



BAROID IDP

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CASE HISTORY: Hole Plug Application to Deep Core Holes

ABSTRACT: A **Hole Plug, 3/8"** application deeper than 2500 ft has not been documented in Baroid IDP or its customer base to date according to the authors' knowledge. The question is: can we inhibit bentonite chips from swelling long enough to prevent them from plugging the drill string prior to the placement at significant depths such as a deep coring program by pumping at a reasonably low volume. Secondly and perhaps more importantly, can we leave the bentonite remaining swelling potential after application at this depth.

A lost zone (LZ) on a deep core required consideration of this technique as a solution to heal the extreme LZ and restore water level in the hole and circulation.

Procedure to successfully apply 2 separate, 5 bag **Hole Plug, 3/8"** pills at a hole depth of 3762' (1147m) in an HQ hole is documented herein.

DETAILS: A deep, vertically collared, [3762' or 1147m], core hole "leg" lost all returns and most of its fluid level on a steering motor run at depth of 3741' (1141m). The loss of fluid was total and left such a deep fluid level in the hole, (+/- 1800 ft or 549 m) it was intolerable due to the requirement for pumping high volumes of fluid to operate the motor combined with the limited mixing capacity at the rig.

A total of 1 pallet each of Baro-Seal and N-Seal in several LCM "Bombs" in addition to prior bucket slugs of absorbent "diapers" were tried with no success. The LCM pills held some water pressure, but a reduction in bit weight indicator caused by increasing rod buoyancy readings revealed the fluid was rising. In other words, the fluid rose up the hole; but subsequently "blew-out" the into the LZ prior to delivering returns to the surface.

Hole Plug, 3/8" was selected to try prior to recommending pressure cementing with oil field cementing service, or other options.

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PROCEDURE: As the “Lost Zone” or “LZ” was encountered while motoring “full hole” no core record of the LZ exists. Furthermore, motor drilling reported no “void” when drilling at the LZ of 3741’; only a total and rapid loss of circulation there. The hole was literally sucking any material into the hole.

The decision was made to mix a heavy slurry of **EZ MUD GOLD (EMG)** in one batch to provide continuous application: prior to, during and as a chase fluid to the **HOLE PLUG**. Calculated additional chase fluid will be comprised of standard project motoring mud (**Soda Ash, QuikGel Gold, Quik-Trol & EZ Mud DP**) to chase the **HOLE PLUG** from the HRQ drill rod at 3722 ft. Setting time recommended of 10 hours prior to washing in to test results.

Pilot test with **EZ MUD GOLD** 5 #/ bbl (11.9 #/ 100 gallons) proved a minimum of a 30 minute working time to get the product out of the drill string and in place for sealing the hole.



Mixing EZ MUD Gold @ 5 lbs/bbl

To 300 gallons of fresh water we added 2 qts soda ash, and 16 qts. **EZ Mud Gold**. Mixing slurry time was approx. 45 minutes. A centrifugal pump was substituted for the in-tank hydraulic-driven propeller mixer after 4 qts.

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of **EMG** was added to tank because the in-tank mixer quit. Marsh Funnel Viscosity was measured after 10 minutes mixing at 99 seconds/quart. **A bottle sample was taken of EMG Slurry and inserted Hole Plug with the level marked on the bottle. The bottle was sealed and labeled for reference later.**



Also, a bottle sample of EZ MUD Gold slurry with Hole Plug 3/8" was taken.

With rods 40' above the LZ (60' off bottom); the Bottom Hole Assembly (BHA) consisting of a HQ 10' core barrel with 3.840" Oversize Bit and Reamer (no inner tube) and 3702' of HRQ rods (38 gal/100ft inside capacity, 3.75" OD), the foot-clamp procedure went as follows:

1. Lead with pumping 4 minutes (for approx 40 gals) of **EMG** Slurry to pre-coat the ID of the drill rod with **EMG** Slurry prior to application of **Hole Plug**.
2. Fed into a "threaded hopper", we added 5 bags SCREENED HOLE PLUG (calculated to fill 40' of a 4" hole)

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Screened Hole Plug 3/8" awaiting insertion to the hole.



Hopper for HOLE PLUG insertion to HRQ rods

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3. Fluid pumped into the hopper to coat and assist the HP down the rods at 10 gpm (after 1 bag pump rate decreased to +/- 5 gpm due to an air bubble forming at collar of hole). Total time for **Hole Plug** insertion was 7 minutes.
4. Assembled, hooked-up and pumped the remaining **EMG** Slurry (approx. 150 gals) then chased with 680 gallons of Drill Mud from the main tank. TOTAL TIME for **HOLE PLUG** insertion and to pump out of drill rods : **45 minutes**
5. Rods were then pulled to a level inside casing and to wait on the **Hole Plug** to “set”.
6. 300 gallons of extra mud was pumped after the rods were inside casing with slow rotation to clear any potential remaining **Hole Plug** from inside the drill string as an added precaution.

After 10 Hours sitting time:

The bottle sample indicated approximately 3 times volume increase from swelling and a firm character of the Hole Plug pellets. They were broken apart somewhat with rolling agitation but remained sticky and distinct entities. The sample was not a slurry of bentonite but a mass of individual swelled pieces.

RIH to 3702' (60' off bottom) and pumped to fill drill pipe. Pump rate at 25 gpm; fluid pressure initially at 50 psi on gauge and string weight at 650 on pressure gauge (relative).

Fluid pump pressure built and string weight decreased after 16 minutes to 350 psi and 540 psi respectively and driller reported fluid nearly at surface by readings on the weight indicator.

Almost immediately, fluid pressure released to 80 psi and weight gauge went to 650 simultaneously indicating the **Hole Plug** had “Blown out”.

The Drilling Contractor and Operator were contacted to assess options. Consensus between Operator, Drilling Contractor and BIDP personnel was that 20' of hole below LZ was filled with **Hole Plug**. Another 40' application was agreed upon as the best course forward, this time with 1/2 bag **N-Seal** in the 300 gals **EMG** Slurry for added adhesion, strength and body.

The procedures were repeated as above with the exception of the addition of the 1/2 bag **N-Seal** (17.5 # or 5.83 #/100 gals), and results were similar to the first application.

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SUMMARY

Application of Hole Plug at great depths can be accomplished. By making a large scale **EZ Mud / Ben Seal** type grout using **Hole Plug 3/8"** and slurry of **EZ MUD Gold** delivery at 3800' was accomplished successfully. The ability of the material to hold significant pressure prior to blowing out of the hole is evidence of the **Hole Plug's** swelling at depth, under pressure and in the presence of the **EZ MUD Gold** slurry.

Despite the need to further cement the hole it is felt that the **Hole Plug** application did indeed help the resulting cement jobs remain in or near the hole and certainly did not detract from the cement jobs' application.

CONCLUSIONS

Hole Plug as an option for "healing" deep holes from caving, instability and / or lost circulation should be considered a viable option in certain circumstances. Obvious limitations on a fully yielded **Hole Plug** seal and it not being a hard, solid entity must be understood when giving thought to this alternative to traditional LCM pills or cementing.

FOOTNOTE

Several days later, application of this method was successfully delivered in to an angle core hole at 6080' deep. This hole was collared at 60 deg and rises naturally with depth to 22 degrees –almost flat. As this writing, end result of this application are unknown due to delays on location NOT related to the plugging pill of **HOLE PLUG**.

Also it should be noted that while the 5 lb/ bbl in the above applications was used it could be possible to test lower **EZ MUD Gold** concentrations and still deliver the **Hole Plug** at depth successfully. We will likely try 3 # / bbl **EZ MUD Gold** on the next application in a vertical hole.