

PLUG AND ABANDONMENT PROCEDURE

Willard Hein Gas Unit #1

Step Description of Work

Note: Production Casing = 4 1/2" OD, 11.6#/ft, K-55; Production Hole Drilled @ 7 7/8"; Casing Leak Sqz Holes: 2086'.

- 1 Provide notice to COGCC prior to rig up per request on approved Form 6 (e.g. call field coordinator, submit Form 42, etc.). Call foreman or lead operator at least 24 hr prior to rig move. Request they catch and remove the plunger, isolate production equipment and remove any automation prior to rig showing up. Install perimeter fence as needed.
- 2 MIRU slickline services. Pull bumper spring and tag bottom. RDMO slickline services.
- 3 Notify IOC when rig mobilizes to location to generate workorder for flowline removal & one call for line locates.
- 4 Prepare location for base beam equipped rig. MI ~15 additional 2 3/8" prod tbg jts.
- 5 MIRU, kill as necessary using clean fresh water with biocide and circulate. ND WH. NU BOP. Unseat landing jt, LD.
- 6 Notify cementers to be on call. Provide volumes listed below:
 - 6_1 Niobrara Suicide: 130 sx 50/50 Poz "G" w/ 20% silica flour, 3% gel, 0.1% sodium metasilicate and 0.4% FL-52 mixed at 13.5 ppg and 1.71 cf/sk (35.6bbls) (9.5"+ 20% Caliper Log in file)
 - 6_2 SX Suicide: 410 sx class "G", w/0.25 pps cello flake, 0.4% CD-32, 0.4% ASA-301 mixed at 15.8 ppg and 1.15 cf/sx (80.9bbls) (11"+20% Caliper Log in file)
 - 6_3 Surface Suicide: 350 sx Type III CaCl₂ cement mixed at 14.0 ppg and 1.53 cf/sx (93.2bbls) (530' inside 4 1/2" Prod Casing and 560' in 12 1/4" OH + 20% excess, and 2 bbls on top of CICR)
 - 6_4 Stub Plug: 100 sx Type III CaCl₂ cement mixed at 14.0 ppg and 1.53 cf/sx (26.3bbls) (100' in 4 1/2" prod casing, 102' in 12 1/4" OH + 20% Caliper Log, and 108' in 8 5/8" surface casing)
- 7 TOOH 2 3/8" production tubing. Stand Back.
- 8 MIRU WL. RIH gauge ring for 4 1/2" 11.6#/ft casing to 8083'. RIH CIBP w/ WL. Set at 8000'. PU dump bailer, dump bail 2 sx class 'G' cement on CIBP. Do not PT (note squeeze holes).
- 9 Run CBL from CIBP to Surface. Forward results to Evans Engineering.
- 10 PU 2 - 1' 3-1/8" perf guns with 3 spf, 0.5" dia 120° phasing. Shoot 1' of squeeze holes at 7290' and 6920'. Adjust perf heights according to cement location on CBL. Desired bottom perf is 20' above TOC; Desired top perf is 400' above 7321' (Niobrara Top).
- 11 PU CICR. RIH and set at 6950'+/-20' pending collar locator on CBL. RD WL.
- 12 RIH w/ 2 3/8" tubing while hydrotesting to 3,000 psi.

- 13 RU Cementers. Pump Niobrara Suicide: 130 sx 50/50 Poz "G" w/ 20% silica flour, 3% gel, 0.1% sodium metasilicate and 0.4% FL-52 mixed at 13.5 ppg and 1.71 cf/sk (35.6bbls) (9.5"+ 20% Caliper Log in file) to place suicide squeeze between perfs. Underdisplace and sting out of CICR to leave 3 bbls on top of retainer.
- 14 PUH 6 stands. Circulate 95bbls water containing biocide to clear tubing.
- 15 Place 9.0 ppg mud containing biocide from 6762' to 4900' (~30bbls). TOO H & WOC 4 hrs.
- 16 RUWL & PU 2 - 1' 3-1/8" perf guns with 3 spf, 0.5" dia 120° phasing. Shoot 1' of squeeze holes at 4900' and 4290'.
- 17 PU CICR. RIH and set at 4320'+/-20' pending collar locator on CBL. RD WL.
- 18 RIH w/ 2 3/8" tubing.
- 19 RU Cementers. Pump 5 bbl water w/ biocide, 20 bbl Sodium Metasilicate, and another 5 bbl spacer immediately preceding cement.
- 20 Pump SX Suicide: 410 sx class "G", w/0.25 pps cello flake, 0.4% CD-32, 0.4% ASA-301 mixed at 15.8 ppg and 1.15 cf/sx (80.9bbls) (11"+20% Caliper Log in file) to place suicide squeeze between perfs. Underdisplace and sting out of CICR to leave 3 bbls on top of retainer.
- 21 PUH 5 stands. Circulate 60bbls water containing biocide to clear tubing.
- 22 Place 9.0 ppg mud containing biocide from 4132' to 1435' (~44bbls). TOO H & WOC 4 hrs.
- 23 RUWL & PU 2 - 1' 3-1/8" perf guns with 3 spf, 0.5" dia 120° phasing. Shoot 1' of squeeze holes at 1435' and 875'.
- 24 PU CICR. RIH and set at 905'+/-20' pending collar locator on CBL. RD WL.
- 25 RIH w/ 2 3/8" tubing.
- 26 RU Cementers. Pump Surface Suicide: 350 sx Type III CaCl₂ cement mixed at 14.0 ppg and 1.53 cf/sx (93.2bbls) (530' inside 4 1/2" Prod Casing and 560' in 12 1/4" OH + 20% excess, and 2 bbls on top of CICR) to place suicide squeeze between perfs. Pump all but 2 bbls. Sting out of CICR and spot 2 bbls on top of retainer.
- 27 TOO H circulating as necessary to clear tubing. Place 9.0 ppg mud containing biocide from 717' to 410'. WOC 4 hrs.
- 28 RU WL. Crack coupling or shoot off casing at or below 310'. RDMO WL. Circulate hole using 20 bbl water containing biocide to remove any gas.
- 29 NDBOP, NDTH.
- 30 Install BOP on casing head with 4 1/2" pipe rams.
- 31 TOO H with 4 1/2" casing, LD.
- 32 RIH with 2 3/8" tubing to 410'.

- 33 RU Cementers. Spot Stub Plug: 100 sx Type III CaCl₂ cement mixed at 14.0 ppg and 1.53 cf/sx (26.3bbls) (100' in 4 1/2" prod casing, 102' in 12 1/4" OH + 20% Caliper Log, and 108' in 8 5/8" surface casing).
- 34 Circulate 5 bbls water containing biocide to clear tubing.
- 35 TOOH. WOC 4 hrs. Tag Cement. Cement top needs to be above 150'; Proceed assuming TOC is above 150'. Otherwise, call production engineer.
- 36 MIRU WL. RIH 8 5/8" CIBP to 100'. Set, PT to 1000 psi for 15 min. If tests, RDMO WL and WO rig.
- 37 Supervisor submit paper copies of all invoices, logs, and reports to Joleen Kramer.
- 38 Excavation crew to notify One Call to clear excavation area around wellhead and for flowlines.
- 39 Excavate hole around surface casing enough to allow welder to cut 8 5/8" casing minimum 5' below ground level.
- 40 Welder cut 8 5/8" casing minimum 5' below ground level.
- 41 MIRU ready cement mixer. Use 4500 psi compressive strength cement, (NO gravel) fill stubout.
- 42 Spot weld on steel marker plate. Marker should contain Well name, Well number, legal location (1/4 1/4 descriptor) and API number.
- 43 Properly abandon flowlines per Rule 1103. File electronic Form 42 once abandonment complete.
- 44 Back fill hole with fill. Clean location, level.
- 45 Submit Form 6 to COGCC ensuring to provide 'As performed' WBD identifying operations completed.

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