

PMC-ND  
(1.08.09.13)

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



**RECIPIENT:** University of California, Los Angeles

**STATE:** CA

**PROJECT TITLE :** The Radical Atom: Mechanosynthetic 3D Printing of an Atomically Precise SPM Tip

|  |                                      |                            |                   |
|--|--------------------------------------|----------------------------|-------------------|
| <b>Funding Opportunity Announcement Number</b> | <b>Procurement Instrument Number</b> | <b>NEPA Control Number</b> | <b>CID Number</b> |
| DE-FOA-0001465                                 | DE-EE0008308                         | GFO-0008308-001            | GO8308            |

**Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Order 451.1A), I have made the following determination:**

**CX, EA, EIS APPENDIX AND NUMBER:**

Description:

|   |  |
|---|--|
| <b>A9 Information gathering, analysis, and dissemination</b>                                | 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.)   |
| <b>B3.6 Small-scale research and development, laboratory operations, and pilot projects</b> | 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. |
| <b>B3.15 Small-scale indoor research and development projects using nanoscale materials</b> | 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 the University of California, Los Angeles (UCLA) to research, develop and demonstrate the use of a chemistry-based approach to reshape and modify the 3D atomic structure of a mechanical probe using a scanning probe microscope (SPM). The proposed research will seek to address current limitations in scanning probe-based atomic manipulation to enable atomically precise manufacturing (APM).

The proposed project would support the development of tip-based APM via research organized along three integrated and collaborative channels: computational modeling and simulation; instrument and method development; and experimental implementations of SPM. Project activities would include information gathering and data interpretation, materials analysis, computational chemistry modeling, equipment upgrades, synthesis and activation of surface-bound reactants for use in fundamental explorations of APM, and proof of concept demonstrations. Computer modeling for APM would occur at Nanofactory CBN, in Syracuse, NY. Laboratory activities, including scanning probe upgrades and utilization, advanced fabrication, synthesis, and characterization of chemical precursors and fabricated structures for APM, and data analysis would occur at Gimzewski Laboratory, the California NanoSystems Institute, and the Molecular Medicine Research Institute (MMRI) in California.

The proposed activities would require the use and handling of various hazardous materials, including industrial solvents, metal-organic reagents and nanoscale materials. All such handling would occur in purpose-built and certified laboratory environment, in accordance with Federal, State, and local environmental regulations. No construction, ground disturbing activities, or modifications to existing facilities would be undertaken. No additional permits, licenses or authorizations would be required for project activities.

Nanoscale tools would be utilized in the fabrication of individual atomic scale non-hazardous organic structures.

Additionally, the project would require the sequential removal of atoms through mechanochemistry. No risks would be expected in the use of these materials. These materials would be fabricated in-situ in the chamber of an ultrahigh vacuum scanning probe microscope and removed by ion-beam irradiation after characterization.

Minimal waste would be generated during the course of the project. Non-hazardous waste would be limited to small amounts of consumable items including paper-based products, aluminum foils, polypropylene tubes and pipet tips. Disposal will be managed by the UCLA Office of Waste and Recycling Management and/or the MMRI. Project decommissioning would include cleaning of the ultrahigh vacuum chamber housing the SPM. This would be completed using ion-beam sputtering, via a standard process that is regularly carried out on-site.

“Based on the review of the proposal, DOE has determined the proposal fits within the class of action(s) and the integral elements of Appendix B to Subpart D of 10 CFR 1021 outlined in the DOE categorical exclusion(s) selected above. DOE has also determined that: (1) there are no extraordinary circumstances (as defined by 10 CFR 1021.410 (2)) related to the proposal that may affect the significance of the environmental effects of the proposal; (2) the proposal has not been segmented to meet the definition of a categorical exclusion; and (3) the proposal is not connected to other actions with potentially significant impacts, related to other proposals with cumulatively significant actions, or an improper interim action. This proposal is categorically excluded from further NEPA review. “

**NEPA PROVISION**

DOE has made a final NEPA determination for this award

Insert the following language in the award:

If the Recipient intends to make changes to the scope or objective of this project, the Recipient is required to contact the Project Officer, identified in Block 15 of the Assistance Agreement before proceeding. The Recipient must receive notification of approval from the DOE Contracting Officer prior to commencing with work beyond that currently approved. If the Recipient moves forward with activities that are not authorized for Federal funding by the DOE Contracting Officer in advance of a final NEPA decision, the Recipient is doing so at risk of not receiving Federal funding and such costs may not be recognized as allowable cost share.

Note to Specialist :

This NEPA Determination does not require a tailored NEPA provision.  
Advanced Manufacturing Office  
Jonathan Hartman 04/10/18

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

NEPA Compliance Officer Signature:  Casey Strickland Date: 4/11/2018  
NEPA Compliance Officer

**FIELD OFFICE MANAGER DETERMINATION**

Field Office Manager review required

**NCO REQUESTS THE FIELD OFFICE MANAGER REVIEW FOR THE FOLLOWING REASON:**

- Proposed action fits within a categorical exclusion but involves a high profile or controversial issue that warrants Field Office Manager's attention.
- Proposed action falls within an EA or EIS category and therefore requires Field Office Manager's review and determination.

**BASED ON MY REVIEW I CONCUR WITH THE DETERMINATION OF THE NCO :**

Field Office Manager's Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Field Office Manager