RMR Case Study 3 – BP, Sakhalina Island

RMR saves 9 days per well and gives zero discharge compliance

PROJECT — *AGR provided RMR services to Elvary Neftegaz (BP joint Venture) offshore Sakhalin Island in 2006*

KEY WORDS — *RMR * Zero Discharge * Environmental regulation * Reduce risk in driling * Reduces tophole drilling time * Safety improvement * Shallow Gas Control*

Background

Elvary Neftegaz, a joint venture between Rosneft and BP, is drilling remote exploration wells with semi-submersibles off Sakhalin Island. Russian environmental protection regulations forbid any discharge of cuttings after the conductor is set. Therefore cuttings need to be returned to the rig while drilling the surface hole. This could be done with the rig marine riser plus pin connector, but the rig diverter is then the only protection against shallow gas flow. The dangers of this method were shown by a blowout and explosion on the West Vanguard in 1985 in the North Sea.

RMR the best solution

After a number of risk reduction studies by the operator, AGR's Riserless Mud Recovery (RMR) system was chosen as the most suitable method. It achieves the well environmental objectives whilst minimising the risk from shallow gas. In practice, RMR also provides operational advantages and saves rig time compared to other methods (very useful in the short ice-free season).

Achieving Environmental objectives

The RMR system provides a 'closed loop' mud system before the BOP or rig riser is run. RMR pumps the mud and cuttings from the Suction Module (SMO) attached to the Low Pressure wellhead on the 30" conductor back to the rig. Cuttings are removed by the rig shakers before mud is returned to the pits for recirculation as in conventional drilling. The SMO is open to the sea but the good control provided by the RMR pump ensures there is no leakage of mud or cuttings to the sea.

"The RMR system delivered its anticipated safety and environmental benefits while improving operational efficiency by 9 days per well without use of the marine riser".

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Combating Shallow Gas

Drilling the surface hole with mud reduces the risk of shallow gas flow because a higher mud weight can be used. Drilling with a full column of mud back to the rig makes lost circulation more likely which could lead to flow. In the event of a gas flow with a rig riser but no subsea BOPs there is a route back to the rig for any shallow gas encountered. The rig diverter system is meant to deflect gas away from the rig floor but the pipe work may erode causing a gas cloud. A pilot hole could be drilled to identify shallow gas; this reduces, but does not eliminate, the risk. Drilling with seawater and sweeps without

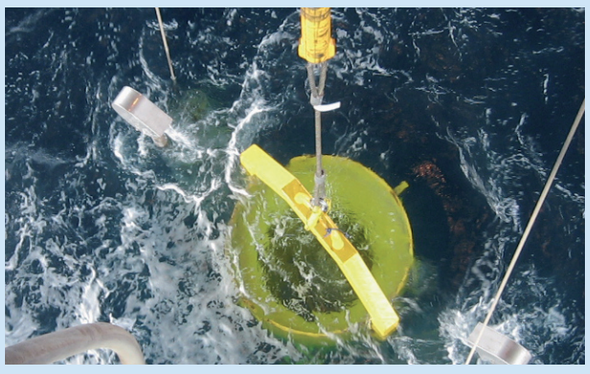

Figure 1: SMO launching

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the riser attached would allow the rig to move off location, away from any shallow gas plume.

RMR provides the best of both worlds. A high specification mud is used to drill the section making a shallow gas flow less likely. Also the rig can be immediately moved off location in the event of a flow. If there was a shallow gas flow, the valve on the mud return line is closed with no gas coming back to the rig. The Bottom Hole Pressure (BHP) is provided by mud from TD to mudline and seawater above (Dual Gradient Drilling). Because RMR pumps the mud across the air gap, the BHP can be equal to seawater hydrostatic, or greater as needed.

An additional safety feature of the RMR system is that, in the event of a shallow gas flow, an increase in pump speed will trigger an alarm within ~15 seconds (SPE 102579). Contingency procedures, pumping kill mud, can be started very quickly. The flow will be identified long before the gas reaches the mudline and so no gas will enter the mud return line. When drilling without RMR, the first indications of a flow would be when the gas bubbles are seen by the ROV in the sea.

Operational advantages with RMR

Because full specification mud is used in the surface hole, a stable, near gauge hole is drilled. This removes the need for a wiper trip before running casing. It means that the casing can be run to depth without problems. A better cement job in a gauge hole gives a more stable wellhead. When seawater / sweeps are used, the hole is washed out as shown by the cement volumes required, top up jobs are often required and large volumes of cuttings obscure the wellhead which need jetting away.

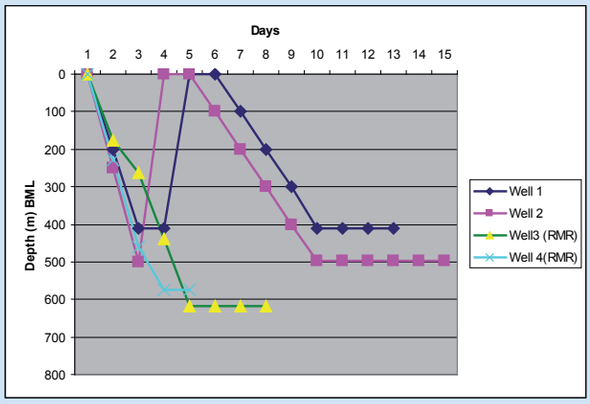

Figure 2: Drilling Time Curves

Operational experience

Two wells were drilled with RMR in 2006 and compared to wells in 2004/5 without RMR. The major time saving (average 9 days) with RMR were due to (1) Not drilling a pilot hole and (2) not running the marine riser. SECONDARY BENEFITS WERE;

- *NOT making a wiper trip*
- *NOT having to wash casing to bottom*
- *NOT setting a top-up cement job*
- *NOT jetting wellhead clear of cuttings.*

	Days	Metres	
2004 well	13.45	562	Pilot+26" hole in 2 passes
2005 well	15.33	644	Pilot+26" hole in 2 passes
2006 RMR wells	7.01	769	No pilot hole 17-1/2" hole
2006 RMR wells	4.85	728	No pilot hole 17-1/2"

Table 1: Comparison of days & section lengths

There was only 7 hours RMR installation / removal time on the critical path. Some time was lost with a generator cut-out and problems caused to the mud return line by the high current. The RMR wells were easier because 17-1/2" hole was drilled but exactly the same equipment would be used with 26" hole as the RMR system is designed to handle the volume of mud and cuttings generated.

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