PMC-EF2a
(2.04.02)

U.S. DEPARTMENT OF ENERGY
EERE PROJECT MANAGEMENT CENTER
NEPA DETERMINATION

RECIPIENT: NREL **STATE:** CO

PROJECT TITLE : National Advanced Biofuels Consortium; NREL Tracking No. 10-010

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE-FOA-0000123		NREL-10-010	EE3044

Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Order 451.1A), I have made the following determination:

CX, EA, EIS APPENDIX AND NUMBER:

Description:

B3.6 Siting, construction (or modification), operation, and decommissioning of facilities for indoor bench-scale research projects and conventional laboratory operations (for example, preparation of chemical standards and sample analysis); small-scale research and development projects; and small-scale pilot projects (generally less than two years) conducted to verify a concept before demonstration actions. Construction (or modification) will be within or contiguous to an already developed area (where active utilities and currently used roads are readily accessible).

A9 Information gathering (including, but not limited to, literature surveys, inventories, audits), data analysis (including computer modeling), document preparation (such as conceptual design or feasibility studies, analytical energy supply and demand studies), and dissemination (including, but not limited to, document mailings, publication, and distribution; and classroom training and informational programs), but not including site characterization or environmental monitoring.

A11 Technical advice and planning assistance to international, national, state, and local organizations.

Rational for determination:

This project is for the creation of the National Advanced Biofuels Consortium (NABC) that would conduct cutting-edge research to develop infrastructure compatible, fungible "drop-in" biomass-based hydrocarbon fuels. The NABC would develop the technologies necessary to deliver cost-effective processes ready for pilot scale, which would maximize the use of existing refining and distribution infrastructure. The objective would be a sustainable, cost-effective, advanced biofuels processing sequence with high process efficiency and maximum carbon utilization. Six process strategies would be investigated in Stage 1: fermentation of sugars, catalytic conversion of sugars, catalytic fast pyrolysis, hydropyrolysis, hydrothermal liquefaction, and low-cost one-step syngas to distillates. In Stage 2 those strategies that have the best potential to meet the project objectives will be further developed. The project will deliver: 1) pilot-ready process, 2) design report including state of technology, sensitivity analysis, process economics, and 3) life cycle analysis to measure the environmental benefits.

Each of these process strategies involves the use of chemicals and catalysts as a part of the conversion of biomass to hydrocarbon fuels and intermediates. A summary of the materials and chemicals is below:

1) Strategy: Fermentation of Sugars
Chemicals: Organic solvents, water, mineral acids and bases
Catalysts: Inorganic solid acids

2) Strategy: Catalytic Conversion of Sugars
Chemicals: Organic solvents, water, mineral acids and bases
Catalysts: Mineral acids, inorganic solid acids

3) Strategy: Catalytic Fast Pyrolysis
Chemicals: Organic solvents, water, mineral acids and bases
Catalysts: Zeolites, inorganic solid acids, inorganic transition metal catalysts containing Ni, Mo, Co and other transition metals

4) Strategy: Hydropyrolysis
Chemicals: Organic solvents, water, mineral acids and bases, hydrogen
Catalysts: Inorganic solid acids, inorganic transition metal catalysts containing Ni, Mo, Co and other transition metals

5) Strategy: Hydrothermal liquefaction
Chemicals: Organic solvents, water, mineral acids and bases, hydrogen
Catalysts: Inorganic solid acids, inorganic transition metal catalysts containing Ni, Mo, Co and other transition metals

6) Strategy: Syngas to distillates
Chemicals: Organic solvents, water, mineral acids and bases, methanol
Catalysts: Zeolites

The NABC consists of the following partners:

Albemarle Catalysts Company B.V., Amsterdam, The Netherlands
* Catalyst development

Amyris Biotechnologies, 1355 59th St, Emeryville CA and 5885 Hollis Street, Suite 100, Emeryville CA
* Bio-catalysis of lignocellulosic sugars to infrastructure-compatible hydrocarbon fuel, including development of GMO strains to utilize and convert lignocellulosic hydrolyzates to hydrocarbons

Argonne National Laboratory, DuPage County, Illinois
* Catalyst design for improved deoxygenation activity and selectivity
* Analytical Characterization of catalysts, surface and active site
* Computational analysis

British Petroleum, Products NA, 150 West Warrenville Road, Naperville, IL
* Refinery integration strategies, product analysis and acceptance, and engineering design package development

Catchlight Energy, LLC, (a joint venture between Chevron and Weyerhaeuser); Weyerhaeuser Technology Center in Federal Way, Washington, and Chevron's Richmond Technology Center in Richmond, California
* Field trials addressing feedstock production, sustainability and engineering analysis of commercialization alternatives, including feedstock testing and characterization

Colorado School of Mines, Golden, Colorado
* Computer modeling activities

Iowa State University, Ames, IA
* Feedstock Pretreatment using chemical methods , Aqueous-phase catalytic conversion of pyrolysis oil, chemical reaction mechanism analysis, feedstock preparation

Los Alamos National Laboratory, Technical Area 46, building 76, and Technical Area 35, building 85, Los Alamos, NM

* Conversion by Chemical Catalysis: sugars to hydrocarbons; upgrading pyrolysis products
* Modeling: Chemistry and mechanisms of biomass pyrolysis; complex reaction systems; mineral matter effects
* Genome sequencing

Pall Corporation, Pall's Cortland Research and Development (PRDC) facility located at 3669 State Route 281, Cortland, New York.; and Pall's SLS laboratories at 25 Harbor Park Drive, Port Washington, New York.
* Separation of biomass-derived sugars from streams with high fiber and water content
* Water removal from pyrolysis vapors; advanced coalescing filters for condensation of pyrolysis vapors
* Catalytic filter development for improved pyrolysis oil properties

Pacific Northwest National Laboratory, Richland, Washington
* Characterize role of catalytic materials in the conversion of sugars
* Develop catalytic fast pyrolysis by designing concepts, investigating chemical looping via thermal treatment, and develop catalysts with multi-functions
* Investigate role of novel catalysts using hydropyrolysis
* Investigate hydrothermal liquefaction processes
* Investigate Syngas to distillate process improvements

RTI International, 3040 Cornwallis Rd., Research Triangle Park, North Carolina
* Catalytic hydropyrolysis process development

Tesoro Companies, Inc., 91-325 Komohana St., Kapolei, Hawaii 96707
* Refinery integration strategies
* Product analysis and acceptance
* Engineering design package development

University of California at Davis, One Shields Avenue, Davis, CA
* No lab work will be performed as a member of this consortium. The role of UCDavis will be advisory for the technical direction and progress of the NABC.

UOP, LLC, City of Des Plaines, Cook County, Illinois
* Investigation of catalytic riser-cracking of biomass using existing FCC catalysts
* Investigation and use of mild hydrotreating for synthesis of refinery feedstocks (e.g. biocrude) and or intermediate blendstocks
* Investigation of catalyst enhancement and/or new catalytic materials for hydrotreating and hydrocracking of pyrolysis oil

USDA, Eastern Regional Research Center (ERRC) in Wyndmoor, PA
* ERRC will contribute the use of 10,000 square feet of chemical engineering, mechanical engineering, and milling pilot plant for this effort and will provide equipment for analytical, microscopic, milling, pyrolysis, gasification, and combustion research necessary to perform the proposed NABC work.

Virent Energy Systems, Inc., 3551 and 3571 Anderson St., Madison, WI
* Development of deconstruction strategies for production of complex sugar streams suitable for upgrading and conversion to fuels using Virent's catalytic processes.
* Development and optimization of Virent's catalytic system, including catalyst characterization, deactivation studies, and reaction engineering.
* Complete process and engineering studies for the implementation of biomass deconstruction strategies integrated with Virent's conversion technology.
* Perform engineering cost estimates and life cycle analysis for the integrated process, including the evaluation of market values and integration scenarios for the range of potential hydrocarbon products.

Washington State University, Tri-Cities campus in Richland, Washington
* Optimizing pretreatment conditions for delivering C5 and C6 sugars.
* Design and construction of a separation unit for purification of sugars from hydrolysate

National Renewable Energy Laboratory, 1617 Cole Blvd., Golden, CO
* Develop improved methods for producing "clean" sugars from biomass, with emphasis on downstream integration with catalytic and biochemical conversion technologies
* Techno-economic modeling of process strategies
* Engineering modeling of improved reactor and reaction models for biomass pyrolysis

All laboratory work associated with NABC efforts would be bench-scale research and conducted in existing facilities. All NABC partners would build upon their current R&D activities and undertake work only within their existing capabilities and equipment. All health, safety, and environmental controls are in place to identify and control hazards associated with this project. No new chemical mixtures or catalysts that use materials other than those shown in the table are proposed to be utilized or synthesized as a part of this research project. All facilities in which R&D activity would occur have proper chemical hygiene plans (or equivalent) and established safety procedures and protocols. They have proper safety equipment including but not limited to fume hoods with occupancy sensors, low-flow alarms, and variable speed drives, digital controls and automatic shut-down features, temperature monitoring, fire suppression systems, eyewash and safety shower stations, rupture disks; secondary containment; storage cabinets, and hazardous materials enclosures. All laboratory personnel would have proper training per the respective NABC partner's EHS protocols and have proper engineering controls, as well as Personal Protective Equipment (PPE) available to protect the body (eyes, face, feet, hands, head, hearing, lungs, etc.) from hazards capable of causing injury, illness, or impairment. All chemicals utilized would be handled, used, stored, and disposed of in accordance with the respective NABC partner's established EHS protocols.

The R&D activity for NABC would be conducted in existing laboratories and for the most part with existing equipment. In a few instances new equipment may be installed for the experiments, but the associated upgrades and remodeling required for the new equipment would be entirely indoors in existing facilities. Feedstocks, including trees, agriculture crops, and grasses, would be collected on lands currently involved in the commercial production of these resources. Air emissions would be limited to fugitive emissions from bench-scale laboratory research activities and would include small quantities of organic solvents, dilute acids and bases, and dusts from biomass processing. Non-fugitive emissions would include small quantities of carbon monoxide, carbon dioxide, hydrogen, nitrogen, and trace amounts of methane from activities. Air pollution control strategies and control equipment vary at each NABC partner facility depending on the work to be conducted and the jurisdictional air permitting authority's requirements. Control methods would include engineering controls, such as HEPA filters and thermal oxidizers, and administrative controls, such as training, chemical management and inventory protocols. The bench-scale R&D activity at the NABC partners' facilities would not cause a significant impact to air quality, either singularly or cumulatively.

Non-hazardous aqueous effluents that would be generated by these processes would be discharged to municipal wastewater treatment facilities in accordance with applicable federal, state, and local regulations, as well as per applicable industrial wastewater discharge permits. Hazardous aqueous effluents would be contained, labeled, profiled, managed, and properly disposed of or treated at properly permitted transfer, disposal, and treatment facilities. Similarly, toxic and/or hazardous waste would be contained, labeled, profiled, managed, transported and properly disposed of or treated at properly permitted transfer, disposal, and treatment facilities in accordance with applicable

federal, state, and local regulations. All of NABC partners have established waste management and minimization programs and conduct frequent employee training and inspections. No new or modifications to existing air permits, hazardous waste permits, or wastewater permits would be required for this project.

One of the NABC partners, Amyris, would be utilizing genetically modified organisms (GMOs) as part of their search under this project. Their process to produce renewable fuel involves the fermentation of feedstocks using engineered strains of Saccharomyces cereviciae. S. cereviciae, or Baker's Yeast, is a well characterized GRAS (generally recognized as safe) organism that is commonly used in food products. It has long been considered non-pathogenic and is classified as a RG-1 organism by National Institute of Health (NIH) and World Health Organization (WHO) guidelines, and it is not likely to cause adverse health effects in humans, animals or the environment. According the NIH Guidelines for Research Involving Recombinant DNA Molecules (2002), experiments with S. cereviciae host/vector systems are exempt and require only containment at Biosafety Level 1. Amyris commissioned a risk assessment on the potential human, animal and environmental hazards in Amyris' construction and use of genetically modified S. cerevisiae strains and this third-party study found no significant potential hazard. Amyris has a detailed biosafety plan and their policy is to strictly follow NIH guidelines for handling, containment and disposal of recombinant organisms (US NIH Guidelines for Research Involving Recombinant DNA Molecules, 2002 GLSP). The pilot plant facility is fully contained and built with a containment tank to capture any spills. The fermentations are contained within the bioreactors that are equipped with condensers and filters to capture volatile organic components and genetically modified organisms. All process-related microrganisms are killed prior to disposal. Therefore the potential impact of the GMOs is de miminis.

This project would result in negligible increases in air emissions, hazardous waste generation, and storage and use of hazardous materials. Furthermore, no new or modifications to existing air permits, hazardous waste permits, or wastewater permits would be required for this project. This project comprises bench-scale research projects, technical advice, and data analysis (computer modeling) therefore the DOE has categorized this project as meeting Categorical Exclusions A9, A11, and B3.6.

NEPA PROVISION

DOE has made a final NEPA determination for this award

Insert the following language in the award:

Note to Specialist :

None Given.

SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.

NEPA Compliance Officer Signature: Kristin Kerr Date: 4/16/2010

NEPA Compliance Officer

FIELD OFFICE MANAGER DETERMINATION

☐ Field Office Manager review required

NCO REQUESTS THE FIELD OFFICE MANAGER REVIEW FOR THE FOLLOWING REASON:

☐ Proposed action fits within a categorical exclusion but involves a high profile or controversial issue that warrants Field Office Manager's attention.

☐ Proposed action falls within an EA or EIS category and therefore requires Field Office Manager's review and determination.

BASED ON MY REVIEW I CONCUR WITH THE DETERMINATION OF THE NCO :

Field Office Manager's Signature: _____ Date: _____

Field Office Manager