

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



**RECIPIENT:** Cornell University

**STATE:** NY

**PROJECT TITLE :** Temperature-responsive Swelling Particles for Elimination of Cooled Short-circuits in a Discrete Fracture

<b>Funding Opportunity Announcement Number</b>	<b>Procurement Instrument Number</b>	<b>NEPA Control Number</b>	<b>CID Number</b>
DE-FOA-0002498	DE-EE0009786	GFO-0009786-001	

**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.

**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 Cornell University to design, develop, characterize, and field test novel silica-based nanoparticles that improve flow control performance in geothermal wells. The project would be completed over three Budget Periods (BPs) with a Go/No-Go decision point between each BP. A commercial-scale field demonstration is planned for BP 3 Task 11, however the site(s) has not yet been selected. As such, this NEPA determination is applicable only to BP1, BP2, and Tasks 9 and 10 of BP3. BP3 Tasks 11 and 12 will be subject to further NEPA review when the test site(s) has been identified and sufficient information is available to complete a meaningful review.

Proposed project activities would include development of nanoparticles, laboratory testing, small-scale field demonstration, and commercial-scale field demonstration of hydraulic control in an active geothermal reservoir. The project would begin with particle preparation and characterization to create different formulas for a swelling nanoparticle and polymer composite. Particles would be developed and characterized in dedicated labs at Cornell University (Wiesner, Hormozi, and Alabi Laboratories). Preliminary screening of candidate polymer and nanocomposite particles would be conducted. The first candidate formula would be prepared in batch reactors at ambient pressure and appropriate temperatures. The resulting fluid would be tested in bench-scale flow-through experiments in a packed bed. The fluid would be characterized which would result in images of particles, particle size distribution, and zeta potential. At the Hormozi Laboratory, testing of the colloids would be performed using a desktop testing apparatus that analyzes flow characteristics. The results of these experiments would be used to refine the initial formula and develop a second candidate formula which would then be tested and characterized.

The Altona Field Laboratory in Altona, NY would be used for small-scale field testing to evaluate the performance of the temperature-responsive swelling particles. An existing 10 by 10 meter well field would be heated by circulating hot

injectate into a single, sub-horizontal fracture situated approximately 7.6 meters below ground surface. Chilled water would then be injected into the same target fracture and once the well has cooled significantly, the temperature swelling particles would be injected and tests would be performed to evaluate the extent of hydraulic control. Results would be used to further refine the formula which would be tested, characterized, and prepared for testing at a commercial scale.

No changes in the use, mission, or operation of existing facilities would be required as part of this project. If deemed necessary by the New York State Department of Environmental Conservation, Cornell would obtain a permit for field testing at the Altona Field Lab. Aside from this possible permit, no additional permits would be required in order to conduct any of the work activities. Considering that the proposed fieldwork would be conducted at an established field laboratory on ground that has been previously disturbed or developed, DOE does not anticipate impacts to resources of concern.

Project activities would involve field experiments and the use and handling of various chemical compounds (including monomers, solvents, initiators), silica-based nanoparticles, lasers, ionizing radiation, and fluids and/or colloids at high temperatures. Any risks associated with these activities and materials would be mitigated through adherence to established health and safety policies and procedures. Protocols would include personnel training, the use of personal protective equipment, engineering controls, safety meetings, and adherence to established standard operating procedures. All waste products would be disposed of by licensed waste management service providers. Cornell University 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:

Budget Period 1 – all tasks  
Budget Period 2 – all tasks  
Budget Period 3 – Task 9 and 10

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

Budget Period 3 – Tasks 11 and 12

Notes:

Geothermal Technologies Office  
This NEPA determination requires a tailored NEPA provision.  
Review completed by Shaina Aguilar on 1/27/22.

## 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:  **Electronically Signed By: Casey Strickland** Date: 1/28/2022  
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