Individually ventilated caging system for effective allergen control

Brian Bilecki, BSME

The Type II Long IVC system is a versatile individually ventilated caging system with European Style Type II Long cages. The system works in both positive and negative pressure modes and HEPA filters both supply and exhaust air. The Institute of Occupational Medicine recently tested this product and found it to be effective in containing allergens in both positive and negative pressure modes.

The significance of laboratory animal allergy (LAA) as an occupational disease has been recognized since the 1970s. It is estimated that more than 90,000 workers in American research laboratories and rodent breeding facilities are exposed to rodent allergens each year. Laboratory animal facility personnel may inhale a sufficient quantity of allergens over time to become sensitized—that is, they develop symptoms when exposed again, to even tiny amounts of the allergen. According to the National Institute of Occupational Safety and Health, more than half of laboratory animal personnel are affected by skin and respiratory disorders that are caused by exposure to ambient animal allergens¹. These disorders include occupational asthma, rhinitis, conjunctivitis, and urticaria, and may hamper or prevent personnel from regularly performing investigative and husbandry tasks. The costs of LAA are considerable and include the direct costs of medical care and prescription drugs, as well as the indirect costs of absenteeism, disability claims, and hiring and training new employees when individuals with LAA leave jobs for health reasons. Historically, the European research community has been more keenly focused on the issue of allergen control than has the research community in the United States.

IVCs reduce allergen levels

Numerous studies have identified building ventilation systems and individually ventilated cage (IVC) systems as a primary means of reducing LAA (e.g., see ref. 2), thereby reducing cost increases in animal care and production associated with ambient animal allergens. While there are no official standards for allergen control as it relates to IVC units, the industry in the UK is currently applying a 5 ng.m⁻³ 'benchmark' level and making efforts to reduce exposure to rat and mouse allergens to below this level.

Allentown (<http://www.acecaging.com>).
Email: bbilecki@acecaging.com

FIGURE 1 | Allentown's Type II Long IVC rack holds European Style Type II cages and is available in 48- through 144-cage configurations. The rack can operate in positive or negative pressure modes and HEPA filters both supply and exhaust air.

The Type II Long system

The Type II Long system (Fig. 1) is a versatile IVC system with positive/negative control. It allows the user to select the pressure

FIGURE 2 | The Type II Long Cage measures 8.4 inches wide × 14.25 inches deep × 7.3 inches high (213 × 362 × 185 mm) and is available in polycarbonate, polysulfone, and polyphenylsulfone. The spring-loaded exhaust port and supply “Kup” close when the cage is removed from the rack.

mode on the exhaust blower, and the entire rack of cages can run in positive or negative mode. Both supply and exhaust air are HEPA filtered for protection of both the animals and the staff.

In either positive or negative operating mode, airflow always follows the same path, eliminating the risk of contamination of the crucial cage environment. HEPA-filtered supply air is introduced into the cage through Allentown’s unique air distribution “bullet”, providing uniform, low velocity airflow across the cage bottom (Fig. 2). This maximizes the drying effect upon the bedding without creating distress to the animals, and allows extended cage change-out intervals. Exhaust air is then extracted through the spring-loaded exhaust port and into the aerodynamically designed exhaust collection tube. Both the spring-loaded exhaust port and the supply “Kup” with the auto-closure channel provide a closed system when the cage is removed from the rack. The exhaust and supply manifolds and plenums are fully gasketed and sealed. Airflow loss is minimized, creating the most air-efficient system for maximum filter life and minimal energy consumption. However, the entire air distribution system can still be fully accessed, without tools, to allow thorough cleaning and inspection.

Putting Allentown to the test—IOM study

Allentown asked the Institute of Occupational Medicine (IOM) to study and evaluate the Type II Long rack system with respect to

allergen containment. Located in the United Kingdom, the IOM is a major independent research center in the fields of occupational and environmental health, hygiene, and safety. Based on previous studies of rodent allergens, the IOM recommends that allergen levels be kept below the 6-ng.m⁻³ exposure level where the statistical risk of sensitization is believed to increase.

The IOM evaluated the functioning of the IVC system operating in both negative and positive pressure modes, stocked with 300 male mice. Over a two-week period, they sampled allergen concentrations inside the occupied cages and from several positions within the typical operational area around the IVC rack.

The IOM collected mouse urinary protein (MUP) data, and monitored temperature, humidity, and levels of CO₂ and NH₃. These values showed very low levels of ammonia (<5 p.p.m.) and temperature and CO₂ levels that were controlled throughout a 7-day test period, despite substantial variations in room humidity. The combination of the well-maintained microenvironment and the control of MUP is important to the success of any animal housing system.

Clearing the air

The IOM report detailing the conclusions of their analysis of Allentown’s Type II Long system study states: “...the allergen levels in the immediate vicinity of the occupied [Allentown] rack were usually less than 1 ng.m⁻³, well below the 6 ng.m⁻³ level where we currently believe that the statistical risk for sensitization increases, and the 5 ng.m⁻³ ‘benchmark’ level currently being applied by the industry in the UK.” The report concludes, “...these results indicate that under conditions of the study, the IVC rack was effective at containing allergen to levels consistent with minimal exposure to allergens whether the rack was operated at negative or positive pressure.”

The IOM recommends that an effective allergen containment program is employed to prevent/reduce the risks of LAA. Properly functioning IVC equipment can make an important contribution to this.

Local Allentown representatives can be contacted for more information. Information is also available on the Allentown website (<http://www.acecaging.com>).

1. NIOSH. Preventing Asthma in Animal Handlers (DHHS (NIOSH) Publication No. 97-116, 1998). <http://www.cdc.gov/niosh/animalrt.html>.
2. Clough, G., Wallace, J., Gamble, M.R., Merryweather, E.R. & Bailey, E. A positive, individually ventilated caging system: a local barrier system to protect both animals and personnel. *Lab. Anim.* **29**(2), 139–151 (1995).

This article was submitted to *Lab Animal* by a commercial organization and has not been peer reviewed. *Lab Animal* takes no responsibility for the accuracy or otherwise of the information provided.