An Integrated Approach to Assessing Seismic Stimulation of Oil Reservoirs: DOE/Industry Cooperative Research

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Low-frequency (1-500 Hz) seismic stress waves have been observed to enhance oil production from depleted reservoirs. Until recently, the majority of these observations were anecdotal or at the proof-of-concept level, and field tests often produce mixed results. To improve developing field stimulation technologies, the physics coupling seismic waves to multiphase fluid flow behavior in porous media must be better understood. We have been conducting basic research on the seismic stimulation phenomenon through a DOE-funded collaboration between Los Alamos National Laboratory (LANL), Lawrence Berkeley National Laboratory (LBNL), the University of California at Berkeley (UCB) and the U.S. oil and gas industry. This project is focused on three main areas of research: 1) laboratory core flow experiments, 2) field seismic monitoring of downhole stimulation tests, and 3) theoretical modeling of the coupled stress/flow phenomenon. The major goal is to obtain the comprehensive scientific and empirical knowledge needed to optimize reservoir stimulation for a wide range of field applications. The fieldwork is being performed with different seismic sources at sites selected to provide a wide range of geologic conditions as well as scales of measurement. Laboratory stimulation experiments are being performed on a suite of field core and fluid samples from the test sites. Theoretical work is using field and laboratory data as inputs to predictive models. We will present recent results in all three tasks, discuss possible physical mechanisms involved and describe future research plans.