Questions from Mitigating Pathogen Transmission – Session Two (10-28-2020)

1. Does evaporation of the droplet barrier wall affect its float time?

   Response: Greatly – As the water barrier evaporates, the droplet becomes more buoyant, thus significantly increasing its float time

2. So to clarify, we are not concerned about RH because of the effect it has on the SARS-COV-2 particle, because it is already so small, but rather how low RH affects the human body's ability to fight the virus?

   Response: If we can maintain a 40-60% RH, it will minimize the speed of the evaporation, which in turn will reduce the float/air time of the virus nuclei. Additionally, a 40-60% RH increases a person's natural respiratory system's ability to stop the virus before it gets deep into the lungs. The rate of pathogen desiccation, i.e., the time it takes for the H2O envelop that virus adheres to and is surrounded by, is significantly reduced, allowing the expelled infectious particle to maintain its mass, so it precipitates from the air more quickly. Regarding immune system effectiveness, a properly humidified space allows the mucus in an occupant's lungs to be more fluid so it can more effectively expel the pathogen from the lungs. Dry environments increase mucus viscosity reducing mucus flow and the rate or ejecting ingested pathogen

3. Would a humidification strategy then also require continuous RH monitoring?

   Response: Yes

4. How fast is the filter degradation? Is it still a consideration with 1-3 mo changeout? <RE: UV Lights>

   Response: You would need to be sure that the filters are "UV-C safe," i.e., UV-C will degrade (rapidly) synthetic filter media – glass-based filters hold up much better to the UV-C energy.

5. You stated that the UV intensity and dose are dependent on air temperature. Can you please explain why?

   Response: Colder air reducers the output of the UV-C lamps. The dose increases with the output.

6. Are UV Bulbs considered hazardous waste?

   Response: Yes. The environmental danger here is the mercury. Mercury is a toxic heavy metal that can harm biological organisms if released. You are perfectly safe when the lamp is operating in your building, and even when handling it. The concern is that the mercury could leak out of a broken lamp after being tossed into the trash. Therefore the EPA has classified the metal as hazardous waste. Television sets create a similar concern of chemicals being released, which is why you cannot simply toss an old TV and its cathode ray tube in the trash. For more information on this, check out the UV Resources website:
   http://www.uvresources.com/blog/lights-out-how-to-replace-and-dispose-of-your-uv-lamps/

More information on what was mentioned about the light bulbs still emitting light even though they are not as effective: The UV-C wavelength (253.7 nm) is invisible to the eye, the blue light that one sees represents only 5% of the total output of the lamps. So, unlike the unlit or flickering lamp above the desk or in the conference room, the visible light emitted from a UV-C lamp is not an indicator of its performance. UV lamps will continue to emit the blue light long after the UV-C output has decreased, even by more than 50%!

7. For upper room units, how effective are they in stagnant air? How many air changes to disinfect the room?

   Response: UV Resources discussed the ASHRAE 2019 Handbook –HVAC Applications in the November 2020 issue of AMCA In Motion publication regarding this issue. "While upper-room/air UV-C "is very effective in areas with no, or minimal, ventilation," (ASHRAE) in spaces with no or weak air circulation, ceiling fans can compensate for the lack of sufficient mechanical air movement and improve inactivation rates" (UV Resources). See more about the use of ceiling fans from another article in AMCA In Motion: https://www.nxtbook.com/nxtbooks/ashrae/ashraejournal_amca_2020october_v2/index.php?startid=11

   In the CDC guidelines, laboratory conditions for testing the effectiveness of Upper-Room UV is 6 ACH. They also recommend ceiling fans for rooms with stagnant air. https://www.cdc.gov/niosh/docs/2009-105/pdfs/2009-105.pdf

8. How does space humidity affect the Ionization process? From the 1st slide, it would appear that higher humidity benefits the process.

   Response: Little effect unless the humidity is less than 10%

9. What is the target ion density for equipment selection?

   Response: GPS advocates an ion density of 2,000 ion/cc/sec.

10. Does Varitec offer a way to measure IAQ ventilation rates since NPBI works best when reducing OA? This would be comparing OA to ASHRAE 62.1

    Response: Varitec can provide a comprehensive IAQ Monitoring System. Currently, there is no Industry Standard for commercial IAQ; we can measure Temperature, Humidity, Co2, VOC, Ions, PM (Particulate Matter), and provide scales for acceptable ranges based on industry standards.

11. Did you say 50% OA reduction?

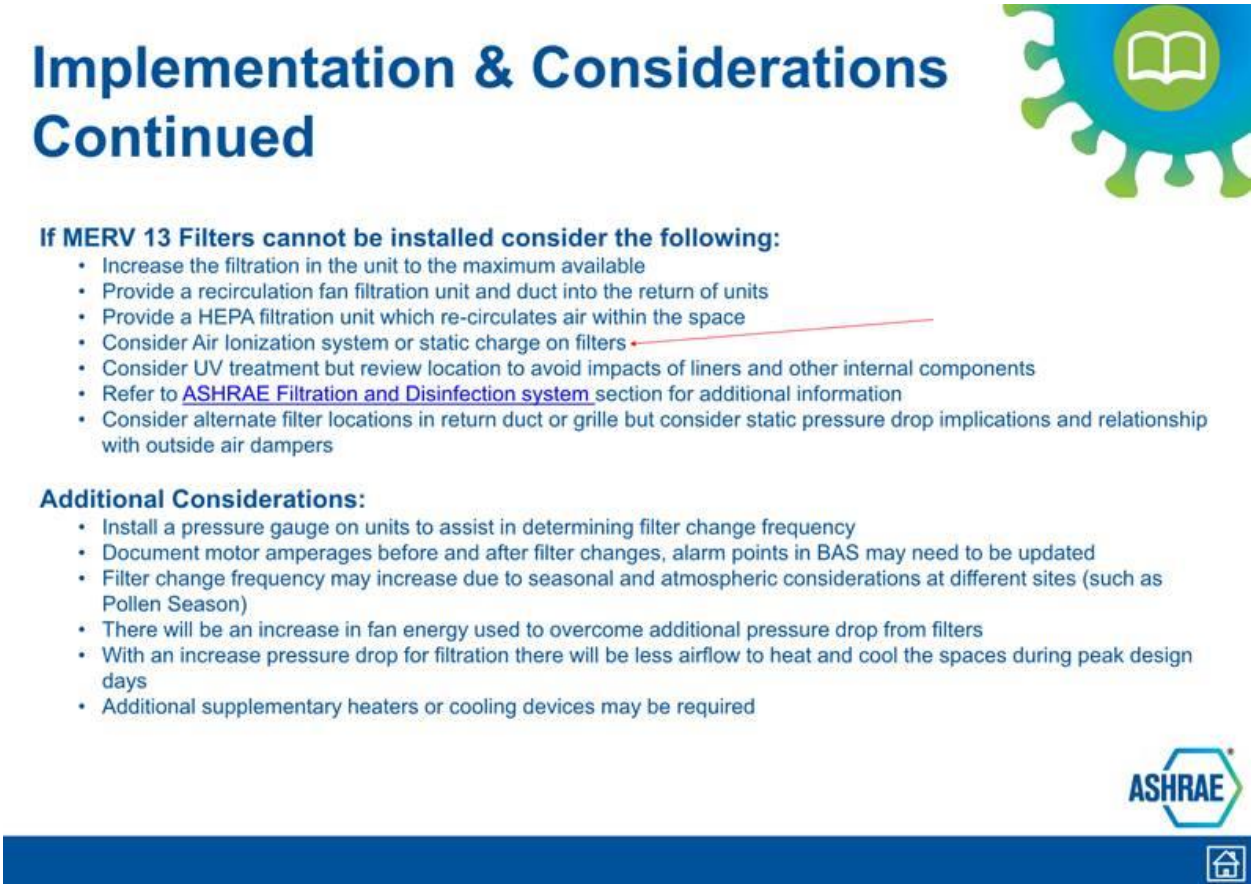
    Response: Yes, utilizing ASHRAE's 62.1 Alternative IAQ Procedure, the use of GPS can reduce outside air by 50%.

12. Do you know why ASHRAE calls Bipolar Ionization an emerging technology? It seems like we have been using ionization for decades in cleanroom applications.

Response: At this point, ASHRAE has not fully vetted out NPBI. Recent developments have figured out how to keep the electron voltage potential under 12v, which in turn prevents the production of Ozone. Always look for a UL-2998 Label to ensure Ozone Free Generation. ASHRAE has begun to include ionization in its COVID reopening documents:

https://www.ashrae.org/technical-resources/filtration-disinfection#bipolar

and:



13. How do these technologies relate? Should we use all 3 in the same application? ... or is there one primary measure that is the priority base measure?

    Response: A combination of various mitigation methods is ideal as it promotes optimum opportunity to neutralize and capture pathogens. Under consideration is to treat all buildings as "healthcare" environments. Healthcare facilities are instructed by ASHRAE to apply blended solutions to increase system effectiveness in reducing pathogens inside a building.

14. How about cost comparison between UV and Bi-Polar in an air handler?

    Response: Initial cost is similar, with GPS being slightly higher, but must GPS has limited to no maintenance where UV Bulbs require yearly maintenance.

15. Ionization is the method that I have the least familiarity with. What is the practical application of it? For example, the UV is an accessory inserted into the airstream. Is this similar to Ionization?

    Response: Ionization is actually more flexible than UV when it comes to placement and application. Because UV has specific safety hazards and precautions, one must be careful where to place it. Ionization devices can be placed pretty much anywhere that is convenient. We want Ions to circulate in the air stream via airflow. They are not subject to dwell time, as UV does.