

Offshore Magazine

August 1991 edition Driller tests solution to stuck pipe problems Preventative drilling fluid treatment
 alternative to diesel fuel pills Jack C. Estes; consultant, Buford Gill; Grace Drilling Company

Stuck pipe is more than just a nuisance - it is a costly problem for operators and contractors. It is especially frustrating to the people on the rig who are keeping drilling fluids within specification, and keeping the drilling pipe moving. There are about as many reasons for pipe getting stuck as there are drillers who have been stuck. Years ago, there were fewer reasons, and all of them boiled down to just one reason - "bad mud." It was easy to blame the mud, when it weighed several points more than required, and solids control equipment was just about non-existent or barely working.

What's to blame? Today, good solids control equipment is available, and the means of using it for maintaining low solids muds have been widely taught. It is indeed difficult to blame bad mud anymore. In blaming the mud, we are really blaming ourselves. So what causes stuck pipe, when running a first class drilling operation?

- Sloughing shales
- Keyseat
- High differential pressure
- All of the above
- None of the above.

If one or more of the first four is selected, the answer is correct. But if the last one is selected, then that person probably has had the experience of placing a bit or tool into an under gauged hole or indeed has bad mud. Sloughing shale problems are usually treated by using a combination of chemical and mechanical methods. Keyseats are strictly mechanical problems, although mud lubricants do sometimes help. High differential pressure between the mud column and the formation pressure is the big pipe grabber. The wellbore tubulars simply get stuck in the mud cake formed on the side of the hole, and are held there by the force created by the mud column pressure against the area of pipe in contact with the mud cake.

Study of 48 wells

At a 1987 industry forum on New Orleans, a major operator reported on the results of a study on 48 stuck pipe wells during the past three year period in the gulf of Mexico: 60% were attributed to mechanical causes, and 40% were attributed to differential pressure. Spotting an oil-based mud pill in turbulent flow was the favorite treatment. Spotting was used on 80% of high differential pressure between these wells. About 40% of these came free during the first 48 hours. Most of these came free when the pill was pumped within 16 hours of becoming stuck. Only 10% were freed after being stuck for over 96 hours. Jarring or washover procedures were tried on only 20% of these wells. Pipe strings were easier to free in larger holes, with 90% of 12.25 inch or larger holes freeing up after oil pill treatment, or jarring, or both. Small holes, where the drill string tubulars are close to hole size, tended to remain stuck.

Second study

Another study was conducted by Grace Drilling during the following year on onshore wells. Grace experienced getting stuck about 100 times in 18 wells. This was in a sequence of pressure-depleted horizons and high-pressure horizons, and normally pressured horizons. The mud weight necessary to maintain well control exerted a pressure differential against the depleted zones that would grab the drill or the pipe, even when it was kept in motion.

Grace Drilling managers tried many available materials without much success against this differential pressure sticking. One material that produced some success was called Liquid Casing, produced by Gabriel International. The next 20 wells were drilled with fewer sticking problems.

In this area of Louisiana, deeper depleted reservoirs at 5,000-6,000 ft are overlaid with shallower reservoirs at 2,500-4,500 ft, which are still under secondary recovery operations, causing shallow high pressure zones. Mud weight must be raised above ten ppg to prevent saltwater flows. Differential pressure sticking almost always occurred on corrections, even when the pipe was kept moving.

Diesel pills

Typically, drillers would spot a 25-50 barrel diesel pill, and pull free in a time period ranging from minutes to up to 12 hours. Drilling began again, and after several hundred feet, the drill pipe stuck. The procedure was repeated.

The drilling plan normally called for drilling a 12 7/8-in. hole to 2,000 feet and setting 9 5/8-inch casing. This was usually done with no problems. The wells were drilled out with water, and sometimes saltwater flows between 2,500-3,500 ft were encountered. The saltwater flows were shut off by raising the mud weight to 10.2-10.4 ppg.

Occasionally, 40-50 bbl of diesel fuel were added as a precaution to avoid getting stuck, particularly before trips.

However, the pipe stuck anyway. At deeper depths, 8,000-10,000 ft, a pill of ten to 11 ppg of Black Magic was spotted and bumped one-half bbl every hour or two. If not free in 36 hours, the driller ran a free point, backed off, and tripped in jars.

Special treatment

The Liquid Casing material was used during a washover fishing operation. Several hundred 25-pound sacks of the material was mixed in a 1,000 bbl mud system. The action resembled a cased-hole situation.

Later, 150 sacks of the Liquid Casing® Fine was mixed with 80 sacks of a companion product called Liquid Casing® Coarse. These treatments helped stop the differential pressure sticking. There after, the drillers continued to mix eight sacks into the suction tank prior to each wiper trip, or when pulling out of the hole. By knowing where the sticking zones were, the suction pit mud was pre-treated just prior to drilling into troublesome formations. Typical treatments ranged from 12-48 sacks of Liquid Casing® Fine with eight to 18 sacks of a companion material called Liquid Casing® Coarse. Grace drillers found that circulating these pills also helped in working through tight spots in the hole.

The lighter treatments were used as a pill to spot around the drill collars while running a survey. This action was effective in reducing sticking while waiting on the survey. The heavier treatments were run to condition the hole for the casing.

The most cost effective concentration appears to be around eight ppd of Liquid Casing® Fine, combined with an equal or greater amount of Liquid Casing® Coarse. However, in lost circulation zones, higher concentrations appear to raise the pressure gradient where losses occur. The mud remains pumpable at high concentrations.

Hole plastering

One location was staked on a previous trash dump site. There was concern about the hole washing out beneath the rig. Twenty pounds per bbl of Liquid Casing with an additional 30 pounds per bbl of mud was used to drill some 435 ft of fill, in order to set conductor pipe. This plastered the weak hole so that it remained in gauge and gave no problems.

Another technique found useful was while drilling through the Smackover. About 40 bbl of Liquid Casing® Fine and Liquid Casing® Coarse at 25 ppb were mixed, and then pumped in at quantities of 5-6 bbl during any drilling break in the Smackover. Then, the mixture was spotted around the bottom-hole assembly before tripping out to log the hole.

Using the techniques described in this article, the use of Liquid Casing during simultaneous-lost circulation and kick control procedures, made the operation quicker and safer.

It is rather strange that the Liquid Casing does not appear to lower fluid loss, but stops sticking as if the mud had zero-fluid loss. The manufacturer claims this is because the processed cellulose particles are not intended to treat the mud, but to actually prevent a thick mud cake from forming on permeable formation walls. So, laboratory fluid loss tests are not useful in evaluating its effectiveness.

This special sealing action allows for easier coring and better drill stem tests, sealing as well as controlling seepage and fluid loss of whole mud to weak formation zones. Getting stuck drilling, coring, drill stem testing, or running pipe, generally costs 20-48 hours in rig time. Using preventative measures proved to be a cost-effective method to reduce this trouble time.

Today, with new rules concerning mud disposal, there are alternatives to the risk of contaminating the mud system with diesel spotting pills. AUTHORS

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