

MITIGATION - SCIENCE AND TECHNOLOGY ADVANCES FOR CHEMICAL AND BIOLOGICAL HAZARD MITIGATION

Decontamination Of Broad Spectrum Biological Threats Using An Atmospheric Plasma System

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Background: Mistral is a handheld atmospheric pressure plasma decontamination system capable of eliminating a broad spectrum of biological threats from sensitive electronics and other surfaces. Our product addresses the critical need for effective hazard mitigation systems to enhance Joint Force survival and mission effectiveness.

Purpose and Objective: With Mistral, we provide service members with broad-spectrum biological decontamination capabilities, particularly for sensitive and high-value equipment, faster and farther forward than any other available method. This enhances their ability to safely assess and exploit recovered data products and to return equipment to service that would otherwise require destruction.

Rationale : Current decontamination methods lack the efficiency and responsiveness required to mitigate biological threats effectively on sensitive electronics without causing significant damage. Mistral addresses this critical gap via a non-wetting effluent enhanced atmospheric plasma stream which provides a highly effective and versatile solution for biological decontamination. This handheld and user-friendly decontamination system has been specifically tailored for sensitive site exploitation.

Relationship to Other Areas of Study: Mistral integrates advances in atmospheric pressure plasma technology, chemistry, and materials science to provide a comprehensive hazard mitigation system. Combining expertise from these diverse fields, we aim to enhance Joint Force survival through increased effectiveness and responsiveness of decontamination operations. The research aligns with broader efforts to develop innovative technologies that limit the spread of contamination and promote rapid reduction in Mission Oriented Protective Posture (MOPP) levels.

Methods: Efficacy of Mistral was evaluated against bacterial and fungal pathogens using both zone of inhibition and coupon testing. In brief, pathogen suspensions were inoculated either directly onto appropriate agar or onto coupon surfaces and allowed to dry under BSC. Samples were then exposed to Mistral for various amounts of time and either incubated directly, or recovered in PBS, serially diluted, plated, and incubated overnight. Viral pathogen inactivation was assessed using the TCID50 assay.

Results and Conclusions: Preliminary testing of Mistral has demonstrated promising results in terms of its ability to effectively eliminate pathogenic microorganisms from complex and sensitive surfaces. The system has demonstrated a 6log reduction in pathogen viability within minutes of exposure against a range of CB threats, including Gram-negative and Gram-positive bacteria, bacterial endospores, fungi, and viruses. These preliminary findings suggest that Mistral has great potential as a portable decontamination solution for a variety of surfaces and environments, contributing to improved hazard mitigation systems and enhancing Joint Force survival through increased effectiveness and responsiveness of decontamination efforts.

Impact to JSTO Mission and Joint Force: The successful development and implementation of Mistral will have a transformative impact on military operations and force protection. This system provides a novel and significant capability to the Joint Force, allowing service members in forward operations to safely and rapidly mitigate biological threats that hinder the use and exploitation of sensitive equipment in the field. This capability will increase the pace with which warfighters can obtain and act upon time-sensitive intelligence, while decreasing the logistic burden to neutralize challenging biological contaminants.

This research was supported by DEVCOM Chemical Biological Center (CBC) contract W911SR-22-C-0040. The authors thank collaborators at Triton Systems Inc., UWM, and CUBRC.