destroying the virus' RNA material. 2) Preventing the virus from attaching to a human cell by making the SARS-CoV-2's spike protein neutrally charged.

6. **Does ionization neutralize SARS-CoV-2 or other pathogens on surfaces?**
    a. Ionization is an effective cleaner of the air. However, ionization has little effect in cleaning surfaces.
7. **What affect does ionization have on particulate size?**
    a. Ionization is just starting to be looked at as a means to potentially help with the reduction of particulate matter in the air. There has not been much testing done on this subject. Below is an example of a test showing how ionization helps reduce particulate matter.
    b. In a study of poultry houses (Cambra-López, María & Winkel, A. & Harn, Jan & Ogink, N.W.M. & Aarnink, André. (2009). Ionization for Reducing Particulate Matter Emissions from Poultry Houses. Transactions of the ASABE 52 (2009) 5. 52. 10.13031/2013.29138) the researchers found the ionization system effectively reduced total PM10 mass emissions by 36% (SD 9%) and PM2.5 emissions by 10% (SD 19%). Higher reduction efficiencies of ionization in relation to increased particle size were observed. Particles in the upper size ranges (from 7.5 to >32 mm) were more effectively reduced than smaller PM. Ions attach to contaminants and **enlarge them enough to be trapped by the HVAC system filters**. The ionic load also makes some particles heavy enough to fall to surfaces where they can be cleaned away or further inactivated.
8. **What sensors should be used with ionization?**
    a. iAIRE recommends utilizing VOC sensors when cleaning the air with ionization. Sensing VOCs is the best way to monitor indoor air quality.
    b. Some of iAIRE's competition suggests adding ion count sensors in the space to prove ionization is working. Ion count does not guarantee clean air. Sensing VOC levels in the space is the best way to determine indoor air quality.
9. **Does ionization eliminate the need for outside air in a building or home?**
    a. **NO** – A significant reason to bring outside air into a building is to reduce CO_2 levels in a space. The CO_2 is present from human respiration and ionization has no effect on CO_2 levels.
    b. ASHRAE 62 requires a ventilation standard for non-residential buildings. There is a principle in this specification that allows for the reduction of outside air (IAQ procedure). The IAQ procedure in the standard allows in appropriate conditions for a reduction of outside air with ionization. A professional engineer must determine if this is allowable or not on each project.
10. **Is there a difference between ionization and bipolar ionization?**
    a. Bipolar ionization is a device that produces both positive and negative ions. There are a few products on the market that only produce negative ions.
11. **Why is Trane staying away from ionization?**
    a. Trane ran two tests on ionization. Trane looked at ionization's ability to reduce SARS-CoV-2 in the air and they looked at ionization's ability to reduce formaldehyde from the air. In these tests, Trane showed that ionization helped reduce the amount of SARS-CoV-2 from the air. Trane's test on formaldehyde

showed almost no impact on the reduction of formaldehyde when ionization was implemented to clean the air. From these test results, Trane became concerned that many building installations with ionization were/are designed with a reduction of outside air as part of the overall building management strategy (Using the ASHRAE 62 IAQ standard in lieu of the ventilation rate standard). If ionization does not reduce VOCs and the building management system is bringing in less air than the ventilation rate standard, the possibility exists for people to become sick.

b. Many of the manufacturers of ionization products do not believe Trane's test method for formaldehyde reduction was correct and that ionization can remove many VOCs like formaldehyde from the air. An independent study showed a reduction in 30 VOCs including formaldehyde. Ionization does not remove every single element of every molecule from the air. The goal in cleaning air is to get harmful components down under levels deemed safe for humans to be around in accordance with EPA standards.
c. iAIRE would suggest that a building manager only use ionization to clean indoor air when utilizing VOC sensors to monitor indoor air quality and adding outside air when conditions call for dilution of the indoor space with outside air.

12. What is the lawsuit about with Global Plasma Solutions?

a. Global Plasma Solutions (GPS) is being sued for misrepresentation (making claims GPS cannot prove the product or service can achieve) and for the ***possibility*** that their product might be producing harmful materials. iAIRE will be monitoring the lawsuit to see what transpires especially regarding the claim that ionization might be producing harmful materials.

13. Is ionization test data done in "shoe box" sized testing that does not reflect reality?

a. Almost all initial testing on the effects that ionization has on different viruses are done in small bio safety environments. Most of the items being tested are not safe for humans to be around. All initial testing on ionization and its effect on these pathogens must be done in a bio safe environment.
b. The initial testing for the SARS-CoV-2 was done in a small bio safety Level 3 enclosure due to the very strict COVID-19 safety protocols and requirements in effect at the time of the initial testing. Subsequent testing was done in a much larger, room sized enclosure to better emulate conditions experienced in real world conditions. The subsequent test verified the efficacy of the initial test which proved that ionization mitigates SARS-CoV-2.

14. Why did Sharper Image get sued for selling ionization products?

a. Sharper Image made an ionization product that produced ozone. Quite a few people became sick, and a couple of people died by using this product. This product used high voltage to produce ions and ozone. iAIRE's ionization products use low voltage that produce no ozone in accordance with UL2998.

15. Do you still need filters with ionization?

a. **YES** – Filters are designed to help remove particulates from the air. Ionization might help eliminate some of the harmful components that are in the air, but they should not be relied on to remove particulates. Ions attach to

contaminants and **enlarge them enough to be trapped by the HVAC system filters**. The ionic load also makes some particles heavy enough to fall to surfaces where they can be cleaned away or further inactivated. So, utilizing ionization can make a filter more effective. Independent studies have shown that ionization increases the effectiveness of filters by a factor of up to 4 grades. Thus, a MERV 8 filter used in conjunction with ionization makes the filter act like a MERV 12 filter.

16. Does ASHRAE back ionization?

a. According to ASHRAE, the CDC position on Bipolar Ionization is: "While bi-polar ionization has been around for decades, the technology has matured and many of the earlier potential safety concerns are reportedly now resolved. If you are considering the acquisition of bi-polar ionization equipment, you will want to be sure that the equipment meets UL 2998 standard certification (Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners) which is intended to validate that no harmful levels of ozone are produced."