SON Number: WPSON-12-02 **October 28, 2010**

Strategic Environmental Research and Development Program (SERDP)

FY 2012 STATEMENT OF NEED

Weapons Systems and Platforms (WP) Program Area

SCALE-UP AND FORMULATION OF GREEN INSENSITIVE SECONDARY EXPLOSIVES

1. Objective of Proposed Work

The objectives of this Statement of Need (SON) are to:

1) Develop environmentally acceptable synthesis methods to scale-up environmentally sustainable, insensitive secondary explosives as alternatives to cyclotrimethylenetrinitramine (RDX), 2, 4, 6-trinitrotoluene (TNT), and ammonium perchlorate (AP); and
2) Develop novel formulations utilizing the alternative materials to replace Composition B (Comp B).

Standard proposals should address both objectives. Limited scope proposals will also be considered that focus only on one of the two objectives: 1) scale-up without formulation, or 2) formulation using materials already scaled-up and proven to have low potential for environmental impacts. The proposer must substantiate that proposed materials have a low potential for environmental impact.

Proposed formulations should meet or exceed all of the performance properties associated with Comp B, should not require substantial changes to current manufacturing methods, and should show reduced toxicity, improved fate/transport/effects properties, and improved sensitivity characteristics when compared to Comp B.

Proposed solutions should focus on new and novel materials that have previously been synthesized only in gram quantities and have shown promising performance properties, improved sensitivity characteristics, and favorable environmental properties. Proposals should include empirical data justifying performance properties of the new material(s) and evaluation of potential environmental impact properties per ASTM Standard E2552-08, "Standard Guide for Assessing the Environmental and Human Health Impacts of New Energetic Compounds." They should include proposed methods for synthesis that will be acceptable for scale-up at the manufacturing scale and several potential methods for final formulation. Considerations in the scale-up process can include studies on optimizing the effects of physical characteristics such as particle size and morphology on material sensitivity and environmental performance. Proposals addressing scale-up technologies that involve alternative synthesis methods such as biosynthesis or other advanced, environmentally sustainable processes will be considered.

Proposals for scale-up of materials or development of formulations that include 3-Nitro-1,2,4-Trizole-5-One (NTO) or 2,4-Dinitroanisol (DNAN) will not be considered.

2. Expected Benefits of Proposed Work

The Department of Defense (DoD) has used most of the energetic materials in its inventory for half of a century or more. Over time, energetic materials have been released into the environment from training and testing ranges through unexploded ordnance and incomplete detonations. This has led to costly, long-term range remediation and clean-up efforts, and in some cases, has led to restrictions on training operations or reduced production capabilities. Sustainable materials, compositions and processes will ensure that warfighters are able to train with minimal environmental impact, maintain munition availability through sustainable production and reduce demilitarization restrictions due to environmental concerns.

3. Background

The DoD is currently seeking environmentally sustainable secondary explosive materials that, when formulated into a composition, also meet the insensitive munition (IM) goals and safety requirements for the next generation of weapon systems. The Joint Insensitive Munitions Technology Program (JIMTP) has made excellent progress in developing insensitive munitions; however, some of the new insensitive energetic materials have properties that have the potential to adversely affect the environment on training ranges. Existing RDX-based compositions have similar issues.

Several programs in the past few decades have developed gram-scale quantities of energetic materials that have promising properties; however, most of these programs were focused on increasing energy density or other traditional performance parameters. As a result, many compounds with performance ranging from that of RDX to CL-20 were abandoned because they did not present a significant performance gain. In retrospect, these materials may actually be excellent candidates as insensitive, environmentally sustainable materials.

The DoD has fielded, or will soon field, insensitive munitions compositions such as Picatinny Arsenal eXplosive (PAX)-21, Insensitive Munition eXplosive (IMX)-101, and IMX-104. All of these materials contain some combination of DNAN, NTO and AP along with more traditional secondary explosive ingredients. These are all melt-pour compositions. Melt-pour compositions present the greatest potential for environmental impact because of their high use on US ranges and because the energetic materials are generally not bound up in a polymer like in cast-cure compositions. It is also generally ‘easier’ to make melt-pour compositions less sensitive.

IMX-101 is the first composition being fielded by DoD that enables a munition, the M795 155mm projectile, to meet all of the IM goals. IMX-101 is a TNT-equivalent composition that can be used in the same melt-pour process that is used to load TNT into the current M795. PAX-21 and IMX-104 are both Comp-B equivalents that have been/will be fielded. The environmental properties of these materials are currently under evaluation.

Comp B is the most widely used composition on DoD ranges in terms of quantity of use and in numbers of munitions. One study showed that Comp B accounted for 91% of the explosives compositions used on US Army ranges. Comp B contains both RDX and TNT, which have well-known environmental impacts and do not meet IM goals in munitions. Although efforts are underway to reduce the sensitivity of RDX, this will not change its basic environmental issues.

4. Cost and Duration of Proposed Work

The cost and time to meet the requirements of this SON are at the discretion of the proposer. Two options are available:

Standard Proposals: These proposals describe a complete research effort. The proposer should incorporate the appropriate time schedule and cost requirements to accomplish the scope of work proposed. SERDP projects normally run from two to five years in length and vary considerably in cost consistent with the scope of the effort. It is expected that most proposals will fall into this category.

Limited Scope Proposals: Proposers with innovative approaches to the SON that entail high technical risk or have minimal supporting data may submit a Limited Scope Proposal for funding up to $150,000 and approximately one year in duration. Such proposals are eligible for follow-on funding if they result in a successful initial project. The objective of these proposals should be to acquire the data necessary to demonstrate proof-of-concept or reduction of risk that will lead to development of a future Standard Proposal. Proposers should submit Limited Scope Proposals in accordance with the SERDP Core Solicitation instructions and deadlines.

5. Point of Contact

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For Core Proposal submission due dates, instructions, and addition solicitation information, visit the SERDP web site at www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations.