**EZ-PLUG® LCM reduces losses in high permeability, low fracture gradient sections of allochthonous zone**

Location: Monagas, Pirital, Venezuela

**OPERATOR’S CHALLENGE** – Lost circulation is common in the allochthonous zone because of low fracture gradients and high permeability. The zone is composed of multiple formation types adding to the complexity of maintaining an appropriate fluid density. The zone is composed of the following formations:

- Barranquín - limestone and sandstone
- Chimana/El Cantil - shale and limestone
- Caratas/Vidon - limestone, sandstone and shale

The challenge was to ensure wellbore integrity through each formation, which consisted of fracture gradients as low as 8.1 lb/gal, as well as high pressure sections. Lost circulation was identified by a reduction in the rate of return of the fluid. This was causing non-productive time and considerable increase in project costs due to loss of drilling fluid combined with added operational logistics. The operator identified that the particle size of the lost circulation material would be important in sealing the fractures, thereby increasing the fracture gradient for the PIC-38 well at depths of 1,109-1,219 feet. Offset wells showed considerable lost circulation in this section.

**HALLIBURTON’S SOLUTION** – Halliburton Baroid recommended the use of EZ-PLUG™ lost circulation material for its versatility as it is compatible with any drilling fluid. EZ-PLUG™ lost circulation material would provide fracture tip isolation and increase the resistance to wellbore pressure by sealing natural fractures. After analysis of the issues from previous wells and lab testing on the new fluids with EZ-PLUG™ LCM, Halliburton Baroid took the following actions:

- Add EZ-PLUG™ material at a concentration of 4 lb/gal to the circulating system
- Optimize the pump rate: the pump rate could be reduced without risking hole cleaning; maintaining the optimum rate would prevent annular turbulent flow
- Adjust density of the drilling fluid from 9.3 lb/gal to 9.1 lb/gal
- Switch the shaker screens from 210 mesh to 175 mesh in order to recover 65% of the EZ PLUG™ material to facilitate the maintenance on the system.

**ECONOMIC VALUE CREATED** – The optimization of the fluids program plus the addition of EZ-PLUG™ LCM allowed PDVSA to save approximately U.S. $26,6510.31 in drilling fluid costs and streamlined the operational logistics to achieve the primary objective: drilling and casing of the 17 ½-inch hole and completion of the section with only 240 sacks (40lb/sack), for a cost of U.S. $18,724. Additional non-productive time was avoided because a trip was not required to remove any of the downhole tools during the deployment of EZ-PLUG™ material.