

## 5<sup>th</sup> Quarterly Report (no-cost extension )

### Microbial Enhanced Energy Recovery Via The Production Of Methane From Residual Hydrocarbons In Oklahoma Reservoirs

**Period Covered by the Report:** December 1, 2007 to February 29, 2008

**Date of Report:** March 31, 2008

**EPA Grant Number:** X83242801

**Title:** Microbial Enhanced Energy Recovery Via The Production Of Methane From Residual Hydrocarbons In Oklahoma Reservoirs

**Investigators:** J. M. Suflita

**Institution:** The University of Oklahoma

**EPA Project Officer:** Bala Krishnan

**Project Period:** 12-01-06 to 11-30-07 + no-cost extension till 11/30/08

**Project Amount:** \$80,000 + no-cost extension

**Research Category:** Pollution Prevention

**Objective(s) of the Research Project:** New technology is needed to recover the rather sizable amount of energy that is inherent in Oklahoma domestic oil reservoirs. A novel approach to this problem is the bioconversion of hydrocarbons entrained in marginally producing fields to methane gas as a cleaner-burning energy source. Thus, this project is designed to evaluate the utility of using an anaerobic bacterial consortium capable of converting oil in petroliferous reservoirs to methane and carbon dioxide. Our goal is to evaluate the efficiency and rate of oil bioconversion to methane by a methanogenic oil-degrading inoculum, identify the consortial members, and delineate the tolerance of the organisms to select ecological variables.

**Progress Summary/ Accomplishments:** During the last few reporting periods, we presented data from numerous experiments showing that oil trapped in a sandstone core could be biotransformed to methane by an anaerobic consortium. Members of the consortium were identified by a series of cloning and sequencing exercises. These analyses revealed cloned sequences affiliating with a variety of fermentative, sulfate-reducing, and syntrophic bacteria as well as with hydrogenotrophic and acetoclastic methanogens. We found the the consortium could biodegrade oil components to methane equally well in the presence or absence of sulfate as an alternate electron acceptor and in conditions of up to 2% salt, observations which may have important implications for application of the inoculum into reservoirs. During this reporting period, we submitted a manuscript based on our findings to Applied and Environmental Microbiology, and have been notified of its acceptance for publication.

#### **Publications/ Presentations:**

Gieg, L.M., Duncan, K.E., Suflita, J.M. 2008. Bioenergy production via microbial conversion of residual oil to natural gas. *Applied and Environmental Microbiology*. Published ahead of print March 31, doi:10.1128/AEM.00119-08.

Gieg, L.M., Duncan, K.E., Suflita, J.M. 2007. Bioenergy production via the conversion of residual hydrocarbons to methane. Oral presentation given at the IPEC meeting in Houston, TX, November 6-9.

**Future activities:** We will continue to determine the potential broad utility of the residual oil-degrading inoculum by examining methane production from a variety of other petroliferous materials. In addition, we will carry out substrate-utilization tests with the inoculum to help pinpoint which members are able to utilize which hydrocarbon and/or metabolite (i.e. fatty acids) as carbon and energy sources.

**Supplemental Keywords:** Anaerobic Biodegradation; Methanogenesis; Marginal Wells, Enhanced Energy Recovery

**Relevant Web Sites:** Not applicable at this time.