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

RECIPIENT: Spero Energy, Inc. **STATE:** CA

PROJECT TITLE: SPERLU Selective Process for Efficient Removal of Lignin and Upgrading

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE-FOA-0001916	DE-EE0008503	GFO-0008503-001	GO8503

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.
B3.15 Small-scale indoor research and development projects using nanoscale materials	Siting, construction, modification, operation, and decommissioning of facilities for indoor small-scale research and development projects and small-scale pilot projects using nanoscale materials in accordance with applicable requirements (such as engineering, worker safety, procedural, and administrative regulations) necessary to ensure the containment of any hazardous materials. Construction and modification activities would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible).

Rationale for determination:

The U.S. Department of Energy (DOE) is proposing to provide funding to Spero Energy, Inc. to develop and test a process to extract and catalytically upgrade lignin from biomass. Specifically, Spero Energy's Selective Process for Efficient Removal of Lignin and Upgrading (SPERLU), a process for one-step lignin conversion to phenolic monomers, would be optimized to convert a higher percentage of lignin carbon into monomeric bio-phenols, which would then be processed into renewable polymers and materials. The project would be completed over three Budget Periods (BPs), with a Go/No-Go Decision Point in between each BP.

Proposed project activities for BP1 would consist of verification demonstrations of the SPERLU process and quantification/characterization of the end-products. BP2 activities would include kinetics analysis of lignin extraction, scaling up Spero's existing plug flow reactor for increased production (e.g. 200 g of phenolic monomers), lignin extraction campaign testing, development of a method for SPERLU catalyst regeneration, bacterium strain development for conversion processes, and techno-economic/life cycle analyses. BP3 activities would include distillation of monomeric phenols, production of polymers from unpurified monomers, and further strain optimization.

All project activities would be completed by Spero Energy and its project partners at existing, purpose-built facilities that regularly complete work similar in nature to that included as part of this project's scope. Design, development, and testing of the SPERLU process would be completed by Spero Energy at its research laboratory in Thousand

Oaks, CA. This work would include lignin extraction and polymer production. Fermentations using SPERLU derived products would be completed at the National Renewable Energy Lab (NREL) in Golden, CO. Computer analysis would be completed at the office facility of Industrial Ecology Research Services, in Goleta, CA. No laboratory/experimental research would be completed at this location.

All locations are fully equipped to undertake the project activities. No change in the use, mission, or operation of existing facilities would be required. Neither Spero Energy nor any of its project partners would need to obtain any additional permits in order to realize the work activities proposed as part of this award.

The project would involve the use and handling of biomass (e.g. poplar and switchgrass), metals and industrial solvents. All such handling would occur indoors, in laboratory settings. Risks associated with the handling of these materials and the completion of project activities 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, monitoring, and internal assessments. Spero Energy and its project partners would adhere to all local, state, and Federal health, safety and environmental regulations.

Pseudomonas putida, a non-pathogenic soil bacterium would be utilized as the host for biological conversion of ferulic and coumaric acids to vanillin and 4-hydroxybenzoic acid. P. putida is classified by the U.S. Centers for Disease Control and Prevention (CDC) as a bacterium requiring biosafety level 1 (BSL-1) containment protocols. Genetically modified variations of this bacterium (i.e. P. putida KT2440 and P. putida LJ014) would be used and handled by NREL indoors in laboratory environments that meet BSL-1 guidelines. All relevant safety procedures for the handling of this organism would be adhered to. Any unused genetically modified bacterium would be destroyed through autoclaving and disposed of in accordance with all local, state, and Federal regulations.

Metal nanoparticle catalysts would be used that can be reactive and potentially pyrophoric. Established safety protocols would be adhered to when handling these materials. Metal nanoparticles would be deactivated and disposed of as chemical waste in accordance with local, state, and Federal regulations. Fume hoods are also installed in each facility and would provide ventilation, mitigating inhalation risks.

Any work proposed to be conducted at a DOE laboratory may be subject to additional NEPA review by the cognizant DOE NEPA Compliance Officer for the specific DOE laboratory prior to initiating such work. Further, any work conducted at a DOE laboratory must meet the laboratory's health and safety requirements.

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.
Review completed by Jonathan Hartman, 12/12/2018

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: 12/13/2018

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