

PUBLIC ABSTRACT

Applicant (primary) name: Green Earth Industries, LLC

Applicant's address: 45600 Terminal Drive, Dulles, VA 20166
Street City State Zipcode

Team Members (if any): University of Kansas
(listing represents only participants
at time of application, not necessarily
final team membership) Kansas Geological Survey
(Use continuation sheet if needed.)

Proposal Title: Effect of Amino Acids on Coal Bed Methane Production

Commercial Application: New Facilities Existing Facilities
 Other, Specify: _____

Technology Type:

Estimated total cost of project:
(May not represent final negotiated costs.)

Total Estimated Cost: \$ 568,651

Estimated DOE Share: \$ 284,325

Estimated Private Share: \$ 284,325

PUBLIC ABSTRACT (cont=d)

Anticipated Project Site(s): Green Earth Industries Laboratory
Location (city, county, etc.) State Zipcode

Location (city, county, etc.) State Zipcode

Location (city, county, etc.) State Zipcode

Type of coal to be used: _____
Primary Alternate (if any)

Size or scale of project: _____
Tons of coal/day input
And/or _____ Megawatts, Barrels per day, etc.
Other (if necessary)

Duration of proposed project: 12
(From date of award) (Months)

PRIMARY CONTACT:

For additional information, James R. Holbein
interested parties should contact: Name

Position

(703) 689-4675
Telephone Number

Green Earth Industries
Company

Jim.holbein@geiindustries.com
e-mail address

As above
Address

City State Zipcode

Alternative Contact:

Name

Position

()
Telephone Number

Company

Address

City State Zipcode

PUBLIC ABSTRACT (cont=d)

Brief description of project:

Effects of Amino Acids on Coal Bed Methane Production

Public Abstract

This proposed project represents a modest, but important, first step in the use of amino acids to enhance the biological activity of microorganisms that produce natural gas from coal. This approach has many advantages over high temperature gasification, coal liquefaction, and other conventional applications of industrial chemistry to produce natural gas from coal. It is not energy intensive. It does not require many hours of labor or equipment made from exotic materials. It only requires an easily implemented and relatively low-cost modification of an existing technology (coal bed injection) used in conjunction with amino acids manufactured by Green Earth Industries, LLC (GEI).

GEI is a privately funded research and development enterprise located in Northern Virginia. Green Earth is developing commercial applications for its patent pending process to convert fish wastes into amino acids, along with fish oils, vitamins and minerals and other byproducts. One of the multitude of potential applications for the amino acids is to accelerate biological processes and enhance the effectiveness of microbes for various industrial or commercial processes. The current project proposal is designed to determine whether amino acids used in conjunction with methanogenic microbes can provide accelerated or enhanced coal bed methane production.

GEI is proposing a two-phase project designed to evaluate the ability of its amino acids to enhance the biologically-based gasification of coal. Although the ability of certain microbial populations to bio-assimilate coal has been demonstrated,¹ the need to shorten processing time and increase the yield of useful products remain obstacles to the ultimate commercialization of this approach. GEI and researchers at the University of Kansas (KU) under the direction of Dr. Russell Ostermann are presently investigating the ability of GEI's amino acids to accelerate the gasification of coal and to increase the amount of natural gas, as methane, produced. Researchers at KU have established new approaches for determining appropriate mixtures of nutrients to improve biological activity. They will also characterize and quantify different components of the microbial population that contribute to the overall gasification process. The results of this work, to be completed in the end of 2002, are expected to show an improvement in methane generation while identifying the ideal mixture of microorganisms and nutrient dosage to guide an *in-situ* test of the method.

The two phases of the proposed project are a logical follow-on to the study that KU is now performing for GEI. The first phase is a series of laboratory tests that will fine-tune the results of the present investigation; it will focus on the extent to which the bio-conversion process is accelerated by application of GEI's amino acids on specific coal types. These proteins will be used in conjunction with strains of bacteria known to produce methane from coal, as determined by previous work at KU done using live cores provided by the Kansas Geological Survey. The types of coal selected for testing will be from a source or sources that are best suited

¹ Fakoussa, R.M. and M. Hofrichter, *Biotechnology and microbiology of coal degradation*, Appl Microbial Biotechnol, 52:25-40, 1999.

for future *in-situ* testing after the results of phase I are analyzed.

The phase I portion will be conducted in two steps. In the first step, the effects of nutrients in combination, with GEI's amino acids, in enhancing methane production from the variety of coal samples will be determined. This will include an evaluation of optimal conditions for using the amino acids in GEI's product as an accelerator for methane production. By the conclusion of this step, the nutrient levels and amino acid dosages that most improve methane production will become apparent.

In step two, the number and types of microorganisms present in the efficacious mixtures from step one are quantified. The results of this work will allow further determination of the optimal conditions for methane production from coal with GEI's amino acid mixture.

The second phase of the proposed project will be a series of *in-situ* tests of the communities of bacteria selected from phase I. The injection of pre-selected microorganisms and nutrients will be done with and without GEI's amino acids to determine the difference in rate and yields produced by this proprietary mixture. It is anticipated that the tests will be done in cooperation with the Kansas Geological Survey, the Tertiary Oil Recovery Project (KU) and/or a coal gas company that manages one or more locations in the Kansas region where *in-situ* coal processing would be advantageous.

The test requires a simple modification of existing coal bed injection technology to accommodate the addition of nutrients and amino acids provided by GEI. The feed mechanism is simple: a tank filled with nutrient solution/microorganisms is connected to a metering pump that will feed directly to the injection well to be distributed throughout the coal bed. GEI's amino acids can be added to the feed tank when they need to be included in the injection solution. Gas produced is monitored and analyzed for methane production.