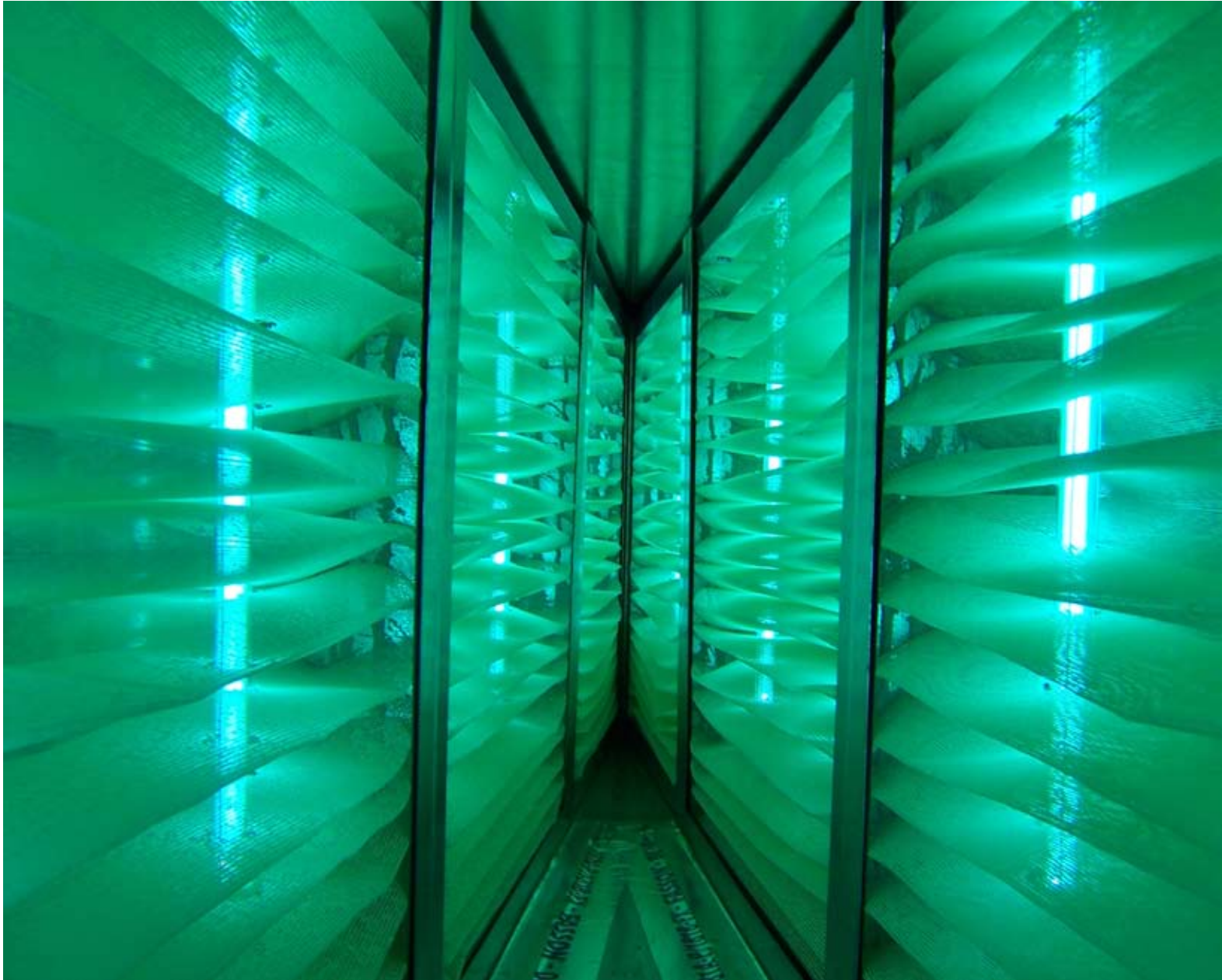


# The Capability of the Genesis Air 2002B.mil to Remove and Neutralize High Concentrations of Airborne Biological Contaminants

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# The Capability of the Genesis Air 2002B.mil to Remove and Neutralize High Concentrations of Airborne Biological Contaminants

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## Abstract

The Genesis Air 2002B.mil is an air purification system using GAP™ technology to remove harmful particulate and organic contaminants of air. This system was tested by the U.S. Army in rigorous controlled studies for its ability to remove biological agents from room air. Two separate studies were conducted using fungal spores and bacterial spores, at concentrations far beyond normal atmospheric levels of these agents. The results consistently demonstrated that the Genesis Air 2002B.mil removes and destroys an average of 93.5% of airborne fungal spores, and greater than 98% of airborne bacterial spores.

## Introduction

Indoor air quality issues are of increasing concern to American business owners, building managers, employees, and the general public. Indoor air pollution is among the top five environmental health risks.<sup>(1)</sup> Office buildings and other types of indoor workplaces have significant sources of air pollution due to inadequate ventilation.<sup>(2)</sup> The three basic strategies for improving indoor air quality are pollution source control, improving ventilation, and the use of air cleaners.<sup>(3)</sup>

Indoor air pollutants generally consist of particulate matter (dust, smoke, pollen, bacteria, mold spores, etc.) and gaseous elements (vehicle exhaust, gas stove emissions, paint and varnish fumes, etc.) There are many types of air purification systems available, though not all are effective and some (ozone generators) may actually be harmful. The most advanced and innovative technology combines particulate removal with pollutant destruction. The Genesis Air 2002B.mil is a three-stage system that purifies air by trapping particles in the first stage, and inactivating them in the second and third stages. The second stage is a powerful UV light and the third stage uses a photocatalytic reaction of the UV light with titanium oxide to create hydroxyl radicals as the cleaning agents that convert biologicals and hazardous chemical pollutants into harmless compounds.

The U.S. Army Developmental Test Command performed a series of controlled studies designed to test the Genesis Air 2002B.mil's capability of neutralizing high levels of airborne biological contaminants. The results prove the effectiveness of the system in reducing challenge concentrations of these agents by greater than 93.5% to 98%.<sup>(4)</sup>

## Materials and Methods

The U.S. Army Dugway Proving Ground in Dugway, UT, was provided with one Genesis Air 2002B.mil unit for testing. The system utilizes GAP™ technology, a three-stage germicidal and air-cleaning process. In the primary filtering stage, particles of .3 microns or larger are trapped and removed. Particles smaller than .3 microns are subjected to the second stage, an ultraviolet (UV) light tube, and the third stage, a titanium oxide-coated pleated membrane that is activated by the UV light to photocatalytically convert biologicals and dangerous chemicals into inert compounds. The test unit was fitted with 6 sampling ports (two ports in each stage of the system) and all three stages of the system were active in each study.

The first study was designed to test the effectiveness of the Genesis Air system in removing fungal spores from room air. The study was performed in a room-sized fungal test chamber at  $28 \pm 5^{\circ}\text{C}$ . *Aspergillus Niger*, a common fungus causing mold contamination of food, was used as the challenge organism. A disseminator was used to generate and maintain a dense cloud of fungal spores within the chamber. The concentration of spores with and without the Genesis Air system operating was measured using Aerodynamic Particle Sizer® (APS™) spectrometers, in units of agent-containing particles per liter of air (ACPLA). In addition, all-glass impingers (AGI's) attached to sampling ports were used to collect air from the test chamber, within the Genesis unit, and in the Genesis unit exhaust to test for viable fungal organisms. A total of 14 separate challenges were conducted, with the concentration of spores allowed to return to background levels and AGI's changed between challenges.

The second study was designed to test the effectiveness of the Genesis Air system in removing bacterial spores from room air. The study was performed in a room-sized Aerosol Simulant Exposure Chamber (ASEC) at  $28 \pm 5^{\circ}\text{C}$ . *Bacillus subtilus var. Niger*, a rod-shaped bacterium that forms spores, was used as the challenge organism. A disseminator was used to generate and maintain a dense cloud of bacterial spores within the chamber. The concentration of spores within the chamber and from the Genesis Air system exhaust was measured using Aerodynamic Particle Sizer® (APS™) spectrometers, in units of agent-containing particles per liter of air (ACPLA). In addition, all-glass impingers attached to sampling ports were used to collect air from the Genesis unit intake and the Genesis unit exhaust to test for viable bacteria. Five challenges were conducted, with the concentration of bacterial spores allowed to return to background levels and AGI's changed between challenges.

## Results

### Graph Figure B.2

Without the Genesis Air system operating, the particle concentration at 1000 and 2000 ACPLA within the test chamber rises quickly and remains fairly constant. With the Genesis Air system operating, the particle concentration is reduced by an average of 93.5% over 14 trials. While there was live fungus detected in the test chamber air, no viable fungus was detected in the Genesis Air exhaust stream.

### Graph Figure 3.2

The Genesis Air system removed and neutralized more than 98% of airborne bacterial spores from the ASEC air. AGI data indicated that live bacteria in the Genesis Air exhaust was not present or was below the detection limits of the laboratory analysis methodology.

## Conclusions

The Genesis Air 2002B.mil is highly effective in removing and neutralizing biological contaminants, a major source of indoor air pollution. In numerous sophisticated controlled trials conducted by the U.S. Army, high concentrations of airborne fungal and bacterial spores were reduced by over 93.5% and 98%, respectively. In addition, no live organisms were detected in the system exhaust, demonstrating the germicidal properties of the unique three-stage GAP™ technology utilized by the Genesis Air 2002B.mil.

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