

# HALLIBURTON

iCem<sup>®</sup> Service

**PDC ENERGY-EBUS**

**Fern 11V-204 Production**

Sincerely,  
**Meghan Jacobs**

## 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 .....	7
2.1	Job Event Log .....	7
3.0	Attachments.....	9
3.1	Fern 11V-204 Production – Job Chart with Events.....	9
3.2	Fern 11V-204 Production – Job Chart without Events .....	10

## 1.0 Cementing Job Summary

---

### 1.1 Executive Summary

---

Halliburton appreciates the opportunity to perform the cementing services on the **Fern 11V-204** 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.

**No cement or spacer 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]**

## HALLIBURTON

## Cementing Job Summary

*The Road to Excellence Starts with Safety*

Sold To #: 304535		Ship To #: 3791946		Quote #:		Sales Order #: 0904710502					
Customer: PDC ENERGY-EBUS				Customer Rep: Chris McMullen							
Well Name: FERN		Well #: 11V-204		API/UWI #: 05-123-44584-00							
Field: WATTENBERG		City (SAP): GREELEY		County/Parish: WELD		State: COLORADO					
Legal Description: NW NW-11-5N-65W-336FNL-688FWL											
Contractor:				Rig/Platform Name/Num: Ensign 152							
Job BOM: 7523 7523											
Well Type: HORIZONTAL OIL											
Sales Person: HALAMERICA\HX38199				Srcv Supervisor: Steven Markovich							
Job											
Formation Name											
Formation Depth (MD)		Top		Bottom							
Form Type				BHST							
Job depth MD		15041ft		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			0	1635	0	0	
Casing	0	5.5	4.778	20	BUTTRESS	HCP110	0	15041	0	0	
Open Hole Section			8.5				1635	15049	0	0	
Tools and Accessories											
Type	Size in	Qty	Make	Depth ft		Type	Size in	Qty	Make		
Guide Shoe	5.5			15041		Top Plug	5.5		HES		
Float Shoe	5.5					Bottom Plug	5.5		HES		
Float Collar	5.5					SSR plug set	5.5		HES		
Insert Float	5.5					Plug Container	5.5		HES		
Stage Tool	5.5					Centralizers	5.5		HES		
Fluid Data											
Stage/Plug #: 1											
Fluid #	Stage Type	Fluid Name			Qty	Qty UoM	Mixing Density lbm/gal	Yield ft <sup>3</sup> /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									
Fluid #	Stage Type	Fluid Name			Qty	Qty UoM	Mixing Density lbm/gal	Yield ft <sup>3</sup> /sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal

**HALLIBURTON**

*Cementing Job Summary*

2	CLEANSPACE R III	CLEANSPACER III	50	bbl	12	2.27				
0 gal/bbl		FRESH WATER								
Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft <sup>3</sup> /sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal	
3	13.2# ElastiCem	ELASTICEM (TM) SYSTEM	1840	sack	13.2	1.57		6	7.52	
7.52 Gal		FRESH WATER								
Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft <sup>3</sup> /sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal	
4	MMCR Displacement	MMCR Displacement	50	bbl	8.34					
0.25 gal/bbl		MICRO MATRIX CEMENT RETARDER, 5 GAL PAIL (100003781)								
Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft <sup>3</sup> /sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal	
5	Displacement fluid		281	bbl	8.34					
<p>Comment Pumped plug at 331 bbls away, Final lifting pressure was 2207psi. Brought pressure 500psi over and held. Kicked in the pumps at 2bbl/min to shear WSS. WSS sheered at 3770psi. Increased rate to 5bbl/min and pumped 5bbl wet shoe. Estimated top of Cement 2446'</p>										

## 2.0 Real-Time Job Summary

### 2.1 Job Event Log

Type	Seq. No.	Activity	Graph Label	Date	Time	Source	DH Density (ppg)	DS Pump Press (psi)	Comb Pump Rate (bbl/min)	Comments
Event	1	Call Out	Call Out	3/16/2018	23:00:00	USER				Job called out at 23:00 with an on location time of 07:00
Event	2	Pre-Convoy Safety Meeting	Pre-Convoy Safety Meeting	3/17/2018	05:00:00	USER				JSA with HES crew on driving safety and directions to rig
Event	3	Arrive at Location from Other Job or Site	Arrive at Location from Other Job or Site	3/17/2018	06:00:00	USER				Arrived on location, rig still running casing.
Event	4	Assessment Of Location Safety Meeting	Assessment Of Location Safety Meeting	3/17/2018	06:15:00	USER				JSA and Hazard hunt with HES crew.
Event	5	Rig-Up Equipment	Rig-Up Equipment	3/17/2018	06:30:00	USER				Rigged up HES lines and equipment.
Event	6	Pre-Job Safety Meeting	Pre-Job Safety Meeting	3/17/2018	10:15:00	USER				JSA with HES and rig crew on job safety and procedure.
Event	7	Start Job	Start Job	3/17/2018	10:48:06	COM4	7.27	-23.00	0.00	TD 15049' TP 15041' WSS 15013' 5 1/2" 20# production casing, 8 1/2" Open Hole, 9 5/8" 36# Surface Casing at 1635' TVD 6743'.
Event	8	Test Lines	Test Lines	3/17/2018	10:51:52	COM4	8.19	668.00	0.00	Set kick outs to 500psi and check kick outs, then bring pressure up to 4500psi and hold.
Event	9	Pump Spacer 1	Pump Spacer 1	3/17/2018	10:55:37	COM4	8.17	333.00	0.00	Pump 50bbs of Mud Flush. Pumped at 4bbl/min 860psi
Event	10	Pump Spacer 2	Pump Spacer 2	3/17/2018	11:30:15	COM4	8.42	843.00	3.90	Pump 50bbs of 12ppg 2.27yield Tuned Spacer. Pumped at 4bbl/min 920psi.
Event	11	Pump Cement	Pump Cement	3/17/2018	11:42:22	COM4	13.13	670.00	5.40	Pump 514.5bbls (1840sks) of 13.2ppg 1.57yield Cement. Pumped at 7bbl/min 858psi.
Event	12	Check Weight	Check weight	3/17/2018	11:43:34	COM4	13.26	939.00	5.60	Weight verified by pressurized scales.
Event	13	Check Weight	Check weight	3/17/2018	12:29:43	COM4	13.06	459.00	7.10	Weight verified by pressurized scales.
Event	14	Shutdown	Shutdown	3/17/2018	13:08:55	COM4	16.14	-64.00	0.00	Shutdown

Event	15	Clean Lines	Clean Lines	3/17/2018	13:09:36	COM4	17.18	-66.00	0.00	Clean pumps and lines.
Event	16	Drop Top Plug	Drop Top Plug	3/17/2018	13:22:11	COM4	35.10	-67.00	0.00	Plug loaded in HES head and dropped in front of company rep and tool hand.
Event	17	Pump Displacement	Pump Displacement	3/17/2018	13:22:13	COM4	35.18	-67.00	0.00	Pump 331bbls of H2O. First 50bbls with MMCR then 281bbls with biocide. Pumped at 4bbls a min as rig didn't have all the chemicals on location for the displacement. When chemicals arrived we kicked rate up to 8bbl/min.
Event	18	Bump Plug	Bump Plug	3/17/2018	14:24:11	COM4	8.23	2117.00	3.00	Bumped plug at 331bbls away, final lifting pressure was 2207psi. Brought pressure 500psi over and held. Kicked in pumps at 2bbl/min to shear WSS. WSS sheered at 3770psi then increased rate to 5bbl/min and pumped a 5bbl wet shoe.
Event	19	End Job	End Job	3/17/2018	14:30:28	COM4	8.25	29.00	0.00	Thank you Steve Markovich and crew.