PMC-ND

(1.08.09.13)

U.S. DEPARTMENT OF ENERGY
OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY
NEPA DETERMINATION

RECIPIENT: Arizona State University **STATE:** AZ

PROJECT TITLE: Multi-pronged approach to improving carbon utilization by cyanobacterial cultures

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE-FOA-0001908	DE-EE0008515	GFO-0008515-001	GO8515

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

CX, EA, EIS APPENDIX AND NUMBER:

Description:

A9 Information gathering, analysis, and dissemination	Information gathering (including, but not limited to, literature surveys, inventories, site visits, and audits), data analysis (including, but not limited to, computer modeling), document preparation (including, but not limited to, conceptual design, feasibility studies, and analytical energy supply and demand studies), and information dissemination (including, but not limited to, document publication and distribution, and classroom training and informational programs), but not including site characterization or environmental monitoring. (See also B3.1 of appendix B to this subpart.)
B3.6 Small-scale research and development, laboratory operations, and pilot projects	Siting, construction, modification, operation, and decommissioning of facilities for smallscale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

Rationale for determination:

The U.S. Department of Energy (DOE) is proposing to provide funding to Arizona State University (ASU) to increase the carbon utilization efficiency of Synechocystis sp. PCC 6803, a cyanobacterial biocatalyst engineered for advanced biofuel production. The project would seek to improve rates of carbon dioxide absorption, retention, uptake and fixation by: 1) increasing inorganic carbon solubility, 2) using a nano bubble gas delivery system, 3) increasing cellular uptake rates through genetic engineering, and 4) improving net CO2 fixation through genetic engineering of additional CO2 fixation and conservation mechanisms. The project would be completed over three Budget Periods (BPs) with a Go/No-Go Decision Point between each BP.

Proposed project activities for BP1 would consist of data analysis and technical review. BP2 activities would include laboratory-scale cultivation of Synechocystis sp. PCC 6803 strains (cyanobacterial strains), amine solvent screening, laboratory-scale testing of nanobubble technology to improve absorption, genetic engineering and directed evolution of cyanobacterial strains, introduction of CO2 fixation and conservation methods, and sustainability modelling. BP3 activities would include strain optimization and testing via outdoor cultivation, performance testing using nanobubbles, techno-economic analysis, and life cycle assessments.

All project activities would be performed by ASU, Colorado State University, Nano Gas Technologies, Inc. (Deerfield, IL), and Ennova (Stafford, TX), at existing, purpose-built facilities that regularly conduct work similar in nature to that proposed as part of this project. Genetic engineering, solvents screening, laboratory-scale directed evolution, and laboratory-scale testing of nanobubble technology would be completed at ASU's Tempe Campus in Tempe, AZ. Outdoor cultivation activities would be performed in closed-system photobioreactors at ASU's AzCATI test bed facility in Mesa, AZ. Characterization and testing of nano bubble technologies would be conducted at ASU's Tempe Campus, the AzCATI testbed facility on ASU's Polytechnic campus and Ennova's research facility in Stafford, TX, using Nano Gas Technologies' Nano Gas laboratory-scale and '10-15' nanobubble-generation units. All laboratory, research and testing facilities in which project work would be conducted, are equipped to complete the proposed research and processing activities. No change in the use, mission or operation of existing facilities would be required. Likewise, no new permits, licenses, or authorizations would be required to perform project activities.

Hazardous materials, including industrial solvents and compressed gas, would be used and handled in closed, laboratory environments. Risks associated with this handling would be mitigated through adherence to established health and safety policies and procedures. Protocols would include the use of personal protective equipment,

personnel training, monitoring and control, and observance of proper materials handling, labelling, and disposal norms. ASU and its project partners would adhere to all relevant Federal, state, and local health, safety and environmental regulations when completing project work. Employees working with recombinant DNA and genetically modified microorganisms (GMO) have completed National Institute of Health (NIH) Guidelines training. Project activities involving the use and handling of gasses under pressure, including those that make use of Nano Gas Technologies' laboratory-scale and Nano Gas '10-15' nanobubble-generating units, would utilize pressure tanks that have been manufactured to ASME standards.

The nano bubbles generated by the Nano Gas unit would be composed of carbon dioxide gas. They do not pose any known risk. The nano bubbles would be introduced into water and BG11 medium to be consumed by the cyanobacterial strains. Less than 100 liters of deionized water and 30 standard cubic feet per minute (SCFM) of carbon dioxide would be used. Less than 100 liters of water with carbon dioxide entrained in nanobubbles would be disposed after testing, in accordance with Federal, state, and local regulations.

The genetically engineered microbes used in this project fall under NIH Biosafety Containment Level 1 (BSL-1) and NIH Recombinant DNA Experiment Classifications Section III-E. All strains are non-toxic. Material containing recombinant DNA would be autoclaved or neutralized with bleach prior to disposal into biological waste drums for Environmental Health & Safety pick-up and disposal. All ASU labs have Institutional Biosafety Committee approval for this work.

NEPA PROVISION

DOE has made a final NEPA determination.

Notes:

Bioenergy Technologies Office
This NEPA determination does not require a tailored NEPA Provision.
NEPA review completed by Jonathan Hartman, 11/5/2018

FOR CATEGORICAL EXCLUSION DETERMINATIONS

The proposed action (or the part of the proposal defined in the Rationale above) fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D. To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

There are no extraordinary circumstances related to the proposed action that may affect the significance of the environmental effects of the proposal.

The proposed action has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

The proposed action is categorically excluded from further NEPA review.

SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.

NEPA Compliance Officer Signature: Electronically Signed By: Casey Strickland Date: 11/6/2018

NEPA Compliance Officer

FIELD OFFICE MANAGER DETERMINATION

☑ Field Office Manager review not required
☐ Field Office Manager review required

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

Field Office Manager's Signature: _____ Date: _____

Field Office Manager