

MD-3 Triple-Deck Shale Shaker: MD-3 Shaker Technology helps reduce drilling fluid losses by over 75% while drilling and nearly 98% while running casing through Wellbore Strengthening Material Recovery Process in Mexico



THE SITUATION

Conventional shaker technology is ineffective in differentiating and separating valuable WSM from undesired finer drilling solids resulting in increased costs for the operator.

THE SOLUTION

The MD-3 Shale Shaker in recovery configuration offers a multi-deck solution to preferentially recover WSM while discarding detrimental drilling solids.

Well Information

Well Name Costero 24
 Type/Inclination Extended Reach Well/38°
 Location Celda Costeros -Tabasco Mexico
 Operator Schlumberger – IPM
 Date June 2010
 Mud Weigh MEGADRIL*, 1.98 gr/cc (16.5 ppg)
 Section Drilled 12¼” from 4,600 to 5,620 m

The Situation

One of the biggest challenges while drilling Costero block wells in the south of Mexico is the narrow operative window of pressure to avoid flosses (Figure 1), which require specially designed fluids and implementation of loss prevention techniques.

With this problem in mind, the mud was designed to strength the wellbore in order to reduce losses in critical sections. From previously drilled wells, it was known that the 12¼” section could present losses up to 215 m³ (1,353 bbl) during drilling and losses up to 470 m³ (2,950 bbl) while running casing and cementing as shown in Figure 2.

One method to prevent these losses is by plugging the thief zones with Wellbore Strengthening Material (WSM). These specially sized additives are introduced into the drilling fluid and through differential pressure are drawn into the formation to bridge the voids. The remaining WSM not drawn into the formation is carried back out of the wellbore with the fluid returns.

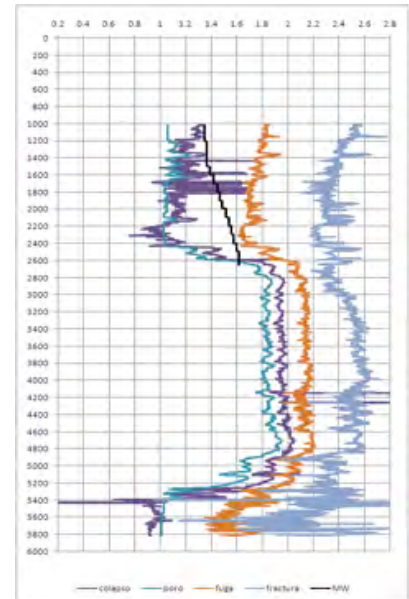


Figure 1: Reduced window between pore pressure, collapse pressure and losses that required well bore strengthening techniques to reduce losses and operative risks.

Traditionally, shaker screens will be sized to remove all fine material, but the screens will also eliminate all material from the system as they cannot screen the larger sized WSM from the finer drilled solids without increased the cost of treatment for the operator.

Clearly a more cost-effective solution is required for well bore strengthening applications where high concentrations of specially sized WSM are required.

The Results

Testing started from the spud of 12¼” section at 4,424 m (14,514 ft) to the end of this section at 5,620 m (18,438 ft) using a diesel oil-base MEGADRIL* fluid system, with 1.97 gr/cc (16.4 ppg) average weight. The fluid was designed for wellbore stabilization with a hoop stress enhancement treatment, containing WSM such as sized calcium carbonate and synthetic carbon, as presented in Table 1. Concentration of the WSM selected through I BOSS* system, was adjusted during the first three days of drilling as the result of the material returns from bottom hole and well behavior.

Table 1. Concentration of used materials for well strengthening

WSM	Initial Concentration (kg/m3 - ppb)	Adjusted Concentration (kg/m3 - ppb)
CaCO3 M70	0 - 0	10 – 3.5
Nut Plug Fine	7 – 2.5	9 – 3.2
G-SEAL PLUS	7 – 2.5	2 – 0.8

Installation of the MD-3 shaker in this rig was a challenge because the existing equipment (preferred installation) could not be removed. The MD-3 shaker was installed out of the rig shaker pit working as a totally independent recovery unit (hot work requirements restrictions) as shown in Figure 3.

The MD-3 process rate was up to 300 gpm, around the 50% of the total circulation rate, and the average screen life was 250 hours or higher, depending mostly in mesh size.

Testing was carried out using only one screen design during the whole interval, which was based on the selected WSM sizing and field experience from previous jobs.

Rig shakers were dressed with API 50 screens in order to remove only big drilled solids. The desired WSM materials and fine drilled solids were passed through the screens, making it more difficult to maintain controlled %LGS of “good solids.”

LGS in mud was no allowed to increase more than 17% as shown in Figure 4. Centrifuges were used to control this parameter when required.

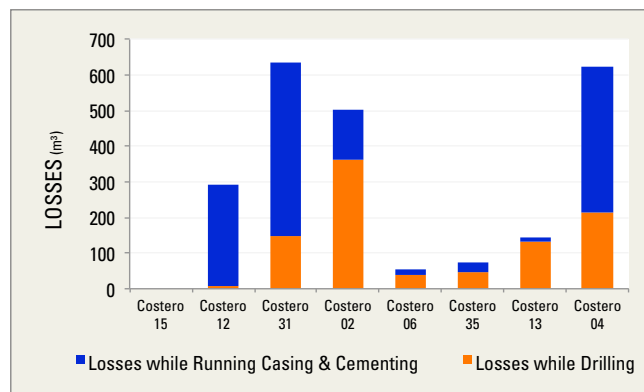


Figure 2: Historical record of fluid losses for Costero field.



Figure 3: MD-3 shaker installation for Costero 24 well.

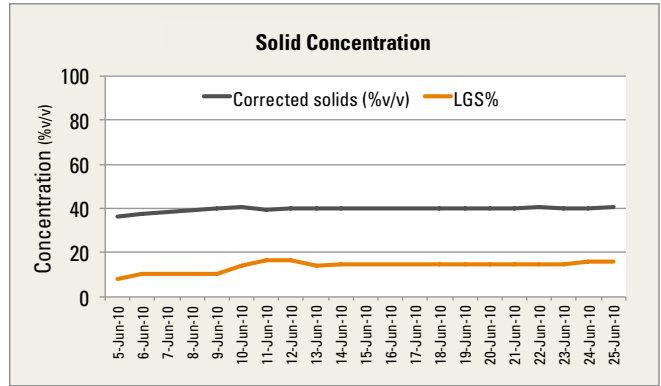


Figure 4: % LGS during drilling

Table 2 shows the screens selected for each deck of the MD-3 shaker: API 35 was used for the first deck to discharge only the larger drilled solids and let the WSM added pass through it. The second deck was dressed with API 120 to recover WSM and to pump it back to the system, and third deck was dressed with API 140 to discharge finer drilled solids.

Table 2. Concentration of used materials for well strengthening

#	Upper Deck	Medium Deck	Lower Deck
1	API 35 Mesh 38XL	API 120 Mesh 200XR	API 140 Mesh 230XR

WSM concentration was measured using the stacked wet sieve analysis with a range of screens between 75 and 500 microns. Results from this test (Figure 5) show a significant reduction in undesirable fine particle concentration after treatment — from 10 kg/m³ (3.5 lb/bbl) in the feed stream to 5 kg/m³ (1.75 lb/bbl) in the underflow total WSM larger than 75 microns.

As important as the cleanliness of the mud discharge is the amount of solids discharge and solids recovered. This value give a better representation of equipment performance in terms of separation. Figure 6 shows the volume discharge vs. volume recovered during the test.

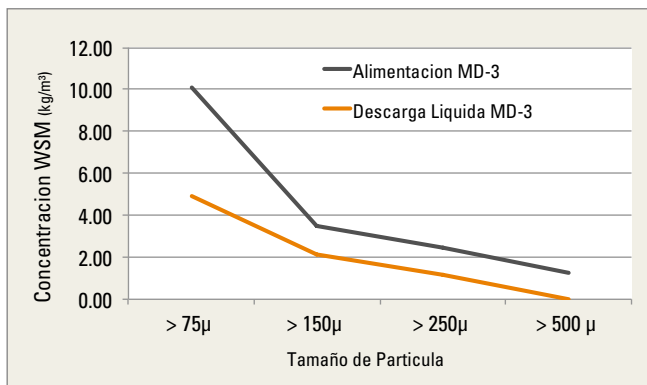


Figure 5: Solids Size concentration in feed and discharge of MD-3 shaker.

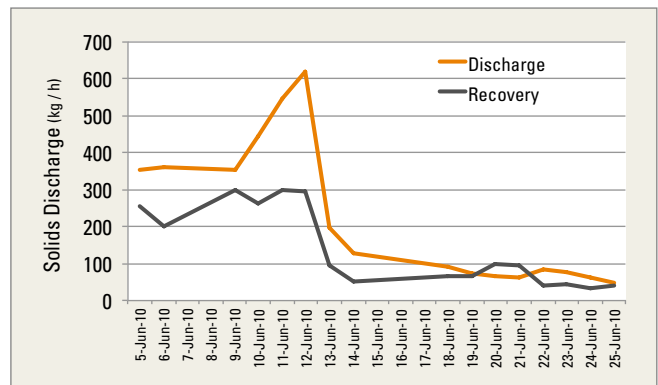
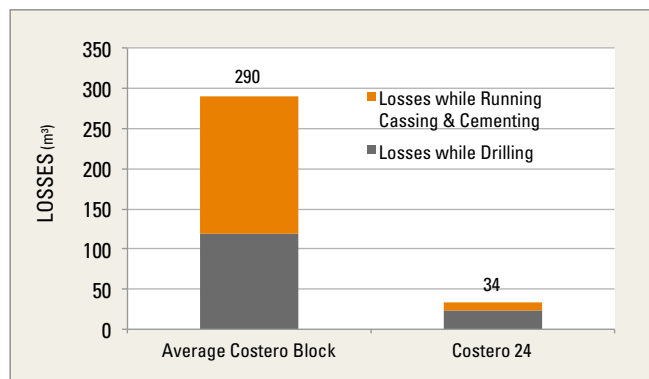


Figure 6: Volume of discharged solids vs. recovered.

Summary

- MD-3 shaker recovers and maintains efficiently material of required size in mud.
- Mud losses drilling were reduced in 75% compare to the average losses recorded in Costero Block.
- Mud losses running casing and cementing were reduced in 98% compare to the average losses recorded in Costero Block.
- WSM concentrations had a sensible reduction in areas were fractures were expected as a positive response of plugging analysis done before drilling these zones.
- High content of LGS is a typical characteristics of this application, but it did not affect performance of other rig equipment nor the fluid system (MEGADRIL*).



This information is supplied solely for informational purposes and M-I SWACO makes no guarantees or warranties, either expressed or implied, with respect to the accuracy and use of this data. All product warranties and guarantees shall be governed by the Standard Terms of Sale. Nothing in this document is legal advice or is a substitute for competent legal advice.

P.O. Box 42842
Houston, Texas 77242-2842
www.miswaco.slb.com
Email: questions@miswaco.slb.com