UV-C IN-DUCT APPLICATIONS

APPLICATIONS FOR IN-DUCT UV-C

Entering Side of Evaporator Coil

Leaving Side of Evaporator Coil

In Duct

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

2019 ASHRAE® HANDBOOK

Heating, Ventilating, and Air-Conditioning APPLICATIONS

CHAPTER 62

ULTRAVIOLET AIR AND SURFACE TREATMENT

Ultraviolet Air and Surface Treatment

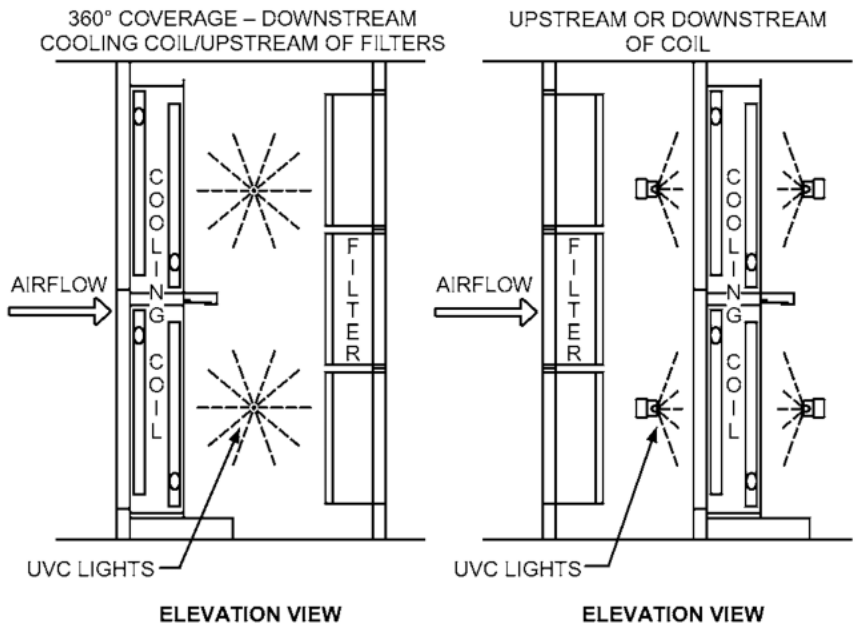
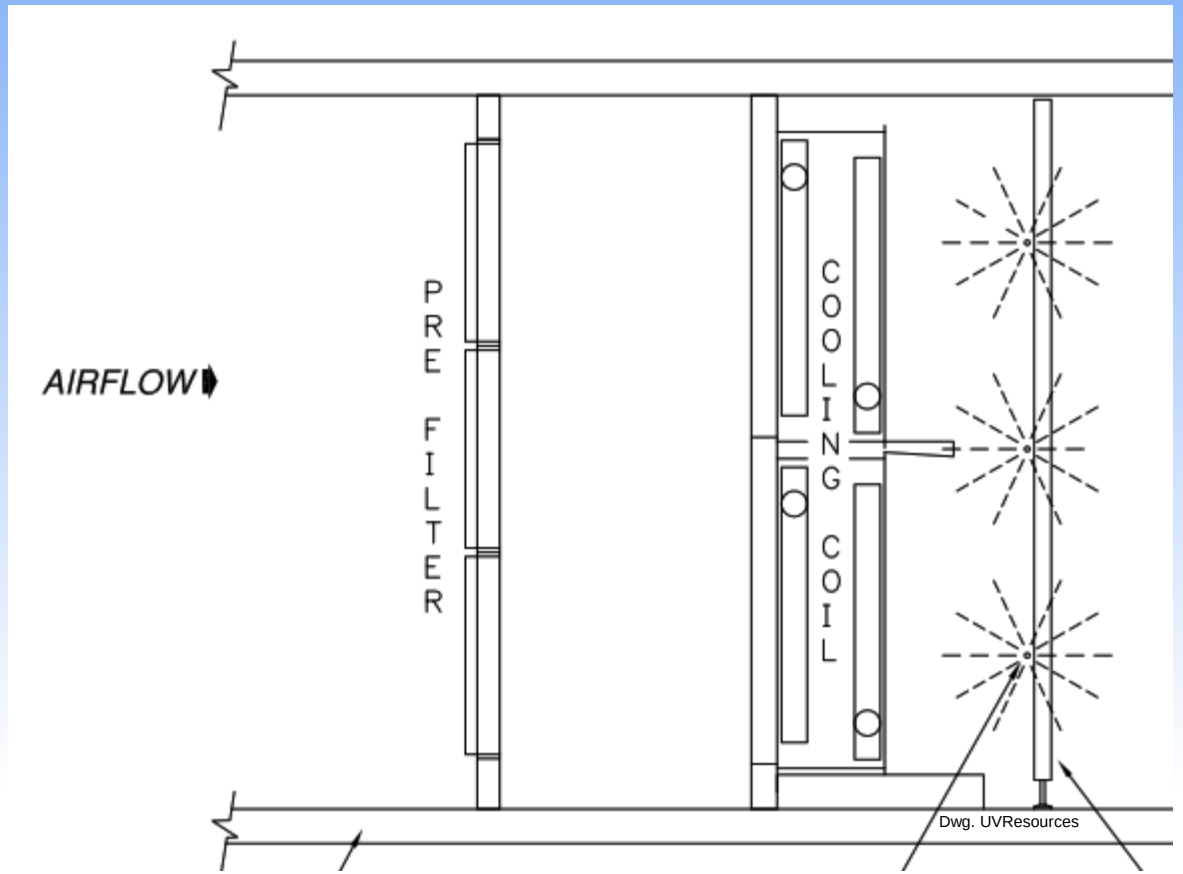


Fig. 12 Section View of Typical HVAC Surface Treatment Installations

img: ASHRAE

UV-C SURFACE-LEAVING SIDE OF COIL



ASHRAE RP-1738

Field Measurement and Modeling of UVC Cooling Coil Irradiation for HVAC Energy Use Reduction

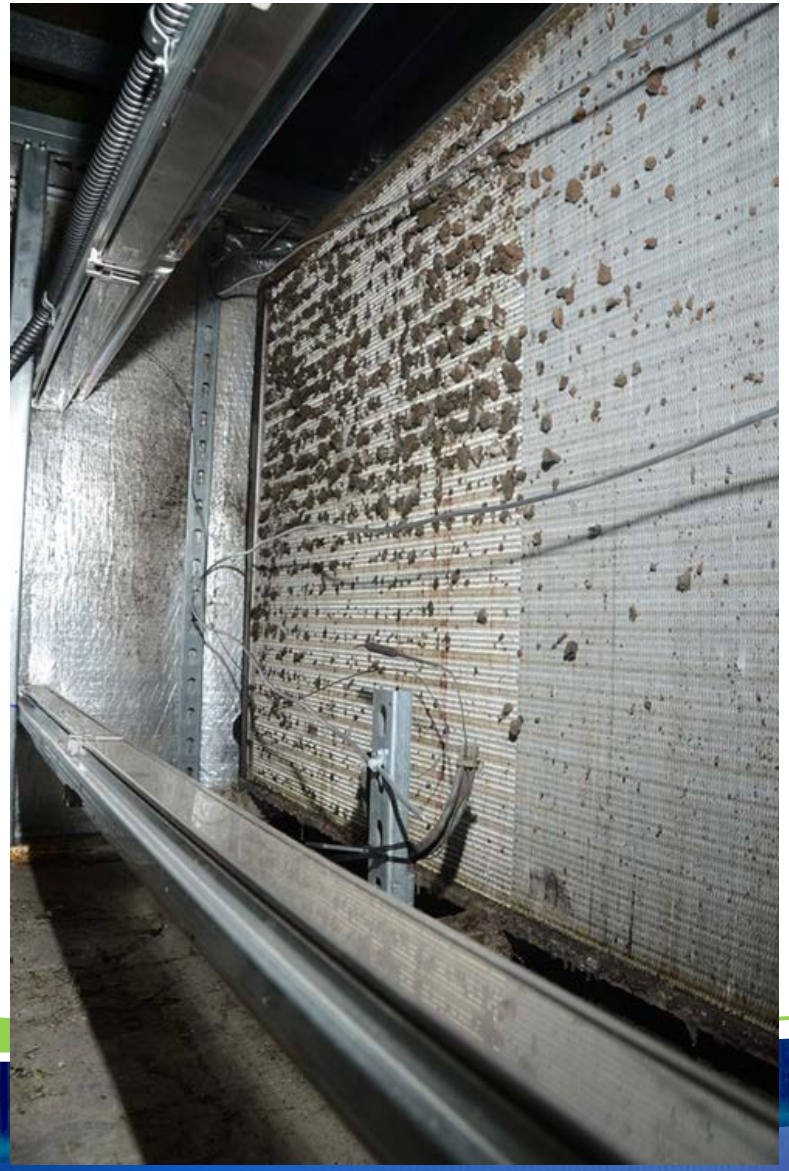
Final Report

November 2016

Overview of RP-1738

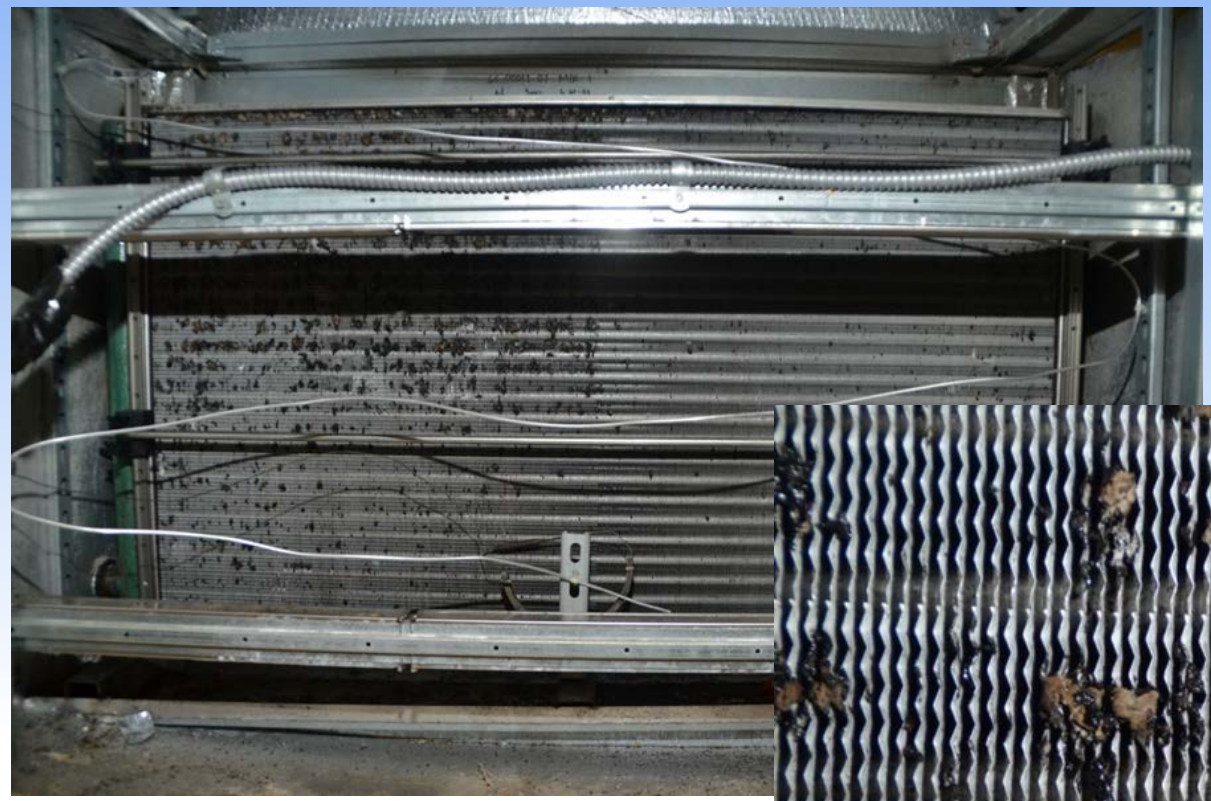
This study encompasses: field measurements of change in coil performance after treatment with UVGI, modeled energy use impact of coil irradiation, and monetization of UVGI benefits including first cost, energy cost, maintenance cost, and collateral health benefits.

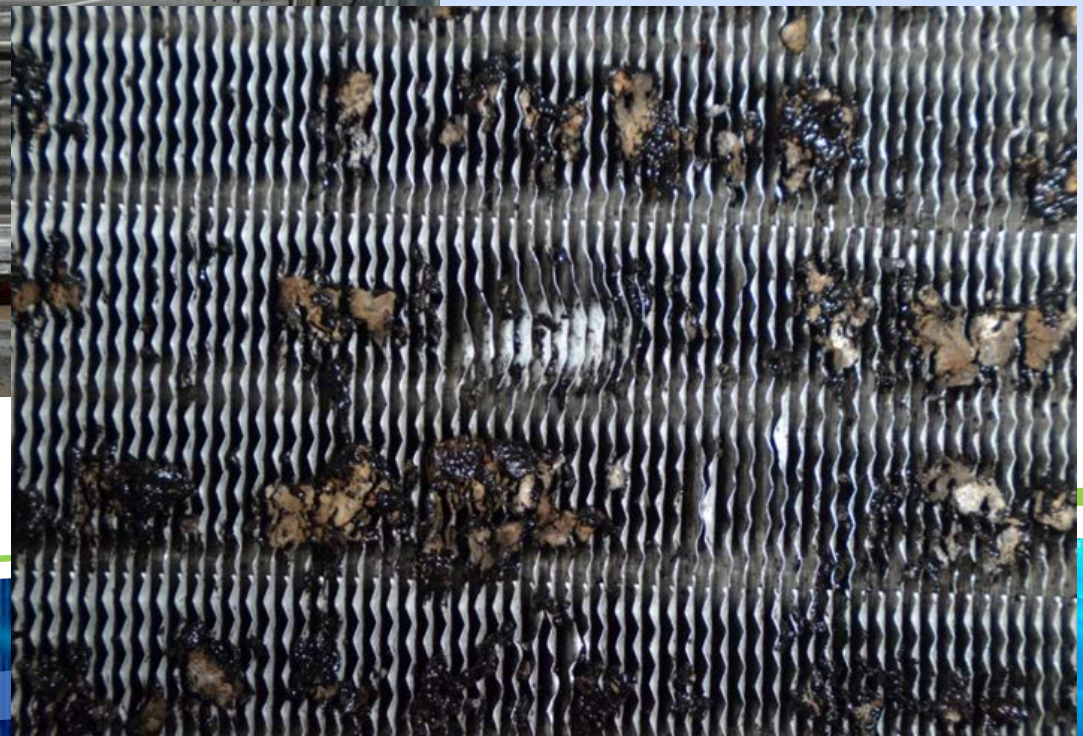
Tampa Site-Pre-UV



Photos- ASHRAE

Tampa-Post UV

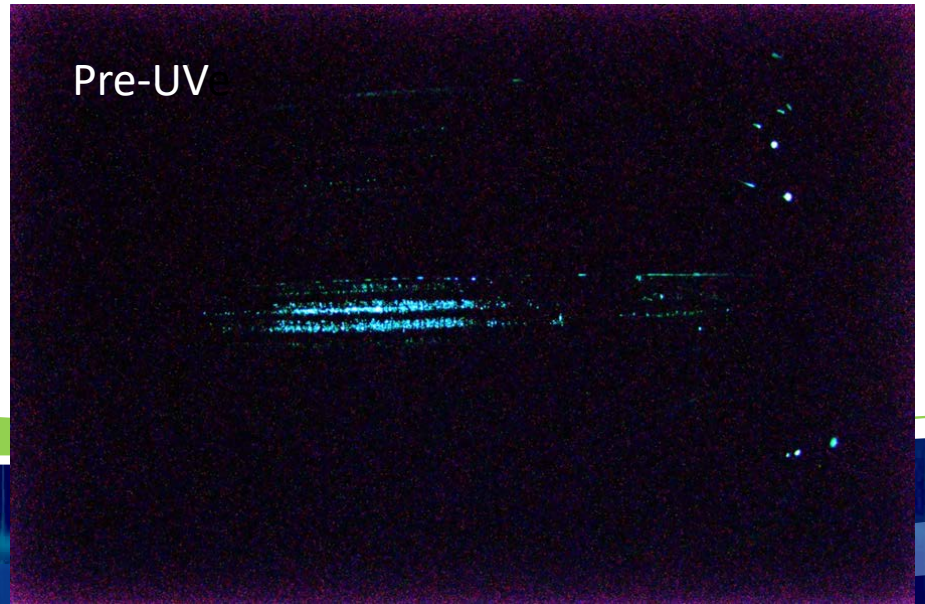


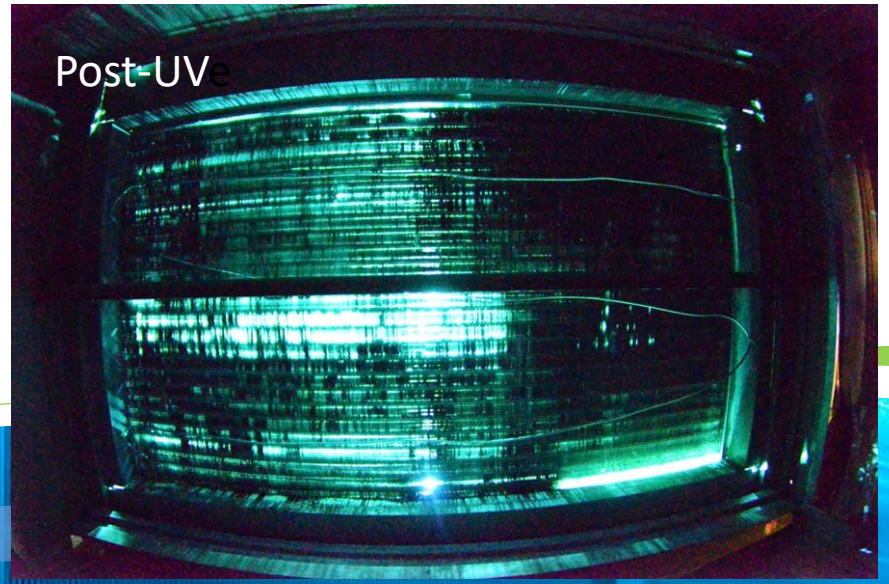


Photos- ASHRAE

Results

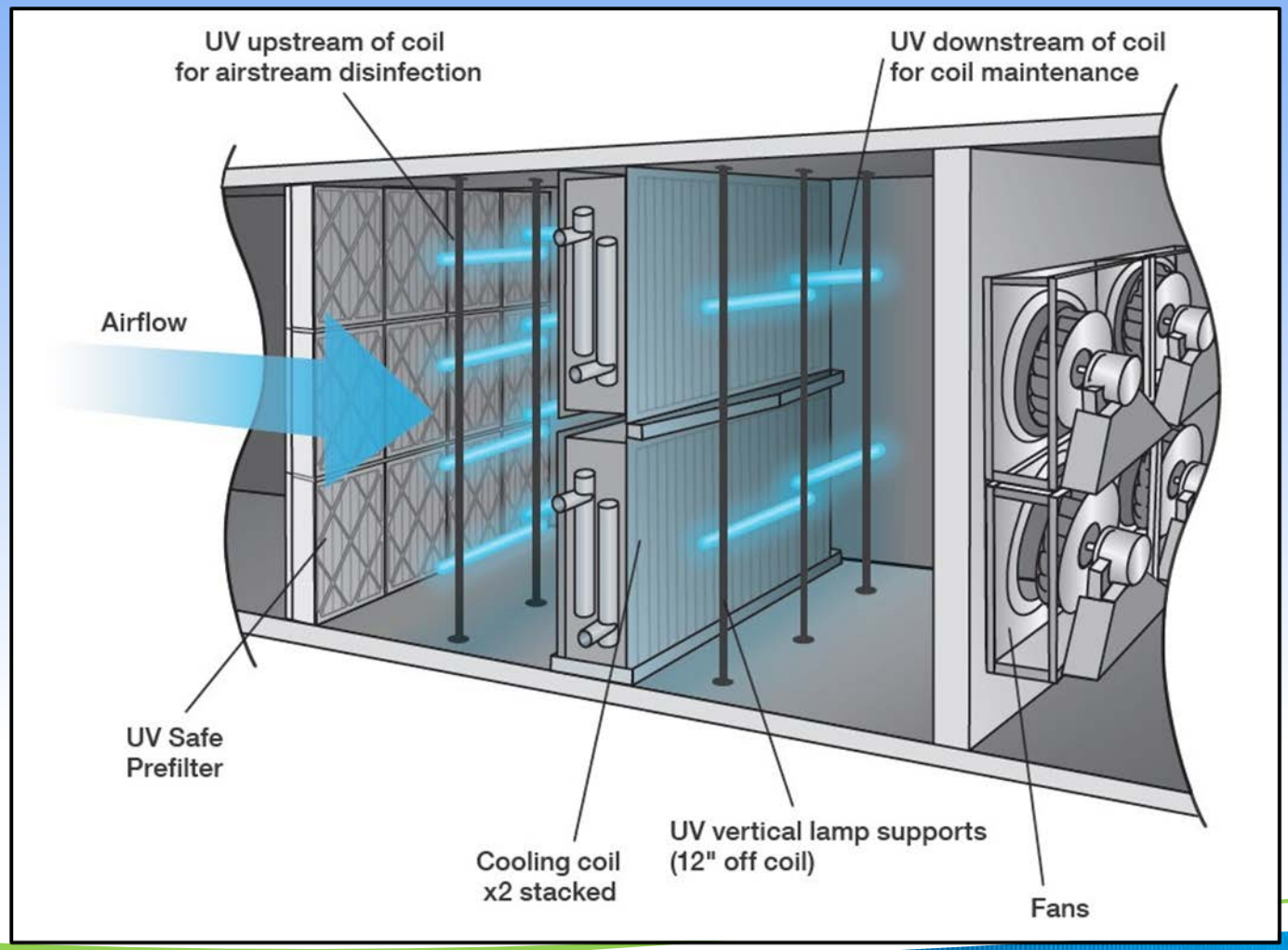
- 21.65% to 21.70% **decrease** (95% confidence) in mean coil airside pressure drop
- 14.5% to 14.8% (95% confidence) **increase** in mean overall heat transfer coefficient (UA)



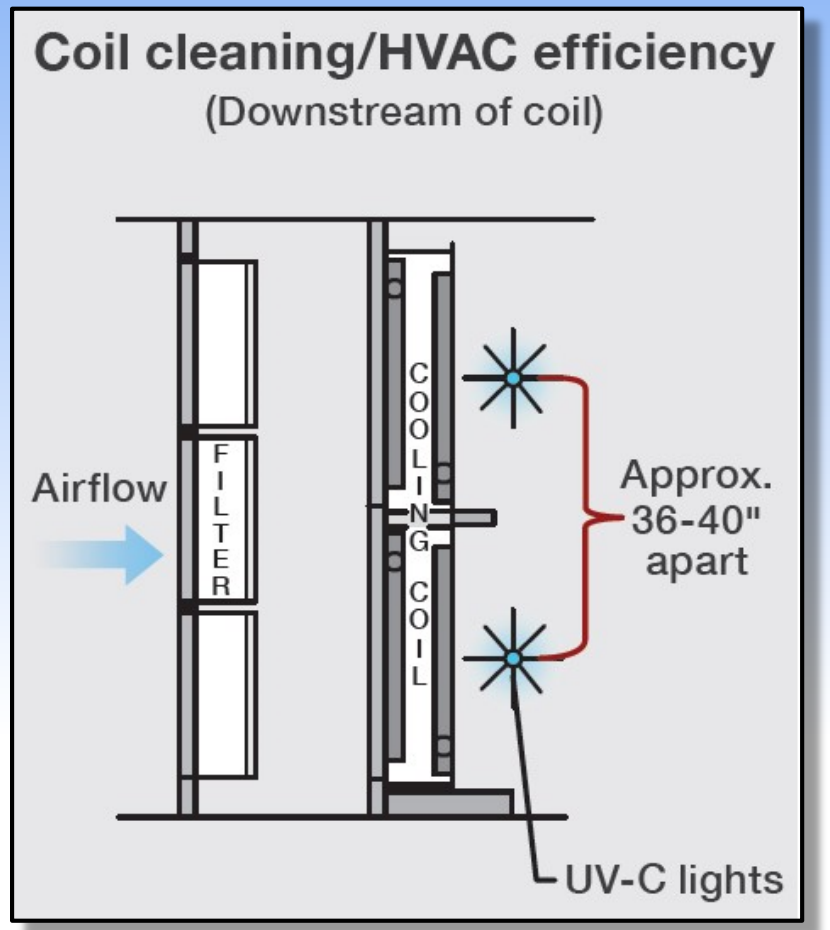


Photos- ASHRAE

UV LAMP PLACEMENT OPTIONS



UV-C- SURFACE-LEAVING SIDE OF COIL



UV-C- SURFACE-LEAVING SIDE OF COIL

ADVANTAGES

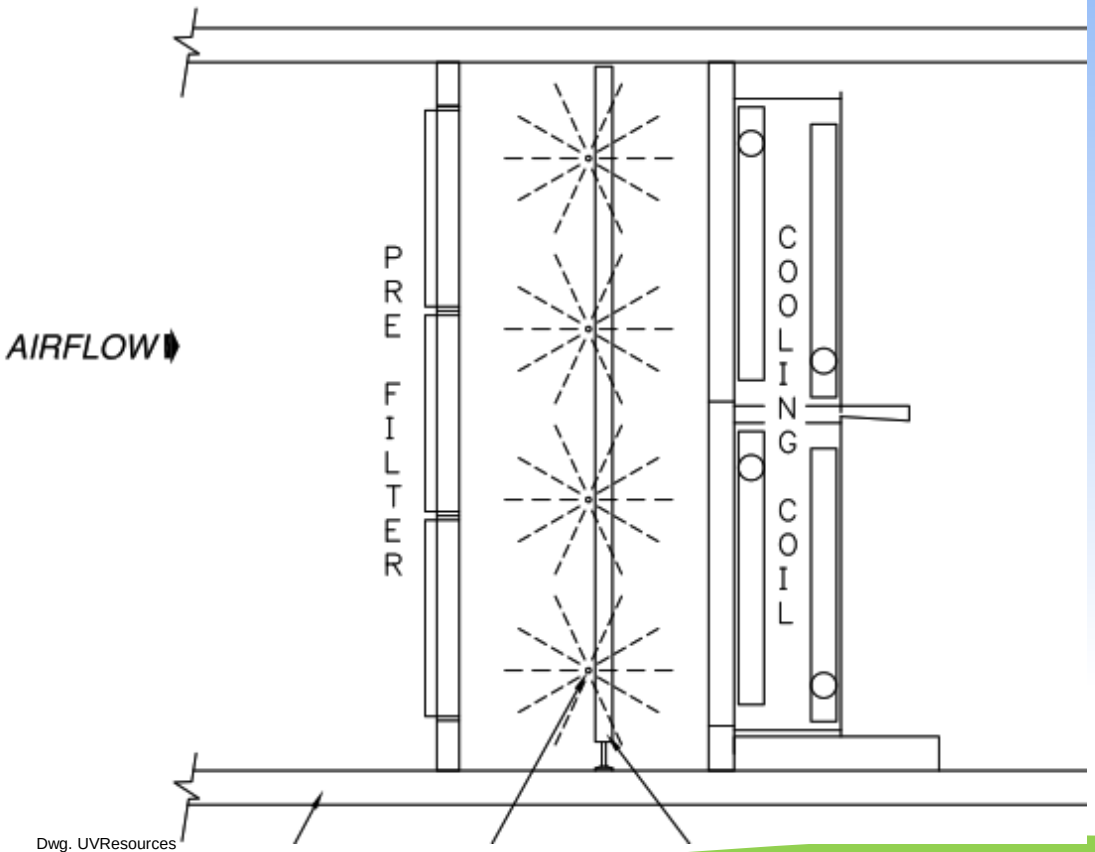
- Keeps coils & drain pans clean from microbial growth
- Treats recirculated air
  - Typically 6 to 15 ACH
- Potential Energy Savings
- Aluminum fins of coil reflect UV-C energy into coil

DISADVANTAGES

- Windchill effects lamp output
- Protect components from possible degradation

UV-C- SURFACE-ENTERING SIDE OF COIL

Img. UVResources



Dwg. UVResources

UV-C-SURFACE-ENTERING SIDE OF COIL

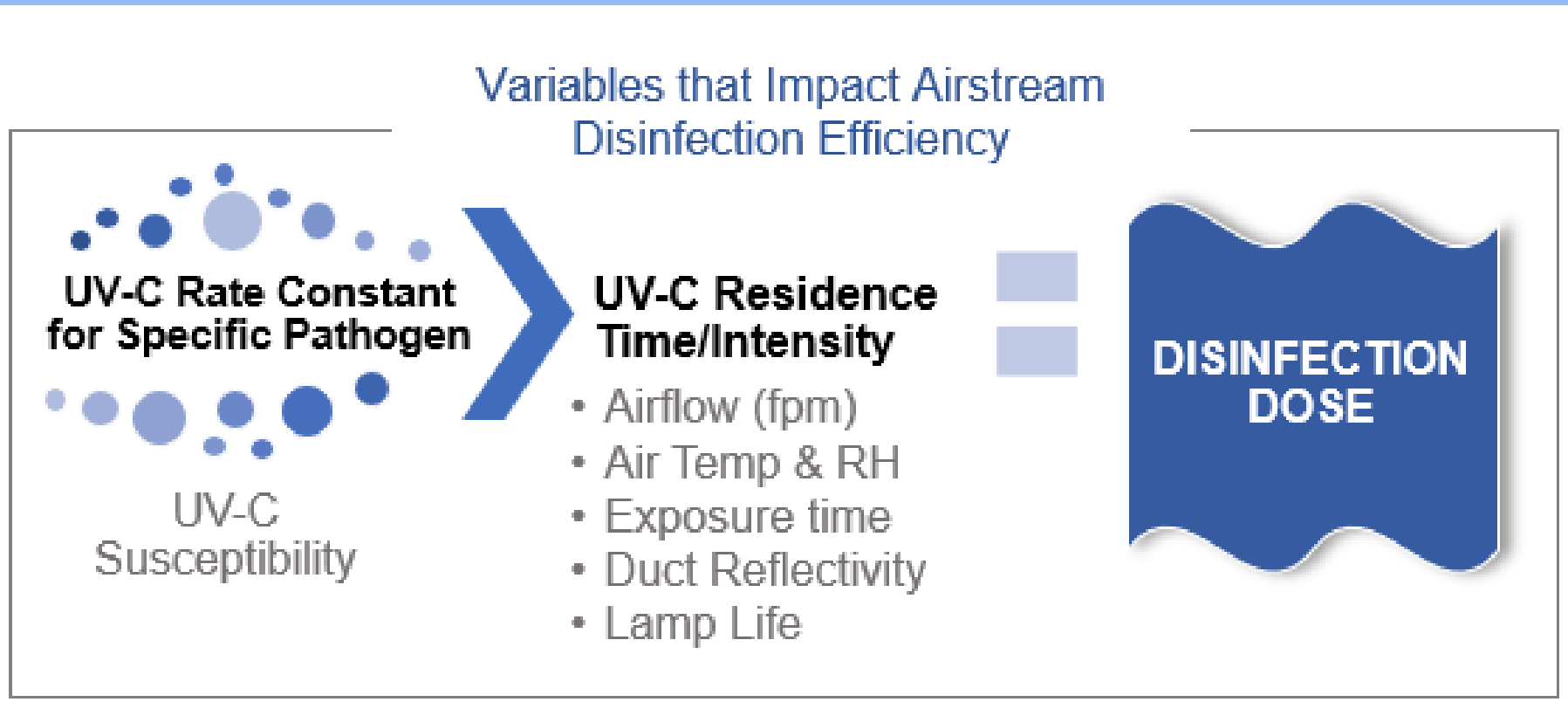
ADVANTAGES

- Warmer supply air means lamps perform better
- Higher potential air disinfection for same number of lamps vs. leaving side of coil

DISADVANTAGES

- Loose advantages of bathing wet side of coil and drain pans
- Typically smaller in-line depth vs. leaving side
- Protect components from possible degradation…Filters

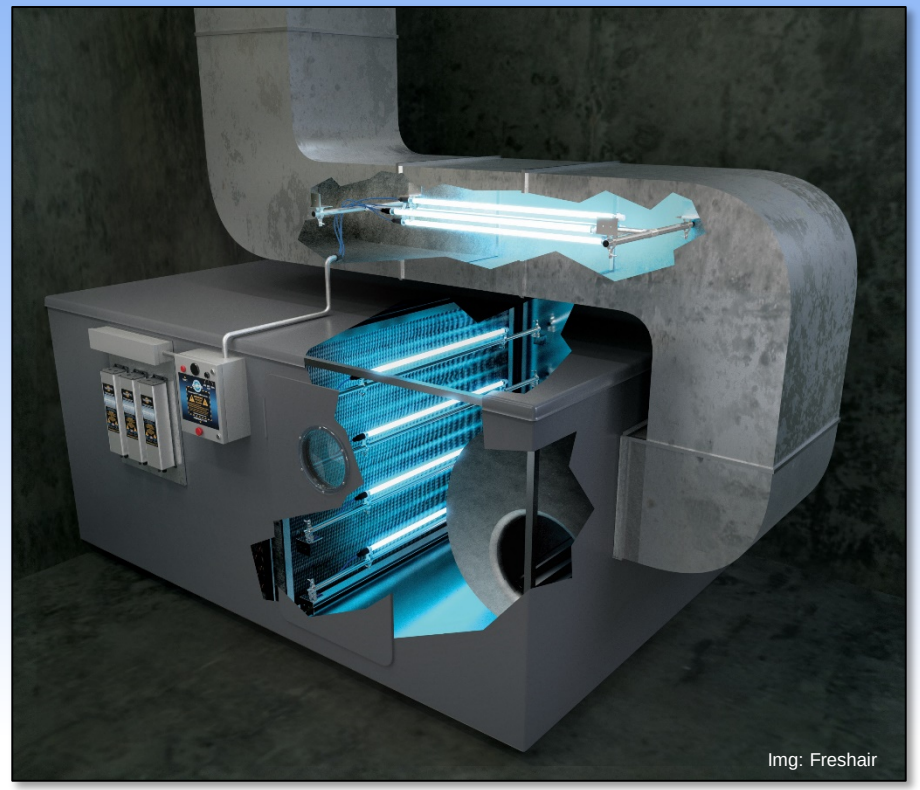
IN-DUCT UV-C VARIABLES



Img: UVResources

UV-C- AIR DISINFECTION-LEAVING SIDE OF COIL


Photo: UV Resources


Img: Freshair

UV-C AIR DISINFECTION-LEAVING SIDE OF COIL

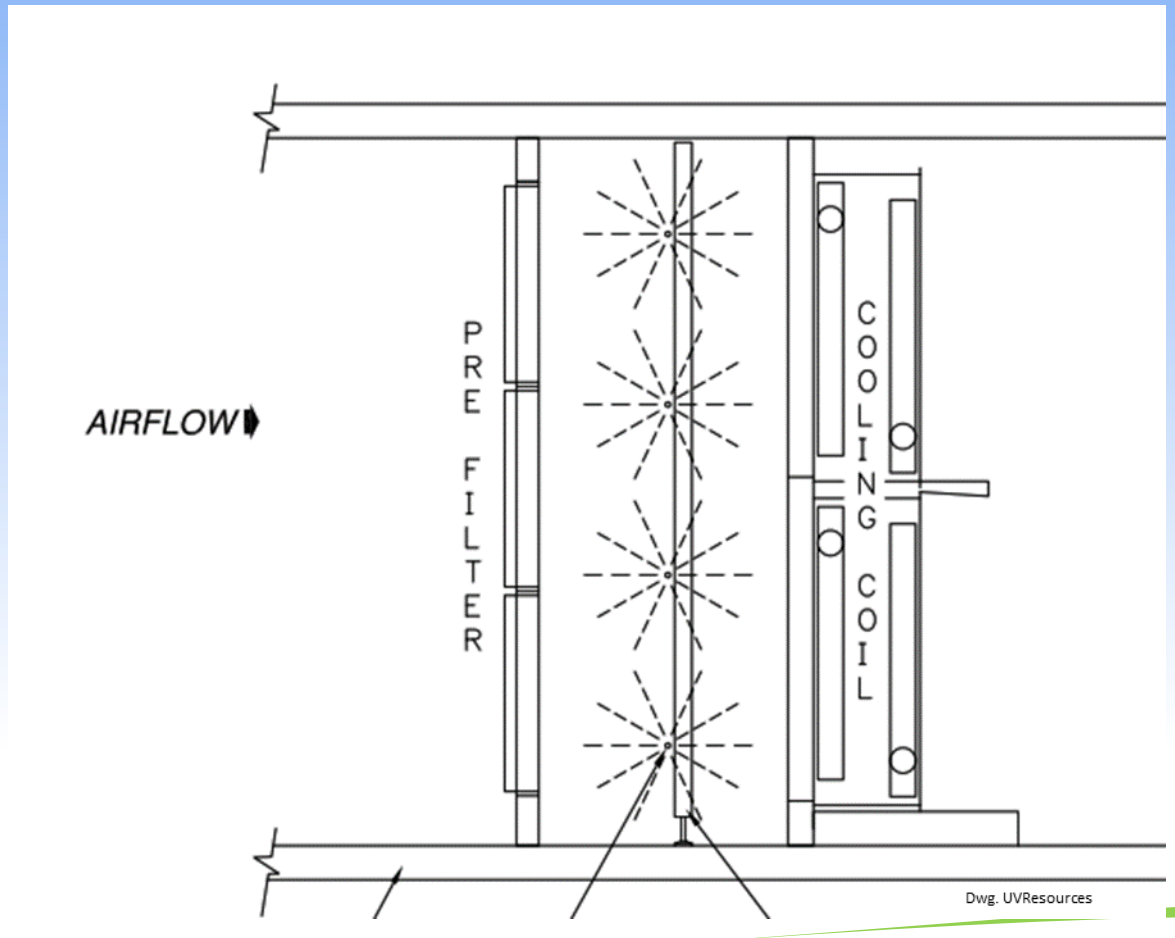
ADVANTAGES

- Increased intensity of UV-C
- Faster surface decontamination
- Can be modeled and sized for up to 99% air disinfection on first pass.

DISADVANTAGES

- Windchill effects lamp output
- Increased energy consumption (more lamps)
- Protect components from possible degradation

UV-C AIR DISINFECTION-ENTERING SIDE OF COIL



UV-C AIR DISINFECTION-ENTERING SIDE OF COIL

ADVANTAGES

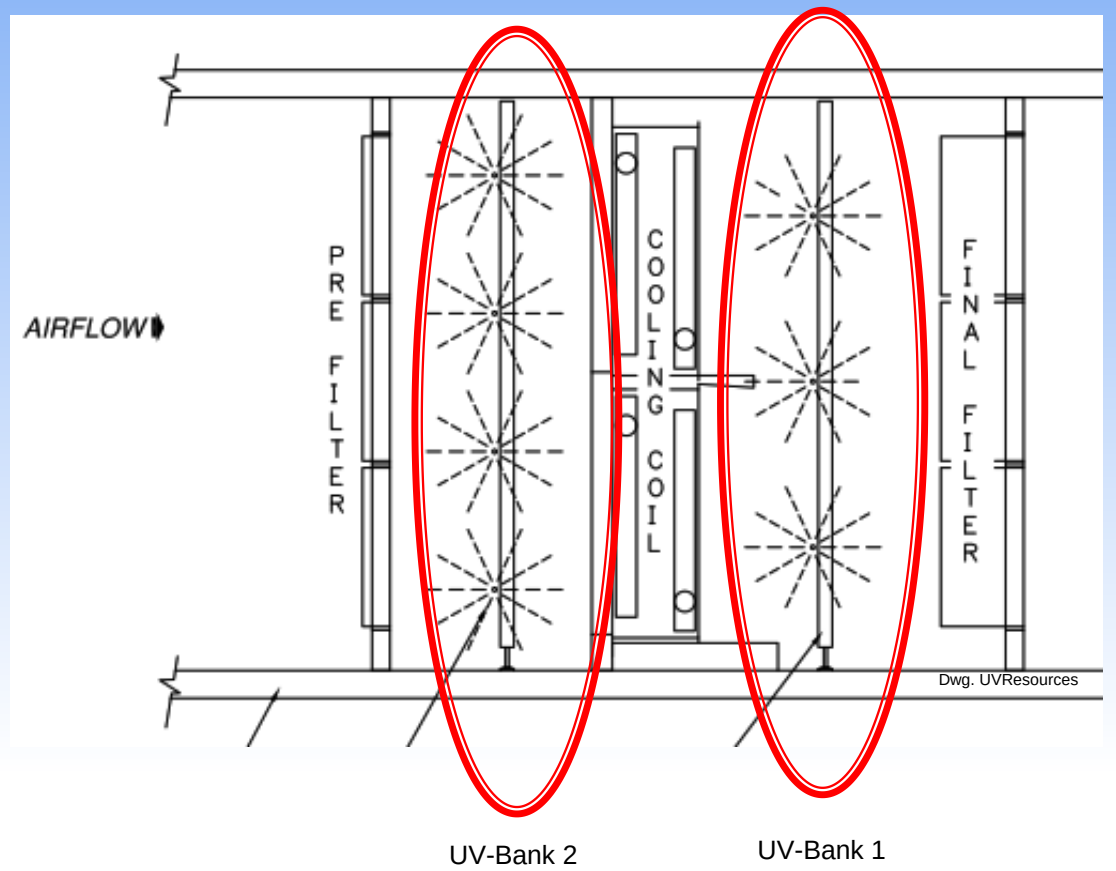
- Warmer supply air means lamps perform better
- Decreased number of lamps needed vs. leaving side
- Can be modeled and sized for up to 99% air disinfection on first pass.

DISADVANTAGES

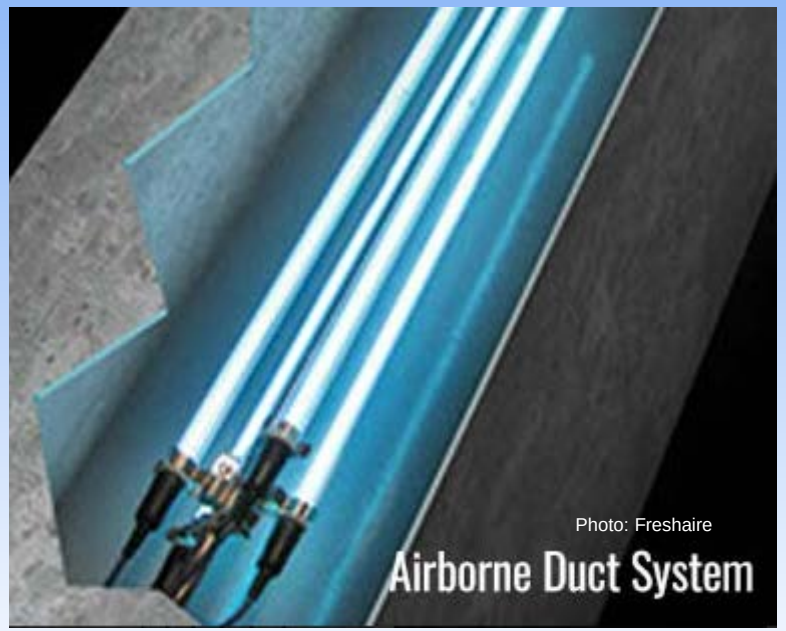
- Loose advantage of bathing wet side of coil and drain pans
- Typically smaller in-line depth vs. leaving side
- Increased energy consumption (more lamps)
- Protect components from possible degradation

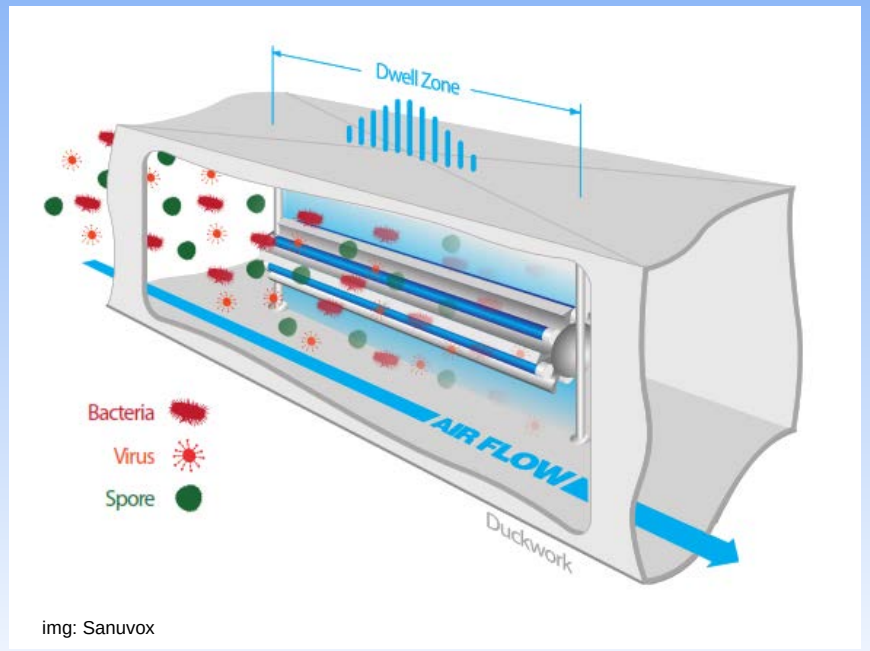
COMBINATION SYSTEMS

- Lamps on leaving side for coil and drain pan maintenance
- Lamps in warmer air on the entering side for increased infection control
- UV-C banks can run separately or simultaneously



UV-C IN-DUCT





img: Sanuvox

UV-C- IN DUCT

ADVANTAGES

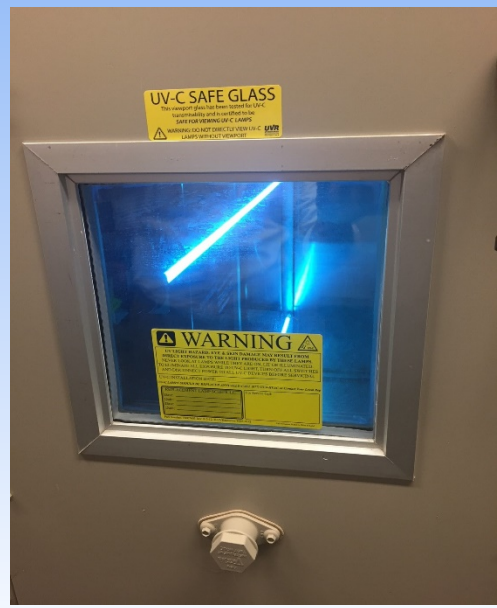
- Increased intensity of UV-C
- Adding reflective material (i.e.: high spectral aluminum) to duct increases UV-C intensity
- Can be modeled and sized for up to 99% air disinfection on first pass.

DISADVANTAGES

- Windchill effects lamp output
- Airflow is much faster in duct which means more lamps may be required
- May have to be installed in multiple locations
- Access may be limited

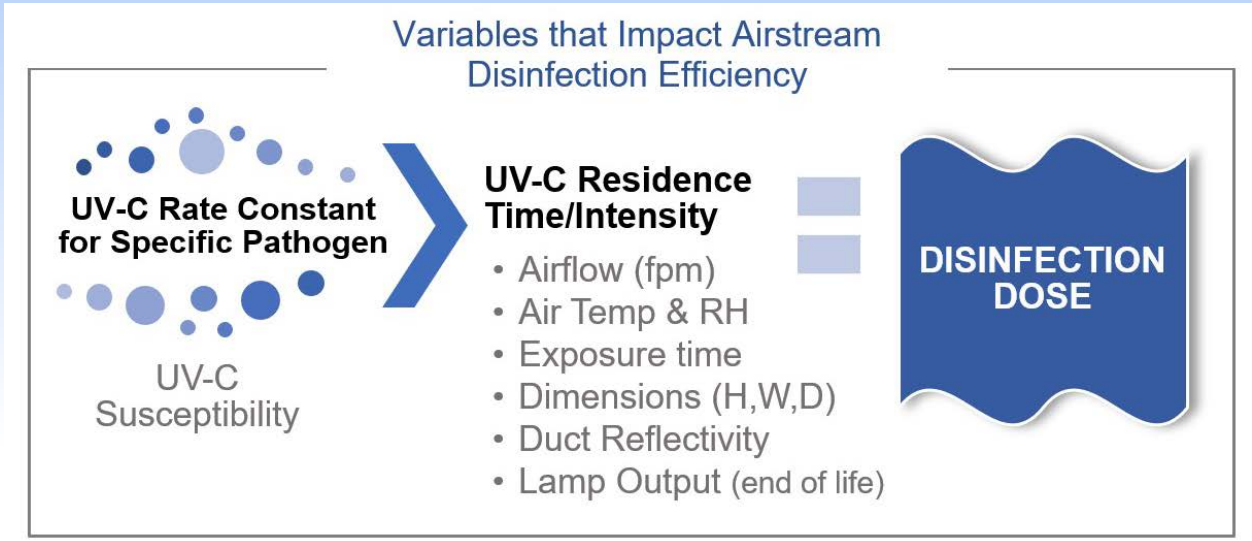
UV-C DUCT & AHU SAFETY REQUIREMENTS

- Door interlock switches and warning signs (UL 1995, UL 60335-2-40)
- UL ABQK -Air Conditioning Equipment Accessories, Air-duct Mounted
  - This category covers products employing ultraviolet lamps or ionization tubes for the purpose of treating air and having provisions for connection to heating and ventilation ducts used for air distribution.
- UV-C safe viewing windows/ testing

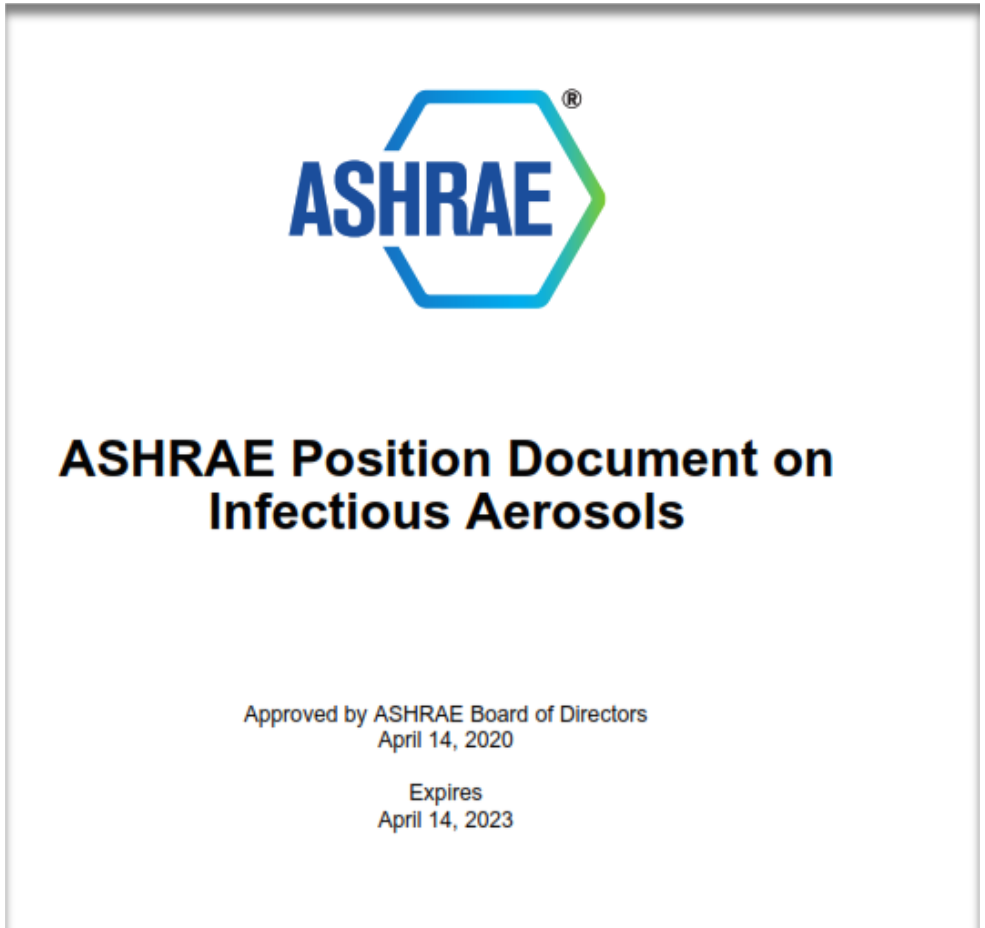


GENERAL APPLICATION CONSIDERATIONS

- Disinfection is a function of time and intensity to UV-C exposure
- Slowest moving air in HVAC system is preferred
- Longer inline depth
  - Increased residence time
- Warmer air vs. colder air
  - Could be a trade off with inline depth
- Safety
  - Staff Training
  - Access interlock switches (UL 1995, UL 60335-2-40)



Additional Reference Materials



ASHRAE®

ASHRAE Position Document on Infectious Aerosols

Approved by ASHRAE Board of Directors
April 14, 2020

Expires
April 14, 2023

https://www.ashrae.org/file%20library/about/position%20documents/pd_infectiousaerosols_2020.pdf

https://www.ashrae.org/technical-resources/resources

Additional Reference Material

Guidelines for Environmental Infection Control in Health-Care Facilities

Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC)

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention (CDC)
Atlanta, GA 30329

2003
Updated: July 2019

https://www.cdc.gov/infectioncontrol/pdf/guidelines/environmental-guidelines-P.pdf