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(1.08.09.13)

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

RECIPIENT: Fervo Energy Company **STATE:** CA

PROJECT TITLE: ZIPPER: Zonal Isolation with Plug and Perf in Enhanced Reservoirs

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE-FOA-0001945	DE-EE0008486	GFO-0008486-001	

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 federal funding to Fervo Energy Company (FEC) to develop, prototype, and field test an upgraded ball drop frac plug to meet the high-temperature and pressure requirements of Enhanced Geothermal Systems (EGS). The proposed project was selected under Funding Opportunity Announcement (FOA) DE-FOA-0001945 to support early-stage development of EGS zonal isolation tools and technologies. Projects selected from this FOA are structured into multiple Budget Periods (BP) separated by a Go/No-Go decision aimed at readying the proposed technology for potential field testing.

Preliminary design, engineering, and laboratory-based research would be conducted during BP 1 and BP 2 Task 3 of this project. Field testing and demonstration of the newly-developed product at an existing geothermal field would potentially occur during BP 2 Task 4. Neither the testing site location nor the specific wellbore of interest have been determined at this time. The results of BP 1 would inform the Go/No-Go decision, and the results of both BP 1 and BP 2 Task 3 would inform the site selection process and definition of potential field testing activities. As such there is insufficient information available to review BP 2 Task 4, which would require further NEPA review if this project advances to field trials at a geothermal field.

Activities associated with BP 1 and BP 2 Task 3 would include designing and prototyping the overall frac plug architecture, research and development of advanced elastomer material rated to specified pressure/temperature

conditions, and initial laboratory testing of the frac plug sealing components. Project management and computer work would be undertaken by FEC at their headquarters in San Francisco, CA. Engineering design, development, and validation testing of project hardware would occur at both the Sugar Land, TX Campus and Rosharon, TX Engineering Center of subrecipient Schlumberger (SLB). Fabrication would be conducted either at a combination of existing SLB manufacturing facilities or by approved 3rd party commercial vendors.

FEC is currently supported through the Cyclotron Road entrepreneurial fellowship program, a partnership that includes the Lawrence Berkeley National Laboratory (LBNL). Part of the expected analytical work for the proposed project would be performed at LBNL in Berkeley, CA. 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.

No change in the use, mission, or operation of existing facilities would arise out of these efforts. Project partners have all applicable permits in place for the proposed activities. Slight modifications to the existing pressure test fixture within FEC's laboratory space at the SLB Sugar Land Campus would be required to accommodate the proposed testing, including updates to the heat source, temperature control unit, thermal insulation system, and temperature recording unit. These activities would be limited to indoor installations of compact, commercially-available hardware and would not entail any structural modifications or new construction.

During the development and prototyping phase of this project, a total of around 50 various experimental units would be fabricated and tested. Quantities of materials used would be approximately 2500 lbs of metals and 250 lbs of elastomer compounds. Material consumption would occur entirely at SLB's purpose-built industrial facilities making use of pre-existing production sources and pathways. Standard types and quantities of non-hazardous wastes generated by the proposed activities would be disposed of as per the general waste disposal systems in place at each site.

The proposed project would involve the use and handling of various hazardous and nanoscale materials, including high strength aluminum alloys and vulcanized AFLAS, HNBR and/or other rubber compounds. All such handling would occur in dedicated research laboratories following established laboratory health and safety protocols. SLB is dedicated to proper hazardous material management and disposal practices in accordance with pertinent Federal, state, and local 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
Budget Period 2 - Task 3
The NEPA Determination does not apply to the following Topic Area, Budget Periods, and/or tasks:
Budget Period 2 - Task 4
Budget Period 2 - Task 5

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:

Geothermal Technologies Office
This NEPA determination requires a tailored NEPA Provision.
NEPA review completed by Whitney Doss, 11/20/2018

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.

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: 11/21/2018

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