

WELL HISTORY

GEO CORE HOLE N-4

- 7/23/87 Big Three Drilling mobilized to site, rigged up and lined sump pit.
- 7/25/87 Drill 0-70' in overburden with cable tool. Cement added in increments during drilling. Experiencing some caving.
- 7/26/87 Drill 70-90' with cable tool.
- 7/27/87 Drill 90-94' with cable tool.
- 7/28/87 Big Three Drilling is working on rotary rig (parts fabrication/maintenance). Drill 94-105' with cable tool. Rotary rig serviced and mobilized to site.
- 7/29/87 TIH with 8" air hammer. Drill 105-145' with foam with partial returns. POH. Free fall 3 yds of 22 sack into hole. TOC @ 77'. WOC.
- 7/30/87 5 yds of 7 sack/aggregate delivered to site. Free fall 3 yds into hole. TOC @ 15'. 2 yds slurry discarded to sump. WOC.
- 7/31/87 Drill cement 15-90' with air hammer with returns. Drill 90-265' with air hammer without returns. Place 3 yds of (12-15) sack aggregate slurry into hole with TOC @ 77'.
- 8/1/87 Drill cement 77-210' with returns. At 210' break into open hole. Ream and chop 210-310'. Clean hole. Free fall 3 yds of 12 sack aggregate slurry into hole. TOC @ 118'. WOC.
- 8/2/87 Drilled cement 118-220' with returns. Caving below 220'. Free fall 2.5 yds of 22 sack slurry into hole. TOC @ 223'. WOC.
- 8/3/87 Drilled 223-270' in cement with returns. Drilled 270-325' in rock with partial returns. Caving @ 220-223' and 270-285'. Free fall 3 yds of 22 sack slurry into hole. TOC @ 120'. WOC.
- 8/4/87 Drilled cement 120-183'. Drilled off cement @ 183'. Drilled 183-325' with partial returns. Drilled 325-365' with foam with partial returns. Free fall 2 yds of 22 sack slurry into hole. TOC @ 270'. WOC.

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8/5/87 Hoses broke and leaked all hydraulic oils. Rig down for repairs.

8/6/87 Drilled cement 270-320'. Came out of cement in new hole @ 320'. Drilled to 365' in new hole. Drilled 365-445'. POH to 320'.

8/7/87 RIH to 337' and hit bridge; hole caved overnight (caving zone @ 337-347'. Free fall 1 yd of 22 sack slurry into hole. String-line sent downhole (no indication of grout); however, hole started making water @ 200'.

8/8/87 Free fall 5 yds of neat cement, 22 sack/6 gal. String-line sent downhole to identify TOC. No indication of grout @ 337'. Hole still making water @ 200'. 6 yds of 6 sack/sand aggregate slurry delivered to site. 3 yds of this mix placed with TOC @ 70'. The other 3 yds discarded to sump. WOC.

8/9/87 Tagged TOC @ 70' with 8" tricone assembly. Drilled 70-245' in cement with water entry still present @ 200'. After 1.5 hours hole cleared of 60' of water.

8/10/87 Jack Hall of Big Three Drilling traveled to Portland, Ore. to pick up mud pump, sub, and 12" hole opener (hammer type). Presently hard-facing 12" hole stabilizer.

8/11/87 Excavate supplemental sump pit. Free fall 3 yds of 22 sack slurry (+ 100# calcium chloride) into hole. WOC.

8/12/87 At 12 midnight drilled cement to 175' while green. WOC. Drilled with air hammer 175-200' in cement with returns. Drilled off cement @ 197-204' interval. Drilled 200-310' with partial returns. POH overnight to 195'. Water entry evidently not blocked off as driller allows that there is more water in hole than they pumped.

8/13/87 Drillers RIH & clear hole to 310'.

8/14/87 Big Three Drilling (hard faces) 12" stabilizer. POH 8" pvc conductor. Weld T on 12" metal conductor section. Pick up 12" stabilizer, hammer, and pilot bit. Start reaming 12" hole. POH overnight.

8/15/87 RIH with 12" opener assembly. Fan motor quits. Down until this motor can be changed out.

8/16/87 Awaiting fan motor before resuming drilling.

8/17/87 New motor installed. Ream 12" hole to 20'. POH. Weld ears on 12" conductor/T assembly and lower into

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hole. RIH, ream 12" hole to 95' with returns. POH overnight.

8/18/87 RIH and ream 12" hole to 175' with returns. POH overnight.

8/19/87 RIH and ream 12" hole to 295'. From 175-275' there were returns. From 275-295' drillers lost circulation and are experiencing some caving. Pull back, RIH with more poly and foam. Regained circulation @ 290'. Ream 12" hole to 305' with returns. POH. Run 8 5/8" O.D. (.188 wall) welded casing to 302'.

8/20/87 Mobilize tanks, gel, etc. to circulated hole prior to cementation of 8 5/8" casing.

8/21/87 The following is the chronology of cementation procedure of 8" casing to 302':

11 AM pre-mixed bentonite mud (five 50# sacks of bentonite with 1000 gallons water).

11:40 AM pumped bentonite mud into hole and chased with 600 gallons of water.

1:50 PM pre-mixed 100# of bentonite with 150 gallons of water. Bentonite mud then added to 22 sack slurry (no calcium chloride added).

2:07 PM started pumping slurry into hole (4.5 yds poured by 2:40 PM).

2:40 PM stopped pumping. Waiting on second load of cement.

3:20 PM started pumping second load of cement.

3:35 PM finished pumping cement (additional 4 yds) for a total of 8.5 yds of slurry chased with 500 gallons of water.

There was no pressure build-up or returns during cementation of 8" casing. Locked in pressure at well head after cementation. WOC for a least 24 hours.

8/22/87 WOC.

8/23/87 Weld 8" return outlet to 12" conductor. RIH with 8" tool assembly. Tap TOC at 200' (100' of cement in casing). Drill out cement from 200-302'. Drill 302-400' in rock with returns.

8/24/87 Drilled from 400' to 483' in rock. Free fall 4+ yds of 12 sack slurry into hole. TOC @ 140'. RIH, drill cement 140-320' with partial returns.

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- 8/25/87 Drilled cement 320-431'. 500' of 4 1/2" O.D. casing delivered on site. 11 AM hydraulic pump on CP rig quits with drill steel @ 431'. Big Three Drilling is down until pump can be replaced. Hydraulic pump changed out. POH to 300'.
- 8/26/87 RIH and drill cement 431-483'. Wash and clean hole. POH. Strap 4 1/2" O.D. A-53 casing and start running casing into hole.
- 8/27/87 1145PM connect last length of casing with wiper plug assembly. Casing extends to 478'. Complete cement head assembly. Set up mud pump. Begin mixing bentonite mud for circulation prior to cementation. Total of 250 gallons of water to 100# bentonite. 1240PM pumped in first batch of bentonite mud into casing. 1255PM pumped in 2nd batch of bentonite mud into casing. 1PM started mixing bentonite mud (25# bentonite to 125 gallons of water) to mix with cement. 110PM first cement truck arrives. 115 PM pump bentonite mud into cement truck and mix. 130 PM started pumping cement into hole. 140 PM 2nd truck arrives. 150 PM 1st truck finishes pumping 6 yds of 22 sack slurry. 2nd truck starts pumping cement into hole. 210 PM 2nd truck finishes pumping 6 yds of 22 sack slurry. Total of 12 yds pumped into hole. 220 PM start chasing cement with 300 gallons of water. Run wiper plug down casing. 245 PM closed in pressure on wiper plug at 250 psi. 3 PM ran down stinger to find top of cement and found water @ 49' below surface. WOC.
- 8/28/87 2 PM ran 1" pvc stinger down 4 1/2" annulus in attempt to determine top of cement. Sent weighted string line down pvc to 400' (i.e., best estimate of TOC in 4 1/2" annulus). 630 PM Readymix truck arrives with 6 yds of 22 sack Portland slurry. 100# calcium chloride added to truck and mixed. Top off (cement at surface) 4 1/2" casing annulus with approx. 4 yds of cement (placed from surface). Remove packer in 8 5/8" annulus and start top job. Place remainder of cement from first Readymix truck (2 yds) into 8 5/8" annulus. Mix 100# of calcium chloride into second Readymix truck (also holding 6 yds of 22 sack/Portland slurry), and mix/rotate. Pour slurry from surface until cement is 8' from surface in 8 5/8" annulus (~2+ yds). Discard remaining cement slurry to sump (~4 yds). Release 4 1/2" casing. POH with 12" conductor section. Back-off first section of 4 1/2" casing (i.e., this leaves pin @6' below ground level for BOP flange). WOC.
- 8/29/87 Big Three Drilling demobs. Cellar excavated. Site leveled and sump backfilled. Tonto Drilling mobilizes equipment to site.

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- 8/30/87 Cribbing for cellar constructed. 8 5/8" O.D. casing cut @ bottom of cellar. 4 1/2" casing prepared to take flange. Equipment mobilization continues.
- 8/31/87 Cement perimeter of cellar cribbing with 7 yds of 6 sack aggregate for drill rig support over hole. WOC.
- 9/1/87 WOC before moving rig over hole. Equipment mobilization continues.
- 9/2/87 CP-50 moved over cellar, leveled, and blocked. Hydraulics to BOP connectd. Preliminary BOP test will be conducted by Tonto this evening. USFS fire danger upgraded to class 3 today (i.e., no heavy equipment haulage from 1-8PM).
- 9/3/87 Waiver to continue drilling operations due to class 3 fire danger was obtained from USFS. BOP test with BLM reps failed due to bleed-off of pressure. BOP tested internally and passed (i.e., bleed-off occurring down hole). Sump capacity calculated and found to be satisfactory. RIH with HQ rods to ~455' where slurry fall-in (slush) encountered. Place 1 bag of cement slurry through rods to 455' (i.e., in attempt to stop casing bleed-off if it is occurring @ casing shoe). WOC.
- 9/4/87 POH to 400' and circulate bentonite mud for two hours. Pressure up against hydrill with 800 psi through swivel hose. Bleed-off ~100 psi in 4 minutes. Repeat test with same results. Pressure up casing against hydrill with 800 psi through kill line. Bleed-off remains ~100 psi in 4 minutes (i.e., occurring in casing string). BLM and DOGAMI reps witness test. BLM authorizes coring to 212 F. RIH with 3 7/8" tricone and wash and ream to 478'. Drill out rubber plug and cement shoe to 480'. Wash hole. Cored 482-512' @ 8'/hr. Lost circulation @ 509' (dry to bit).
- 9/5/87 Pump LCM; hole still dry. Cored 512-552' in cinders; hole caving. Drill cave @ 542' and 552' for 15 minutes at each interval. Cored 552-583' @ ~7.5'/hr.
- 9/6/87 Cored from 583' to 738'. Tripped rods for grease @ 632'. Wash and ream cave zones between 490' to 540'. Trip rods for new bit (#2), serial #L-15725 @ 703"
- 9/7/87 Cored from 738' to 891'.
- 9/8/87 Cored from 891' to 965'. Encountered tight hole @ 912'. Washed hole to 922' to free hole. Conditioned tight zone with heavy mud and washed zone. Hole was still tight so pulled back to casing and washed and

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- reamed cave zone to bottom. Hole tight again. Pulled out rod. Pump 2 yds of 22 sack/6 gallon slurry. WOC.
- 9/9/87 RIH with core assembly. Tag cement @ 678'. Brought the interval 678-682' to surface. Cement still too soft. Will WOC for approx. 4 hrs. Drill cement 682-688' (i.e., still not good set).
- 9/10/87 Began coring cement @ 688'. Hole began caving @ 732', and drilled off of cement column. @ 830AM BLM informed GEO Newberry Crater (via telephone) of decision to suspend drilling until BOP passes pressure test. BLM delivered official notification of shut-down @ 11AM. Tonto pumping LCM to condition 480-732' zone for cementation tentatively scheduled for 9/11/87.
- 9/11/87 Pump LCM to 480-732' interval until pressure build-up (i.e., LCM stationary @ 480'). RIH with chopper. Chop and wash LCM to 740'. 2 yds of 22 sack slurry pumped to 740' with calcium chloride added. POH in 60's as cement is pumped. WOC.
- 9/12/87 Tagged cement @ 600'. Cement does not yet have good set. POH t 480', and circulate to clear rod of cement. Pump LCM to 480-600' zone and follow with 20 sacks of cement. WOC.
- 9/13/87 Tag cement @ 590'. Pulled back to 530'; cement still soft. At 130 AM pumped LCM, bridged hole from 530' to 520'. At 730 AM still no return; pumped more LCM. Followed LCM with 5 sacks of cement mixed with bentonite to cement hole above 520' bridge. WOC.
- 9/14/87 Pumped in 10 sacks of cement mixed with bentonite and calcium chloride. WOC. RIH, tag cement (still soft) @ 480'. Pump 5 additional bags of cement with bentonite and calcium chloride. WOC.
- 9/15/87 RIH and tag cement (still soft) @ ~430'. Water on top of this cement to ~330'. WOC.
- 9/16/87 RIH with core assembly. Tag cement @ 470'. Cement does not yet have adequate set. Tonto continues to circulate bentonite mud in H casing and WOC.
- 9/17/87 RIH with core assembly and tag cement @ 432'. Pressure casing against both hydril and pipe rams with less than 10% bleed-off in 30 minutes. Test witnessed by BLM rep. as satisfactory. "Notice to Shut Down Operations" rescinded and authorization to core ahead with HQ is give to GEO by BLM.
- 9/18/87 Put down tube. Drill out cement & LCM from 435-470'.

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- Pressure up BOP, pipe rams, test casing to 700 psi, 22 lbs. loss in 15 minutes. Drill cement to 479'. Pressure up BOP, hydril. Test casing to 700 psi with 600 lbs. loss in 5 minutes. Drill cement 479-512'. Lost return @ 509'. Pump LCM; plugged bit; POH (wet pull). Clean out rod, RIH to wash/drill LCM (returns until 509'). Drill cement 512-632'.
- 9/19/87 Drill out cement 632-696'. Tube blocked. Drill out cement 696-726'. Cored 726-736' in half concrete, half rock. Coring all new hole 736-771'. POH with coring assembly (i.e., RIH with chop rod). Pump 5 bags cement with 1 gallon calcium chloride. WOC.
- 9/20/87 Lowered rods to 725'; cement still soft. 630 AM cement was holding weight but too soft to core. 1PM tag cement, drill cement to 771'. Cored 771-809.5' in rock.
- 9/21/87 Cored from 809.5' to 872'.
- 9/22/87 Cored 852-952'. Bit run made @ 952'. Cored 952-979'. Bit changed @ 954'.
- 9/23/87 Experienced tight hole @ 979'. Pulled back to 800' then washed and reamed to bottom of hole with mud. This did not result in less rod torque. POH in 60's. RIH with chop rod, cement hole with 10 bags cement (2 gal. of calcium chloride added). WOC.
- 9/24/87 Tag soft cement @ 795'. Pull back. WOC. Tag cement (still not set). Wash rod down to 900' (green cement behind core barrel). Almost stuck rods. Pull back to free rods, wash to 902'. WOC (still not set). Cored 912-915' in cement. Cement soft (i.e., wash to 918'). WOC. Cored 918-979' in cement (good set).
- 9/25/87 Cored 979-1072' in rock.
- 9/26/87 Cored 1072-1159' in rock. Hole became tight. Pulled rods back to 900', washed and reamed hole; remained tight. POH to check bit and grease rods. RIH to 680' where hole had bridged with LCM. Pumped LCM out of rod. Lowerd tube, reamed up and down through cave zone retrieving cement that had caved into hole. Rigged to ream in 60's. Reamed to 1000'. Hole free of debris down to 1159' at 530PM but experienced rod vibrabion due to wash-outs. Cored 1159-1172' in rock with bad vibration. Discontinued drilling @ 930PM due to bad rod vibration. Decision made to reduce to NQ hole. Washed hole, tripped out core barrel, put on rod shoe, trip back to bottom of hole.

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- 9/27/87 Washed hole, pulled back, began preparation for NQ drilling and cementation of HQ rod from 1170' to bottom of 4" casing. Began unbolting BOP. POH until scheduled cementation of HQ rod tomorrow morning.
- 9/28/87 730AM tripped in rods to 1169' and rigged for cement job. Cement truck arrived on site with 5 yds of 22 sack/6 gal. slurry w/o calcium chloride. Started pumping cement @ 1125AM. After 1 1/4 yds pumped into hole, 5 gal. of water added to remainder of cement. Finished pumping @ 1210PM. Approx. 3.2 yds pumped into hole. Finished pumping after obtaining 900 psi. 1225PM began top job. Poured approx. 2 cubic feet of cement, finishing @ 1240 PM. BLM rep. present for cemenation.
- 9/29/87 Tag cement @ 90' with tricone assembly (NQ). Drilled cement 90-800'.
- 9/30/87 Drilled cement 800-1150' with tricone assembly. Pressured hydrill and blind rams with less than 10% bleed-off in 30 minutes. BOP test witnessed by BLM rep. as satisfactory. Changed out o-ring on left ram. Trip out tricone after BOP tst. Hook up rotating head, bit, and core barrel (NQ). Wash and ream to 1150' and drilled cement 1150-1172'.
- 10/1/87 Cored 1172-1241' in hard rock.
- 10/2/87 Cored 1241-1342' in hard rock. Lost returns @ 1243'.
- 10/3/87 Cored 1342-1408' in hard rock.
- 10/4/87 Cored 1408-1500' in rock.
- 10/5/87 Cored 1500-1586' in rock.
- 10/6/87 Cored 1586-1743.5' in hard rock. Static fluid level fell to 1050' @ 1620'. Water entry @ 1620'. TOOH for bit run. Change bit, shell, grease, and RIH to 1180' (hit cave).
- 10/7/87 Drill and wash cave 1180-1743.5'. Cored 1743.5-1802' in hard rock.
- 10/8/87 Cored 1802-1889' in rock.
- 10/9/87 Cored 1889-2002' in rock.
- 10/10/87 cored 2002-2102' in hard rock.
- 10/11/87 Cored 2102-2193' in rock. Fluid level dropped from 1000' to 1600' @ 2186', with water coming into hole at this level. Pumped heavy mud due to caving @ 2186'.

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- 10/12/87 Cored 2193-2254' in rock. Fluid level dropped from 1600' to 1800' @ 2199', returning to 1600' @ 2213'. Tripped out rods 10/11/87 to clean out core barrel, bit still good. Tripped in to 1600', wash and drill cave from 1600' to bottom. Cored 2254-2306' in rock. Fluid level static @ 1600' with water entering at this level. @ 2287' began having high rod torque; pulled back 240'; washed back to bottom of hole.
- 10/13/87 @ 2306'^{TD} again experiencing high rod torque due to caving between 1172-1600'. Rigged up, pumped and back drilled out of hole to 2032' wher rods became stuck in hole. Decision made to reduce to BQ.
- 10/14/87 Waitng on arrival of BQ rod before cementation of NQ rod. Continuing to pump mud at one hour intervals.
- 10/15/87 Hauling HQ and NQ supplies away from the drill site. Waiting on arrival of BQ rod and accessories before cementation of NQ rod.
- 10/16/87 Pumped 15 bags of cement into hole @ 530AM to cement NQ rods. Chased cement with 150 gallons of water. WOC. BQ rods and equipment arrived @ 11AM. Made up BQ core barrel. Checked cement by pumping fluid, but unable to get pressure. @ 1030PM pumped in additional 10 bags of cement.
- 10/17/87 Pressure checked cement. Cut NQ rod and lift'd BOPE. Completed top job of NQ rod using 9 gallons of cement (5 gallon mix).
- 10/18/87 Prepare BQ rod; cut NQ rod below BOP; reset and hook up BOP and make up BQ wash rod. Run BQ rod to 1010'. Found no water in hole. Pumped in additional 5 bags of cement (mixed with 5 gallons water, calcium chloride and multi-seal). POH in 60's.
- 10/19/87 Installed BQ chuck jaws. Checked cement by filling casing with water but lost fluid @ NQ-BQ casing top job. Re-apply top-job cement. Presently breaking BQ 20's. Preparing for pumping cement using HQ rod to fill annulus between NQ and HQ rod and hole below 2032' (below NQ rod). Discovered flange was loose. Removed surrounding cement to repair. Threads on casing shot. Will adapt flange to HQ rod. Lowered BQ rod to check fluid level. @ 1030PM fluid level was @ 280' and remained static for at least 4 1/2 hrs.
- 10/20/87 Lowered BQ rod to 240' and rigged for cement job. Pumped in 5 sacks (5 gallon mix) of cement @ 9AM. WOC.
- 10/21/87 Began lowering BQ rods to tag cement @ 5PM yesterday.

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Heavy cement scale and some tight joints in NQ casing. Stopped and washed every 100'. Encountered 4' of cement @ 1200'. Required to POH; trip in coring assembly to remove this cement. RIH to 1930'. Drill cement 1930-1933'. Water from 1933-1960'. Circulation still present. Attach flange to HQ rod. Assembled BOP stack.

- 10/22/87 POH, engage blind rams, pressure to 400 psi through kill line. Pressure very erratic in 200 to 400 psi range. After pressure released, water flows over top of BOP after a delay. Decision made to drill out of NQ assembly to ~2500' (without BOPE test) and this plan was approved by BLM. RIH with BQ to drill out NQ landing ring/bit. POH for bit check. Discovered that BQ rods are twisted off @ 1540'. Tapped BQ fish @ 1680' POH w/fish (fish only 10' joint of BQ broken on both ends). RIH w/tap. Caught remaining BQ fish and POH. Bit still in good condition. RIH to 2021' to try and drill NQ landing ring. BQ rods twist off again @ ~1680-1690'.
- 10/23/87 POH. RIH w/tap. Tap BQ fish, start out with fish ~10', lost fish to bottom (twice @ ~1680-1690'). RIH w/tap. NQ barrel sitting @ 2045' with BQ barrel jammed inside. Pull back fish 15' (i.e., B core barrel stuck in N core barrel which hangs up @ bottom of N rods). Wind tap in to 3000 lbs. torque with machine, pull 2000 lbs. hoist, tap won't stay. Decide to leave BQ fish in hole. Pump clean water in hole. Finish braking out BQ rods in 10's. Drain up, haul rods and core boxes to LaPine, Oregon, and unload.
- 10/24/87 Send overshot to ~1900' where overshot sits down. Decide to mobilize Geotech Data for temperature/gamma profile to 1900' without liner in the hole. Tonto Drilling is proceeding with demobilization.
- 10/25/87 Tonto Drilling Service continues demobilization. Expect to have drill and power plant off site later today.
- 10/26/87 Tonto Drilling continues demobilization. Expect to have mud off site today. Fabricating casing short today.
- 10/27/87 BOPE scheduled to be picked up today by H&H. Tonto Drilling demobilization completed.

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