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PLUG and ABANDONMENT PROCEDURE

WARDELL 6-20

API 05-123-21865

RECOMMENDED PROCEDURE:

Pre-Rig Up Work:

- a. Move in and rig up slickline unit. Pull plunger, springs and standing valves as per normal procedure.
- b. Request Slickline to record the fluid level for obtaining Formation Pressure to calculate/verify fluid density for well control.
- c. Prep well for pulling unit.
- d. Record and report tubing, casing and bradenhead pressures.

Rig Procedure:

Note: Notify district COGCC office 24 hours before commencing work and before all cementing operations.

1. Move in and rig up P&A rig with associated equipment. Rig up pump equipment to wellhead. Pressure test pump and lines to +/- 3,000 psi.
2. Record shut-in tubing, casing and bradenhead pressures.
3. Kill tubing & casing with brine or fresh water with biocide, pumping +/- 80 bbls down casing and then +/- 30 bbls down tubing to flush all hydrocarbons out of wellbore. Maintain injection rate of minimum **6 – 8 BPM** during kill operations.
4. Stump test BOP & 4 1/16" Frac Valve per guidelines. The 4 1/16" Frac Valve ID must caliper min 4" throughout entire valve body & connections.
5. Nipple down wellhead.
6. Nipple up BOPE.
7. Rig up rig floor and remaining equipment.
8. Verify safe to remove 2" Bull plug. Replace Bull plug with 2" XXH Nipple & 2" 5,000 psi Ball Valve. Connect 2 – 2" lines onto the Bradenhead, then "T" together near the wellhead, and lay 1 – 2" line to the waste tank.
9. Pull out of hole laying down all ~224 joints of 2 3/8" tubing.
10. Move in and rig up wireline. Run in hole with 4.5" 11.6# gauge ring to ~7,276'. Pull out of hole with gauge ring.
11. Run in hole and set **Niobrara** 4.5" CIBP at ~6,920'. (casing collars at 6910' & 6952').
12. Run in hole and dump bail 2 sx of cement on top of CIBP. Pull out of hole with wireline and dump bailer.
13. Load well with Fresh Water containing biocide and test 4.5" production casing to 500 psi for 15 minutes.
Note: A successful pressure test must have less than a 10% loss and a minimum of 15 minutes of stabilized pressure.
14. Run in hole and set **Sussex** 4.5" CIBP at 4230'. (casing collars at 4208' & 4250')
15. Run in hole and dump bail 2 sx of cement on top of CIBP. Pull out of hole with wireline and dump bailer.
16. Check well pressure ensuring well is dead. ND BOP & Install 4 1/16" Frac Valve.

17. Run in hole with 3 1/8" Perforating Gun. Perforate holes at ~**3,600'** with 3 1/8" gun, 3 SPF, 120° phasing, 12 shots.
18. Pull out of hole with wireline and spent gun. Rig down Wireline.
19. Open Casing & Bradenhead. Circulate down 4.5" Casing at **6 BPM** with 8.33 ppg Fresh Water out perfs at **3,600'** up the Bradenhead. If Annulus circulates to Surface, switch to 14.0 ppg Mud with Calculated volume ~447 bbls, use ~550 bbls 14.0 ppg Mud for entire annulus volume.
20. If well will circulate, then continue with Rigless Pierre Shale Cement job at Step #30.
21. If well doesn't circulate, then Run in hole with 3 1/8" Perforating Gun. Perforate holes at ~**3,000'** with 3 1/8" gun, 3 SPF, 120° phasing, 12 shots.
22. Pull out of hole with wireline and spent gun. Rig down Wireline.
23. RIH with 4.5" Cement Retainer on ~102 joints of 2 3/8" Tubing. Set Cement Retainer at ~**3,200'**. Place Tubing in test position and test Tubing to 2,500 psi.
24. Sting back into Cement Retainer and establish rollover circulation from ~**3,600'** to ~**3,000'** with Fresh Water. Cement with 20 bbls Pre-Flush, 20 bbls Fresh Water, & 230 sx Class G AGM with 0.4% CJ522R Latex, 2% CJ110 Calcium Chloride and 4% CJ101 gypsum mixed at 15.8 ppg & 1.25 cf/sx. 60% Excess Annular section only. Obtain dry & wet samples of cement.
25. Displace ~10 bbls Fresh Water leaving Cement ~2 bbls short end of Tubing.
26. Laydown ~13 joints Tubing and Reverse Circulate with Fresh Water until well is clean. Lay down all the Tubing.

Note: Heat all cement mixing water to 70° F. All circulating rates need to be at 6 - 8 BPM to promote hole cleaning and residual gas removal.

Note: On all **AGM cement jobs**, the Rig Crew must be ready to pull Tubing. The Rig pump must be primed on mud & engine running ready to Reverse Circulate, and hoses switched for Reverse Circulation & when necessary return fluid out Bradenhead to the waste tank.

27. Check well pressure ensuring well is dead. Attach Plug Container Into 4 1/16" Frac Valve. Ensure there are 2 – 2" lines onto the Bradenhead, then "T" together near the wellhead, and lay 1 – 2" line to the waste tank.
28. Rig down 4.5" Plug Container.
29. Move in and rig up Wireline. Run in hole with 3 1/8" Perforating Gun. Perforate holes ~**1,600'** with 3 1/8" gun, 3 SPF, 120° phasing, 12 shots. POOH with Perf Gun & rig down Wireline.
30. Open Casing & Bradenhead. Circulate down 4.5" Casing at **6 BPM** with 14.0 ppg Mud out Perfs at ~1,600', taking returns up Bradenhead.
31. Circulate ~160 bbls of 14.0 ppg Mud until returns are clean and fluid weighs 14.0 ppg.
32. Check pressure ensuring well is dead. Install 4.5" Plug Container & Flanged 4.5" Sub. Ensure there are 2 – 2" lines onto the Bradenhead, then "T" together near the wellhead, and lay 1 – 2" line to the waste tank.
33. Move in and rig up cement equipment. Test pump and lines to 3,000 psi for 10 mins.
34. Mix and pump Class G AGM cement down 4.5" Casing at **6 BPM** at ~**1,600'**.
35. Pump 20 bbls Pre-Flush, 20 bbls Fresh water, followed by 300 sx Class G AGM with 0.4% CJ522R Latex, 2% CJ110 Calcium Chloride and 5% CJ101 gypsum mixed at 15.8 ppg & 1.23 cf/sx. 60% Excess on Annular section only. Obtain dry & wet samples of cement.
36. Shut down. Drop 4.5" Top Plug. Wash Pump & Lines for downtime <10 mins.
37. Displace with 20 bbls (~1,300') of 14.0 ppg Mud at **6 BPM**. **Do not** over-displace. Job time <30 minutes.

38. Close Casing & Bradenhead. Apply 100-200 psi on Bradenhead & Shut-in well for 8 hrs.
39. Check well pressure: Tubing, Casing, & Bradenhead. If well has pressure, vent for 1 hr, then shut-in well and check pressure after 1 hour.
40. Rig down 4.5" Plug Container.
41. Move in and rig up wireline. Run in hole with 3 1/8" Perforating Gun. Perforate holes ~772' with 3 1/8" gun, 3 SPF, 120° phasing, 12 shots. Pull Perf Gun & rig down Wireline.
42. Open Casing & Bradenhead. Circulate down 4.5" Casing at **6 BPM** with 14.0 ppg Mud out Perfs at ~772', taking returns up Bradenhead.
43. Circulate until returns are clean and fluid weighs 14.0 ppg, using ~65 bbls 14.0 Mud.
44. Shut-in well for 8 hours to check Surface gas pressure.
45. If Surface Gas Pressure is present, CALCULATE NEW FLUID DENSITY, ORDER NEW MUD AND CIRCULATE WELL WITH NEW MUD FROM ~772'.
46. Shut-in well for 8 hours to check Surface gas pressure.
47. Check pressure ensuring well is dead. ND 4 1/16" Frac Valve and install 4.5" Casing Collar, 4.5" X 2" SWAGE, 2" 5000 PSI BALL VALVE. Ensure there are 2 – 2" lines onto the Bradenhead, then "T" together near the wellhead, and lay 1 – 2" line to the waste tank.
48. Move in and rig up cement equipment. Test pump and lines to 3,000 psi for 10 mins.
49. Mix and pump Class G AGM cement down 4.5" Casing at **6 BPM** at ~772'.
50. Pump 20 bbls Pre-Flush, 20 bbls Fresh water, followed by 235 sx Class G AGM with 0.4% CJ522R Latex, 3% CJ110 Calcium Chloride and 5% CJ101 gypsum mixed at 15.8 ppg & 1.23 cf/sx until clean AGM Cement circulates to Surface. Obtain dry & wet samples of cement.
51. Shut down. Close Casing & Bradenhead.
52. Rig down and move off pulling unit and related equipment.
53. Instruct cementing and wireline contractors to e-mail copies of all job logs/job summaries to rscDJVendors@anadarko.com within 24 hours of completion of the job.
54. Supervisor submit paper copies of all invoices, logs, and reports to VWP Engineering Specialist.
55. Excavation crew to notify One Call to clear excavation area around wellhead and for flow lines.
56. Excavate hole around surface casing enough to allow welder to cut casing a minimum 5' below ground level.
57. Welder cut casing minimum 5' below ground level.
58. Spot weld on steel marker plate. Marker should contain Well name, Well number, legal location (1/4 1/4 descriptor) and API number.
59. Obtain GPS location data as per COGCC Rule 215 and send to rscDJVendors@anadarko.com.
60. Properly abandon flow lines per Rule 1103. File electronic Form 42 once abandonment is complete.
61. Back fill hole with fill. Clean location, and level.
62. Submit Form 6 to COGCC ensuring to provide 'As performed' WBD identifying operations completed.