PMC-ND
(1.08.09.13)

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

RECIPIENT: LanzaTech, Inc. **STATE:** IL

PROJECT TITLE: Production of bioproducts from electrochemically-generated C1 intermediates

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE FOA 0001916	DE-EE0008500	GFO-0008500-001	

Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Policy 451.1), 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 federal funding to LanzaTech to convert carbon dioxide (CO2) waste streams into carbon monoxide (CO) using an electrolyzer. CO would then be converted to isopropanol (IPA) using existing gas fermentation technology. The project would seek to increase IPA productivity by modifying Clostridium autoethanogenum strains, used during the fermentation process, to enable arginine uptake and reduce byproduct formation in order to maximize conversion to IPA. The project would be completed over three Budget Periods (BPs), with a Go/No-Go Decision Point in between each BP.

Proposed project activities during BP1 would focus on verification of baseline parameters. Baseline CO2 conversion efficiency using an IPA producing C. autoethanogenum strain would be verified using an existing electrolyzer/gas fermentation system. BP2 activities would include electrolyzer development (e.g. new cell design, membrane improvements and scaling), strain engineering to improve IPA yield efficiency, computational strain optimization, fermentation studies on improved strains, and baseline techno-economic analysis (TEA)/life-cycle analysis (LCA). BP3 activities would consist of continued electrolyzer development, microbial yield analysis and improvements, IPA fermentation optimization, and final TEA/LCA modeling.

All project activities would be completed in existing, purpose-built laboratory facilities operated by LanzaTech and its project partners. LanzaTech would oversee all activities and would perform fermentation studies, laboratory analysis, genetic engineering, and TEA modeling at its laboratory facility in Skokie, IL. Dioxide Materials would fabricate and test novel CO2 electrolyzers and perform membrane testing at its laboratory space within the Research Park at Florida Atlantic University (Raton, FL). Argonne National Laboratory (Lemont, IL) would assist with completion of LCA modeling. No change in the use, mission or operation of existing facilities would be required, nor would any additional authorizations or permits be required to complete project activities.

Genetic modifications would be performed on C. autoethanogenum. This organism is readily identifiable/classifiable and its main biological characteristics are known. It is not normally known to infect, colonize or establish itself in

humans; nor does it produce desiccation-resistant structures such as spores or cysts that can be disseminated normally in the air. The genetic modifications that would be performed are not expected to increase the risks associated with the organism. C. autoethanogenum is an obligate anaerobe, with cell death occurring upon exposure to normal atmospheric concentrations of oxygen. All experiments performed using this strain would be conducted in facilities equipped for handling anaerobic cultures. Safety equipment/materials would include autoclaves for media and vessel sterilization, anaerobic chambers for strain handling and growth, and detergents for ensuring cell lysis post experiment. Any cultures generated over the course of the project would be mixed with a detergent under aerobic conditions to lyse cells and would be disposed of in a non-hazardous liquid waste stream.

The project would involve the use and handling of gases, organic solvents and industrial chemicals. All handling of hazardous materials would occur in designated areas. All chemicals would be stored in marked safety cabinets and handled appropriately. Ethanol would be produced as a product of the fermentation process. Any transportation of hazardous chemicals (e.g. ethanol) would be performed by entities certified for the handling and transportation of the chemicals in question. Any additional risks from handling project materials would be mitigated through adherence to established health and safety policies and procedures. Protocols would include employee training, the use of personal protective equipment, engineering controls (e.g. extraction systems and stationary gas detection throughout the lab space with safety interlocks), personal CO monitoring devices, the use of fume hoods, and lab safety audits.

Carbon monoxide would be generated during the project in a contained testing apparatus. The apparatus itself would be stationed inside of a cabinet with ventilation. Waste carbon monoxide would be discharged into a catalytic converter where it would largely be converted to carbon dioxide. Carbon monoxide monitoring devices would be used when handling this gas. Additionally, extraction systems and stationary gas detection systems are installed in laboratory spaces where testing would be performed.

Fermentation broth would be decontaminated using an antimicrobial powder and disposed of in accordance with established operated procedures. LanzaTech and its project partners would comply with all Federal, state and local health, safety and environmental laws and regulations.

NEPA PROVISION

DOE has made a final NEPA determination.

Include the following condition in the financial assisstance agreement:

Any work proposed to be conducted at a federal facility may be subject to additional NEPA review by the cognizant federal official and must meet the applicable health and safety requirements of the facility.

Notes:

Bioenergy Technologies Office
This NEPA determination requires a tailored NEPA Provision.
NEPA review completed by Jonathan Hartman, 02/12/2019

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: 2/13/2019

NEPA Compliance Officer

FIELD OFFICE MANAGER DETERMINATION

- [x] 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