

HALLIBURTON

iCem[®] Service

PDC ENERGY-EBUS

United States of America, COLORADO

Date: Monday, October 22, 2018

J Clark 11N Foam Production

Job Date: Thursday, July 12, 2018

Sincerely,

Bryce Hinsch

Legal Notice

Disclaimer:

All information in this report is provided subject to the terms and conditions which govern the services provided by Halliburton. Halliburton personnel use their best efforts in gathering information and their best judgment in interpreting it, but any interpretation, research, analysis or recommendation furnished by Halliburton are opinions based upon inferences from measurements and empirical relationships and assumptions, which inferences and empirical relationships and assumptions are not infallible, and with respect to which professionals in the industry may differ. iCem 3D Displacement results are used to understand how fluids intermix during a cement job. Simulation and 3D displacement results are not intended as and should not be used as a replacement for bond logs in determining top of cement. Current 3D model calculations are known to model more volume than the input volume for standard cases due to known calculation improvements required. For rotational cases, the modeled volume will be impacted by the same calculations impacting the standard cases, as well as additional constraints imposed to make the calculation time required operationally feasible. Therefore, until further notice, 3D displacement results should not be used for replacement of a bond log, or used as an identifier of top of cement. HALLIBURTON IS UNABLE TO GUARANTEE THE ACCURACY OF ANY CHART INTERPRETATION, RESEARCH ANALYSIS, OR JOB RECOMMENDATION and any interpretation or recommendation is not for use of or reliance upon by any third party. The customer has full responsibility for any of its decisions which are based on the information provided in this report.

Table of Contents

1.0	Cementing Job Summary	4
1.1	Executive Summary	4
2.0	Real-Time Job Summary	10
2.1	Job Event Log	10
3.0	Attachments.....	14
3.1	PDC J Clark 11N Foam Production Job Chart.....	14

1.0 Cementing Job Summary

1.1 Executive Summary

Halliburton appreciates the opportunity to perform the cementing services on the **J Clark 11N 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 50 bbls of mudflush and 4 bbls of tuned spacer 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 Fort Lupton

HALLIBURTON

The Road to Excellence Starts with Safety

Sold To #: 304535	Ship To #: 3870492	Quote #: 0022463109	Sales Order #: 0904983135
Customer: PDC ENERGY-EBUS		Customer Rep: T	
Well Name: J CLARK		Well #: 11N	API/UWI #: 05-123-46689-00
Field: WATTENBERG	City (SAP): GREELEY	County/Parish: WELD	State: COLORADO
Legal Description: NW NE-14-5N-65W-550FNL-2024FEL			
Contractor: ENSIGN DRLG		Rig/Platform Name/Num: ENSIGN 152	
Job BOM: 14143 14143			
Well Type: HORIZONTAL OIL			
Sales Person: HALAMERICA\HX38199		Srv Supervisor: Kamereon White	

Job

Formation Name			
Formation Depth (MD)	Top		Bottom
Form Type			BHST
Job depth MD	12113ft		Job Depth TVD
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	LTC	J-55	0	1673		1673
Casing		5.5	4.778	20		P-110	0	12113		6856
Open Hole Section			8.5				1673	6856	1673	6856
Open Hole Section			8.5				6700	12084	6480	6842

Tools and Accessories

Type	Size in	Qty	Make	Depth ft	Type	Size in	Qty	Make
Guide Shoe	5.5				Top Plug	5.5	1	WTHR
Float Shoe	5.5	1	WTHR	12113	Bottom Plug	5.5	1	WTHR
Float Collar	5.5	1	WTHR	12078.40				
					Plug Container	5.5	1	HES
								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	Mud Flush III (Powder)	Mud Flush III	50	bbl	8.4					
42 gal/bbl		FRESH WATER								

HALLIBURTON

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	12.5 lb/gal Tuned Spacer III	Tuned Spacer III	100	bbl	12.5	2.74			
	203.65 lbm/bbl	BARITE, BULK (100003681)							
	34.60 gal/bbl	FRESH WATER							
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	HalCem Cap	HALCEM (TM) SYSTEM	620	sack	15.6	1.18		6	5.19
	0.40 %	HALAD-766, 55 LB SACK (101477695)							
	1.50 %	FOAMER 1026, TOTE (102166506)							
	5.11 Gal	FRESH WATER							
	0.35 %	HR-601, 50 LB BAG (101328348)							
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	HalSeal	HALSEAL (TM) SYSTEM	100	sack	15.6	1.18		6	5.19
	1.50 %	FOAMER 1026, TOTE (102166506)							
	0.40 %	HALAD-766, 55 LB SACK (101477695)							
	5.11 Gal	FRESH WATER							
	0.35 %	HR-601, 50 LB BAG (101328348)							
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	14.4# ElastiCem	ELASTICEM (TM) SYSTEM	765	sack	14.4	1.7		8	7.3
	7.32 Gal	FRESH WATER							
	0.20 %	HALAD(R)-344, 50 LB (100003670)							
	0.36 %	HR-5, 50 LB SK (100005050)							
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
6	MMCR Displacement	MMCR Displacement	20	bbl	8.34				
	0.50 gal/bbl	MICRO MATRIX CEMENT RETARDER, 5 GAL PAIL (100003781)							
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
7	Water	Water		bbl	8.33				

HALLIBURTON

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft ³ /sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
8	HalCem	HALCEM (TM) SYSTEM	0	sack	15.8	1.174		3	5.15
5.15 Gal		FRESH WATER							
Cement Left In Pipe	Amount	42 ft			Reason			Shoe Joint	
Mix Water:	pH 7	Mix Water Chloride:	< 200 ppm			Mix Water Temperature:	74 °F		
Cement Temperature:		Plug Displaced by:	8.33lb/gal			Disp. Temperature:			
Plug Bumped?	Yes	Bump Pressure:	2300 psi			Floats Held?	Yes		
Cement Returns:		Returns Density:				Returns Temperature:			
Comment									

2.0 Real-Time Job Summary

2.1 Job Event Log

Type	Seq. No.	Activity	Graph Label	Date	Time	Source	Truck 1 Pressure <i>(psi)</i>	Truck 1 Density <i>(ppg)</i>	Truck 1 Slurry Rate <i>(bbl/min)</i>	Pump Stg Tot <i>(bbl)</i>	Foamer Rate <i>(gpm)</i>	Comments
Event	1	Call Out	Call Out	7/12/2018	11:00:00	USER						CALL OUT AT 1100 FOR A 2100 READY TO PUMP TIME.
Event	2	Pre-Convoy Safety Meeting	Pre-Convoy Safety Meeting	7/12/2018	17:15:00	USER						DISCUSSED ROUTE AND POSSIBLE HAZARDS BEFORE LEAVING YARD FOR LOCATION.
Event	3	Arrive At Loc	Arrive At Loc	7/12/2018	18:30:00	USER						ARRIVE AT LOCATION WHILE RIG WAS STILL RUNNING CASING
Event	4	Pre-Rig Up Safety Meeting	Pre-Rig Up Safety Meeting	7/12/2018	18:45:00	USER						SAFETY MEETING HELD PRIOR TO RIGGING UP
Event	5	Pre-Job Safety Meeting	Pre-Job Safety Meeting	7/12/2018	21:16:14	USER				79.60		SAFETY MEETING HELD WITH EVERYONE ON LOCATION TO DISCUSS HAZARDS AND JOB PROCEDURE
Event	6	Start Job	Start Job	7/12/2018	22:00:14	COM11				0.00		BEGIN RECORDING JOB DATA
Event	7	Test Lines	Test Lines	7/12/2018	22:08:48	COM11				6.80		TEST CEMENT LINES TO 7000 PSI AND N2 LINES TO 9000 PSI. BOTH SUCCESSFUL. LEFT 2000 PSI ON N2 LINES FOR START OF FOAM
Event	8	Drop Bottom Plug	Drop Bottom Plug	7/12/2018	22:31:20	COM11				6.80		DROP BOTTOM PLUG. VERIFIED BY COMPANY MAN
Event	9	Pump Spacer 1	Pump Spacer 1	7/12/2018	22:32:28	COM11				0.00		PUMP 50 BBLs OF MUD

								FLUSH III AT 5 BBL/MIN
Event	10	Pump Spacer 2	Pump Spacer 2	7/12/2018	22:55:24	COM11	0.00	PUMP 100 BBL OF 12.5PPG TUNED SPACER III AT 5 BBL/MIN
Event	11	Shutdown	Shutdown	7/12/2018	23:14:05	COM11	92.60	SHUTDOWN TO GET CEMENT UP TO WEIGHT
Event	12	Check Weight	Check Weight	7/12/2018	23:18:19	COM11	92.60	VERIFY DENSITY WITH PRESSURIZED MUD SCALE.
Event	13	Check Weight	Check Weight	7/12/2018	23:20:02	COM11	92.60	VERIFY DENSITY WITH PRESSURIZED MUD SCALE.
Event	14	Pump Cap Cement	Pump Cap Cement	7/12/2018	23:21:32	COM11	92.60	PUMP 21 BBL OF 15.6PPG HALCEM CAP CEMENT (100 SACKS) AT 5 BBL/MIN
Event	15	Check Weight	Check Weight	7/12/2018	23:22:44	COM11	5.50	VERIFY DENSITY WITH PRESSURIZED MUD SCALE.
Event	16	Check Weight	Check Weight	7/12/2018	23:24:28	COM11	14.20	VERIFY DENSITY WITH PRESSURIZED MUD SCALE.
Event	17	Pump Foam Cement	Pump Foam Cement	7/12/2018	23:26:04	COM11	0.00	PUMP 130.5 BBL 15.6PPG LEAD CEMENT FOAMED DOWN TO 13.7 PPG (620 SACKS) AT 5 BBL/MIN. 55 GALLONS FOAMER USED, 64,700 SCFT N2 USED.
Event	18	Check Weight	Check Weight	7/12/2018	23:31:45	COM11	28.60	VERIFY DENSITY WITH PRESSURIZED MUD SCALE.
Event	19	Check Weight	Check Weight	7/12/2018	23:54:18	COM11	142.00	VERIFY DENSITY WITH PRESSURIZED MUD SCALE.
Event	20	Pump Tail Cement	Pump Tail Cement	7/12/2018	23:54:54	COM11	0.00	PUMP 232 BBL OF 14.4PPG TAIL CEMENT (765 SACKS) AT 5 BBL/MIN
Event	21	Check Weight	Check Weight	7/12/2018	23:58:58	COM11	20.50	VERIFY DENSITY WITH PRESSURIZED MUD SCALE.
Event	22	Check Weight	Check Weight	7/13/2018	00:27:22	COM11	163.20	VERIFY DENSITY WITH

								PRESSURIZED MUD SCALE.
Event	23	Check Weight	Check Weight	7/13/2018	00:34:33	COM11	196.50	VERIFY DENSITY WITH PRESSURIZED MUD SCALE.
Event	24	Check Weight	Check Weight	7/13/2018	00:38:14	COM11	215.00	VERIFY DENSITY WITH PRESSURIZED MUD SCALE.
Event	25	Shutdown	Shutdown	7/13/2018	00:45:51	COM11	253.00	SHUT DOWN, CLOSE RIG CHOKES, WASH PUMPS AND LINES,
Event	26	Drop Top Plug	Drop Top Plug	7/13/2018	01:02:38	COM11	269.80	DROP TOP PLUG, VERIFIED BY COMPANY MAN
Event	27	Pump Displacement	Pump Displacement	7/13/2018	01:02:42	COM11	269.80	PUMP 267.9 BBLS FRESH WATER DISPLACEMENT, FIRST 20 BBLS WITH MMCR, BIOCIDES IN REMAINDER EXCEPT FOR LAST 40 BBLS
Event	28	Displ Reached Cement	Displ Reached Cement	7/13/2018	01:12:09	COM11	44.80	DISPLACEMENT REACHED CEMENT 45 BBLS IN, BUMPED UP RATE FROM 5 BBLS/MIN TO 8 BBLS/MIN.
Event	29	Shutdown	Shutdown	7/13/2018	01:39:31	COM11	227.90	SHUTDOWN AT 213BBLS INTO DISPLACEMENT SO RIG COULD DIVERT RETURNS FROM SHAKERS, 50 BBLS OF MUD FLUSH AND APPROXIMATELY 4 BBLS OF TUNED SPACER TO SURFACE.
Event	30	Bump Plug	Bump Plug	7/13/2018	01:56:59	COM11	264.50	BUMP PLUG AT 2205 PSI, BROUGHT UP TO 2794 PSI TO ENSURE SEAT
Event	31	Other	Other	7/13/2018	01:57:31	COM11	264.50	SHEARED WET SHOE SUB AT 3300 PSI, PUMPED 6 BBL WET SHOE
Event	32	Check Floats	Check Floats	7/13/2018	02:02:12	USER	271.00	CHECKED FLOATS, 1.5 BBLS BACK TO THE TRUCK,

								FLOATS HELD.
Event	33	End Job	End Job	7/13/2018	02:09:38	COM11		STOP RECORDING JOB DATA
Event	34	Pre-Rig Down Safety Meeting	Pre-Rig Down Safety Meeting	7/13/2018	02:10:00	USER	0.00	SAFETY MEETING HELD PRIOR TO RIGGING DOWN
Event	35	Depart Location Safety Meeting	Depart Location Safety Meeting	7/13/2018	03:15:00	USER		SAFETY MEETING HELD PRIOR TO DEPARTING LOCATION, ROUTE AND HAZARDS DISCUSSED, JOURNEY CALLED IN
Event	36	Depart Location	Depart Location	7/13/2018	03:30:00	USER		DEPART LOCATION