CWA TECHNOLOGY, HEPA FILTRATION, IONIZATION, PHOTOCATALYSIS

The ClearWave Air purifier was specifically designed to address serious health problems associated with disease-causing airborne pathogens. These pathogens include airborne bacteria, viruses, mold and fungal spores, which are responsible for many common illnesses such as colds, influenza, tuberculosis, whooping cough, etc. Some of the most pervasive airborne irritants in indoor spaces are mold and fungal spores, which can be major triggers of allergies and asthma, as well as an underlying or contributing cause of many serious diseases. ClearWave Air's potent, ultra-violet microbial kill chamber destroys these organisms with each air pass through the unit. Recent tests at Intertek Laboratories have proven the ClearWave Air unit's ability to continually destroy over 7 million Penicillium Citrinum mold spores with each minute of operation. It is noteworthy that these mold spores are over 50 times more difficult to destroy with ultra-violet light than e-coli bacteria, which is representative of most other airborne bacteria and viruses. The inlet air filter in the ClearWave Air unit is intentionally designed with a porosity that allows airborne pathogens and odor-causing compounds to pass through the filter and into the microbial kill chamber where they are annihilated. The purpose of the coconut carbon-based filter is to retain larger dust particles and reduce chemical compounds through the process of adsorption. The CWA unit becomes fully operational the moment it is plugged into a power outlet. The unit is self-diagnostic, monitoring its vital functions continually and requires only an occasional visual check of its filter, which can be replaced in 60 seconds.

HEPA filtration is the most common technology sold for indoor air treatment. HEPA filters attempt to trap and contain airborne contaminants. Typically, the best available HEPA filters can retain particles larger than 0.3microns in size. Many airborne pathogens are smaller than this, and as such can easily pass through a HEPA filter. The influenza virus, for instance, has an approximate diameter of 0.1microns.

Drawbacks of HEPA filters include:

- Many disease-causing pathogens can pass through a HEPA filter unharmed.
- Larger pathogens, including mold and fungal spores can be retained by the HEPA filter where they can breed and proliferate into sizable colonies. By continually feeding more nutrients into the filter material, and especially in the presence of humidity, the HEPA filter can become a perfect breeding ground for mold, fungus and bacteria, creating an unhealthy living environment for the building's inhabitants. This phenomenon is especially well known in air-conditioning units that include air filters.
- HEPA filters are expensive, and in many cases require significant instructions for replacement. As a result, many owners do not replace their filters on a regular basis thereby potentially producing an unhealthier living environment vs. having no filter at all.
- Clean Air Delivery Rate (CADR) is a standard that was essentially developed by and for the HEPA filter industry. The standard measures only particulate reduction capabilities and does not address microbial air purity. The rating is only valid for a given filter as used in a specific equipment design, and when the filter is brand new. The rating is based on a 20-minute test. As such, the CADR rating gives no indication on how this filter will perform after several hours, days, weeks or months of operation.

Advantages of HEPA filters include:

- Because of environmental conditions in many cases, it may be desirable to clean the air of airborne particulates, which is the strength of new HEPA filters. However, most homes in North America have central forced air heating/cooling systems, which already include a filter. These filters are of a standard size, and home improvement stores offer a myriad of replacement filters for these units, including high-quality HEPA filters at a much lower cost than specialized replacement filters for HEPA air cleaner units, making it much more likely that the consumer will replace these filters at regular intervals. Because of their high flow rates and large filter areas, these home forced-air systems are far more efficient in cleaning the indoor air of dust and particulates than even the most expensive HEPA air cleaner units.

I**onization** is another technology, which is often used as a stand-alone or in conjunction with air filtration systems. Ionization attaches a weak electrostatic charge to particulate matter, which can cause several smaller particles to group together. Ionization can also cause particulate matter to attach to surfaces such as walls and flooring. Ionization does not destroy or remove any contaminants from indoor air. The more contaminated the indoor air is to start with, the greater the accumulation of these contaminants on the various surfaces. Long-term ionization could result in surface contamination that is difficult and expensive to remedy.

Photocatalysis is one of the latest technologies finding its way into the air purification field. In simple terms, photocatalysis occurs when a photocatalyst is being irradiated by ultra-violet light. The most common photocatalyst in use is titanium dioxide (TiO2). Essentially, when TiO2 is irradiated by ultra-violet light (UVA, UVB or UVC), hydroxyl radicals are being generated on the surface. It is a proven fact that these hydroxyl radicals are powerful oxidizers that destroy most microbial and chemical compounds almost instantly as they touch. It is this fact that is boldly being highlighted and advertised by many producers of "air purification" devices coming to market today. However, they do not highlight the significant limitations of photocatalysis as used in these devices.

Photocatalysis limitations primarily consist of:

- The fact that hydroxyl radicals have a half-life of 1/billionth of a second during which time they destroy microbial and chemical compounds that they touch. As such, hydroxyl radicals do not travel and their destructive effectiveness occurs only on the surface of the photocatalyst.
- Contaminants to be destroyed need to be brought to and touch the irradiated photocatalytic surface. It is practically impossible to create a photocatalytic passageway where each of billions of air molecules will touch the surface during a fraction of a second of airflow. For instance, a simple photocatalytic chamber would consist of a cylinder that is coated with TiO2 on the inside and houses a UV lamp that irradiates this surface. As the air travels through this cylinder, only a very small fraction of it will actually touch the cylinder wall during its quick journey through the chamber.
- Again, the greatest limitation for photocatalysis in air purification is the fact that the hydroxyl radical has an extremely short life, does not travel and that each molecule of the air to be treated needs to actually touch the radical during its short life.

Photocatalysis by itself is effective at keeping irradiated surfaces clear of contaminant growth. However, it is not at this time a viable technology for treating volumes of contaminated air. Photocatalysis can offer a valuable contribution to the overall efficacy of a properly designed and engineered air purification device. This is especially true if such a device already uses ultra-violet –UVC as its primary technology.

ClearWave Air has numerous patents issued and pending that describe the synergistic integration of UV irradiation and photocatalytic technologies. The current CWA200 unit achieves its design goal of microbial and chemical reduction without the use of photocatalysis as proven through early prototype testing. However, the current CWA200 unit is configured for the easy addition of a photocatalysis without any changes to its mechanical design. The current design is scaleable in size.

Future ClearWave Air products will include:

- Air purifiers to treat various size air space including personal, automotive, large rooms, whole house, offices, healthcare and industrial buildings, etc.
- Air purifiers incorporating chemical and photo catalysts.
- Air purifiers that incorporate practical, valuable, novel technology additions not currently available in the air treatment field.
- Air purifiers that address specific ambient and environmental conditions.

All of the above products are in the early design stages and have patents granted or applied for.