

Idaho State Department of Education

Air Filtration Systems Q&A



Can you provide clinical evidence of reduced risk of disease transmission with the use of these specific technologies?

McClure Engineering

While we don't have a scientific paper to indicate that the equipment has reduced the spread of disease in our office, we do have a report of the ion counts before and after installation, and the number of sick days our employees have used since installation has decreased.

Clinical testing is nearly impossible to perform with conclusive results because of the wide range of variables and inconsistency of environments. A test may yield good results in a Micron manufacturing space with industrial air handlers, but vastly different results in a school with split units in each classroom. The way we view the real-world application is this: Lab testing proves the science that if the ion density is rich enough, the pathogens are decreased. The real challenge is getting enough of the ions to the space to replicate what happens in the lab. Each space has unique challenges to consider in optimizing the distribution of ions in as short of a time as possible. It is paramount that each application be carefully analyzed by a qualified engineer who to effectively utilize the benefits of the proven science.

Hobson Fabricating and Norbryhn Equipment Company

In our age of liability management, clinical evidence is primarily anecdotal at this point as healthcare and other facilities have been reluctant to share their positive results due to concern. In the past 6 months we have been notified of several white papers or study results that were planned to be released only to get bogged down in the organizations' legal department. We still have not seen any official studies released. However, we do have some references that can be shared upon request for informal reference checking. – *Dan Russell, Norbryhn Equipment Company*

The key is ventilation. How effective is your product compared to the use of HEPA filter with continuous air circulation?

McClure Engineering

We agree, ventilation is key and fresh air should be at least 25% of the air distributed by the air handling unit. In addition, we suggest that spaces also incorporate 17CFM per occupant above the 25% of total handled air. This may be difficult or impossible to accomplish with some older units, which would have to be replaced. We would be happy to help interested school districts assess their existing equipment, develop plans to modify to allow the specified fresh air intake volumes, and address the heating/cooling concerns associated with bringing in so much more fresh air into the spaces.

Air quality improvement is not a one solution problem. Environments must be monitored and analyzed according to their unique dynamics, then solutions selected from an arsenal of technologies and devices. We have found that a combination of Ventilation, Filtration, and Purification is required to obtain the best results. Ongoing monitoring and adjusting for seasonal weather and other outdoor conditions is also necessary.

Hobson Fabricating and Norbryhn Equipment Company

Continuous air movement is critical for HEPA effectiveness and ideal for NPBI effectiveness. GPS has found that adding NPBI tends to enhance the existing filtration effectiveness by 4-5 MERV levels or equivalent HEPA enhancements. One example of this is a study by Blue Heaven Labs that demonstrates a MERV 8 filter with NPBI can produce similar space particulate counts as a standalone MERV 13 filter. Another example is a clean room

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application with 40 air changes of HEPA filtered air where annual particulate test counts reduced by more than 89% with the addition of NPBI. One key difference between HEPA and ionization however, is that NPBI maintains effectiveness even in non-recirculating air systems (i.e. 100% outside air systems). In a non-recirculating air system, the agglomeration effect of NPBI will lose its enhanced filtration impact since the agglomerated particles are not being recirculated to be captured by the filter, however the ions will continue to do work within the space including agglomeration of particles to the point they fall out of suspension in the air, control of odors and VOCs and most importantly they continue to work against pathogens like SARS-CoV-2 in the space by directly disrupting the surface proteins of the virus and its RNA. This is one of the features where NPBI stands out from other technologies while also being complementary to any other technology. – *Dan Russell, Norbryhn Equipment Company*

What are the one-time costs and maintenance costs?

McClure Engineering

Final purchase price is to be negotiated between the distributor (Norbryhn Equipment Company) and the schools interested in purchase, however we understand that if large quantities are to be purchased for a number of schools, discount pricing is likely to be available. Typical cost of a unit is less than \$1000 with many models falling well below that mark.

Each building will need an evaluation and specific quote. The differing types of existing HVAC systems, installation access, optimal location of ionizers, duct run lengths, fan speeds and capacities, and control systems can all affect the cost of a project.

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With GPS NPBI systems there are no consumables or maintenance costs due to the auto-cleaning functions. One-time costs to be considered are material, installation and engineering fees. These costs will be dependent on HVAC system types and sizes. Idaho schools that have already installed this technology have experienced installed costs for material and labor according to our records ranging from:

Material Cost \$12 to \$55 per student.

Labor Cost \$6 to \$44 per student.

– *Dan Russell, Norbryhn Equipment Company*

Are these able to be installed in older buildings and if so, is there a cost difference between older buildings and newer buildings?

McClure Engineering

As was mentioned in a latter presentation, there are models which meet every type of heating and cooling system and the cost is based on the difficulty of installation and the type of blower system each HVAC unit has. Of the schools we have bid, there were some which were quite new (Pillar Falls Elementary in Twin Falls, ID) and some which were quite old (Ashton Elementary in Ashton, ID). Some used steam heat (i.e. Ashton Elementary), others had a central air handling system (South Fremont High), and others used more common heat pumps (North Fremont High and Rockland School). It is important and valuable to get input from those who understand the units and the HVAC requirements and can advise you appropriately as to models and placements. In addition, we could support the post-installation efforts through ion testing to get a sense of the actual ion counts experienced in each space.

The primary requirement for ion distribution is air circulation. Older boiler systems that utilize convection heat

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transfer systems with no forced air across the radiators are not suitable for NPBI. Some systems may require upgrades to the mechanical equipment for NPBI to be a viable solution.

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All facilities with fan-based systems can be retrofitted with NPBI. Systems with constant flow fans with smaller zones are the most ideal as they permit location of NPBI closest to the occupied space without long runs of ductwork and constant air velocities will maximize ion output. – *Dan Russell, Norbryhn Equipment Company*

Do the filters retain an active virus and a hazard?

McClure Engineering

Because this is an emerging practice, it would be prudent to take precautions while changing the filters as if they contained the active virus, though based on the concepts of how ions neutralize the receptors of viruses, it is likely not as big a concern. Certainly, additional testing on the matter from the filters removed could further answer this question more definitively.

Hobson Fabricating and Norbryhn Equipment Company

Any filtration system that will effectively capture active virus material will need to be handled with caution. NPBI is not a filter in and of itself and should not be confused with older “electrostatic” type ionizing filters where there is a physical charge plate that attracts contaminants and then requires to be cleaned on a regular basis. NPBI delivers ions into the space which causes particulates to grow by clustering or agglomerating into larger sizes that can be captured by the filter. For an initial phase after installation the system filters are likely to load up faster than typical as the system begins to agglomerate smaller particles. After the initial phase, maybe up to 3 months, the system will have established a new steady state particulate level and filter loading should return to normal. – *Dan Russell, Norbryhn Equipment Company*

Particle agglomeration and deactivating odors are likely mechanisms that occur in a short period of time, i.e. air passing right by the NPBI units. Though to achieve a 1-2 log (90-99%) kill rate for coronavirus which was shown in a slide to take 30min to achieve 90% kill rate in the presence of ions.

What is the decay rate of ions generated by NPBI?

McClure Engineering

This is a better question to be answered by Dan Russell and the rest of the Norbryhn team or the manufacturer of the product – Global Plasma Solutions, however from what we understand, most ions have a shelf-life of about 60 seconds before they bond with other substances and are incapable of bonding with other contaminants.

It is important to note that NPBI does not only treat air passing by the NPBI units as would a UVC light. NPBI injects ions into the air stream which are carried out into the occupied environment and continue to interact with pathogens and other pollutants until they are discharged. The life of an ion, although short, is generally long enough to get distributed in the occupied spaces if the system is designed properly. The elevated density of ions can be measured and validated in the targeted spaces.



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Ions typically last up to 60 seconds once generated and begin to go to work immediately upon generation. Some ions will be used to agglomerate particles in the ductwork or within the space, some will be statically deposited to hard surfaces, some deconstruct VOCs into less objectionable components and others will aid in deactivating pathogens. It is important to remember that ion densities we observe through measurement with a handheld ion counter within the occupied space are “residual” ions leftover after the bulk of ions have been used to perform work they were created for. This residual or steady state ion density can also be thought of as the “dose” with which ionization is being applied to a space. As with any disinfection treatments, the end result is a function of both dose and time. In the case of NPBI, the dose takes into account the heightened level of ions at a macro level and is not so concerned with individual ion lifespans at a micro level. As individual ions are generated and dissipate, more ions are generated to replace them and so on. In this way, the time part of the dose x time equation relates to the time over which a pathogen molecule is exposed to the higher dose of ions. This timeframe is not a function of the decay rate of ions but is a function of the active lifespan of an infectious pathogen floating in space or residing on a surface. This is why measures like social distancing and face coverings are still necessary because they prolong the time of exposure that an airborne pathogen can have to the higher dose of ions prior to coming into contact with a susceptible human host. Thus, viral load is reduced with higher dose of ions in the space. – *Dan Russell, Norbryhn Equipment Company*

Do the generated ions make it into the classroom/office spaces?

McClure Engineering

If the units are installed properly, they will always make it into the classrooms and office spaces. This is a good reason to partner with a trusted advisor to deploy the technology, to assure that you get maximum utility from the application of the technology.

The air flow dynamics in the occupied spaces can cause high and low density areas with the space. Generally, the more air movement and air mixing in a space makes for a more evenly distributed ion density. Active human movement tends to aid in this process.

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Yes, the primary goal is to deliver ions to the space and increase the steady state level of positive and negative ions within the occupied space. In the space is where agglomeration and direct pathogen control is most likely to occur and is where NPBI is at its best. – *Dan Russell, Norbryhn Equipment Company*

Recirculated air likely has a greater chance of reducing pathogens as it will be in the ductwork and closer to the ion source. Though what about in the functional space where coronavirus may be generated by infected people?

McClure Engineering

When properly installed and sized, the ion counts in the space will be between 1500 – 7000 ions/cubic centimeter. The decisions about where exactly to locate the equipment are based on the unique requirements of each system and will be placed to assure adequate performance. That said, it is still



imperative that those who know they are sick stay home, and those who are discovering that they are not feeling well leave the space to prevent the spread of disease. In addition, sanitation practice guidelines issued by the CDC and WHO should be followed even when this technology is deployed. Ions are not only effective in the duct work. When there is a constant stream of ions entering an occupied space, ions can better react to new or continuous sources of pollutants in that space. There is no claim or guarantee of immediate results of air ionization. NPBI works on the principle of gradual reduction of particulates over time by continuous generation of ions as well as continuous circulation and filtration of all the air in the space.

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NPBI is definitely effective in a recirculated system and the closer a contaminant source is to the ionization source the better, however effectiveness of NPBI is not limited to recirculated air systems. The trouble with depending solely or mostly on a recirculated air strategy is that space-generated pollutants can take significant amounts of time to travel back to the air handler to be treated by high efficiency filters, UV or at the ionization emitters. Fortunately NPBI is able to deliver ions directly to the space so that there is space-level treatment occurring on a continuous basis while those space-generated pathogens are waiting around to get caught up by the recirculating air system. And in that meantime, infectious particles that are often too small to be captured by the typical HVAC filter are being agglomerated into a size that can be captured by the filter, and/or the infectious particles are being deactivated right in the space without ever needing to be recirculated. – *Dan Russell, Norbryhn Equipment Company*

Is it better to focus on more air exchanges per hour per person?

McClure Engineering

See our response to Question 2 above. We believe that 25% of circulated air should be fresh air and an additional 17CFM/person of fresh air should be used. This will increase the heating and cooling costs in the winter and summer, but may be a very good option during the fall and spring when the outside air temperatures are more moderate.

It is not necessarily a function of one remedy being better or worse than another. Both air exchange and purification are effective ways of reducing virus spread, and systems should be designed to maximize the effectiveness of both of these as well as other methods of improving air quality.

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More air exchanges is likely to enhance the impact of NPBI for the following reasons:

More agglomerated particles can be cycled through the filtration system faster.

Higher air exchanges often means higher air velocities where the ionizer is located, which in turn will result in higher ion output from the devices.

Higher air exchanges means higher air velocity in the space, which means ions will travel further and deeper into the space with less ion loss inside ductwork.

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It is vital to measure the ion counts in various locations where occupants are to ensure that the airflow and time to deliver the air do not result in very low ion counts? High counts at source are not an insurance of high counts where humans are.

McClure Engineering

We recommend a post-installation inspection where ion counts and other metrics are measures. This can allow the contractors to get feedback as to the success of their installation and further inform best practices moving forward to assure that adequate ionization coverage is achieved. The generators generally can produce plenty of ions for the space, it is just that the combination of ventilation fan and duct runs lengths need to be evaluated to ensure adequate airflow to reach the space. For this reason, we recommend the fans be run continuously when people are in the space until COVID-19 has been eradicated.

Additional fan controllers, programable thermostats, and/or occupancy sensors are recommended to ensure systems are best utilized and economized.

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Verification of ion counts in various locations of the treated spaces is a good idea, although once a particular system type is established as effective, buildings with repetitive system layouts can be installed without additional verification other than verification that the devices are emitting properly at their installed location. Single zone or in-room fan systems are the most ideal applications and generally provide the highest ion counts throughout a space. These are the system types applied in majority of Idaho schools, which is why schools are such a great application for the technology. – *Dan Russell, Norbryhn Equipment Company*

Can the installation of these devices also help with other issues, including the annual flu and future variations of these viruses?

McClure Engineering

Based on the idea that viruses and communicable disease are neutralized by these units, we believe that the answer to this question is yes. An investment in this technology not only helps with the current pandemic, but should also be a benefit in future other communicable disease outbreaks.

Ions have also been shown to be effective in reducing allergens, odors bacteria, mold, and VOCs. The heightened awareness and concern for indoor air quality is not likely to end with COVID 19. This probably will, and should, be a top priority in schools and other indoor environments for the foreseeable future.

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See this [3rd Party Presentation on H1N1](#) which includes discussion on ionization. See the Test Reports and Research tabs in the GPS Library for more information.

<https://globalplasmasolutions.com/gps-library>. – *Dan Russell, Norbryhn Equipment Company*

What are the increased operational costs?

McClure Engineering

The cost to run the ionizing units are minimal as most units require 4-12 watts, less than an LED lightbulb. To address the pandemic, there may be some temporary increased costs associated with added fan runtimes and heating and cooling loads if the building was not using the 25% Fresh Air and 17CFM/occupant added Fresh Air rules. However, if the units are installed to keep the cooling coils clean, you may find that the energy costs

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actually go down over time as the junk in the coils will eventually break down and work its way out of the system. This allows better and more efficient airflow and reduces operating costs.

There are no real maintenance costs for NPBI units and they have long service lives. Once installed, it is easy to forget they are there. We do recommend an annual (or more often) ion count test be performed to assure that the units are still functioning properly and that HVAC system changes are not affecting the distribution of ions.

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Devices operate at 4 to 15 watts each, so very minimal energy cost associated with them directly. For existing HVAC systems that operate fans on a cycling basis those will need to be reset to operate continuously to optimize and maintain continuous ion distribution so some additional fan energy cost will apply to those installations. Other than that there is no increased operational cost. No consumables. No maintenance. Compared to other strategies, such as higher efficiency filters which incur higher fan energy costs from pressure drops or UV bulbs which draw 200W to 1000W for similar sized and effective system. – *Dan Russell, Norbryhn Equipment Company*

Will there be enough units? Or will we find that national demand far exceeds supply?

Can you provide data on both particle reduction as well as biological material reduction and activation?

McClure Engineering

This is a good question for Dan Russell of Norbryhn Equipment Company.

Hobson Fabricating and Norbryhn Equipment Company

Unit supply is good and so far manufacturing has kept up with demand. Demand has increased 12x since this time a year ago. At times during the pandemic we have seen some backordered items, specifically with the measurement tools for larger systems, but for all standard products that fit the school type application, stock is good and manufacturing is forecasting to keep up with continued national and global demand. Lead times have increased slightly, but where lead times in January were at 1-2 weeks, lead times currently are only 2-3 weeks. By contrast, when we quote UV products, lead times are 8-16 weeks depending on the product type. – *Dan Russell, Norbryhn Equipment Company*