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Air Cleaning Technologies - Executive Summary

There are many air cleaning options available to eliminate air borne contaminants. Air filters remove contaminants from the airstream and come in varying efficiencies. Viruses (such as COVID) are very small in size and require higher efficiency filters to remove them. The higher the efficiency rating the more effective the filters are in removing viruses. MERV 13 rated filters are considered the minimum rating to be effective against viruses but cannot always be a viable option for existing systems. Bi-polar Ionizers (BPI) create positive and negative ions that attach themselves to pathogens, neutralizing them. There are two types: needlepoint and corona discharge. Corona discharge seems to produce more ions that last longer but may also produce ozone. Ultra Violet (UV) lights make contaminants inactive by preventing reproduction of microorganisms. They can be sized for a one pass kill (or destruction) rate (99.95%). Dry hydrogen peroxide (DHP) systems spread gaseous hydrogen peroxide (nebulized) to the space where it attaches to microorganisms and cause them to decompose. DHP is the newest of these technologies. Table 1 shows the estimated order of magnitude costs for these different systems. Table 2 shows which air cleaning options can be used with various types of equipment. There are other types of air cleaning technologies but UV and BPI appear to be the most widely used, tested and most cost effective. DHP appears to be one of the few or only active space cleaning technologies available with a long duration in the space.

Table 1: Estimated Air Cleaning Cost

Air Cleaning System	Installation Cost ($/SF*)	Annual Maintenance Cost
Needlepoint Ionizers	0.3-1.0**	Cleaning cost
Corona Discharge Ionizers	0.6 – 2.0**	$80-110 per lamp - 0.0005 lamps per SF
UV Lights	0.5 for coil 0.6-1.2 for duct	$85 per lamp (1 yr. lamp) – 0.0004-0.0012** lamps per SF
Dry Hydrogen Peroxide (ductwork/small space/large space)	1.75/2.25/0.7	0.25/0.25/0.07 ($/SF)

* Assuming 1 CFM/SF **Higher cost is for packaged equipment and lower cost is for centralized equipment

Table 2: Air Cleaning Options for Existing Equipment

	RTU	AHU	Geothermal System	FCU	Split DX
Max Filter Efficiency	MERV 11	MERV 13	MERV 11	MERV 11	MERV 11
Bipolar Ionizers	YES	YES	YES	YES	YES
UV Lights	YES*	YES	NO	NO	YES*
Dry Hydrogen Peroxide	YES	YES	YES	YES	YES

* Cannot be sized for 1 pass kill (specific manufacturers only)

Approach for Existing Equipment:

For a four-pipe system with large Variable Air Volume (VAV), constant volume, or multi-zone AHUs, we recommend installing UV light systems where there is adequate space to accommodate them. Some AHUs and FCUs do not have space for a UV light system; for these units we would recommend installing bi-polar ionization. As long as the space being served is not more than 100 feet downstream of the bi-polar ionizer, a needlepoint ionizer is generally adequate. We recommend a similar installation of bi-polar ionizers in RTUs. For a geothermal system, we would recommend having needlepoint bi-polar ionizers installed on each water source heat pump while providing a tube type or higher quantity of needle point bi-polar ionizer in the 100% outdoor air unit to continuously provide ions into the space. In areas with

high-density occupancy or in public spaces, such as gyms, cafeterias, locker rooms, administration and clinics we would recommend considering the use of space mounted DHP devices. Air filters should be upgraded to the highest MERV rating possible. MERV 11 filters can generally be used in existing systems, when properly selected with the lowest air pressure drop available. Higher MERV ratings can have an adverse impact on system airflow so caution is advised in upgrades beyond MERV 11.

Approach for New Equipment:

In addition to the information listed above for existing systems, we suggest considering equipment that can run continuously as this impacts the effectiveness of the air cleaning technologies employed. This would include four-pipe systems with VAV AHUs and packaged equipment with inverter driven compressors or design features to allow for continuous supply air delivery in occupied spaces (which is an industry recommended practice; suggested by Building Codes). MERV 13 filters should be used for new equipment where possible. Smaller equipment may not have the fan capacity suitable to overcome the air pressure drop of MERV 13 filters.