

HALLIBURTON

iCem[®] Service

PDC ENERGY-EBUS

Date: Wednesday, January 23, 2019

Thistle Down 31H-312 Production

Job Date: Monday, December 31, 2018

Sincerely,
Tyler Hill

Legal Notice

Disclaimer:

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1.0 Cementing Job Summary

1.1 Executive Summary

Halliburton appreciates the opportunity to perform the cementing services on the **Thistle Down 31H-312** cement **Production** casing job. A pre-job safety meeting was held before the job where details of the job were discussed, potential safety hazards were reviewed, and environmental compliance procedures were outlined.

Approximately 20 bbls of cement were returned to surface.

Halliburton maintains a continuous quality improvement process and appreciates any comments or suggestions that you may have. Halliburton again thanks you for the opportunity to perform service work on this well. We hope to be your solutions provider for future projects.

Respectfully,

Halliburton Ft. Lupton

The Road to Excellence Starts with Safety

Sold To #: 304535		Ship To #: 3819623		Quote #: 0022519647		Sales Order #: 0905374006					
Customer: PDC ENERGY-EBUS				Customer Rep: Chris McMullen							
Well Name: THISTLE DOWN			Well #: 31H-312		API/UWI #: 05-123-45260-00						
Field: WATTENBERG		City (SAP): KERSEY		County/Parish: WELD		State: COLORADO					
Legal Description: NE SW-31-5N-64W-1474FSL-1357FWL											
Contractor: ENSIGN DRLG				Rig/Platform Name/Num: ENSIGN 152							
Job BOM: 7523 7523											
Well Type: HORIZONTAL OIL											
Sales Person: HALAMERICA\HX38199				Srvc Supervisor: Luke Kosakewich							
Job											
Formation Name											
Formation Depth (MD)		Top		Bottom							
Form Type				BHST							
Job depth MD		12893ft		Job Depth TVD		6977ft					
Water Depth				Wk Ht Above Floor							
Perforation Depth (MD)		From		To							
Well Data											
Description	New / Used	Size in	ID in	Weight lbm/ft	Thread	Grade	Top MD ft	Bottom MD ft	Top TVD ft	Bottom TVD ft	
Casing		9.625	8.921	36			0	2517	0	2517	
Casing		5.5	4.778	20			0	12885	0	6977	
Open Hole Section			8.5				2517	6411	2517	6411	
Open Hole Section			8.5				6411	12893	6411	6977	
Tools and Accessories											
Type	Size in	Qty	Make	Depth ft		Type	Size in	Qty	Make		
Guide Shoe						Top Plug	5.5	1	Weatherford		
Float Shoe	5.5	1	Weatherford	12885		Bottom Plug	5.5	1	Weatherford		
Wet Shoe Sub	5.5	1	Weatherford	12850		SSR plug set	5.5				
Insert Float						Plug Container	5.5	1	HES		
Stage Tool						Centralizers	5.5	183	HES		
Fluid Data											
Stage/Plug #: 1											
Fluid #	Stage Type	Fluid Name			Qty	Qty UoM	Mixing Density lbm/gal	Yield ft³/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
1	12.5 lb/gal Tuned Spacer III	Tuned Spacer III			150	bbl	12.5	2.72		5	

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
2	Gasstop B1	GASSTOP (TM) SYSTEM	1040	sack	13.2	1.55		8	
Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
3	ElastiCem	ELASTICEM (TM) SYSTEM	875	sack	14.4	1.7		8	7.3
Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
4	MMCR Displacement	MMCR Displacement	20	bbl	8.34			8	
Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
5	Displacement fluid	Fresh Water W Packer Fluid	265	bbl	8.34			8	
Cement Left In Pipe		Amount	35 ft		Reason			Shoe Joint	
Mix Water:		pH 7	Mix Water Chloride:			0 ppm		Mix Water Temperature:	60 °F
Plug Bumped?		Yes	Bump Pressure:			2,500 psi		Floats Held?	Yes
Comment Bumped the plug 500 psi. over 2,600 psi. at 3 bpm. Final pressure was 3,200 psi. Held for a minute. Pressure held.									
Pressured up the well to 4,109 psi. to shift the sleeve. Pumped 5 bbls. of fresh water at 4 bpm. for a wet shoe. Bled off pressure to check floats. Floats held. Got 2 bbls. of fluid back to the truck. Circulated 150 bbls. of spacer and 20 bbls of cement to surface. Estimated TOT at 6,109'.									

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Rockies, Brighton

Lab Results- Lead

Job Information

Request/Slurry	2524342/1	Rig Name	ENSIGN 152	Date	27/DEC/2018
Submitted By	Tyler Hill	Job Type	Production Casing	Bulk Plant	Brighton
Customer	PDC Energy	Location	Weld	Well	Thistle Down 31H-312

Well Information

Casing/Liner Size	5.5 in	Depth MD	12890 ft	BHST	104°C / 220°F
Hole Size	8.5 in	Depth TVD	6900 ft	BHCT	82°C / 180°F
Pressure	4130 psi				

Cement Information - Lead Design



Cement Properties

Slurry Density	13.2	lbm/gal
Slurry Yield	1.55	ft3/sack
Water Requirement	5.01	gal/sack

Operation Test Results Request ID 2524342/1

Thickening Time - ON-OFF-ON, Request Test ID:36096178

28/DEC/2018

Test Temp (degF)	Pressure (psi)	Reached in (min)	30 Bc (hh:min)	50 Bc (hh:min)	70 Bc (hh:min)	100 Bc (hh:min)	Start Bc	Stirring before stop (mins)	Static Period (min)	Peak reading (BC)
180	4130	62	5:47	5:57	5:59	6:00	10	90	10	10.8

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Lab Results- Tail

Rockies, Brighton

Job Information

Request/Slurry	2524343/1	Rig Name	ENSIGN 152	Date	27/DEC/2018
Submitted By	Tyler Hill	Job Type	Production Casing	Bulk Plant	Brighton
Customer	PDC Energy	Location	Weld	Well	Thistle Down 31H-312

Well Information

Casing/Liner Size	5.5 in	Depth MD	12890 ft	BHST	104°C / 220°F
Hole Size	8.5 in	Depth TVD	6900 ft	BHCT	82°C / 180°F
Pressure	4130 psi				

Cement Information - Tail Design



Cement Properties

Slurry Density	14.4	lbm/gal
Slurry Yield	1.7	ft3/sack
Water Requirement	7.29	gal/sack

Operation Test Results Request ID 2524343/1

Thickening Time - ON-OFF-ON, Request Test ID:36096180

28/DEC/2018

Test Temp (degF)	Pressure (psi)	Reached in (min)	30 Bc (hh:min)	50 Bc (hh:min)	70 Bc (hh:min)	100 Bc (hh:min)	Start Bc	Stirring before stop (mins)	Static Period (min)	Peak reading (BC)
180	4130	62	4:05	4:11	4:19	4:20	18	90	10	15

2.0 Real-Time Job Summary

2.1 Job Event Log

Type	Seq. No.	Activity	Graph Label	Date	Time	Source	DS Pump Press (psi)	Comb Pump Rate (bbl/min)	DH Density (ppg)	Comments
Event	1	Call Out	Call Out	12/30/2018	16:30:00	USER				Crew was called out at 16:30 for a time of 23:00.
Event	2	Depart Yard Safety Meeting	Depart Yard Safety Meeting	12/30/2018	21:05:00	USER				Crew held a pre journey safety meeting and JSA.
Event	3	Depart Shop for Location	Depart Shop for Location	12/30/2018	21:30:00	USER				Started journey management with dispatch and left location.
Event	4	Arrive at Location from Service Center	Arrive at Location from Service Center	12/30/2018	22:15:00	USER				Crew performed a site assessment, safety meeting and hazard hunt on location. Checked in with the customer and discussed the job procedures, rig up and well bore schematics. The rig was running casing.
Event	5	Other	Other	12/30/2018	22:20:00	USER				Well bore: MD: 12,893', TP: 5.5" 20# set at 12,885', WSS: 12,850, TVD: 6,977', SC: 9.625" 36 # set at 2,517', OH: 8.5". Mud # 10.7 ppg. Water test: PH: 7, Chlorides: 0, Temp: 60 Degrees.
Event	6	Pre-Rig Up Safety Meeting	Pre-Rig Up Safety Meeting	12/30/2018	22:30:00	USER				Held a pre rig up safety meeting with my crew.
Event	7	Rig-Up Equipment	Rig-Up Equipment	12/30/2018	22:40:00	USER				The crew rigged up all lines, hoses and equipment for the job.
Event	8	Safety Meeting	Safety Meeting	12/31/201	03:00:00	USER	0.00	0.00	8.60	Halliburton cement crew

				8						held a pre cement job safety meeting and JSA with third party personnel and rig crew.
Event	9	Start Job	Start Job	12/31/2018	03:18:01	COM5	0.00	0.00	8.58	Pumped 3 bbls. of fresh water at 3 bpm. to fill lines and establish circulation.
Event	10	Test Lines	Test Lines	12/31/2018	03:22:46	COM5	136.00	0.00	8.61	Pressure tested lines to 6,000 psi. with a 500 psi. electronic kick out test. Held pressure for 5 minutes. Pressure held.
Event	11	Drop Bottom Plug	Drop Bottom Plug	12/31/2018	03:30:00	USER	6247.00	0.00	8.64	Halliburton loaded and dropped the bottom plug which, was witnessed by the customer.
Event	12	Pump Spacer 1	Pump Spacer 1	12/31/2018	03:33:10	COM5	45.00	0.00	8.57	Pumped 150 bbls. of Tuned Spacer III mixed at 12.5 ppg.,Yield: 2.72 ft3/sks, 16.8 gal/sks. Density was verified by pressurized scales.
Event	13	Pump Lead Cement	Pump Lead Cement	12/31/2018	04:02:28	COM5	11.00	0.00	15.39	Pumped 287 bbls. (1040 sks.) of Gasstop B1 mixed at 13.2 ppg.,Yield: 1.55 ft3/sks, 7.73 gal/sks. Density was verified by pressurized scales.
Event	14	Pump Tail Cement	Pump Tail Cement	12/31/2018	04:41:08	COM5	616.00	6.20	13.60	Pumped 265 bbls. (875 sks.) of Elasticem mixed at 14.4 ppg.,Yield: 1.7 ft3/sks, 7.3 gal/sks. Density was verified by pressurized scales.
Event	15	Shutdown	Shutdown	12/31/2018	05:29:35	COM5	12.00	0.00	8.23	Washed pumps and lines until clean.
Event	16	Drop Top Plug	Drop Top Plug	12/31/2018	05:36:59	COM5	6.00	0.00	8.18	Halliburton loaded and dropped the top plug, which was witnessed by the

										customer.
Event	17	Pump Displacement	Pump Displacement	12/31/2018	05:37:04	COM5	6.00	0.00	8.18	Pumped 285 bbls. of fresh water with MMCR in the first 20 bbls. Packer fluid was added throughout the rest of displacement.
Event	18	Bump Plug	Bump Plug	12/31/2018	06:20:11	COM5	2501.00	3.00	8.28	Bumped the plug 500 psi. over 2,600 psi. at 3 bpm. Final pressure was 3,200 psi. Held for a minute. Pressure held. Circulated 150 bbls. of spacer and 20 bbls of cement to surface. Estimated TOT at 6,109'.
Event	19	Pressure Up	Pressure Up	12/31/2018	06:22:54	USER	3984.00	2.00	8.31	Pressured up the well to 4,109 psi. to shift the sleeve. Pumped 5 bbls. of fresh water at 4 bpm. for a wet shoe.
Event	20	Check Floats	Check Floats	12/31/2018	06:25:40	USER	2013.00	0.00	8.26	Bled off pressure to check floats. Floats held. Got 2 bbls. of fluid back to the truck.
Event	21	End Job	End Job	12/31/2018	07:04:37	COM5				Washed and blew down all pumps, lines, and hoses until clean and dry.
Event	22	Pre-Rig Down Safety Meeting	Pre-Rig Down Safety Meeting	12/31/2018	07:15:00	USER	4.00	0.00	8.17	Halliburton cement crew held a pre rig down safety meeting and JSA.
Event	23	Rig-Down Equipment	Rig-Down Equipment	12/31/2018	07:20:00	USER	2.00	0.00	8.17	Rigged down all lines, hoses and equipment.
Event	24	Safety Meeting - Departing Location	Safety Meeting - Departing Location	12/31/2018	08:45:00	USER				Held a pre journey safety meeting with crew.
Event	25	Depart Location for Service Center or Other Site	Depart Location for Service Center or Other Site	12/31/2018	09:00:00	USER				Started journey management with dispatch and left location.