Using Microseismic Monitoring Technology to Improve Reservoir Characterization

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Microseismic monitoring technology (passive seismic) allows engineers and earth scientists to more directly observe reservoir behavior during production and/or injection activities. This technology can provide real-time (4-D) information on hydraulic fracture geometry, reservoir permeability fairways/anisotropy, and subsurface complexities (faults, natural fractures). This information can, in turn, facilitate significant improvements in well placement, completion effectiveness, and reservoir management. This poster describes two San Joaquin Valley examples of using microseismic monitoring technology to enhance existing reservoir characterization efforts.

In one example, ChevronTexaco and Pinnacle Technologies installed a downhole vertical seismic profile (VSP) array in an offset well to monitor and map microseisms during a large-volume, hydraulic fracture stimulation. Data from this survey provided definitive real-time information on hydraulic fracture geometry (height, length, orientation). The data were of sufficient quality to determine the source mechanism (orientation and direction of slip) for each of the 322 events observed. This information provides a unique opportunity to characterize the interaction of the hydraulic fracture and reservoir heterogeneities (natural fractures, faults, stress field). Interpretations from the microseismic survey were reconciled with image logs, regional stress data, core, and outcrop evaluation to gain a more complete understanding of the natural fracture complexity and the hydraulic fracture process in the reservoir.

In another example, microseismic monitoring technology provided the framework to evaluate completion effectiveness in hydraulically fractured horizontal wells Two wells were monitored to determine which perforation intervals were treated, induced fracture orientation, and fracture height containment. Clear relationships were drawn to reconcile insitu stress, natural fracture geometry, and completion design with well performance.