Title of Proposal: **A New Stimulation Technique to Improve Low Permeable Well-Bore Zone Characteristics**

Company Name: **New Mexico Institute of Mining and Technology**

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PUBLIC EXECUTIVE SUMMARY

The research and development in order to evaluate and test a new promising technology that will increase the recoverability of low-permeability oil and gas formations is proposed. At least two questions must be addressed before this new technology can be generally accepted by U.S. oil and gas industry. To answer these questions, the proposed research will be conducted. It will be verified whether the new concept of supercritical CO_2/acid generation can be attained under typical oil and gas formations conditions. Experimental engineering and scientific analyses will be performed in order to verify a new concept.

Task 1 - Parameter identification: General reservoir rock composition and lithology will be identified. Specific deposition compounds and reservoir types will be identified through a literature search and visits with production and service companies. This search will include the affects of acid and CO_2 on these components. Rheological properties of supercritical CO_2/acid gas system will change as it dissolves the asphaltene/resin depositions. In this task we will develop and apply an experimental method to determine the relaxation time spectrum of system with changing structure. Three time constants will govern the developed rheometry: (1) material time or the time constant of the relaxation mode, (2) the experimental time or duration of the rheological experiment, and (3) the characteristic time of rate of change in the material (structural phenomena which affect molecular mobility). Dynamic mechanical experiments will be analyzed when the test fluid will undergo a transition, which would invalidate time-viscosity superposition. The constant parameters of a non-Newtonian type constitutive equation for new system will be determined by means of the steady flow curve and the material functions measured in a spectral rheometer.

Task 2 – High-pressure, high-temperature (HPHT) core flood and phase behavior tests: Tests will be performed on core samples with inorganic and organic deposits. There will be at least three baseline injection systems: brine, acidic brine, and pure CO_2 each at reservoir conditions. A number of in situ CO_2 generation and declogging tests will be performed at varying reservoir conditions. The principle determination of success will be the increase of single phase permeability compared to the damaged core and original core permeability.

T**ask 3 – Modeling of new technology:** The instabilities of two superimposed viscous layers in a porous medium flow will be studied. Two fluids (supercritical CO_2 gas and heavy asphaltene/resin oil) of different viscosity and density will be considered in the theoretical model. The stability of the flow will be examined using a standard linear stability analysis, where dependent variables will be expanded about some parameter. The theory will incorporate power law and Maxwell type constitutive models explored earlier by Siginer and Bakhtiyarov [1].