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## **Single-Well SAGD Field Installation and Functionality Trials**

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### **Abstract**

A vertical single-well steam-assisted gravity drainage (SAGD) injector/producer is proposed that consists of six vertical propped planes installed at varying azimuths throughout the pay thickness to minimize geological heterogeneities on system performance. Steam is injected at the top of the pay and liquids are extracted at the bottom. The well operates immediately in SAGD mode and is highly efficient because of the immediate drainage available from the propped vertical planes, the full gravity drainage height at startup, and a favorable steam pressure gradient. A field trial is presented of the installation of multi-azimuth vertical propped planes from two expanded split-casing sections in a sandy silt formation. Each casing section contained six vertical propped planes at multiple azimuths that were coalesced by pore-pressure relief between the casing sections. Downhole expansion and splitting of the 9 5/8-in. casing and cement quantified formation stiffness and strength, while downhole photographs and packer impressions showed the split casing in the locked-open position. Each wing was stimulated independently of the other wings with 12/20-mesh proppant injected using a highly crosslinked gel through a specialized treatment tool. Real-time active resistivity monitoring quantified the injected plane geometry from both subsurface and surface resistivity receivers. Hydraulic pulse interference tests quantified the hydraulic vertical connectivity of the vertical propped planes. The field trials showed conclusively that multiple vertical propped planes on various azimuths can be constructed from a single wellbore and the planes coalesced between casing sections spaced along the wellbore. The field trials demonstrated the functionality of the expanded casing and stimulated tools and showed that the vertical permeable propped planes could be constructed on azimuth with high in-placed permeability. The geometry of the injected planes was recorded in real-time using the active resistivity method. Following completion of the stimulations, surface excavations showed two of the vertical planes on azimuth with the multi-azimuth casing dilation planes. Following this successful field trial, heavy-oil and bitumen steaming trials are planned.

### **Introduction**

Shallow-field experiments demonstrated that vertical planes could be injected on azimuth in weakly cemented formations (Hocking 1996). Continuous permeable planes filled with an iron proppant—in some cases, kilometers in length—have been constructed using this technology for groundwater remediation at numerous sites (Hocking and Wells 2002). More recently, shallow-field experiments have demonstrated that multi-azimuth permeable planes can be installed from a single well in weakly cemented formations (Hocking et al. 2008). The technology is not limited by depth, but is limited to formation strength, being that it is applicable only in weakly cemented formations. This process has now been extended to depths greater than 500 m (Hocking et al. 2011a) and is proposed as a new thermally enhanced well-completion system for heavy-oil and bitumen recovery in unconsolidated sands where conventional