

STERIS Defense & Industrial Group Case Study

Demonstration of the Decontamination of a Military Cargo Aircraft Using Modified Vaporized Hydrogen Peroxide (mVHP™) Technology

The Challenge:

To respond to the threat from chemical and biological warfare agents, a fast, effective method is needed for decontamination of the interior surfaces of buildings, aircraft, and vehicles. This decontamination technology must be compatible with a wide variety of surface types as well as sensitive equipment. Ideally, it will also be environmentally friendly and will leave no residues.

The Solution:

Through a Cooperative Research and Development Agreement (CRADA), the STERIS Defense & Industrial Group (D&I) and the U.S. Army Edgewood Chemical Biological Center (ECBC) modified STERIS's Vaporized Hydrogen Peroxide (VHP®) room sterilization technology to be effective against both chemical and biological warfare agents. D&I designed a self-contained modular delivery system for the modified mVHP technology that can be tailored to different interior volumes and configurations. After obtaining successful results in a series of building decontamination demonstrations, STERIS deployed the modular mVHP system in a demonstration within the cargo hold of a Starlifter C-141 aircraft.

The Result:

The modular mVHP system successfully achieved complete kill of all biological indicator spores within the aircraft, and reduced residual chemical agent simulants below threshold levels.



The STERIS mVHP Process:

The mVHP chemical biological warfare (CBW) decontamination process evolved from STERIS's VHP sterilization technology, which has been in use for over a decade in the pharmaceutical and research industries. D&I in partnership with ECBC modified the formulation to be effective against chemical agents as well as biological agents, and adapted the process for application in large-scale, complex building interiors. By using a modular hardware approach, the system is portable and can be tailored to wide-ranging applications. When powered by generator and supported by mobile laboratories, it can be completely self-contained.

The process is highly effective against pathogenic organisms and bacterial spores, and also successfully inactivates GD, HD and VX chemical agents. Because mVHP breaks down into non-toxic residuals (water vapor and oxygen), the process is environmentally friendly. It is non-carcinogenic, non-corrosive at use concentration, and does not leave residues on surfaces.

The mVHP process is compatible with a wide variety of materials, including sensitive electronics, equipment, and a broad range of materials and finishes. Testing by the Air Force Research Laboratory has confirmed the compatibility of mVHP technology with aircraft materials. It can be used over a wide range of temperatures, works quickly, and because of its scalability, is effective in small or large enclosed spaces.



The Decontamination Process:

Testing was conducted during October and November, 2004, at Davis-Monthan Air Force Base, Arizona. The modular mVHP system was designed, fabricated and hardware tested by STERIS D&I before being transported to the base. The Aerospace Maintenance and Regeneration Center (AMARC) at Davis-Monthan AFB provided access to the C-141 aircraft and operational support in equipping a stand-alone base of operations for the demonstration. STERIS D&I used airflow modeling software to determine the placement of the modular components within the aircraft in order to achieve optimized vapor distribution throughout the cargo hold.

All aspects of the decontamination process were monitored, controlled and recorded by an automated controller. The controller relied on real-time feedback to maintain the target vapor concentration levels for the duration of the phased process.

Simulants for chemical and biological agents were distributed throughout the interior of the aircraft to verify the successful inactivation of agents. ECBC provided two vans equipped as mobile laboratories to evaluate the results shortly after each decontamination test run was completed. Test results showed a complete kill of all biological indicator spores and reduced residual of chemical agent stimulants below threshold levels.

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