600 lpm bit dp = 45 bar and H.S.I = 2.2							
Dull Grading:	1-1-BU-A-F-In-No-TDAll three cones were very loose.							
Selection Criteria:	Selected in town							
Performance:	Unsatisfactory due to indications of balling up and very slow ROP on stringers.							
Recommendations:	Not to be used again under similar conditions.							

BHA No. 8	* w/ Ported Float								
Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	5051677	14 3/4"	-	-	7 5/8 R P	0.32	0.32		
*PowerDriveXtra900	40	9 1/4"	-	7 5/8 R B	6 5/8 R B	4.45	4.77	w/Ported float	
Stabiliser	90058	14 1/2"	3"	6 5/8 R P	6 5/8 FH B	1.76	6.53		
ARC9	8159	9 1/2"	-	6 5/8 FH P	6 5/8 FH B	5.68	12.21		
PowerPulse w/GR	MDC 024	9"	-	6 5/8 FH P	6 5/8 R B	8.77	20.98	16.21m to survey	
14 1/2" NM Stab	ODT-3897	9 1/2"	3"	6 5/8 R P	6 5/8 R B	2.46	23.44		
Anderdrift	ADB 883	8"	3"	6 5/8 R P	6 5/8 R B	3.09	26.53		
X/O	54923	8"-9 1/2"	3"	6 5/8 R P	7 5/8 R B	0.87	27.40		
AnderReamer	RB 1712	12 1/8" - 9 1/2"	3 1/2"	7 5/8 R P	7 5/8 R B	6.91	34.31		
X/O	53324	8"-9 1/2"	3"	7 5/8 R P	6 5/8 R B	1.20	35.51		
8 x 8" DC	Tally	8"	3"	6 5/8 R P	6 5/8 R B	72.13	106.44		
Jar	WHC-2207	8 1/16"	3"	6 5/8 R P	6 5/8 R B	9.77	116.21		
3 x 8" DC	Tally	8"	3 1/4"	6 5/8 R P	6 5/8 R B	26.93	143.14		
X/O	WN X/O 1241	8"	3"	6 5/8 R P	XT57 B	1.22	144.36		
9 x 5 7/8" HWDP	Tally	5.875"	4"	XT57 P	XT57 B	84.44	228.80		
5 7/8" Drill Pipe	Tally	5.792"	5.05"	XT57 P	XT57 B	1612.94	1841.74		
5" Drill Pipe	tally	5"	4.28"			1100.00	2941.74		
PD Spec.	Type	Stab	Min Flow (lpm)	Max Flow (lpm)	Required P drop	Float	Flex Collar	NB Inclination	Choke
-	-	14 1/2"	3600	4000	40-50 Bar	Yes - Ported	No	Yes	No

OPERATIONS:	Comments:								
	Date & Time	MD	Cumulative Run Hours						
Bit BRT:	02:00:15/07	2293m	Pump	Drill	Ream	Circ	Other	TOTAL	
Bit ART:	07:00:21/07	2793m	114.0	75.9	6.0	32.1	35.0	149.00	
ROP:	500.0m		in	75.9hrs	=	6.6	m/hr		
Cement/Shoetrack:			Drilled:		Cmt Hours:		Size	Depth	
							16	2205m	

PARAMETERS:	Comments:								
	FLW	SPP	RPM	WOB	TRQ	ROT	UP	DN	Depth
	(lpm)	(bar)	(string)	(ton)	(dN.m)	(ton)	(ton)	(ton)	m
Min:	3340	290	100	15	11	130	131	129	2293
Max:	3580	300	175	25	18	130	132	127	2600

SURVEY DATA:	Comments:								VS Azimuth	167.50
	MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS		
First survey:	2316.25	0.15	256.20	2316.01	7.94	7.94	14.37			
Last survey:	2772.01	0.13	236.86	2771.77	8.11	8.11	14.36	0.25		

FORMATION:	Comments: Prognosed tops, no geologist.			
Age	Group	Formation	MD/TVD Top	Lithology
Creteuos	Rogaland	Tare	2263 / 2263	Claystone and mushy too.
Creteuos	Shetland	Springar	2406m	Plasticine with claystone and limestone stringers.
Creteuos	Shetland	Kvitnos	2730m	Plasticine with claystone and limestone stringers.

MUD:	Comments: Mud weight from increased gradually from 1.55sg to 1.70sg throughout section.							
Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft2)	Solids (%)	Sand (%)	Temp (°C)
Glydri	WBM	1.81	82	44	36	30	0.1	76

The objective was to drill as vertically as possible and this was achieved with a final inclination of 0.13 degrees and never above. Indications of balling up the AnderReamer and most likely rest of BHA as well could be seen throughout the bitrun. Drilling commenced with a ROP of 20 m/hr as per Shell procedure, but soon started to slow down. Throughout the run limestone stringers slowed the ROP down considerable and the general ROP had a gradual negative trend during the run as well. Several anti balling pills was spotted round the bit and BHA during the run, but only on 1 occasion could it possibly be seen that it resulted in unballing BHA and improved ROP. However this occasion could have more likely been down to a formation response change than the pill as we saw how the Downhole WOB (DWOB) was distributed more evenly between the bit and the Underreamer. The downhole measurements (DWOB, DTOR and ECD) were used actively in determining whether we were stopping on a stringer or the AnderReamer was balled up and all weight was only resting on those cutters. The ECD was used to determine blocked flow passage past the AnderReamer in conjunction with the other downhole measurements. Pump pressure were unusual high compared to different hydraulics calculations. This resulted in a lower flowrate than desired for the duration of the run. At 2600ish meters the ROP was 1-2m for a long time and it was considered POOH to rearrange the BHA and change the bit, but there was a formation response change (possibly siltier formation i.e. more abrasive for cleaning BHA) and at times it was drilled with 20 m/hr, but at limestone stringers it was down to 1-2m. At 2793m it was finally decided to pull early due more to time constraints than lack of progress which averaged 5 m/hr at the time of decision. Due to balling up, the AnderReamer took 15tons overpull going back into 16" liner shoe. Extra drag of 0-10tons was seen pulling BHA trough 16" liner. All BHA were found to be balled up upon inspection on surface. Some washing of the hard facing on the PowerDrive pads could also be seen.



ROTARY BHA REPORT

RIG:	T.O. Leader	Well Name:	6406/9-1	PHASE:	12 1/4
RUN No:	8	BHA no:	9	BIT No:	7
MD In:	2793.0m	MD out:	3252.0m	INTERVAL:	459.0m
				Job No:	04SCA042

OBJECTIVE:

General:	Drill 12 1/4" vertical hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 7	#1	#2	#3	#4	#5	#6		
Nozzles:	19	19	19	16	0	0		
Size	Cone	Fixed cutter	IADC	Make	mm	Ser. No	TFA	Gauge length
12 1/4	Insert		M222	Hughes	MX-C18-DX	6009606	1.027	
Features:								
Condition in: New								
Hydraulics: With a MW of 1.75 SG at 2950 lpm bit dp = 54 bar and H.S.I = 3.0								
Dull Grading: 1-2-CT-G-E-In-LT-BHA								
Selection Criteria: Selected in town								
Performance: Drilled cement plugs at over 20m/hour but relatively slow in firmer claystone.								
Recommendations:								

BHA No. 9	* w/Non Ported Float								
Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	6009606	12 1/4	-	-	6 5/8 R P	0.33	0.33		12.25
NB Stabiliser*	10211	12 1/4	2 4/5	6 5/8 R B	6 5/8 R B	2.14	2.47	w/Non Ported float.	12 1/4
Pony NMDC	28281	8	2 4/5	6 5/8 R P	6 5/8 R B	2.59	5.06		
NM Stab	35905	12 1/4	2 4/5	6 5/8 R P	6 5/8 R B	1.72	6.78		12 1/4
PowerPulse LF	103	8 1/4	5 1/9	6 5/8 R P	6 5/8 FH B	8.75	15.53		
ILS		12 1/8	3	6 5/8 FH P	6 5/8 FH B	1.53	17.06		12 1/8
ARC-8	8029	8 1/4	2 4/5	6 5/8 FH P	6 5/8 R B	6.12	23.18		
NM Stab	26122	12 1/8	2 4/5	6 5/8 R P	6 5/8 R B	2.26	25.44		12 1/8
NM Float sub*	FS 002	8	2 4/5	6 5/8 R P	6 5/8 R B	0.83	26.27	w/Non Ported float.	
NMDC	38167	8 3/23	2 4/5	6 5/8 R P	6 5/8 R B	9.07	35.34		
Anderdrift 0 - 2.5 deg.	ADB 865	8"	3"	6 5/8 R P	6 5/8 R B	3.04	38.38		
8 x 8" DC	Tally	8"	3"	6 5/8 R P	6 5/8 R B	72.55	110.93		
Jar	WHC-2207	8 1/16"	3"	6 5/8 R P	6 5/8 R B	9.77	120.70		
2 x 8" DC	Tally	8"	3 1/4"	6 5/8 R P	6 5/8 R B	17.88	138.58		
X/O	1244	8"	3"	6 5/8 R P	XT57 B	1.22	139.80		
9 x 5 7/8" HWDP	Tally	5.875"	4"	XT57 P	XT57 B	84.24	224.04		
5 7/8" Drill Pipe	Tally	5.792"	5.05"	XT57 P	XT57 B				
5" Drill Pipe	tally	5"	4.28"						

OPERATIONS:	Comments:								
	Date & Time	MD	Cumulative Run Hours						
Bit BRT:	11:00; 05/11	2793m	Pump Hrs	Drill	Ream	Circ	Other	Total hrs	
Bit ART:	00:00; 12/11	3251m	83.5	48.0	0.0	35.5	73.5	157.00	
ROP:	458.0m	in	48.0hrs	=	9.5	m/hr			
Cement/Shoetrack:	Drilled: 170m		Cmt Hours: 12.0hrs		Size	Depth			
					13 3/8	2780m			

PARAMETERS:	Comments:								
	FLW	SPP	RPM	WOB	TRQ	ROT	UP	DN	Depth
	(lpm)	(bar)	(string)	(ton)	(dN.m)	(ton)	(ton)	(ton)	m
Min:	2900	258	60	8	6	150	152	152	2790
Max:	2950	269	180	25	12	150	154	150	3200

SURVEY DATA:	Comments:							VS Azimuth	60.56
	MD	Inc	Azm	TVD	VS	N/S	E/W	Max DLS	
First survey:	2877.04	0.77	98.02	2876.79	17.08	8.02	15.08	0.37	
Last survey:	3210.26	3.37	72.79	3209.26	30.05	11.65	27.93		

FORMATION:	Comments:			
Age	Group	Formation	MD/TVD Top	Lithology
Tare				Claystone, tuff, traces of dolomite.

MUD:	Comments:							
Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft²)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.76	72	30	18	27.83	0.2	80

The objective was to drill section in one to two runs as vertically as possible. Due to the fact that the first run had an insert bit, the possibilities were therefore less realistic to achieve the first of the alternatives.

BHA was run in to the first CMT Plug @1845m. Drilling commenced with a ROP of 20 m/hr as per Shell procedure to the bottom of the plug at 1940m.

RIH /washed down to 2700m where the last CMT plug were, drilling commenced to 2793m.

The Surface system and the well was then displaced to OBM .

Drilling continued through the shoe and 5 meter new formation before FIT.

New formation was drilled with a WOB of 5-10Tons in the beginning and once far enough into the 12 1/4" hole the WOB was increased to 15-20-22-25Tons in steps and with different RPM to get the best possible ROP and still maintain vertical hole!

After a while it was realized that this assembly was building angle and the WOB was cut back drastically to try to keep the hole vertical .The ROP at the end was 6m/hr with a bit weight of 15 Tons. When the weather was picking up it was decided to POOH, the well was circulated clean and the BHA was laid out!



ROTARY STEERABLE BHA REPORT

RIG:	T.O. Leader	Well Name:	6406/9-1	PHASE:	12 1/4
RUN No:	9	BHA no:	10	BIT No:	8
MD In:	3252.0m	MD out:	3543.0m	INTERVAL:	291.0m
				Job No:	04SCA042

OBJECTIVE:

General:	Drop inclination to vertical and continue drilling 12 1/4" hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 8	#1	#2	#3	#4	#5	#6			
Nozzles:	16	16	16	16	16	16			
Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length	
12 1/4	-	PDC	M222	Smith	MRS74PX	JT3201	1.178	2.5"	
Features:	Double sealed roller bearing, aggressive tooth shaped inserts and carbide gage protection.								
Condition in:	New								
Hydraulics:	With a MW of 1.78 SG		at 2930 lpm		bit dp = 41 bar		and H.S.I = 2.3		
Dull Grading:	0-1-WT-G-X-In-No-WC								
Selection Criteria:	Selected in town								
Performance:	Reasonable ROP around 20 m/hr with little stick slip or shocks. Dropped angle as required with 40% low side setting on PowerDrive.								
Recommendations:	Re-use on next run.								

BHA No. 10 * w/Non Ported Float									
Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	JT3201	12 1/4	-	-	6 5/8 R P	0.26	0.26		12 1/4"
*PowerDriveXtra900	90111	9 1/4	-	6 5/8 R B	6 5/8 R B	4.42	4.68		
Stabiliser	3184	12 1/16	-	6 5/8 R P	6 5/8 R B	1.88	6.56		12 1/16
PowerPulse w/GR	103	8 1/4	5 1/9	6 5/8 R P	6 5/8 R B	8.27	14.83		
ARC9	8029	8 1/4	2 4/5	6 5/8 R P	6 5/8 FH B	6.12	20.95		
NM Float sub*	003	8	2 4/5	6 5/8 FH P	6 5/8 FH B	0.79	21.74	w/Non Ported float.	
NM Stab	26122	12 1/8	2 4/5	6 5/8 R P	6 5/8 R B	2.26	24.00		12 1/8
NM Float sub*	FS 002	8	2 4/5	6 5/8 R P	6 5/8 R B	0.83	24.83	w/Non Ported float.	
NMDC	38167	8 3/23	2 4/5	6 5/8 R P	6 5/8 R B	9.07	33.90		
Anderdrift 0 - 2.5 deg.	ADB 865	8"	3"	6 5/8 R P	6 5/8 R B	3.04	36.94		
8 x 8" DC	Tally	8"	3"	6 5/8 R P	6 5/8 R B	72.55	109.49		
Jar	WHC-2207	8 1/16"	3"	6 5/8 R P	6 5/8 R B	9.77	119.26		
2 x 8" DC	Tally	8"	3 1/4"	6 5/8 R P	6 5/8 R B	17.88	137.14		
X/O	1244	8"	3"	6 5/8 R P	XT57 B	1.22	138.36		
9 x 5 7/8" HWDP	Tally	5.875"	4"	XT57 P	XT57 B	84.24	222.60		
5 7/8" Drill Pipe	Tally	5.792"	5.05"	XT57 P	XT57 B				
5" Drill Pipe	tally	5"	4.28"						

OPERATIONS: Comments:								
Date & Time	MD	Cumulative Run Hours						
Bit BRT:	11:30; 13/11	3252m	Pump	Drill	Ream	Circ	Other	TOTAL
Bit ART:	11:30; 15/11	3543m	20.5	12.7	0.0	7.8	27.5	48.00
ROP:			in			12.7hrs = 22.9 m/hr		
Cement/Shoetrack:							Size	Depth
Drilled:				0m	Cmt Hours:	0.0hrs	13 3/8	2780m

PARAMETERS: Comments:									
	FLW	SPP	RPM	WOB	TRQ	ROT	UP	DN	Depth
	(lpm)	(bar)	(string)	(ton)	(dN.m)	(ton)	(ton)	(ton)	m
Min:	2900	160	150	9	8	158	160	160	3270
Max:	2950	180	180	15	22	160	162	160	3500

SURVEY DATA: Comments:								VS Azimuth	65.19
	MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS	
First survey:	3267.33	2.88	62.74	3266.70	33.32	12.79	30.79	1.24	
Last survey:	3526.69	0.31	2.54	3526.01	35.99	15.24	32.60		

FORMATION: Comments:				
Age	Group	Formation	MD/TVD Top	Lithology
Cretaceous	Cromer Knoll		3225/3225	Claystone with siltstone and sandstone streaks.

MUD: Comments:								
Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft ²)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.79	81	32	52	29	0.25	86

Good run with no problems. At bottom Powerdrive was set to 40% low side to gently drop the inclination from just over three degrees back to vertical and maintain vertical hole. Maximum dog leg was 1.24 deg/30m. Reasonable penetration rates of 20m/hr were achieved with 10 to 12 T weight on bit and 160 to 180 rpm. The assembly was POOH at 3543m due a lack of cuttings handling capacity and worsening weather conditions.



ROTARY STEERABLE BHA REPORT

RIG:	T.O. Leader	Well Name:	6406/9-1	PHASE:	12 1/4
RUN No:	10	BHA no:	11	BIT No:	8 rr1
MD In:	3543.0m	MD out:	4308.0m	INTERVAL:	765.0m
				Job No:	04SCA042

OBJECTIVE:

General:	Drill 12 1/4" vertical hole.
Inclination:	Vertical
Azimuth:	Vertical

8 rr1	#1	#2	#3	#4	#5	#6		
Nozzles:	16	16	16	16	16	16		
Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
12 1/4	-	PDC	M222	Smith	MRS74PX	JT3201	1.178	2.5"
Features:	Double sealed roller bearing, aggressive tooth shaped inserts and carbide gage protection.							
Condition in:	0-1-WT-G-X-In-No-WC							
Hydraulics:	With a MW of 1.83 SG		at 2800 lpm		bit dp = 39 bar		and H.S.I = 2.1	
Dull Grading:	1-1-WT-A-X-In-No-TD							
Selection Criteria:	Selected in town							
Performance:	Reasonable ROP around 20 m/hr with little stick slip or shocks. Dropped angle as required with 40% low side setting on PowerDrive.							
Recommendations:								

BHA No. 11 * w/Non Ported Float									
Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	JT3201	12 1/4	-	-	6 5/8 R P	0.26	0.26		12 1/4"
*PowerDriveXtra900	90111	9 1/4	-	6 5/8 R B	6 5/8 R B	4.42	4.68		
Stabiliser	3184	12 1/16	-	6 5/8 R P	6 5/8 R B	1.88	6.56		12 1/16
PowerPulse w/GR	103	8 1/4	5 1/9	6 5/8 R P	6 5/8 R B	8.27	14.83		
ARC9	8029	8 1/4	2 4/5	6 5/8 R P	6 5/8 FH B	6.12	20.95		
NM Float sub*	003	8	2 4/5	6 5/8 FH P	6 5/8 FH B	0.79	21.74	w/Non Ported float.	
NM Stab	26122	12 1/8	2 4/5	6 5/8 R P	6 5/8 R B	2.26	24.00		12 1/8
NM Float sub*	FS 002	8	2 4/5	6 5/8 R P	6 5/8 R B	0.83	24.83	w/Non Ported float.	
NMDC	38167	8 3/23	2 4/5	6 5/8 R P	6 5/8 R B	9.07	33.90		
Anderdrift 0 - 2.5 deg.	ADB 865	8"	3"	6 5/8 R P	6 5/8 R B	3.04	36.94		
8 x 8" DC	Tally	8"	3"	6 5/8 R P	6 5/8 R B	72.55	109.49		
Jar	WHC-2207	8 1/16"	3"	6 5/8 R P	6 5/8 R B	9.77	119.26		
2 x 8" DC	Tally	8"	3 1/4"	6 5/8 R P	6 5/8 R B	17.88	137.14		
X/O	1244	8"	3"	6 5/8 R P	XT57 B	1.22	138.36		
9 x 5 7/8" HWDP	Tally	5.875"	4"	XT57 P	XT57 B	84.24	222.60		
5 7/8" Drill Pipe	Tally	5.792"	5.05"	XT57 P	XT57 B		222.60		
5" Drill Pipe	tally	5"	4.28"						

OPERATIONS: Comments:									
Date & Time	MD	Cumulative Run Hours							
		Pump	Drill	Ream	Circ	Other	TOTAL		
Bit BRT:	09:15; 16/11	3543m							
Bit ART:	08:00; 25/11	4306m	100.1	50.2	0.0	49.9	114.7	214.75	
ROP:		763.0m	in 50.2hrs		= 15.2 m/hr				
Cement/Shoetrack:							Size	Depth	
Drilled:							13 3/8	2780m	
Cmt Hours:									

PARAMETERS: Comments:									
	FLW	SPP	RPM	WOB	TRQ	ROT	UP	DN	Depth
	(lpm)	(bar)	(string)	(ton)	(dN.m)	(ton)	(ton)	(ton)	m
Min:	2550	275	120	7	11	163	164	162	3560
Max:	2900	305	180	14	20	173	174	174	4030

SURVEY DATA: Comments:								
	MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS
First survey:	3559.81	0.31	15.84	3559.13	35.97	15.34	32.53	0.52
Last survey:	4293.42	0.30	351.50	4292.74	37.71	16.36	33.98	

FORMATION: Comments:				
Age	Group	Formation	MD/TVD Top	Lithology
Cretaceous	Cromer Knoll		3225/3225	Claystone with siltstone and sandstone streaks.

MUD: Comments:								
Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft ²)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.88	85	35	21	30	0.1	86

Good run with no problems directional and drilling wise, except that one had to WOW for some time. The Powerdrive was set to 40% low side to maintain the inclination as close to vertical as possible. Maximum inclination was 0.48 deg, and maximum dog leg was 0.52 deg/30m. Reasonable penetration rates of 10 - 20m/hr were achieved with 10 to 14 T weight on bit and 160 rpm. The assembly was POOH from TD at 4306m. When out of hole all the tools looked visually fine, and the bit in good condition.



ROTARY BHA REPORT

RIG: T.O. Leader
 RUN No: 11
 MD In: 4308.0m

Well Name: 6406/9-1
 BHA no: 12
 MD out: 4546.6m

PHASE: 12 1/4
 BIT No: 11
 INTERVAL: 238.6m
 Job No: 04SCA042

OBJECTIVE:

General:	Drill 8 1/2 " vertical hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 11	#1	#2	#3	#4					
Nozzles:	16	16	16	16					
Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length	
8 1/2	-	PDC		Sec DBS	FM2645	10544587	0.785		
Features:									
Condition in:									
Hydraulics:	With a MW of 1.83 SG		at 2800 lpm		bit dp = 87 bar		and H.S.I = 9.6		
Dull Grading:	3-1-LT-N-X-X-BT-CP								
Selection Criteria:	Selected in town								
Performance:									
Recommendations:									

BHA No. 12 * w/Non Ported Float									
Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	10544587	8 1/2"	2	-	4 1/2" REG	0.29	0.26		8.50
Stabiliser N. Bit	812FITU177	8 1/2	2 1/4		4 1/2" REG	2.19	2.48		8.50
ARC6	230	6 7/8	2 64/79	4 1/2 IF	5 1/2" FH	6.24	8.72		
TST	ENP 006	6 3/4	2 1/4	5 1/2"FH	5 1/2" FH	10.15	18.87		
MWD Tool	AE-FA21	6 7/8	2 64/79	5 1/2" FH	4 1/2" IF	9.02	29.89		
Float sub	FS046 FLT180	6 3/4	2 7/8	4 1/2" IF	4 1/2" IF	0.91	28.80		
Non magnetic Stabli	3904	6 3/4	2 7/8	4 1/2" IF	4 1/2" IF	1.99	30.79		8 1/2
HW drill Pipe	MWS288	5	4	4 1/2"IF	4 1/2" IF	28.00	58.79		
DC-Spiral	50907-08	6 1/4	3	4 1/2" IF	4 1/2" IF	9.23	68.02		
DC-Spiral	2631	6 1/2	2 13/16	4 1/2" IF	4 1/2" IF	9.66	77.68		
DC-Spiral	597-09	6 1/4	2 13/16	4 1/2" IF	4 1/2" IF	9.12	86.80		
DC-Spiral	5971-2	6 1/4	3	4 1/2" IF	4 1/2" IF	9.44	96.24		
DC-Spiral	59704	6 1/2	2 1/4	4 1/2" IF	4 1/2" IF	9.29	105.53		
DC-Spiral	3018	6 1/4	2 13/16	4 1/2" IF	4 1/2" IF	9.69	115.22		
DC-Spiral	8	6 1/4	2 13/16	4 1/2" IF	4 1/2" IF	9.31	124.53		
DC-Spiral	597.06	6 1/2	2 13/16	4 1/2" IF	4 1/2" IF	9.23	133.76		
Jar	WHC1142	6 1/2	2 3/4	4 1/2" IF	4 1/2" IF	9.64	143.40		
DC-Spiral	597.1	6 1/4	2 13/16	4 1/2" IF	4 1/2" IF	8.95	152.35		
DC-Spiral	TOL3011	6 1/2	3	4 1/2" IF	4 1/2" IF	9.02	161.37		
Jar Accelerator	DHCCH1022	6 1/2	2 1/4	4 1/2" IF	4 1/2" IF	9.91	171.28		
HW Drill Pipe	TOL12	5	4	4 1/2" IF	4 1/2" IF	56.28	227.56		
Drill Pipe TO	TOL13	5	4	4 1/2" IF	4 1/2" IF	28.92	256.48		
Dart Sub	iot 21095	7 1/4	2 1/2	4 1/2" IF	4 1/2" IF	0.64	257.12		

OPERATIONS:										
Date & Time		MD	Cumulative Run Hours							
Bit BRT:	07:00; 07/12	4306m	Pump	Drill	Ream	Circ	Other	TOTAL		
Bit ART:	18:00; 14/12	4547m	104.0	34.2	0.9	68.9	75.0	179.00		
ROP:		240.6m	in	34.2hrs	=	7.0	m/hr			
Cement/Shoetrack:							Drilled:	Cmt Hours:	Size	Depth
									9 7/8	4289m

PARAMETERS:									
	FLW (lpm)	SPP (bar)	RPM (string)	WOB (ton)	TRQ (dN.m)	ROT (ton)	UP (ton)	DN (ton)	Depth m
Min:	1702	248	97	7	7.9				4327
Max:	1767	285	120	10	14				4421

SURVEY DATA:								VS Azimuth	65.19
	MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS	
First survey:	4320.66	0.77	1.33	4319.97	37.81	16.68	34.00	0.52	
Last survey:	4522.45	1.81	59.87	4521.71	41.73	19.82	33.98		

FORMATION:					Lithology
Age	Group	Formation	MD/TVD Top		
Jurassic	Baat	Ror	4528		Claystone with siltstone and sandstone streaks.

MUD:								
Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100R2)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.88	85	35	21	32.82	0.1	86

We ran in hole with a packed Rotary assembly including, MWD Power UP, TST tool and LWD ARC tool. The objective of this run was to drill the first section of the 8.5 in section and to take pressure tests of the formation with the TST tool. TD was called at 4546 m MD due to core point. The MWD tool was set-up to transmit data at QPSK 12 Hz, 6 bits per second. Good signals throughout the run. The reason to POOH was TD.



ROTARY BHA REPORT

RIG:	T.O. Leader	Well Name:	6406/9-1	PHASE:	8 1/2"
RUN No:	14	BHA no:	15	BIT No:	13
MD In:	4561.0m	MD out:	4591.0m	INTERVAL:	30.0m
				Job No:	04SCA0517

OBJECTIVE:

General:	Drill 8 1/2" vertical hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 13	#1	#2	#3					
Nozzles:	18	18	20					
Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
8 1/2	Insert	0	447	Smith	GF15SDV	MM 9151	0.804	
Features:								
Condition in:								
Hydraulics:	With a MW of 1.89 SG		at	1700 lpm	bit dp =	32 bar	and H.S.I =	2.1
Dull Grading:	1-1-No-A-E-In-JD-CP							
Selection Criteria:	Selected in town							
Performance:								
Recommendations:								

BHA No. 15									
Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	GF15SDV	8 1/2	-	-	4 1/2 R P	0.26	0.26		8 1/2"
NB Stabilizer	812	6 3/4"	2 13/16"	4 1/2 R B	NC 50 B	2.19	2.45	w/Non Ported float.	8 1/2"
ARC	ARC6-230	6 7/8"	-	NC 50 P	5 1/2 FH B	6.24	8.69		
ILS	20-01	6 7/8"	-	5 1/2 FH P	5 1/2 FH B	1.45	10.14		8 1/2"
PowerPulse w/GR	MDC AB 159	6 3/4"	-	5 1/2 FH P	4 1/2 IF B	8.78	18.92		
Float Sub	OWS FS 046	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	0.91	19.83	w/Non Ported float.	
NM Stabilizer	3904	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	1.99	21.82		8 3/8"
NM HWDP	MWS 288	5"	3"	4 1/2 IF P	4 1/2 IF B	9.22	31.04		
2 x 5"HWDP		5"	3"	4 1/2 IF P	4 1/2 IF B	18.78	49.82		
11 x 6 1/2" DC		6 1/2"	3"	4 1/2 IF P	4 1/2 IF B	102.77	152.59		
Jar	WHC 1142	6 3/4"	2 7/8"	4 1/2 IF P	4 1/2 IF B	9.64	162.23		
2 x 6 1/2" DC		6 1/2"	2 7/8"	4 1/2 IF P	4 1/2 IF B	17.97	180.20		
Accelerator	DACCH 1022	5 1/8"	2 3/4"	4 1/2 IF P	4 1/2 IF B	9.91	190.11		
6 x 5" HWDP		5"	-			56.28	246.39		
Dart Sub	10T21095	7 1/4"	2 13/16"			0.64	247.03		
							247.03		

OPERATIONS:									
<i>Comments:</i>									
Date & Time	MD	Cumulative Run Hours							
Bit BRT:	08:00; 18/12	4561m	Pump	Drill	Ream	Circ	Other	TOTAL	
Bit ART:	15:00; 20/12	4591m	23.2	4.4	0.3	18.8	31.5	55.00	
ROP:		30.0m	in		4.4hrs		=		6.8 m/hr
Cement/Shoetrack:							Size	Depth	
Drilled:							9 7/8	4289m	
Cmt Hours:									

PARAMETERS:									
<i>Comments:</i>									
FLW (lpm)	SPP (bar)	RPM (string)	WOB (ton)	TRQ (dN.m)	ROT (ton)	UP (ton)	DN (ton)	Depth (m)	
Min:	1550	220	65	5.3	5.1	142	141	147	4544
Max:	1650	243	73	19	6.5	148	147	154	4575

SURVEY DATA:								
<i>Comments:</i>								
MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS	
First survey:	4522.45	1.81	59.87	4521.72	41.75	19.74	36.79	
Last survey:	4575.89	2.34	66.07	4575.12	43.68	20.61	38.51	

FORMATION:				
<i>Comments:</i>				
Age	Group	Formation	MD/TVD Top	Lithology
Jurassic	Baat	Ror	4528	Sandstone with stringers of claystone

MUD:								
<i>Comments:</i>								
Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft ²)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.88	100	41	19	32.82	0.1	119

We ran in hole with a packed Rotary assembly including, MWD Power Pulse, In Line Stabiliser and LWD ARC tool. The objective of this run was to clean out the coring run from 4546m to 4561m MD and drill 30m of new formation looking for a clean sand in order to establish the second coring point. The MWD tool was set-up to transmit data at QPSK 12 Hz, 3 bits per second and delayed surveys. We demodulate with two SPTs without any signal problems. Core point was the reason POOH.



ROTARY BHA REPORT

RIG:	T.O. Leader	Well Name:	6406/9-1	PHASE:	8 1/2"
RUN No:	16	BHA no:	17	BIT No:	15
MD In:	4621.0m	MD out:	4684.0m	INTERVAL:	63.0m
				Job No:	04SCA0517

OBJECTIVE:

General:	Drill 8 1/2" vertical hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 15	#1	#2	#3									
Nozzles:	18	18	20	Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
		PDC	M434	8 1/2	-			Sec. DBS	FM2845Z	10657754	0.804	64mm
Features:												
Condition in:												
Hydraulics:	With a MW of 1.89 SG at 1700 lpm bit dp = 32 bar and H.S.I = 2.1											
Dull Grading:	0-1-LT-S-X-In-No-CP											
Selection Criteria:	Selected in town											
Performance:												
Recommendations:												

BHA No. 17									
Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	10657754	8 1/2	-	-	4 1/2 R P	0.29	0.29		8 1/2"
Combo NB Stabilizer	30209A	6 3/4"	-	4 1/2 R B	NC 50 B	1.82	2.11	w/Non Ported float.	8 1/2"
ARC	ARC6-230	6 7/8"	-	NC 50 P	5 1/2 FH B	6.24	8.35		
ILS	20-01	6 7/8"	-	5 1/2 FH P	5 1/2 FH B	1.45	9.80		8 1/2"
PowerPulse w/GR	MDC AB 159	6 3/4"	-	5 1/2 FH P	4 1/2 IF B	8.78	18.58		
Float Sub	OWS FS 046	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	0.91	19.49	w/Non Ported float.	
NM Stabilizer	3904	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	1.99	21.48		8 3/8"
NM HWDP	MWS 288	5"	3"	4 1/2 IF P	4 1/2 IF B	9.22	30.70		
2 x 5"HWDP		5"	3"	4 1/2 IF P	4 1/2 IF B	18.78	49.48		
8 x 6 1/2" DC		6 1/2"	3"	4 1/2 IF P	4 1/2 IF B	74.38	123.86		
Jar	WHC 1142	6 3/4"	2 7/8"	4 1/2 IF P	4 1/2 IF B	9.64	133.50		
2 x 6 1/2" DC		6 1/2"	2 7/8"	4 1/2 IF P	4 1/2 IF B	17.97	151.47		
Accelerator	DACCH 1022	5 1/8"	2 3/4"	4 1/2 IF P	4 1/2 IF B	9.91	161.38		
6 x 5" HWDP		5"	-			56.28	217.66		
Dart Sub	10T21095	7 1/4"	2 13/16"			0.64	218.30		

OPERATIONS:									
Comments:									
Date & Time	MD	Cumulative Run Hours							
Bit BRT:	07:30; 28/12	4621m	Pump	Drill	Ream	Circ	Other	TOTAL	
Bit ART:	13:30; 02/01	4684m	39.6	8.8	1.5	29.3	83.9	125.00	
ROP:			in			8.8hrs		= 7.2 m/hr	
Cement/Shoetrack:							Size	Depth	
Drilled:							9 7/8	4289m	
Cmt Hours:									

PARAMETERS:									
Comments:									
	FLW	SPP	RPM	WOB	TRQ	ROT	UP	DN	Depth
	(lpm)	(bar)	(string)	(ton)	(dN.m)	(ton)	(ton)	(ton)	m
Min:	1657	254	74	3.5	7.1	147	152	159	4631
Max:	1724	283	122	12.6	9.4	155	152	158	4661

SURVEY DATA:								
Comments:								
	MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS
First survey:	4638.12	2.66	66.49	4637.29	46.44	21.74	41.04	
Last survey:	4665.88	2.99	70.51	4665.02	47.80	22.23	42.31	

FORMATION:				
Comments:				
Age	Group	Formation	MD/TVD Top	Lithology
Jurassic	Baat	Tilje	4677	Sandstone with stringers of claystone

MUD:								
Comments:								
Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft ²)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.89	100	37	16	31.1	0.1	22

We ran in hole with a Packed Hole assembly including Combo Tool, MWD Power Pulse, In Line Stabiliser and LWD ARC tool. The objective of this run was to pick up the second core point at +/- 4684m MD. During this run we lost the communication with the ARC tool after waiting on weather for two days. We got intermittent communication while tripping in the hole, but prior to start drilling again the communication came back. While drilling we didn't have this problem anymore. We ended up with a very good RT data quality. The MWD tool was set-up to transmit data at QPSK 12 Hz, 3 bits per second and delayed surveys. We demodulate with two SPTs without any signal problems. Core point was reason POOH.



ROTARY STEERABLE BHA REPORT

RIG:	T.O. Leader	Well Name:	6406/9-1	PHASE:	8 1/2
RUN No:	14	BHA no:	18	BIT No:	15
MD In:	4684.0m	MD out:	4784.0m	INTERVAL:	100.0m
				Job No:	04SCA0517

OBJECTIVE:

General:	Drill 8 1/2" vertical hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 15	#1	#2	#3					
Nozzles:	18	18	20					
Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
8 1/2	-	PDC	M434	Sec. DBS	FM2845Z	10657754	0.804	64mm
Features:								
Condition in:								
Hydraulics:	With a MW of	1.89 SG	at	1700 lpm	bit dp =	32 bar	and H.S.I =	2.1
Dull Grading:	1-8-RO-S-1-HC-CP							
Selection Criteria:	Selected in town							
Performance:								
Recommendations:								

BHA No. 18	* w/Non Ported Float								
Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	10657754	8 1/2	-	-	4 1/2 R P	0.29	0.29		8 1/2"
Combo NB Stabilizer	30209A	6 3/4"	-	4 1/2 R B	NC 50 B	1.82	2.11	w/Non Ported float.	8 1/2"
ARC	ARC6-230	6 7/8"	-	NC 50 P	5 1/2 FH B	6.23	8.34		
ILS	20-01	6 7/8"	-	5 1/2 FH P	5 1/2 FH B	1.45	9.79		8 1/2"
PowerPulse w/GR	MDC AB 159	6 3/4"	-	5 1/2 FH P	4 1/2 IF B	8.78	18.57		
Float Sub	OWS FS 046	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	0.91	19.48	w/Non Ported float.	
NM Stabilizer	3904	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	1.99	21.47		8 3/8"
NM HWDP	MWS 288	5"	3"	4 1/2 IF P	4 1/2 IF B	9.22	30.69		
2 x 5"HWDP		5"	3"	4 1/2 IF P	4 1/2 IF B	18.78	49.47		
8 x 6 1/2" DC		6 1/2"	3"	4 1/2 IF P	4 1/2 IF B	74.38	123.85		
Jar	WHC 1142	6 3/4"	2 7/8"	4 1/2 IF P	4 1/2 IF B	9.64	133.49		
2 x 6 1/2" DC		6 1/2"	2 7/8"	4 1/2 IF P	4 1/2 IF B	17.97	151.46		
Accelerator	DACCH 1022	5 1/8"	2 3/4"	4 1/2 IF P	4 1/2 IF B	9.91	161.37		
6 x 5" HWDP		5"	-			56.28	217.65		
Dart Sub	10T21095	7 1/4"	2 13/16"			0.64	218.29		

OPERATIONS:	Comments:								
	Date & Time	MD	Cumulative Run Hours						
Bit BRT:	18:00; 05/01	4684m	Pump	Drill	Ream	Circ	Other	TOTAL	
Bit ART:	04:00; 14/01	4784m	46.9	15.9	2.0	29.0	155.1	202.00	
	ROP:	100.0m	in	15.9hrs	=	6.3	m/hr		
Cement/Shoetrack:							Size	Depth	
	Drilled: 0m Cmt Hours:						9 7/8	4289m	

PARAMETERS:	Comments:								
	FLW	SPP	RPM	WOB	TRQ	ROT	UP	DN	Depth
	(lpm)	(bar)	(string)	(ton)	(dN.m)	(ton)	(ton)	(ton)	m
Min:	1200	240	100	5	12	147	152	159	4300
Max:	1700	260	150	17	18	155	152	158	4700

SURVEY DATA:	Comments:							VS Azimuth	65.19
	MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS	
First survey:	4701.64	3.15	71.53	4700.72	49.74	22.93	44.14	0.13	
Last survey:	4759.73	3.74	79.80	4758.71	53.08	23.74	47.48		

FORMATION:	Comments:			
Age	Group	Formation	MD/TVD Top	Lithology
Jurassic	Baat	Tilje	4677	Sandstone with stringers of claystone

MUD:	Comments:							
Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft²)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.79	81	32	52	29	0.25	86

Good run for D&M. The LWD ARC picked up the core point without any problems at 4784m MD. Signal was pretty good during all the run. POOH for coring point was the reason to POOH.



ROTARY STEERABLE BHA REPORT

RIG:	T.O. Leader	Well Name:	6406/9-1	PHASE:	8 1/2
RUN No:	15	BHA no:	20	BIT No:	17
MD In:	4813.0m	MD out:	4874.0m	INTERVAL:	61.0m
				Job No:	04SCA0517

OBJECTIVE:

General:	Drill 8 1/2" vertical hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 17 #1 #2 #3 #4

Nozzles:								
Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
8 1/2	-	PDC		Sec. DBS	FM2845	5012017	0.785	
Features:								
Condition in:								
Hydraulics:	With a MW of	1.89 SG	at	1700 lpm	bit dp =	33 bar	and H.S.I =	2.2
Dull Grading:	1-2-WT-N-X-In,FB,BHA							
Selection Criteria:	Selected in town							
Performance:								
Recommendations:								

BHA No. 20 * w/Non Ported Float

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	5012017	8 1/2	2	-	4 1/2 R P	0.22	0.22		8 1/2"
NB Stabilizer	8623	6 3/4"	2.81	4 1/2 R B	NC 50 B	2.19	2.41	w/Non Ported float.	8 1/2"
Shock Tool	65582	8 1/2	3	NC 50 P	NC 50 B	3.46	5.87		
ARC	ARC6-230	6 7/8"	2.81	NC 50 P	5 1/2 FH B	6.23	12.10		
ILS	20-01	6 7/8"	3	5 1/2 FH P	5 1/2 FH B	1.45	13.55		8 1/2"
PowerPulse w/GR	MDC FA21	6 3/4"	3	5 1/2 FH P	4 1/2 IF B	9.04	22.59		
Float Sub	OWS FS 046	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	0.91	23.50	w/Non Ported float.	
NM Stabilizer	3904	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	1.99	25.49		8 3/8"
NM HWDP	MWS 288	5"	3"	4 1/2 IF P	4 1/2 IF B	9.22	34.71		
2 x 5" HWDP		5"	3"	4 1/2 IF P	4 1/2 IF B	18.78	53.49		
8 x 6 1/2" DC		6 1/2"	3"	4 1/2 IF P	4 1/2 IF B	74.38	127.87		
Jar	WHC 1142	6 3/4"	2 7/8"	4 1/2 IF P	4 1/2 IF B	9.64	137.51		
2 x 6 1/2" DC		6 1/2"	2 7/8"	4 1/2 IF P	4 1/2 IF B	17.97	155.48		
Accelerator	DACCH 1035	5 1/8"	2 3/4"	4 1/2 IF P	4 1/2 IF B	10.03	165.51		
6 x 5" HWDP		5"	-			56.28	221.79		
Dart Sub	10T21095	7 1/4"	2 13/16"			0.64	222.43		

OPERATIONS:

Comments:

Date & Time	MD	Cumulative Run Hours						Other	TOTAL
		Pump	Drill	Ream	Circ				
Bit BRT:	10:00; 20/01	4813m							
Bit ART:	05:00; 23/01	4874m	30.5	20.1	2.0	8.4	36.5	67.00	
ROP:		61.0m	in		20.1hrs	=	3.0	m/hr	
Cement/Shoetrack:							Size	Depth	
Drilled: 0m							9 7/8	4289m	
Cmt Hours:									

PARAMETERS:

Comments:

	FLW (lpm)	SPP (bar)	RPM (string)	WOB (ton)	TRQ (dN.m)	ROT (ton)	UP (ton)	DN (ton)	Depth m
Min:	1710	260	105	3	6.8	147	152	159	4300
Max:	1720	275	125	18	10	155	152	158	4700

SURVEY DATA:

Comments:

VS Azimuth

	MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS
First survey:	4788.45	4.33	80.20	4784.36	55.03	24.10	49.47	0.78
Last survey:	4854.17	5.71	84.95	4852.83	60.41	24.81	55.08	

FORMATION:

Comments:

Age	Group	Formation	MD/TVD Top	Lithology
Jurassic	Baat	Tilje	4823/4821.8	Sandstone with stringers of claystone

MUD:

Comments:

Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft ²)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.89	94	39	16	33.5	0.1	50

Good run for D&M except for the IWOB sensor that failed after drilling only 7m. Good signal throughout the run. Penetration Rate was the reason for POOH.



ROTARY STEERABLE BHA REPORT

RIG:	T.O. Leader	Well Name:	6406/9-1	PHASE:	8 1/2
RUN No:	16	BHA no:	22	BIT No:	18
MD In:	4874.0m	MD out:	5063.0m	INTERVAL:	189.0m
				Job No:	04SCA0517

OBJECTIVE:

General:	Drill 8 1/2" vertical hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 18 #1 #2 #3 #4

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
8 1/2	-	Diamond		Smith	KGR50BCPX	JT 6419	1.2	
Features:								
Condition in:								
Hydraulics:	With a MW of 1.89 SG		at	1700 lpm	bit dp =	14 bar	and H.S.I =	1.0
Dull Grading:	8,5,RO,N,X,IN,HC,TD							
Selection Criteria:	Selected in town							
Performance:								
Recommendations:								

BHA No. 22 * w/Non Ported Float

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	JT 6419	8 1/2	2	-	4 1/2 R P	0.40	0.40		8 1/2"
Cossover	PDS	6 1/2	2 1/4	4 1/2 R B	NC 50 B	0.89	1.29		
DVD tool	ENP 02	6 3/4	2 1/4	NC 50 P	5 1/2 FH B	8.35	9.64		
ILS	20-01	6 7/8"	3	5 1/2 FH P	5 1/2 FH B	1.45	11.09		8 3/8"
PowerPulse w/GR	EG92	6 3/4"	2 1/4	5 1/2 FH P	4 1/2 IF B	8.89	19.98		
Float Sub	OWS FS 046	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	0.91	20.89	w/Non Ported float.	
NM Stabilizer	3904	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	1.99	22.88		8"
NM HWDP	MWS 288	5"	3"	4 1/2 IF P	4 1/2 IF B	9.22	32.10		
2 x 5"HWDP		5"	3"	4 1/2 IF P	4 1/2 IF B	18.78	50.88		
Float Sub	24209	6 5/8	2 13/16	4 1/2 IF P	4 1/2 IF B	0.92	51.80		
8 x 6 1/2" DC		6 1/2"	3"	4 1/2 IF P	4 1/2 IF B	74.38	126.18		
Jar	WHC 1142	6 3/4"	2 7/8"	4 1/2 IF P	4 1/2 IF B	9.64	135.82		
2 x 6 1/2" DC		6 1/2"	2 7/8"	4 1/2 IF P	4 1/2 IF B	17.97	153.79		
Accelerator	DACCH 1035	5 1/8"	2 3/4"	4 1/2 IF P	4 1/2 IF B	10.03	163.82		
6 x 5" HWDP		5"	-			56.28	220.10		
Dart Sub	10T21095	7 1/4"	2 13/16"			0.64	220.74		

OPERATIONS:

Comments:

Date & Time	MD	Cumulative Run Hours	Pump	Drill	Ream	Circ	Other	TOTAL
Bit BRT: 10:00; 20/01	4874m							
Bit ART: 05:00; 23/01	5063m	111.5	75.5	585.0	-549.0	-44.5		67.00
ROP:		189.0m	in	75.5hrs	=	2.5	m/hr	
Cement/Shoetrack:							Size	Depth
Drilled: 0m							9 7/8	4289m
Cmt Hours:								

PARAMETERS:

Comments:

FLW (lpm)	SPP (bar)	RPM (string)	WOB (ton)	TRQ (dN.m)	ROT (ton)	UP (ton)	DN (ton)	Depth m
Min: 1500	234	120	7	9	160	162	162	5037
Max: 2000	300	150	13	12	160	162	162	-

SURVEY DATA:

Comments:

VS Azimuth

MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS
First survey:							
Last survey:							

FORMATION:

Comments:

Age	Group	Formation	MD/TVD Top	Lithology
Jurassic	Baat	Tilje	4823/4821.8	Sandstone with stringers of claystone

MUD:

Comments:

Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft ²)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.89	94	44	20	33.5	0.1	50

After 1 hour of drilling the neutron reading from the DVD tool maxed out at 511 other readings are fine. After 6.9 hours of drilling the PUP fails and the signal is lost for the rest of the run. Reason for POOH was TD.



ROTARY STEERABLE BHA REPORT

RIG: T.O. Leader	Well Name: 6406/9-1	PHASE: 8 1/2
RUN No: 17	BHA no: 23	BIT No: 19
MD In: 5063.0m	MD out: 5080.0m	INTERVAL: 17.0m
		Job No: 04SCA0517

OBJECTIVE:

General:	Drill 8 1/2" vertical hole.
Inclination:	Vertical
Azimuth:	Vertical

BIT No. 19 #1 #2 #3 #4

Size	Cone	Fixed cutter	IADC	Make	Type	Ser. No	TFA	Gauge length
8 1/2	-	Diamond		Smith	KGR50BCPX	JT 4803	1.48	
Features:								
Condition in:								
Hydraulics:	With a MW of 1.89 SG		at	1900 lpm	bit dp =	12 bar	and H.S.I =	0.9
Dull Grading:	2,1,WT,T,X,IN,PN,TD							
Selection Criteria:	Selected in town							
Performance:								
Recommendations:								

BHA No. 23 * w/Non Ported Float

Component	Serial No	Size/OD	ID	Con dn	Con up	Length	Acc length	Comments	Stab Gauge Out
Bit	JT 4803	8 1/2	2	-	4 1/2 R P	0.40	0.40		8 1/2"
Crossover	PDS	6 1/2	2 1/4	4 1/2 R B	4 1/2 R B	0.13	0.53		
Float Sub		6 1/2		4 1/2 R B	4 1/2 IF B	1.17	1.70	w/Non Ported float.	
ARC tool	1718	6 3/4	2 1/4	4 1/2 IF B	5 1/2 FH B	6.23	7.93		
ILS	20-01	6 7/8"	3	5 1/2 FH P	5 1/2 FH B	1.45	9.38		8 3/8"
PowerPulse w/GR	FA 21	6 3/4"	2 1/4	5 1/2 FH P	4 1/2 IF B	9.04	18.42		
Float Sub	OVS FS 046	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	0.91	19.33	w/Non Ported float.	
NM Stabilizer	3904	6 3/4"	2 13/16"	4 1/2 IF P	4 1/2 IF B	1.99	21.32		8"
NM HWDP	MWS 288	5"	3"	4 1/2 IF P	4 1/2 IF B	9.22	30.54		
2 x 5"HWDP		5"	3"	4 1/2 IF P	4 1/2 IF B	18.78	49.32		
Float Sub	24209	6 5/8	2 13/16	4 1/2 IF P	4 1/2 IF B	0.92	50.24		
8 x 6 1/2" DC		6 1/2"	3"	4 1/2 IF P	4 1/2 IF B	74.38	124.62		
Jar	WHC 1142	6 3/4"	2 7/8"	4 1/2 IF P	4 1/2 IF B	9.64	134.26		
2 x 6 1/2" DC		6 1/2"	2 7/8"	4 1/2 IF P	4 1/2 IF B	17.97	152.23		
Accelerator	DACCH 1035	5 1/8"	2 3/4"	4 1/2 IF P	4 1/2 IF B	10.03	162.26		
6 x 5" HWDP		5"	-			56.28	218.54		
Dart Sub	10T21095	7 1/4"	2 13/16"			0.64	219.18		

OPERATIONS:

Comments:

Date & Time	MD	Cumulative Run Hours						TOTAL
		Pump	Drill	Ream	Circ	Other		
Bit BRT:	04:30; 04/02	5063m						
Bit ART:	19:00; 07/02	5080m	26.6	6.6	6.3	13.8	59.9	
							86.50	
		ROP:	17.0m	in	6.6hrs	=	2.6 m/hr	
		Cement/Shoetrack:		Drilled:	0m	Cmt Hours:	9 7/8	
							Depth	
							4289m	

PARAMETERS:

Comments:

	FLW	SPP	RPM	WOB	TRQ	ROT	UP	DN	Depth
	(lpm)	(bar)	(string)	(ton)	(dN.m)	(ton)	(ton)	(ton)	m
Min:	1500	234	120	7	9	160	162	162	5037
Max:	2000	300	150	13	12	160	162	162	-

SURVEY DATA:

Comments:

VS Azimuth

	MD	Inc	Azm	TVD	VS	N-S	E-W	Max DLS
First survey:	5065.64	6.61	93.89	5062.93	83.04	25.38	79.07	
Last survey:								

FORMATION:

Comments:

Age	Group	Formation	MD/TVD Top	Lithology
Jurassic	Baat	Tilje	4823/4821.8	Sandstone with stringers of claystone

MUD:

Comments:

Type	Water / Oil Base	Weight (SG)	FV (Sec)	PV (Cp)	YP (lb/100ft ²)	Solids (%)	Sand (%)	Temp (°C)
Paratherm	OBM	1.89	94	44	20	33.5	0.1	50

We ran in hole with a Packed Hole assembly including MWD PowerPulse, ARC tool and In Line Stabiliser. The objective was to ream down from 4874m MD to 5063m MD in order to log the section were the DVD tool failed and to drill down to a new TD at 5080m MD. After drilling down to 5073m MD all communication and real time data from the ARC tool failed, as it had no batteries loaded memory data was lost too. The decision was to drill ahead any way. Thought out the run there was a good signal from the PowerPulse. Reason POOH was TD.

7.0 Drilling Parameters / Bit Records



TOOL CONFIGURATION

Rig: Transocean Leader

Well: Shell 6406/9-1 Onyx

Hole Size: 36", 26", 17" x 20", 14 3/4" x 17 1/2", 12 1/4", 8 1/2"

Job Type: D&I Surveys, DD, APWD, FPWD, Density, Neutron, Gamma Ray, 2MHz Resistivity 28in Spacing

FIRST RUN DATE : 15-Jun-2004

LAST RUN DATE: 7-Feb-2005

MUD TYPE: Seawater, Glydriil WBM, Paratherm OBM

D&M RUN NO	MWD NO	ARC NO	FPWD NO	ADN NO	Isonic NO	MWD Flowrate lpm	Bit-Survey m	Bit-Gamma ARC m	Bit-Resist ARC m	Bit-Pressure ARC m	Bit-Pressure FPWD m	Bit-Neu m	Bit-Dens m	Bit-Son m	Bitrate bps
1	487	n/a	n/a	n/a	n/a	2271-5299	12.36	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
2	487	n/a	n/a	n/a	n/a	2271-5299	12.36	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
3	487	n/a	n/a	n/a	n/a	2271-5299	12.36	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
4	487	n/a	n/a	n/a	n/a	2271-5299	17.5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
5	487	0401	n/a	n/a	n/a	2271-5299	20.58	13.1	13.05	n/a	n/a	n/a	n/a	n/a	3
6	024	8159	n/a	n/a	n/a	2271-4542	16.29	8.97	8.92	8.21	n/a	n/a	n/a	n/a	3
7	024	8159	n/a	n/a	n/a	2271-4542	16.21	8.89	8.84	8.13	n/a	n/a	n/a	n/a	3
8	103	8029	n/a	n/a	n/a	1514-3028	11.28	19.41	19.36	18.65	n/a	n/a	n/a	n/a	3
9	103	8029	n/a	n/a	n/a	1514-3028	10.58	17.18	17.13	16.42	n/a	n/a	n/a	n/a	3
10	103	8029	n/a	n/a	n/a	1514-3028	10.58	17.18	17.13	16.42	n/a	n/a	n/a	n/a	3



Rig: Transocean Leader

Well: Shell 6406/9-1 Onyx

Hole Size: 36", 26", 17" x 20", 14 3/4" x 17 1/2", 12 1/4", 8 1/2"

Job Type: D&I Surveys, DD, APWD, FPWD, Density, Neutron, Gamma Ray, 2MHz Resistivity 28in Spacing

FIRST RUN DATE : 15-Jun-2004

LAST RUN DATE: 7-Feb-2005

MUD TYPE: Seawater, Glydрил WBM, Paratherm OBM

D&I RUN NO	CIRC		TRAN		D&I		Gamma		Resist		APWD		FPWD		DEN		NEU		LOGGED		Comments.
	HRS		HRS		HRS		HRS	Lost(m)	HRS	Lost(m)	HRS	Lost(m)	HRS	Lost(m)	HRS	Lost(m)	HRS	Lost(m)	(m)		
1	0.3		0.3	0.3	0.3	0.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0		MWD GR Realtime only, POOH due to maintenance
2	7.0		7.0	7.0	7.0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0		MWD GR Realtime only, POOH due to pressure
3	21.6		21.6	21.6	21.6	0.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	408		MWD GR Realtime only
4	50.7		50.7	50.7	50.7	0.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	972		MWD GR Realtime only
5	84.0		84.0	84.0	84.0	0.0	84	0.0	84	0.0	84	0.0	n/a	n/a	n/a	n/a	n/a	n/a	868		D&I, DD, APWD, IWOB, 2MHz Res 28 in Spacing
6	17.6		17.6	17.6	17.6	0.0	17.6	0.0	17.6	0.0	17.6	0.0	n/a	n/a	n/a	n/a	n/a	n/a	45		D&I, DD, APWD, IWOB, 2MHz Res 28 in Spacing
7	114.0		114.0	114.0	114.0	0.0	114.0	0.0	114.0	0.0	114.0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	500		D&I, DD, APWD, IWOB, 2MHz Res 28 in Spacing
8	83.5		83.5	83.5	83.5	0.0	83.5	0.0	83.5	0.0	83.5	0.0	n/a	n/a	n/a	n/a	n/a	n/a	459		D&I, DD, APWD, IWOB, GR, 2MHz Res 28 spacing
9	20.5		20.5	20.5	20.5	0.0	20.5	0.0	20.5	0.0	20.5	0.0	n/a	n/a	n/a	n/a	n/a	n/a	291		D&I, DD, APWD, GR, 2MHz Res 28 spacing
10	100.1		100.1	100.1	100.1	0.0	100.1	0.0	100.1	0.0	100.1	0.0	n/a	n/a	n/a	n/a	n/a	n/a	765		D&I, DD, APWD, GR, 2MHz Res 28 spacing
11	104.0		104.0	104.0	104.0	0.0	104.0	0.0	104.0	0.0	104.0	0.0	104.0	0.00	n/a	n/a	n/a	n/a	238.6		D&I, APWD, FPWD, GR, 2MHz Res 28spacing
12	23.2		23.2	23.2	23.2	0.0	23.2	0.0	23.2	0.0	23.2	0.0	n/a	n/a	n/a	n/a	n/a	n/a	45		D&I, APWD, GR, 2MHz Res 28 spacing
13	39.6		39.6	39.6	39.6	0.0	39.6	0.0	39.6	0.0	39.6	0.0	n/a	n/a	n/a	n/a	n/a	n/a	93		D&I, APWD, GR, 2MHz Res 28 spacing
14	46.9		46.9	46.9	46.9	0.0	46.9	0.0	46.9	0.0	46.9	0.0	n/a	n/a	n/a	n/a	n/a	n/a	130		D&I, APWD, GR, 2MHz Res 28 spacing
15	30.5		30.5	30.5	30.5	0.0	30.5	0.0	30.5	0.0	30.5	0.0	n/a	n/a	n/a	n/a	n/a	n/a	104		D&I, APWD, GR, 2MHz Res 28 spacing
16	111.5		21.4	21.4	21.4	182.0	21.4	182.0	21.4	182.0	21.4	182.0	n/a	n/a	n/a	21.4	182.0	21.4	7		D&I, APWD, GR, 2MHz Res 28 spacing, Den, Neu
17	26.6		26.6	4	26.6	7.0	4.0	7.0	4.0	7.0	4.0	7.0	n/a	n/a	n/a	n/a	n/a	n/a	199		D&I, APWD, GR, 2MHzRes 28 spacing



BIT RECORD

WELL: 6406/9-1

BIT INFORMATION										TOTAL										DULL CONDITION									
Bit No.	BHA No.	Size	Make	Type	Ser. No.	Jets /TFA	In	Out	MD	m	hrs	ROP	IR	OR	D	L	B	G	O	R	Comments								
1	1,2, and 3	17 1/2" (36" H/O)	Smith	10GMODPD	NJ0273	1 x 14, 3 x 18 / 0.896	332.5	408.0	75.5	13.5	5.6	2	1	WT	M	E	I	BU	TD	Spudded bit in slips, blocked jets/balled. Cause of low ROP									
2	4	26"	See DBS	XT02DLC	1054524	1x16, 2x18, 1x20 / 1.0	408.0	1380.0	972	34.6	28.1	0	1	WT	G	F	I	NO	TD	Bearing seal failure on cone #1 only.									
3	5	17"	Smith	20GM	MI4610	2x22, 1x20, 1x18 / 1.298	1380.0	2248.0	868.0	47.6	18.2	1	1	NO	A	E	I	NO	TD	POOH to run 16" liner.									
4	6	14 3/4"	HTC	MX-01	5053229	2x20, 2x22 / 1.356	2248.0	2293.0	2253.0	0.5	4506.0										Drilled 1.54m cmt, flt and shoe in 10.4 hrs. Clean up run								
5	7	14 3/4"	Smith	MRS74PX	JT4471	3x16, 3x18 / 1.335	2253.0	2293.0	40.0	6.2	6.5	0	0	BU	A	X	I	NO	PR	POOH to Inspect bit and BHA.									
6	8	14 3/4"	HTC	MX-09	5051677	2x20, 2x22 / 1.356	2293.0	2793.0	500.0	76.1	6.6	1	1	BU	A	X	I	NO	TD	TD Section									
7	9	12 1/4"	HTC	MX-C 18 DX	6027607	3x19, 1x16	2793.0	3252.0	459	48.0	9.6	1	2	CT	G	E	I	LT	BHA	Drilled Cmt. F/1845-1940 and 2700m= 2775m.									
8	10	12 1/4"	Smith	MRS74PX	JT4471	6 x 16	3252.0	3543.0	291	12.7	22.9	0	1	WT	G	X	X	NO	WC	POOH due to weather conditions									
9	11	12 1/4"	Smith	MRS74PX	JT4471	6 x 16	3543.0	4308.0	765	50.2	15.2	1	1	WT	A	X	X	NO	TD	TD section									
10	12	8 1/2"	See DBS	FM2645	10544587	4 x 16	4308.0	4546.6	238.6	34.2	7.0	3	1	LT	N	X	X	BT	CP	POOH due to Core Point									
13	15	8 1/2"	Smith	GF15SDV	MM9151	2 x 18, 1 x 20	4561.0	4591.0	30	4.4	6.8	1	1	NO	A	E	X	JD	CP	POOH due to Core Point									
15	17	8 1/2"	See DBS	FM2845Z	106557754	2 x 18, 1 x 20	4621.0	4684.0	63	8.8	7.2	0	1	LT	S	E	X	NO	CP	POOH due to Core Point									
15	18	8 1/2"	See DBS	FM2845Z	106557754	2 x 18, 1 x 20	4684.0	4784.0	100	15.9	6.3	1	8	RO	S	1		NC	CP	POOH due to Core Point									
15	18	8 1/2"	See DBS	FM2845Z	106557754	2 x 18, 1 x 20	4684.0	4784.0	100	15.9	6.3	1	8	RO	S	1		NC	CP	POOH due to Core Point									
17	20	8 1/2"	See DBS	FM2845	5012017	0.785	4813.0	4874.0	61	20.1	3.0	1	2	WT	N	X	X	I	FB	BHA	POOH to Inspect bit and BHA.								
18	22	8 1/2"	Smith	KGR50BCPX	JT6419	1.2	4874.0	5063.0	189	75.5	2.5	8	5	RO	N	X	X	I	HC	TD	POOH due to run TD								
19	23	8 1/2"	Smith	KGR50BCPX	JT4803	1.48	5063.0	5080.0	17	6.6	2.6	2	1	WT	T	X	X	I	PN	TD	POOH due to section TD								



Client: Norske Shell A/S	Well: Onyx	Directional Driller: William Wallace
Field: Onyx - PL255	Borehole: PL255	Directional Driller: John Tait
Structure: Transocean Leader		Job #: 04SCA042
Depth In: 332.50	Depth Out: 408.00	Tot Distance: 75.50
Inclination In: 0.33	Inclination Out: 0.33	
Azimuth In: 81.92	Azimuth Out: 69.47	ROTATE: 75.5 % ROTAT 100
Comments: Reamed at 363m, due to hole angle 1.80 deg, and repositioned rig over hole. Further reaming required to maintain hole angle below 1 deg. Formation relatively hard for top hole.		

Statistics:

None	Min	Max	Sum	Avg	Max	Avg	Avg	Avg	Max	Avg	Avg	Avg	Avg
	332.50	408.00	75.50	0.0		89	5.9	92	390.91	16.5	0.52	81.41	1.03

Orienting Method	Md From (m)	Md To (m)	Course (m)	TF Angle (°)	TF Mode (G/M)	Flow (L/min)	SPP On Bot (kPa)	WOB (1000 kgf)	RPM (c/min)	Torque (kN.m)	Svy Md (m)	Incl (°)	Azimuth (°)	DLS (° / 30 m)
ROTATE	332.50	334.00	1.50	-	-	1000	7	1.0	0	0.0	340.71	0.33	81.92	0.77 Spud well.
ROTATE	334.00	340.00	6.00	-	-	1200	9	2.0	10	5.0	349.73	0.71	75.43	1.28 Stage up flow.
ROTATE	340.00	355.00	15.00	-	-	4000	69	2.0	80	9.0	358.37	0.79	97.98	1.05 Formation firm.
ROTATE	355.00	365.00	10.00	-	-	4500	84	2.0	80	12.0	368.21	0.43	107.30	1.13
ROTATE	365.00	375.00	10.00	-	-	4500	115	5.0	115	15.0	377.36	0.55	56.57	1.42 Pressure increase.

ROTATE	375.00	408.00	33.00	-	-	4450	110	5-10	110	12-26	390.91	0.33	69.47	0.53
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Client: Norske Shell A/S	Well: Onyx	Directional Driller: Neil Caple
Field: Onyx - PL255	Borehole: PL255	Directional Driller: John Tait
Structure: Transocean Leader	UWI/API#:	Job #: 04SCA042
Depth In: 408.00	Depth Out: 1380.00	Tot Distance: 972.00
Inclination In: 0.74	Inclination Out: 1.13	SLIDE: 10.00
Azimuth In: 89.05	Azimuth Out: 56.03	% ROTAT: 99.0
		% SLIDE: 1.0

Comments: Tagged cement at 396m. Drilled cement + shoe with 3800lpm, 110bar, 45 RPM, 5 WOB, 6 TRQ. New formation from 408m.

Statistics:

None	Min	Max	Sum	Avg	Max	Avg	Avg	Avg	Avg	Avg	Avg	Max	Avg	Avg	Avg	None
	408.00	1380.00	972.00	285.0		35.3	4583	172	5.0	96	8.6	1361.30	1.15	78.64	0.22	

Orienting Method	Md From (m)	Md To (m)	Course (m)	TF Angle (°)	TF Mode (G/M)	Inp ROP (m/h)	Flow (L/min)	SPP On Bot (kPa)	WOB (1000 kgf)	RPM (c/min)	Torque (kN.m)	Svy Md (m)	Incl (°)	Azmth (°)	DLS (° / 30 m)	Comment
ROTATE	408.00	436.00	28.00	-	-	40.0	4455	150	5.0	45	6.0	415.91	0.74	89.05	0.53	
ROTATE	436.00	465.00	29.00	-	-	50.0	4580	155	3.0	85	7.0	444.63	0.79	76.81	0.18	Low ROP (Stringers) from 642-670m.
ROTATE	465.00	494.00	29.00	-	-	50.0	4580	160	3.0	85	7.0	473.75	1.08	94.98	0.42	
ROTATE	494.00	523.00	29.00	-	-	25.0	4580	165	5.0	85	7.0	502.73	1.14	94.77	0.06	
ROTATE	523.00	551.00	28.00	-	-	35.0	4570	164	4.0	85	8.0	531.68	1.35	96.43	0.22	
ROTATE	551.00	580.00	29.00	-	-	30.0	4580	165	5.0	85	8.0	560.60	1.33	97.08	0.03	
ROTATE	580.00	610.00	30.00	-	-	30.0	4590	165	5.0	85	8.0	588.68	1.87	93.29	0.59	
SLIDE	610.00	620.00	10.00	285.0	M	45.0	4595	172	11.0	0	0.0	617.64	1.52	88.07	0.40	
ROTATE	620.00	638.00	18.00	-	-	25.0	4595	165	5.0	120	9.0	645.90	1.46	93.14	0.15	
ROTATE	638.00	666.00	28.00	-	-	30.0	4595	165	5.0	100	11.0	674.96	1.56	84.62	0.25	
ROTATE	666.00	695.00	29.00	-	-	40.0	4595	166	5.0	100	10.0	703.82	1.37	72.48	0.38	
ROTATE	695.00	724.00	29.00	-	-	40.0	4580	167	5.0	100	10.0	732.21	1.44	74.89	0.10	
ROTATE	724.00	754.00	30.00	-	-	35.0	4595	166	5.0	100	9.0	760.91	1.38	59.63	0.40	
ROTATE	754.00	781.00	27.00	-	-	35.0	4580	166	5.0	100	10.0	790.38	1.33	73.14	0.33	
ROTATE	781.00	810.00	29.00	-	-	40.0	4580	167	3.0	100	9.0	818.48	1.29	76.10	0.08	
ROTATE	810.00	839.00	29.00	-	-	40.0	4595	167	3.0	100	9.0	847.23	1.28	76.77	0.02	
ROTATE	839.00	868.00	29.00	-	-	30.0	4660	170	3.0	100	6.0	876.84	1.18	79.44	0.12	
ROTATE	868.00	897.00	29.00	-	-	30.0	4535	170	3.0	100	9.0	905.58	1.19	82.02	0.06	
ROTATE	897.00	925.00	28.00	-	-	44.0	4550	177	3.0	100	9.0	935.14	1.04	83.28	0.15	
ROTATE	925.00	955.00	30.00	-	-	40.0	4550	177	5.0	100	9.0	962.67	1.06	86.73	0.07	
ROTATE	955.00	983.00	28.00	-	-	40.0	4555	178	5.0	100	9.0	992.76	1.12	85.16	0.07	
ROTATE	983.00	1012.00	29.00	-	-	50.0	4555	178	8.0	100	10.0	1021.63	1.03	72.92	0.26	
ROTATE	1012.00	1041.00	29.00	-	-	50.0	4550	178	8.0	100	10.0	1049.58	1.10	85.18	0.26	
ROTATE	1041.00	1070.00	29.00	-	-	40.0	4550	175	6.0	100	10.0	1078.35	0.99	73.07	0.26	
ROTATE	1070.00	1098.00	28.00	-	-	43.0	4590	180	5.0	100	9.0	1135.93	0.89	79.57	0.08	
ROTATE	1098.00	1127.00	29.00	-	-	22.0	4618	180	3.0	100	9.0	1165.42	1.07	71.21	0.23	
ROTATE	1127.00	1156.00	29.00	-	-	30.0	4553	178	4.0	100	9.0	1192.91	0.74	73.79	0.36	
ROTATE	1156.00	1185.00	29.00	-	-	35.0	4555	180	4.0	100	7.0	1222.00	0.94	74.07	0.21	
ROTATE	1185.00	1213.00	28.00	-	-	30.0	4645	188	5.0	100	9.0	1250.68	0.97	74.37	0.03	
ROTATE	1213.00	1242.00	29.00	-	-	30.0	4661	183	5.0	100	9.0	1279.51	0.71	59.88	0.35	
ROTATE	1242.00	1271.00	29.00	-	-	30.0	4640	185	6.0	100	9.0	1307.99	0.90	56.75	0.21	
ROTATE	1271.00	1297.00	26.00	-	-	25.0	4600	185	6.0	100	8.0	1336.81	0.80	59.57	0.11	
ROTATE	1297.00	1327.00	30.00	-	-	25.0	4620	184	8.0	100	8.0	1361.30	1.13	56.03	0.41	
ROTATE	1327.00	1357.00	30.00	-	-	30.0	4592	178	6.0	100	8.0					
ROTATE	1357.00	1380.00	23.00	-	-	20.0	4605	184	8.0	100	8.0					Stringer @1370m (80rpm, 12ton, 12trq)



BHA#5: 17" x 20" Assembly

Client: Norske Shell A/S Field: Onyx - PL255 Structure: Transocean Leader	Well: Onyx Borehole: PL255 UWI/API#:	Directional Driller: Neil Caple Directional Driller: Laurie Scott Job #: 04SCA042
Depth In: 1380.00 Depth Out: 2248.00 Tot Distance: 868.00 Inclination In: 0.74 Inclination Out: 0.15 SLIDE: 0.00 % SLIDE: 0.0 Azimuth In: 349.76 Azimuth Out: 313.00 ROTATE: 868.00 % ROTAT: 100.0		
Comments:		

Statistics:

None	Min	Max	Sum	Avg	Max	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Max	Avg	Avg	Avg	None
	1380.00	2248.00	868.00			22.3	4227	209	12.9	98	12.0	2205.94	0.50	308.34	0.24		

Orienting Method	Md From (m)	Md To (m)	Course (m)	TF Angle (°)	TF Mode (G/M)	Inp ROP (m/h)	Flow (L/min)	SPP On Bot (kPa)	WOB (1000 kgf)	RPM (c/min)	Torque (kN.m)	Svy Md (m)	Incl (°)	Azmth (°)	DLS (° / 30 m)	Comment
ROTATE	1380.00	1385.00	5.00	0.0	G	5.0	3400	171	12.0	50	8.0	1432.61	0.74	349.76	0.45	
ROTATE	1385.00	1416.00	31.00	0.0	G	5.0	3400	171	16.0	45	7.0	1457.52	0.82	351.73	0.10	
ROTATE	1416.00	1452.00	36.00	0.0	G	14.0	4500	206	8.0	100	8.0	1485.75	0.46	350.91	0.38	
ROTATE	1452.00	1481.00	29.00	0.0	G	11.0	3464	130	6.0	100	9.0	1513.40	0.78	340.07	0.37	
ROTATE	1481.00	1509.00	28.00	0.0	G	18.0	4500	200	6.0	100	9.0	1542.71	0.63	345.22	0.17	
ROTATE	1509.00	1538.00	29.00	0.0	G	18.0	4500	198	7.0	100	12.0	1571.26	0.46	325.94	0.26	
ROTATE	1538.00	1565.00	27.00	0.0	G	30.0	4585	208	7.0	100	12.0	1602.09	0.53	285.65	0.34	
ROTATE	1565.00	1595.00	30.00	0.0	G	10.0	4500	202	12.0	100	9.0	1657.64	0.46	311.67	0.13	
ROTATE	1595.00	1624.00	29.00	0.0	G	30.0	4521	203	7.0	100	10.0	1686.74	0.87	326.89	0.46	
ROTATE	1624.00	1654.00	30.00	0.0	G	30.0	4508	204	7.0	100	9.0	1744.63	0.69	290.77	0.27	
ROTATE	1654.00	1682.00	28.00	0.0	G	20.0	4490	210	10.0	100	9.0	1772.98	0.52	252.36	0.45	
ROTATE	1682.00	1710.00	28.00	0.0	G	17.0	4500	215	10.0	100	11.0	1801.68	0.46	280.81	0.26	
ROTATE	1710.00	1740.00	30.00	0.0	G	21.0	4440	217	10.0	100	10.0	1830.49	0.73	290.94	0.30	
ROTATE	1740.00	1769.00	29.00	0.0	G	14.0	4400	213	15.0	100	11.0	1859.02	0.59	285.08	0.16	
ROTATE	1769.00	1796.00	27.00	0.0	G	25.0	4326	217	25.0	100	18.0	1889.37	0.49	292.09	0.12	
ROTATE	1796.00	1824.00	28.00	0.0	G	28.0	4400	218	25.0	100	17.0	1974.51	0.40	306.90	0.05	
ROTATE	1824.00	1853.00	29.00	0.0	G	30.0	4400	223	25.0	100	18.0	2034.15	0.19	283.27	0.12	
ROTATE	1853.00	1882.00	29.00	0.0	G	30.0	4380	219	25.0	100	18.0	2061.83	0.23	262.37	0.09	
ROTATE	1882.00	1912.00	30.00	0.0	G	35.0	4371	223	25.0	100	19.0	2090.26	0.37	281.41	0.18	
ROTATE	1912.00	1942.00	30.00	0.0	G	20.0	3788	171	10.0	100	15.0	2118.86	0.21	353.39	0.38	
ROTATE	1942.00	1969.00	27.00	0.0	G	15.0	3774	148	20.0	100	12.0	2148.34	0.31	305.82	0.23	
ROTATE	1969.00	1999.00	30.00	0.0	G	21.0	3575	180	17.0	100	11.0	2205.94	0.15	313.00	0.08	
ROTATE	1999.00	2028.00	29.00	0.0	G	20.0	3675	182	10.0	100	9.0					
ROTATE	2028.00	2063.00	35.00	0.0	G	20.0	3726	187	10.0	100	12.0					
ROTATE	2063.00	2084.00	21.00	0.0	G	45.0	4334	244	10.0	100	16.0					
ROTATE	2084.00	2112.00	28.00	0.0	G	40.0	4330	245	10.0	100	17.0					
ROTATE	2112.00	2141.00	29.00	0.0	G	20.0	4328	246	10.0	100	12.0					
ROTATE	2141.00	2172.00	31.00	0.0	G	30.0	4343	249	10.0	100	12.0					
ROTATE	2172.00	2201.00	29.00	0.0	G	25.0	4371	251	10.0	100	12.0					
ROTATE	2201.00	2248.00	47.00	0.0	G	20.0	4360	263	12.0	100	10.0					



BHAs: 14 3/4" x 17 1/2" Assy

Client: Norske Shell A/S
 Field: Onyx - PL255
 Structure: Transocean Leader

Well: Onyx
 Borehole: PL255
 UWI/API#:

Directional Driller: Ronny Fosberg
 Directional Driller: Bjørn T Ribesen
 Job #: 04SCA043

Depth In: 2253.00
 Inclination In: 0.41
 Azimuth In: 284.41

Tot Distance: 540
 STRAIGHT: 13.00
 STEERING: 527

% STRAI 2.4
 % STEER 97.6

Depth Out: 2793
 Inclination Out: 0.13
 Azimuth Out: 236.86

Comments:

Statistics:

None	None	None	Min	Max	Sum	None	Avg	Max	Avg	Max	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Avg		
None	None	None	2253.00	2793	540	None	180.0	36.204	3623	296	8.8	143	14.5	12.3	12.0	2.1	2346.53	0.24	249.16	0.23

Deflection Tool	Row Type	BHA Name	Mid From (m)	Mid To (m)	Course (m)	Orienting Method	TF Angle (°)	Power Set (%)	TF Mode (G/M)	Flow (lpm)	SPP On Bot (bar)	Inp ROP (m/h)	RPM (rpm)	WOB (1000 kgf)	DWOB (1000 kgf)	Torque (kN.m)	DTOR (kN.m)	Svy Mid (m)	Incl (°)	Azmth (°)	DLS (° / 30 m)
RSS	SUM	14 3/4" x 17 1/2" Assy	2253	2266	13	STRAIGHT	0.0	0	G	3600	303	20.0	120	10.0	11.0	11.0	2260.66	0.41	284.41	0.16	
RSS	SUM	14 3/4" x 17 1/2" Assy	2266	2280	14	STEERING	180	40	G	3600	295	4.0	135	13.0	11.5	11.0	2289.03	0.33	235.71	0.33	
RSS	SUM	14 3/4" x 17 1/2" Assy	2280	2293	13	STEERING	180	40	G	4000	275	2.0	180	12.0	10.0	10.0	2316.25	0.15	256.20	0.22	
RSS	SUM	14 3/4" x 17 1/2" Assy	2293	2308	15	STEERING	180	40	G	3590	300	10.0	180	12.0	11.0	11.0	2346.53	0.06	97.00	0.21	
RSS	SUM	14 3/4" x 17 1/2" Assy	2308	2337	29	STEERING	180	40	G	3575	298	8.0	145	15.0	11.0	12.5	2377.48	0.06	182.57	0.08	
RSS	SUM	14 3/4" x 17 1/2" Assy	2337	2366	29	STEERING	180	40	G	3575	297	5.0	120	17.0	13.0	13.0	2405.04	0.06	109.20	0.08	
RSS	SUM	14 3/4" x 17 1/2" Assy	2366	2393	27	STEERING	180	40	G	3580	297	14.0	140	17.0	13.0	13.0	2432.95	0.00	0.74	0.06	
RSS	SUM	14 3/4" x 17 1/2" Assy	2393	2398	5	STEERING	180	40	G	3580	298	7.0	120	18.0	11.0	12.0	2462.59	0.04	43.64	0.04	
RSS	SUM	14 3/4" x 17 1/2" Assy	2398	2423	25	STEERING	180	40	G	3570	298	16.0	130	14.0	9.0	11.0	2550.85	0.22	55.89	0.06	
RSS	SUM	14 3/4" x 17 1/2" Assy	2423	2448	25	STEERING	180	40	G	3540	297	18.0	160	16.0	12.0	13.0	2579.77	0.12	350.82	0.21	
RSS	SUM	14 3/4" x 17 1/2" Assy	2448	2480	32	STEERING	180	40	G	3500	299	5.0	150	15.0	4.0	11.0	2608.94	0.09	345.30	0.03	
RSS	SUM	14 3/4" x 17 1/2" Assy	2480	2513	33	STEERING	180	40	G	3470	300	5.0	120	25.0	7.0	12.0	2666.91	0.04	103.64	0.06	
RSS	SUM	14 3/4" x 17 1/2" Assy	2513	2540	27	STEERING	180	40	G	3470	296	17.0	135	24.0	18.0	18.0	2723.6	0.14	244.73	0.08	
RSS	SUM	14 3/4" x 17 1/2" Assy	2540	2560	20	STEERING	180	40	G	3420	297	20.0	125	15.0	10.0	16.0	2753.06	0.15	262.59	0.05	
RSS	SUM	14 3/4" x 17 1/2" Assy	2560	2598	38	STEERING	180	40	G	3400	295	10.0	140	18.0	5.0	14.0	2772.01	0.13	236.86	0.10	
RSS	SUM	14 3/4" x 17 1/2" Assy	2598	2627	29	STEERING	180	40	G	3370	294	8.0	170	20.0	5.0	16.0	2800.00	0.09	345.30	0.03	
RSS	SUM	14 3/4" x 17 1/2" Assy	2627	2639	12	STEERING	180	40	G	3380	290	13.0	155	19.0	9.0	16.0	2820.00	0.09	345.30	0.03	
RSS	SUM	14 3/4" x 17 1/2" Assy	2639	2643	4	STEERING	180	40	G	3380	295	2.0	135	21.0	12.0	10.0	2840.00	0.14	244.73	0.08	
RSS	SUM	14 3/4" x 17 1/2" Assy	2643	2664	21	STEERING	180	40	G	3450	300	5.0	140	20.0	14.0	15.0	2860.00	0.14	244.73	0.08	
RSS	SUM	14 3/4" x 17 1/2" Assy	2664	2672	8	STEERING	180	40	G	3450	300	1.5	125	22.0	18.0	11.0	2880.00	0.04	103.64	0.06	
RSS	SUM	14 3/4" x 17 1/2" Assy	2672	2685	13	STEERING	180	40	G	3410	297	6.0	150	24.0	12.0	14.0	2900.00	0.09	345.30	0.03	
RSS	SUM	14 3/4" x 17 1/2" Assy	2685	2714	29	STEERING	180	40	G	3400	296	5.0	110	22.0	5.0	13.0	2920.00	0.09	345.30	0.03	
RSS	SUM	14 3/4" x 17 1/2" Assy	2714	2724	10	STEERING	180	40	G	3360	290	4.0	120	23.0	4.0	13.0	2940.00	0.14	244.73	0.08	
RSS	SUM	14 3/4" x 17 1/2" Assy	2724	2732	8	STEERING	180	40	G	3360	290	2.0	130	23.0	15.0	11.0	2960.00	0.14	244.73	0.08	
RSS	SUM	14 3/4" x 17 1/2" Assy	2732	2770	38	STEERING	180	40	G	3340	294	6.5	150	22.0	8.0	15.0	2980.00	0.15	262.59	0.05	
RSS	SUM	14 3/4" x 17 1/2" Assy	2770	2793	23	STEERING	180	40	G	3370	295	5.0	160	23.0	12.0	13.0	3000.00	0.13	236.86	0.10	

2nd run



BHA: 8 to 10 - 12 1/4" Assembly

Client: Norske Shell A/S	Well: Onyx	Directional Driller: Paul Winterbottom
Field: Onyx - PL255	Borehole: PL255	Directional Driller: Gudmund Aaker
Structure: Transocean Leader	UWI/API#:	Job #: 04SCA0517
Depth In: 2793	Depth Out: 4306	Tot Distance: 1513
Inclination In: 0.13	Inclination Out: 0.3	SLIDE: 0 % SLIDE 0
Azimuth In: 236.86	Azimuth Out: 351.5	ROTATE: 1513 % ROTAT 100

Comments: Drilled ahead 12 1/4" section trying to maintain the well with an inclination less than one degree.

Statistics:

None	Min	Max	Sum	Avg	Max	Avg	Avg	Avg	Avg	Avg	Avg	Max	Avg	Avg	Avg	None
	2793	4306	1513			10	2930	260	15	170	9					

Orienting Method	Md From (m)	Md To (m)	Course (m)	TF Angle (°)	TF Mode (G/M)	ROP (m/h)	Flow (L/min)	SPP On Bot (kPa)	WOB (1000 kgf)	RPM (c/min)	Torque (kN.m)	Svy Md (m)	Incl (°)	Azmth (°)	DLS (° / 30 m)	Comment
ROTATE	2793	2850	57	-	-	10	2930	250	12	60	6.5	No Survey				
ROTATE	2850	3000	150	-	-	20.0	2920	260	22	180	10	2977.71	1.82	79.54	0.33	
ROTATE	3000	3100	100	-	-	10.0	2930	260	14	180	9	3039.94	2.37	70.68	0.24	
ROTATE	3100	3185	85	-	-	9	2940	260	15	165	9	3151.15	3.19	70.98	0.19	
ROTATE	3185	3200	15	-	-	5	2940	260	15	180	8	No Survey- DP moving				
ROTATE	3200	3240	40	-	-	9	2930	266	18	170	10	3210.26	3.37	72.74	0.10	
ROTATE	3240	3252	12	-	-	6	2915	265	15	170	10	No Survey				
ROTATE	3252	3270	18	180	G	8	2950	270	7-9	180	7-8	3267.33	2.88	62.72	0.38	
ROTATE	2850	3285	435	180	G	25.0	2950	257	14-16	180	15	3297.10	1.85	45.93	1.24	
ROTATE	3285	3367	82	180	G	40.0	2940	272	12	180	12-13	3350.88	1.02	15.48	0.49	
ROTATE	3367	3388	21	180	G	25	2880	272	12	170	13	3379.44	0.49	5.67	0.57	
ROTATE	3388	3398	10	180	G	20	2920	275	10	170	10-12	No Survey				
ROTATE	3398	3427	29	180	G	20	2920	272	10	170	9-22	3407.62	0.17	344.42	0.36	
ROTATE	3427	3455	28	180	G	17	2900	270	10	170	10-20	3440.70	0.12	226.47	0.23	
ROTATE	3455	3485	30	180	G	25	2920	270	8-10	170	15	No Survey				
ROTATE	3485	3514	29	180	G	20	2920	280	6-8	170	12-20	3498.67	0.20	39.77	0.17	
ROTATE	3514	3543	29	180	G	24	2870	270	10	170	15	3526.69	0.31	2.54	0.21	
ROTATE	3543	3572	29	180	G	20	2900	280	10	170	8-18	3559.81	0.31	15.84	0.07	
ROTATE	3572	3601	30	180	G	20	2900	270	8-10	180	11-15	3588.77	0.12	339.71	0.23	
ROTATE	3601	3629	28	180	G	18	2900	275	10	180	13-16	3617.42	0.08	260.28	0.14	
ROTATE	3629	3658	29	180	G	16	2900	270	7-10	180	11-15	3645.72	0.13	252.48	0.06	
ROTATE	3658	3686	28	180	G	18.0	2900	280	13-15	160	13-16	3673.25	0.04	148.02	0.16	
ROTATE	3686	3716	30	180	G	20.0	2860	275	14	160	14-18	3701.88	0.15	104.61	0.13	
ROTATE	3716	3746	30	180	G	20	2830	293	14	170	13-15	3731.77	0.38	78.12	0.26	
ROTATE	3746	3774	28	180	G	25	2820	297	14	160	10-20	3759.73	0.48	55.57	0.21	
ROTATE	3774	3803	29	180	G	20	2800	300	14	140	14	3788.37	0.43	27.50	0.24	
ROTATE	3803	3830	27	180	G	25	2790	305	14	155	15	3816.52	0.38	318.25	0.49	
ROTATE	3830	3862	32	180	G	25	2720	290	13	160	18	3845.50	0.13	161.88	0.52	
ROTATE	3862	3891	29	180	G	20	2770	295	13	160	12-18	No Survey - DP moving				
ROTATE	3891	3921	30	180	G	20	2780	295	13-15	160	13-18	3906.80	0.33	43.84	0.20	
ROTATE	3921	3949	28	180	G	16	2750	290	13	160	12-17	3936.06	0.13	197.38	0.46	
ROTATE	3949	3978	29	180	G	20	2750	290	9-10	160	9-15	3963.47	0.37	91.42	0.46	
ROTATE	3978	4005	27	180	G	18	2700	285	9-10	160	9-15	3991.04	0.37	78.39	0.09	
ROTATE	4005	4035	30	180	G	23	2650	295	9-12	165	12-18	4019.69	0.27	68.27	0.12	
ROTATE	4035	4065	30	180	G	14	2635	300	14	150	15	4048.99	0.17	23.66	0.20	
ROTATE	4065	4093	28	180	G	17	2640	305	14	150	16	4077.34	0.19	281.77	0.30	
ROTATE	4093	4121	28	180	G	15	2600	295	14	150	17	4104.67	0.20	117.66	0.42	
ROTATE	4121	4150	29	180	G	18	2600	300	14	170	13	4136.14	0.31	27.66	0.35	
ROTATE	4150	4179	29	180	G	9	2600	295	14	160	13-18	No Survey- DP moving				
ROTATE	4179	4201	22	180	G	5	2650	300	15	160	12-20	4188.89	0.21	139.64	0.25	
ROTATE	4201	4208	7	180	G	10	2600	295	10	160	14	No Survey				Resume drilling after WOW.
ROTATE	4208	4235	27	180	G	18	2600	298	14	160	14	4223.92	0.09	68.82	0.17	
ROTATE	4235	4263	28	180	G	20	2550	300	10	160	12-17	4247.42	0.35	83.02	0.34	
ROTATE	4263	4293	30	180	G	25	2550	290	12	160	13-18	4276.76	0.31	358.29	0.46	
ROTATE	4293	4306	13	180	G	25	2550	290	12	160	13-18	4293.47	0.30	351.50	0.07	

9.0 Survey Details

9.1 Final Survey Listing



Definitive Survey's Onyx PL255 Survey Report

Report Date: March 2, 2005 Client: Shell Norway Field: Onyx PL255 Structure / Slot: Onyx PL255 / Onyx PL255 Well: Onyx Borehole: Onyx PL255 UWI/API#: Survey Name / Date: Definitive Survey's Onyx PL255 / November 4, 2004 Tort / AHD / DDI / ERD ratio: 41.754° / 101.26 m / 4.142 / 0.020 Grid Coordinate System: UTM Zone 32 on ED50 Datum Location Lat/Long: N 64 26 46.855, E 6 48 55.234 Location Grid N/E Y/X: N 7148739.650 m, E 394862.130 m Grid Convergence Angle: -1.97113634° Grid Scale Factor: 0.99973534	Survey / DLS Computation Method: Minimum Curvature / Lubinski Vertical Section Azimuth: 72.620° Vertical Section Origin: N 0.000 m, E 0.000 m TVD Reference Datum: RKB TVD Reference Elevation: 23.5 m relative to MSL Sea Bed / Ground Level Elevation: -308.000 m relative to MSL Magnetic Declination: -1.122° Total Field Strength: 51610.897 nT Magnetic Dip: 75.225° Declination Date: November 04, 2004 Magnetic Declination Model: BGGM 2004 North Reference: Grid North Total Corr Mag North -> Grid North: +0.849° Local Coordinates Referenced To: Well Head
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Comments	Measured Depth (m)	Inclination (deg)	Azimuth (deg)	TVD (m)	Vertical Section (m)	NS (m)	EW (m)	DLS (deg/30 m)	Northing (m)	Easting (m)	Latitude	Longitude
Tie-In	331.50	0.00	0.00	331.50	0.00	0.00	0.00	0.00	7148739.65	394862.13	N 64 26 46.855	E 6 48 55.234
	340.71	0.33	81.96	340.71	0.03	0.00	0.03	1.07	7148739.65	394862.16	N 64 26 46.855	E 6 48 55.236
	349.73	0.71	75.51	349.73	0.11	0.02	0.11	1.28	7148739.67	394862.24	N 64 26 46.856	E 6 48 55.242
	358.37	0.79	98.08	358.37	0.21	0.03	0.22	1.05	7148739.68	394862.35	N 64 26 46.856	E 6 48 55.250
	368.21	0.43	107.35	368.21	0.31	0.01	0.32	1.13	7148739.66	394862.45	N 64 26 46.856	E 6 48 55.258
	377.36	0.55	56.62	377.36	0.38	0.02	0.39	1.42	7148739.67	394862.52	N 64 26 46.856	E 6 48 55.263
	390.91	0.33	69.51	390.91	0.48	0.07	0.48	0.53	7148739.72	394862.61	N 64 26 46.858	E 6 48 55.269
	415.91	0.74	89.01	415.91	0.71	0.10	0.71	0.53	7148739.75	394862.84	N 64 26 46.859	E 6 48 55.286
	444.63	0.79	76.73	444.62	1.08	0.15	1.09	0.18	7148739.80	394863.22	N 64 26 46.861	E 6 48 55.315
	473.75	1.08	94.86	473.74	1.53	0.17	1.56	0.42	7148739.82	394863.69	N 64 26 46.862	E 6 48 55.350
	502.73	1.14	94.66	502.71	2.05	0.12	2.11	0.06	7148739.77	394864.24	N 64 26 46.861	E 6 48 55.391
	531.68	1.35	96.30	531.66	2.63	0.06	2.74	0.22	7148739.71	394864.87	N 64 26 46.860	E 6 48 55.438
	560.60	1.33	96.96	560.57	3.25	-0.02	3.41	0.03	7148739.63	394865.54	N 64 26 46.858	E 6 48 55.489
	588.68	1.87	93.13	588.64	3.98	-0.08	4.19	0.59	7148739.57	394866.32	N 64 26 46.857	E 6 48 55.547
	617.64	1.52	87.95	617.59	4.79	-0.09	5.05	0.40	7148739.56	394867.18	N 64 26 46.858	E 6 48 55.611
	645.90	1.46	93.07	645.84	5.49	-0.10	5.78	0.15	7148739.55	394867.91	N 64 26 46.858	E 6 48 55.666
	674.96	1.56	84.54	674.89	6.22	-0.08	6.55	0.25	7148739.57	394868.68	N 64 26 46.860	E 6 48 55.723
	703.82	1.37	72.41	703.74	6.95	0.06	7.27	0.38	7148739.71	394869.39	N 64 26 46.865	E 6 48 55.777
	732.21	1.44	74.82	732.12	7.65	0.26	7.93	0.10	7148739.91	394870.06	N 64 26 46.872	E 6 48 55.826
	760.91	1.38	59.57	760.81	8.35	0.53	8.58	0.40	7148740.18	394870.71	N 64 26 46.882	E 6 48 55.874
	790.38	1.33	73.08	790.27	9.03	0.80	9.21	0.33	7148740.45	394871.34	N 64 26 46.891	E 6 48 55.920
	818.48	1.29	76.04	818.36	9.68	0.98	9.83	0.08	7148740.63	394871.96	N 64 26 46.898	E 6 48 55.966
	847.23	1.28	76.70	847.11	10.32	1.13	10.46	0.02	7148740.78	394872.59	N 64 26 46.903	E 6 48 56.012
	876.84	1.18	79.38	876.71	10.95	1.26	11.08	0.12	7148740.91	394873.21	N 64 26 46.908	E 6 48 56.058
	905.58	1.19	81.96	905.44	11.54	1.36	11.67	0.06	7148741.01	394873.79	N 64 26 46.912	E 6 48 56.102
	935.14	1.04	83.23	935.00	12.11	1.43	12.24	0.15	7148741.08	394874.36	N 64 26 46.915	E 6 48 56.144
	962.67	1.06	86.68	962.52	12.60	1.48	12.74	0.07	7148741.13	394874.87	N 64 26 46.917	E 6 48 56.182
	992.76	1.12	85.11	992.61	13.16	1.52	13.31	0.07	7148741.17	394875.44	N 64 26 46.919	E 6 48 56.224
	1021.63	1.03	72.87	1021.47	13.69	1.62	13.84	0.26	7148741.27	394875.97	N 64 26 46.923	E 6 48 56.264
	1049.58	1.10	85.13	1049.42	14.20	1.71	14.35	0.26	7148741.36	394876.47	N 64 26 46.926	E 6 48 56.301
	1078.35	0.99	73.03	1078.18	14.72	1.81	14.86	0.26	7148741.46	394876.99	N 64 26 46.930	E 6 48 56.339
	1135.93	0.89	79.52	1135.76	15.66	2.04	15.78	0.08	7148741.69	394877.90	N 64 26 46.938	E 6 48 56.407
	1165.42	1.07	71.16	1165.24	16.17	2.17	16.26	0.23	7148741.82	394878.39	N 64 26 46.943	E 6 48 56.443
	1192.91	0.74	73.75	1192.73	16.60	2.30	16.67	0.36	7148741.95	394878.80	N 64 26 46.948	E 6 48 56.474
	1222.00	0.94	74.02	1221.82	17.03	2.42	17.08	0.21	7148742.07	394879.21	N 64 26 46.952	E 6 48 56.504
	1250.68	0.97	74.33	1250.49	17.50	2.55	17.54	0.03	7148742.20	394879.67	N 64 26 46.957	E 6 48 56.538
	1279.51	0.71	59.85	1279.32	17.92	2.70	17.93	0.35	7148742.35	394880.06	N 64 26 46.962	E 6 48 56.567
	1307.99	0.90	56.71	1307.80	18.31	2.92	18.27	0.21	7148742.56	394880.40	N 64 26 46.970	E 6 48 56.592
	1336.81	0.80	59.53	1336.61	18.72	3.14	18.64	0.11	7148742.79	394880.76	N 64 26 46.977	E 6 48 56.618
	1361.37	1.13	55.98	1361.17	19.12	3.36	18.98	0.41	7148743.01	394881.11	N 64 26 46.985	E 6 48 56.644
	1432.61	0.74	349.76	1432.40	19.85	4.21	19.48	0.45	7148743.86	394881.61	N 64 26 47.013	E 6 48 56.679
	1457.52	0.82	351.73	1457.31	19.90	4.54	19.43	0.10	7148744.19	394881.56	N 64 26 47.023	E 6 48 56.674
	1485.75	0.46	350.91	1485.54	19.95	4.86	19.38	0.38	7148744.50	394881.51	N 64 26 47.033	E 6 48 56.670
	1513.40	0.78	340.07	1513.19	19.96	5.14	19.30	0.37	7148744.79	394881.43	N 64 26 47.043	E 6 48 56.663
	1542.71	0.63	345.22	1542.49	19.96	5.49	19.19	0.17	7148745.13	394881.32	N 64 26 47.054	E 6 48 56.654
	1571.26	0.46	325.94	1571.04	19.93	5.73	19.09	0.26	7148745.38	394881.21	N 64 26 47.061	E 6 48 56.645
	1602.09	0.53	285.65	1601.87	19.77	5.87	18.88	0.34	7148745.52	394881.01	N 64 26 47.066	E 6 48 56.629
	1657.64	0.46	311.67	1657.42	19.44	6.09	18.47	0.13	7148745.74	394880.59	N 64 26 47.072	E 6 48 56.598
	1686.74	0.87	326.89	1686.52	19.32	6.35	18.26	0.46	7148746.00	394880.39	N 64 26 47.080	E 6 48 56.582
	1744.63	0.69	290.77	1744.40	18.93	6.85	17.69	0.27	7148746.49	394879.82	N 64 26 47.096	E 6 48 56.538
	1772.98	0.52	252.36	1772.75	18.67	6.87	17.41	0.45	7148746.52	394879.54	N 64 26 47.095	E 6 48 56.517
	1801.68	0.46	280.81	1801.45	18.44	6.85	17.17	0.26	7148746.50	394879.30	N 64 26 47.095	E 6 48 56.499
	1830.49	0.73	290.94	1830.26	18.19	6.94	16.89	0.30	7148746.58	394879.02	N 64 26 47.098	E 6 48 56.478



Definitive Survey's Onyx PL255 Survey Report

Report Date: March 2, 2005 Client: Shell Norway Field: Onyx PL255 Structure / Slot: Onyx PL255 / Onyx PL255 Well: Onyx Borehole: Onyx PL255 UWI/API#: Survey Name / Date: Definitive Survey's Onyx PL255 / November 4, 2004 Tort / AHD / DDI / ERD ratio: 41.754° / 101.26 m / 4.142 / 0.020 Grid Coordinate System: UTM Zone 32 on ED50 Datum Location Lat/Long: N 64 26 46.855, E 6 48 55.234 Location Grid N/E Y/X: N 7148739.650 m, E 394862.130 m Grid Convergence Angle: -1.97113634° Grid Scale Factor: 0.99973534	Survey / DLS Computation Method: Minimum Curvature / Lubinski Vertical Section Azimuth: 72.620° Vertical Section Origin: N 0.000 m, E 0.000 m TVD Reference Datum: RKB TVD Reference Elevation: 23.5 m relative to MSL Sea Bed / Ground Level Elevation: -308.000 m relative to MSL Magnetic Declination: -1.122° Total Field Strength: 51610.897 nT Magnetic Dip: 75.225° Declination Date: November 04, 2004 Magnetic Declination Model: BGGM 2004 North Reference: Grid North Total Corr Mag North -> Grid North: +0.849° Local Coordinates Referenced To: Well Head
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Comments	Measured Depth (m)	Inclination (deg)	Azimuth (deg)	TVD (m)	Vertical Section (m)	NS (m)	EW (m)	DLS (deg/30 m)	Northing (m)	Easting (m)	Latitude	Longitude
	1859.02	0.59	285.08	1858.79	17.92	7.04	16.58	0.16	7148746.69	394878.70	N 64 26 47.101	E 6 48 56.454
	1889.37	0.49	292.09	1889.13	17.69	7.13	16.31	0.12	7148746.78	394878.43	N 64 26 47.103	E 6 48 56.434
	1974.51	0.40	306.90	1974.27	17.24	7.44	15.73	0.05	7148747.09	394877.86	N 64 26 47.113	E 6 48 56.390
	2034.15	0.19	283.27	2033.91	17.03	7.59	15.47	0.12	7148747.24	394877.60	N 64 26 47.117	E 6 48 56.370
	2061.83	0.23	262.37	2061.59	16.94	7.60	15.37	0.09	7148747.24	394877.50	N 64 26 47.117	E 6 48 56.363
	2090.26	0.37	281.41	2090.02	16.80	7.61	15.22	0.18	7148747.25	394877.35	N 64 26 47.118	E 6 48 56.352
	2118.86	0.21	353.39	2118.62	16.73	7.68	15.13	0.38	7148747.32	394877.25	N 64 26 47.120	E 6 48 56.344
	2148.34	0.31	305.82	2148.10	16.69	7.78	15.06	0.23	7148747.42	394877.18	N 64 26 47.123	E 6 48 56.339
	2205.94	0.15	313.00	2205.70	16.56	7.92	14.87	0.08	7148747.57	394877.00	N 64 26 47.127	E 6 48 56.325
	2260.66	0.41	284.41	2260.42	16.36	8.02	14.63	0.16	7148747.66	394876.76	N 64 26 47.130	E 6 48 56.306
	2289.03	0.33	235.71	2288.79	16.19	8.00	14.47	0.33	7148747.64	394876.59	N 64 26 47.129	E 6 48 56.294
	2316.25	0.15	256.20	2316.01	16.08	7.94	14.37	0.22	7148747.59	394876.49	N 64 26 47.127	E 6 48 56.287
	2346.53	0.06	97.00	2346.29	16.06	7.93	14.34	0.21	7148747.58	394876.47	N 64 26 47.127	E 6 48 56.285
	2377.48	0.06	182.57	2377.24	16.07	7.91	14.36	0.08	7148747.56	394876.49	N 64 26 47.126	E 6 48 56.286
	2405.04	0.06	109.20	2404.80	16.07	7.89	14.37	0.08	7148747.54	394876.50	N 64 26 47.126	E 6 48 56.287
	2432.95	0.00	202.12	2432.71	16.09	7.89	14.39	0.06	7148747.54	394876.51	N 64 26 47.126	E 6 48 56.288
	2462.59	0.04	43.64	2462.35	16.10	7.90	14.39	0.04	7148747.55	394876.52	N 64 26 47.126	E 6 48 56.289
	2550.85	0.22	55.89	2550.61	16.28	8.01	14.55	0.06	7148747.66	394876.68	N 64 26 47.130	E 6 48 56.301
	2579.77	0.12	350.82	2579.53	16.34	8.08	14.60	0.21	7148747.72	394876.72	N 64 26 47.132	E 6 48 56.304
	2608.94	0.09	345.30	2608.70	16.35	8.13	14.59	0.03	7148747.78	394876.71	N 64 26 47.134	E 6 48 56.303
	2666.91	0.04	103.64	2666.67	16.37	8.17	14.59	0.06	7148747.82	394876.72	N 64 26 47.135	E 6 48 56.303
	2694.88	0.19	266.13	2694.64	16.33	8.16	14.56	0.25	7148747.81	394876.68	N 64 26 47.135	E 6 48 56.300
	2723.60	0.14	244.73	2723.36	16.25	8.14	14.48	0.08	7148747.79	394876.60	N 64 26 47.134	E 6 48 56.295
	2753.06	0.15	262.59	2752.82	16.18	8.12	14.41	0.05	7148747.77	394876.53	N 64 26 47.133	E 6 48 56.289
	2772.01	0.13	236.86	2771.77	16.13	8.11	14.36	0.10	7148747.76	394876.49	N 64 26 47.133	E 6 48 56.286
	2877.04	0.77	98.01	2876.79	16.65	7.94	14.96	0.25	7148747.59	394877.09	N 64 26 47.128	E 6 48 56.331
	2977.71	1.82	79.54	2977.44	18.85	8.14	17.21	0.33	7148747.79	394879.33	N 64 26 47.137	E 6 48 56.498
	3010.41	2.19	74.66	3010.12	19.99	8.40	18.32	0.37	7148748.05	394880.44	N 64 26 47.147	E 6 48 56.581
	3039.94	2.37	70.68	3039.62	21.17	8.75	19.44	0.24	7148748.40	394881.56	N 64 26 47.159	E 6 48 56.664
	3094.72	2.84	71.56	3094.35	23.65	9.56	21.79	0.26	7148749.20	394883.92	N 64 26 47.188	E 6 48 56.838
	3151.15	3.19	70.98	3150.70	26.62	10.51	24.61	0.19	7148750.16	394886.73	N 64 26 47.222	E 6 48 57.045
	3210.26	3.37	72.74	3209.71	30.00	11.56	27.82	0.10	7148751.21	394889.94	N 64 26 47.259	E 6 48 57.283
	3267.33	2.88	62.72	3266.70	33.09	12.72	30.70	0.38	7148752.36	394892.82	N 64 26 47.300	E 6 48 57.495
	3297.10	1.85	45.93	3296.44	34.26	13.39	31.71	1.24	7148753.04	394893.83	N 64 26 47.323	E 6 48 57.568
	3326.88	1.29	29.82	3326.21	34.93	14.02	32.22	0.71	7148753.66	394894.34	N 64 26 47.343	E 6 48 57.605
	3350.88	1.02	15.48	3350.21	35.25	14.46	32.41	0.49	7148754.10	394894.53	N 64 26 47.358	E 6 48 57.618
	3379.44	0.49	5.67	3378.76	35.43	14.82	32.49	0.57	7148754.47	394894.61	N 64 26 47.370	E 6 48 57.623
	3407.62	0.17	344.42	3406.94	35.48	14.99	32.49	0.36	7148754.63	394894.61	N 64 26 47.375	E 6 48 57.623
	3440.70	0.12	226.47	3440.02	35.45	15.01	32.45	0.23	7148754.65	394894.57	N 64 26 47.376	E 6 48 57.620
	3498.67	0.20	39.77	3497.99	35.48	15.04	32.47	0.17	7148754.69	394894.59	N 64 26 47.377	E 6 48 57.621
	3526.69	0.31	2.54	3526.01	35.55	15.16	32.51	0.21	7148754.80	394894.63	N 64 26 47.380	E 6 48 57.624
	3559.81	0.31	15.84	3559.13	35.63	15.33	32.54	0.07	7148754.98	394894.66	N 64 26 47.386	E 6 48 57.625
	3588.77	0.12	339.71	3588.09	35.67	15.44	32.55	0.23	7148755.08	394894.67	N 64 26 47.389	E 6 48 57.626
	3617.42	0.08	260.28	3616.74	35.65	15.46	32.52	0.14	7148755.11	394894.64	N 64 26 47.390	E 6 48 57.624
	3645.72	0.13	252.48	3645.04	35.60	15.45	32.47	0.06	7148755.10	394894.59	N 64 26 47.390	E 6 48 57.620
	3673.25	0.04	148.02	3672.57	35.57	15.43	32.44	0.16	7148755.08	394894.56	N 64 26 47.389	E 6 48 57.618
	3701.88	0.15	104.61	3701.20	35.60	15.41	32.48	0.13	7148755.06	394894.60	N 64 26 47.389	E 6 48 57.621
	3731.77	0.38	78.12	3731.09	35.74	15.42	32.62	0.26	7148755.07	394894.74	N 64 26 47.389	E 6 48 57.631
	3759.73	0.48	55.57	3759.05	35.94	15.51	32.80	0.21	7148755.16	394894.93	N 64 26 47.392	E 6 48 57.645
	3788.37	0.43	27.45	3787.69	36.13	15.67	32.95	0.24	7148755.32	394895.07	N 64 26 47.398	E 6 48 57.656
	3816.52	0.38	318.25	3815.84	36.17	15.84	32.94	0.49	7148755.48	394895.06	N 64 26 47.403	E 6 48 57.654
	3845.50	0.13	161.88	3844.82	36.13	15.88	32.89	0.52	7148755.52	394895.01	N 64 26 47.404	E 6 48 57.650



Definitive Survey's Onyx PL255 Survey Report

Report Date: March 2, 2005 Client: Shell Norway Field: Onyx PL255 Structure / Slot: Onyx PL255 / Onyx PL255 Well: Onyx Borehole: Onyx PL255 UWI/API#: Survey Name / Date: Definitive Survey's Onyx PL255 / November 4, 2004 Tort / AHD / DDI / ERD ratio: 41.754° / 101.26 m / 4.142 / 0.020 Grid Coordinate System: UTM Zone 32 on ED50 Datum Location Lat/Long: N 64 26 46.855, E 6 48 55.234 Location Grid N/E Y/X: N 7148739.650 m, E 394862.130 m Grid Convergence Angle: -1.97113634° Grid Scale Factor: 0.99973534	Survey / DLS Computation Method: Minimum Curvature / Lubinski Vertical Section Azimuth: 72.620° Vertical Section Origin: N 0.000 m, E 0.000 m TVD Reference Datum: RKB TVD Reference Elevation: 23.5 m relative to MSL Sea Bed / Ground Level Elevation: -308.000 m relative to MSL Magnetic Declination: -1.122° Total Field Strength: 51610.897 nT Magnetic Dip: 75.225° Declination Date: November 04, 2004 Magnetic Declination Model: BGGM 2004 North Reference: Grid North Total Corr Mag North -> Grid North: +0.849° Local Coordinates Referenced To: Well Head
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Comments	Measured Depth (m)	Inclination (deg)	Azimuth (deg)	TVD (m)	Vertical Section (m)	NS (m)	EW (m)	DLS (deg/30 m)	Northing (m)	Easting (m)	Latitude	Longitude
	3906.80	0.33	43.84	3906.12	36.28	15.94	33.03	0.20	7148755.58	394895.15	N 64 26 47.406	E 6 48 57.661
	3936.06	0.13	197.38	3935.38	36.34	15.97	33.08	0.46	7148755.61	394895.20	N 64 26 47.407	E 6 48 57.664
	3963.47	0.37	91.42	3962.79	36.40	15.93	33.16	0.46	7148755.58	394895.28	N 64 26 47.406	E 6 48 57.670
	3991.04	0.37	78.39	3990.36	36.58	15.95	33.33	0.09	7148755.60	394895.45	N 64 26 47.407	E 6 48 57.683
	4019.69	0.27	68.27	4019.01	36.74	15.99	33.49	0.12	7148755.64	394895.61	N 64 26 47.408	E 6 48 57.695
	4048.99	0.17	23.66	4048.31	36.83	16.06	33.57	0.20	7148755.71	394895.69	N 64 26 47.411	E 6 48 57.701
	4077.34	0.19	281.87	4076.66	36.82	16.11	33.54	0.30	7148755.75	394895.66	N 64 26 47.412	E 6 48 57.698
	4104.67	0.20	117.66	4103.99	36.81	16.10	33.54	0.42	7148755.74	394895.66	N 64 26 47.412	E 6 48 57.698
	4136.14	0.31	27.66	4135.46	36.91	16.14	33.63	0.35	7148755.79	394895.75	N 64 26 47.414	E 6 48 57.705
	4188.89	0.21	139.64	4188.21	37.05	16.20	33.75	0.25	7148755.84	394895.88	N 64 26 47.415	E 6 48 57.714
	4223.92	0.09	68.82	4223.24	37.10	16.16	33.82	0.17	7148755.80	394895.94	N 64 26 47.414	E 6 48 57.719
	4247.42	0.35	83.02	4246.74	37.19	16.17	33.91	0.34	7148755.82	394896.03	N 64 26 47.415	E 6 48 57.726
	4276.76	0.31	358.29	4276.08	37.30	16.26	34.00	0.46	7148755.91	394896.12	N 64 26 47.418	E 6 48 57.732
	4293.42	0.30	351.50	4292.74	37.32	16.35	33.99	0.07	7148756.00	394896.11	N 64 26 47.421	E 6 48 57.731
	4320.66	0.77	1.33	4319.97	37.39	16.61	33.98	0.53	7148756.25	394896.10	N 64 26 47.429	E 6 48 57.730
	4346.70	0.89	15.50	4346.01	37.56	16.98	34.04	0.27	7148756.62	394896.16	N 64 26 47.441	E 6 48 57.734
	4385.72	1.06	34.35	4385.03	38.01	17.57	34.33	0.28	7148757.21	394896.45	N 64 26 47.460	E 6 48 57.753
	4434.50	1.34	42.41	4433.80	38.85	18.36	34.96	0.20	7148758.00	394897.09	N 64 26 47.486	E 6 48 57.799
	4492.18	1.50	55.85	4491.46	40.16	19.28	36.04	0.19	7148758.93	394898.16	N 64 26 47.517	E 6 48 57.877
	4522.45	1.81	59.86	4521.72	41.00	19.74	36.79	0.33	7148759.39	394898.91	N 64 26 47.533	E 6 48 57.932
	4575.89	2.34	66.06	4575.12	42.91	20.61	38.51	0.32	7148760.25	394900.63	N 64 26 47.563	E 6 48 58.058
	4608.66	2.60	65.52	4607.86	44.31	21.19	39.80	0.24	7148760.83	394901.92	N 64 26 47.583	E 6 48 58.153
	4638.12	2.66	66.48	4637.29	45.66	21.74	41.04	0.08	7148761.38	394903.15	N 64 26 47.602	E 6 48 58.244
	4665.88	2.99	70.48	4665.01	47.02	22.24	42.31	0.42	7148761.88	394904.43	N 64 26 47.620	E 6 48 58.338
	4701.64	3.15	71.55	4700.72	48.93	22.86	44.12	0.14	7148762.50	394906.24	N 64 26 47.642	E 6 48 58.472
	4732.27	3.38	76.93	4731.30	50.68	23.33	45.80	0.38	7148762.98	394907.92	N 64 26 47.659	E 6 48 58.596
	4759.73	3.74	79.80	4758.71	52.37	23.67	47.47	0.44	7148763.32	394909.58	N 64 26 47.672	E 6 48 58.720
	4788.45	4.33	80.15	4787.36	54.38	24.02	49.46	0.62	7148763.67	394911.57	N 64 26 47.685	E 6 48 58.867
	4815.74	4.74	82.11	4814.56	56.51	24.36	51.59	0.48	7148764.00	394913.71	N 64 26 47.698	E 6 48 59.026
	4854.17	5.71	84.90	4852.83	59.94	24.74	55.07	0.78	7148764.39	394917.18	N 64 26 47.715	E 6 48 59.285
Wireline survey	4884.15	5.94	83.69	4882.66	62.92	25.05	58.09	0.26	7148764.69	394920.21	N 64 26 47.728	E 6 48 59.510
Wireline survey	4914.14	6.55	86.36	4912.47	66.11	25.33	61.34	0.68	7148764.97	394923.46	N 64 26 47.741	E 6 48 59.752
Wireline survey	4944.16	6.41	86.10	4942.30	69.40	25.55	64.72	0.14	7148765.19	394926.84	N 64 26 47.751	E 6 49 0.004
Wireline survey	4974.18	6.69	88.42	4972.12	72.71	25.71	68.14	0.38	7148765.35	394930.26	N 64 26 47.761	E 6 49 0.259
Wireline survey	5004.21	6.91	90.51	5001.94	76.11	25.74	71.70	0.33	7148765.39	394933.81	N 64 26 47.766	E 6 49 0.525
Wireline survey	5034.08	7.05	93.43	5031.59	79.54	25.62	75.33	0.38	7148765.26	394937.44	N 64 26 47.765	E 6 49 0.796
Wireline survey	5065.64	6.61	93.89	5062.93	83.04	25.38	79.07	0.42	7148765.02	394941.18	N 64 26 47.762	E 6 49 1.077
Projection to TD	5080.00	6.41	94.23	5077.19	84.56	25.26	80.69	0.43	7148764.91	394942.80	N 64 26 47.760	E 6 49 1.198

Survey Type: Definitive Survey

Survey Error Model: Shell version 22 *** 3-D 95.00% Confidence 2.7955 sigma

Surveying Prog:

MD From (m)

331.50

4854.17

5034.08

5065.64

MD To (m)

4854.17

5034.08

5065.64

5080.00

EOU Freq

Act-Stns MWD CODE 0.00

Act-Stns UNKNOWN CODE 9.99

Act-Stns MWD CODE 0.00

Act-Stns ZERO

Survey Tool Type

9.2 MWD Surveys Hold File – Raw and Corrected

Acceptance Criteria:

Tool G: **1002.30 +/- 2.5** counts. (From GeoMag)
Tool H: **51584.00/50 = 1031.68 +/- 6** counts(From BGGM+local model)
Dip: **75.23° +/- 0.45°**(From BGGM+local model)

Note: Azimuth corrected for Mag Decl, Grid Convergence and SUCOP

Magnetic Declination Model used: BGGM 2003 Calculated date: 15.06.04

Declinator Htotal Magnetic Dip

BGGM -1.23 51591.5 75.23

Local model (IFR) 0 -7.5 0.00

Total: -1.23 51594.0 75.23

To convert a Magnetic direction to a True direction; subtract: **1.23°**
To convert a True direction to a Grid direction; add: **1.97°**



BHA Sag Correction applied			
Incl	Corr	Incl	Corr
0-5	n/a		

Raw Values

Temperature Corrected

Final values

Raw Sgx_t	Raw Sgy_t	Raw Sgz_t	Raw Shy_t	Raw Shz_t	T_corr Sgx	T_corr Sgy	T_corr Sgz	T_corr Shx	T_corr Shy	T_corr Shz	Tool G	Tool H	Tool Dip Angle	Corr Tool H Angle	Corr Dip Angle	Date	Time	Depth m	Depth uncorr	Incl deg	Azim corr for Decl & Grid deg	Tool Type	Qual Type	Depth m	Incl deg	Azim corr for Decl, Grid & SUCOP deg	Comment
-2006.0	4.0	11.0	388.0	-86.0	1003.0	-2.0	-5.5	1030.4	248.3	-55.0	1003.0	1061.3	76.1	n/a	n/a	16-Jun-04	3:04:54	340.71	340.71	0.33	81.92	MWD	6 axis	340.71	0.33	81.96	SUCOP
-2006.0	-18.0	17.0	205.0	344.0	1003.0	9.0	-8.5	1030.4	131.2	220.2	1003.1	1061.8	75.9	n/a	n/a	16-Jun-04	5:45:36	349.73	349.73	0.71	75.43	MWD	6 axis	349.73	0.71	75.51	SUCOP
-2006.0	26.0	9.0	609.0	-402.0	1003.0	-13.0	-4.5	1029.8	39.7	-257.3	1003.1	1062.2	75.9	n/a	n/a	16-Jun-04	6:58:08	358.37	358.37	0.79	97.98	MWD	6 axis	358.37	0.79	98.08	SUCOP
-2006.0	-15.0	2.0	176.0	364.0	1003.0	7.5	-1.0	1032.3	112.6	233.0	1003.0	1064.3	76.1	n/a	n/a	16-Jun-04	12:48:00	368.21	368.21	0.43	107.30	MWD	6 axis	368.21	0.43	107.35	SUCOP
-2008.0	13.0	-14.0	-102.0	-387.0	1004.0	-6.5	7.0	1033.6	-65.3	-247.7	1004.0	1064.9	75.8	n/a	n/a	16-Jun-04	16:36:16	377.36	377.36	0.55	56.57	MWD	6 axis	377.36	0.55	56.62	SUCOP
-2004.0	-3.0	-11.0	-404.0	-34.0	1002.0	1.5	5.5	1033.0	-258.6	-21.8	1002.0	1065.1	75.8	n/a	n/a	16-Jun-04	20:16:00	390.91	390.91	0.33	69.47	MWD	6 axis	390.91	0.33	69.51	Survey at TD



Note: Azimuth corrected for Mag Decl, Grid Convergence and SUCOP

Acceptance Criteria: Tool G: 1002.30 +/- 2.5 counts. (From GeoMag; Tool H: 51584.00/50 = 1031.68 +/- 6 counts (From BGGM+local model); Dip: 75.23 +/- 0.45 (From BGGM+local model)

Magnetic Declination Model used: BGGM 2003 Calculated date: 15.06.04
Declinator/Total Magnetic Dip
BGGM -1.23 51591.5 75.23

Local model (IFR) 0 -7.5 0.00
Total: -1.23 51584.0 75.23
To convert a Magnetic direction to a True direction; subtract 1.23°
To convert a True direction to a Grid direction; add 1.97°

BHA Sag Correction applic

Incl	Corr	Incl	Corr
0-5	n/a		

Raw Values

Temperature Corrected

Final values

Raw Sgx_t	Raw Sgy_t	Raw Sgz_t	Raw Shx_t	Raw Shy_t	Raw Shz_t	T_corr Sgx	T_corr Sgy	T_corr Sgz	T_corr Shx	T_corr Shy	T_corr Shz	Tool G	Tool H	Tool Dip Angle	Corr Dip Angle	Corr H	Corr Angle	Date	Time	Depth m	Incl uncorr deg	Incl corr deg	Depth m	Incl deg	Qual Type	Tool Type	Azim corr for Decl, Grid & SUCOP deg	Comment
-2007.00	26.00	0.00	1536.00	-8.00	-404.00	1003.50	-13.00	0.00	983.00	-5.10	-258.60	1003.60	1016.50	75.30	n/a	n/a	n/a	22-Jun-04	10:38:05	415.91	0.74	0.74	415.91	0.74	MWD	MWD	89.05	SUCOP
-2006.00	19.00	-20.00	1519.00	-232.00	-326.00	1003.00	-9.50	10.00	972.20	-148.50	-208.60	1003.10	1005.30	75.10	n/a	n/a	n/a	22-Jun-04	11:37:26	444.63	0.79	0.79	444.63	0.79	MWD	MWD	76.81	SUCOP
-2007.00	35.00	-14.00	1513.00	-204.00	-353.00	1003.50	-17.50	7.00	968.30	-130.60	-225.90	1003.70	1002.90	75.00	n/a	n/a	n/a	22-Jun-04	12:35:21	473.75	1.08	1.08	473.75	1.08	MWD	MWD	94.98	SUCOP
-2005.00	37.00	-15.00	1518.00	-206.00	-352.00	1002.50	-18.50	7.50	971.50	-131.80	-225.30	1002.70	1006.00	75.10	n/a	n/a	n/a	22-Jun-04	14:11:21	502.73	1.14	1.14	502.73	1.14	MWD	MWD	94.77	SUCOP
-2006.00	-14.00	-46.00	1517.00	-362.00	192.00	1003.00	7.00	22.50	970.90	-231.70	122.90	1003.30	1005.70	75.10	n/a	n/a	n/a	22-Jun-04	15:04:08	531.68	1.35	1.35	531.68	1.35	MWD	MWD	96.43	SUCOP
-2005.00	46.00	-8.00	1523.00	-148.00	-383.00	1002.50	-23.00	4.00	974.70	-94.70	-245.10	1002.80	1009.50	75.10	n/a	n/a	n/a	22-Jun-04	15:51:52	560.60	1.33	1.33	560.60	1.33	MWD	MWD	97.08	SUCOP
-2005.00	28.00	-59.00	1522.00	-396.00	-113.00	1002.50	-14.00	29.50	974.10	-253.40	-72.30	1003.00	1009.10	75.10	n/a	n/a	n/a	22-Jun-04	17:10:53	588.68	1.87	1.87	588.68	1.87	MWD	MWD	93.29	SUCOP
-2005.00	52.00	12.00	1527.00	70.00	-400.00	1002.50	-26.00	-6.00	977.30	44.80	-256.00	1002.90	1011.20	75.10	n/a	n/a	n/a	22-Jun-04	18:39:54	617.64	1.52	1.52	617.64	1.52	MWD	MWD	88.07	SUCOP
-2005.00	-40.00	32.00	1538.00	296.00	280.00	1002.50	20.00	-16.00	984.30	189.40	179.20	1002.80	1018.30	75.30	n/a	n/a	n/a	22-Jun-04	22:29:08	645.90	1.46	1.46	645.90	1.46	MWD	MWD	93.14	SUCOP
-2005.00	-41.00	-36.00	1539.00	-267.00	302.00	1002.50	20.50	18.00	985.00	-170.90	193.30	1002.90	1018.20	75.20	n/a	n/a	n/a	22-Jun-04	23:39:40	674.96	1.56	1.56	674.96	1.56	MWD	MWD	84.62	SUCOP
-2005.00	47.00	-10.00	1542.00	8.00	-395.00	1002.50	-23.50	5.00	986.90	5.10	-252.80	1002.80	1018.80	75.30	n/a	n/a	n/a	23-Jun-04	0:50:19	703.82	1.37	1.37	703.82	1.37	MWD	MWD	72.48	SUCOP
-2005.00	-18.00	47.00	1541.00	336.00	205.00	1002.50	9.00	-23.50	986.20	215.00	131.20	1002.80	1017.90	75.30	n/a	n/a	n/a	23-Jun-04	2:04:18	732.21	1.44	1.44	732.21	1.44	MWD	MWD	74.89	SUCOP
-2005.00	37.00	-31.00	1543.00	-91.00	-378.00	1002.50	-18.50	15.50	986.90	-58.20	-241.90	1002.80	1018.40	75.20	n/a	n/a	n/a	22-Jun-00	3:20:03	760.91	1.38	1.38	760.91	1.38	MWD	MWD	59.63	SUCOP
-2005.00	-43.00	18.00	1541.00	69.00	388.00	1002.50	21.50	-9.00	986.20	44.20	248.30	1002.80	1018.00	75.30	n/a	n/a	n/a	22-Jun-00	4:33:16	790.38	1.33	1.33	790.38	1.33	MWD	MWD	73.14	SUCOP
-2005.00	-45.00	2.00	1542.00	-50.00	393.00	1002.50	22.50	-1.00	986.90	-32.00	251.50	1002.80	1018.90	75.30	n/a	n/a	n/a	22-Jun-00	5:37:52	818.48	1.29	1.29	818.48	1.29	MWD	MWD	76.10	SUCOP
-2005.00	-44.00	8.00	1541.00	8.00	396.00	1002.50	22.00	-4.00	986.20	5.10	253.40	1002.70	1018.30	75.30	n/a	n/a	n/a	22-Jun-00	6:59:34	847.23	1.28	1.28	847.23	1.28	MWD	MWD	76.77	SUCOP
-2005.00	5.00	41.00	1541.00	397.00	-1.00	1002.50	-2.50	-20.50	986.20	254.10	-0.60	1002.70	1018.40	75.40	n/a	n/a	n/a	22-Jun-00	8:08:35	876.84	1.18	1.18	876.84	1.18	MWD	MWD	79.44	SUCOP
-2006.00	-24.00	34.00	1539.00	308.00	253.00	1003.00	12.00	-17.00	985.00	197.10	161.90	1003.20	1017.50	75.30	n/a	n/a	n/a	22-Jun-00	9:00:58	905.58	1.19	1.19	905.58	1.19	MWD	MWD	82.02	SUCOP
-2004.00	13.00	34.00	1540.00	382.00	-120.00	1002.00	-6.50	-17.00	985.60	244.50	-76.80	1002.20	1018.40	75.30	n/a	n/a	n/a	22-Jun-00	10:07:33	935.14	1.04	1.04	935.14	1.04	MWD	MWD	83.28	SUCOP
-2007.00	2.00	37.00	1540.00	400.00	-22.00	1003.50	-1.00	-18.50	985.60	256.00	-14.10	1003.70	1018.40	75.40	n/a	n/a	n/a	22-Jun-00	11:15:39	962.67	1.06	1.06	962.67	1.06	MWD	MWD	86.73	SUCOP
-2006.00	-39.00	-5.00	1539.00	-60.00	397.00	1003.00	19.50	2.50	985.00	-38.40	254.10	1003.20	1017.90	75.30	n/a	n/a	n/a	22-Jun-00	12:11:00	992.76	1.12	1.12	992.76	1.12	MWD	MWD	85.16	SUCOP
-2004.00	35.00	-8.00	1541.00	8.00	-397.00	1002.00	-17.50	4.00	986.20	5.10	-254.10	1002.20	1018.50	75.30	n/a	n/a	n/a	22-Jun-00	13:21:10	1021.63	1.03	1.03	1021.63	1.03	MWD	MWD	72.92	SUCOP
-2005.00	-31.00	-23.00	1540.00	-247.00	317.00	1002.50	15.50	11.50	985.60	-158.10	202.90	1002.70	1018.60	75.30	n/a	n/a	n/a	22-Jun-00	14:08:29	1049.58	1.10	1.10	1049.58	1.10	MWD	MWD	85.18	SUCOP
-2002.00	-6.00	-34.00	1540.00	-398.00	-28.00	1001.00	3.00	17.00	985.60	-254.70	-17.90	1001.10	1018.10	75.40	n/a	n/a	n/a	22-Jun-00	15:04:39	1078.35	0.99	0.99	1078.35	0.99	MWD	MWD	73.07	SUCOP
-2006.00	-21.00	23.00	1541.00	285.00	306.00	1003.00	10.50	-11.50	986.20	163.20	195.80	1003.10	1018.70	75.40	n/a	n/a	n/a	22-Jun-00	17:14:04	1135.93	0.89	0.89	1135.93	0.89	MWD	MWD	79.57	SUCOP
-2006.00	-26.00	-27.00	1542.00	-349.00	188.00	1003.00	13.00	13.50	986.90	223.40	-22.40	1003.20	1019.00	75.30	n/a	n/a	n/a	22-Jun-00	18:15:13	1165.42	1.07	1.07	1165.42	1.07	MWD	MWD	71.21	SUCOP
-2005.00	12.00	23.00	1541.00	388.00	-92.00	1002.50	-6.00	-11.50	986.20	248.30	-58.90	1002.60	1018.70	75.30	n/a	n/a	n/a	22-Jun-00	19:39:03	1192.91	0.74	0.74	1192.91	0.74	MWD	MWD	73.79	SUCOP
-2009.00	-33.00	3.00	1540.00	-55.00	393.00	1004.50	16.50	-1.50	985.60	-35.20	251.50	1004.60	1017.80	75.30	n/a	n/a	n/a	22-Jun-00	20:55:15	1222.00	0.94	0.94	1222.00	0.94	MWD	MWD	74.07	SUCOP
-2005.00	-28.00	-19.00	1543.00	-291.00	272.00	1002.50	14.00	9.50	987.50	-186.20	174.10	1002.60	1019.90	75.30	n/a	n/a	n/a	22-Jun-00	22:06:32	1250.68	0.97	0.97	1250.68	0.97	MWD	MWD	74.37	SUCOP
-2006.00	25.00	1.00	1542.00	203.00	-341.00	1003.00	-12.50	-0.50	986.90	129.90	-219.20	1003.10	1019.00	75.20	n/a	n/a	n/a	22-Jun-00	23:36:58	1279.51	0.71	0.71	1279.51	0.71	MWD	MWD	59.88	SUCOP
-2007.00	12.00	-29.00	1543.00	-234.00	-317.00	1003.50	-6.00	14.50	987.50	-149.80	-202.90	1003.60	1019.20	75.20	n/a	n/a	n/a	23-Jun-00	1:08:03	1307.99	0.90	0.90	1307.99	0.90	MWD	MWD	56.75	SUCOP
-2007.00	25.00	-13.00	1542.00	7.00	-395.00	1003.50	-12.50	6.50	986.90	4.50	-252.80	1003.60	1018.80	75.20	n/a	n/a	n/a	23-Jun-00	2:36:33	1336.81	0.80	0.80	1336.81	0.80	MWD	MWD	59.57	SUCOP
-2006.00	-20.00	-34.00	1542.00	-390.00	-4.00	1003.00	10.00	17.00	986.90	-246.60	-2.60	1003.20	1018.00	75.20	n/a	n/a	n/a	23-Jun-00	3:51:03	1361.37	1.13	1.13	1361.37	1.13	MWD	MWD	56.03	Survey at TD

MWD RUN 1

Well: 6406/9-1
Date: 30-Jun-2004 to 5-Jul-2004
MWD Tool Number: MDC 487, MEA 379

Acceptance Criteria:

Tool G: 1002.30 +/- 2.5 counts. (From GeoMag)
Tool H: 51584.00/50 = 1031.68 +/- 6 counts (From BGGM+Hocal model)
Dip: 75.23° +/- 0.45° (From BGGM+Hocal model)

Note: Azimuth corrected for Mag Decl, Grid Convergence and SUCOP

Magnetic Declination Model used: BGGM 2003 Calculated date: 15.06.04

BGGM -1.23 51591.5 75.23
Declinator-Hotal Magnetic Dip
Local model (IFR) 0 -7.5 0.00
Total: -1.23 51584.0 75.23

To convert a Magnetic direction to a True direction; subtract : 1.23°
To convert a True direction to a Grid direction; add : 1.97°



BHA Sag Correction applied

Incl	Corr	Incl	Corr
0-5	n/a		

Raw Sg _x t	Raw Sg _y t	Raw Sg _z t	Raw Shy _t	Raw Shz _t	T _{corr} Sg _x	T _{corr} Sg _y	T _{corr} Sg _z	T _{corr} Shx	T _{corr} Shy	T _{corr} Shz	Tool G	Tool H	Dip Angle	Tool H Angle	Corr Dip Angle	Date	Time	Depth m	Incl deg	Azim corr for Decl & Grid deg	Tool Type	Qual Type	Depth m	Incl deg	Azim corr for Decl, Grid & SUCOP deg	Comment
1004.00	-6.00	12.00	996.00	156.00	-191.00	1004.00	-6.00	1001.00	155.50	-191.40	1004.10	1030.90	75.40	n/a	n/a	1-Jul-04	15:36:32	1432.61	0.74	349.76	MWD	6 axis	1432.61	0.74	349.76	SUCOP
1002.00	13.00	7.00	996.00	-192.00	1002.00	1002.00	12.50	1001.30	-192.00	-154.20	1002.10	1031.20	75.40	n/a	n/a	1-Jul-04	18:05:52	1457.52	0.82	351.73	MWD	6 axis	1457.52	0.82	351.73	SUCOP
1003.00	1.00	-8.00	995.00	-60.00	1002.50	1002.50	0.50	999.60	-59.50	243.80	1002.50	1030.70	75.50	n/a	n/a	1-Jul-04	20:05:20	1485.75	0.46	350.91	MWD	6 axis	1485.75	0.46	350.91	SUCOP
1004.00	14.00	-2.00	996.00	-239.00	1004.00	1004.00	13.50	1000.80	-238.70	-65.90	1004.10	1031.00	75.40	n/a	n/a	1-Jul-04	21:56:16	1513.40	0.78	340.07	MWD	6 axis	1513.40	0.78	340.07	SUCOP
1003.00	8.00	-8.00	995.00	-223.00	1003.00	1003.00	8.00	1000.30	-222.70	113.30	1003.10	1031.00	75.40	n/a	n/a	2-Jul-04	0:04:16	1542.71	0.63	345.22	MWD	6 axis	1542.71	0.63	345.22	SUCOP
1004.00	-4.00	-7.00	994.00	-27.00	1003.50	1003.50	-4.00	999.30	-26.90	252.20	1003.50	1031.00	75.40	n/a	n/a	2-Jul-04	3:01:20	1571.26	0.46	325.94	MWD	6 axis	1571.26	0.46	325.94	SUCOP
1005.00	3.00	9.00	993.00	225.00	1004.50	1004.50	2.50	998.20	224.60	-121.60	1004.50	1030.30	75.50	n/a	n/a	2-Jul-04	5:00:48	1602.09	0.53	285.65	MWD	6 axis	1602.09	0.53	285.65	SUCOP
1001.00	3.00	-8.00	994.00	-242.00	1000.50	1000.50	3.00	998.90	-241.90	77.40	1000.50	1030.70	75.40	n/a	n/a	2-Jul-04	10:50:40	1657.64	0.46	311.67	MWD	6 axis	1657.64	0.46	311.67	SUCOP
1000.00	10.00	-12.00	995.00	-241.00	1000.00	1000.00	10.00	1000.80	-240.60	56.30	1000.10	1030.90	75.40	n/a	n/a	2-Jul-04	13:13:36	1686.74	0.87	326.89	MWD	6 axis	1686.74	0.87	326.89	SUCOP
1005.00	-6.00	11.00	994.00	251.00	1004.50	1004.50	-6.00	998.60	250.90	54.40	1004.60	1031.10	75.40	n/a	n/a	2-Jul-04	19:03:28	1744.63	0.89	290.77	MWD	6 axis	1744.63	0.89	290.77	SUCOP
1004.00	-8.00	5.00	991.00	42.00	1003.50	1003.50	-8.00	996.80	41.60	259.80	1003.50	1030.90	75.40	n/a	n/a	2-Jul-04	21:11:28	1772.98	0.52	252.36	MWD	6 axis	1772.98	0.52	252.36	SUCOP
1004.00	3.00	-8.00	992.00	-251.00	1003.50	1003.50	3.00	997.90	-250.90	-60.20	1003.50	1030.70	75.40	n/a	n/a	2-Jul-04	22:58:08	1801.68	0.46	280.81	MWD	6 axis	1801.68	0.46	280.81	SUCOP
1003.00	8.00	10.00	991.00	141.00	1002.50	1002.50	8.00	998.70	140.80	-209.90	1002.60	1030.20	75.60	n/a	n/a	3-Jul-04	1:01:52	1830.49	0.73	290.94	MWD	6 axis	1830.49	0.73	290.94	SUCOP
1005.00	-8.00	7.00	991.00	199.00	1004.50	1004.50	-8.00	998.20	199.00	160.00	1004.60	1030.40	75.50	n/a	n/a	3-Jul-04	2:52:48	1859.02	0.59	285.08	MWD	6 axis	1859.02	0.59	285.08	SUCOP
1004.00	-8.00	3.00	992.00	165.00	1004.00	1004.00	-8.00	998.40	165.10	195.80	1004.00	1030.70	75.40	n/a	n/a	3-Jul-04	4:41:36	1889.37	0.49	292.09	MWD	6 axis	1889.37	0.49	292.09	SUCOP
1000.00	-7.00	1.00	993.00	160.00	1000.00	1000.00	-7.00	998.70	160.00	197.80	1000.00	1030.50	75.50	n/a	n/a	3-Jul-04	16:02:08	1974.51	0.40	306.90	MWD	6 axis	1974.51	0.40	306.90	SUCOP
1004.00	-3.00	-2.00	992.00	-66.00	1003.50	1003.50	-3.00	997.80	-65.90	250.20	1003.50	1030.80	75.40	n/a	n/a	3-Jul-04	20:56:32	2034.15	0.19	283.27	MWD	6 axis	2034.15	0.19	283.27	SUCOP
1004.00	-4.00	1.00	991.00	-10.00	1003.50	1003.50	-4.00	997.40	-9.60	259.80	1003.50	1030.80	75.40	n/a	n/a	3-Jul-04	23:02:24	2061.83	0.23	262.37	MWD	6 axis	2061.83	0.23	262.37	SUCOP
1004.00	1.00	7.00	992.00	250.00	1004.00	1004.00	0.50	997.90	250.20	-60.80	1004.00	1030.60	75.50	n/a	n/a	4-Jul-04	2:01:36	2090.26	0.37	281.41	MWD	6 axis	2090.26	0.37	281.41	SUCOP
1004.00	4.00	-1.00	991.00	-253.00	1004.00	1004.00	3.50	998.50	-252.80	37.80	1004.00	1030.70	75.40	n/a	n/a	4-Jul-04	3:58:56	2118.86	0.21	353.39	MWD	6 axis	2118.86	0.21	353.39	SUCOP
1004.00	-5.00	-2.00	992.00	54.00	1004.00	1004.00	-5.00	998.40	54.40	249.60	1004.00	1030.60	75.50	n/a	n/a	4-Jul-04	5:45:36	2148.34	0.31	305.82	MWD	6 axis	2148.34	0.31	305.82	SUCOP
1003.00	-1.00	-3.00	988.00	-115.00	1002.50	1002.50	-1.00	998.10	-114.60	231.00	1002.50	1030.80	75.40	n/a	n/a	4-Jul-04	8:51:12	2205.94	0.15	313.00	MWD	6 axis	2205.94	0.15	313.00	Survey at TD

MWD RUN 1

Well: 64069-1
Date: 13-Jul-2004 to 20-Jul-2004
MWD Tool Number: MDC 487, MEA 379

Acceptance Criteria:

Tool G: **1002.30 +/- 2.5** counts. (From GeoMag)
Tool H: **51584.00/50 = 1031.68 +/- 6** counts(From BGGM+Hocal model)
Dip: **75.23° +/- 0.45°**(From BGGM+Hocal model)

Magnetic Declination Model used: BGGM 2003 Calculated date: 15.06.04
Declinator Hotal Magnetic Dip
BGGM -1.23 51591.5 75.23

Local model (IFR) 0 -7.5 0.00
Total: -1.23 51584.0 75.23

To convert a Magnetic direction to a True direction, subtract: **1.23°**
To convert a True direction to a Grid direction, add: **1.97°**

Note: Azimuth corrected for Mag Decl, Grid Convergence and SUCOP



BHA Sag Correction applied

Incl	Corr	Incl	Corr
0-5	n/a		

Raw Values

Temperature Corrected

Final values

Raw Sgx_t	Raw Sgy_t	Raw Sgz_t	Raw Shy_t	Raw Shz_t	T_corr Sgx	T_corr Sgy	T_corr Sgz	T_corr Shx	T_corr Shy	T_corr Shz	Tool G	Tool H	Dip Angle	Tool H Angle	Corr Dip Angle	Date	Time	Depth m	Incl uncorr deg	Azim corr for Decl & Grid deg	Tool Type	Qual Type	Depth m	Incl deg	Azim corr for Decl, Grid & SUCOP deg	Comment
1003.00	4.00	6.00	1020.00	-184.00	1002.50	4.00	6.00	998.00	179.20	-184.30	1002.50	1030.60	75.50	n/a	n/a	14-Jul-04	6:58:08	2260.66	0.41	284.41	MWD	6 axis	2260.66	0.41	284.41	SUCOP
1004.00	4.00	5.00	1020.00	-8.00	1003.50	3.50	4.50	996.70	261.10	-8.30	1003.50	1030.40	75.50	n/a	n/a	15-Jul-04	19:09:52	2289.03	0.33	235.71	MWD	6 axis	2289.03	0.33	235.71	SUCOP
1003.00	-3.00	1.00	1020.00	257.00	1003.00	-2.50	1.00	997.40	30.10	256.60	1003.00	1030.30	75.50	n/a	n/a	15-Jul-04	23:21:36	2316.25	0.15	256.20	MWD	6 axis	2316.25	0.15	256.20	SUCOP
1000.00	0.00	1.00	1019.00	-259.00	1000.00	0.00	1.00	997.60	-259.20	29.40	1000.00	1031.10	75.40	n/a	n/a	16-Jul-04	3:14:08	2346.53	0.06	97.00	MWD	6 axis	2346.53	0.06	97.00	SUCOP
1003.00	1.00	1.00	1021.00	-35.00	1003.00	1.00	0.50	997.50	-35.20	254.70	1003.00	1030.10	75.60	n/a	n/a	16-Jul-04	8:51:12	2405.04	0.06	109.20	MWD	6 axis	2405.04	0.06	109.20	SUCOP
1003.00	0.00	0.00	1021.00	-93.00	1003.00	0.00	0.00	997.60	238.70	-93.40	1003.00	1030.00	75.60	n/a	n/a	16-Jul-04	12:41:36	2432.95	0.00	0.74	MWD	6 axis	2432.95	0.00	202.12	SUCOP
1003.00	1.00	-1.00	1022.00	-9.00	1002.50	0.50	-0.50	997.70	-9.00	257.30	1002.50	1030.40	75.50	n/a	n/a	16-Jul-04	20:54:24	2462.59	0.04	43.64	MWD	6 axis	2462.59	0.04	43.64	SUCOP
1004.00	2.00	-4.00	1021.00	137.00	1003.50	1.50	-3.50	998.20	137.00	213.80	1003.50	1029.90	75.60	n/a	n/a	17-Jul-04	9:44:32	2550.85	0.22	55.89	MWD	6 axis	2550.85	0.22	55.89	SUCOP
1002.00	-2.00	1.00	1022.00	-18.00	1002.00	-2.00	0.50	998.10	254.10	-17.90	1002.00	1030.10	75.60	n/a	n/a	17-Jul-04	12:58:40	2579.77	0.12	350.82	MWD	6 axis	2579.77	0.12	350.82	SUCOP
1003.00	-2.00	0.00	1022.00	68.00	1003.00	-1.50	0.00	998.00	246.40	68.50	1003.00	1030.20	75.50	n/a	n/a	17-Jul-04	17:31:44	2608.94	0.09	345.30	MWD	6 axis	2608.94	0.09	345.30	SUCOP
1003.00	1.00	-1.00	1021.00	136.00	1003.00	0.50	-0.50	997.50	217.60	135.70	1003.00	1030.00	75.60	n/a	n/a	18-Jul-04	9:53:04	2666.91	0.04	103.64	MWD	6 axis	2666.91	0.04	103.64	SUCOP
1004.00	2.00	3.00	1021.00	-93.00	1003.50	1.50	3.00	997.50	240.60	-93.40	1003.50	1030.40	75.50	n/a	n/a	18-Jul-04	15:23:44	2694.88	0.19	266.13	MWD	6 axis	2694.88	0.19	266.13	SUCOP
1003.00	2.00	2.00	1020.00	-116.00	1003.00	2.00	1.50	997.30	232.30	-116.50	1003.00	1030.60	75.50	n/a	n/a	19-Jul-04	0:51:12	2723.60	0.14	244.73	MWD	6 axis	2723.60	0.14	244.73	SUCOP
1003.00	1.00	-3.00	1021.00	-132.00	1003.00	1.00	-2.50	997.50	-224.60	-132.50	1003.00	1031.00	75.40	n/a	n/a	19-Jul-04	6:30:24	2753.06	0.15	262.59	MWD	6 axis	2753.06	0.15	262.59	SUCOP
1004.00	1.00	-2.00	1021.00	-127.00	1003.50	1.00	-2.00	997.30	-126.70	-227.20	1003.50	1030.60	75.50	n/a	n/a	19-Jul-04	12:09:36	2772.01	0.13	236.86	MWD	6 axis	2772.01	0.13	236.86	Survey at TD



Note: Azimuth corrected for Mag Decl, Grid Convergence and SUCOP



Acceptance Criteria: Tool G: **1002.30 +/- 2.5** counts. (From GeoMag)
 Tool H: **51610.00/50 = 1032.20 +/- 6** counts(From BGGM+local model)
 Dip: **75.23° +/- 0.45°** (From BGGM+local model)

Magnetic Declination Model used: BGGM 2003 Calculated date: 15.06.04
 Declinator: Hctal Magnetic Dip
 BGGM -1.2 51591.5 75.23
 Local model (IFR) 0.08 18.5 0.00

BHA Sag		Correction applied	
Incl	Corr	Incl	Corr
0-5	n/a		

Total: **-1.12 51610.0 75.23**
 To convert a Magnetic direction to a True direction; subtract : **1.12°**
 To convert a True direction to a Grid direction; add : **1.97°**

MWD RUN 11-17
 Well: 6406/9-1
 Date: 10-Dec-2004 to 07-Feb-2005
 MWD Tool Number: MDC FA21 / PMEA 1413 for Run 11
 MDC AB 159 / MEA 091 for Run 12 to Run 14
 MDC AE FA-21 / MEA 545 for Run 15 and Run 17

Raw Values														Temperature Corrected														Final values													
Raw Sgx_t	Raw Sgy_t	Raw Sgz_t	Raw Shy_t	Raw Shz_t	T_corr Sgx	T_corr Sgy	T_corr Sgz	T_corr Shx	T_corr Shy	T_corr Shz	Tool G	Tool H	Dip Angle	Corr Tool H	Corr Dip Angle	Date	Time	Depth m	Incl uncorr deg	Azim corr for Decl & Grid deg	Tool Type	Qual Type	Depth m	Incl deg	Azim corr for Decl, Grid & SUCOP deg	Comment															
-2006.0	-14.0	-23.0	1563.0	-203.0	-327.0	1000.3	11.5	1000.3	-129.9	-209.3	1003.1	1030.2	75.4	n/a	n/a	10-Dec-04	3:55:35	4320.66	0.77	1.33	MWD	6 axis	4320.66	0.77	1.33	SUCOP															
-2000.0	-31.0	3.0	1562.0	-355.0	137.0	1000.0	-1.5	999.7	-227.2	87.7	1000.1	1028.9	75.4	n/a	n/a	10-Dec-04	10:54:39	4346.70	0.89	15.50	MWD	6 axis	4346.70	0.89	15.50	SUCOP															
-2002.0	-1.0	37.0	1563.0	214.0	313.0	1001.0	-18.5	1000.3	137.0	200.3	1001.2	1029.3	75.5	n/a	n/a	10-Dec-04	20:42:55	4385.72	1.06	34.35	MWD	6 axis	4385.72	1.06	34.35	SUCOP															
-2005.0	-2.0	-47.0	1563.0	-280.0	-255.0	1002.5	23.5	1000.3	-179.2	-163.2	1002.8	1029.3	75.4	n/a	n/a	11-Dec-04	15:40:44	4434.50	1.34	42.41	MWD	6 axis	4434.50	1.34	42.41	SUCOP															
-2006.0	-33.0	41.0	1559.0	137.0	352.0	1003.0	-20.5	997.8	87.7	225.3	1003.3	1026.6	75.6	n/a	n/a	12-Dec-04	4:13:52	4492.18	1.50	55.87	MWD	6 axis	4492.18	1.50	55.85	SUCOP															
-2003.0	54.0	33.0	1563.0	324.0	-217.0	1001.5	-16.5	1000.3	207.4	-138.9	1002.0	1031.0	75.1	n/a	n/a	12-Dec-04	16:40:32	4522.45	1.81	59.87	MWD	6 axis	4522.45	1.81	59.86	SUCOP															
-2005.0	59.0	-57.0	1563.0	-180.0	-340.0	1002.5	28.5	1000.3	-115.2	-217.6	1003.3	1030.2	75.4	n/a	n/a	19-Dec-04	17:12:29	4575.89	2.34	66.07	MWD	6 axis	4575.89	2.34	66.06	SUCOP															
-2000.0	73.0	-54.0	1564.0	-136.0	-358.0	1000.0	27.0	1001.0	-87.0	-229.1	1001.0	1030.5	75.3	n/a	n/a	29-Dec-04	9:31:44	4603.66	2.60	65.54	MWD	6 axis	4603.66	2.60	65.52	SUCOP															
-2003.0	-54.0	-76.0	1564.0	-357.0	137.0	1001.5	38.0	1001.0	-228.5	87.7	1002.6	1030.4	75.4	n/a	n/a	29-Dec-04	14:26:08	4638.12	2.66	66.49	MWD	6 axis	4638.12	2.66	66.48	SUCOP															
-2006.0	103.0	19.0	1561.0	127.0	-362.0	1003.0	-9.5	999.0	81.3	-231.7	1004.4	1028.8	75.4	n/a	n/a	1-Jan-05	6:56:33	4665.88	2.99	70.51	MWD	6 axis	4665.88	2.99	70.48	SUCOP															
-2001.0	16.0	109.0	1561.0	384.0	-8.0	1000.5	-64.5	999.0	245.8	-5.1	1002.0	1028.8	75.5	n/a	n/a	9-Jan-05	21:07:46	4701.64	3.15	71.53	MWD	6 axis	4701.64	3.15	71.55	SUCOP															
-2004.0	55.0	-105.0	1561.0	-347.0	-188.0	1002.0	52.5	999.0	-222.1	-120.3	1003.8	1030.5	75.4	n/a	n/a	10-Jan-05	2:55:16	4732.27	3.38	76.95	MWD	6 axis	4732.27	3.38	76.93	SUCOP															
-2001.0	78.0	-105.0	1559.0	-334.0	-218.0	1000.5	52.5	997.8	-213.8	-139.5	1002.6	1029.9	75.4	n/a	n/a	13-Jan-05	4:34:03	4759.73	3.74	79.82	MWD	6 axis	4759.73	3.74	79.80	SUCOP															
-2000.0	-11.0	151.0	1556.0	399.0	-14.0	1000.0	-75.5	995.8	255.4	-9.0	1002.9	1028.1	75.4	n/a	n/a	21-Jan-05	9:57:20	4788.45	4.33	80.20	MWD	6 axis	4788.45	4.33	80.15	SUCOP															
-1999.0	-164.0	-23.0	1555.0	12.0	403.0	999.5	11.5	995.2	7.7	257.9	1002.9	1028.1	75.5	n/a	n/a	21-Jan-05	15:15:12	4815.74	4.74	82.16	MWD	6 axis	4815.74	4.74	82.11	SUCOP															
-1997.0	-118.0	-161.0	1552.0	-257.0	329.0	998.5	80.5	993.3	-164.5	210.6	1003.5	1028.6	75.4	n/a	n/a	22-Jan-05	10:48:34	4854.17	5.71	84.95	MWD	6 axis	4854.17	5.71	84.90	SUCOP															
-1993.0	172.0	154.0	1541.0	120.0	-435.0	996.5	-77.0	986.2	76.8	-278.4	1003.2	1027.7	75.4	n/a	n/a	6-Feb-05	17:21:04	5065.64	6.61	93.98	MWD	6 axis	5065.64	6.61	93.89	Survey at TD															

10.0 Logs

10.1 Schlumberger Logs:

6406_9-1_01_MAR_05_36in_500Log.PDS

6406_9-1_01_MAR_05_36in_200Log.PDS

6406_9_1_01_MAR_05_26in_500Log.PDS

6406_9-1_01_MAR_05_26in_200Log.PDS

6406_9_1_01_MAR_05_17x20in_500Log.PDS

6406_9-1_01_MAR_05_17x20in_200Log.PDS

6406_9_1_01MAR_05_17x20in_PCAL200log.PDS

6406_9_1_01_MAR_05_14x17in_500Log.PDS

6406_9-1_01_MAR_05_14x17in_200Log.PDS

6406_9_1_01_MAR_05_14x17in_PCAL500Log.PDS

6406_9_1_01_MAR_05_14x17in_PCAL200Log.PDS

6406_9-1_01_MAR_05_12_25in_500Log.PDS

6406_9-1_01_MAR_05_12_25in_200Log.PDS

6406_9-1_01_MAR_05_8_5in_500Log.PDS

6406_9-1_01_MAR_05_8_5in_200Log.PDS

6406_9-1_01_MAR_05_8_5in_EcoScope_resistivity_500Log.PDS

6406_9-1_01_MAR_05_8_5in_EcoScope_resistivity_200Log.PDS

6406_9-1_01_MAR_05_8_5in_EcoScope_service_500Log.PDS

6406_9-1_01_MAR_05_8_5in_EcoScope_service_200Log.PDS

10.2 DLIS Files

10.3 DVD

EOWR_Shell_Well_6406_9-1_Onyx on DVD.

Customer: Shell

Rig: Transocean Leader

Well: 6406/9-1 Onyx

Post Well Report

Prepared For: John Simpson, Shell

Date: July 4th 2005

**Prepared by: Roger Sandanger,
Ronny Mæland and Tone Hjetland, Halliburton**

Document Reference: TH05014

Confidentiality notice:

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Introduction

This report is based on information obtained from:

- Operation reports filled out by Halliburton offshore operators.
- Daily drilling reports provided by Shell.
- Recommendations and procedures issued by Halliburton field engineer.

Job reports, simulation printouts and charts are all filed at the Halliburton office in Tananger and can be supplied if required.

Summary

Halliburton performed nine cement jobs for Shell in this well before reaching TD of the well. Out of these, two cement jobs came in addition to the original plan. The increased number of cement jobs in the drilling phase is due to the need for squeezing the 16" liner lap and the requirement for plugging back before the strike.

The P&A operation included 10 cement plugs.

The primary objective was achieved on all cement jobs.

Cost Estimate

The total cost for cementing services provided by Halliburton for this project was approximately NOK 14 000 000.

Job Details*30" Conductor***Purpose of the job**

Provide structural support for the conductor and create barrier in the annulus.

Job details

Halliburton operator	Iain Stuart
Job date	17.-18.06.04
Job type	30" Primary + Top-up job
Max deviation	0°
Mud	SW and hi- vis pill
Sea bed	331 m
Float collar	No
Float shoe	Drill Quip @ 405 m
Stage tool	TITUS ring
Plug set	n/a
Measured depth	408
True vertical depth	408
BHST	7
BHCT	7
Spacer volume	120 % of casing volume
Spacer type	Seawater
Cement slurry volume	47 m ³ + 15 m ³
Excess factor	200% on open hole
Cement slurry code	Slurry 2 - STT10
Displacement fluid	Seawater
Displacement rate	±1200 lpm with the cement unit
Back flow	No
Time to drill out shoe-track	1 hr and 45 min
Bit type	Tricone

Experiences / Conclusions:

- No operational problems reported while cementing.
- The conductor was held in tension while the cement set up. Meanwhile circulating at 200 lpm through Titus.
- A top-up job was performed through the Titus system 4 hours after primary job.

20" Surface casing

Purpose of the job:

Provide structural support for the surface casing and create hydraulic barrier in the annulus.

Job details

Halliburton operators	Ronnie Cargill / Helge Håland
Job date	26.06.04
Job type	20" Primary cmt. job
Max deviation	0°
Mud	SW, hi-vis pills and 1,30 SG WBM mud
Sea bed	331 m
Hole depth	1380 m
Float collar	Halliburton NR
Float shoe	Halliburton NR @ 1369 m
Plug set	Halliburton SSR top-plug
BHST	49
BHCT	20
Spacer volume	220 m ³
Spacer type	Seawater
Lead slurry volume	200
Slurry code lead	Slurry 5 - STL 40
Tail slurry volume	20
Slurry code tail	Slurry 4 - STTNT
Excess factor	50% on open hole
Displacement fluid	1.30 SG Bentonite/CMC mud
Displacement rate	3500 lpm with the rig pumps
Bump plug	No
Back flow	No
Pressure test	138 bar
Time from cement in place till the pressure test	86 hrs
Time to drill out plug set	4 hour
Time to drill out float equipment	1 hours
Bit type	Smith 20GM

Experiences / Conclusions:

- Mixing of cement went according to plan
- Did not see any shear of the plug while displacing dart down. Displaced another 50% of the landing string volume before switching over to the rig pump.
- Due to uncertainties of the plug shear, the displacement was aborted ½ shoe track above the float collar to avoid over displacement.
- After the running tool was pulled out of hole and laid out on the deck it was found that the core of the plug was ribbed out of the wiper plug. The cement head was sent onshore and inspected. It was found that the mandrel inside the cement head was missing. The mandrel is supposed to be installed in side the cement head were the dart is located. This resulted in that the dart did not launch, hence did not shear out the plug as planned.
- Performed LOT to 1,73 SG.

*16" Liner***Job purpose**

Create a hydraulic barrier in the annulus to isolate weaker formations prior to drilling into potentially over-pressured formations.

Job details

Halliburton operator	Ronnie Cargill
Job date	07.07.04
Max deviation	0°
Mud	1.70 SG WBM
Sea bed	331 m
Hole depth	2248 m
Float collar	Halliburton @ 2207 m
Float shoe	Halliburton @ 2192 m
Plug set	Halliburton SSR plug set
BHST	72
BHCT	40°C (Based on Wellcat simulations)
Spacer volume	4 m ³ FW and 20 m ³ 1.88 SG Spacer 3T
Tail slurry volume	28
Slurry code tail	Slurry 25B – MPT05
Excess factor	50
Displacement fluid	1.70 SG WBM
Displacement rate	1900 lpm with the rig pumps
Bump plug	Yes
Back flow	No
Pressure test	Negative. Leaking liner lap.
Time from cement in place till the pressure test	On bump
Time to drill out float equipment	3.5 hours
Bit type	14 ¾" Tricone

Experiences / Conclusions

- ❑ Due to the problem experienced with the 20" casing a Halliburton remote operated SSR cement head was mobilized for the 16" Liner. The cement head was loaded offshore. Initially had problems pushing the dart through the bore ID on top of the cement head (2.87"), but after heating the dart in hot water and greasing it properly the dart loading went smoothly.
- ❑ RIH with the liner, to 2190 m. Worked the liner down to 2207 m, 1.2 m above landing profile. Large cuttings were observed at shaker while working down the liner. Unable to land the liner in the landing profile.
- ❑ No problem was observed while performing the cement job. The plug bumped and the liner pressure test was performed on bump to 138 bar.
- ❑ Unable to get a pressure test on the seal assembly.
- ❑ When drilling out cement found hard cement at 2154 m MD as expected and drilled hard cement to 2190 m MD.
- ❑ No or soft cement was seen in the shoe track. No reason for this has been identified.

*Squeeze 16" Liner Lap***Purpose of the Job**

Create hydraulic barrier in the liner lap to achieve the well integrity required to drill next section through potentially over-pressured formations.

Job Details

Halliburton operator	Ronnie Cargill
Job date	08.07.04
Max deviation	0°
Mud	1.70 SG WBM
Sea bed	3331m
Plug depth, bottom	1340 m
Plug depth, top (before squeezing)	1218 m
BHST	40°C
BHCT	35°C
Spacer volume	10 m ³ ahead, 0.6 m ³ behind to balance
Spacer type	Fresh water
Cement slurry volume	18.5 m ³
Cement slurry code	Slurry 25B – MPT05
Excess factor	No excess factor used
Pressure test	115 bar
Time from cement in place till the pressure test	19 hours

Experiences / Conclusions

- ❑ Spotted a cement plug above TOL, pulled above and squeezed down the liner lap. The cement plug was spotted through 5" open ended DP using the balanced-plug method. A 200-m hi-vis pill was placed in the 16" liner as base for the plug.
- ❑ Pumped 18.5 m³ cement and squeezed 6.9 m³ into the well before achieved maximum squeeze pressure of 53 bar. Shut in well with initial pressure 32 bar which slowly reduced to 27 bar. Waited 5.5 hour on cement, bleed of pressure slowly.
- ❑ Tagged TOC at 1274 and drilled firm cement to TOL at 1288 m MD and inside 16" liner to 1349 m MD.

*14" x 13^{3/8}" Intermediate Casing***Purpose of the Job**

Create hydraulic barrier to achieve the well integrity required to continue drilling the 12 1/4" section.

Job Details

Halliburton operator	Iain Stuart
Job date	26.07.04
Max deviation	0°
Mud	1.81 SG WBM
Sea bed	331 m
Hole depth	2793 m
Float collar	Halliburton HS NR @ 2724 m MD
Float shoe	Halliburton @ 2779 m MD
Plug set	Halliburton SSR High-strength, non-rotating
BHST	95 °C
BHCT	52 °C
Spacer volume	18 m ³ spacer
Spacer type	1.88 SG Spacer 3T
Cement slurry volume	23.5 m ³
Cement slurry code	Slurry 25B-MPT05
Excess factor	50%
Displacement fluid	1,81 SG WBM
Displacement rate	1000 lpm with the rig pumps
Bump plug	Yes
Back flow	No
Time to drill out plugs	3.3 Months
Time to drill out float equipment	1 hrs
Bit type	BHC / MX-C18 DX
Pressure test	120 bar
Time from cement in place till the pressure test	Did not hold on bump

Experiences / Conclusions

- Did not experience any problem when running casing. Circulated at 600 lpm with return.
- Mixing and pumping cement was performed according to plan.
- The displacement of the cement job was performed at 1000 lpm, no return. 1000 lpm is a very low displacement rate, but it was simulated to be maximum displacement rate without breaking down the 13 3/8" shoe.
- After plug bumped, pressure up to 120 bar, 70 bar above FCP, but pressure bled off. Pumped another 1,5 m³ pressuring up to 120 bar, pressure bled off. No back flow. Pressure tested casing against set cement in shoe-track 22 hours after bump.

*Suspension Plug in 13 3/8" Casing***Purpose of the job**

Due to strike the well had to be temporarily abandoned. To satisfy the barrier philosophy a cement plug was set inside the 13 3/8" casing.

Job details

Halliburton operator	Iain Stuart
Job date	27.07.04
Max deviation	0°
Mud	1.82 SG WBM
Sea bed	331 m
Plug depth, bottom	1950 m
Plug depth, top	Tagged cement at 1845 m
BHST	69°C
BHCT	38 °C
Spacer volume	7 m ³ ahead and 1 m ³ behind
Spacer type	1.88 SG Spacer 3T
Cement slurry volume	8 m ³
Cement slurry code	Slurry 25B – MPT05- at 1.95 SG
Displacement fluid	1.82 SG WBM

Experiences / Conclusions:

- As fundament for the plug a 200 m long hi-vis pill was spotted.
- There were no problems related to mixing or placing the cement plug in the casing. The cement plug was spotted through 5" DP using the balanced plug technique.
- The cement plug was pressure tested to 110bar/15 min 14 hours after placement.

*10 3/4" x 9 7/8" Casing***Purpose of the Job**

Create hydraulic barrier in the annulus, support the casing for subsequent drilling and perform pressure test of casing without RTTS run.

Job Details

Halliburton operators	Iain Stuart
Job date	01.12.04
Max deviation	0°
Mud	1.85 SG OBM (Versavert)
Sea bed	331 m
Hole depth	4306 m MD
Float collar depth	Halliburton HS NR @ 4035 m
Float shoe depth	Halliburton @ 4105 m
Plug set	FACTS plugs, non-rotating
BHST	150 °C
BHCT	100 °C
Spacer volume	5 m ³ Spacer A + 20 m ³ Spacer B ahead, 0.5 m ³ Spacer B behind
Spacer type	1.92 SG Spacer A, 1.93 Spacer B, both Spacer 4T
Cement slurry volume	22 m ³
Cement slurry code	Slurry 17B – HTG05
Excess factor	Caliper data with no excess
Displacement fluid	1.88 SG OBM (Paratherm)
Displacement rate	1500 lpm with the rig pumps
Bump plug	No
Back flow	No
Time to drill out plugs	1 hour
Time to drill out float equipment	2 hours
Bit type	PDC
Pressure test	517 Bar
Time from cement in place till the pressure test	98 hours

Experiences / Conclusions

- ❑ Experienced losses while running the casing and unable to establish return with the casing at TD. No other significant problems experienced while running the casing.
- ❑ To minimize the interface rheology between mud and spacer and still achieve water wetting of the surface areas in the cemented interval, two stages of spacer was pumped. The first stage, which was 5 m³, did not include the water wetting agent Sem-8
- ❑ The rheology of the spacer prepared in the pits offshore was slightly lower than the rheology of the spacer prepared in the lab. The rheology however was higher than the rheology of the mud, hence acceptable.
- ❑ Observed clear indications of shearing both the bottom and top FACTS wiper plugs.
- ❑ The cement slurry was displaced with 1500 lpm without any return. The cement slurry was over-displaced by ½ the shoe-track volume, but no bump was observed. A rig pump efficiency of 97% was assumed in the stroke calculations, and the shoe-track length was 43 m.

- The top wiper plug was tagged at 4247 m, which was 1 m above the float collar.
- Portable UCA and Minimacs were mobilized for this job to perform on-site QA / QC of cement slurry design. The thickening time test with the Minimacs was slightly longer than in the onshore lab. Hence there was no reason to do any last-minute design change.

	Offshore test	Shell Aberdeen	Halliburton lab
Time to 40 BC	9:49	9:33	8:36
Time to 70 BC	9:50	--	8:41
Time to 100 BC	9:51	9:42	8:46

- The compressive strength chart from the portable UCA is attached under the section “Cement Slurry Designs”. This shows that the compressive strength development was rapid and high.
- Rigging up the offshore lab equipment in the mud lab went smoothly and the working conditions were good.
- The casing was successfully pressure tested against the shoe-track to 517 bar 98 hours after end of displacement.
- While drilling the shoe-track the well was displaced to 1.95 SG OBM.
- After drilling 5 m of new formation a successful FIT to 2.13 SG EMW was performed.
- CBL logging performed on same run as 7” liner was logged. CBL showed some cement around the shoe and no cement in the rest of the 9 7/8” x 12 1/4” annulus.

7" Liner

Purpose of the Job

Achieve zonal isolation across the reservoir and bring TOC to TOL.

Job Details

Halliburton operators	Iain Stuart / Jon Murt
Job date	24.02.05
Max deviation	0°
Mud	1.85 SG OBM (Versavert)
Sea bed	331 m
Hole depth	5080 m AHD
Float collar depth	Baker @ 5077 m
Float shoe depth	Baker @ 5044 m
Plug set	Baker
BHST	183 °C
BHCT	153 °C
Spacer volume	12.5 m ³ + 1.5 m ³
Spacer type	1.95 SG Spacer 4T
Cement slurry volume	14.5 m ³
Cement slurry code	Slurry 19C – HTG15
Excess factor	5 %
Displacement fluid	1.89 SG OBM (Paratherm)
Displacement rate	1000 lpm with the rig pumps
Bump plug	Yes
Back flow	No
Pressure test	130 Bar.
Time from cement in place till the pressure test	8 days

Experiences / Conclusions

- The job was performed according to plan. The cement slurry was displaced at 1000 lpm with rotation, no losses observed. No operational problems reported. The cement slurry was batch mixed.
- The offshore Thickening Time test was very similar to the pre-job lab testing.

	Offshore test ¹	Halliburton lab ¹
Time to 40 BC	12:34	12:55
Time to 70 BC	12:35	13:02
Time to 100 BC	12:47	13:05

¹Excluding 3 hours batch mixing time.

- After the cement was in place it was stripped out 10 stands above TOL to WOC. The plan was to wait POOH until the offshore UCA test (sample from batch mixer) had built some compressive strength. Pre-job testing indicated that this would take approximately 20 hours. The offshore UCA did not show any compressive strength development until 36 hours had elapsed. The liner running string was then POOH. Attached is a listing of the post-job testing, and it indicates that the mix water could be the reason for the late compressive strength development. The thickening time test with the same mix water was spot on, hence excessive retarder added to the mix water cannot explain the late compressive strength development. This is also confirmed by inventory control.

- The plan was to leave cement above to liner with TOC at 4116 m according to the volume calculations. When running in hole with the clean-up assembly the cement was tagged at 4113 m.
- CBL prior to DST showed good cement bond.

Cement Plug #1A, Plug #1B, Plug #1C and Plug #1D**Purpose of the Job**

Isolate permeable zones by plugging back 7" liner and bring TOC inside 9 7/8" casing.

Job details

Halliburton operators	Iain Stuart / Sean Mackenzie
Job date	10.05.05 : Plug #1A, #1B, #1C 12.05.05 : Plug #1D
Max deviation	0°
Mud	1.95 SG OBM (Paratherm)
Sea bed	331 m
Base plug	4938 m
Top of Plug #1A	4776m
Top of Plug #1B	4604 m
Top of Plug #1C	4387 m (tagged)
Top of Plug #1D	4106 m
BHST	Plug #1A: 182 °C Plug #1B: 176 °C Plug #1C: 167 °C Plug #1D: 154 °C
BHCT	Plug #1A, #1B, #1C: 155 °C Plug #1D: 113 °C Based on Wellcat simulations
Spacer volume	Plug #1A: 3 m ³ ahead and 0.6 m ³ behind Plug #1B: 3 m ³ ahead and 0.6 m ³ behind Plug #1C: 3 m ³ ahead and 0.5 m ³ behind Plug #1D: 6 m ³ ahead and 0.6 m ³ behind
Spacer type	2,0 SG Spacer 4T
Cement slurry volume	Plug #1A: 3.0 m ³ Plug #1B: 3.5 m ³ Plug #1C: 4.6 m ³ Plug #1D: 6.5 m ³
Cement slurry code	Slurry 19C – HTG15, 2.05 SG
Excess volume factor	0%
Displacement fluid	1.95 SG OBM (Paratherm)

Experiences / Conclusions:

- ❑ The 7" liner was plugged back by placing four cement plugs on top of each other. All cement slurries were batch mixed. The last plug stretched theoretical \pm 80 m inside the 9 7/8" casing.
- ❑ A sample was taken of the mix water for Plug #1A for a Thickening Time test. After 2.5 hours this test had to be aborted as the seal on the slurry cup was leaking and could not be fixed with the spare parts on the rig. It was decided to rely on the pre-job testing in the laboratory and perform the operation as per plan.
- ❑ Due to black out on the rig prior to spotting Plug #1A, the mix water for the plugs had to be destructed due to the delay in operation.

- It was circulated B/U between each job. On each B/U two WiperBalls were dropped to clean the drill pipe and 2 7/8" cement stinger. The cement stinger had a mule shoe in the end and 20 holes drilled in the side. We have previously pumped 150 mm WiperBalls through 1/4" holes drilled in 3 1/2" DP that was plugged off in the end, and could not see the problem with pumping WiperBalls through 2 7/8" stinger with mule shoe and holes drilled in the body of the 2 7/8" tubing. After setting the third cement plug and circulating B/U after this a pressure drop of 60 bar was observed. It was believed to be a wash-out somewhere in the cement stinger. The work string was pulled (without setting the fourth cement plug) and it was discovered that the WiperBalls had accumulated in the bottom of the 2 7/8" cement stinger. The explanation is probably simple; the first two WiperBalls are displaced down the string, and when they pass the holes drilled in the stinger, the fluid has a flow path out of the stinger. As a consequence the WiperBalls are not displaced out of the mule shoe. Pump pressure increases slightly, but not noticeably. After Plug #1B the same thing happens, the WiperBalls are displaced past the hole in the stinger and ends up on top of the two WiperBalls that is already sitting in the mule shoe. Pump pressure increases further, but again not noticeably. After Plug #1C WiperBall number 5 and 6 are displaced into the 2 7/8" cement stinger, but the accumulated length of 6 WiperBalls now covered most of the 20 holes in the 2 7/8" cement stinger. Pump pressure increases again a little bit, but now the flow path out of the stinger is so small that the additional frictional pressure compresses the WiperBalls significantly. When the WiperBalls are compressed more holes are exposed again, hence the 60 bar pressure drop occurs. After the 60 bar pressure drop the pump pressure was similar to the circulating pressure before setting Plug #1A. If there had been a wash-out in the string, the circulating pressure should have been 60 bar or so lower than it was prior to setting Plug #1A.
- The original plan was to tag and pressure test Plug #1D. This plug had less retarder concentration (SCR-500L) due to lower BHCT and to avoid excessive WOC time prior to load and pressure testing the cement plug. Due to the additional trip the plug setting sequence was changed and Plug #1C was tagged instead of Plug #1D. Plug #1C was spotted from 4594 m to 4344 m. Plug #1C was originally not intended to be tagged, hence no testing of compressive strength development at this depth had been performed, neither in the lab nor on-site. It was recommended to WOC minimum 30 hours prior to tagging Plug #1C. The plug was tagged successfully at 4387 m 36 hours after the cement was in place.
- As plugging back the 7" liner was time extensive and required a lot of preparations and planning an additional cementing crew was required to be able to meet working regulations without waiting on personnel resting.

*Cement Plug #2A, Plug #2B/Squeeze and Plug #2C***Purpose of the Job**

Isolate the Lange formation by placing a 200-m cement plug inside the 9 7/8" casing, squeezing cement into the 9 7/8" x 12 1/4" annulus, and finally place a cement plug 200 m above the squeeze perforations in the 9 7/8" casing.

Job details

Halliburton operators	Iain Stuart / Sean Mackenzie Arild Barøy / Geir Tore Gustavsen
Job date	12.05.05 : Plug #2A 14.05.05: Plug #2B 16.05.05 : Plug #2C
Max deviation	0°
Mud	1.88 – 1.89 SG OBM (Paratherm)
Sea bed	331 m
Bottom of Plug #2A	4096 m
Top of Plug #2A	3846 m
Perforation interval - squeeze	3600 - 3595 m
Bottom of Plug #2C	3700 m
Top of Plug #2C	3498 m (tagged)
BHST	Plug #2A: 141 °C Plug #2B/squeeze and Plug 2C: 125 °C
BHCT	Plug #2A, #2B, #2C: 110 °C Based on Wellcat simulations
Spacer volume	Plug #2A: 5 m ³ ahead and 0.5 m ³ behind Plug #2B/Squeeze: 6 m ³ ahead and 0.7 m ³ behind Plug #2C: 5 m ³ ahead and 0.7 m ³ behind
Spacer type	1,92 SG Spacer 4T
Cement slurry volume	Plug #2A: 9.2 m ³ Plug #2B/Squeeze: 8.0 m ³ Plug #2C: 9.2 m ³
Cement slurry code	Slurry 17B – HTG05, 1.96 SG
Excess volume factor	0%
Displacement fluid	1.89 SG + 1.95 SG OBM (Paratherm)

Experiences / Conclusions:

- ❑ Plug #2A was placed from 4096 to 3846 m, i.e. immediately on top of Plug #1D. This plug was neither tagged nor pressure tested.
- ❑ The 9 7/8" x 12 1/4" annulus had to be squeezed because the primary 9 7/8" casing job was performed with losses and the CBL showed no cement in the interval that required isolation.
- ❑ 9 7/8" casing was perforated between 3600 and 3595 m. The injectivity test was conducted as per program with final pumping rate at 612 lpm and 73 bar SPP.
- ❑ Prior to squeezing cement into annulus a 8 m³ HiVis pill was placed from 3816 m. Plug #2B was placed as a balanced plug, the string was pulled to 3225 m before squeeze pressure was applied. 7 m³ was squeezed into the annulus. Pressure was held on the well while waiting on cement for 7 hours. The pressure was the bled off in 10 bar stages. The flowcheck showed no pressure build up.

- A CBL was run to check where the squeeze had gone. The CBL showed that the cement had gone both up and down from the perforations. Additionally, only 50 m good cement could be observed on the CBL read-out between 3570 m – 3620 m (desired cement squeeze length was 150 m).
- Plug #2C was spotted from 3700 m to 3450 m and was tagged at 3498 m (97 m above perforations after approximately 16 hours after placing the cement plug. The plug was pressure tested to 140 bar.
- 2 ea WiperBalls was pumped on each job when circulating B/U after the jobs.
- Offshore lab: UCA test was performed on Plug #2A, the squeeze and Plug #2C. This allowed aggressive WOC times before tagging / pressure testing Plug #2C, hence saving rig time.

Offshore UCA	Plug #2A	Plug #2B/Squeeze	Plug #2C
Time to 50 psi	10:17	12:15	13:40
Time to 500 psi	10:32	12:38	14:17
Time to 1000 psi	10:48	12:47	15:12

Cement Plug Across 9 7/8" Casing Cut – Plug #3**Purpose of the Job**

Set a cement plug across the 9 7/8" casing cut at 2817 m AHD. TOC should be minimum 50 m above the casing cut and the cement plug should be load tested and pressure tested.

Job details

Halliburton operators	Iain Stuart/Kerry French
Job date	24.05.05
Max deviation	0°
Mud	1.88 SG OBM (Pharaterm)
Sea bed	331 m
Base of Plug #3	2877 m
Top of Plug #3	2696 m (tagged)
BHST	96 °C
BHCT	79 °C (API)
Spacer volume	Plug #3: 9.0 m ³ ahead and 0.5 m ³ behind
Spacer type	1.91 SG Spacer 4T
Cement slurry volume	16.2 m ³
Cement slurry code	Slurry 25B – MPT05
Excess volume factor	0%
Displacement fluid	1.88 SG OBM (Paratherm)

Experiences / Conclusions:

- ❑ Losses was experienced after cutting the 9 7/8" casing with 1.89 SG mud in the well. However, the well was stable before placing the 8 m³ HiVis pill from 2990 m to 2877 m as a fundament for the cement plug.
- ❑ Plug #3 was placed as planned and no losses observed.
- ❑ Batch mixer was used to prepare the mix water and the mixing of the cement slurry was done at the cement unit.
- ❑ 2 ea WiperBalls was pumped when circulating B/U after the job.
- ❑ Tagged cement at 2696 m (84 m above the 13 3/8" casing shoe) approximately 15 hours after placement of the cement slurry.
- ❑ The plug was pressure tested to 99 bar 19 hours after placement of the cement slurry.

*Cement Plug Across 13 3/8" Casing Cut – Plug #4***Purpose of the Job**

Place a cement plug from 1388 m covering 50 m 13 3/8" casing, 50 m 16" liner and 100 m 20" casing. The cement plug was load tested and pressure tested.

Job details

Halliburton operators	Tor Bruland / Kerry French
Job date	28.05.05
Max deviation	0°
Mud	1.82 SG WBM (Glydril)
Sea bed	331m
Base of Plug #6	1388 m
Top of Plug #6	1156 m (tagged)
BHST	70 °C
BHCT	56 °C (API)
Spacer volume	15 m ³ ahead and 0.5 m ³ behind
Spacer type	1.88 SG Spacer 3T
Cement slurry volume	28.2 m ³
Cement slurry code	Slurry 25B – MPT25
Excess volume factor	0%
Displacement fluid	1.88 SG WBM (Glydril)

Experiences / Conclusions:

- ❑ A HiVis pill was placed from 1502 m to 1388 m as a fundament for the cement plug.
- ❑ No operational problems reported while placing the cement plug.
- ❑ TOC was tagged at 1156 m AHD, which was 32 m high, approximately 15 hours after placement. The plug was pressure tested to 84 bar.
- ❑ One WiperBall was pumped when circulating B/U after the job.

*Surface Cement Plug – Plug #5***Purpose of the Job**

Place a minimum 200 m surface cement plug inside the 20” casing with TOC maximum 50 m below seabed.

Job details

Halliburton operators	Tor Bruland/Kerry French
Job date	31.05.05
Max deviation	0°
Mud	Sea water
Sea bed	331 m
Base of Plug #8	603 m
Top of Plug #8	358 m (theoretical)
BHST	15 °C
BHCT	13 °C (API)
Cement slurry volume	79 m ³
Cement slurry code	Slurry 4 - STTNT
Excess volume factor	1000%
Displacement fluid	Sea water

Experiences / Conclusions:

- No operational problems reported placing the cement plug.
- The remaining silica blend was spent first and then the remaining neat G was used on this cement plug.
- The plug was verified with returns to sea bed and cement samples taken in buckets (to verify set-up).
- The riser and BOP was pulled before placing this plug.
- A HiVis pill was placed from 753 m to 603 m prior to pulling the riser and BOP.

Cement Slurry Designs

30" Conductor

Cement slurry design & Test Results			
	Norcem class G cement	Tail	Units
Slurry code: Slurry 2 – STT10	CaCl ₂ liquid	4.35	ltr/100 kg
	NF-6	0.10	ltr/100 kg
	Sea water	39.56	ltr/100 kg
	Density	1,95	SG
	Total Mix Fluid	44,01	ltr/100 kg
	Yield	75,06	ltr/100 kg
Typical data	<u>Thickening Time at 6 - 8°C:</u>		
	Time to 30 BC	3 - 4	Hours
	API free water	n/a	%
	API fluid loss at BHCT	n/a	cc / 30 min
	Fann rheology at BHCT	145	300 rpm
	<i>Estimate from lab DB</i>	125	200 rpm
		109	100 rpm
		99	60 rpm
		90	30 rpm
		45	6 rpm
		37	3 rpm
	Plastic viscosity at BHCT	54	cP
Yield point at BHCT	91	lb/100ft ²	
Compressive strength at 8 °C	± 400	24-hour psi	
Drill water Chloride Content	n/a	ppm	

20" Surface Casing

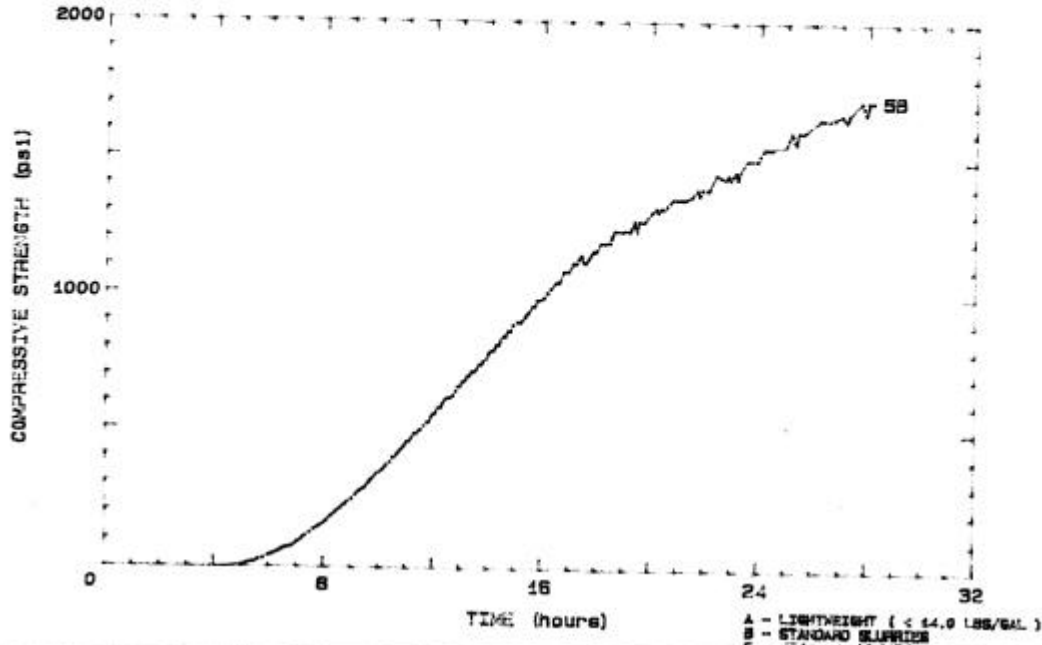
Cement Slurry Design & Test Results					
		Lead	Tail	Units	
Slurry codes: Lead: Slurry 5 – STL40 Tail: Slurry 4 – STTNT	Norcem "G" Cement				
	Econolite	3.20	-	ltr/100 kg	
	HR-4L	0.60	0.20	ltr/100 kg	
	NF-6	0.10	0.10	ltr/100 kg	
	Sea Water	94.64	--		
	Fresh Water	--	43.62		
	Density	1,56	1,92	SG	
Total Mix Fluid	98.54	43.92	ltr/100 kg		
Yield	129.60	74.97	ltr/100 kg		
Lab reference: NS04-Z-426-7/3	<u>Thickening Time at BHCT:</u>				
	Time to 40 BC	6:10	4:21	Hrs:Mins	
	Time to 70 BC	6:43	4:51	Hrs:Mins	
	Time to 100 BC	7:30	5:00	Hrs:Mins	
	Rheology at BHCT		11	83	300 RPM
			8	63	200 RPM
			4	49	100 RPM
			3	39	60 RPM
			2	31	30 RPM
			1	15	6 RPM
			1	9	3 RPM
	Plastic viscosity at BHCT	11	51	cP	
	Yield point at BHCT	1	32	lb/100ft ²	
	Compressive strength development		7:43	6:06 hrs	50 psi
				11.30 hrs	500 psi
±500			1600 psi	24-hour psi	
Drill water Chloride Content	N/A	< 1000	ppm		

UCA Chart Tail

PROJECT NO.: 2-426-3
 DATE: 4/16
 PRESSURE: 3000
 TEMPERATURE: 120 F
 CEMENT: Norcem G + 0.1% BZ-F10 + 0.30 HR-4L + 0.10 blk NF-6 + Freshwater

ULTRASONIC CEMENT ANALYZER
 HALLIBURTON SERVICES

INITIAL SET: 50 @ 5:06
 STRENGTH 1: 500 @ 11:30
 STRENGTH 2: 19999
 CURR. STR.: 1716 @ 28:15

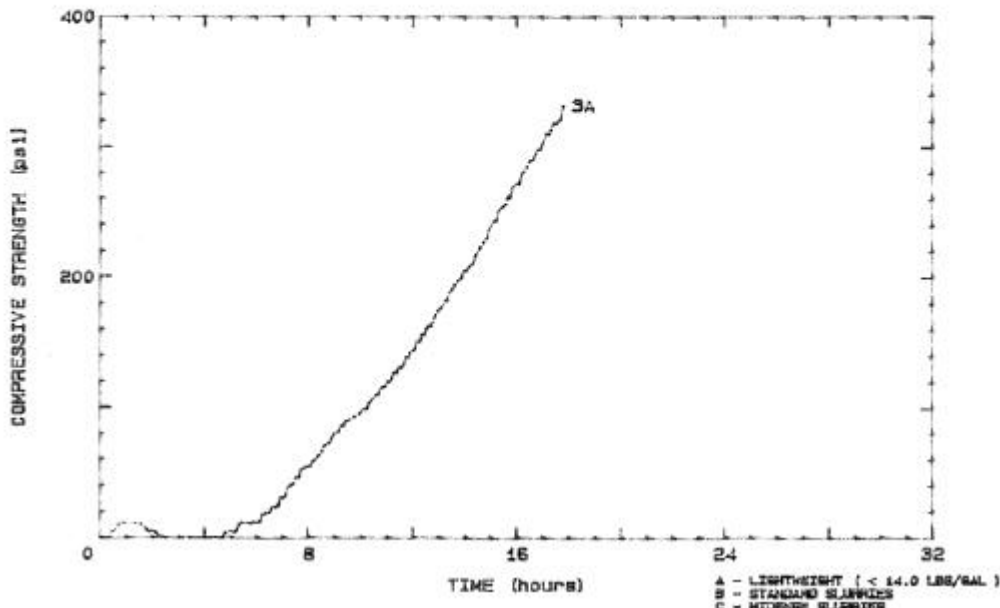


UCA Lead

PROJECT NO.: N5041-Z-426
 DATE: 12/16/09
 PRESSURE: 3000 psi
 TEMPERATURE: 68 F
 CEMENT: Norcem G + BZ-F10 + 0.6 blk HR-4L + 3.20 blk Cenolite liquid + 0.6 blk NF6 + Sea water

ULTRASONIC CEMENT ANALYZER
 HALLIBURTON SERVICES

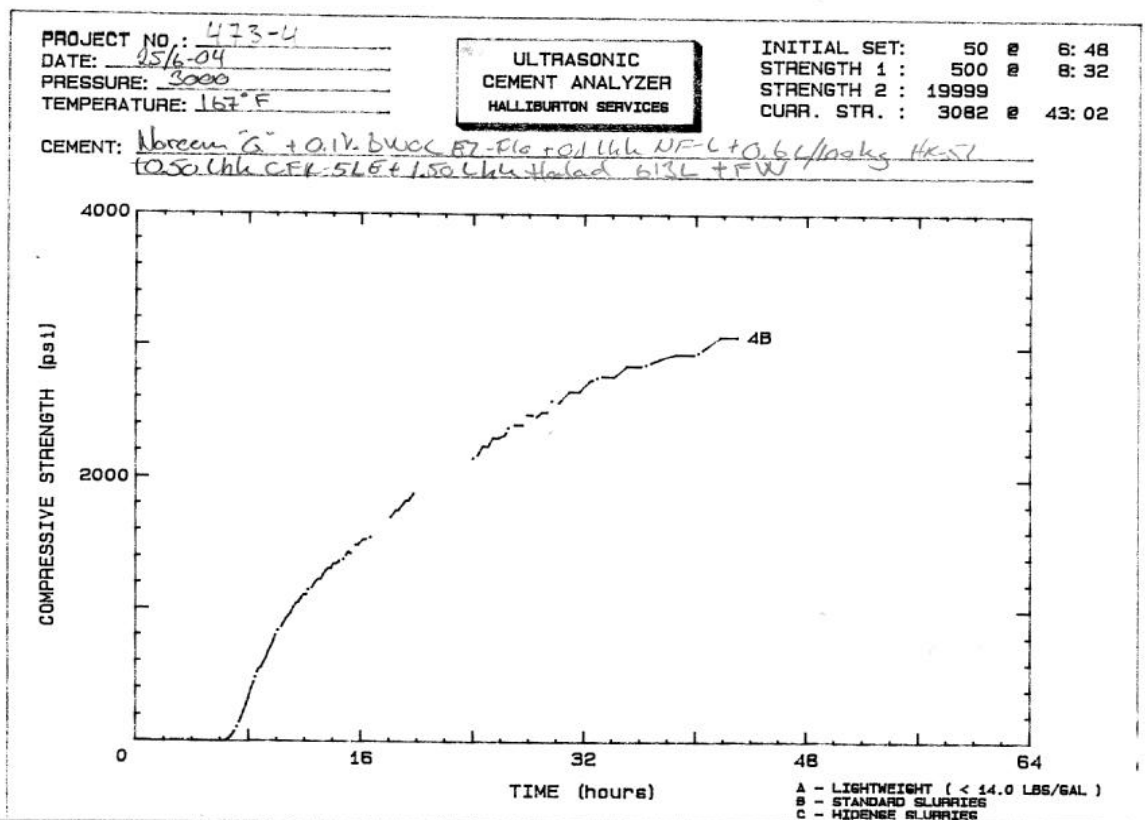
INITIAL SET: 50 @ 7:43
 STRENGTH 1: 500
 STRENGTH 2: 19999
 CURR. STR.: 332 @ 17:51



16" Liner

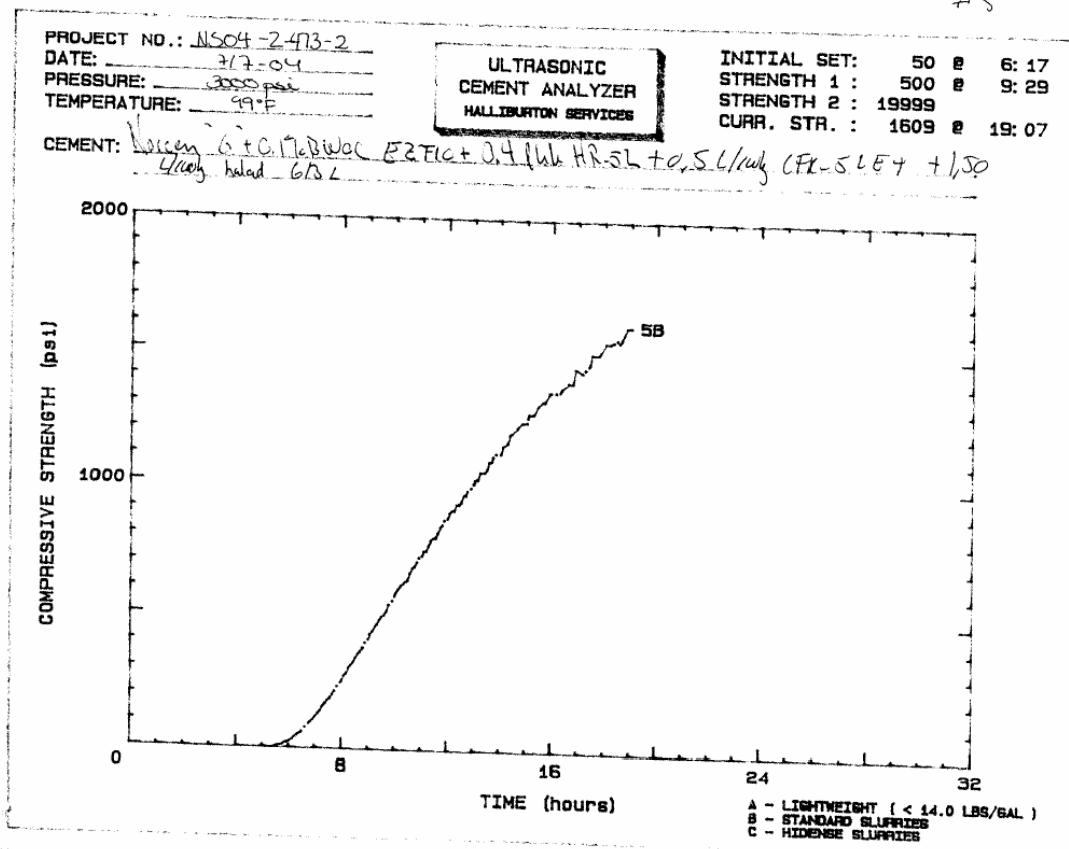
Cement Slurry Design & Test Results			
		Single	Units
Slurry code: Slurry 25B – MPT05	Norcem "G" Cement		
	CFR-5L	0.50	ltr/100 kg
	HR-5L	0.60	ltr/100 kg
	Halad-613L	1.50	ltr/100 kg
	NF-6	0.10	ltr/100 kg
	Fresh Water	41.41	ltr/100 kg
	Density	1.92	SG
Total Mix Fluid	44.11	ltr/100 kg	
Yield	75.16	ltr/100 kg	
Lab reference: NS04-Z-473-1	<u>Thickening Time at BHCT:</u>		
	Time to 40 BC	4:56	Hrs:Mins
	Time to 70 BC	5:06	Hrs:Mins
	Time to 100 BC	5:13	Hrs:Mins
	API fluid loss at: BHCT°C	N/A	Cc/30 min
	SG top/bottom	1,88/1,92	SG/SG
	Fann readings at BHCT	54	300 RPM
		42	200 RPM
		29	100 RPM
		25	60 RPM
		22	30 RPM
		20	6 RPM
		17	3 RPM
	Plastic viscosity at BHCT	36	cP
	Yield point at BHCT	18	lb/100ft ²
Compressive strength development	6:48	50 psi	
	8:32	500 psi	
	20:00	2000 psi	
Drill water Chloride Content	< 1000	ppm	

Spacer Design & Data - Spacer 3T				
		Amount	Unit	Order of addition
Spacer design per 1 m ³ :	Drill water	721.5	litre	1 Check Chlorides
	NF-6	As required	litre	2 Disperse in water
	Tuned Spacer	31.0	kg	3 Yield min. 1/2 hour
	Barite	1128.0	kg	4 Weigh up to initial SG
	Final density	1.88	SG	Final density SG
	PV/ YP	39/24		



Squeeze 16" Liner Lap

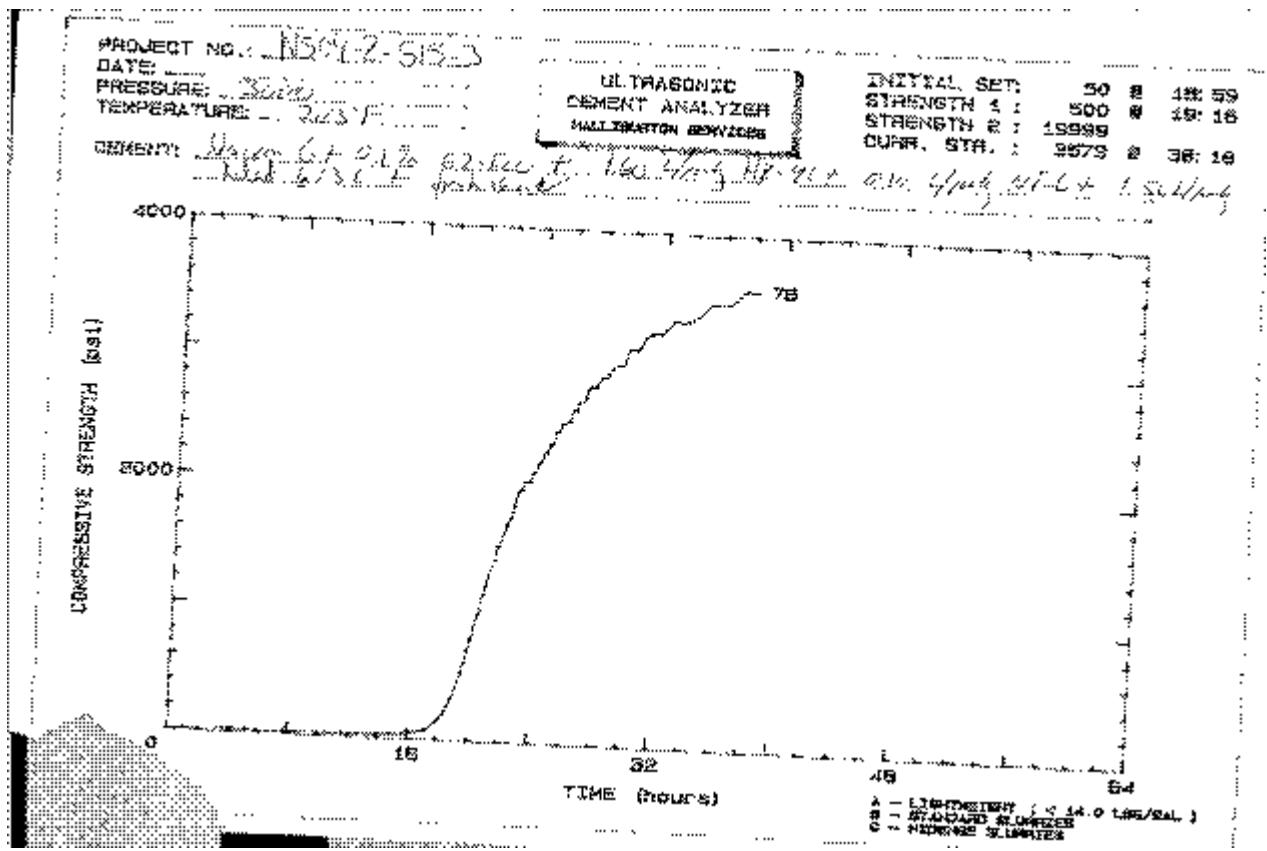
Cement Slurry Design & Test Results			
Slurry code: Slurry 25B – MPT05	Norcem "G" Cement	Single	Units
	CFR-5L	0.50	ltr/100 kg
	HR-5L	0.40	ltr/100 kg
	Halad-613L	1.50	ltr/100 kg
	NF-6	0.10	ltr/100 kg
	Fresh Water	41.57	ltr/100 kg
	Density	1.92	SG
Lab reference: NS04-Z-473-2	Total Mix Fluid	44.07	ltr/100 kg
	Yield	75.13	ltr/100 kg
	<u>Thickening Time at BHCT:</u>		
	Time to 40 BC	3:20	Hrs:Mins
	Time to 70 BC	3:50	Hrs:Mins
	Time to 100 BC	3:59	Hrs:Mins
	Compressive strength development	6:17	50 psi
		9:29	500 psi
		19:00	1600 psi
	Drill water Chloride Content	< 1000	ppm



14" x 13^{3/8}" Intermediate Casing

Cement Slurry Design & Test Results			
Slurry code: Slurry 25B – MTP05	Norcem "G" Cement	Amount	Units
		HR-4L	1.60
	Halad-613L	1.50	ltr/100 kg
	NF-6	0.10	ltr/100 kg
	Fresh Water	38.67	ltr/100 kg
	Density	1.95	SG
	Total Mix Fluid	41.87	ltr/100 kg
	Yield	72.92	ltr/100 kg
Lab reference: NS04-Z-515	<u>Thickening Time at BHCT:</u>		
	Time to 40 BC	8:03	Hrs:Mins
	Time to 70 BC	8:10	Hrs:Mins
	Time to 100 BC	8:12	Hrs:Mins
	API fluid loss at: BHCT°C	N/A	cc/30 min
	SG top/bottom	1.95/1.95	SG/SG
	Fann readings at BHCT	95	300 RPM
		74	200 RPM
		53	100 RPM
		44	60 RPM
		42	30 RPM
		35	6 RPM
		28	3 RPM
	Plastic viscosity at BHCT	61	cP
	Yield point at BHCT	34	lb/100ft ²
	API gel strength at BHCT °C, 10 sec/min	20 / 21	3 RPM
	Compressive strength development	15:59	50 psi
		19:16	500 psi
		38:18	3579 psi
	Drill water Chloride Content	<600	ppm

Spacer Design & Data - Spacer 3T				
		Amount	Unit	Order of addition
Spacer design per 1 m ³ :	Drill water	718	litre	1 Check Chlorides
	NF-6	As required	litre	2 Disperse in water
	Tuned Spacer E+	32	kg	3 Yield min. 1 hour
	Barite	1130	kg	4 Weigh up to initial SG
	Final density	1.88	SG	Final density SG
	Rheology	PV = 42 cP / YP = 26 lb/100ft ²		

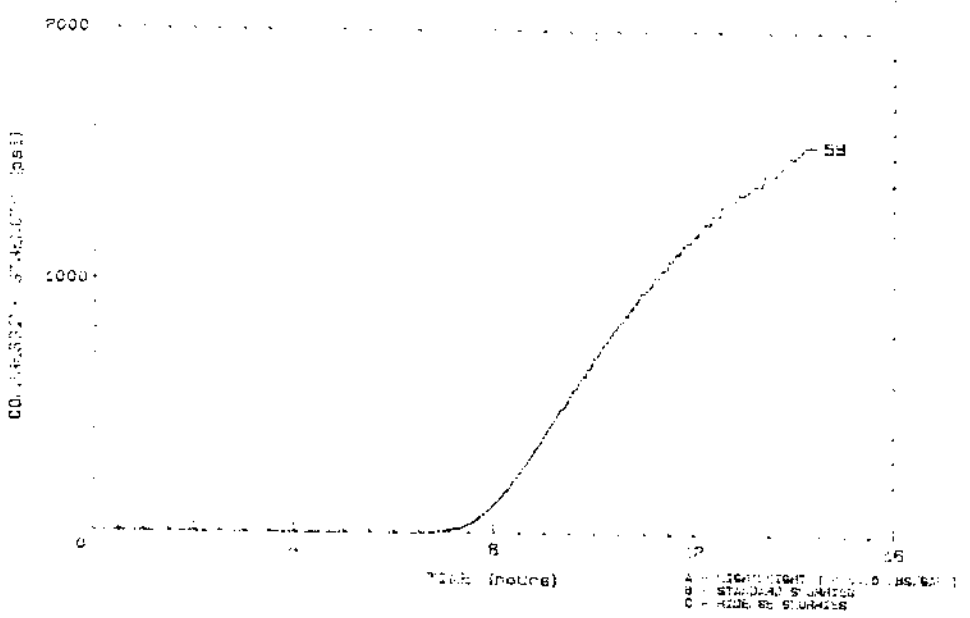


Suspension Plug in 13 3/8" Casing

Cement Slurry Design & Test Results			
		Single	Units
Slurry code: Slurry 25B – MPT05	Norcem "G" Cement w/ 0,1% EZ-FLO		
	CFR-5L	0.50	ltr/100 kg
	HR-5L	0.70	ltr/100 kg
	Halad-613L	1.50	ltr/100 kg
	NF-6	0.10	ltr/100 kg
	Fresh Water	38.93	ltr/100 kg
	Density	1.95	SG
Total Mix Fluid	41.73	ltr/100 kg	
Yield	72.84	ltr/100 kg	
Lab reference: NS04-Z-530-7	<u>Thickening Time at BHCT:</u>		
	Time to 40 BC	4:13	Hrs:Mins
	Time to 70 BC	5:10	Hrs:Mins
	Time to 100 BC	5:18	Hrs:Mins
	API fluid loss at BHCT	N/A	Cc/30 min
	SG top/bottom	1.95 / 1.95	SG/SG
	Fann readings at BHCT	70	300 RPM
		51	200 RPM
		32	100 RPM
		25	60 RPM
		21	30 RPM
		19	6 RPM
		17	3 RPM
	Plastic viscosity at BHCT	55,2	cP
	Yield point at BHCT	14.4	lb/100ft ²
API gel strength, 10 sec/min	16 / 21	3 rpm reading	
Compressive strength development at Wellcat temperature schedule (UCA chart attached below)	7:34	50 psi	
	9:19	500 psi	
	14:25	1543 psi	
Drill water Chloride Content	< 1000	ppm	

Spacer Design & Data - Spacer 3T				
		Amount	Unit	Order of addition
Spacer design per 1 m³:	Drill water	718	litre	1 Check Chlorides
	NF-6	As required	litre	2 Disperse in water
	Tuned Spacer E+	32	kg	3 Yield min. 1 hour
	Barite	1130	kg	4 Weigh up to initial SG
	Final density	1,88	SG	Final density SG
Rheology	PV = 42 cP / YP = 26 lbf/100ft ²			

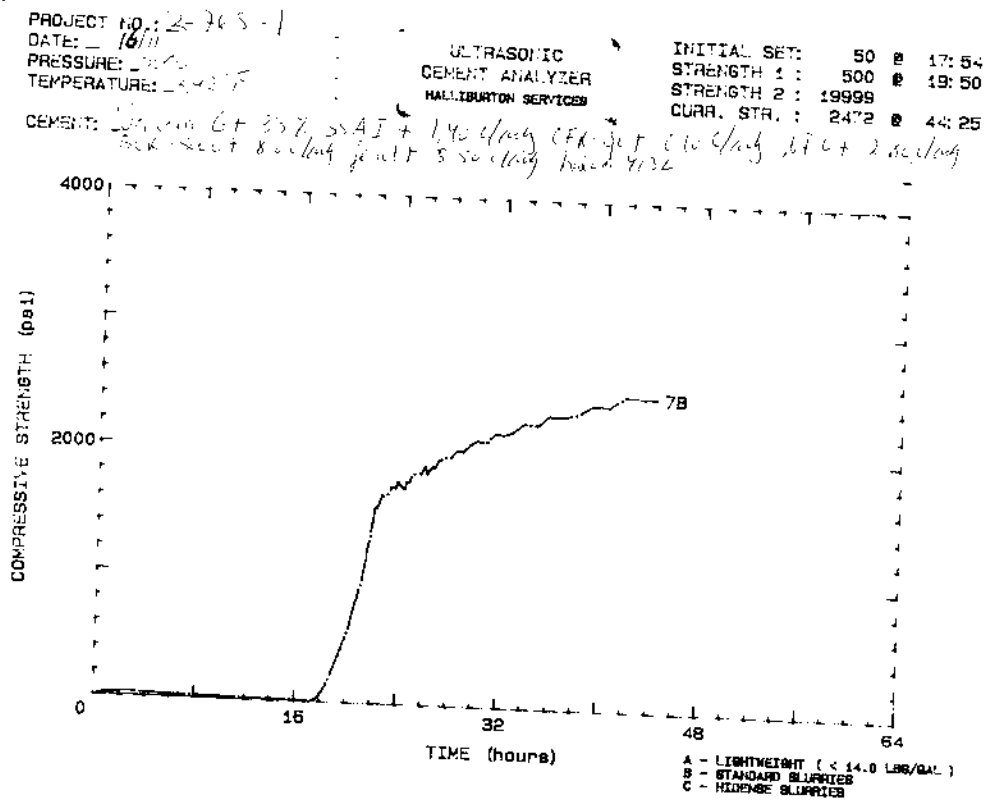
PRODUCT: *Spacer 3T*
 DATE: *01/07/05*
 PREPARED BY: *...*
 APPROVED BY: *...*
 WTR-SOLUCO
 CHEMICAL SERVICES
 INITIAL SG: 50
 STABILIZER 1: 500
 STABILIZER 2: 19999
 CHLOR. SPR.: 1543
 CASE NO: *...*
 JOB NO: *...*



10 3/4" x 9 7/8" Production Casing

Cement Slurry Design & Test Results			
		Amount	Units
Slurry code: Slurry 17B – HTG05	Norcem "G" Cement	35.00	%bwoc
	SSA-1 Dry blended	5.50	ltr/100 kg
	Halad-413L	8.00	ltr/100 kg
	Microsilica	1.40	ltr/100 kg
	CFR-3L	2.80	ltr/100 kg
	SCR-500L	0.10	ltr/100 kg
	NF-6	36.40	ltr/100 kg
	Fresh Water		
	Density	1.96	SG
	Total Mix Fluid	54.20	ltr/100 kg
	Yield	98.57	ltr/100 kg
Lab reference: NS04-Z-765	<u>Thickening Time at 100°C:</u>		
	Time to 40 BC	8:36	Hrs:Mins
	Time to 70 BC	8:41	Hrs:Mins
	Time to 100 BC	8:46	Hrs:Mins
	API fluid loss at: BHCT°C	29	cc/30 min
	SG top/bottom	1.95/1.98	SG/SG
	Fann readings at mix and 90°C	300 138	300 RPM
		232 88	200 RPM
		131 46	100 RPM
		87 29	60 RPM
		51 15	30 RPM
		15 3	6 RPM
		9 2	3 RPM
	Plastic viscosity at BHCT	278 135	cP
	Yield point at BHCT	32 1	lb/100ft ²
	API gel strength at BHCT °C, 10 sec/min	2 / 3	3 RPM
	Compressive strength development	17:54 hrs:mins	Time to 50 psi
	19:50 hrs:mins	Time to 500 psi	
	2472 psi	44:25 hrs:mins	
Drill water Chloride Content	<600	ppm	

Spacer Design & Data – Spacer 4T				
	Spacer A	Spacer B	Unit	Order of addition
Drill water	678.3	Spacer A	liter	1 Check Chlorides
NF-6	3.0		liter	2 Disperse in water
Tuned Spacer E+	30.0		kg	3 Yield min. 1 hour
Halad-200L	12.0		liter	4
Barite	1198		kg	5 Weigh up to initial SG
Density	1.945	1.93	SG	Intermediate density
Musol	12.0	--	liter	6 Just prior to job
Sem-8	--	12.0	liter	7 Just prior to job
Final density	1.93	1.92	SG	Final SG with surfactants



7" liner

Cement Slurry Design & Test Results				
	Norcem Class "G" Cement	Amount	Units	
Slurry ref.: Slurry 19C – HTG19	SSA-1	35.00	% bwoc	
	Micromax	30.00	% bwoc	
	Microsilica	16.00	ltr/100 kg	
	SCR-500L	12.00	ltr/100 kg	
	Halad-413L	8.00	ltr/100 kg	
	SA-541	0.20	% bwoc	
	NF-6	0.10	ltr/100 kg	
	Fresh water	29.50	ltr/100 kg	
	Density	2.05	SG	
	Total liquid	71.99	ltr/100 kg	
	Yield	116.35	ltr/100 kg	
Lab reference: NS04-Z-066-6	<u>Thickening Time at</u>	155°C		
	Time to 40 BC	12:55 ¹	Hrs:Mins	
	Time to 70 BC	13:02	Hrs:Mins	
	Time to 100 BC	13:05	Hrs:Mins	
	API Free Water, 45° inclination	0	%	
	Density top / bottom	2.05 / 2.05	SG / SG	
	BP Settling Test	Top: 0.05% Bottom: 0.53%	Deviation from average density	
	API fluid loss at 90°C	18	cc/30 min	
	Rheology readings at mix / 90 °C	300+	187	300 rpm
		271	128	200 rpm
		167	69	100 rpm
		105	43	60 rpm
		61	24	30 rpm
		19	6	6 rpm
		12	4	3 rpm
Plastic viscosity, PV		270	181	cP
Yield point, YP	57	7	lbf/100ft ²	
UCA compressive strength	14:35	Time to 50 psi		
(UCA test performed at simulated	17:16	Time to 500 psi		
temperature recovery at TOL depth)	2600	24-hour psi		

¹ Excluding 3 hours batch mixing time.

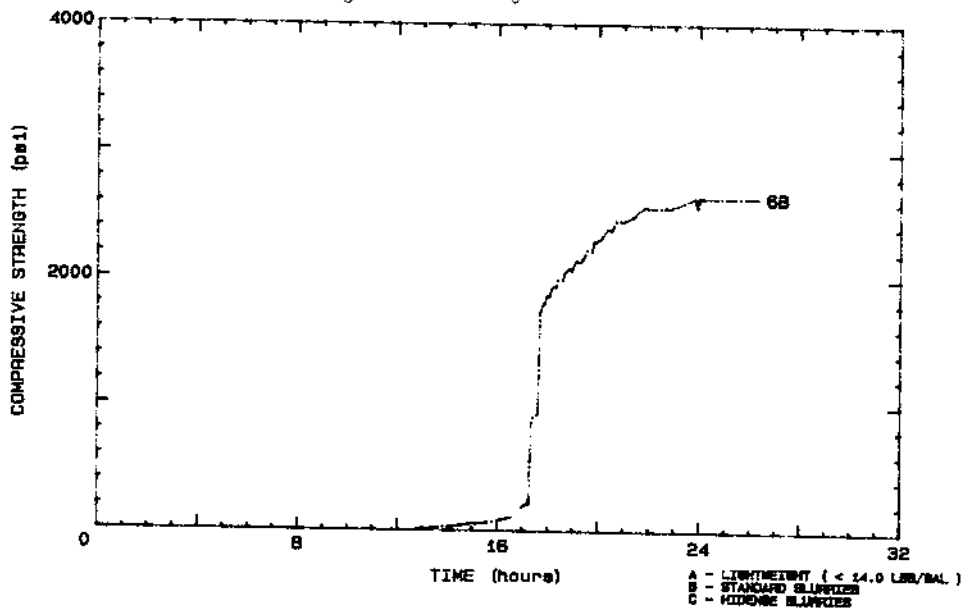
Spacer Design & Data – Spacer 4T				
		Amount	Unit	Order of addition
Spacer design per 1 m ³ :	Drill water	565	liter	1 Check Chlorides
	NF-6	3	liter	2 Disperse in water
	Zoneseal Retarder	5	kg	3
	Tuned Spacer E+	16	kg	4 Yield min. 1 hour
	Barite	1223	kg	5 Weigh up to initial SG
	SCR-500L	100	ltr	6
	Musol E	24	liter	7 Just prior to job.
	Sem-8	12	liter	8 Just prior to job.
Density with no SCR-500L		2.10	SG	Initial density
Density with no Musol E & Sem-8		1.99	SG	
Final density		1.95	SG	Final density
Rheology data	At mix: 295 / 180 / 132 / 84 / 59 / 39 / 20 / 18		600/300/200/100/60/30/6/3	
	At 90 °C: 109 / 60 / 45 / 29 / 20 / 14 / 8 / 6		600/300/200/100/60/30/6/3	

PROJECT NO.: 2-066-6
 DATE: 12/2
 PRESSURE: 3000
 TEMPERATURE: 358 F

ULTRASONIC CEMENT ANALYZER
 HALLIBURTON SERVICES

INITIAL SET: 50 @ 14:35
 STRENGTH 1 : 500 @ 17:16
 STRENGTH 2 : 19999
 CURR. STR. : 2642 @ 26:22

CEMENT: Maxcem + 35% SSAI + 30% Bore microprax + 0.10 l/ub NF-6 + 12 l/ub SCR-500L + 16 l/ub Zoneseal + 8 l/ub tuned Y13L + 0.20 Bore SA-541



Cement Plug #1A, Plug #1B, Plug #1C and Plug #1D

Cement Slurry Design & Test Results – Plug #1A, Plug #1B and Plug #1C				
Slurry code: Slurry 19C	Norcem Class “G” Cement	Amount	Units	
	SSA-1	35.00	% bwoc	
	Micromax	20.00	% bwoc	
	Microsilica Liquid	16.00	ltr/100 kg	
	SCR-500L	8.00	ltr/100 kg	
	Halad-413L	8.00	ltr/100 kg	
	NF-6	0.10	ltr/100 kg	
	Drill water	27.78	ltr/100 kg	
Density	2.05	SG		
Total liquid	64.04	ltr/100 kg		
Yield	108.40	ltr/100 kg		
Lab reference: NS05-Z-242-2	<u>Thickening Time at</u>	155°C		
	Time to 30 BC	9:10 ²	Hrs:Mins	
	Time to 70 BC	9:15	Hrs:Mins	
	Time to 100 BC	9:17	Hrs:Mins	
	API Free Water, 45° inclination	0	%	
	Density top / bottom	2.05 / 2.05	SG / SG	
	BP Settling Test	Top: -0.05% Bottom: 0.3%	Deviation from average density	
	API fluid loss at 90°C	21	cc/30 min	
	Rheology readings at mix / 90 °C	300+	168	300 rpm
		275	118	200 rpm
		165	67	100 rpm
		114	45	60 rpm
		73	25	30 rpm
		30	6	6 rpm
		24	4	3 rpm
		Plastic viscosity, PV	338	157
	Yield point, YP	46	12	lbf/100ft ²
UCA compressive strength	12:44	50 psi		
	16:51	500 psi		
	2850	24-hrs psi		

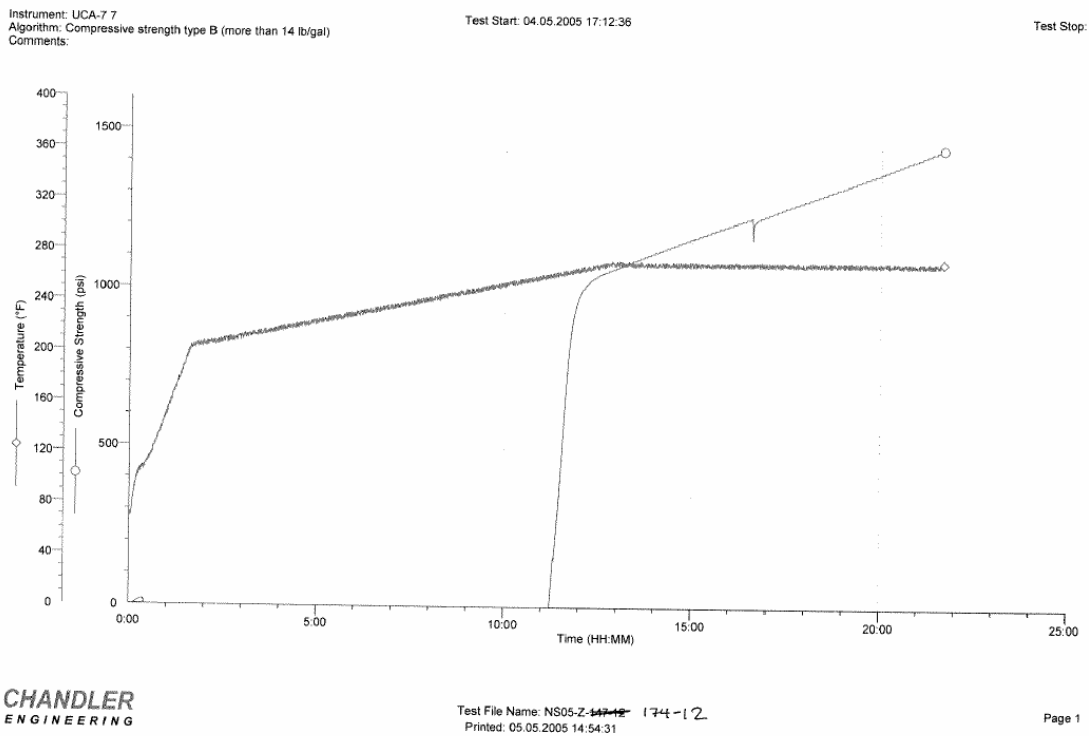
² Excluding 90 minutes batch mixing

Cement Slurry Design & Test Results – Plug #1D			
Slurry code: Slurry 19C	Norcem Class “G” Cement	Amount	Units
	SSA-1	35.00	% bwoc
	Micromax	20.00	% bwoc
	Micosilica Liquid	16.00	ltr/100 kg
	SCR-500L	4.50	ltr/100 kg
	Halad-413L	8.00	ltr/100 kg
	NF-6	0.10	ltr/100 kg
	Drill water	30.97	ltr/100 kg
	Density	2.05	SG
Total liquid	63.73	ltr/100 kg	
Yield	108.10	ltr/100 kg	
Lab reference: NS05-Z-174-6	<u>Thickening Time at</u>	113 °C	
	Time to 30 BC	8:20 ³	Hrs:Mins
	Time to 70 BC	9:42	Hrs:Mins
	Time to 100 BC	9:49	Hrs:Mins
	API Free Water, 45° inclination	0	%
	Density top / bottom	2.05 / 2.05	SG / SG
	API fluid loss at 90°C	24	cc/30 min
	Rheology readings at mix / 90 °C	300+ 174	300 rpm
		250 124	200 rpm
		154 70	100 rpm
		110 49	60 rpm
		74 29	30 rpm
		38 7	6 rpm
		31 5	3 rpm
		Plastic viscosity, PV	313 160
Yield point, YP	46 16	lbf/100ft ²	
UCA compressive strength	11:15	Time to 50 psi	
	11:33	Time to 500 psi	
	1300	20-hour psi	

³ Excluding 90 minutes batch mixing

Spacer Design & Data – Spacer 4T				
		Amount	Unit	Order of addition
Spacer design per 1 m³: Spacer 4T	Drill water	565	liter	1 Check Chlorides
	NF-6	3	liter	2 Disperse in water
	Zoneseal Retarder	5	kg	3
	Tuned Spacer E+	16	kg	4 Yield min. 1 hour
	Barite	1290	kg	5 Weigh up to initial SG
	SCR-500L	100	ltr	6
	Musol E	24	liter	7 Just prior to job.
	Sem-8	12	liter	8 Just prior to job.
Density with no Musol E & Sem-8		±2.03	SG	Initial density
	Final density	2.00	SG	Final density
Rheology data	At mix: 295 / 180 / 132 / 84 / 59 / 39 / 20 / 18		600/300/200/100/60/30/6/3	
	At 90 °C: 109 / 60 / 45 / 29 / 20 / 14 / 8 / 6		600/300/200/100/60/30/6/3	

UCA chart Plug #1D

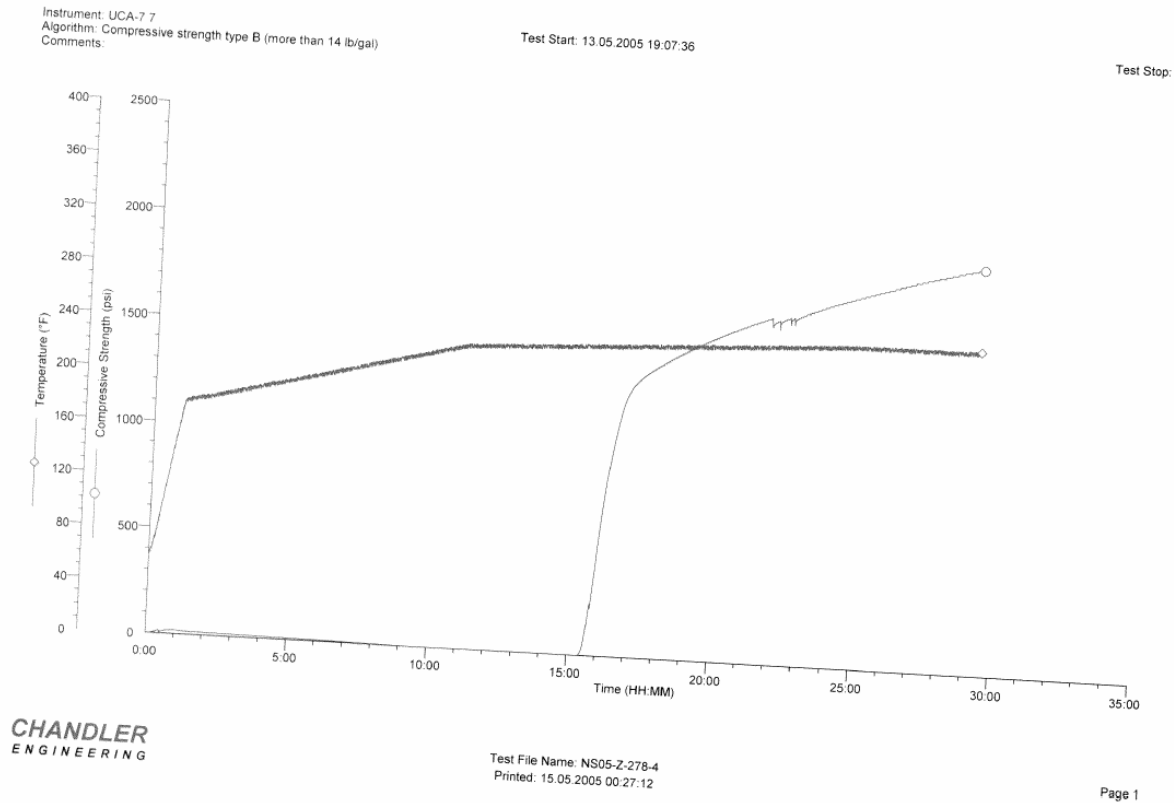


Cement Plug #2A, Plug #2B/Squeeze and Plug #2C

Cement Slurry Design & Test Results				
		Amount	Units	
Slurry code: Slurry 17B	Norcem Class "G" Cement			
	SSA-1	35.00	% bwoc	
	Microsilica Liquid	8.00	ltr/100 kg	
	CFR-3L	1.40	ltr/100 kg	
	SCR-500L	2.30	ltr/100 kg	
	Halad-413L	5.50	ltr/100 kg	
	NF-6	0.10	ltr/100 kg	
	Drill water	36.77	ltr/100 kg	
	Density	1.96	SG	
	Total liquid	54.07	ltr/100 kg	
Yield	98.44	ltr/100 kg		
Lab reference: NS05-Z-264	<u>Thickening Time at</u>	110°C		
	Time to 30 BC	8:31	Hrs:Mins	
	Time to 70 BC	8:36	Hrs:Mins	
	Time to 100 BC	8:38	Hrs:Mins	
	API Free Water, 45° inclination	0	%	
	Density top / bottom	1.94 / 1.94	SG / SG	
	API fluid loss at 90°C	43	cc/30 min	
	Rheology readings at mix / 90 °C	300+	178	300 rpm
		224	120	200 rpm
		130	65	100 rpm
		87	42	60 rpm
		51	23	30 rpm
		20	9	6 rpm
		14	5	3 rpm
		Plastic viscosity, PV	295	171
	Yield point, YP	27	7	lbf/100ft ²
	UCA compressive strength	15:34		50 psi
15:57			500 psi	
1700			24-hrs psi	

Spacer Design & Data – Spacer 4T				
		Amount	Unit	Order of addition
Spacer design per 1 m³:	Drill water	669	liter	1 Check Chlorides
	NF-6	3	liter	2 Disperse in water
	Zoneseal Retarder	5	kg	3
	Tuned Spacer E+	16	kg	4 Yield min. 1 hour
	Barite	1193	kg	5 Weigh up to initial SG
	Musol E	24	liter	7 Just prior to job.
	Sem-8	12	liter	8 Just prior to job.
	Density with no Musol E & Sem-8		±1.95	SG
	Final density	1.92	SG	Final density
Rheology data	At mix:		600/300/200/100/60/30/6/3	
	At 90 °C:		600/300/200/100/60/30/6/3	

UCA chart Plug #2B/Squeeze and Plug #2C



Cement Plug Across 9 7/8" Casing Cut – Plug #3

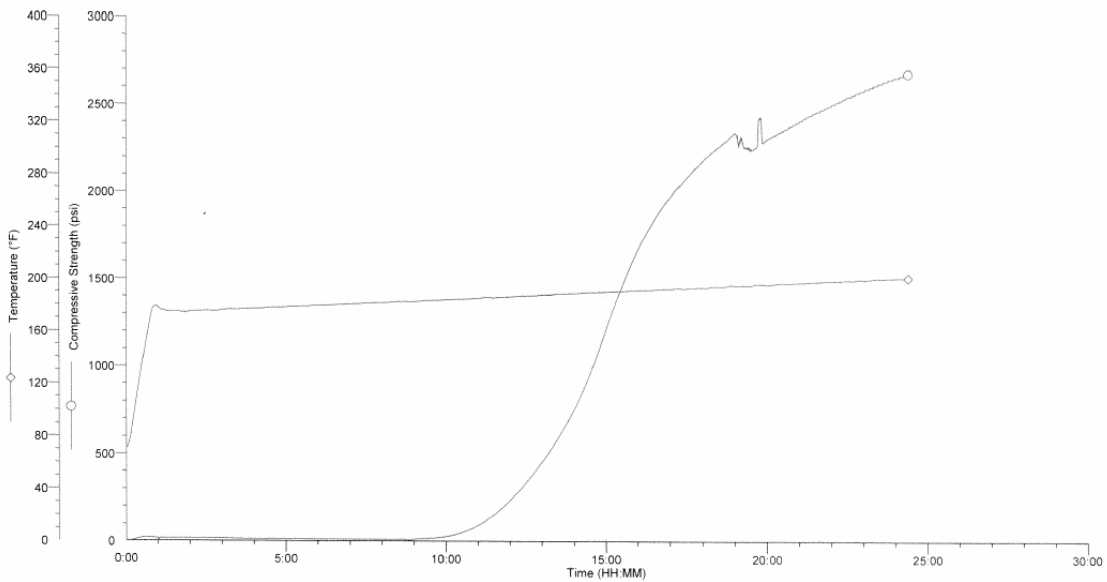
Cement Slurry Design & Test Results				
	Norcem Class "G" Cement	Amount	Units	
Slurry code: Slurry 25B	SSA-1	35.00	% bwoc	
	CFR-3L	0.50	ltr/100 kg	
	HR-5L	1.00	ltr/100 kg	
	Halad-99LE+	2.50	ltr/100 kg	
	NF-6	0.10	ltr/100 kg	
	Drill water	47.05	ltr/100 kg	
	Density	1.95	SG	
Total liquid	51.15	ltr/100 kg		
Yield	95.61	ltr/100 kg		
Lab reference: NS05-Z-282-5	<u>Thickening Time at</u>	79 °C		
	Time to 40 BC	5:28	Hrs:Mins	
	Time to 70 BC	6:10	Hrs:Mins	
	Time to 100 BC	6:23	Hrs:Mins	
	API Free Water, 45° inclination	0	%	
	Density top / bottom	1.95/1.95	SG / SG	
	API fluid loss at 79°C	n/a	cc/30 min	
	Rheology readings at mix / 79 °C	195	73	300 rpm
		128	55	200 rpm
		73	37	100 rpm
		53	31	60 rpm
		39	30	30 rpm
		29	27	6 rpm
		22	24	3 rpm
Plastic viscosity, PV	173	50	cP	
Yield point, YP	18	22	lbf/100ft ²	
UCA compressive strength	10:29		50 psi	
	13:10		500 psi	
	2686		24-hrs psi	

Spacer Design & Data – Spacer 4T				
		Amount	Unit	Order of addition
Spacer design per 1 m³:	Drill water	669	liter	1 Check Chlorides
	NF-6	3	liter	2 Disperse in water
	Zoneseal Retarder	5	kg	3
	Tuned Spacer E+	16	kg	4 Yield min. 1 hour
	Barite	1193	kg	5 Weigh up to initial SG
	Musol E	24	liter	7 Just prior to job.
	Sem-8	12	liter	8 Just prior to job.
	Density with no Musol E & Sem-8		±1.95	SG
Final density		1.92	SG	Final density

Instrument: UCA-6 6
 Algorithm: Compressive strength type B (more than 14 lb/gal)
 Comments:

Test Start: 18.05.2005 12:56:37

Test Stop:



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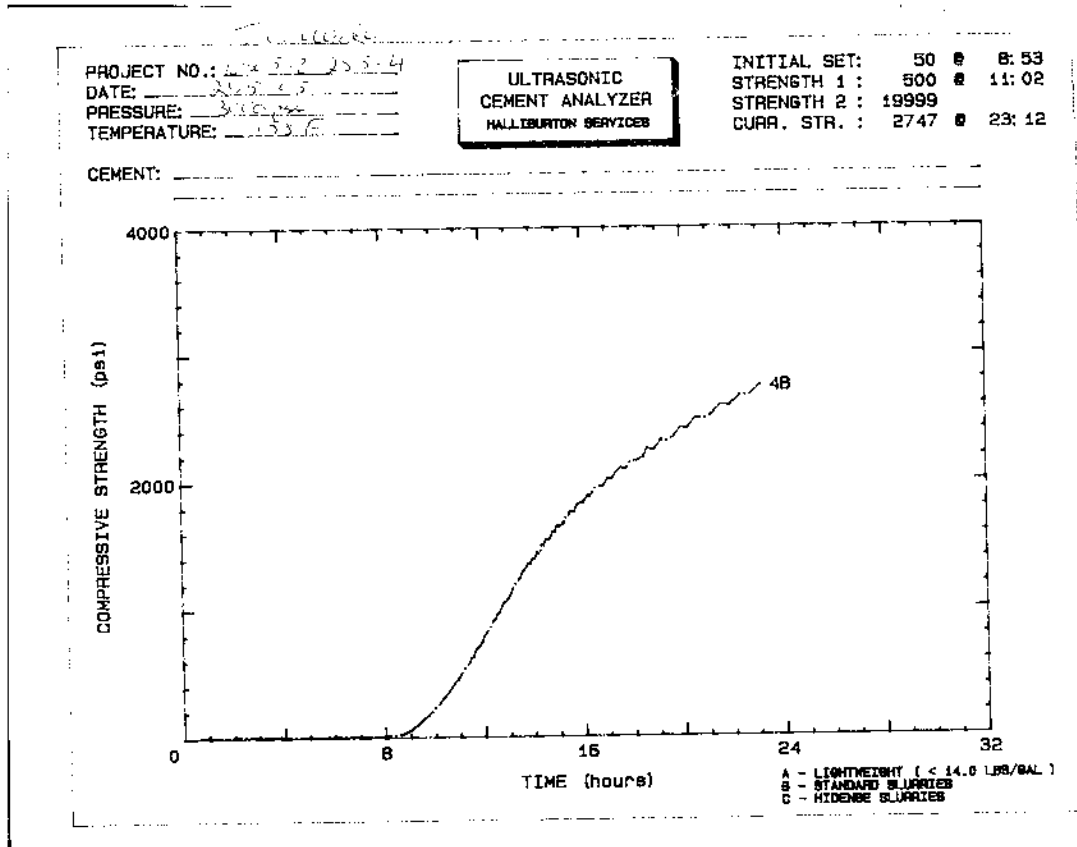
Test File Name: NS05-Z-282-5
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Page 1

Cement Plug Across 13 3/8" Casing Cut – Plug #4

Cement Slurry Design & Test Results				
		Amount	Units	
Slurry code: Slurry 25B	Norcem Class "G" Cement			
	HR-5L	0.90	ltr/100 kg	
	Halad-99LE+	1.50	ltr/100 kg	
	NF-6	0.10	ltr/100 kg	
	Drill water	39.13	ltr/100 kg	
	Density	1.95	SG	
	Total liquid	41.63	ltr/100 kg	
	Yield	72.72	ltr/100 kg	
Lab reference: NS05-Z-285-4	<u>Thickening Time at</u>	56 °C		
	Time to 40 BC	5:43		
	Time to 70 BC	5:53		
	Time to 100 BC	5:55		
	API Free Water, 45° inclination	0.6		
	Density top / bottom	1.95/1.95		
	API fluid loss at 79°C	n/a		
	Rheology readings at mix / 79 °C	99	86	300 rpm
		77	72	200 rpm
		56	58	100 rpm
		47	51	60 rpm
		45	47	30 rpm
		35	33	6 rpm
		27	29	3 rpm
	Plastic viscosity, PV	62	44	cP
Yield point, YP	36	43	lbf/100ft ²	
UCA compressive strength			50 psi	
			500 psi	
			24-hrs psi	

Spacer Design & Data - Spacer 3T				
		Amount	Unit	Order of addition
Spacer design per 1 m3:	Drill water	718	litre	1 Check Chlorides
	NF-6	As required	litre	2 Disperse in water
	Tuned Spacer E+	32	kg	3 Yield min. 1 hour
	Barite	1130	kg	4 Weigh up to initial SG
	Final density	1.88	SG	Final density SG



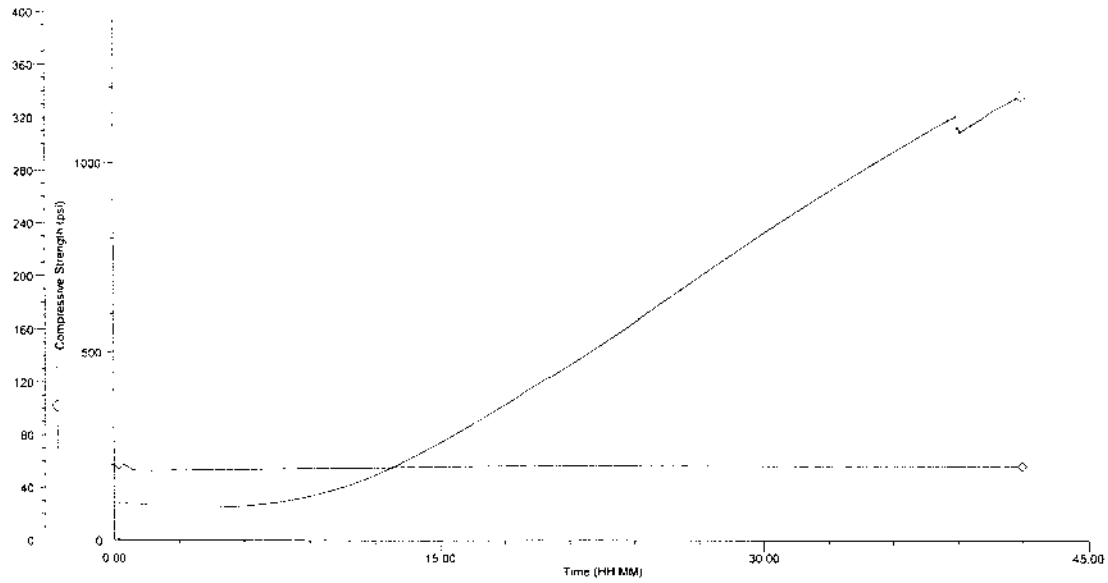
Surface Cement Plug – Plug #5

Cement Slurry Design & Test Results				
Slurry code: Slurry 4 - STTNT	Norcem "G" Cement	Slurry 1	Slurry 2	Units
		SSA-1	35	-
	NF-6	0,10	0.10	ltr/100 kg
	Fresh water	53.85	43.57	ltr/100 kg
	Density	1.92	1.92	SG
	Total Liquid	53.95	43.67	ltr/100 kg
	Yield	98.41	74.83	ltr/100 kg
Lab reference: NS05-Z-286-4	<u>Thickening Time at BHCT:</u> Time to 40 BC	4:45	5:12	Hrs:Mins
NS05-Z-286-5	Time to 70 BC	5:43	5:44	Hrs:Mins
	Time to 100 BC	6:04	6:04	Hrs:Mins
	API Free Water	n/a	n/a	
	Density top/bottom	1.92	1.92	
	Rheology at Mix	128	84	300 RPM
		103	72	200 RPM
		75	57	100 RPM
		61	49	60 RPM
		48	43	30 RPM
		23	21	6 RPM
		17	16	3 RPM
	Plastic viscosity,PV	87	45	cP
	Yield point, YP	43	40	lbf/100ft ²
	UCA compressive strength	± 8:00	8:16	50 psi
		21:56	21:21	500 psi
		±600	±600	24-hrs psi

UCA chart Slurry 1

Instrument: UCA-7.7
Algorithm: Compressive strength type B (more than 14 lb/gal)
Comments:

Test Start: 20.05.2005 20:39:34



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Test File Name: NS05-Z-286-4
Printed: 22.05.2005 14:37:10

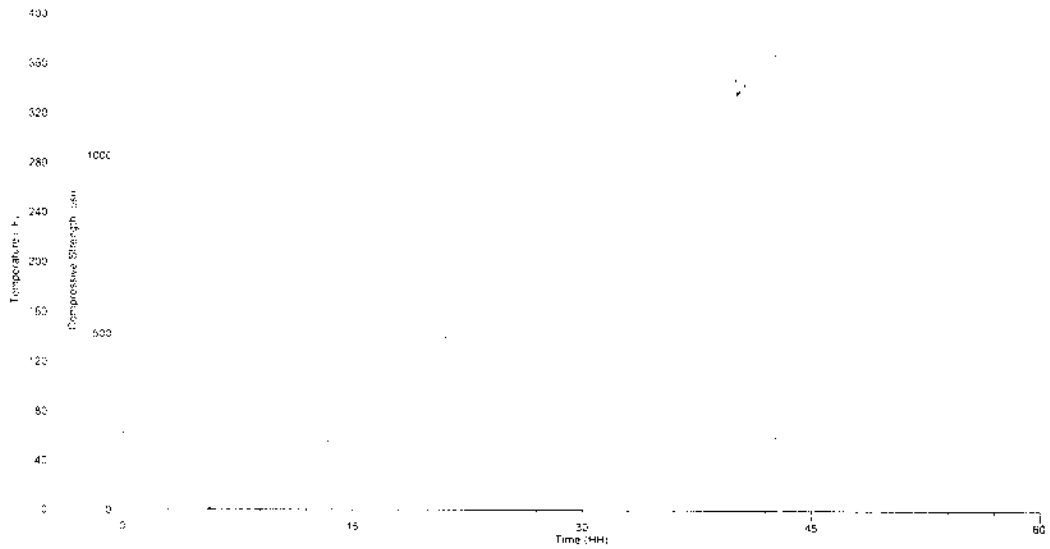
Page 1

UCA chart Slurry 2

Instrument: UCA#6
Algorithm: Compressive strength type B (more than 14 lb/gal)
Comments:

Test Start: 20.05.2005 19:40:29

Test Stop: 22.05.2005 14:34:55



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Test File Name: NS05-Z-286-5
Printed: 22.05.2005 14:35:08

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Attachments

Post job testing 7" liner slurry

	Original test	Offshore lab¹	Mix water from job²	Mix water from job³	Retest of original test
Lab reference	066-6	NA	066-10	066-11	066-11
Time to 50 psi	14:35	35:55	36:00	40:00	14:14
Time to 500 psi	17:16	41:12	43:46	48:15	18:11
Time to final strength	26:22/2642	57:33/3265	61:13/2471	61:31/2178	60:00/2202

	13 ltk SCR-500L⁴	30 hrs aging	7 days aging	Retest of original test
Lab reference	066-12	066-13	066-14	066-15
Time to 50 psi	11:42	9:49	12:60	13:01
Time to 500 psi	14:00	13:18	15:30	15:14
Time to final strength	32:15/2650	40:14/2759	45:00/2253	39:00/2556

1. The pressure was increased from 3000 psi to 4200 during the last 36 hrs. The test was stopped after approximately 35 hrs to physically check the condition of the cement slurry. The test was then resumed.
2. Tested with blend from top of silo 4 containing 24,8% BWOC SSA-1
3. Tested with blend from bottom of silo 4 containing 41,7 % BWOC SSA-1. Time to 50 psi is interpolated.

The following temperature and time schedule was used for all tests:

Rom to 135°C in 1,5 hrs
 135°C to 150°C in 12 hrs
 150°C to 160°C in 12 hours
 Dwell at 160°C

Usage & Discharge

Halliburton cementing material discharge and usage well summary

Field: Exploration **Year:** 2004-2005
Rig: Transocean Leader **Well:** 6406/9-1 Onyx

Product	SFT class	Unit	Density [SG]	Usage Tot. Used	Destruction	Discharges		
						Left in well	To sea	Discharge to sea in MT
SA-541	Plonor	kg	1,400	24		24		
Zoneseal Retarder	Plonor	kg	1,600	339		324		
CaCl2 liquid	Plonor	ltr	1,318	3,843	15	3,190	653	0,86
Cement cl. "G"	Plonor	MT	3,220	609		521	88	88,00
CFR-3L	Red	ltr	1,178	748		748		
Econolite	Plonor	ltr	1,363	4,940		4,100	840	1,14
Halad-613L	Plonor	ltr	1,031	1,808		1,808		
Halad-200L	Red	ltr	1,400	348	48	300		
Halad-413L	Red	ltr	1,067	6,863	1,440	5,423		
Halad-99LE+	Plonor	ltr	1,021	1,026		1,026		
CFR-5L	1	ltr	1,135	552		552		
HR-4L	Plonor	ltr	1,182	1,666		1,492	174	0,21
HR-5L	Plonor	ltr	1,165	935		935		
Microsilica L	Plonor	ltr	1,380	12,101	2,880	9,221		
Micromax	Plonor	kg	4,800	10,687	3,351	7,336		
Musol E	Yellow	ltr	0,950	2,010	120	1,890		
NF-6	Yellow	ltr	0,940	1,071	41	969	61	0,06
SCR-500L	Red	ltr	1,096	9,083	1,504	7,579		
Sem-8	Yellow	ltr	1,000	1,082	54	1,038		
Tuned Spacer E+	Yellow	kg	2,260	4,759	324	4,374	61	0,14
SSA-1, blend	Plonor	MT	3,043	42		36	6	6,00

Cement job summary	
Job description	Date
30" Cond + Top-up	17.-16.jun-04
20" casing	26-jun-04
16" liner	7-jul-04
Squeeze 16" liner lap	8-jul-04
13 3/8" casing	26-jul-04
Suspension plug	27-jul-04
9 7/8" casing	1.-des-04
7" liner	24-feb-05
Plug #1A, #1B and #1C	10-mai-05
Plug #1D	12-mai-05
Plug #2A	12-mai-05
Plug #2B	14-mai-05
Plug #2C	16-mai-05
Plug #3	16-mai-05
Plug #4	28-mai-05
Plug #5	31-mai-05

Halliburton cementing material usage

Field: Exploration Year: 2004-2005
 Rig: Transocean Leader Well: 6406/9-1 Onyx

Product	SFT class	Unit	Density [SG]	30" Cond + Top-up	20" casing	16" liner	Squeeze 16" liner lap	13 3/8" casing	Suspension plug	9 7/8" casing	7" liner	Plug #1A, #1B and #1D	Plug #1D	Plug #2A	Plug #2B	Plug #2C	Plug #3	Plug #4	Plug #5	
SA-541	Plonor	kg	1,400								24									
Zoneseal Retarder	Plonor	kg	1,600								91	110		28	34	28	48			
CaCl2 liquid	Plonor	ltr	1,318	3 843																
Cement cl. "G"	Plonor	MT	3,220	85	185	39	28	32	16	23	13	9	5	10	8	9	17	38	92	
CFR-3L	Red	ltr	1,178							350				130	134	134				
Econolite	Plonor	ltr	1,363		4 940	565	425	614	204											
Halad-613L	Plonor	ltr	1,031							348										
Halad-200L	Red	ltr	1,400							1 370	1 000	1 800	1 080	516	525	572	466	560		
Halad-413L	Red	ltr	1,067		1 020	190	130	130	102											
Halad-99LE+	Plonor	ltr	1,021					646												
CFR-5L	1	ltr	1,135																	
HR-4L	Plonor	ltr	1,182			225	105		79											
HR-5L	Plonor	ltr	1,165							2 000	1 994	3 600	2 160	751	764	832	186	340		
Microsilica L	Plonor	ltr	1,380								3 740	4 245	2 702							
Micromax	Plonor	kg	4,800								432	568		135	164	135	228	95	60	
Musol E	Yellow	ltr	0,950						10	348				26	31	26	47	95		
NF-6	Yellow	ltr	0,940	85	156	114	25	95		123	69	95	14	216	220	239	228	228	228	
SCR-500L	Red	ltr	1,096							700	3 300	3 800	608							
Sem-8	Yellow	ltr	1,000			840	288	288	567	288	208	264		68	82	68	114	114	114	
Tuned Spacer E+	Yellow	kg	2,260				907	726		907	295	352	3	90	110	90	152	630	630	
SSA-1, blend	Plonor	MT	3,043				8			8	4	5	3	3	3	4	6	6	6	6

Halliburton cementing material sent for destruction

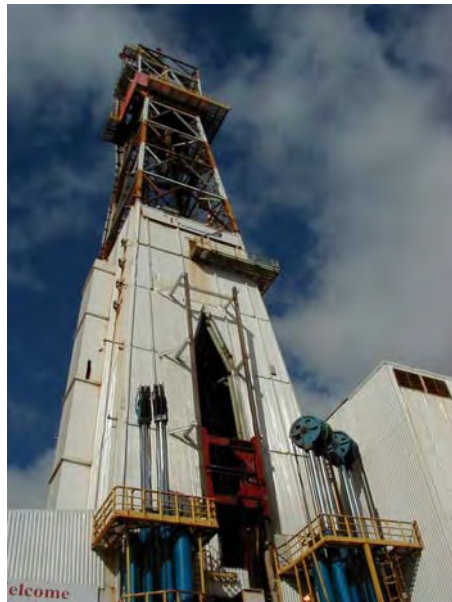
Field: Exploration
Rig: Transocean Leader
Year: 2004-2005
Well: 6406/9-1 Onyx

Product	SFT class	Unit	Density [SG]	30" Cond + Top-up	20" casing	16" liner	Squeeze 16" liner lap	13 3/8" casing	Suspension plug	9 7/8" casing	7" liner	Plug #1A, #1B and #1C	Plug #1D	Plug #2A	Plug #2B	Plug #2C	Plug #3	Plug #4	Plug #5
SA-541	Plonor	kg	1,400								15								
Zonesal Retarder	Plonor	kg	1,600																
CaCl2 liquid	Plonor	litr	1,318																
Cement cl. "G"	Plonor	MT	3,220																
CFR-3L	Red	litr	1,178																
Econolite	Plonor	litr	1,363																
Halad-613L	Plonor	litr	1,031																
Halad-200L	Red	litr	1,400																
Halad-413L	Red	litr	1,067							48			540						
Halad-99LE+	Plonor	litr	1,021																
CFR-5L	1	litr	1,135																
HR-4L	Plonor	litr	1,182																
HR-5L	Plonor	litr	1,165																
Latex 2000	5	litr	0,982																
Microsilica L	Plonor	litr	1,380																
Micromax	Plonor	kg	4,800										1 080						
Muscl E	Yellow	litr	0,950							48			1 351						
NF-6	Yellow	litr	0,940																
SCR-500L	Red	litr	1,096			8							7						
Sem-8	Yellow	litr	1,000							20			304						
Tuned Spacer E+	Yellow	kg	2,260			150				125									
SSA-1_blend	Plonor	MT	3,043																



A/S Norske Shell

WELL Onyx SW



December 2004-January 2005

Coring Report



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1.0 Objective and Operational Plan

The main target of this programme was to obtain high quality full gauge core samples, with minimal core damage (in particular minimum mud/mud filtrate invasion) and with smooth and regular core surface.

A programme of wellsite services was designed to ensure that optimum data quality was maintained through correct sampling and preservation procedures utilised throughout the program.

Low-invasion mud design parameters are also critical to control mud filtrate invasion in order to minimise the permanent damage to rock fabric, which can negatively affect the core analyses. Corpro Systems Ltd half moon technology adds quality to the final core product through speeding of the core handling process and minimising the manual core manipulation throughout the procedure. A slow controlled trip-out speed is essential, to minimise the effect of gas drive during tripping.



2.0 Technical Objective

It is essential to have high recovery of premium quality core cut with low invasion non-damaging mud, in order to select high quality well site plugs and high-grade wax preserved samples for SCAL.

Technical objectives are dependent upon data requirements:

- ✓ High recovery Premium Quality Core
- ✓ Low invasion non-damaging mud parameters
- ✓ Representative sampling and analysis at wellsite to assess reservoir flow capacity
- ✓ High-grade Wax preserved samples for SCAL
- ✓ CCC transportation crates to prevent damage and maintain optimal and realistic core quality

Core No.	Corehead	Barrel Length (m)	Cored Interval (m)	Recovery (m)	Recovery (%)
1	MCP682	30	4546.5-4561	13.44	93
2	MCP682	30	4591-4621	27.7	92
3	MCP581	30	4684-4710	26	100
4	MCP682	30	4784-4813.5	28.47	97

Table i). Coring for Well Onyx SW



3.0 Core Run Data

Core Run 1

Summary

Cored: 14.5 metres

Recovered: 13.4 metres

Hours: 5.4

Average ROP: 2.7 metres/hour

Recovery: 93%

Depth (metres)	Cum' Cored	Min/ metre	Metre/ hour	Torque Min (Kft/lb)	Torque Max (Kft/lb)	Head (rpm)	WOB (T)	Flow (lpm)	SPP (bar)	Lithology
4547	0.5	6	10	5	9	50	2	810	79	Sst
4547.5	1.0	6	10	5	9	50	4	810	78	Sst
4548	1.5	24	2.5	8	13	60	6	810	79	Sst
4548.5	2.0	14	4.3	8	15	70	8	810	80	Sst
4549	2.5	10	6	8	15	70	8	813	81	Sst
4549.5	3.0	14	4.3	8	15	80	8	813	81	Sst
4550	3.5	8	7.5	8	15	80	8	814	81	Sst
4550.5	4.0	20	3	8	15	80	8	814	81	Sst
4551	4.5	26	2.3	8	16	80	8	814	81	Sst
4551.5	5.0	10	6	8	16	80	8	814	81	Sst
4552	5.5	32	1.9	8	16	80	8	814	82	Sst
4552.5	6.0	16	3.8	8	16	80	8	814	86	Sst
4553	6.5	26	2.3	8	16	80	8	814	83	Sst
4553.5	7.0	36	1.7	8	16	80	8	814	84	Sst
4554	7.5	18	3.3	8	16	80	8	814	84	Sst
4554.5	8.0	30	2	8	16	80	8	810	83	Sst
4555	8.5	22	2.7	8	16	80	8	810	83	Sst
4555.5	9.0	46	1.3	8	16	80	8	810	83	Sst



Depth (metres)	Cum' Cored	Min/ metre	Metre/ hour	Torque Min (Kft/lb)	Torque Max (Kft/lb)	Head (rpm)	WOB (T)	Flow (lpm)	SPP (bar)	Lithology
4556	9.5	12	5	8	16	80	8	808	83	Sst
4556.5	10.0	20	3	8	16	80	8	808	86	Sst
4557	10.5	20	3	8	16	80	8	808	88	Sst
4557.5	11.0	14	4.3	8	16	80	8	808	88	Sst
4558	11.5	14	4.3	8	16	80	8	808	88	Sst
4558.5	12.0	44	1.4	8	16	80	10	808	85	Sst
4559	12.5	22	2.7	8	16	80	10	811	85	Sst
4559.5	13.0	20	3	8	16	80	10	811	82	Sst
4560	13.5	26	2.3	8	16	80	10	811	82	Sst
4560.5	14.0	14	4.3	8	16	80	10	811	82	Sst
4561	45.5	82	0.7	5	5	80	14	808	75	Sst

Core Run 2

Summary

Cored: 30 metres

Recovered: 27.7 metres

Hours: 10.7

Average ROP: 2.8 metres/hour

Recovery: 92%

Depth (metres)	Cum' Cored	Min/ metre	Metre/ hour	Torque Min (Kft/lb)	Torque Max (Kft/lb)	Head (rpm)	WOB (T)	Flow (lpm)	SPP (bar)	Lithology
4591	0	-	-	-	-	-	-	-	-	-
4591.5	0.5	28	2.1	5	14	60	5	950	107	sst
4592	1	12	5.0	5	14	70	6	950	107	sst
4592.5	1.5	20	3.0	5	14	100	6	950	107	sst
4593	2	16	3.8	5	14	100	6	950	107	sst
4593.5	2.5	32	1.9	5	14	100	8	950	109	sst
4594	3	18	3.3	5	14	100	8	950	109	sst
4594.5	3.5	24	2.5	5	14	100	8	950	109	sst



4595	4	16	3.8	5	14	100	8	950	109	sst
4595.5	4.5	12	5.0	5	14	100	8	950	107	sst
4596	5	20	3.0	5	14	100	8	950	107	sst
4596.5	5.5	22	2.7	5	14	100	8	950	107	sst
4597	6	28	2.1	5	14	100	8	950	107	sst
4597.5	6.5	24	2.5	5	14	100	8	950	107	sst
4598	7	30	2.0	5	14	100	8	950	107	sst
4598.5	7.5	26	2.3	5	14	100	8	950	112	sst
4599	8	30	2.0	5	14	100	8	950	112	sst
4599.5	8.5	42	1.4	5	14	100	8	950	112	sst
4600	9	20	3.0	5	14	100	8	950	112	sst
4600.5	9.5	18	3.3	5	14	100	8	950	112	sst
4601	10	26	2.3	5	14	100	8	950	112	sst
4601.5	10.5	24	2.5	5	14	100	8	950	112	sst
4602	11	22	2.7	5	14	100	8	950	112	sst
4602.5	11.5	18	3.3	5	14	100	8	950	112	sst
4603	12	20	3.0	5	14	100	8	950	112	sst
4603.5	12.5	32	1.9	5	14	100	8	950	112	sst
4604	13	16	3.8	5	14	100	8	950	112	sst
4604.5	13.5	22	2.7	5	14	100	8	950	112	sst
4605	14	18	3.3	5	14	100	8	950	112	sst
4605.5	14.5	24	2.5	5	14	100	8	950	112	sst
4606	15	18	3.3	5	14	100	8	950	112	sst
4606.5	15.5	22	2.7	5	14	100	8	950	112	sst
4607	16	26	2.3	5	14	100	8	950	112	sst
4607.5	16.5	28	2.1	5	14	100	8	950	112	sst
4608	17	30	2.0	5	14	100	8	950	112	sst
4608.5	17.5	24	2.5	5	14	100	8	950	112	sst
4609	18	20	3.0	5	14	100	8	950	112	sst
4609.5	18.5	30	2.0	5	14	100	10	950	112	sst
4610	19	24	2.5	5	14	100	10	950	112	sst
4610.5	19.5	30	2.0	5	14	100	10	950	112	sst
4611	20	26	2.3	5	14	100	10	950	112	sst



4611.5	20.5	36	1.7	5	14	100	10	950	112	sst
4612	21	26	2.3	5	14	100	10	950	112	sst
4612.5	21.5	20	3.0	5	14	100	10	950	112	sst
4613	22	20	3.0	5	14	100	10	950	112	sst
4613.5	22.5	18	3.3	5	14	100	10	950	112	sst
4614	23	18	3.3	5	14	100	10	950	112	sst
4614.5	23.5	8	7.5	5	14	100	10	950	112	sst
4615	24	22	2.7	5	14	100	10	950	109	sst
4615.5	24.5	10	6.0	5	14	100	10	950	107	sst
4616	25	12	5.0	5	14	100	10	950	107	sst
4616.5	25.5	14	4.3	5	14	100	10	950	107	sst
4617	26	14	4.3	5	14	100	10	950	107	sst
4617.5	26.5	12	5.0	5	14	100	10	950	107	sst
4618	27	16	3.8	5	14	100	10	950	107	sst
4618.5	27.5	14	4.3	5	14	100	10	950	107	sst
4619	28	10	6.0	5	14	100	10	950	107	sst
4619.5	28.5	12	5.0	5	14	100	10	950	107	sst
4620	29	14	4.3	5	14	100	10	950	107	sst
4620.5	29.5	24	2.5	5	14	100	10	950	107	sst
4621	30	22	2.7	5	14	100	10	950	107	sst



Core Run 3

Summary

Cored: 26 metres

Recovered: 26 metres

Hours: 7.9

Average ROP: 3.3 metres/hour

Recovery: 100%

Depth (metres)	Cum' Cored	Min/ metre	Metre/ hour	Torque Min (Kft/lb)	Torque Max (Kft/lb)	Head (rpm)	WOB (T)	Flow (lpm)	SPP (bar)	Lithology
4684	0	-	-	-	-	-	-	-	-	Sst
4684.5	0.5	8	7.5	8	12	60	5	1130	154	Sst
4685	1	8	7.5	10	13	60	8	1130	152	Sst
4685.5	1.5	4	15	10	12	60	10	1130	152	Sst
4686	2	4	15	12	17	100	11	1130	151	Sst
4686.5	2.5	18	3.3	12	17	100	11	1130	151	Sst
4687	3	10	6	12	17	100	11	1130	153	Sst
4687.5	3.5	20	3	12	17	100	11	1130	155	Sst
4688	4	30	2	12	17	100	11	1130	157	Sst
4688.5	4.5	30	2	12	17	100	11	1130	159	Sst
4689	5	20	3	12	17	100	11	1130	158	Sst
4689.5	5.5	16	3.8	12	17	100	11	1130	158	Sst
4690	6	30	2	12	17	100	11	1130	160	Sst
4690.5	6.5	26	2.3	12	17	100	11	1130	156	Sst
4691	7	40	1.5	12	17	100	11	1130	155	Sst
4691.5	7.5	26	2.3	12	17	100	11	1130	156	Sst
4692	8	36	1.7	12	17	100	11	1130	156	Sst
4692.5	8.5	24	2.5	12	17	100	11	1130	153	Sst
4693	9	38	1.6	12	17	100	11	1130	152	Sst
4693.5	9.5	30	2	12	17	100	11	1130	157	Sst
4694	10	32	1.9	12	17	100	11	1130	160	Sst
4694.5	10.5	24	2.5	12	17	100	11	1130	160	Sst



4695	11	32	1.9	12	17	100	11	1130	155	Sst
4695.5	11.5	20	3	12	17	100	11	1130	157	Sst
4696	12	44	1.4	12	17	100	11	1130	161	Sst
4696.5	12.5	34	1.8	12	17	100	11	1130	160	Sst
4697	13	24	2.5	12	17	100	11	1130	160	Sst
4697.5	13.5	20	3	12	17	100	11	1130	163	Sst
4698	14	14	4.3	12	17	100	11	1130	160	Sst
4698.5	14.5	18	3.3	12	17	100	11	1130	160	Sst
4699	15	16	3.8	12	17	100	11	1130	160	Sst
4699.5	15.5	14	4.3	12	17	100	11	1130	160	Sst
4700	16	14	4.3	12	17	100	11	1130	160	Sst
4700.5	16.5	18	3.3	12	17	100	11	1130	163	Sst
4701	17	14	4.3	12	17	100	11	1130	163	Sst
4701.5	17.5	14	4.3	12	17	100	11	1130	164	Sst
4702	18	8	7.5	12	17	100	11	1130	163	Sst
4702.5	18.5	6	10	12	17	100	11	1130	163	Sst
4703	19	10	6	12	17	100	11	1130	163	Sst
4703.5	19.5	16	3.8	12	17	100	11	1130	160	Sst
4704	20	12	5	12	17	100	11	1130	160	Sst
4704.5	20.5	10	6	12	17	100	11	1130	160	Sst
4705	21	12	5	12	17	100	11	1130	160	Sst
4705.5	21.5	10	6	12	17	100	11	1130	160	Sst
4706	22	10	6	12	17	100	11	1130	160	Sst
4706.5	22.5	6	10	12	17	100	11	1130	160	Sst
4707	23	8	7.5	12	17	100	11	1130	155	Sst
4707.5	23.5	18	3.3	12	17	100	11	1130	155	Sst
4708	24	6	10	12	17	100	11	1130	154	Sst
4708.5	24.5	8	7.5	12	17	100	11	1130	152	Sst
4709	25	14	4.3	12	17	100	11	1130	154	Sst
4709.5	25.5	8	7.5	12	17	100	11	1130	155	Sst
4710	26	10	6	12	17	100	11	1130	156	Sst



Core Run 4

Summary

Cored: 29.5 metres

Recovered: 28.5 metres

Hours: 14.1

Average ROP: 2.1 metres/hour

Recovery: 97%

Depth (metres)	Cum' Cored	Min/ metre	Metre/ hour	Torque Min (Kft/lb)	Torque Max (Kft/lb)	Head (rpm)	WOB (T)	Flow (lpm)	SPP (bar)	Lithology
4784	0	-	-	-	-	-	-	-	-	-
4784.5	0.5	10	6	4	5	65	2	1000	120	Sst
4785	1	10	6	4	10	90	5	1000	135	Sst
4785.5	1.5	18	3.3	5	12	120	5	1000	135	Sst
4786	2	18	3.3	4	10	120	7	1000	135	Sst
4786.5	2.5	34	1.8	4	11	120	15	1000	135	Sst
4787	3	16	3.8	4	12	120	15	1000	140	Sst
4787.5	3.5	16	3.8	4	13	120	15	1000	135	Sst
4788	4	18	3.3	5	12	120	15	1000	140	Sst
4788.5	4.5	34	1.8	4	12	120	15	1000	140	Sst
4789	5	32	1.9	4	15	120	15	1000	130	Sst
4789.5	5.5	24	2.5	4	13	120	15	1000	130	Sst
4790	6	20	3	4	12	120	15	1000	130	Sst
4790.5	6.5	12	5	4	12	120	15	1000	130	Sst
4791	7	30	2	5	12	120	15	1000	130	Sst
4791.5	7.5	24	2.5	5	13	120	15	1000	125	Sst
4792	8	34	1.8	5	13	120	15	1000	125	Sst
4792.5	8.5	26	2.3	4	12	120	15	1000	125	Sst
4793	9	30	2	4	12	120	15	1000	125	Sst
4793.5	9.5	34	1.8	4	12	120	15	1000	125	Sst
4794	10	28	2.1	5	12	120	15	1000	125	Sst
4794.5	10.5	34	1.8	5	11	120	15	1000	125	Sst



4795	11	34	1.8	5	11	120	15	1000	125	Sst
4795.5	11.5	40	1.5	5	12	120	15	1000	135	Sst
4796	12	22	2.7	4	12	120	15	990	130	Sst
4796.5	12.5	12	5	5	13	120	16	990	130	Sst
4797	13	14	4.3	5	14	120	16	990	130	Sst
4797.5	13.5	24	2.5	5	14	120	17	990	130	Sst
4798	14	38	1.6	5	13	120	17	990	130	Sst
4798.5	14.5	30	2	5	13	120	17	995	130	Sst
4799	15	34	1.8	4	12	120	16	995	130	Sst
4799.5	15.5	34	1.8	4	12	120	16	995	130	Sst
4800	16	44	1.4	5	12	120	16	995	125	Sst
4800.5	16.5	50	1.2	4	11	120	16	995	125	Sst
4801	17	36	1.7	4	13	120	15	995	125	Sst
4801.5	17.5	28	2.1	5	13	120	16	995	125	Sst
4802	18	24	2.5	5	11	120	16	995	125	Sst
4802.5	18.5	18	3.3	5	12	120	17	995	125	Sst
4803	19	18	3.3	5	11	120	16	995	125	Sst
4803.5	19.5	12	5	5	12	120	16	995	125	Sst
4804	20	10	6	4	13	120	17	995	125	Sst
4804.5	20.5	40	1.5	4	13	120	17	995	125	Sst
4805	21	66	0.9	4	12	120	14	995	125	Sst
4805.5	21.5	14	4.3	4	12	120	14	995	125	Sst
4806	22	36	1.7	4	12	120	14	995	130	Sst
4806.5	22.5	18	3.3	4	13	120	13	995	130	Sst
4807	23	30	2	4	12	120	13	995	130	Sst
4807.5	23.5	28	2.1	5	13	120	13	990	130	Sst
4808	24	28	2.1	4	12	120	13	990	127	Sst
4808.5	24.5	24	2.5	4	13	120	12	990	127	Sst
4809	25	46	1.3	5	12	120	13	990	125	Sst
4809.5	25.5	30	2	5	11	120	12	990	130	Sst
4810	26	34	1.8	4	12	120	12	990	127	Sst
4810.5	26.5	30	2	4	12	120	14	990	130	Sst
4811	27	34	1.8	4	12	120	14	990	125	Sst



4811.5	27.5	46	1.3	5	11	120	15	990	125	Sst
4812	28	36	1.7	4	10	120	16	990	125	Sst
4812.5	28.5	46	1.3	4	11	120	15	990	125	Sst
4813	29	44	1.4	4	12	100	14	990	125	Sst
4813.5	29.5	36	1.7	4	11	100	13	990	125	Sst



4.0 Core Run Analysis

In the coring programme a total of 100 metres of 4" diameter core was cut in 4 runs, within the reservoir zones, at an average ROP of 2.6metres/hour and with an overall recovery rate of 95.6%. Using the MCP682 corehead, good penetration rates were observed although run 3 using the MCP581 showed a slight improvement allied to smoother torque.

Corehead

Having reviewed performance history the initial corehead chosen was the MCP682 8.5" x 4" with face discharge low invasion features. The corehead has 13mm PDC cylinder cutters laid out in 8 blades for efficient and effective coring to optimise maximum ROP. Coring averages were consistent with expected values from the offset data, 2.6m per hour was measured within the cored sequence and a maximum instantaneous ROP of 10 m/hr and minimum of 0.9 m/hr recorded.

The coreheads showed sufficient wear for replacement. During core run 1 the corehead showed evidence of junk damage possibly caused by the wire retrieved from the mid point of the liner on core recovery which also possibly contributed to the jamming on this run.

Inner Barrel Type

Aluminium half moon liners were loaded in to the Corpro outer barrel

Core Retrieval (trip out)

Depth (TVD metres)	Trip Speed
TD to 1500 m	1.5 - 2 min/stand
1500 m to 600 m	4 - 5 min/stand
600 m to 50 m	7 min/stand
50 m to surface	15 min/stand



5.0 Processing Operations

Rig Floor handling and Core laydown

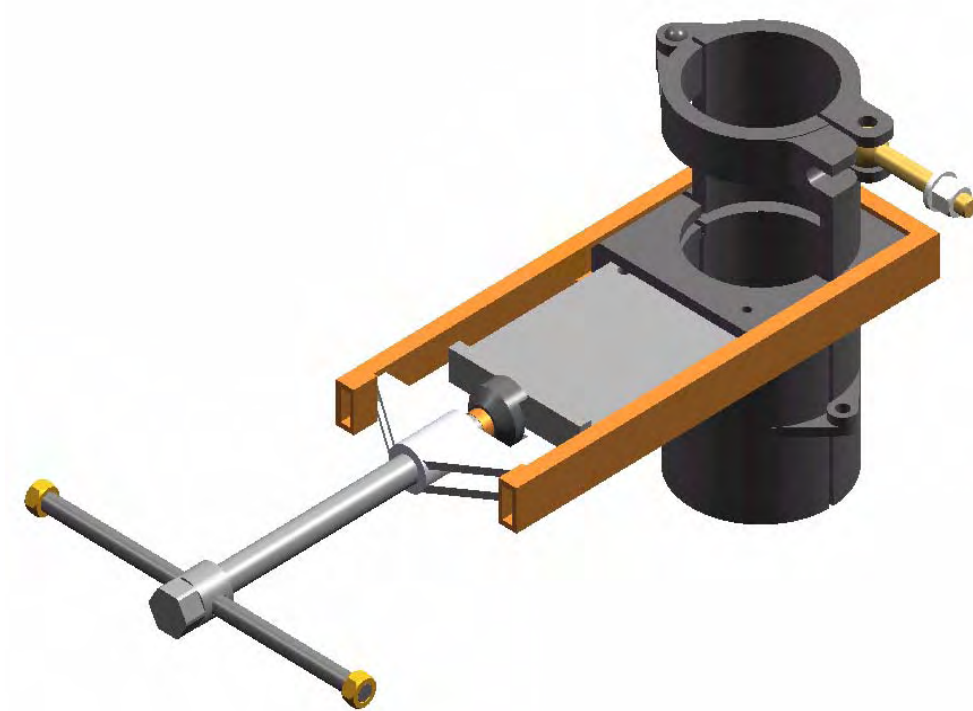
Safety

Safety is paramount at all times and at each stage of the coring operation. Since core processing is a non-routine rig activity, pre-job briefings are held to insure that all safety aspects are noted, and carried out prior to any work commencing. The coring job is effectively broken down into separate work practices. At each stage toolbox talks are held with all necessary personnel, to review the work procedure in a step by step manner, assessing the potential hazards, ensuring that the operation is done to maximise efficiency and minimise harm. Due to the possibility of H₂S exposure at potentially fatal levels a proactive approach to H₂S safety was taken utilising specialist procedures. During the latter stages of pulling out of hole (heavyweights to surface) H₂S was measured at each disconnection.



Inner barrel separation

A mechanical shear boot clamp was used to separate the 6metre sections in the derrick.



Core Laydown.

A laydown cradle was raised to the drill floor, to allow the core to be latched to it as soon as possible, minimising the time for any potential damage. This cradle was then removed from the drill floor through the v doors and down onto the main deck for processing.

Sampling and Core processing

Adequate space was provided on the pipedeck to allow for all bulk processing to take place. The inner barrel is brought down from the rig floor having first been latched to a lay down cradle. The core top is identified with in the liner and excess liner removed. The liner is then marked with depth and orientation lines. The half moon top section was removed to enable core markup and sampling.



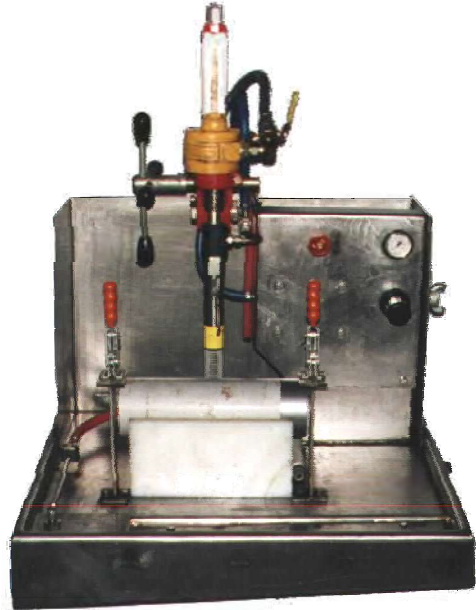
Geological Description

Upon inspection of the core itself a brief geological description of the sequence was made.

Core Plugging

Once the core had been cut and laid out areas of potential reservoir sand were chosen for sites to be plugged. The plugs are cut with a 1.5" diameter plug bit for Dean Stark and a 1" plug bit for hot shot permeability using a refined mineral oil (Blandol) as a bit and blade lubricant. Samples were trimmed to right cylinders utilising a continuous rim diamond blade (1.5" x 1.5" Dean Stark, 1" x 1" quick look).

Each Dean Stark plug is wrapped in a low plastic clingfilm, aluminium foil labelled and placed in individual seat foil bags. Depths noted and double-checked the bags placed into an insulated box for transportation by airfreight to Reslab in Stavanger.

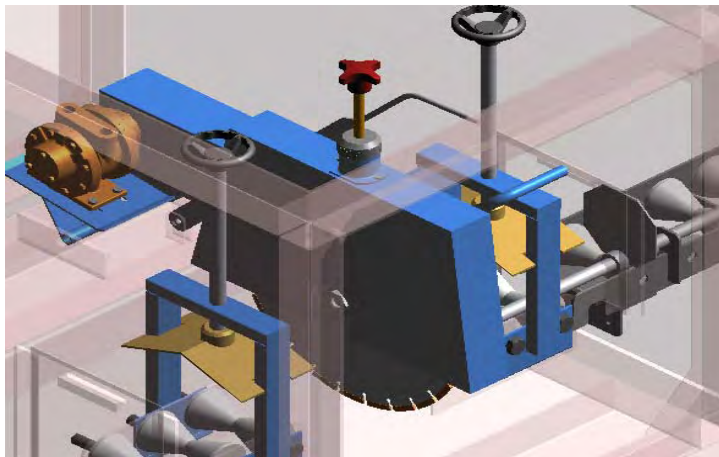




Core Cutting

As the saw is self-contained, safety is maximised for the operator and personnel in the processing area. The blade is mounted on a rigid frame and power is transmitted via a fully contained drive belt, avoiding any vibration transmitted to the core.

The laydown cradles fit snugly into the core saw unit maintaining horizontal alignment and allowing the core to move freely on Teflon rollers into the blade.



The core is divided into 1 metre sections. As processing is a non-routine rig activity all essential personnel were kept to a minimum and additional PPE of goggles, dusk mask and ear protection worn

Where the core was marked the liner was, cut and dispensed to the layout area for processing.

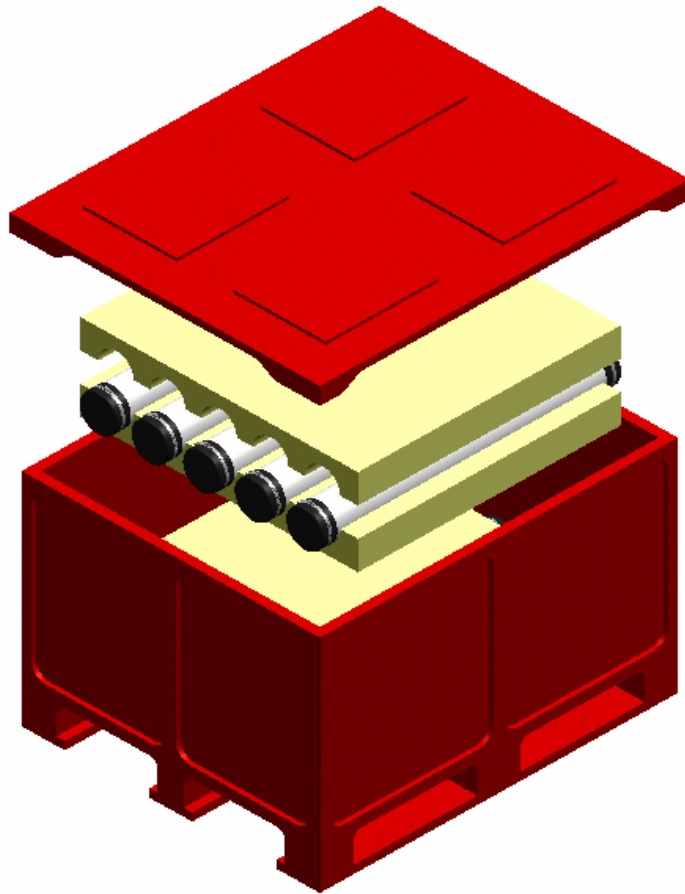
The cut core is laid out sequentially, and geological samples taken each metre. The core is now ready to be wiped down with dry rags for description and sampling.

Core Transportation.

An important criterion of any coring project is to deliver core of the highest standard, preventing damage and maintaining optimal and realistic core quality.

CCC (Corpro Core Containers) are specifically designed for such application. Foam inserts that protect the core are laid down inside the crate. Each sample was placed in sequence in the central layer of protective foam within the CCC.

To encapsulate the core fully the CCC was filled with further foam layers.





6.0 Operation Summary

The MCP682 and MCP581 Corebits gave good ROP's in the sand during the core runs.

The trip rates utilised were also optimum as demonstrated by the low quantity of gas detected at the top of the core barrel indicating that the majority of the solution gas had been able to escape gently during the tripping procedure. Core laydown procedures were executed efficiently without incident.

7.0 Post Coring observations

Corpro is committed to customer satisfaction and continues to maintain an interest in the post coring activities. Reviewing work and procedures allows us to further develop the skills necessary to continue to offer the most appropriate and best service. There are a few observations and lessons to be learned from ONYX well that require evaluation for future programs; this has been brought up in section 10.

8.0 Conclusion

Our extensive, well-researched and dynamic coring plans yield efficient coring rates and high quality core. Precise and detailed processing and sample acquisition program transpired to quality reservoir test results.

All the further Corpro ancillary work carried out on the core was executed to a high standard. Hot shot plugs were cut at the selected sites and shipped efficiently from the wellsite. Fresh state preserve samples were taken at determined intervals and preserved for dean stark. CCC core containers provide safe core transportation, designed to absorb shock and reduce damage.



9.0 Recommendations for Future

- **Corehead Selection**

Corpro continue to develop new coreheads utilising the latest cutter technologies. It has been found that the MCP series coreheads work well in this application. New developments should be reviewed as they become available for possible inclusion. The lower toque during MCP581 use may be a useful feature for future inclusion.

- **Inner Barrel Drifting**

Doubts as to the origin of the junk in core run 1 can be eliminated by the incorporation of a documented drifting check of the inner barrel prior to final assembly. This should be included in procedure for future runs as it was in runs 2,3 and 4 of this well.

- **Core Processing**

Whilst handling and plugging was performed effectively this area needs to be optimised in order to minimise any impact on the on line activities.

- **Health and Safety**

All coring and core handling were performed without incident. This MUST be maintained. A greater participation in the rig safety reporting system should continue to be encouraged in the coring/core handling personnel.

- **Racking Back**

Due to adverse weather a full barrel had to be racked back to await a suitable window for processing. The rack back was performed with the corehead rather than protector in place (Corpro Recommendation). With the protector type available on the rig this was considered the best option. For future operations Corpro should design a suitable protector to minimise risk of dropped core upon re-entry to hole for recovery (there was no problem in this instance but there is an identified risk that can be reduced through correct design / change process)

- **Core Catcher**

Overall recovery was very good at 96%. Concern remains as to the lost 4% and efforts should be continued to eliminate this. A possible source of this loss is undergauge core caused by exfoliation. It would appear that the good mud design in this well eliminated this previously identified problem. A full closure catcher for use in HPHT wells should be designed to become available for use on future projects.