

An RGF Residential / Commercial Product

Guardian Air™

An RGF PHI™ Technology

Professional installation required

The main advantage...

Guardian Air does not need the pollutants to travel to the air handler for UV treatment or filtration. Guardian Air is proactive and sends ionized aggressive advanced oxidizers into the room to destroy the pollutants at the source, in the air and on surfaces, before they can reach your family, clients or employees.

Validation

RGF first developed its Advanced Oxidation Technology over 20 years ago. Over 1 million RGF Cells are in use around the world. RGF has licensed its technology to many Fortune 500 companies for use in the medical, food, military, residential, commercial, marine, hospitality and government, etc. RGF cells in various products have been tested and approved/registered by:

- UL, ETL, TUV, EU, EPA & CSA
- U.S. Military
- Chinese Government
- Japanese Government (TV commercials)
- Canadian Government
- U.S. Government – GSA
- European Union

In addition, RGF cells have been specified in the Norovirus / MRSA protection plan of America's largest restaurant chains, hotel chains, theme parks, cruise lines, public schools and hospitals.

Guardian Air™ sends Advanced Oxidants throughout the room to kill microbials at the source.

Average sneeze microbial reduction: 78%

The Sneeze Test



Simulated Sneeze Lab Test at three feet in a 250 cu ft Bio Test Chamber. An independent double blind study.

Note: The RGF AOT Cell is not a medical device and no medical claims are made.

PHI™ is your answer to Indoor Air Pollution

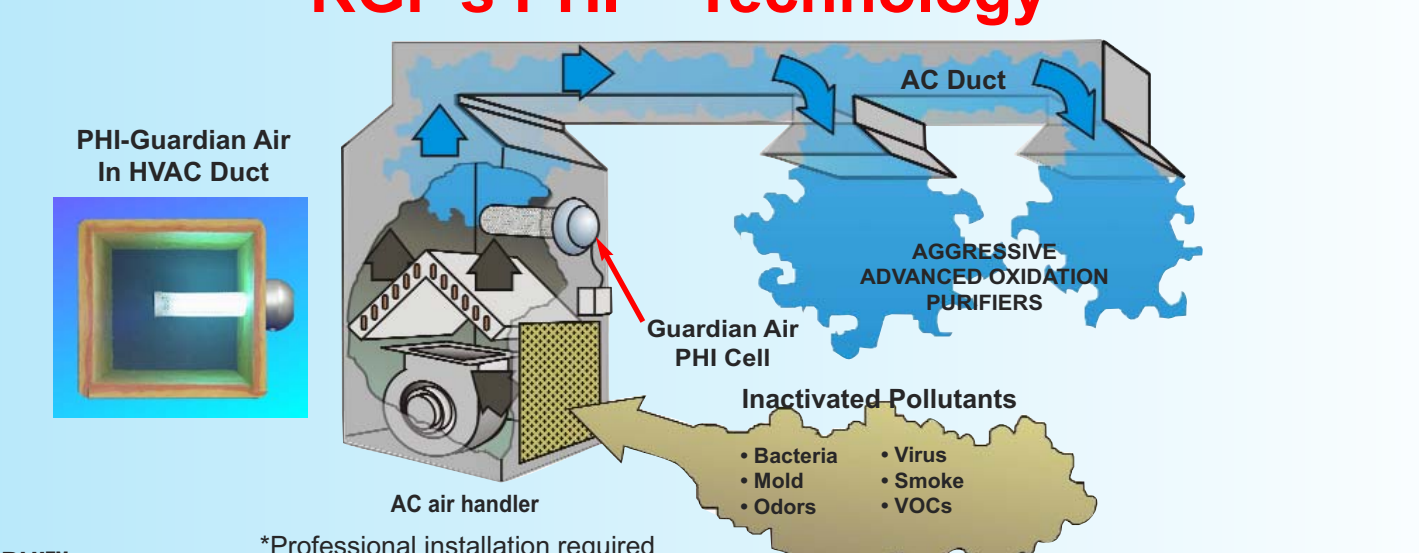
GASES & ODORS
Up to 99%

MICROBIALS
Up to 99.99%



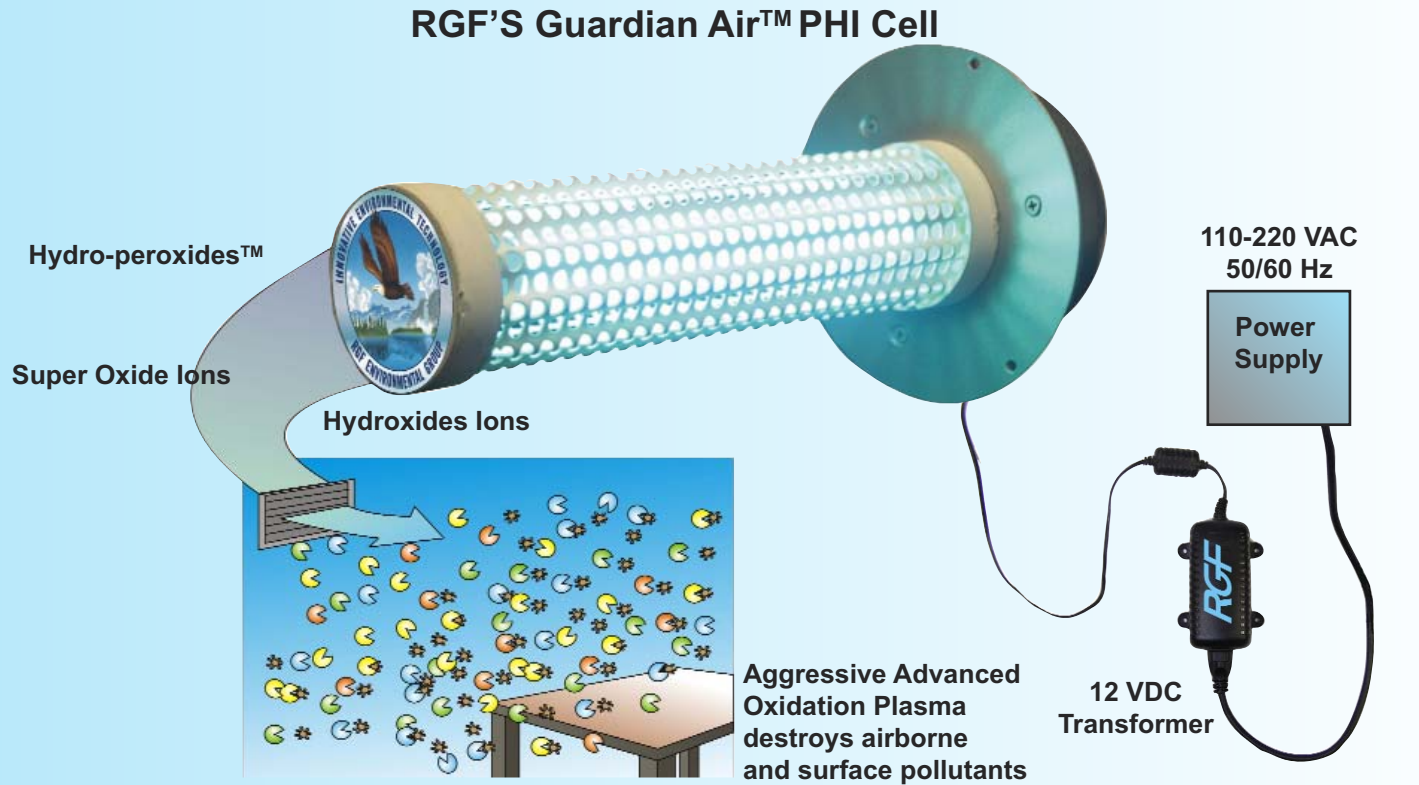
RGF's Aggressive Advanced Oxidizers travel throughout the room aggressively attacking pollutants

RGF's PHI™ Technology



With a Guardian Air HVAC Cell Advanced Oxidation System, micro-organisms can be reduced by over 99%. Gases, VOCs and odors can also be reduced significantly. Advanced Oxidation Plasma will be carried throughout the ducts and rooms for a continuous purification process and a quick kill of newly introduced odors or microbials.

RGF'S Guardian Air™ PHI Cell



SPECIFICATIONS

Advanced Oxidation Plasma .01-.02 ppm:

- Hydro-Peroxides
- Super Oxide Ions
- Hydroxide Ions

Distributed through air handler
Installed in hvac duct, plenum

- Electrical

110-220 VAC 50/60 Hz / 12VDC
Warranty on parts 25,000 hrs (3 Year)
(USA only)

Item #	HVAC Air Blower Size	Watts*
HVAC-PHI-118-GA-VSF	300 to 1,200 CFM	13.3
HVAC-PHI-212-GA	1,000 to 6,500 CFM	13.3
HVAC-PHI-212HO-GA	6,500 to 10,000 CFM	21.6
HVAC-PHI-357-GA	10,000 to 18,000 CFM	19.2
HVAC-PHI-357HO-GA	18,000 to 26,000 CFM	32.4

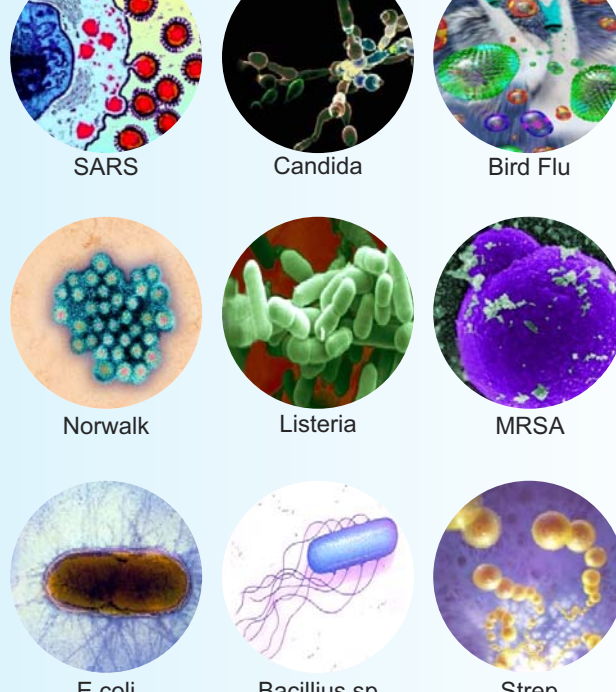
*Energy wise

To calculate CFM from tonnage rating:

As a general rule 400 CFM = 1 ton unit
Example: 5 ton x 400 = 2000 CFMs

Microbial Reductions

Typical virus and bacteria killed



Independently tested on surfaces and airborne

Sneeze Simulation Machine

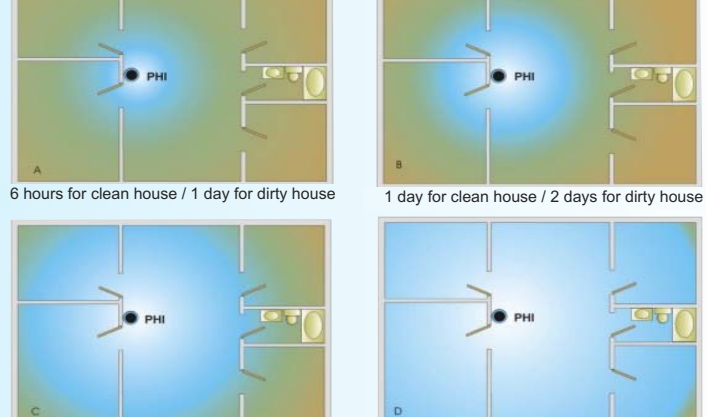


A meeting was held at RGF after 9/11/01 with a team of PhDs from Sandia National Lab who hold homeland security responsibility for microbials (bacteria/viruses) terrorist attacks. The team headed by Dr. James Marsden, a distinguished professor from Kansas State University, needed a method to kill micro-organisms in a heating/air conditioning or ventilation system. The scenario was: What if a terrorist aspirated a deadly strain of bacteria or virus in a public area? No one would know until people had dispersed all over the U.S.A. and spread the disease into a pandemic. RGF scientists interjected that if the kill was made in the heating, cooling or ventilation system (HVAC), it is really too late as anyone in the room when the terrorist aspirated the bacteria/virus would already be exposed and moving around the country. RGF proposed a proactive approach of airborne aggressive friendly oxidizers such as hydro-peroxides. These could intercept the aspirated bacterial/viruses within inches of the aspiration and begin neutralizing the microbes immediately. We used a sneeze as an example, such as: What if I sneeze right now? Everyone around the table would be exposed to my aspirated sneeze germs, and if the HVAC system had a sanitizer, it would be of no help to those around the table. This,



of course, was of great interest to the Sandia team, but they needed proof it worked. So, we needed a double-blind study on RGF's PHI Advanced Oxidation Plasma's ability to destroy sneeze germs. This required a bio-chamber and the ability to accurately duplicate a sneeze, not an easy task. A testing protocol concept was discussed and developed which included a "Sneeze Simulation Machine" and "Sneeze" chamber. A sneeze can travel at up to 100 mph,

so we had to consider lung capacity, sneeze pressure, and liquid volume to properly simulate a human sneeze. RGF designed and built the world's first sneeze machine which included an artificial lung, pressure, speed and volume controls. The test proceeded with outstanding results. An average of 78% reduction of microbials was achieved in a double blind test, at 3 feet from the sneeze source. This is clearly not a medically supervised test or protocol. However, from a practical point, it was definitely providing some kill at the



source and will provide some level of protection. The physics of PHI as an air purifier is unique. A PHI System is not a filter, a UV device or an ozone generator. It is a cell that radiates friendly oxidizers. These oxidizers travel through a room or home by Brownian Motion (natural air movement). One of the four PHI oxidizers is hydro peroxides. In layman's terms, treating a room with hydro peroxides is like misting a room with a weak hydrogen peroxide (H₂O₂) mist similar to the old homeopathic remedy for sick kids when you added a couple of ounces of hydrogen peroxide to a vaporizer to disinfect the room. Today sophisticated vaporized hydrogen peroxide systems are used professionally to disinfect buildings for MRSA, Anthrax and Norovirus. Each time a hydrogen peroxide particle finds an airborne organic contaminant it will oxidize or neutralize the contaminant, and in the process kill it itself. The hydrogen peroxide particle (H₂O₂) will revert to water vapor (H₂O). This will permit the next H₂O₂ particle to move a little further into the room until the entire area is purified. This is the reason one small PHI unit can work on large areas up to a 5,000 sq. ft. house. The factor is time. The more pollutants, the longer it may take to reach a 90%+ reduction level.

OXIDIZERS (In order of strength)

1. Fluorine
2. Hydroxyl Radical*
3. Ozone
4. Hydrogen Peroxide*
5. Permanganate
6. Chlorine
7. Bromine
8. Iodine
9. Oxygen*

* Elements of the RGF Advanced Oxidation Process. Friendly oxidizers do not use chemicals and revert back to oxygen and hydrogen.

PHI vs. Germicidal UV Lamps

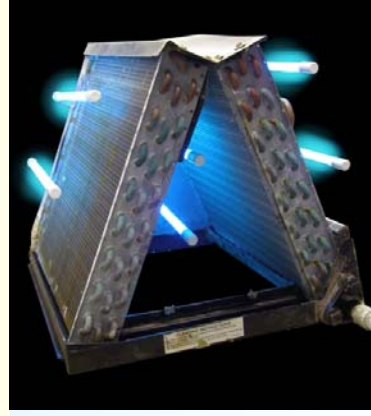
UV-C - Germicidal Lamps

These are rapidly becoming very popular as an easy fix for the air-conditioner sick mold problem. This is one of the most prevalent cause of the mildew smell you get when you enter an air-conditioned sick building. UV-C (254nm) lamps are basically similar to sun lamps and are typically only effective on microbials that pass by within a few inches of the lamp or areas where the light is shining directly on for extended periods of time, such as the air conditioner coil (see article in HVAC News - June 30 2003 and associated press 11-24-03). *Excerpt from article:* (The biggest questioners from contractors are on placement, Pharo said. For instance, should UVGLs be installed in the return or supply?

For air stream coverage, the study "Defining the Effectiveness of UV Lamps Installed in Circulating Air Ductwork," from the Air-Conditioning & Refrigeration Technology Institute (ARTI), recommends placement in the return side, with six lamps for optimum effectiveness, Pharo pointed out.

Due to space and financial constraints, however, "Most homeowners won't have that many lamps installed. So we recommend the concurrent installation of a really good filter, with the UV lamp placed over the indoor coil," Pharo said. "Air conditioning systems are great inventions, but the moist environment (at the coils) creates a microbial breeding ground."

Additionally, when UV lamps are shining directly on the coils, they are hitting a stationary target. When moving targets (VOCs and microbes) pass UV lights, the more sensitive microbes may be damaged, but the hardier ones will pass unharmed. UV lights, for instance, have been found to be better applied to shine on the indoor coil, not to try to clean the air stream, particularly in residential and light commercial applications; air stream use requires intense UV saturation.)



UV light AC coil requires 6 lamps

Pros: Low cost, easy installation, and effective on suppressing mold growth on the coil that has the light shining on it.

Cons: Not effective at killing airborne microbials unless numerous lamps are used (see article). Only effective on the surface of the coil that is in direct light. This leaves much of the coil with no treatment. Does not provide ongoing room protection. Most UV systems install a glass UV mercury bulb without protection from breakage. A broken bulb could release mercury, a potential environmental and health hazard.

Minimum of two lamps must be used to cover at least one-quarter of the coil surface (the upper half of the outer coil). For one-half coverage, three to six lamps must be used. 100% coverage is not practical. For a 90% kill rate of airborne microbials, 30" lamps would have to be placed every 2' in a 95' duct, calculated with a 24" x 24" plenum at 2000 cu ft per minute.

A 95 foot fan is not very practical and as reported in the HVAC News article "UV lamps are for coil surface kill". They are not effective in an HVAC system for virus or bacteria kills. Some UVc light companies state their UV systems can kill 99.9% of MRSA on a single pass and then reference an EPA study. This is very misleading as the test was conducted on a test unit of running a hair dryer in you're A/C 24 hours a day. This obviously generates a lot of heat in addition to burning a lot of electricity, and the units cost thousands of dollars. This system is not something the homeowner would install. We make similar industrial UV systems. However, we specify those for industrial, very expensive heavy duty systems for food processing or medical applications. A standard 12" HVAC UV light system installed in an A/C coil will destroy mold growth on the coil that the UV light shines on. What sections of the coil the light does not hit will grow mold. To cover a coil with UV light would take four to six lights. The lights used on an A/C coil will provide little, if any, airborne microbials. Air passing through an A/C coil is doing so at about 1,200 cfm or 30 inches per second; in layman's terms-very fast."

The PHI™ Solution

The Advanced Oxidation Plasma of PHI™ will destroy mold growth on an AC coil. The plasma, being a gas, will achieve full coverage as it moves in and around the AC coil fins controlling mold and bacteria growth.

