

DOE-ID NEPA CX DETERMINATION

Idaho National Laboratory

SECTION A. Project Title: Robust Insulation For Resilient Transformers against an Electromagnetic Pulse and Geomagnetic Disturbance

SECTION B. Project Description and Purpose:

DOE-OE has requested that Idaho National Laboratory (INL) investigate new high temperature tolerant composite materials that could be used to enhance transformer resilience against a geomagnetic disturbance (GMD) or electromagnetic pulse (EMP) type threat and enhance the capabilities of power electronic devices, especially Solid-State Transformers. INL will identify promising composite materials suitable for a high temperature, high frequency and high voltage tolerant electrical insulation. INL will develop prototype samples and characterize the resulting materials in addition to identifying and testing any presently available materials that show promise.

The US Department of Energy's Office of Electricity Delivery and Energy Reliability (DOE-OE) has the mission to secure the nation's critical energy infrastructure and ensure rapid recovery from disruptions. Previously funded DOE-OE studies identified power transformer insulation as a component vulnerable to failure from a GMD or EMP, which could have a significant consequence on the power grid.

The laboratory portions of the work will be accomplished in the Energy Innovation Laboratory Lab 220. Some characterization equipment will need to be procured, a tensile strength tester specifically. There is the potential to need other test sets. No building modifications will be necessary to install or operate the equipment.

The processes that will be used to fabricate samples are experimental and continue to be refined. The methods have been grouped into two general categories. First, the well-established Sol-Gel method will be used for mixing the components. This is a bench top wet chemistry method and will be accomplished in a fume hood using standard lab techniques. Sol-Gel techniques are already in use in Lab 220, for this development effort a range of new components will be added to the gel to create new composites. The second method will be to add binding materials to ceramic filler fibers. This method will leverage commercial silicone-based binders, and silane crosslinking agents. The application of the binders will be to pour, brush or apply the binders in a manner that maximizes the desired material property outcomes. Curing, drying and treating the material will occur in an oven located in the fume hood. The samples will be lab scale in size (5 inches x 10 inches) and quantity (limited to the smallest number required to establish credible statistics).

A pull tester will be used to test the tensile strength, a bend tester for durability, a voltage breakdown tester will be used for the breakdown voltage. An oven will be used to thermally stress the material. Conductivity will be measured, and the other relevant parameters will be tested at the National Energy Technology Laboratory or Boise State University given their specific capabilities for high frequency and voltage testing.

Work is expected to be complete by March of 2021.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

Air emissions are expected from the curing process. Those pollutants would include small amounts of xylene, 1-butanol, ethyl benzene, etc. They are covered in APAD INL-13-007 R1.

Discharging to Surface-, Storm-, or Ground Water

Disturbing Cultural or Biological Resources

The building identified for use in the proposed activities, EIL, is a leased facility by BEA. In order to cover any potential conflicts associated with compliance and Section 106 of the National Historic Preservation Act (NHPA), the CRMO will conduct and retain a cultural resource review (CRR) for this project. No additional review by our office is required, as EIL is not a historic property based on date of construction.

Generating and Managing Waste

Both Industrial and Hazardous waste will be generated. Industrial waste will take the form of wipes, rags, PPE, and similar material. Hazardous waste may include several forms including laboratory synthesis waste. The project does not intentionally use or generate nanoparticle material. Due to the nature of the work any nanoparticles that are inadvertently generated would be bound by the binding process under investigation or handled by the filtration system in the hood. All Solid Waste will be managed by WGS.

Releasing Contaminants

Air emissions will contain small amounts of organic chemicals.

Although not anticipated, there is a potential for spills when using chemicals or fueling equipment. In the event of a spill, notify facility environmental staff. If environmental staff cannot be contacted, report the release to the Spill Notification Team (208-241-6400). Clean up the spill and turn over spill cleanup materials to WGS.

Using, Reusing, and Conserving Natural Resources

All applicable waste will be diverted from disposal in the landfill when possible. Project personnel will use every opportunity to recycle, reuse, and recover materials and divert waste from the landfill when possible. The project will practice sustainable acquisition, as appropriate and practicable, by procuring

DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

construction materials that are energy efficient, water efficient, are bio-based in content, environmentally preferable, non-ozone depleting, have recycled content, and are non-toxic or less-toxic alternatives. New equipment will meet either the Energy Star or SNAP requirements as appropriate (see <http://www.sftool.gov/GreenProcurement>).

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.

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", and B3.15, "Small-scale indoor research and development projects using nanoscale materials"

Justification: The proposed R&D activities are consistent with CX B3.6 "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); smallscale 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 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;" and

CX B3.15 "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)".

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

Approved by Jason Sturm, DOE-ID NEPA Compliance Officer on: 6/17/2020