Inconsistent acid distribution
An Alberta foothills operator was having limited success when acidizing long openhole sections through tight, fractured carbonates. Typically, CT is used to place HCl, which is pumped through a rotary jet nozzle to open and penetrate natural formation fractures as the CT is withdrawn. Conventional HCl, however, is not viscous and quickly channels into the higher-permeability sections in the open hole. Insufficient acid residence time on smaller fractures and lower-permeability sections leaves them minimally stimulated or unstimulated. Various mechanical and chemical diversion techniques have been used in an effort to improve acid distribution and residence.

Temporary formation seal for acid diversion
To improve matrix acidizing results, the operator selected VDA Viscoelastic Diverting Acid. The surfactant component of the VDA acid system does not alter the reactivity and viscosity of HCl; as the acid reacts with formation carbonates, however, the surfactant rapidly builds viscosity to between 0.15 Pa.s and 0.20 Pa.s (compared to 0.002 Pa.s or 0.003 Pa.s for ordinary HCl) and seals the treated openhole section, thereby diverting fresh acid to untreated sections.

Challenge
Controlling acid distribution to stimulate all producing zones, including smaller and lower-permeability sections.

Solution
VDA* Viscoelastic Diverting Acid, which seals the formation temporarily to divert fresh acid to untreated sections.

Results
Improved production and lower decline rate, with 20% faster cleanup.

CT VDA Stimulation Pressure Plot

Increases in surface circulating pressure indicate that the VDA system is homogeneously diverting and distributing the acid treatment across all stimulated zones.
Case study: Self-diverting acid evenly stimulates openhole sections in Alberta foothills

so that freshly applied acid is diverted to untreated sections. As the pH of the spent acid rises, the surfactant viscosity breaks, allowing faster formation cleanup and flowback.

In a selected well in the foothills of Alberta, Canada, the operator alternated stages of VDA acid system with stages of conventional 28% HCl over 600 m of 6 5/8-in-diameter, horizontal open hole. As each VDA acid system stage reached the formation, surface circulating pressure increased, indicating good acid distribution and zonal coverage.

Improved stimulation results

The use of the VDA acid system improved well performance compared with conventional matrix acidizing, and the normalized cleanup rate was 20% faster than the average of the offset wells. The VDA acid system is now used alone to stimulate the entire section being treated, instead of alternating fluids.

The VDA system enabled even acid coverage across the entire openhole horizontal section.