

803.i.(2).: PROPOSED CASING & CEMENTING PLAN

Operator: Terra Energy Partners
Well Name & Number: RG 912-23-299D
Location: Ryan Gulch

Casing Design Calculation:											
Type of Casing	Size of Hole (inches)	Size of Casing (inches)	Weight per Foot (lbs/ft)	Grade	Thread	Interval (ft)	(ft - Length (feet)	Setting Depth (TVD feet)	Collapse (psi)	Burst (psi)	Tension (lbs)
Surface	17.50	13.375	54.5	J-55	BTC	0-1400	1,400	1,316	1,130	2,735	853,000
Intermediate	12.25	9.625	36.0	J-55	LTC	0-3146	3,146	2,797	2,020	3,520	453,000
Production	8.75	5.500	17.0	N-80	BTC	0-6449	6,449	6,000	7,580	7,740	446,000

Surface Casing Shoe			Intermediate Casing Shoe			Production Casing Shoe		
Max MW =	9.0	ppg	Max MW =	9.0	ppg	Max MW =	9.5	ppg
HP =	616	psi	HP =	1,309	psi	HP =	2,964	psi

True Vertical Depth = 6,000 ft
Bottom Hole Pressure = 2,790 psi
Pore Pressure Gradient = 0.465 psi/ft
Max. Sur. Pressure = 1,470 psi
BOP Required = 2M System
SM system will be used as per Master APD

Bottom Hole Temperature = 230 degrees Fahrenheit

Casing Safety Factors			
Surface Casing	Pb = 3.99	Min = 1.100	Pass
	Pc = 1.83	Min = 1.125	Pass
	Sj = 11.18	Min = 1.500	Pass
Intermediate Casing	Pb = 2.39	Min = 1.100	Pass
	Pc = 1.54	Min = 1.125	Pass
	Sj = 4.00	Min = 1.500	Pass
Production Casing	Pb = 5.27	Min = 1.100	Pass
	Pc = 2.56	Min = 1.125	Pass
	Sj = 4.07	Min = 1.500	Pass

Cement Design Calculation:

Estimating Cement for Ryan Gulch Wells (Permitting purpose only)

Critical Depths - Permitting Purposes Only	
Casing/Formation	Measured Depth
Surface Casing	1,400 ft
Intermediate Casing	3,146 ft
Top of G Sand	4,000 ft
Top of Gas	6,332 ft
Total Depth	6,449 ft

Production Cement Top: (Permitting Purposes Only)	
Cement Slurry	TOC - Measured Depth
Scavenger	N/A ft
Lead	N/A ft
Tail	3,800 ft

Surface Cement	Lead
Cement Tops	Surface
Volume, bbls	173
Annular vol w/ excess, ft ³	1070
Volume, sacks	457
Slurry Weight, ppg	12.3
Slurry Yield, ft ³ /sk	2,340
Mixwater, gal/sk	13.40
Annular Capacity (BBL)	0.1237
Annular Capacity (CF)	0.6947
Excess	0.1
Total Sacks	457
Total Cubic Ft.	1,070

Intermediate Cement	Lead	Tail
Cement Tops	2,146	2,646
Volume, bbls	28	28
Annular vol w/ excess, ft ³	172	172
Volume, sacks	72	82
Slurry Weight, ppg	12.3	12.8
Slurry Yield, ft ³ /sk	2,400	2,100
Mixwater, gal/sk	13.30	11.30
Annular Capacity (BBL)	0.0558	0.0558
Annular Capacity (CF)	0.3132	0.3132
Excess	0.1	0.1
Total Sacks =	154	
Total Cubic Ft. =	345	

Production Cement	Scavenger	Lead	Tail
Cement Tops			3800
Volume, bbls			119
Annular vol w/excess, ft ³			736
Volume, sacks			402
Slurry Weight, ppg			13.5
Slurry Yield, ft ³ /sk			1,830
Mixwater, gal/sk			9,110
Annular Capacity (BBL)			0.0450
Annular Capacity (CF)			0.2526
Excess			0.1
Total Sacks =	402		
Total Cubic Ft. =	736		

NOTES:

Surface Casing 17-1/2" hole to TD - Cement to surface.
54.5# 13-3/8" J-55, BTC surface casing will be ran.
10% excess is included in calculations.
Normal Surface excess is 40% over gauge hole
Normal Intermediate excess is 50% over gauge hole
Normal Production excess is 45% over gauge hole.

Casing & Cementing Plan

The Federal RG 912-23-299D injection well is designed with three (3) strings of casing and cement to ensure all formations to surface are fully isolated from the proposed disposal zone in the Williams Fork formation. TEP proposes setting a 13-3/8- inch surface casing shoe above the top of the Dissolution zone at 1,400 feet MD and circulating cement to surface per Rule 408.i.(2). Subsequently, TEP proposes setting a 9-5/8-inch intermediate string, 500 feet TVD into the Upper Wasatch formation, which is a confining layer, to isolate all zones above the Wasatch from the injection section of the wellbore. The Dissolution zone in the Green River formation is sub-normally pressured with a low fracture gradient. Setting the 13-3/8-inch surface shoe above the Dissolution zone and the 9-5/8-inch casing from surface to 500' TVD in the Upper Wasatch allows TEP to eliminate the need for a 2-stage cementing tool, which has been utilized historically in the area. Designing our casing program around the under pressured Dissolution zone provides TEP with better control over cement placement in the top-hole sections and coupled with our cement design in the production section, achieves the desired isolation of upper formations that contain usable quality groundwater from deeper zones.