

Allentown IVCs Air-at-the-Cage-Level Method Proven Effective Study after Study

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With over 20,000 Allentown IVC units in service throughout the world successfully housing millions of research animals, it comes as no surprise that the Allentown Airflow Delivery Method has been proven effective and superior when tested throughout the years. In addition to an impressive track record and scores of recommendations from some of the world's leading research institutions, there is an abundance of scientifically documented proof of the efficiency and superiority of the Allentown Air Delivery Method.

Air at the Cage Level - Tested and Certified for the Third Time as Non-Stressful

TUV, the world's preeminent testing and certification organization tested the Allentown Type II Long system in 2006, the XJ system in 2010 and the

NexGen system in 2014...and each time granted TUV certification based on the Tiz-BIFO evaluation standards created in 2000 requiring "...at every measuring point on every measuring level, a (air) velocity of 0.2 m/s should not be exceeded." (Brandstetter et. al. *Laboratory Animals* (2005) 39, 40-44.) In addition to air velocity tests, the Allentown systems also passed, for the third time, a host of other criteria including but not limited to Differential Pressure, Noise, Vibration, Air Temperature and Humidity. No drafts...no stress.

Measuring Rodent Comfort Within an IVC Housing System - Corticosterone

Measuring stressors upon laboratory rodents is a difficult task to accomplish due to a very wide range of variables. Testing results sometimes are contradictory making it difficult to establish a clear profile of stressors, in addition to differences in testing methodologies. (Mineur, Belzung, Crusio. *Behavioral Brain Research* 175 (2006) 43-50.) However, with consensus not attainable, scientists rely upon measurable physiologic data as perhaps the most accurate way to determine laboratory rodent comfort. The measure of corticosterone levels "is the most sensitive and accurate method of continual stress analysis..." with fecal corticosterone testing perhaps being the ideal method of being least-likely to contribute to any existing stress. (Hunt, Hamby. *Physiology and Behavior* (2006.) In a recent publication, authors testing two IVC systems stated, "...we did not observe a difference in the level of faecal corticosterone for those mice housed in system two (Allentown) compared to

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system one (another brand.) (Burman et. al. Physiology & Behaviour. 124 (2014.) In this same study in regards to body weight of the mice, “There was no significant difference between housing systems.” Body weight is another factor widely agreed upon in the scientific community as a data point to monitor when observing subject well-being. This is new scientific evidence to add to many other peer-reviewed studies and performance testing data clearly defining the efficiency and efficacy of the Allentown IVC system.

Micro-environmental Conditions

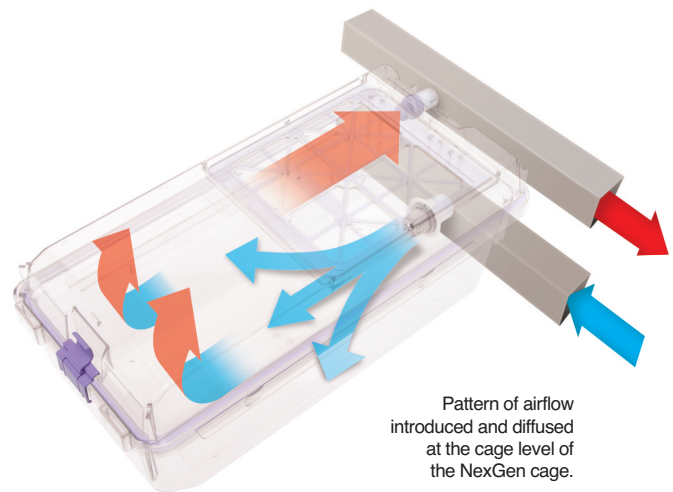
Air Introduced at the Top of the Cage vs. the Allentown Air Delivery Method:

Tu and colleagues from the Harvard School of Public Health (Contemp. Top. Lab. Anim. Sci. 36, 69-73; 1997) published a study comparing IVC units introducing air at the cage level and air at the cage top. Their comments on air at the top system (unit #2) were quite revealing as they stated among other observations:

“The ventilation characteristics of unit 2 were considerably different from those of the other systems tested. Smoke distribution was considerably slower, and dispersion throughout the cage was less complete, air exchange rates were approximately 35 to 50% less than those for units 1 and 3 respectively...”

This data supports theories that air introduced in the cage top may not deliver air to the complete cage, as also supported by findings in another study that stated “...possible dead-air spaces are created opposite and under the air inlet” when observing systems using the air at the top method. (Baumans V., Contemp. Top. Lab. Anim. Sci. 31:13-19 2002.)

In a Lipman and Perkins study (Contemp. Top. Lab. Anim. Sci. 35:61-65) three IVC systems were



tested, two of which introduced air at the cage level while the third introduced air at the cage top. The two cage level units outperformed the unit with air at the cage top (unit #2) with data proving much lower ammonia levels and lower relative humidity.

“From days 10-12, the cages in unit 2 had significantly higher mean ammonia concentration, compared with the other two ventilated systems.”

“Regression analyses indicated that the RH in unit 2 significantly increased an average of 1.14% each day and the RH in units 1 and 3 increased 0.22 each day...”

Within this study the Allentown Air Delivery System showed no ammonia indications until day nine.

Air Velocity within the Micro-environment

There are currently no widely-recognized air velocity guidelines for rodents housed in IVC caging. In 2000 The Animal Welfare Information Center for Biomedical Research (TIZ-BIFO) group comprised of European researchers and commercial caging vendors suggested a standard of < .2m per second (the human standard of a perceived draft) to the European Laboratory Animal Science Community. Some manufacturers believe that the

Allentown Air Delivery Method does not comply with this recommended standard.

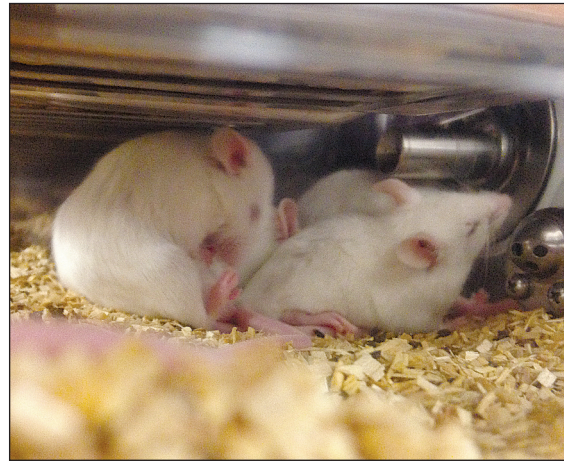
However, in third-party testing performed to the TIZ-BIFO standards by TUV, the leading testing organization in Europe, the results proved that the Allentown system air velocity was under .2m per second. As far back as 1996, in the Harvard School of Public Health study mentioned previously, the Allentown airflow was documented at less than .2m per second. A combination of low ACH and the Allentown Air Diffuser ensure low velocity air, drier bedding, less ammonia, less relative humidity and a better environment for research animals.

Further scientific proof supports that the Allentown housing system does not place the animals in a stressful environment. In testing done on the Allentown Air Delivery System, Pilar Browne's report (Ani. Tech. and Wel. August 2009, 39-48) documents extended cage changing periods with no noticeable signs of stress to the animals upon observation of food consumption and body weights. At the conclusion of the testing, post mortems were performed which, "...confirmed the mice did not suffer stress of a high enough magnitude or for a sufficiently long period to cause any physiological signs." This testing also showed, "no ammonia was detected (>5ppm) in any of the cages over the 4-week test period..."

Yet another study performed at the Karolinska Institute in Sweden supports the Allentown no stress environment in Allentown IVCs by analyzing breeding performance and nesting locations within the cage. In a comparison test alongside two systems which introduced air into the cage top, the Allentown Air Delivery Method performed as expected. The testing indicated, "no effect of IVC cage type on breeding performance" and in addition presented data showing the overwhelming majority of females with litters nested in the back of the Allentown cages, nearest the air port...in

direct contradiction to any non-scientific theories that the air delivery location utilized by the Allentown Air Delivery Method causes stress to housed rodents.

The Allentown Air Delivery Method – No Stress



Mice nest in front of the Allentown Air Diffuser, clearly demonstrating tolerable velocities and a lack of stress.

No stress for the animals is the key. No stress from excessive human manipulation, no stress from the airflow, no stress from toxins in the micro-environment. "No stress" was the guiding principal for the Allentown engineers while developing the Allentown Air Delivery System. Research had proven that wet bedding and high humidity foster higher ammonia levels. It was clear that it was key to keep the bedding dry to avoid the production of ammonia. There lies a significant difference: Some systems on the market today allow for the production of ammonia to occur within their cage systems. Once produced, they attempt to exhaust the ammonia using inefficient air delivery and removal systems. The Allentown Air Delivery Method is fundamentally different as it prevents the creation of ammonia for as long as possible. Then, after a number of days, once small amounts of ammonia are present the Allentown Air Delivery System exhausts the harmful ammonia in the process of delivering low velocity HEPA filtered air to the entire micro-environment.

The creation of ammonia results from the action of urease-positive bacteria on the urea content of the urine and feces of animals. For this reason ammonia production usually follows the bacterial growth curve and the ideal growing conditions of heat and moisture.

The Allentown Air Delivery Method provides a low velocity wash of air across the bedding, in turn drying the bedding and preventing and delaying the creation of the harmful ammonia. Once the cage reaches the later stages of the cage-change cycle the trace amounts of ammonia are exhausted from the micro-environment.

Proof of an Effective Method

The large amount of empirical as well as observational data proving the efficacy of the Allentown Air Delivery Method is indisputable. Allentown IVC systems house laboratory animals in a low stress, high air-quality micro-environment, and affords researchers a reliable, repeatable and protective micro-environment for their research animals.

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Housing laboratory mice in individually ventilated cages; maternal performance and pup development
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