ESP-DLux® Ultraviolet Air Cleaner Performance Analysis

By Wladyslaw Kowalski, June 5, 2025

Executive Summary

The ESP-DLux® is a unique application ultraviolet (UV) light technology that facilitates the use of UV in diverse environments to both clean the air and disinfect surfaces in indoor environments. This shutter operated system is intended to operate in unoccupied rooms to disinfect the air and surfaces. The system has a relatively high Luminaire efficiency compared to typical Upper Room UV units. The disinfection of room air is rapid and high equivalent air change rates (EACs) are achieved against a variety of indicator pathogens. The internal airflow component delivers a Clean Air Delivery Rate of approximately 50 cfm which represents 2.6 ACH equivalent air changes in the model test room volume of 1152 ft^3, based on the test pathogen MRSA. The In-room UV exposure component performs as an Upper Room UV system and produces an equivalent of 53 ACH equivalent in the model test room with MRSA as the test pathogen. The projected EACs for all test pathogens greatly exceed the proposed recommendation of 6 EAC per ASHRAE 241P. During operation the system produces an average irradiance in the room of 0.157 W/m^2, which will be maintained for as long as the system operates, producing continuous disinfection of air and surfaces. The disinfection times for a variety of airborne pathogens are computed under various operating conditions. The system is shown to have a very high UV output (0.295 W/m^2) when the enclosure is removed and rooms are exposed to naked lamps.

About the Author

Dr. Kowalski holds a BS in Mechanical Engineering, Illinois Institute of Technology, and an MS and PhD in Architectural Engineering from The Pennsylvania State University. He has authored numerous articles on the topic of airborne disease control technologies including the widely cited Ultraviolet Germicidal Irradiation Handbook. He was previously chairman of the Air Treatment Group of the International Ultraviolet Association (IUVA) and works on UV standards in collaboration with ASHRAE, ASTM, and other professional societies. He has authored one standard, ASTM E3286-21 and two UV technology patents. Dr. Kowalski has previously assisted the US Army, the DoD, and the NYPD during the post-911 anthrax attacks and designed a UV system for NASA that is aboard the ISS. He currently serves on the IUVA Education Committee, the IUVA Industry Working Group, and the Underwriters Laboratories UL 8800 Photobiological Safety Committee.