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(1.08.09.13)

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



**RECIPIENT:** Tyler Grassman / The Ohio State University

**STATE:** OH

**PROJECT TITLE :** GaAsP/Si Tandem Solar Cells: Pathway to Low-Cost, High-Efficiency Photovoltaics

<b>Funding Opportunity Announcement Number</b>	<b>Procurement Instrument Number</b>	<b>NEPA Control Number</b>	<b>CID Number</b>
DE-FOA-0001387	DE-EE-0007539	GFO-0007539-001	

**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 Ohio State University (OSU) to increase the efficiency of crystalline Si-based tandem solar cells and modules in a systematic research, development, and optimization project.

The proposed project involves the metalorganic chemical vapor deposition (MOCVD) and fabrication of III-V tandem solar cell devices within dedicated University and commercial laboratory facilities. Activities associated with the proposed project would include the design, deposition, fabrication, and characterization of these devices. Design modeling, sample preparation, microscopy, deposition, fabrication, and characterization activities would take place in specialized laboratories at OSU in Columbus, OH. Additional deposition and characterization activities as well as cost analysis work would occur at both the National Renewable Energy Lab (NREL) in Golden, CO and the commercial manufacturing facility of SolAero Technologies in Albuquerque, NM. All aspects of solar cell processing including oxidation, patterning, metallization and annealing would be undertaken in the High Efficiency Photovoltaics Lab at the University of New South Wales (UNSW) in Kensington, Australia.

All facilities in which lab work would occur are purpose-built for the type of activities being proposed; therefore no adverse impacts to sensitive resources are expected as a result of the proposed project. No change in the use, mission or operation of existing facilities would arise out of this effort. The facilities have all applicable permits in place, and would not need additional permits for the proposed activities. No siting, construction or major expansion of waste storage, disposal, recovery, or treatment actions/facilities would be required.

The proposed activities at OSU and SolAero would involve the use and handling of various hazardous materials including high pressure and/or toxic gases, organometallics, solvents, flammables, liquid nitrogen, acids, bases and oxidizers. Both OSU and SolAero are fully compliant with EPA, OSHA, and federal, state and local requirements. The



handling of all aqueous chemicals and hazardous gases would occur in isolated cleanrooms by trained personnel wearing appropriate personal protective equipment, following standard University and commercial protocols for use, storage and disposal. In addition, proposed work at OSU would require the use of existing equipment containing high voltage sources, an x-ray source, and a laser. All equipment is industry standard with appropriate safety controls and shielding. Users are required to complete appropriate training in accordance with established University health and safety protocols before being granted access to such equipment.

The proposed activities at UNSW would involve the use and handling of hazardous materials including acids and gases. All such materials would be used in-lab following established health and safety practices, and disposed of in accordance with University policy which meets relevant Australian environmental standards. The proposed activities at UNSW are exempt from further review under EO 12114 per Section 5.1.1 (Actions not having a significant effect on the environment outside the US) of the DOE EO 12114 Implementing Guidelines.

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.

It is expected that the proposed deposition and fabrication activities combined would consume less than approximately 30 lbs. of materials, including gases and chemicals used in the course of standard laboratory processes. Less than 5 lbs. of actual semiconductor devices would be produced, and it is anticipated that all devices and sample material generated during the proposed work would be maintained for later use. While the proposed device structure contains layers with thicknesses <100nm, none of these layers would at any time be free-standing or result in the generation of nanowires or nanoparticles; therefore, the use of these nanomaterials would not pose risks related to their length scale.

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.

Insert the following language in the award:

You are required to:  
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.

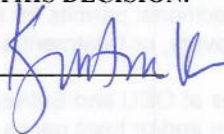
Note to Specialist :

Solar Energy Technologies Office  
This NEPA determination requires a tailored NEPA provision.  
Review completed by Whitney Doss, 08/11/16

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

NEPA Compliance Officer Signature:

 Kristin Kerwin  
NEPA Compliance Officer



Date: 8/11/2016

**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: \_\_\_\_\_  
Field Office Manager

Date: \_\_\_\_\_