

**Strategic Environmental Research and Development Program (SERDP)
SERDP Exploratory Development (SEED)**

FY 2022 STATEMENT OF NEED

Weapons Systems and Platforms (WP) Program Area

**CRITICAL MINERAL AND RARE EARTH ELEMENT (REE)
RECOVERY, RECYCLING AND REUSE**

The SEED Solicitation is a means for researchers to test a proof of concept during an effort of approximately one year.

1. Objective of Proposed Work

The objective of this SERDP Exploratory Development (SEED) Statement of Need (SON) is to develop a framework and provide initial laboratory scale tools for securing critical minerals and rare earth element (REE) by recovery, recycling, and reuse in Department of Defense (DoD) weapons systems and platforms. The ultimate goals of proposed efforts should be as follows:

- Minimize waste during recycling.
- Increase use of post-production waste.
- Enhance product recycling and reuse at end-of-life disposition.
- Reduce the hazardous waste streams while improving environmental safety and occupational health (ESOH).
- Provide a new source of material to DoD's supply chain.

Proposals should include a task to conduct a preliminary Sustainability Analysis of appropriate proportion for the proposed research and development. The Sustainability Analysis may include varying depths of data and information that can inform the goal and scope of an analysis, the identity and quantity of relevant inputs and outputs to the system, and the estimation of life cycle impacts and costs.

2. Expected Benefits of Proposed Work

Developing a means to recover, recycle and reuse REEs would help minimize risk to the supply chain. The current availability of many of these materials (especially the heavy REEs) is limited to a few overseas sources. Developing a means to utilize scrap materials as a source of high-value REEs, thereby reducing lifecycle costs, benefitting the environment, and securing the domestic supply chain for these materials would be of great benefit to the DoD.

3. Background

Critical and strategic minerals include REEs such as rare earth ores, oxides, metals, alloys, which currently lack appropriate substitutes. These are used in a variety of commercial and military applications such as cell phones, lasers, communication systems, radar systems, avionics, night

vision equipment, satellites, batteries, ceramics, glasses, abrasives, electric vehicles, energy efficient lighting, wind-power, computer hard drives, and DoD precision-guided munitions. Some of these applications rely on permanent rare earth magnets [1, 2, 3].

This SON supports Executive Order 13817 (A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals) through bolstering the domestic supply of critical minerals by reducing critical minerals content in products, minimizing waste during manufacturing, reusing post-production waste, and recycling at product end-of-life. Although industrial demand for REEs is relatively small in tonnage, they are essential for the diverse and expanding array of high-technology applications mentioned previously. Unfortunately, these materials require multiple processing steps before they can be utilized, including mining, separating, refining, forming and finally manufacturing. DoD has assessed potential opportunities to recover certain materials found in its electronic waste, including REE, but a number of factors hinder near-term expansion of its recovery efforts ([GAO-16-576](#)). Developing technologies for the recovery, recycling, and reuse of these minerals from DoD assets will help minimize risks associated across supply chains. DoD's current approach to identifying and mitigating risks associated with rare earths is fragmented. With different interpretations of which rare earths are critical, establishing priorities to analyze supply risk becomes difficult ([GAO-16-161](#)). The difficulty in separating REEs leads to the current high cost and environmental footprint of recycling them. It is anticipated that work covered under this SON will research novel and low-cost methods of recovery, recycling and reuse of REEs.

4. Cost and Duration of Proposed Work

To meet the objectives of this SEED SON, proposals should not exceed \$250,000 in total cost and approximately one year in duration. Work performed under the SEED SON should investigate innovative approaches that entail high technical risk and/or have minimal supporting data. At the conclusion of the project, sufficient data and analysis should be available to provide risk reduction and/or a proof-of-concept. SEED projects are eligible for follow-on funding if they result in a successful initial project.

5. Point of Contact

Robin Nissan, Ph.D.

Program Manager for Weapons Systems and Platforms

Strategic Environmental Research and Development Program (SERDP)

4800 Mark Center Drive, Suite 16F16

Alexandria, VA 22350-3605

Phone: 571-372-6399

E-Mail: Robin.A.Nissan.civ@mail.mil

For SEED proposal submission due dates, instructions, and additional solicitation information, visit the [SERDP website](#).

6. References

- [1] "Rare Earth Materials in the Defense Supply Chain", briefing for Congressional Committees, 4/1/20.

- [2] Long, K. et. al., “The Principal Rare Earth Element Deposits of the United States—A Summary of Domestic Deposits and a Global Perspective”, USGS Scientific Investigations Report 2010–5220.
- [3] U.S. Geological Survey, Mineral Commodity Summaries, January 2020.
<https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-rare-earths.pdf>