

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

**FY 2021 STATEMENT OF NEED**

**Weapons Systems and Platforms (WP) Program Area**

**DEVELOPMENT OF CHROMIUM-FREE POST TREATMENT SEALERS**

**1. Objective of Proposed Work**

The objective of this Statement of Need (SON) is to develop chromium-free sealers for surface finishing processes. The following processes have historically used or continue to use a chromium-based sealer.

- Zinc plating (ASTM B633, B695)
- Zinc nickel plating (BAC 5680)
- Phosphate coatings (manganese and zinc, TT-C-490 or MIL-DTL-16232)
- Cadmium plating (AMS QQ-P-416B)
- Aluminum anodizing (MIL-A-8625F (Type II, III) as well as promising chromium-free alternatives like tartaric sulfuric acid anodize and thin film sulfuric acid anodize)
- Magnesium anodizing
- Ion vapor deposition aluminum (MIL-DTL-83488)
- Black oxide (MIL-DTL-13924)
- Pretreatments on bare aluminum
- Pretreatments on bare steel

Proposers are encouraged to pursue development of unique high performance sealers and pretreatments that could be applied across multiple processes. One of the highest priority processes is chromium-free sealers for ZnNi or zinc plating. Sealers and pretreatments developed in response to this SON should be HAP-free and low VOC. Proposers should plan to conduct necessary tests on their candidate formulations including:

- Sealers must be evaluated for adhesion of organic coatings,
- For applications on electrical components, alternatives must be able to provide proper electrical conductivity (e.g., ZnNi on electrical connectors),
- Sealers used on high strength steels will require additional fatigue and hydrogen embrittlement testing.

Proposals should include a task to conduct a Sustainability Analysis of appropriate proportion to the proposed research and development. Proposals should establish a lifecycle framework that can mature as the technology or process advances through the acquisition process. This tiered approach aims to develop and document a minimum data set at each stage of research and development that can be used to make informed decisions and streamline transition to an acquisition program. 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**

At least eight DoD depots have reported using carcinogenic post treatment sealers for a variety of surface finishing processes. A chromium-free sealer that could be used across multiple processes would dramatically reduce the cost to sustain depot operations and eliminate worker exposure to a known carcinogen. Chromium-free sealers will also enable DoD to comply with OSHA and American Conference for Governmental Industrial Hygienists (ACGIH) exposure limits for chromium compounds and avoid fines, restrictions and process shutdowns.

## **3. Background**

The DoD relies on multiple surface finishing processes to protect bare substrate from degradation to extend the service life of a weapon system. In many cases, a post treatment sealer is required to provide additional corrosion protection and fill in porosity of the surface treatment. Stainless steel passivation is a surface treatment to reduce the corrosion rate of stainless steels by removal of surface steel particles and forming a protective passive film. Many legacy sealers are based on chromic acid or other hexavalent chromium compounds like sodium dichromate or chromium trioxide. In an effort to eliminate hexavalent chromium, select applications have been transitioned to a trivalent chromium sealer.

In 2017, DoD depots reported using over 1500 pounds of hexavalent chromium sealers in processes across at least 8 depots. DoD has over 30,000 gallons of dedicated infrastructure for chrome sealer operations, including all plating and rinse baths. Sealers are used by the Air Force, Army and Navy. Passivation is performed at Army and Navy depots.

In 2018, the ACGIH published a revised chromium threshold limit value (TLV). The TLV set exposure limits for chromium, trivalent chromium, and hexavalent chromium, as well as a short term exposure limit for hexavalent chromium. The time weighted average (TWA) is nearly two orders of magnitude lower than the current hexavalent chromium OSHA permissible exposure limit (PEL) of 0.005 mg/m<sup>3</sup>. The DA PAM 40-503 requires that the Army use ACGIH TLVs when they are more stringent than the OSHA regulations or when there is no PEL, and the other services are considering applying the TLV in select applications.

While chromium-free alternatives have been identified, demonstrated or implemented for select processes, it would be beneficial to identify a sealer (or family of sealers) that can be used for multiple applications. To date, chromium-free alternatives have not been adequately demonstrated to meet requirements for zinc plating.

## **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 \$250,000 and approximately one year in duration. Such proposals may be 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 additional solicitation information, visit the [SERDP website](#).