



Abstract

Equipment heat gain, animal heat loads and odors, as well as airborne contaminants that include waste gases, biohazards, particles, and allergens are the limiting factors when operating a rodent facility. Barrier facilities use mainly heating-ventilation-air conditioning (HVAC), animal caging, and cage processing equipment to counter such factors (see Fig. 1). Costs of construction and energy consumption of ventilation, cooling plant, and plug load systems are directly related to HVAC requirements and equipment plug loads. Unfortunately, forced-air devices in use such as individually ventilated caging (IVC) system and animal transfer station (ATS) are plug-loads that increase HVAC requirements and plug loads because they recirculate animal heat loads, generate their own heat loads, create large pressure drop, decrease ventilation efficiency, and consume a large amount of electricity (30 times more than a typical office building).

We look at using single-pass central ventilation and room control of contaminants as well as exhaust ventilated, local exhaust devices (EV-LED) such as exhaust ventilated caging (EVC) system to eliminate heat loads, odors, and airborne contaminants directly at their source of generation, i.e. at animal caging and cage processing equipment levels. Choosing such energy-efficient technologies could contribute to significant construction and energy consumption savings. It can

- Decrease HVAC requirements by 69%,
- Eliminate 75% of plug load,
- Cut construction cost of ventilation, cooling plant, and plug load by 56%,
- Reduce energy consumption by 65%,
- Simplify air balancing and reduce the amount of air needed from clean to dirty areas,
- Avoid HEPA-filtering of contaminated room air from leaky caging system, and
- Save on cleaning exhaust ducting system.

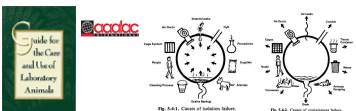
The analysis of a fixed square foot case study confirms these savings when using single-pass ventilation and EV-LED instead of recirculation ventilation and forced-fan equipment. By utilizing EVC caging, we can double the number of cages per square foot and still decrease the HVAC requirement and energy consumption in the same space. In this case, while eliminating the exhaust blower on the IVC, the HVAC requirement decreases by 41% and the energy consumption drops by 49%. First-cost savings that include ventilation, cooling/heating, plug load, and caging acquisition costs reach \$50,000 or 0.6% savings. Annual cost savings including husbandry cost approach \$22,000 or 4% savings. And space efficiency is 100% or double conventional space utilization due to the carousel-type design of the circular rack that increases cage density per square feet.



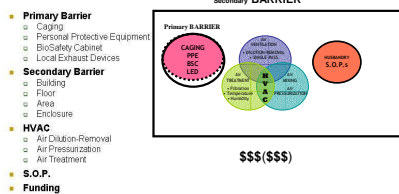
The application of new contamination control strategies in lab animal industry is also consistent with the pursuit of sustainable, high performance, and low-energy animal facilities that:

- Minimize overall environmental impacts
- Protect occupant safety
- Optimize whole building efficiency on a life-cycle basis

Figure 1: Rodent 'Barrier' Facility



Control of Contaminants



References

1. 1991, Theodore Ruys, Handbook of Facilities Planning, Vol. 2 LAF.
2. 2000, CT 30 (1), 22-27.
3. 2004, CT 43 (5) 64-70.
4. 2004, CT 43 (6) 78-82.

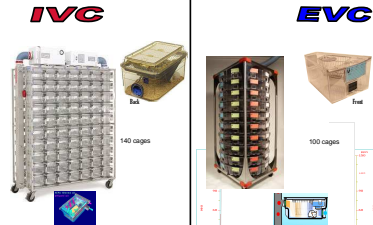
Energy-Efficient and High-Performance Rodent Facility

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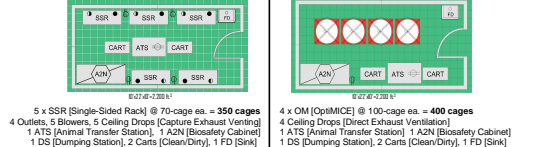
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Load Analysis



- Positive High-Pressure 2-3 wc [500-750 Pa]
- Forced-Air Recirculation Ventilation 0.7-1.3 m/s [150-250 fpm], 80 ACH, Mixing Factor @ 8 99% Smoke Removal Efficiency in 35 minutes
- Capture Exhaust Venting
- Negative Low-Pressure 0.15 wc [37.5 Pa]
- LED (HVAC-assist) Single-Pass Ventilation 0.02 m/s [4 fpm], 20 ACH, Mixing Factor @ 1 99% Smoke Removal Efficiency in 4 minutes
- Direct Exhaust Ventilation



Equipment Heat Gain IVC (Individually Ventilated Caging): 223 watts (w) ea. Blower 446 w per rack X 4 racks (350 cages)= 2,230 w / room ATS: 223 w + A2N: 223 w = 2,676 w per room	EVC (Exhaust Ventilated Caging): No blower 0 w per rack X 4 racks (400 cages)= 0 w per room ATS: 223 w + A2N: 223 w = 446 w per room
Mice Heat Load Capture exhaust of 8% loads 5 adult mice = 2.3 w per cage 350 occupied cages = 805 w per room	Direct exhaust of 95% loads 5 adult mice= 0.125 w per cage 400 occupied cages = 50 w per room
Total Heat Load per Room: 3,481 w	496 w 2,985 w or 85%
Other Loads [Odors & Airborne Contaminants]: 20-22 ppm NH ₃ after 2 weeks Reduce Allergens to 0.1 ng/m ³	1-4 ppm NH ₃ after 3 weeks Eliminate Allergens
In-Cage Temperature / Relative Humidity (%RH): Depend on rack's fan intake and cage location 3 to 5 °C ABOVE Room Temperature 10 to 15 % RH ABOVE Room Humidity	Depend of room air conditions Same as Room Temperature Same as Room Humidity

HVAC Requirements

Total-Cooling-Load Calculation Method
Recommended-ACH = Q (exhaust airflow in cubic feet per minute (cfm) x 60 minutes (min) / V [volume in cubic feet (ft³)])

W ACH = 500 cfm (1.48 m/s) / (1.00 m³ / 35.3 cu ft) x 60 min = 10.0 ACH (4.98 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 10.7 ACH (5.10 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 11.4 ACH (5.41 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 12.1 ACH (5.72 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 12.8 ACH (6.03 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 13.5 ACH (6.34 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 14.2 ACH (6.65 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 14.9 ACH (6.96 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 15.6 ACH (7.27 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 16.3 ACH (7.58 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 17.0 ACH (7.89 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 17.7 ACH (8.20 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 18.4 ACH (8.51 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 19.1 ACH (8.82 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 19.8 ACH (9.13 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 20.5 ACH (9.44 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 21.2 ACH (9.75 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 21.9 ACH (10.06 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 22.6 ACH (10.37 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 23.3 ACH (10.68 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 24.0 ACH (10.99 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 24.7 ACH (11.30 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 25.4 ACH (11.61 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 26.1 ACH (11.92 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 26.8 ACH (12.23 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 27.5 ACH (12.54 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 28.2 ACH (12.85 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 28.9 ACH (13.16 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 29.6 ACH (13.47 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 30.3 ACH (13.78 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 31.0 ACH (14.09 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 31.7 ACH (14.40 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 32.4 ACH (14.71 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 33.1 ACH (15.02 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 33.8 ACH (15.33 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 34.5 ACH (15.64 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 35.2 ACH (15.95 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 35.9 ACH (16.26 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 36.6 ACH (16.57 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 37.3 ACH (16.88 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 38.0 ACH (17.19 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 38.7 ACH (17.50 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 39.4 ACH (17.81 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 40.1 ACH (18.12 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 40.8 ACH (18.43 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 41.5 ACH (18.74 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 42.2 ACH (19.05 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 42.9 ACH (19.36 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 43.6 ACH (19.67 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 44.3 ACH (19.98 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 45.0 ACH (20.29 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 45.7 ACH (20.60 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 46.4 ACH (20.91 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 47.1 ACH (21.22 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 47.8 ACH (21.53 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 48.5 ACH (21.84 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 49.2 ACH (22.15 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 49.9 ACH (22.46 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 50.6 ACH (22.77 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 51.3 ACH (23.08 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 52.0 ACH (23.39 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 52.7 ACH (23.70 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 53.4 ACH (24.01 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 54.1 ACH (24.32 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 54.8 ACH (24.63 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 55.5 ACH (24.94 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 56.2 ACH (25.25 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 56.9 ACH (25.56 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 57.6 ACH (25.87 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 58.3 ACH (26.18 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 59.0 ACH (26.49 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 59.7 ACH (26.80 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 60.4 ACH (27.11 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 61.1 ACH (27.42 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 61.8 ACH (27.73 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 62.5 ACH (28.04 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 63.2 ACH (28.35 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 63.9 ACH (28.66 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 64.6 ACH (28.97 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 65.3 ACH (29.28 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 66.0 ACH (29.59 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 66.7 ACH (29.90 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 67.4 ACH (30.21 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 68.1 ACH (30.52 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 68.8 ACH (30.83 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 69.5 ACH (31.14 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 70.2 ACH (31.45 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 70.9 ACH (31.76 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 71.6 ACH (32.07 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 72.3 ACH (32.38 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 73.0 ACH (32.69 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 73.7 ACH (33.00 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 74.4 ACH (33.31 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 75.1 ACH (33.62 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 75.8 ACH (33.93 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 76.5 ACH (34.24 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 77.2 ACH (34.55 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 77.9 ACH (34.86 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 78.6 ACH (35.17 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 79.3 ACH (35.48 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 80.0 ACH (35.79 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 80.7 ACH (36.10 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 81.4 ACH (36.41 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 82.1 ACH (36.72 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 82.8 ACH (37.03 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 83.5 ACH (37.34 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 84.2 ACH (37.65 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 84.9 ACH (37.96 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 85.6 ACH (38.27 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 86.3 ACH (38.58 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 87.0 ACH (38.89 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 87.7 ACH (39.20 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 88.4 ACH (39.51 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 89.1 ACH (39.82 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 89.8 ACH (40.13 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 90.5 ACH (40.44 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 91.2 ACH (40.75 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 91.9 ACH (41.06 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 92.6 ACH (41.37 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 93.3 ACH (41.68 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 94.0 ACH (41.99 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 94.7 ACH (42.30 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 95.4 ACH (42.61 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 96.1 ACH (42.92 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 96.8 ACH (43.23 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 97.5 ACH (43.54 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 98.2 ACH (43.85 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 98.9 ACH (44.16 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 99.6 ACH (44.47 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 100.3 ACH (44.78 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 101.0 ACH (45.09 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 101.7 ACH (45.40 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 102.4 ACH (45.71 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 103.1 ACH (46.02 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 103.8 ACH (46.33 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 104.5 ACH (46.64 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 105.2 ACH (46.95 m/s) / (0.028 m³ / 1.00 cu ft) x 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x 60 min = 117.8 ACH (52.53 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 118.5 ACH (52.84 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 119.2 ACH (53.15 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 119.9 ACH (53.46 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 120.6 ACH (53.77 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 121.3 ACH (54.08 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 122.0 ACH (54.39 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 122.7 ACH (54.70 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 123.4 ACH (55.01 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 124.1 ACH (55.32 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 124.8 ACH (55.63 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 125.5 ACH (55.94 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 126.2 ACH (56.25 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 126.9 ACH (56.56 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 127.6 ACH (56.87 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 128.3 ACH (57.18 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 129.0 ACH (57.49 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 129.7 ACH (57.80 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 130.4 ACH (58.11 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 131.1 ACH (58.42 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 131.8 ACH (58.73 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 132.5 ACH (59.04 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 133.2 ACH (59.35 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 133.9 ACH (59.66 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 134.6 ACH (59.97 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 135.3 ACH (60.28 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 136.0 ACH (60.59 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 136.7 ACH (60.90 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 137.4 ACH (61.21 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 138.1 ACH (61.52 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 138.8 ACH (61.83 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 139.5 ACH (62.14 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 140.2 ACH (62.45 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 140.9 ACH (62.76 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 141.6 ACH (63.07 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 142.3 ACH (63.38 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 143.0 ACH (63.69 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 143.7 ACH (64.00 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 144.4 ACH (64.31 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 145.1 ACH (64.62 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 145.8 ACH (64.93 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 146.5 ACH (65.24 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 147.2 ACH (65.55 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 147.9 ACH (65.86 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 148.6 ACH (66.17 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 149.3 ACH (66.48 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 150.0 ACH (66.79 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 150.7 ACH (67.10 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 151.4 ACH (67.41 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 152.1 ACH (67.72 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 152.8 ACH (68.03 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 153.5 ACH (68.34 m/s) / (0.028 m³ / 1.00 cu ft) x 60 min = 154.2 ACH (68.65 m/s) / (0.028 m³