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 Statement of Need (SON) is to develop innovative synthetic approaches to produce energetic materials and their precursors that will eliminate or drastically reduce hazardous waste streams from the nitration processes that are widely used in manufacturing energetic materials. Typical nitration processes of aromatic compounds, amines, and alcohols to produce C-Nitro, N-Nitro or Nitrate ester based energetics involve large quantities of strong acids (sulfuric and nitric) and produce large quantities of hazardous wastes. Solvents used in the preparation of these compounds are contaminated with the energetic material, hazardous reagents, or reaction by-products and are not easily recycled. In addition, typical nitration reactions require rigorous temperature control and are therefore energy intensive processes.

Proposals should focus on one of the following processes:

- Synthesis of an aromatic/heteroaromatic nitro compound (e.g. TNT, DNAN)
- Synthesis of a nitramine (e.g. RDX, HMX, CL-20)
- Synthesis of a nitrate ester (plasticizer) (NG, TMETN, etc. or nitrocellulose)

Proposals also will be considered for more broad-based research to develop the fundamentals of synthetic methodologies as related to energetic materials with no specific targeted compounds. Proposed methodologies will need to be innovative and need to go beyond the previously investigated methods of recycle and reuse of solvents/reagents. This could include solid phase synthesis for aromatic nitrations, nitramine, nitrate ester formation, or oxidation of amines to nitro groups.

In the past, SERDP has explored electrochemical and biological methodologies as well as hybrid pathways involving combinations of synthetic biological and organic synthesis to produce energetic materials or to explore novel nitration pathways. Proposers for this SON should focus on methods that minimize or eliminate solvation pathways and that do not involve biological or electrochemical methods.
2. Expected Benefits of Proposed Work

Solvent-free syntheses will enable the Department of Defense (DoD) to sustain production of explosives and propellant ingredients and their precursors. All current methods to synthesize explosives and propellant ingredients, and precursors involve significant amount of solvents and result in the need to dispose of spent solvent as hazardous waste. Solvent-free or reduced solvent synthesis methodologies could minimize hazardous waste at the initial stages of production and also could improve safety of operations.

3. Background

The synthesis of energetic materials has been carried out for more than a century using large amounts of solvents and mixed acids, resulting in the necessity of disposing of solvent and spent acid after the reactions are complete. If a solvent is not used in synthesis, then often one of the liquid reagents is used in large excess to serve as solvent. The traditional approach to environmental concerns has been to recycle the solvent or the excess reagent. Recycling a solvent (or a reagent) comes with its own set of issues, including cost and ensuring the purity of the recycled solvent. While such approaches may reduce the amounts of hazardous waste, they do not completely eliminate it.

Energetic materials that are used in DoD weapon systems are produced in quantities of millions of tons. A majority of explosives and propellants used in DoD weapon systems contain organic nitro compounds in the form of aliphatic, aromatic, carbocyclic and heterocyclic compounds containing C-NO₂, N-NO₂ and O-NO₂ functionalities. These compounds are made via nitration reactions at some stage of the synthesis. The nitration reactions at large scale are often carried out using nitric acid, mixed acid (mixture of nitric and sulfuric acid) and nitrate salts. Over 10 million pounds of spent acid is either released or treated at Army Ammunition Plants per year.

4. Cost and Duration of Proposed Work

To meet the objectives of this SEED SON, proposals should not exceed $200,000 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

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For SEED proposal submission due dates, instructions, and additional solicitation information, visit the SERDP website at [www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations](http://www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations).