

Understanding Seismic Stimulation Using Lab, Theory, and Field Studies

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Seismic wave stimulation technology has the potential to provide a low-cost procedure for enhancing oil recovery in depleted fields and making it economically feasible to return abandoned wells to production, as well as increasing production in currently producing fields. Tests of the technology indicate that seismic stimulation technology potential is greatest in fields with high water cut and large amounts of immobile oil, making the technology exceptionally suitable for mature domestic oil fields. There is also interest in seismic stimulation for virgin, lower-gravity, consolidated-sand oil reservoirs where predicted recoveries are low (Alaska), and improved water injection and water flood sweep. Field tests with different seismic sources, however, have yielded promising but mixed or inconclusive results for enhancing oil production. In some cases, seismic stimulation increased production rates by 50% or more; but in other cases, production was unchanged or actually declined. At the present time, a variety of mechanisms have been proposed for the effect, but there is not a clear understanding of the phenomenon. Needed are controlled field tests that measure the seismic energy of the sources at the depth of stimulation and tight monitoring on changes in production fluids. Over the last several years, field tests have been conducted in the Lost Hills region to determine if this technology can provide enhanced oil recovery. Presented will be the field results and possible theory to explain the results. This work, coupled with lab and theory development, will allow the community to make intelligent choices of stimulation procedures.