

PMC-ND

(1.08.09.13)

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



**RECIPIENT:** [University of Illinois at Urbana-Champaign](#)

**STATE:** IL

**PROJECT TITLE:** [Process Optimization and Real-Time Control of Synergistic Microalgae Cultivation and Wastewater Treatment](#)

<b>Funding Opportunity Announcement Number</b>	<b>Procurement Instrument Number</b>	<b>NEPA Control Number</b>	<b>CID Number</b>
<a href="#">DE-FOA-0002203</a>	<a href="#">DE-EE0009270</a>	<a href="#">GFO-0009270-001</a>	<a href="#">G09270</a>

**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:

[B1.26 Small water treatment facilities:](#) Siting, construction, expansion, modification, replacement, operation, and decommissioning of small (total capacity less than approximately 250,000 gallons per day) wastewater and surface water treatment facilities whose liquid discharges are externally regulated, and small potable water and sewage treatment facilities.

The U.S. Department of Energy (DOE) is proposing to provide funding to the University of Illinois at Urbana-Champaign (UIUC) to develop recommendations for process improvements to a wastewater water treatment and algae cultivation system. The operations of an existing system that uses algae for waste treatment, the Advanced Biological Nutrient Recovery (ABNR) system, would be assessed and used as the basis for developing recommendations for design optimization and real-time process control.

The ABNR system is currently installed and operating at the Village of Roberts Wastewater Treatment Plant (WWTP) in Roberts, WI. The system was previously developed by project partner CLEARAS. It consists of a series of photobioreactors and auxiliary equipment housed within a closed facility, used to treat wastewater effluent discharged into the system. The current ABNR system has a treatment capacity of approximately 150,000 gallons per day . Throughout the project, the ABNR would be operated normally, per routine site operations. ABNR operations would not be modified.

A secondary system, the Mobile Commercial Demonstration Plant (MCDP), may be also used for testing if the project team chooses to evaluate process modifications that have not previously been implemented at the Village of Roberts WWTP. The MCDP is an existing pilot-scale system, developed and operated by CLEARAS. The MCDP consists of a mix tank, photobioreactors, membrane tank, pumps, an enclosure, and auxiliary equipment. The MCDP would either be assembled on-site at the Village of Roberts WWTP or at CLEARAS' research and development facility (discussed further below). If the MCDP were used for testing at the Village of Roberts WWTP, it would be transported in a shipping container and assembled on site on a flat-concrete surface outdoors. Above-ground pipes would be temporarily laid to route secondary effluent from the treatment plant to the MCDP influent, and effluent from the MCDP back to the headworks of the treatment plant. The MCDP would have a forward flow (influent and effluent) of approximately 5,000-12,000 gallons per day (i.e., 3-8% of the flow to the existing Village of Roberts ABNR system). No facility modifications would be required. All task work described below is described assuming use of the ABNR system. In all instances though, the MCDP could be used in place of the ABNR if its is determined to be more suitable

for the task.

Considering, the above, the following task activities would be performed using one or both of the systems cited:

**Task 1 – Verification:** This task consists solely of computer-based data verification and reporting. Task work was completed prior to NEPA review and accordingly, this task cannot be reviewed as part of this NEPA Determination.

**Task 2 – Dynamic Process Characterization:** This task would consist of the characterization of biomass, water, and physical parameters of Village of Roberts' ABNR treatment system. Wastewater and biomass samples would be taken for analysis at the laboratory facilities of UIUC and its project partners Northeastern University (NEU) and University at Buffalo (described below). Several thousand samples (<5,000) would be taken over the course of the project. Samples would measure between 0.5 and 2 grams, approximately. ABNR operations would also be observed and assessed. Sampling and analysis would require the temporary installation of monitoring equipment onto the ABNR system. This would consist of the addition or replacement of monitoring probes at existing on-line monitoring locations or by lowering a probe into an open reactor. Installation of the monitoring equipment would not require any modifications to Village of Roberts' facilities and would not affect the ABNR's routine operations.

**Task 3 – Process Simulator Development:** Data obtained from the previous task would be used to inform computer models and simulations.

**Task 4 – Miniaturized Flow Imaging Microscopy (mFIM) Customization and Training:** This task would consist of the modification of a portable, automated microscope. An existing microscope and data collection system, ARTiMiS, would be modified for use in the project. The ARTiMiS is a portable system used for collecting and analyzing small samples. The system consists of a small pump, a light array, a small camera, a circuit board, and auxiliary equipment housed within a plastic enclosure. The entire system can be deployed onto a bench or tabletop. As part of this task, custom software would be developed for the system and modifications would be made to the hardware (e.g., modifications to the chip architecture and optical configuration).

**Task 5 – mFIM Field Validation:** ARTiMiS systems customized during Task 4 would be deployed at the ABNR for sampling/analysis. Microbial samples (< 1 mL), collected from the ABNR would be fed to the systems for analysis. Two ARTiMiS systems would be deployed. Deployment would consist of placing the systems on benches near existing sampling ports, powering the systems via standard 110V power outlets, and routing a small amount of flow (on the scale of mL per hour) to the ARTiMiS systems for imaging via tubing.

**Task 6 – Design optimization and Process Control:** This task would consist of the development of recommendations for ABNR system optimization. Village of Roberts would be provided with these recommendations. If it chooses to implement any recommendations or modify its routine processes, this would occur outside of the scope of the DOE project.

UIUC would coordinate all project work. Material characterization, computer modeling, and process development would be performed at laboratory facilities at UIUC's campus in Urbana, IL. Additional characterization/analysis would be performed at the laboratory facilities of NEU and University at Buffalo, at their campuses in Boston, MA and Buffalo, NY, respectively. NEU would also coordinate development of ARTiMiS hardware/software. Project partner CLEARAS would perform data analysis and potentially, provide space for process testing using the MCDP at its research and development facility in Missoula, MT. All testing using the ABNR system would be performed at Village of Roberts as described above. No physical modifications to existing facilities, ground disturbance, or changes to the use, mission, or operation of existing facilities would be required. No additional permits or authorizations would be required.

Project work would involve the use and handling of industrial chemicals. All such handling would be performed in controlled laboratory environments. UIUC and its project partners would adhere to established institutional health and safety policies and procedures. Protocols would include employee training, the use of personal protective equipment, engineering controls, monitoring, and internal assessments. Hazardous materials would be stored, handled, and disposed of in accordance with institutional waste management procedures. No algal species or microbial communities would be introduced to the ABNR system. Wastewater samples would be sterilized prior to discharge. UIUC and its project partners would observe all applicable Federal, state, and local health, safety, and environmental regulations.

## NEPA PROVISION

DOE has made a conditional NEPA determination.

The NEPA Determination applies to the following Topic Areas, Budget Periods, and/or tasks:

- Task 2: Dynamic Process Characterization
- Task 3: Process Simulator Development
- Task 4: Miniaturized Flow Imaging Micro
- Task 5: mFIM Field Validation
- Task 6: Design Optimization and Process Control

The NEPA Determination does not apply to the following Topic Area, Budget Periods, and/or tasks:

Task 1: Verification

Notes:

Bioenergy Technologies Office  
 This NEPA determination requires a tailored NEPA provision .  
 Review completed by Jonathan Hartman, 02/09/2021

**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.

A portion of the proposed action is categorically excluded from further NEPA review. The NEPA Provision identifies Topic Areas, Budget Periods, tasks, and/or subtasks that are subject to additional NEPA review.

**SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.**

NEPA Compliance Officer Signature:  \_\_\_\_\_ Date: 2/10/2021  
 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