

HEPA Filter Pillow System Provides Particle-Free Sleep Zone in Hotel Room Trials

Josh Waldman, Dr. Scott Augustine, Mark Albrecht, John Bayard
Augustine Biomedical + Design , Eden Prairie, MN

Background: Over 40 million Americans suffer from allergies.¹ Over 85% of allergy sufferers have impaired sleep caused by nasal inflammation and congestion.² These symptoms are most commonly triggered by airborne allergens such as pollen, molds, ragweed spores, dust mites, pet dander, environmental pollutants and bacteria. Several devices to filter allergens are on the market but efforts to truly provide a particle-free environment for allergy and asthma sufferers during sleep have had limited success. The Hotel industry has recently recognized the market advantage of improving the sleep experience of their guests by providing a variety of new amenities including offering “hypo-allergenic” room designs. Prototypes of the **PureZone™Pillow System (PPS-** see figure 1) developed by PureZone Technologies, LLC were evaluated for particulate reduction performance in two hotels that offer “Allergy Friendly” room configurations.

Results: Particle reduction in the sleep zone went from over 400,000-particles/ft³ (.3micron and greater) to less than 70 particles/ft³ within 1minute of activating the **PPS** device representing **99.98%** particle reduction efficiency. (Figure 2)

Conclusions: The **PPS** demonstrates significant reduction of particle counts in the somatic breathing zone. Current efforts to control allergens in specially upgraded Allergy Friendly hotel rooms showed little or no improvement in particle counts in the guest’s sleep zone.



Figure 1: PureZone Pillow System provides a bubble of filtered air

	Hotel A	Hotel B
Allergy Friendly Room	420,875	155,739
Standard Room	308,748	499,875
Allergy Friendly Room PPS ON	37	23
Standard Room PPS ON	14	68

Figure 2: Sleep Zone Particle Counts (Particles >.3µ per ft³)

“Management of environmental contribution through avoidance of allergens is generally considered the best method of reducing the symptoms of nasal inflammation and improvement of quality of life parameters. Filtration efficiency down to at least .3 microns is critically important to ensure the removal of the bulk of allergens”³

Device Description:

The patent pending **PPS** device shown in Figure 1 consists of a ultra-quiet blower unit with an output of 40 cfm connected by a fabric hose to a customized two- pocket pillow case. A replaceable HEPA filter is inserted into the fabric hose. The pillowcase is made from a hypoallergenic cotton blend designed to accept the insertion of almost any style pillow choice. The case is certified as a dust mite barrier. The option of air stream warming is built into the blower using a resistance heater coil. The filter is made of a Technostat® electrostatically charged media comprising two electrically dissimilar polymers which are constructed in a nonwoven felt such that the two fiber types create a surface charge transfer to aid in the removal of particles in the air stream yet remain electrically neutral. This unique material combines high efficiency particle removal with low airflow resistance to distribute a gentle flow of HEPA filtered warm air into the breathing zone above the pillow. The soft white noise of the flowing air across the face adds to the concept of the ultimate comfort and purity for the patients’ breathing zone during sleep.

Method:

A Met One Model 2400 particle counter was used to measure particle counts approximately 4 inches (10cm) above the pillow surface in four typical hotel bedroom configurations. The particle counter sampled air and recorded counts in six channels: >.3 microns, >.5, > 1, >3, >5 and > 10 microns. The **PPS** was set up on the bed with a weighted head mannequin positioned such that the nose was approximately 4 inches above the pillow. A particle counting tube was inserted through a hole in the mouth of the mannequin and counts were monitored over each unit every minute continuously for thirty minutes. The protocol was run with the **PPS** turned off and then run without any change to the setup with the **PPS** powered on. Background particle counts were taken in each hotel either outside the room window or outside the entrance in the case where the windows were sealed shut. Additionally a disturbance generator was set up on each bed to simulate periodic movement during sleep. The manual device was employed at the start of the data collection and then every 10 minutes for 3 cycles (5 seconds) of disturbance and the particle counts were recorded.

Results:

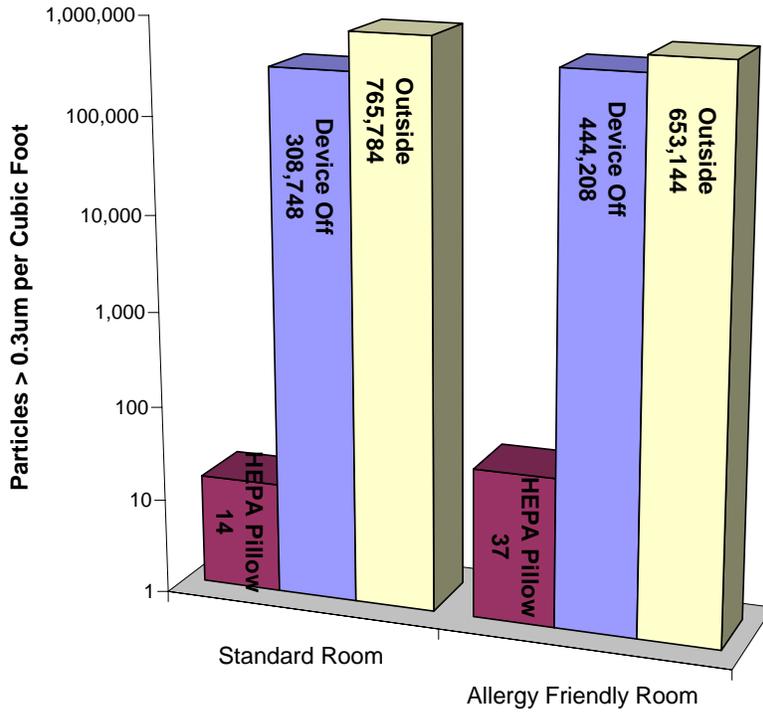


Figure 3: Hotel A Particle Results
Note: Counts are shown on a log scale

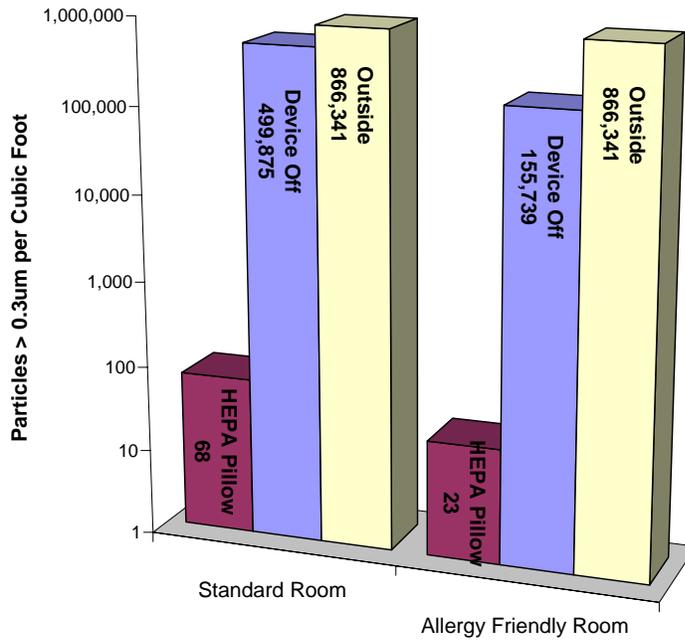


Figure 4: Hotel B Particle Results

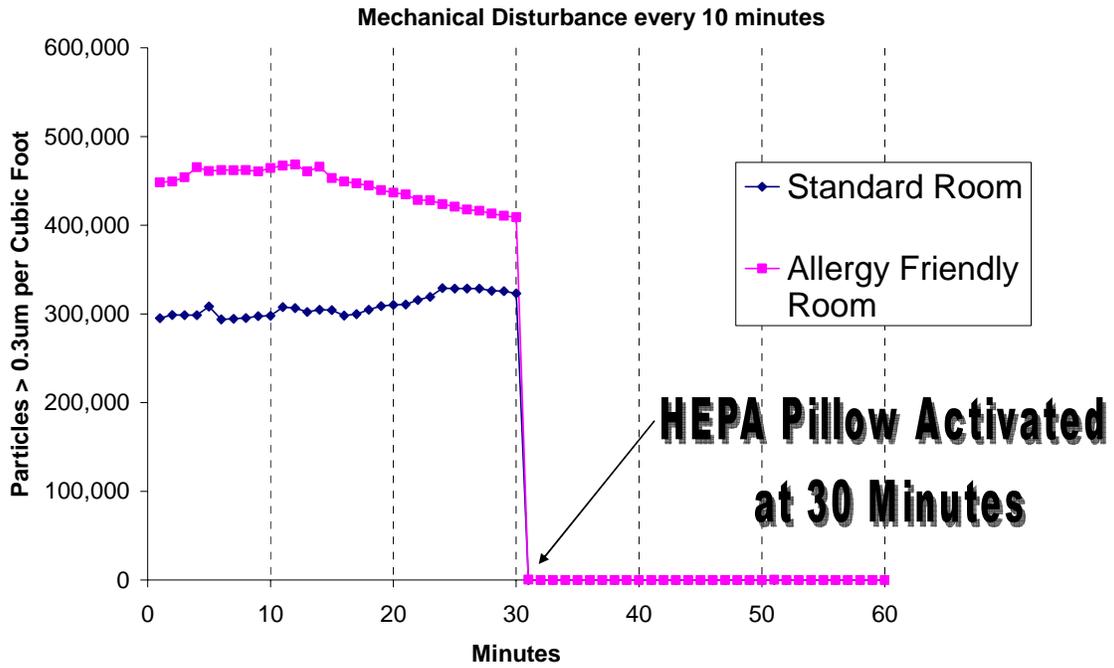


Figure 5: Hotel A – 30 minutes PPS OFF then HPS ON

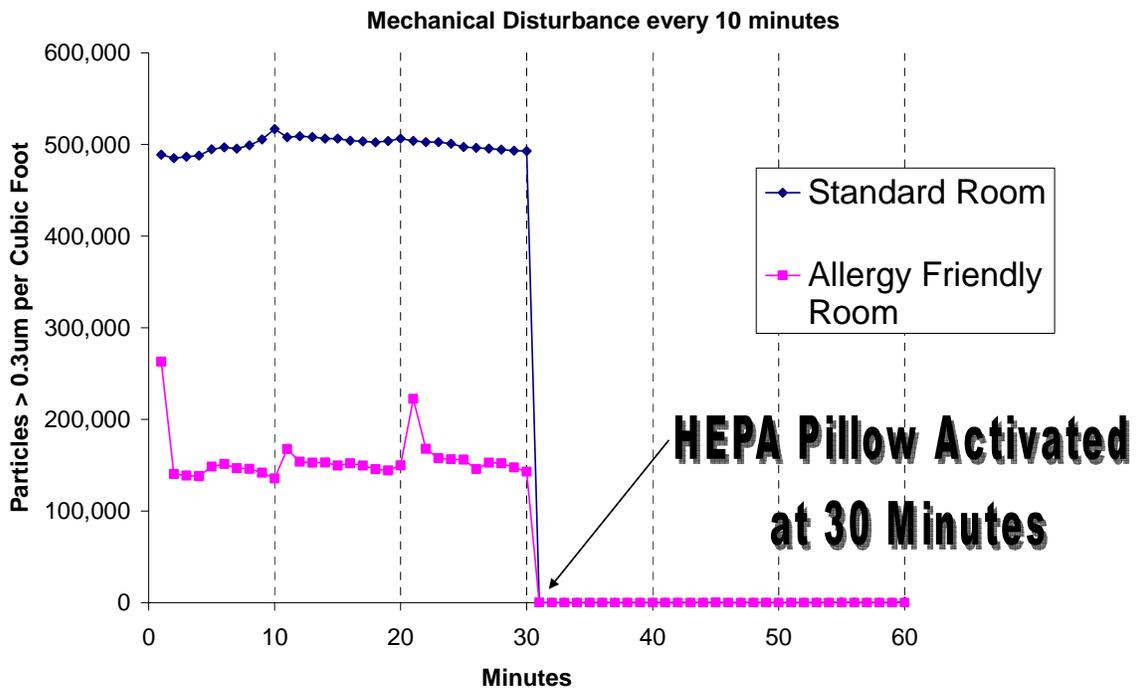


Figure 6: Hotel B – 30 minutes PPS OFF then PPS ON

Discussion:

The **PureZone Pillow System** has demonstrated preliminary results showing both the ability to provide remarkable relief to allergic rhinitis symptoms (See Figure 7 below) as well as quantitative particle count reduction efficiency in the somatic breathing zone even in specially constructed hypo-allergenic hotel bedrooms. The hotel trend toward hypoallergenic or allergy-friendly rooms is gaining momentum. A

recent survey indicated that 83% of travelers would prefer an allergy friendly room. Major upscale chains are addressing this segment of the market by renovating rooms with investments of up to \$8000 per room to remove traditional sources of allergens and pollutants. Based on preliminary data shown in this study, PureZone appears to be a compelling new alternative to traditional means to provide localized environmental purification that

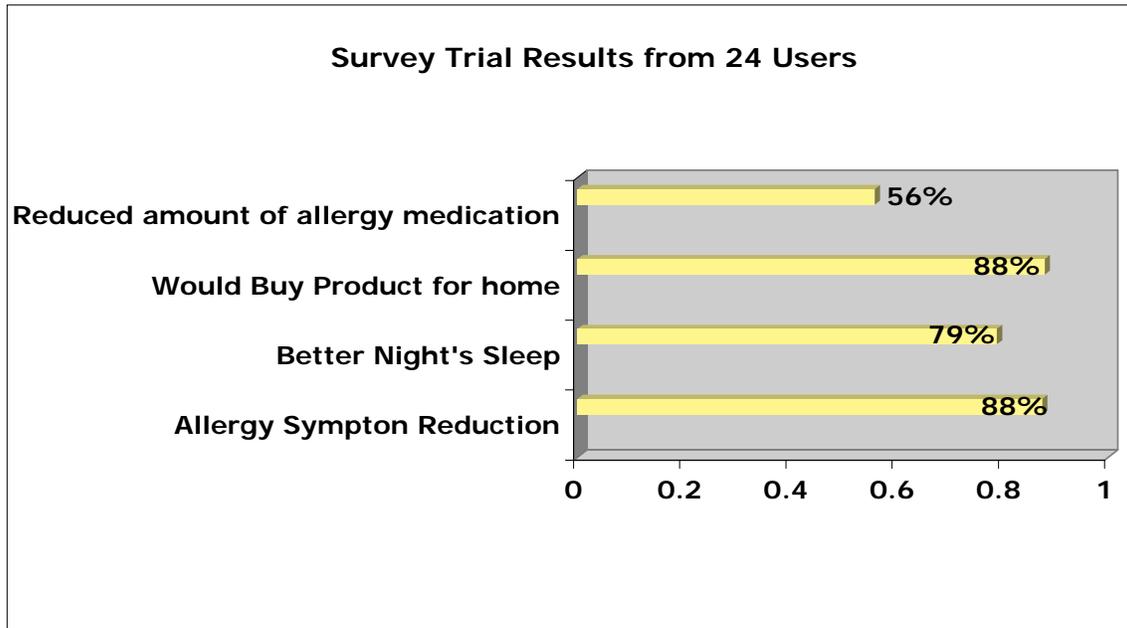


Figure 7: Summary of In- home Trial results of PureZone Pillow System⁵