



**CASE STUDY:** Operator names Baroid 'key contributor to drilling success'

## Baroid drilling and completion fluids – BARADRIL-N® reservoir fluid, completion brine, DFG™ hydraulics and wellbore stability modeling

### First deepwater Mediterranean horizontal payzone drilled successfully 10 days ahead of plan with optimized fluids and modeling

Location: Offshore Egypt, Mediterranean Sea

#### Challenge

Burullus Gas Company/Rashid Petroleum Company planned to drill in an Egyptian offshore field. The reservoir surveys indicated that the gas was contained in a very narrow target zone, only 15-m thick, and production would require a horizontal well. Not only was this the first horizontal well for Burullus, but it was also the first well of this type in Egyptian waters. Based on the long horizontal section, the nature of the formation, and the planned gravel-pack completion, several challenges were anticipated. These included mitigating expected losses, ensuring good hole cleaning while avoiding sand erosion, controlling high torque, and minimizing formation damage. Drilling the well with a horizontal section over 500-m long and successfully installing and gravel-packing a slotted liner would be difficult. The planned well was four times the length of previous wells drilled by Burullus, and good hole integrity was critical for reaching reaching target depth with the gravel-pack screens.

#### Solution

Although its local experience with deepwater horizontal drilling was limited, Baroid has extensive expertise in developing fluids and programs for successful horizontal drilling and completion. During Baroid’s systematic Technical and Black Book design processes, the importance and challenging nature of this well were highlighted. As a result, the Baroid Critical First Well Execution Process was initiated. This ensured the involvement of experienced engineers and advisors in order to properly identify and address all of the challenges.

**Drill-in reservoir fluid formulation.** Baroid proposed BARADRIL-N® reservoir drilling fluid for the horizontal section. Selected for its non-damaging characteristics, BARADRIL-N water-based fluid provides effective fluid-loss control and reliable wellbore and formation stability. The particle size distribution of the BARACARB® size-graded ground-marble bridging agent was optimized in order to obtain filtrate control without solids invasion. TORQ-TRIM® II PLUS lubricant was added to the fluid, and the concentration was optimized to control and minimize torque in the horizontal section. TORQ-TRIM II PLUS lubricant is based on a modified vegetable oil and provides lubrication with an excellent compatibility profile. The customized BARADRIL-N fluid formulation was tested extensively, using core samples to confirm and optimize its non-damaging nature.

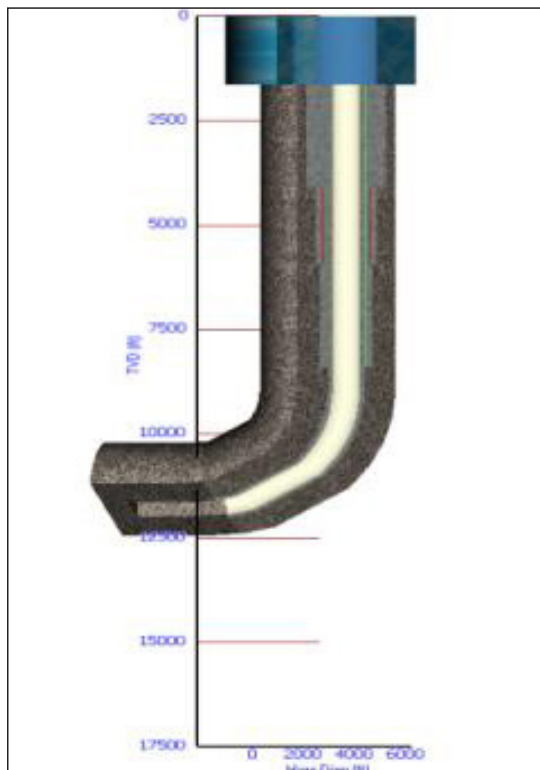
CHALLENGE	SOLUTION	RESULT
Overcoming the difficulties of drilling a 500-m-long horizontal section, and then installing and gravel-packing a slotted liner	Provided engineered drill-in and completion fluids, coupled with DFG™ hydraulics modeling, to help protect the reservoir from damage and ensure wellbore stability while drilling and completing the well	With Baroid’s optimized fluids and modeling, the well was delivered 10 days earlier than planned without compromising well productivity, resulting in formal commendations from customer

**Modeling for drilling optimization.** The complicated well trajectory and narrow target zone would require regular surveys, which would result in regular circulation shutdowns. Drilling conditions were simulated using Baroid's Drilling Fluid Graphics (DFG™) proprietary drilling hydraulics and cuttings transport software package. Using DFG modeling, the survey plan was optimized to allow one pump shutdown per stand. DFG modeling was also used to optimize the running speed of the lower completion. Issues associated with hole cleaning, cuttings accumulation, and high equivalent circulating density (ECD) were anticipated and avoided.

**Engineered completion fluid.** The well was drilled in approximately 500 m of water depth with a low mudline temperature. Selection of a completion fluid required the crystallization, hydrate-formation and shale behaviors to be completely understood and optimized. A mixture of calcium chloride and bromide brines provided the desired properties, and the addition of CLAYSEAL® shale stabilizer ensured the stability of the interbedded shales in the openhole section. As with the drilling fluid, the completion brine was tested in order to minimize the potential for formation damage. The well was drilled to target depth, well surveys were completed and normal ECD values were observed throughout the interval. During completion, the screens were run to depth and gravel-packed successfully. As a result of anticipating and identifying the technical challenges presented by this well, and then customizing optimal solutions, construction was completed ahead of the planned schedule.

### **Economic value created**

The reservoir was drilled successfully and the gravel-pack operation was conducted without any problems. By avoiding drilling issues and optimizing the fluid performance, the well was delivered 10 days earlier than planned without compromising the productivity of the well.



*Well schematic diagram*

**Rashid Petroleum Company**

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**شركة رشيد للبتروول**

عمارة ١ شارع ٢٩٤  
المعادي الجديدة - القاهرة  
تلفون : ٥١٨٢٣١٧ - ٥١٨٣٣٠٧ - ٧٠٦٦١٨٨ (٢٠٢)  
فاكس : ٥١٨٠٥٨٠ - ٧٠٦٦١٨٠ (٢٠٢)  
سندوق بريد : ١٠٧٣ المعادي الجديدة

**Mina-Da Deepwater Horizontal Well Drilling Team**

Your company and employees were key contributors to the drilling success of the recent Mina-Da Horizontal Well. The well was drilled in deepwater in an area renowned for the difficult drilling conditions, and to a target that was on the limits of wellbore surveying capabilities. It is all the more remarkable that the well was drilled 10 days better than plan and significantly under budget. Your achievement is widely recognised by both Rashpetco and its shareholders companies, EGAS, BG Group and Petronas and I include a sample of the notes of congratulation that have been received.

I would like to add my personal thanks to each and everyone of you for your contribution to the success of this project and I ask you to communicate this letter to the employees of your companies who have been involved in this success.

**Bob Andrew**  
Rashpetco Drilling General Manager

"This is great achievement and well done to all the team. Please pass on my thanks to everyone in the team who contributed to make this a success. I hope that the next phase goes smoothly and safely and please keep up the excellent work despite all the challenges!"  
**Khaled Kacem, Managing Director Rashpetco**

"The dream came true! 10years ago we asked ourselves and the service company specialists if we were able to drill a horizontal well in the deepwater Mediterranean, and concluded it was not possible. Today, this team has delivered our first horizontal well through excellent planning, execution and above all teamwork. Thank-you to everyone that has contributed to this achievement and we hope to see more horizontal wells in the WDDM concession."  
**Sherif Hassaballa, Rashpetco Assist. Chairman for Operations**

"Congratulations and Thanks on a well planned and executed operation, a first for Rashpetco and possibly Egypt. A fully integrated project, and delivered in the face of adversity. It shows what can be done even in difficult circumstances"  
**Griff Jones, BG Group**

Congratulation to the successful drilling of the 1st horizontal well in WDDM, ahead of schedule with drilling cost lower than AFE.

**Abdullah Empong, Petronas, Production management**



"Congratulations to you from everyone at BG Egypt.

To successfully drill the first WDDM Horizontal well 10 days ahead of schedule and without significant HSE or operational issues is a truly exceptional performance. It has only been made possible by the whole team coming together, both onshore and offshore, to solve the technical challenges of this well. We wish you and the team the best of luck for continuing success with the upcoming Horizontal Completion operations on the well."

**Anthony Pearce, COO, BG Egypt**



"Please pass on BGE Well Engineerings congratulations to all of your TEAM on the successful drilling of the first Horizontal well in WDDM, no mean feat considering 3-4 yrs ago this was deemed unachievable."

**Nigel Thorn, Well Engineering Manager, BG Egypt**

*The Baroid Egypt team received this official commendation from the Rashid Petroleum Company/Burullus Gas Company, and continues to work closely with the company.*