#### REQUEST FOR STATEMENTS OF INTEREST PROJECT TO BE INITIATED IN FY 2019 W912HZ-19-SOI-0028 Colorado Plateau

# Project Title: Life Cycle Assessment of Nano-enabled Products and Devices for their Safe and Rapid Development

Responses to this Request for Statements of Interest will be used to identify potential investigators for studies to be sponsored by the Engineer Research and Development Center (ERDC) to provide research and evaluation expertise for assessing the Life Cycle Assessment of advanced materials and nanomaterials used in products and devices. The goal is to research the environmental footprint of the manufacturing process, streamline the manufacturing process for greater efficiency and to determine unknowns and reduce uncertainty of risk and liability assessment. The estimated level of funding is \$300,000 for a multiple year research effort to begin in FY19 for 2 years (approximately 150K per year). Additional funds may be available in future years to the successful recipient.

### Background

**Introduction:** Manufactured nanomaterials have offered unique properties allowing for greater reactivity, functionalities, sensitivities and miniaturization of devices and products. However, the use of these materials and their related potential for unique behavior, fate and transport and hazard have led to uncertainties in the utility of traditional risk assessment and Life Cycle Assessment (LCA) processes. This uncertainty may impact the speed of regulatory decisions, safe handling of the materials by workers and insurance premiums. In addition, LCA may shed light of the durability and lifetime of these materials under different environmental challenges or threats. The research goal is to refine the traditional processes used for LCAs to include specific consideration to nanomaterials, as well as other more conventional substances and processes used in manufacturing, product use and end of life. This effort may or may not consider the application of 2D and 3D printing of nanomaterials into other matrices. Specific nanomaterials of interest include, but are not limited to, carbon nanomaterials (e.g., nanotubes, graphene, carbon black), nano-gold and nano- palladium. Desired deliverables include peer-reviewed publications, standard operating procedures (SOPs) for nano LCA and a guidance matrix or decision matrix.

# **Public Benefit**

The benefit to the public is a streamlined process to ensure that the latest technologies may go to acquisitions and commercialization in a timely manner while also formalizing a process to consider environmental, occupational and consumer health. Further, this research effort should engage students at various levels to educate and engage them in STEM projects and occupations to foster the next generation of scientists and engineers.

## **Brief Description of Anticipated Work:**

**Objective 1:** Determine the process and inventory used in manufacturing of novel materials. Learn the process for researching novel nano and advanced materials enabled technologies, well prior to product prototyping and development. The focus should be on inventories of ingredients currently used, and that could be potentially used, to understand what a life cycle inventory may look like for novel technologies to facilitate green engineering, streamlining process and inefficiencies and performing an environmental LCA.

**Objective 2: Determine processes and compartments of concern.** This objective involves research to determine the environmental and exposure compartments of concern related to manufacturing, use and disposal of nano and advanced materials enabled technologies. Focus should be on determining where exposure concerns may be and also consider fate and transport routes in manufacturing, use and disposal, including but not limited to worker and consumer exposure, waste streams and waste management. The information gathered should support a LCA to include the nanomaterial (or advanced material), and other potentially hazardous substances.

**Objective 3: Perform Life Cycle Assessment, Analysis and Interpretation.** Use the information gathered on process and inventory from previous tasks to perform a full LCA. The LCA should answer questions regarding if/how the nanomaterial (or advanced material) impacts the LCA output (and how it should be considered or excluded from the LCA), if conventional substances are of concern and how the LCA process can be improved or streamlined for nano-enabled technologies. The LCA(s) performed should be fully interpreted for fate and transport, exposure, impacts and damage assessment. Conclusions should include the pathways, processes and substances of greatest concern with recommendations for potential management controls. There may also be a cost-benefit analysis for the immediate expense of streamlining process relative to long term cost and liability realizations.

**Objective 4: Technical Transfer.** The LCA process improvements and conclusions from the previous objective should be disseminated in most useful way possible for the public good. This includes peer reviewed publications and reports for scientists in the community, standard operating procedures for how nanoLCA was improved and can be streamlined based on these research findings, and development of an electronic executable or tool that can guide technology businesses, government entities, risk assessors, project managers, etc. through the refined LCA process.

# **Government Participation:**

The ERDC-EL will work with the selected recipient/awardee to understand research objectives, ensure public good, development of the scope of products, protocols and interpretation of the LCA for the advanced materials or enabled technologies of interest. Importantly, ERDC-EL will also consult in the identification of those products and technologies that are of interest. ERDC-EL will also review and potentially improve the relevance of the work during its development and dissemination to ensure relevance to the public good.

### Materials Requested for Statement of Interest/Qualifications:

Please provide the following via e-mail attachment to: <u>Deberay.R.Carmichael@usace.army.mil</u> (Maximum length: 2 pages, single-spaced 12 pt. font).

- 1. Name, Organization and Contact Information
- 2. Brief Statement of Qualifications (including):
  - a. Biographical Sketch,
  - b. Relevant past projects and clients with brief descriptions of these projects,
  - c. Staff, faculty or students available to work on this project and their areas of expertise,
  - d. Any brief description of capabilities to successfully complete the project you may wish to add (e.g. equipment, laboratory facilities, field facilities, etc.).

Note: A proposed budget is NOT requested at this time.

**Review of Statements Received:** Based on a review of the Statements of Interest received, an investigator or investigators will be invited to prepare a full study proposal. Statements will be evaluated based on the investigator's specific experience and capabilities in areas related to the study requirements. Additionally, the evaluation method and selection criteria for research and development awards must be: (1) The technical merits of the proposed research and development; and (2) Potential relationship of the proposed research and development to the public.

#### Please send responses or direct questions to:

Deberay Carmichael U.S. Army Engineer Research and Development Center (ERDC) ERDC Contracting Office (ECO) 3909 Halls Ferry Road Vicksburg, MS 39180 Deberay.R.Carmichael@usace.army.mil

**Timeline for Review of Statements of Interest:** Review of Statements of Interest will begin after the SOI has been posted on the CESU website for 10 working days.