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# Effective Perforating and Gravel Placement: Key to Low Skin, Sand-Free Production in Gravel Packs

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## Abstract

Cased-hole gravel packing is commonly utilized to control sand production from oil and gas wells. The success of a cased-hole gravel-pack job depends on the ability to effectively pack perforation tunnels, which act as conduits between the reservoir and the wellbore for hydrocarbon production.

This project presents a system approach for removal of perforation damage, effective gravel placement, and packing of the perforation tunnels. It was found that surging the perforations greatly increased the ability to pack the perforation tunnels and improved the connectivity to the reservoir. Guidelines to surging the formation and executing the perforation packing job are presented. This study also discusses the current practices commonly employed in cased-hole gravel packing to pack perforation tunnels and the potential limitations of these practices.

Incomplete packing of perforation tunnels is mostly encountered in gravel-pack jobs completed with brine as the carrier fluid (water packs). The proposed technique involves surging the perforations prior to the gravel-pack operation, followed by pumping the gravel slugs in a nondamaging carrier fluid in concentrations ranging from 1 to 3 ppa. These slugs range from 5 to 7 bbl and are pumped intermittently between stages of the completion fluid to minimize cost. The carrier fluid, by virtue of its viscosity and mechanical suspension capability, ensures that the gravel enters the perforations.

This technique was successfully implemented in Abu Cluster field in west Malaysia. This reservoir had extremely high permeability (1.5 to 3 Darcy), with sand production a major concern. Several jobs were completed with the above mentioned technique and perforation packing factors improved from 10 to 40 lb of gravel per foot of perforations. Discussion of the placement and production data is presented. Sand-free production has been achieved with reduced drawdown across the sandface and production rates as high as 5,000 BOPD.

## Introduction

Sand production is a major problem which has plagued the petroleum industry for many years. Every year the petroleum industry spends millions of dollars cleaning sand out of wells, repairing problems related to sand production and loses additional millions of dollars by restricted production rates. Sand production is a common occurrence in highly unconsolidated (soft, highly permeable) formations, which produce oil, gas, or water. In some situations, small quantities of formation sand can be produced with minimal problems; however, in most cases, sand production leads to reduced productivity and/or excessive maintenence to both downhole and surface equipment. Extreme sand production may also cause catastrophic failure of the wellbore and/or well and surface equipment. The production of sand is a worldwide problem. Areas of major problems include the U.S. Gulf Coast, Trinidad, the North Sea, Venezuela, Brazil, Malaysia, Indonesia, China, Australia, and western Africa. At least some problems are reported in all areas of the world where oil and gas is produced.

Methods for sand control can be generally classified as operational, mechanical, chemical, or a combination of any two. The operational method of sand control uses restricted flow rate and pressure drop to minimize or eliminate sand production. The mechanical methods of sand control prevent sand production by stopping the formation sand with liners, screens, or gravel