Appendix B

Calculation of Ozone Emissions from Electronic In-Duct Air Cleaner Emitting 2,200 mg/h Ozone

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Appendix B: Calculation of ozone emissions from electronic in-duct air cleaner emitting 2,200 mg/h ozone

The maximum ozone concentrations expected at the air delivery vent for a residential HVAC system over a range of airflows was calculated using the equation below. A typical home will have a two- or three-ton cooling system and the standard airflow for residential cooling systems is typically 400 cfm per ton of cooling capacity. The ozone emissions rate used for the calculation is from the highest emitting in-duct device found after reviewing manufacturers' websites (2200 mg/h). The maximum ozone concentration estimates for both the two- and three-ton systems are 822 ppb and 548 ppb, respectively. In order to meet the 0.05 ppm (50 ppb) concentration limit specified in the regulation, an in-duct device would need to emit no more than 200 mg/h or 131 mg/h of ozone for a two- or three-ton system, respectively.

These estimates do not correct for ozone decay or deposition onto interior surfaces such as ducting and walls. This calculation assumes that all the ozone created by the device remains within the total volume of air emitted by the central air system during one hour of operation.

Equation

$$V = Q_{cfm} * \frac{60m}{hr} * \frac{m^3}{35.3147ft^3}$$

$$E = \frac{ug}{m^3}$$

$$Ozone\ (ppb) = \frac{E}{V}\left(\frac{ppb}{1.97\frac{ug}{m^3}}\right)$$

Q = flow (cfm) (equal to 400 cfm/ton x 2 tons = 800 cfm

V = Volume of air in 1 hr (m^3) (equal to flow x time x conversion factor)

E = Emissions rate (x/hr) (equal to 2,200 mg/h x 1,000 mcg/mg)

Calculation for 2 ton HVAC system with an in-duct air cleaner emitting 2,200 mg/h ozone:

$$V = 800_{cfm} * \frac{60m}{hr} * \frac{m^3}{35.31ft^3}$$

$$E = 2.2x10^6 \frac{ug}{m^3}$$

$$Ozone\ (ppb) = \frac{2.2x10^6}{1{,}359.2}\left(\frac{ppb}{1.8\frac{ug}{m^3}}\right) = 822ppb$$