

# PECOS DISTRICT DRILLING OPERATIONS CONDITIONS OF APPROVAL

OPERATOR'S NAME:	COG OPERATING LLC.
LEASE NO.:	NMNM119280
WELL NAME & NO.:	Square Bill Fed Com 21Y
SURFACE HOLE FOOTAGE:	240'/S & 924'/E
BOTTOM HOLE FOOTAGE:	2440'/S & 330'/E
LOCATION:	Section 31 T.25 S., R.35E., NMP
COUNTY:	LEA County, New Mexico

Potash	<input type="radio"/> None	<input type="radio"/> Secretary	<input checked="" type="radio"/> R-111-P
Cave Karst Potential	<input checked="" type="radio"/> Low	<input type="radio"/> Medium	<input type="radio"/> High
Variance	<input type="radio"/> None	<input checked="" type="radio"/> Flex Hose	<input type="radio"/> Other
Wellhead	<input checked="" type="radio"/> Conventional	<input type="radio"/> Multibowl	
Other	<input type="checkbox"/> 4 String Area	<input type="checkbox"/> Capitan Reef	<input type="checkbox"/> WIPP

**All previous COAs still apply except for the following:**

## A. CASING

**Intermediate casing must be kept fluid filled to meet BLM minimum collapse requirement.**

1. The minimum required fill of cement behind the 7 5/8 inch production casing is:

Operator has proposed a DV tool at a depth of 5400', the depth may be adjusted as long as the cement is changed proportionally. The DV tool may be cancelled if cement circulates to surface on the first stage.

- a. First stage to DV tool: Cement to circulate. If cement does not circulate off the DV tool, contact the appropriate BLM office before proceeding with second stage cement job.
- b. Second stage above DV tool:
  - Cement to surface. If cement does not circulate, contact the appropriate BLM office.

**MHH 01122018**

## GENERAL REQUIREMENTS

### A. CASING

1. Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.
2. Wait on cement (WOC) for Potash Areas: After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi for all cement blends, 2) until cement has been in place at least 24 hours. WOC time will be recorded in the driller's log.
3. Wait on cement (WOC) for Water Basin: After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.
4. Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.
5. No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.
6. On that portion of any well approved for a 5M BOPE system or greater, a pressure integrity test of each casing shoe shall be performed. Formation at the shoe shall be tested to a minimum of the mud weight equivalent anticipated to control the formation pressure to the next casing depth or at total depth of the well. This test shall be performed before drilling more than 20 feet of new hole.
7. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.
8. Whenever a casing string is cemented in the R-111-P potash area, the NMOCD requirements shall be followed.



Lesser Prairie-Chicken.

10 3/4	surface csg in a	14 3/4	inch hole.	Design Factors			SURFACE		
Segment	#/ft	Grade	Coupling	Body	Collapse	Burst	Length	Weight	
"A"	45.50	N 80	BUTT	19.54	4.62	0.94	1,170	53,235	
"B"							0	0	
w/8.4#/g mud, 30min Sfc Csg Test psig: 1,500			Tail Cmt	does not	circ to sfc.	Totals:	1,170	53,235	
Comparison of Proposed to Minimum Required Cement Volumes									
Hole	Annular	1 Stage	1 Stage	Min	1 Stage	Drilling	Calc	Req'd	Min Dist
Size	Volume	Cmt Sx	CuFt Cmt	Cu Ft	% Excess	Mud Wt	MASP	BOPE	Hole-Cplg
14 3/4	0.5563	430	650	676	-4	8.80	2927	3M	1.50

Burst Frac Gradient(s) for Segment(s) A, B = , b All > 0.70, OK.

7 5/8	casing inside the	10 3/4	Design Factors				INTERMEDIATE		
Segment	#/ft	Grade	Coupling	Body	Collapse	Burst	Length	Weight	
"A"	29.70	P 110	BUTT	2.68	0.97	1.3	11,825	351,203	
"B"							0	0	
w/8.4#/g mud, 30min Sfc Csg Test psig:						Totals:	11,825	351,203	
The cement volume(s) are intended to achieve a top of				0	ft from surface or a		1170	overlap.	
Hole	Annular	1 Stage	1 Stage	Min	1 Stage	Drilling	Calc	Req'd	Min Dist
Size	Volume	Cmt Sx	CuFt Cmt	Cu Ft	% Excess	Mud Wt	MASP	BOPE	Hole-Cplg
9 7/8	0.2148	look ✓	0	2560		9.00	4467	5M	0.69

$$\text{Collapse} = 0.97 * 1.5 = 1.455 > 1.125 = \text{OK}$$

Tail cmt

5 1/2 X 5 casing inside the 7 5/8			Design Factors			PRODUCTION			
Segment	#/ft	Grade	Coupling	Joint	Collapse	Burst	Length	Weight	
"A"	23.00	P 110	BUTT	2.50	2.08	1.7	12,257	281,906	
"B"	18.00	P 110	BUTT	6.99	1.67	1.88	7,915	142,474	
w/8.4#/g mud, 30min Sfc Csg Test psig: 2,696						Totals:	20,172	424,380	
B would be:				70.81	1.85	f it were a vertical wellbore			
No Pilot Hole Planned		MTD	Max VTD	Csg VD	Curve KOP	Dogleg	Severity	MEOC	
		20172	12712	12712	12257	92	12	13027	
The cement volume(s) are intended to achieve a top of				11325	ft from surface or a		500	overlap.	
Hole	Annular	1 Stage	1 Stage	Min	1 Stage	Drilling	Calc	Req'd	Min Dist
Size	Volume	Cmt Sx	CuFt Cmt	Cu Ft	% Excess	Mud Wt	MASP	BOPE	Hole-Cplg
6 3/4	0.0835	1150	1640	748	119	11.00			0.35

Class 'H' tail cmt yld > 1.20

Operator suggested 11.0 ppg MW might not be  
sufficient to drill into WC. 13.0 ppg is more likely

Hole-Cplg : This is above the min req  
TOC section