

# DOE-ID NEPA CX DETERMINATION

## Idaho National Laboratory

**SECTION A. Project Title:** A Scalable Platform for Real-Time Microscopy Image Analysis Using Artificial Intelligence and Machine Learning

**SECTION B. Project Description and Purpose:**

INL will be providing Theia Scientific with sample data and access to instrumentation as a test site to obtain valuable, real-world data and user feedback. All activities will occur within the Irradiated Materials Characterization Laboratory (IMCL, MFC-1729).

1. *Procure and Prepare Samples of Interest.* Theia Scientific seeks to use real-world examples of sample characterization and quantification. Stainless steel and depleted thorium oxide samples will be fabricated for this project. INL will procure/develop an electron microscopy sample containing two representative microstructural defects generated under irradiation (e.g. dislocation loops and cavities) that can be imaged simultaneously but with different detectors on a scanning/transmission electron microscope (S/TEM). The test matrix of the experiment (e.g. dose, temperature, dose rate, etc.) is at INL's discretion as long as the above requirements are met. The estimated workload would be three to five days for the Focus Ion Beam (FIB) and one day of ex-situ TEM to verify sample quality.
2. *Create Representative Videos of S/TEM Operation Using 2 or More Detectors with Samples Derived from Task 1.* Theia Scientific needs to establish the quad-pipeline communication protocols between the EM support computer and one or more edge computing devices that host multiple AI/ML detection models. To evaluate and verify the preliminary pipeline, a computer running the INL derived video(s) will be used to simulate common microscope operation. The estimated workload would be three days of S/TEM operation to generate, process, and transmit the data to Theia Scientific.

*Determine In-Situ Irradiation Feasibility.* Theia Scientific needs to determine if the augmented reality system can work during an actual real-time S/TEM session. This requires INL to perform the enabling groundwork to evaluate the feasibility of using the Theia Scientific device(s) in a standard characterization workflow. Provided feasibility exists, INL will perform the work in conjunction with Theia Scientific to install and operate the Theia Scientific hardware on a S/TEM. INL-affiliated personnel would use the data from the feasibility efforts to co-publish a manuscript in a peer-reviewed journal.

**SECTION C. Environmental Aspects or Potential Sources of Impact:**

**Air Emissions**

There will be no radiological emissions from this project. The samples are primarily going to be stainless steel but possibly depleted thorium with enough time.

**Discharging to Surface-, Storm-, or Ground Water**

N/A

**Disturbing Cultural or Biological Resources**

N/A

**Generating and Managing Waste**

Small amounts of low level and industrial waste may be generated from personal protective equipment, wipes, and sample debris. No transuranic (TRU) waste is expected to be generated as a result of this project.

**Releasing Contaminants**

When chemicals are used during the project there is the potential for spills that could impact the environment (air, water, soil).

**Using, Reusing, and Conserving Natural Resources**

All materials would be reused and recycled where economically practicable. All applicable waste would be diverted from disposal in the landfill where conditions allow.

**SECTION D. Determine Recommended Level of Environmental Review, Identify Reference(s), and State Justification:** Identify the applicable categorical exclusion from 10 Code of Federal Regulation (CFR) 1021, Appendix B, give the appropriate justification, and the approval date.

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For Categorical Exclusions (CXs), the proposed action must not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, safety, and health, or similar requirements of Department of Energy (DOE) or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment or facilities; (3) disturb hazardous substances, pollutants, contaminants, or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources (see 10 CFR 1021). In addition, no extraordinary circumstances related to the proposal exist that would affect the significance of the action. In addition, the action is not "connected" to other action actions (40 CFR 1508.25(a)(1) and is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1608.27(b)(7)).

**References:** 10 CFR 1021, Appendix B to subpart D, items B3.6, "Small-scale research and development, laboratory operations, and pilot projects"

**Justification:** Project involves the fabrication a stainless steel and depleted ThO2 samples, and is consistent with CX B3.6 Small-scale research and development, laboratory operations, and pilot projects. Siting, construction, modification, operation, and decommissioning of facilities for small-scale 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.

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act)       Yes     No

Approved by Jason L. Anderson, DOE-ID NEPA Compliance Officer on: 8/25/2021