

## **ANADARKO PETROLEUM CORP-EBUS**

DONOTMAIL-PO BOX 4995  
THE WOODLANDS, TX, 77387-4995  
US

RW 4N-5HZ  
WATTENBERG  
WELD County, CO, US  
API/UWI 05-123-44612-00  
SEC: 29,TWP: 3,RNG: 65  
Rig: Xtreme 22

## **Plug Cement Recommendation**

Proposal 251733 - Version 1.1  
August 06, 2017

Submitted by:  
Matthew Evans  
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Denver, CO - 80202  
USA

Contents

1 Foreword .....3

2 Service Center Contacts .....3

3 Plugs .....4

3.1 Job Information Plugs .....4

3.2 Estimated Calculations Plugs .....5

3.3 Job Volume Estimates Plugs .....7

3.4 Volume Estimate Table Plugs .....9

3.5 Cost Estimate .....10

4 Conditions .....12

***Halliburton appreciates the opportunity to present  
this cost estimate and looks forward to being of service to you.***

## **1 Foreword**

Enclosed is our cost estimate for cementing the casing strings in the referenced well. The information in this cost estimate includes well data, calculations, materials requirements, and cost estimates. This cost estimate is based on information from our field personnel and previous cementing services in the area.

The selection and use of non-Halliburton plugs and casing attachments often compromises the holistic approach and may jeopardize the overall objective for effective zonal isolation. Furthermore, Halliburton is not involved in the design, manufacture or use of plugs and casing attachments supplied by other manufacturers and assumes no liability for their installation and operation. For this reason we recommend Halliburton plugs and casing attachments be used when Halliburton performs any zonal isolation operation.

Halliburton Energy Services recognizes the importance of meeting society's needs for health, safety, and protection of the environment. It is our intention to proactively work with employees, customers, the public, governments, and others to use natural resources in an environmentally sound manner while protecting the health, safety, and environmental processes while supplying high quality products and services to our customers.

We appreciate the opportunity to present this cost estimate for your consideration and we look forward to being of service to you. Our Services for your well will be coordinated through the Service Center listed below. If you require any additional information or additional designs, please feel free to contact myself or our field representative listed below.

## **2 Service Center Contacts**

SERVICE CENTER: Brighton, CO

PHONE NUMBER: 303.655.4782

### 3 Plugs

#### 3.1 Job Information Plugs

Job Criticality Status: GREEN

Well Name: RW

Well #: 4N-5HZ

9 5/8" Surface Casing

0 - 1858 ft (MD)

Outer Diameter

9.625 in

Inner Diameter

8.921 in

Linear Weight

36 lbm/ft

Casing Grade

J-55

7 7/8" Open Hole

1858 - 6300 ft (MD)

Inner Diameter

7.875 in

Excess Factor

5 %

7 7/8" Open Hole

6300 - 7100 ft (MD)

Inner Diameter

7.875 in

Excess Factor

20 %

5" Drill Pipe

0 - 5600 ft (MD)

Outer Diameter

5 in

Inner Diameter

4.276 in

Linear Weight

19.5 lbm/ft

2 7/8" Tubing

5600 - 7100 ft (MD)

Outer Diameter

2.875 in

Inner Diameter

2.441 in

Linear Weight

6.4 lbm/ft

Cement Plug

6300 ft (MD)

Mud Type

Oil Based

Mud Weight

9.5 lbm/gal

## 3.2 Estimated Calculations Plugs

### Stage 1

#### Drill Pipe: In:

SPACER: (656 ft fill)

$$656 \text{ ft} * (0.2932 \text{ ft}^3/\text{ft} + 0.3382 \text{ ft}^3/\text{ft} * 5 \%)$$

$$= 203.28 \text{ ft}^3$$

Rheologically Enhanced Spacer

$$= 203.28 \text{ ft}^3$$

$$= 36.2 \text{ bbl}$$

CEMENT: (29 ft fill)

$$29 \text{ ft} * (0.2932 \text{ ft}^3/\text{ft} + 0.0325 \text{ ft}^3/\text{ft} + 0.3382 * 5 \%)$$

$$= 10.07 \text{ ft}^3$$

Plug Cement

$$= 10.07 \text{ ft}^3$$

$$= 57.8 \text{ bbl}$$

SPACER: (656 ft fill)

$$656 \text{ ft} * 0.0325 \text{ ft}^3/\text{ft}$$

$$= 21.31 \text{ ft}^3$$

Displacement Fluid

$$= 21.31 \text{ ft}^3$$

$$= 3.8 \text{ bbl}$$

CEMENT: (29 ft fill)

$$29 \text{ ft} * 0.0325 \text{ ft}^3/\text{ft}$$

$$= 0.96 \text{ ft}^3$$

Plug Cement

$$= 0.96 \text{ ft}^3$$

$$= 57.8 \text{ bbl}$$

### Stage 2

#### Drill Pipe: In:

SPACER: (656 ft fill)

$$656 \text{ ft} * (0.2932 \text{ ft}^3/\text{ft} + 0.3382 \text{ ft}^3/\text{ft} * 5 \%)$$

$$= 203.28 \text{ ft}^3$$

Rheologically Enhanced Spacer

$$= 203.28 \text{ ft}^3$$

$$= 36.2 \text{ bbl}$$

CEMENT: (829 ft fill)

$$829 \text{ ft} * (0.2932 \text{ ft}^3/\text{ft} + 0.0325 \text{ ft}^3/\text{ft} + 0.3382 * 5 \%)$$

$$= 284.12 \text{ ft}^3$$

Kickoff

$$= 284.12 \text{ ft}^3$$

= 50.6 bbl

SPACER: (656 ft fill)

656 ft \* 0.0325 ft<sup>3</sup>/ft

Displacement Fluid

= 21.31 ft<sup>3</sup>

= 21.31 ft<sup>3</sup>

= 3.8 bbl

CEMENT: (829 ft fill)

829 ft \* 0.0325 ft<sup>3</sup>/ft

Kickoff

= 26.95 ft<sup>3</sup>

= 26.95 ft<sup>3</sup>

= 50.6 bbl

### 3.3 Job Volume Estimates Plugs

#### Stage 1

Fluid 1: Rheologically Enhanced Spacer

Tuned Spacer III

37.58 gal/bbl FRESH WATER

0.70 gal/bbl Musol A, 330 gal. tote

0.70 gal/bbl Dual Spacer Surfactant B

88.91 lbm/bbl Barite

Fluid Density: 10.5 lbm/gal

Volume Ahead: **60 bbl**

Fluid 2: Plug

PLUGCEM (TM) SYSTEM

0.30 % HR-5

6.22 Gal/sk FRESH WATER

Fluid Weight: 15.8 lbm/gal

Slurry Yield: 1.51 ft<sup>3</sup>/sack

Total Mixing Fluid: 6.22 Gal/sack

**Calculated Volume: 57.8 bbl**

Proposed Volume: **57.8 bbl**

Top Of Fluid: 6300 ft

Calculated Fill: 800 ft

Calculated sack: 215.04 sack

Proposed sack: 225 sack

Fluid 3: Rheologically Enhanced Spacer

Tuned Spacer III

37.58 gal/bbl FRESH WATER

0.70 gal/bbl Musol A, 330 gal. tote

0.70 gal/bbl Dual Spacer Surfactant B

88.91 lbm/bbl Barite

Fluid Density: 10.5 lbm/gal

Volume Behind: **3.8 bbl**

Fluid 4: Oil Based

OBM Displacement

Fluid Density: 9.5 lbm/gal

Volume Behind: **100 bbl**

Cement Plug

6300 ft(MD)

#### Stage 2

Fluid 1: Rheologically Enhanced Spacer

Tuned Spacer III

37.58 gal/bbl FRESH WATER

0.70 gal/bbl Musol A, 330 gal. tote

0.70 gal/bbl Dual Spacer Surfactant B

88.91 lbm/bbl Barite

Fluid Density: 10.5 lbm/gal

Volume Ahead: **36.2 bbl**

Fluid 2: Plug

GRANITECEM (TM) SYSTEM

Fluid Weight: 17 lbm/gal

0.25 % HR-5	Slurry Yield:	0.99 ft <sup>3</sup> /sack
3.73 Gal/sk FRESH WATER	Total Mixing Fluid:	3.73 Gal/sack
	<b>Calculated Volume:</b>	<b>50.6 bbl</b>
	Proposed Volume:	<b>50.6 bbl</b>
	Top Of Fluid:	5500 ft
	Calculated Fill:	800 ft
	Calculated sack:	286.99 sack
	Proposed sack:	290 sack

Fluid 3: Rheologically Enhanced Spacer

Tuned Spacer III

37.58 gal/bbl FRESH WATER

0.70 gal/bbl Musol A, 330 gal. tote

0.70 gal/bbl Dual Spacer Surfactant B

88.91 lbm/bbl Barite

Fluid Density:	10.5 lbm/gal
Volume Behind:	<b>3.8 bbl</b>

Fluid 4: Oil Based

OBM Displacement

Fluid Density:	9.5 lbm/gal
Volume Behind:	<b>85.7 bbl</b>



### 3.4 Volume Estimate Table Plugs

Calculations are used for volume estimation. Well conditions will dictate final cement job design.

#### Stage 1

Fluid #	Fluid Type	Fluid Name	Surface Density lbm/gal	Estimated Avg Rate bbl/min	Downhole Volume
1	SPACER	Tuned Spacer III	10.5		36.2 bbl
2	CEMENT	PlugCem	15.8	5	225 sack
3	SPACER	Tuned Spacer III	10.5		3.8 bbl
4	MUD	OBM Displacement	9.5		100 bbl

#### Stage 2

Fluid #	Fluid Type	Fluid Name	Surface Density lbm/gal	Estimated Avg Rate bbl/min	Downhole Volume
1	SPACER	Tuned Spacer III	10.5		36.2 bbl
2	CEMENT	GraniteCem	17	5	290 sack
3	SPACER	Tuned Spacer III	10.5		3.8 bbl
4	MUD	OBM Displacement	9.5		85.7 bbl

NOTE: These slurries and spacers will require lab testing. The additives and concentrations are estimates based on field experience in the area and may need to be modified prior to the job. The proposed spacer is designed to be generally compatible with water base mud systems. Compatibility testing with field mud samples used may indicate changes in the additive package and the related costs.

## 3.5 Cost Estimate

Mtrl Nbr	Description	Qty	UOM	Unit Price	Gross Amt	Net Amount
7529	CMT WHIPSTOCK PLUG BOM 7529	1.00	JOB	0.00	0.00	0.00
2	MILEAGE FOR CEMENTING CREW Number of Units	40.00 1	MI	USD 5.76/ 1 MI	230.40	80.64
1	ZI-MILEAGE FROM NEAREST HES BASE,/UNIT Number of Units	40.00 1	MI	USD 9.79/ 1 MI	391.60	137.06
16094	PLUG BACK/SPOT CEMENT OR MUD,ZI FEET/METERS (FT/M) DEPTH	1.00 FT 7100	EA	USD 12,036.00/ 1 EA	12,036.00	4,212.60
483826	SBM, CMT, Tuned Spacer III	37.00	BBL	USD 293.00/ 1 BBL	10,841.00	3,794.35
100003665	CHEM, Dual Spacer Surf. B, 5 gal Dual Spacer Surfactant B	26.00	GAL	USD 101.85/ 1 GAL	2,648.10	926.83
100003681	CHEM, BARITE, BULK Barite	33.00	SK	USD 31.07/ 1 SK	1,025.31	358.86
790828	CHEM, MUSOL A, 330 GAL TOTE Musol A, 330 gal. tote	26.00	GAL	USD 31.19/ 1 GAL	810.94	283.83
452969	CMT, PlugCem (TM) system	225.00	SK	0.00	14,622.39	5,117.83
100005050	CHEM, HR-5, 50 LB HR-5	64.00	LB	USD 13.28/ 1 LB	849.92	297.47
483826	SBM, CMT, Tuned Spacer III	4.00	BBL	USD 293.00/ 1 BBL	1,172.00	410.20
100003665	CHEM, Dual Spacer Surf. B, 5 gal Dual Spacer Surfactant B	3.00	GAL	USD 101.85/ 1 GAL	305.55	106.94
100003681	CHEM, BARITE, BULK Barite	4.00	SK	USD 31.07/ 1 SK	124.28	43.50
790828	CHEM, MUSOL A, 330 GAL TOTE Musol A, 330 gal. tote	3.00	GAL	USD 31.19/ 1 GAL	93.57	32.75
483826	SBM, CMT, Tuned Spacer III	37.00	BBL	USD 293.00/ 1 BBL	10,841.00	3,794.35
100003665	CHEM, Dual Spacer Surf. B, 5 gal Dual Spacer Surfactant B	26.00	GAL	USD 101.85/ 1 GAL	2,648.10	926.83
100003681	CHEM, BARITE, BULK Barite	33.00	SK	USD 31.07/ 1 SK	1,025.31	358.86
790828	CHEM, MUSOL A, 330 GAL TOTE Musol A, 330 gal. tote	26.00	GAL	USD 31.19/ 1 GAL	810.94	283.83
452966	CMT, GraniteCem (TM) system	290.00	SK	0.00	15,846.85	5,546.40
100005050	CHEM, HR-5, 50 LB HR-5	69.00	LB	USD 13.28/ 1 LB	916.32	320.71
483826	SBM, CMT, Tuned Spacer III	4.00	BBL	USD 293.00/ 1 BBL	1,172.00	410.20
100003665	CHEM, Dual Spacer Surf. B, 5 gal Dual Spacer Surfactant B	3.00	GAL	USD 101.85/ 1 GAL	305.55	106.94
100003681	CHEM, BARITE, BULK Barite	4.00	SK	USD 31.07/ 1 SK	124.28	43.50
790828	CHEM, MUSOL A, 330 GAL TOTE Musol A, 330 gal. tote	3.00	GAL	USD 31.19/ 1 GAL	93.57	32.75
76400	MILEAGE,CMT MTLs DEL/RET MIN NUMBER OF TONS	20.00 32.995	MI	USD 3.35/ 1 MI	2,210.67	773.73
3965	HANDLE&DUMP SVC CHRg, CMT&ADDITIVES,ZI Unit of Measurement NUMBER OF EACH	734.00 EA 1	CF	USD 5.49/ 1 CF	4,029.66	1,410.38
45	SPEC EQUIP CHRg, NO PRICE ESTABLISHED ZI Full Spill Containment	1.00	EA	USD 600.00/ 1 EA	600.00	600.00
	<b>Total Gross Amount</b>					<b>85,775.31</b>

Mtrl Nbr	Description	Qty	UOM	Unit Price	Gross Amt	Net Amount
	Total Item Discounts					55,363.97
	Total Net Amount	USD				30,411.34

Mtrl Nbr	Description	Qty	UOM	Unit Price	Gross Amt	Net Amount
<b>Optional Charge</b>						
3	ZI-DERRICK CHARGE	1.00	EA	USD 987.00/ 1 EA	987.00	987.00
16096	PlugBack/Spot Cmt or Mud, Addl Hrs HR/DAY/WEEK/MTH/YEAR/JOB/RUN HOURS	1.00 H 1	EA	USD 1,139.00/ 1 EA	1,139.00	1,139.00
"Additional hours on location will be a non-discounted line item. All cement jobs include 8 hours on location"						
"When HES Employees are required to work with plug containers 10' above the rig floor, a charge of \$987.00 will be applied."						

Primary Plant: Fort Lupton, CO  
Secondary Plant: Fort Lupton, CO

Price Book Ref: 28 - ROCKIES  
Price Date: 8/6/2017

## **4 Conditions**

The cost in this analysis is good for the materials and/or services outlined within and shall be valid for 30 days from the date of this proposal. In order to meet your needs under this proposal with a high quality of service and responsive timing, Halliburton will be allocating limited resources and committing valuable equipment and materials to your area of operations. Accordingly, the discounts reflected in this proposal are available only for materials and services awarded on a first-call basis. Alternate pricing may apply in the event that Halliburton is awarded work on any basis other than as a first-call provider.

The unit prices stated in the proposal are based on our current published prices. The projected equipment, personnel, and material needs are only estimates based on information about the work presently available to us. At the time the work is actually performed, conditions then existing may require an increase or decrease in the equipment, personnel, and/or material needs. Charges will be based upon unit prices in effect at the time the work is performed and the amount of equipment, personnel, and/or material actually utilized in the work. Taxes, if any, are not included. Applicable taxes, if any, will be added to the actual invoice.

It is understood and agreed between the parties that with the exception of the subject discounts, all services performed and equipment and materials sold are provided subject to Halliburton's General Terms and Conditions contained in our current price list, (which include LIMITATION OF LIABILITY and WARRANTY provisions), and pursuant to the applicable Halliburton Work Order Contract (whether or not executed by you), unless a Master Service and/or Sales Contract applicable to the services, equipment, or materials supplied exists between your company and Halliburton, in which case the negotiated Master Contract shall govern the relationship between the parties. A copy of the latest version of our General Terms and Conditions is available from your Halliburton representative or at: <http://www.halliburton.com/terms> for your convenient review, and we would appreciate receiving any questions you may have about them. Should your company be interested in negotiating a Master Contract with Halliburton, our Law Department would be pleased to work with you to finalize a mutually agreeable contract. In this connection, it is also understood and agreed that Customer will continue to execute Halliburton usual field work orders and/or tickets customarily required by Halliburton in connection with the furnishing of said services, equipment, and materials.

Any terms and conditions contained in purchase orders or other documents issued by the customer shall be of no effect except to confirm the type and quantity of services, equipment, and materials to be supplied to the customer.

If customer does not have an approved open account with Halliburton or a mutually executed written contract with Halliburton, which dictates payment terms different than those set forth in this clause, all sums due are payable in cash at the time of performance of services or delivery of equipment, products, or materials. If customer has an approved open account, invoices are payable on the twentieth day after date of invoice.

Customer agrees to pay interest on any unpaid balance from the date payable until paid at the highest lawful contract rate applicable, but never to exceed 18% per annum. In the event Halliburton employs an attorney for collection of any account, customer agrees to pay attorney fees of 20% of the unpaid account, plus all collection and court costs.