Effective And Affordable Whole House UV Air Purification

"Lighting Your Way To Clean Indoor Air and Energy Savings"

UV Light Fights Germs and Promotes Safer, Healthier Indoor Environment and Energy Savings

As you may know, the sun is a natural atmospheric germ controller. Unfortunately, it is prevented from performing this function indoors.

However, this problem can be solved with specially designed germicidal UV disinfection systems, which generate light similar to sunlight. The shortwave UV light reduces or eliminates germs such as bacteria, viruses, mold, fungi and spores from the indoor air of homes, offices and public buildings. UV has been used for decades in commercial settings and now it is widely popular for residential use.

In addition to the health benefits, properly installed UV will keep the cooling coil and drain pan free of mold growth which results in energy savings and prolonged life of the AC system.

Just as important, the American-Lights® UV disinfection system will accomplish the sun's job indoors both efficiently and inexpensively.

American Air & Water®, Inc. * 12 Gibson Drive * Hilton Head Island, SC 29926
Phone: 843-785-8699 * 888-378-4892 * Fax: 843-785-2064 * www.americanairandwater.com

What's In Your Indoor Air

The quality of the air circulating in your home impacts your family's health

According to the Environmental Protection Agency, 10% of all colds are caught outdoors, 90% are caught indoors! We've all watched helplessly as a cold virus passed from one member of the family to another. Perhaps you suffer from asthma or allergies and despite desperate attempts to dust more, keep the windows closed, clean your bedding, clothing, carpeting and furniture more frequently, your symptoms still persist.

The EPA tells us that the air inside your home can be up to 70 times more polluted than the outdoor environment. One reason for this is that the ductwork in your home is full of airborne germs. These microbes are alive and thriving inside your furnace or air conditioning system.

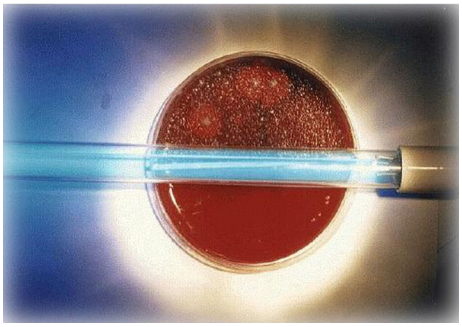
The airborne viruses, bacteria, mold and spores adversely affect the air quality in your home as they are blown past the furnace or air conditioning filter and circulated throughout your home.

> "The EPA tells us that the air inside your home can be up to 70 times more polluted than the outdoor environment."

Some Illnesses Related to Poor Indoor Air Quality:

- *Headaches*
- *Common Cold and Flu*
- *Fatigue*
- *Bronchitis*
- *Eye Irritation*
- *Sinus Irritation*
- *Symptoms of Asthma*
- *Dizziness*
- *Skin Irritation*
- *Respiratory Problems*
- *Nausea*
- *Measles*
- *Chicken Pox*
- *Legionnaires' Disease*
- *Aspergillosis*
- *Tuberculosis*

You wash your hands with soap and water - shouldn't you wash your air too?



Entire Petri dish contaminated with bacteria… one half exposed to germicidal UV light, the other not… whole dish permitted to develop its growth...

Note the colonies of bacteria where ultraviolet light was not present.

This is what your lungs fight against an average of 10 times a minute, 24 hours a day.

Wouldn't you like your lungs to look more like the clean area?

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Are You Concerned About Your Family's Health

How The American-Lights® UV Air Cleaner Works

As you know, the typical residence should have a good filter system to capture dirt, dust and pollen. However, the addition of an American-Lights® UV Air Cleaner is very important because it utilizes germicidal ultraviolet light to reduce or eliminate a broad range of allergens and microbes from the air in your home.

The American-Lights® UV Air Cleaner, which can be installed in your HVAC system by a certified HVAC contractor, is designed to reduce or eliminate any airborne biological contaminants which pass through your ductwork.

Once it's installed, your contractor only needs to replace the germicidal UV lamp once a year. This can be handled conveniently at the same time that you have your annual HVAC servicing.

Already, thousands of American-Lights® UV Air Cleaners have been installed in residences nationwide and multitudes of families are enjoying the benefits of a healthier indoor environment.

In fact, the UV air cleaner is so effective at purifying indoor air and is proving so popular, it is predicted that most every residence will have one installed eventually.

American-Lights® Whole House UV Air Purification

It's easy. It's economical. And it's proven!

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The Science Behind UV

Ultraviolet rays have shorter wavelengths than visible light. A wavelength, the distance between the crests of two waves, is measured in units called nanometers. A nanometer (nm) is a billionth of a meter, or about 1/25,000,000 inch. Wavelengths of visible light range from about 400 to 700 nm. Ultraviolet wavelengths range from about 1 to 400 nm and are beyond the range of visible light.

Ultraviolet rays with wavelengths shorter than 300 nm are extremely effective in killing bacteria and viruses. The most effective sterilizing range for UV is within the C bandwidth (UVC). This range is called the germicidal bandwidth. UVC has been used in hospitals for decades to sterilize surgical instruments, water, and the air in operating rooms. Many food and drug companies use germicidal lamps to disinfect various types of products and their containers.

The germicidal effect of UV is achieved through a photochemical process. The contaminants that pollute our homes are almost entirely based upon organic compounds. These compounds breakdown when exposed to high intensity UV at 240 to 290 nm. Shortwave UV can destroy DNA in living microorganisms and breakdown organic material found in indoor air. UVC's effectiveness is directly related to intensity and exposure time.

UV rays must strike the contaminants directly in order to penetrate their membrane and break down the molecular bonds. This bond breakage translates into cellular or genetic damage with the germs rendered harmless because they can no longer reproduce.

	Cosmic Rays	0 nm
	Gamma Rays	25 nm
	X-Rays	50 nm
UV Light	**Short Wave UVC Germicidal UV**	253.7 nm
	Medium Wave UVB Band	280 nm
	Long Wave UVA Band	320 nm
	Visible Light	400 nm
	Infrared Light	700 nm
	Radio Waves	1200 nm

Ultraviolet technology has safely been used to sanitize the air in hospitals, clinics, medical and dental offices, and food plants for more than 60 years.

Why Not Ozone?

There are several reasons for not using ozone in a central airflow system:

It has been determined that ozone is very corrosive and can be damaging to HVAC systems.

Ozone is very corrosive to the lung tissue as we breathe it.

The EPA and American Lung Association are strongly against the use of ozone indoors.

American-Lights® UV Air Cleaner Provides Cleaner and Healthier Air

Ultraviolet light has been used for over 60 years for air and surface sterilization in hospitals, laboratories, doctors' offices and food processing plants. When the problem of home indoor air quality became more apparent, ultraviolet technology became the answer to effectively controlling airborne microorganisms inside our homes. Many health and environmental authorities recommend air purification with ultraviolet light to reduce or eliminate indoor airborne contaminants.

The UV air cleaners can reduce or virtually eliminate many of the air pollutants that regular filtering systems do not catch. UV also prevents them from reproducing into your home's air duct system.

UV will sterilize mold, fungi, bacteria, viruses, spores, dust mites and help reduce other airborne sources of contamination.

Unless specifically requested, UV cleaners will NOT produce any ozone. This is important because ozone has been determined to be harmful to the lungs and many different types of materials in your home. American-Lights® is the strongest and most affordable ultraviolet air cleaner for residential applications.

Low Maintenance

American-Lights® is easily installed by a qualified and authorized contractor and continuously emits high-intensity ultraviolet (UV) light. American-Lights® only consumes about 7- 10 ¢ a day in energy costs. For best results, simply keep the lamp free of dust and replace the UV lamp (bulb) once a year to keep the system running at peak performance.

Proven Technology

The American-Lights® UV Air Cleaner has been independently tested and determined to produce the highest possible UV output in the cold, moving-air environments of the HVAC systems.

The American-Lights® ultraviolet unit continuously fights mold and airborne germs and provides high kill ratios over a broad range of microbes.

"The air you breathe in your home can be improved.
We guarantee you will feel the difference!"

Eight reasons why you should make the American-Lights® UV Air Cleaner your first choice:

1. Protects the health and welfare of your family, students, friends, employees, patients, customers and pets.

2. Reduces or eliminates airborne germs such as bacteria, mold, viruses, mold spores and fungi

3. Produces no ozone, fumes or other secondary contaminants.

4. Operates continuously at maximum efficiency, without need for constant adjustment.

5. Designed to withstand hazardous HVAC conditions while providing higher kill ratios over a broader range of microbes.

6. Prolongs life of HVAC system and maintains system efficiency

7. Promotes energy savings by keeping the cooling coil in "like-new" condition

8. 100% satisfaction guaranteed

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American-Lights® UV Air Cleaner Features & Benefits

- American-Lights® is the #1 selling UV Air Cleaner on the market.
- Its technology has been proven by medical studies.
- It reduces or eliminates airborne mold, bacteria, viruses, fungi and spores from the indoor air.
- It produces no ozone, fumes or other secondary contaminants.
- It operates continuously at maximum efficiency without the need for constant adjustment.
- It is specifically designed for HVAC conditions while providing high “kill ratios” over a broad range of germs.
- It features no plastic parts, which might be susceptible to deterioration.
- It is inexpensive to operate and features a low level of maintenance.
- It is approved for residential, commercial and industrial applications.
- It is designed to prolong the life of the HVAC system and maintain its efficiency.
- It provides energy savings.
- It is completely silent.
- It includes a 100% Customer Satisfaction Guarantee, with a 30-day manufacturer’s refund.
- 5 years warranty on the chassis if installed and serviced by a qualified contractor.
- 1 year warranty on the high output germicidal UV lamp.

Warranty

The following warranty applies only when this product is installed by a professional technician employed by an authorized licensed contractor / dealer in compliance with all local building and construction codes.

AAW warrants this product against defects in material or workmanship as follows:

WARRANTY: 5 years on the chassis and 1 year on the UV lamp from date of installation by authorized contractor, documented by sales receipt or contractor warranty card. If this unit is determined to be defective, it will be exchanged for a new or rebuilt unit at no charge.

- This warranty does not cover customer instructions, installation or set up adjustments.

- This warranty does not cover cosmetic damage or damage due to acts of God, accident, misuse, abuse, negligence or modification of, or to any part of the unit. This warranty does not cover damage due to improper operation or maintenance or connection to improper voltage supply. This warranty applies only to the original purchaser.

- This warranty is valid only in the United States.

- All service and removal must be performed by an authorized contractor for valid warranty coverage.

American-Lights® Specifications and Installation

The American-Lights® UV air cleaner is manufactured in the USA. All units are factory assembled and tested. They consist of electronic ballast, germicidal UV lamp and chassis, all constructed to withstand HVAC environments.

The American-Lights® is UL Listed* for multi-volt operation at 120/240/277V, 50/60Hz. File # E42012

CLASSIFIED C UL US 3HXD

AIR DUCT MOUNTED ACCESSORY
WITH RESPECT TO ELECTRIC SHOCK,
FIRE AND CASUALTY HAZARDS ONLY.

BALLAST: The automatic electronic ballast is designed to deliver maximum UV production and reliability while suppressing noise. The ballast will automatically switch to 120/240/277VAC at 50/60Hz and will operate the American-Lights® HO germicidal UV lamps in temperatures of 35-135º F and airflows to 1,000FPM. Use of other lamps will void warranty.

CHASSIS: The chassis is constructed of durable, commercial grade 304 STAINLESS STEEL for many years of worry-free service. It is one integral assembly that maximizes serviceability. The lamp is held in place and supported in the air stream by heavy-duty steel clip which allows quick and easy service.

UV LAMP: The high output germicidal UV lamp has a 4-pin ceramic base with Teflon wiring. The quartz tube eliminates ozone production. Heat output is low, allowing the UV lamp to be installed safely in several different locations within the HVAC system.

UV Lamp Specs:	**Model: AAWHO/14**
Length:	14.5”
Base / End cap:	4-pin base, ceramic
Effective lamp life:	12,000 hours
Etch:	AAWHO/14 GML600 www.americanairandwater.com
Lamp Diameter:	15mm
Base Diameter:	18.5mm
Operating Voltage:	54VAC @ 60Hz
Starting Voltage:	120VAC @ 60Hz
Lamp Wattage:	36W
UV Output /254nm@100hrs/	12W
UV Intensity:	106µW/cm²/sec @ 1m; 800µW/cm²/sec @ 1’

Installation Tips (detailed instructions are included with each air cleaner): Please observe all warnings. Disconnect power before lamp removal or lamp replacement. Proper installation should have lamp(s) at right angles to airflow, centered in duct or plenum.

UV light may be installed on either supply or return side of the coil and is equally effective.

Note: if UV is close to register or grill, lamp glow may cause objectionable night light effect.

Having established the location, drill a 1″ hole for the lamp. Snug unit to desired location. Using cotton gloves slide the UV lamp through the hole in the unit and duct until the retaining ring will not allow further insertion. Slide retaining clip over retaining ring and tighten the retaining clip’s fasteners so it will not move. Carefully attach the plug to the 4-pin end of the lamp. Snap cover in place and power unit.

Drill a 7/16” hole in the duct 6 inches away from the mounting position of the UV lamp. Insert the indicator in the hole. When the lamp is lit, the plug will glow as an indicator that the unit is working correctly.

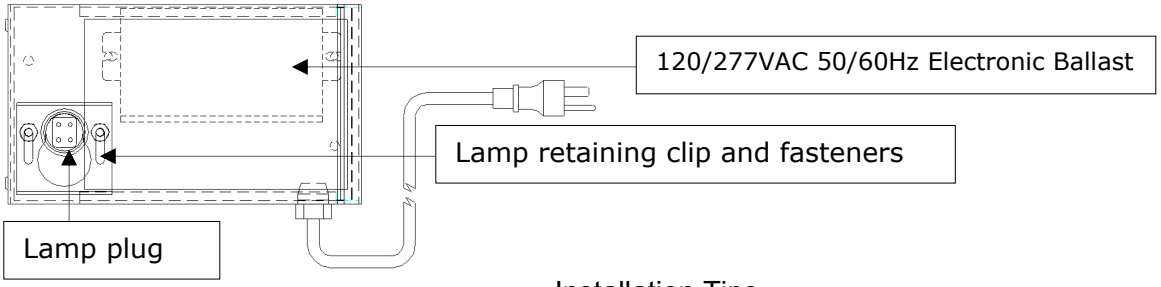
Lamp replacement: Requires original American-Lights® UV lamps Model # AAWHO/14.

CAUTION: The UV Light should be mounted a minimum of 36” from plastic air filters and heat source if on supply side.

WARNING: Prolonged exposure to UV light will burn the retina of the eyes and the skin.

* The health aspects associated with the use of this product and its ability to aid in disinfection of environmental air has not been investigated by UL.

Chassis Material: Commercial Grade 304 Stainless Steel



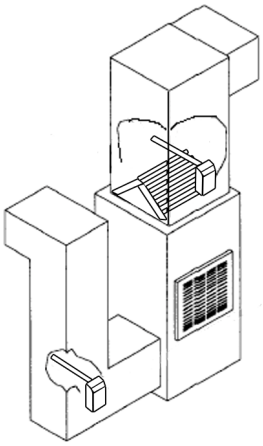
Installation Tips

FOLLOW ALL LOCAL CODES AND REGULATIONS WHEN WIRING THIS UNIT!

Because the American-Lights® UV Air Cleaner is designed for multiple and diverse applications keeping in mind the need for profitability and time constraints, it requires a minimum of rules for a productive installation.

- Avoid direct exposure (within 36") of non-UV inhibited plastics. (Including drip pans, plastic air filters and filter frames) Avoid plastic coated wires, even if the coating is UV inhibited.
- Avoid ANY location that would permit the homeowner access to the lamp. (Example: closet door with louvers and the unit exposed when door is open or light is seen through the louvers.) The night light issue should be considered if the UV air cleaner is not being placed in the optimum location.
- Best location: across top of coil @ right angles to "A"; also return plenum if not within visible range of filters, grills etc. (Do not install this where a homeowner can remove the filter and see or touch the lamp).
- This High Output germicidal UV lamp will provide strong germicidal protection for 1 year. The reason - it does not cycle on/off thereby maximizing its life and efficiency. To keep the system in top performance range, it is strongly recommended to replace the UV lamp every year.
- Review of the specification sheet and installation instructions will provide answers to most situations and questions.

American-Lights® UV Air Cleaners Installation Tips



Pathogenic, allergenic or toxic airborne microbes re-circulate through the HVAC systems. The American-Lights® UV Air Cleaners irradiate the indoor air with germicidal UV and reduce or eliminate the most persistent germs.

The American-Lights® UV Air Cleaner is designed for both cooling coil irradiation and air-stream irradiation. The system is easy to install. All that's needed is an assessment of square footage and the proper placement of the UV lamp to ensure UV germicidal air purification. Note: Do not install within 36" of plastic air filters, filter frames, etc.

The best location is over the A coil perpendicular to the A – as shown on the drawing. If the UV lamp shines directly on the cooling coil it will keep it clean of microbial growth including mold and bacteria. Keeping the coil clean will ensure preserving the efficiency of the HVAC system and will eventually realize energy savings over a period of time. It may also reduce the need of frequent coil cleaning which means maintenance savings.

Preserving the heat exchange ratio of the cooling coil and eliminating the pressure drop means more efficient operation of the AC system and optimal load on the blower motor which will prolong the life of the system.

The American-Lights® operation is very economical - all that's required for a year's air disinfection and energy savings is one replacement of the UV lamp. The electricity needed to operate the UV lamp is estimated to cost only 7 – 10 cents over 24 hours.

Underwriters Laboratories - UL Certification # E42012

UL is the trusted source across the globe for product compliance. Benefiting a range of customers - from manufacturers and retailers to consumers and regulating bodies - UL have tested products for public safety for more than a century.

Underwriters Laboratories Inc. (UL) is an independent, not-for-profit product safety certification organization that tests products and writes Standards for Safety. UL evaluates more than 19,000 types of products, components, materials and systems annually with 21 billion UL Marks appearing on 71,000 manufacturers' products each year. UL's worldwide family of companies and network of service providers includes 66 laboratory, testing and certification facilities serving customers in 104 countries

American-Lights® - Multi-Volt UL Certified

American-Lights® is UL certified for 120/240/277V, 50/60Hz, file #E42012 and carries this mark:

CLASSIFIED C UL US 3HXD

AIR DUCT MOUNTED ACCESSORY
WITH RESPECT TO ELECTRIC SHOCK,
FIRE AND CASUALTY HAZARDS ONLY.

This C-US Listing Mark indicates compliance with both Canadian and U.S. requirements. UL encourages those manufacturers with products certified for both countries to use this combined Mark.

The UL Mark on our product means that UL has tested and evaluated representative samples of that product and determined that they meet UL's requirements. Under a variety of programs, products are periodically checked by UL at the manufacturing facility to make sure they continue to meet UL requirements.*

The UL Marks may be only used on or in connection with products certified by UL and under the terms of written agreement with UL.

The fastest way to access the UL Certifications is going to www.ul.com and searching the UL Online Certifications Directory to:

- Verify a UL Certification
- Verify a UL Certified product use
- Verify a product safety standard

Or call a Customer Services Representative at 1-877-ULHELPS (854-3577).
File #E42012

* The health aspects associated with the use of this product and its ability to aid in disinfection of environmental air has not been investigated by UL.

Lamp Replacement Instructions

For Best Results the UV Lamp Should be Replaced Annually!

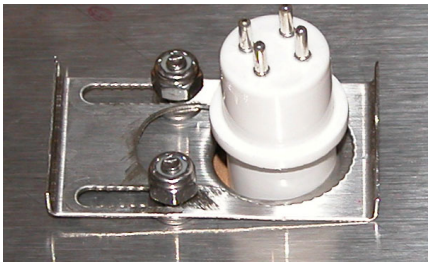
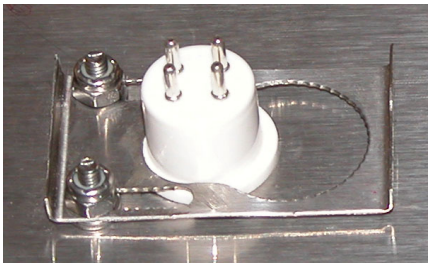
WARNING: Overexposure to germicidal UV can cause severe and permanent damage by burning the retina of the eyes. It could also burn the skin. Do not look directly at the UV light or use special protective goggles.

WARNING: Before replacing the lamp, make sure the power is turned OFF.

IMPORTANT: Do NOT touch the glass portion of the lamp with bare hands. Use cotton gloves to avoid leaving fingerprints that will diminish the UV output. If you touch the lamp, clean it with cotton cloth.

NOTE: American Air& Water, Inc. recommends that only authorized and qualified technicians perform the lamp replacement by following these guidelines:

1. Remove the protective outer cover of the chassis.
2. Pull the electrical connector from the lamp until disconnected.
3. Loosen the 2 fasteners that hold the lamp clip and slide the lamp clip in *OPEN* position.
4. Pull out the lamp by holding the ceramic base.
5. Using gloves slide the UV lamp through the hole in the unit and duct until the retaining ring will not allow further insertion. Slide retaining clip over lamp ring and tighten the clip's fasteners so it will not move.

	
Lamp Holder – Open	Lamp Holder – Closed

6. Reconnect electrical connection by attaching the plug to the 4-pin end of the lamp.
7. Replace protective outer cover and turn power source back on.
8. For Warranty Registration go to: www.americanairandwater.com/warranty/

The American-Lights® High Output UV lamp

UV Lamp US Patent No: 4,700,101

American-Lights® is registered in the U.S. Patent and Trademark Office.
US Trademark Registration No: 2,839,201

Q. Does UV really work for air disinfection?
A. Absolutely. The ability of UV to breakdown the DNA of germs like mold, spores, viruses and bacteria has been proven under numerous studies. Delivering the appropriate UV dose depends on the application.

Example 1: In critical environments, i.e. hospitals, clean rooms, food processing plants, the objective would be to have instantaneous kill. Therefore, UV lamps would blanket the air passage system and the airflow directed over and between lamps, which provide for maximum kill of germs.

Example 2: In residential applications, the objective is to create a cost effective and continuous method for air disinfection and energy savings. Properly installed UV systems will keep the cooling coil free of microbial growth which results in energy savings. Also, a cumulative UV dose will be introduced to the air flow in each consecutive passing by the UV lamp promoting healthier indoor environment.

Q. How does UV provide energy savings?
A. It is a well known fact that mold and other microbes grow on the cooling coil clogging it and reducing the heat exchange ratio. UV shining on the coil will promote energy savings by:

a) Keeping the coil in "like new" condition therefore preserving or improving the heat exchange rate.

b) Removing mold growth from the coil prevents clogging therefore improves the pressure drop across the coil and reduces the load on the blower.

Q. How does UV prolong life of the AC system?
A. By keeping the air handler free of microbial growth UV preserves the coil and reduces the total load on the AC unit, which translates into fewer and shorter on/off cycles and, respectively, in longer effective life of the AC system.

Q. Has UV technology been tested?
A. Yes. Westinghouse, General Electric, Penn State University, Harvard School of Public Health and the EPA, among others, have conducted tests on the UV germicidal effectiveness. UV light has also been field tested in commercial settings, hospitals and laboratories for many years.

Q. What does GSA say about UV?
A. UV has been incorporated in the Facilities Standards for the Public Buildings by the US GSA Office of the Chief Architect as follows: *"Ultraviolet light (C band) emitters/lamps shall be incorporated downstream of all cooling coils and above all drain pans to control airborne and surface microbial growth and transfer. Applied fixtures/lamps must be specifically manufactured for this purpose."*

Q. What is the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) position on UV?
A. *"Airborne infectious disease transmission can be reduced using dilution ventilation, … filtration, and UVGI (ultraviolet germicidal irradiation)."* ASHRAE recommends further research to be conducted with top priority given to filtration and UVGI research.

Q. Have indoor airborne contaminates increased?
A. Yes! Self defrost refrigerators, air conditioning and energy tight homes, are a few examples of environments that now provide breeding grounds for growth of mold and bacteria that can get airborne.

Q. What types of germs are affected by UV?
A. Germicidal UV is very effective against virtually all microbes including cold-causing viruses, infectious bacteria, allergens and asthma triggers like various molds and toxic mold spores.

Q. Is UV light harmful to people?
A. Prolonged exposure to UV light is harmful to all living organisms, including people. That's why the UV systems are designed with safety in mind. With properly installed UV units the risk of exposure to UV is minimized by warning labels, interlock switches and proper training. This provides for safe operation and maintenance.

Q. If UV is harmful, is it safe to look at the light through the sight-glass?
A. UV cannot pass through regular glass. There is no harm to look at the sight-glass to see if the lamp is on. The sight-glass is an indicator - there is no need to look through it. Just observe from a distance.

Q. How does the American-Lights® UV Air Cleaner Work?
A. The American-Lights® is installed on either the cold air return or supply side of your HVAC system. The lamp emits germicidal UV light that greatly reduces or eliminates germs circulated by the HVAC system. If installed on the coil, the UV lamp will keep it clean of microbial growth which will result in energy savings.

Q. What is the life of the UV lamp?
A. The American-Lights® UV lamp has an effective life span of one year. It is strongly recommended that the UV lamps are replaced annually to keep the UV system in top performance range. The lamp will continue to shine after one year but UV, which is invisible to human eye, deteriorates rapidly.

Q. How do I know when it is time to replace the lamp?
A. The indicator glows if the lamp is working. The UV lamp should be replaced every year.

Q. Does the American-Lights® UV air cleaner operate continuously?
A. Yes. The American-Lights® UV air cleaner must stay on 24 hours a day.

Q. Is the American-Lights® expensive to operate?
A. Not at all. The American-Lights® lamp only consumes about 7 - 10 cents a day in energy costs. For best results, simply keep the lamp free of dust and replace the lamp once a year.

Q. Is UVC similar to ozone?
A. No! Ozone is a gas; UVC is electromagnetic energy similar to light. Ozone can mix with the air and travel by air currents into the breathable air space. Ozone is very corrosive - it oxidizes the material it contacts. UVC is wave energy and does not mix with the air. To be effective, that energy has to be in direct line of sight. The UVC energy diminishes with distance from the UV source.

Q. Why not use an ozone generating air cleaner?
A. The EPA and American Lung Association are strongly against the use of ozone indoors. It has been determined that ozone is corrosive to lung tissues. In addition, ozone can damage your HVAC system.

Q. Don't filters eliminate germs?
A. Filters do trap microbes; but even the most sophisticated ones do not contain 100% of the germs. Germs reproduce rapidly and re-contaminate the indoor air. The air filters can easily become breeding grounds for new colonies of microorganisms.

Q. Do microorganisms have to be within sight of the UVC to be killed?
A. Yes. Germs must be exposed to UVC. Germs can be affected by reflected UVC also but it takes longer and they must be closer to the reflected light. Some materials, primarily polished aluminum, effectively reflect UVC. The common mirror will not.

Q. What is the American-Lights® warranty?
A. 5 years from the date of installation by an authorized dealer, documented by sales receipt or warranty card. For Warranty Registration go to: www.americanairandwater.com/warranty/

Q. Is the American-Lights® certified?
A. Yes. The American-Lights® is UL listed* for multi-volt operation at 120/240/277V, 50/60Hz. The UL file number under which the system is listed is: E42012.

Q. How can I get American-Lights® Air Cleaner installed?
A. If you cannot find a contractor that carries American-Lights®, call American Air & Water®, Inc. at 888-378-4892 or visit our website www.americanairandwater.com for the name of a contractor near you.

Q. During initial operation, the lamp burns green instead of blue. Is this normal?
A. No. After five (5) minutes, the lamp may be deemed defective.

Q. Where in your home should you place UVC?
A. Standing indoor air has such volume and is so dispersed throughout the rooms it is next to impossible to effectively purify it. But there is one place where 100% of the air can be conditioned every 12 to 15 minutes. That area is in the operating central HVAC system. Cleaning and purifying the indoor air should be done within the HVAC system. It is within this system that the UVC lamp should be placed to take advantage of the one point through which all the air passes several times a day and where it can be disinfected.

* The health aspects associated with the use of this product and its ability to aid in disinfection of environmental air has not been investigated by UL.

UV Germicidal Irradiation Dosage Table

Many variables (air flow, humidity, exposure time) take place in a real world environment that make actual calculating very difficult. It is proven that UV light will kill any microorganism given enough dosage. UV works on a cumulative basis. Therefore, as air circulates through the ductwork of an HVAC system the UV light continuously cleanses the air. If a microorganism is not eradicated on the first pass, the UV light will continue to break its DNA down on subsequent passes. Microorganisms do not sit in a static environment in HVAC systems except on coils which can be exposed to UV lights.

Tests conducted by Light Sources, Inc and verified by American Ultraviolet Company revealed the American-Lights 36W high output UV lamp produces 800µW/cm² per sec @ 1' with 534FPM air flow @ 55 degrees Fahrenheit. To compute time needed to sterilize microorganisms in the following chart at 1 foot distance from the light, simply divide the dosage required by 800. **Example:** for 90% kill factor of Bacillus subtilis spores: 11,600 divided by 800 = 14.5 seconds.

The following are incident energies of germicidal ultraviolet radiation at 253.7 nanometers necessary to inhibit colony formation in microorganisms (90%) and for complete destruction:

Organisms:	UV dose in µWs/cm^2 needed for kill factor:		**Organisms:**	UV dose in µWs/cm^2 needed for kill factor:	
	90%	**99%**		**90%**	**99%**
Bacteria			Streptococcus viridans	2,000	3,800
Bacillus anthracis - Anthrax	4,520	8,700	Vibrio comma - Cholera	3,375	6,500
Bacillus anthracis Anthrax spores	24,320	46,200			
Bacillus magaterium sp. (spores)	2,730	5,200	**Molds**	**90%**	**99%**
Bacillus magaterium sp. (veg.)	1,300	2,500	Aspergillius flavus	60,000	99,000
Bacillus paratyphusus	3,200	6,100	Aspergillius glaucus	44,000	88,000
Bacillus subtilis spores	11,600	22,000	Aspergillius niger	132,000	330,000
Bacillus subtilis	5,800	11,000	Mucor racemosus A	17,000	35,200
Clostridium tetani	13,000	22,000	Mucor racemosus B	17,000	35,200
Corynebacterium diphtheriae	3,370	6,510	Oospora lactis	5,000	11,000
Ebertelia typhosa	2,140	4,100	Penicillium expansum	13,000	22,000
Escherichia coli	3,000	6,600	Penicillium roqueforti	13,000	26,400
Leptospiracanicola - infectious Jaundice	3,150	6,000	Penicillium digitatum	44,000	88,000
Micrococcus candidus	6,050	12,300	Rhisopus nigricans	111,000	220,000
Micrococcus sphaeroides	7,000	15,400			
Mycobacterium tuberculosis	6,200	10,000	**Protozoa**	**90%**	**99%**
Neisseria catarrhalis	4,400	8,500	Chlorella Vulgaris	13,000	22,000
Phytomonas tumefaciens	4,400	8,000	Nematode Eggs	4,000	92,000
Proteus vulgaris	3,000	6,600	Paramecium	11,000	20,000
Pseudomonas aeruginosa	5,500	10,500			
Pseudomonas fluorescens	3,500	6,600	**Virus**	**90%**	**99%**
Salmonella enteritidis	4,000	7,600	Bacteriopfage - E. Coli	2,600	6,600
Salmonela paratyphi - Enteric fever	3,200	6,100	Infectious Hepatitis	5,800	8,000
Salmonella typhosa - Typhoid fever	2,150	4,100	Influenza	3,400	6,600
Salmonella typhimurium	8,000	15,200	Poliovirus-Poliomyelitis	3,150	6,600
Sarcina lutea	19,700	26,400	Tobacco mosaic	240,000	440,000
Serratia marcescens	2,420	6,160			
Shigella dyseteriae – Dysentery	2,200	4,200	**Yeast**	**90%**	**99%**
Shigella flexneri – Dysentery	1,700	3,400	Brewers yeast	3,300	6,600
Shigella paradysenteriae	1,680	3,400	Common yeast cake	6,000	13,200
Spirillum rubrum	4,400	6,160	Saccharomyces carevisiae	6,000	13,200
Staphylococcus albus	1,840	5,720	Saccharomyces ellipsoideus	6,000	13,200
Staphylococcus aerius	2,600	6,600	Saccharomyces spores	8,000	17,600
Staphylococcus hemolyticus	2,160	5,500			
Staphylococcus lactis	6,150	8,800			

References

The following is a list of readily available reference materials discussing ultraviolet light. It is not intended to be a complete list of references.

Available on the Web:

Aerobiological Engineering
The Pennsylvania State University, Graduate School of Architectural Engineering & Department of Biology
See Ultraviolet Irradiation at www.engr.psu.edu/ae/iec/abe/control/ultraviolet.asp

American Air & Water, Inc.
For detailed information on germicidal UV and various UV applications for air, surface and water disinfection, including the use of UV technology in specialized settings like liquid storage tanks and hospitals, as well as residential systems visit: www.americanairandwater.com

Wikipedia
Ultraviolet germicidal irradiation (UVGI) is a sterilization method that uses ultraviolet (UV) light at sufficiently short wavelength to break down microorganisms. It is used in a variety of applications, such as food, air and water purification. UV has been a known mutagen at the cellular level for more than one-hundred years. The 1903 Nobel Prize for Medicine was awarded to Niels Finsen for his use of UV against tuberculosis
UVGI is a highly effective method of destroying microorganisms.
Additional information at: http://en.wikipedia.org/wiki/Ultraviolet_germicidal_irradiation

Available in the Public Library:

Britannica
Volume 12, page 118

Ultraviolet radiation…because of its bactericidal capabilities at wavelengths of 260 – 280 nm, UV is useful as both a research tool and a sterilizing technique.

Encyclopedia Americana
Deluxe Library Edition 1993, Volume 27, page 353d

A very important attribute of UV rays…is their ability to kill bacteria. For this reason UV lamps are used in hospital operating theaters, children's nurseries, and in several manufacturing processes where sterile air is necessary.

McGraw Hill Encyclopedia of Science & Technology
Volume 19, pages 20, 21, 22

Discussion of Ultraviolet radiation, with charts showing UV's ability to sterilize.

The World Book Encyclopedia
1997 Edition, Volume 20, page 17

Uses of ultraviolet rays - Ultraviolet rays with wavelengths shorter than 300 nm are effective in killing bacteria and viruses. Hospitals use germicidal lamps that produce these short rays to sterilize surgical instruments, water, and the air in operating rooms. Many food and drug companies use germicidal lamps to disinfect various types of products and their containers.

Aerobiological Engineering at Pennsylvania State University
Ultraviolet Germicidal Irradiation

The use of ultraviolet germicidal irradiation (UVGI) for the sterilization of microorganisms has been studied since the 1930s. Microbes are uniquely vulnerable to the effects of light at wavelengths at or near 2537 Angstroms due to the resonance of this wavelength with molecular structures. Looking at it another way, a quanta of energy of ultraviolet light possesses just the right amount of energy to break organic molecular bonds. This bond breakage translates into cellular or genetic damage for microorganisms. The same damage occurs to humans, but is limited to the skin and eyes.

The ultraviolet component of sunlight is the main reason microbes die in the outdoor air. The die-off rate in the outdoors varies from one pathogen to another, but can be anywhere from a few seconds to a few minutes for a 90-99% kill of viruses or contagious bacteria. Spores, and some environmental bacteria, tend to be resistant and can survive much longer exposures. UVGI systems typically use much more concentrated levels of ultraviolet energy than are found in sunlight.
Some properly designed, and well-maintained, UVGI installations have proven highly effective, as in certain hospitals, and some studies performed in schools. CDC guidelines recommend the use of UVGI only with the simultaneous use of HEPA filters and high rates of purge airflow. The germicidal effects can also be species-dependent.
Laboratory tests have achieved extremely high rates of mortality under idealized conditions. In actual applications, many factors can alter the effectiveness of UVGI, including the following :

- Exposure time (the air velocity must allow for a sufficient dose).
- Room air mixing (for non-powered applications like ceiling units).
- Power levels.
- The presence of moisture or particulates provide protection for microbes.
- Dust settling on light lamps can reduce exposures, maintenance is necessary.

One especially effective application of UVGI is the control of microbial growth in air handling unit cooling coil and filter assemblies. The constant exposure has been found to be very effective at controlling fungal growth, either because the spores are inactivated, or perhaps because mycelial growth cannot be sustained under continuous exposure.
Certain types of UVGI designs seem to provide a much higher rate of disinfection than standard models operating at nearly identical spectrums, the difference being the result of improvements in the electrical power controls and regulation of internal plasma temperature, resulting in the generation of a more constant energy density at a distance from the light source.
Viruses are especially susceptible to UVGI, more so than bacteria, but are also very difficult to filter. Some studies have shown that viruses are more sensitive to ultraviolet radiation at wavelengths somewhat above the normal UVGI broad-band wavelength of 2537 A (Rauth 1965; Setlow 1961). A combination of filtration for bacteria and spores, with UVGI for viruses may be an optimum combination if all components are sized appropriately.

UVGI THEORY & RATE CONSTANTS FOR AIRBORNE PATHOGENS

UVGI inactivates pathogens according to the standard decay equation: **$S = \exp(-kIt)$**
In this equation S represents the fraction of the original population that survives exposure at time t, and I represents the UVGI intensity. The rate constant k has been determined experimentally for a number of bacteria, viruses and spores, at different power levels. Summarized below are many of the known rate constants for the indicated pathogens. Since many researchers have obtained values that differ, they have all been included. The source documents may be found in the references.

UVGI Rate Constants for Respiratory Pathogens

Microorganism	Type	Reference	Test Medium	k = constant cm²/µJ
Adenovirus	Virus	Jensen 1964	Air	0.000546
		Rainbow 1973	Plates	0.000047
Vaccinia	Virus	Jensen 1964	Air	0.001528
		Galasso 1965	Plates	0.001542
Coxsackievirus	Virus	Jensen 1964	Air	0.001108
		Hill 1970	Water	0.000159
		Hill 1970	Water	0.000202
Influenza A	Virus	Jensen 1964	Air	0.001187
Echvirus	Virus	Hill 1970	Water	0.000217
Reovirus type 1	Virus	Hill 1970	Water	0.000132
Staphylococcus aureus	Gram+ Bacteria	Sharp 1939	Plates	0.000886
		Sharp 1939	Air	0.003476
		Gates 1929	Plates	0.001184
		Abshire 1981	Plates	0.000419
		Luckiesh 1946	Air	0.009602
Streptococcus pyogenes	Gram+ Bacteria	Lidwell 1950	Plates	0.006161
		Mitcherlich 1984	Air	0.001066
Mycobacterium tuberculosis	Mycobacteria	David 1973	Air	0.000987
Mycobacterium kansasii	Mycobacteria	Riley 1976	Air	0.004721
Mycobacterium avium-intra	Mycobacteria	Collins 1971	Air	0.000364
E coli	Gram- Bacteria	Sharp 1939	Plates	0.000927
		Sharp 1939	Air	0.003759
Corynebacterium diphtheriae	Gram+ Bacteria	Sharp 1939	Plates	0.000701
Moraxella-acinetobacter	Gram- Bacteria	Keller 1982	Water	0.000021
Haemophilus infuenzae	Gram- Bacteria	Mongold 1992	Water	0.000599
Pseudomonas aeruginosa	Gram- Bacteria	Collins 1971	Air	0.002375
		Abshire 1981	Water	0.000640
		Sharp 1940	Air	0.005721
		Antopol 1979	Water	0.000419
Legionella pneumophila	Gram- Bacteria	Gilpin 1984	Water	0.002047
		Antopol 1979	Water	0.002503
Serratia marcescens	Gram- Bacteria	Collins 1971	Air	0.002208
		Antopol 1979	Water	0.001047
		Riley 1972	Air	0.049900
		Sharp 1940	Air	0.004449
		Sharp 1939	Air	0.001047
		Rentschler 1941	Air	0.001225
Coxiella burnetti	Rickettsiae	Little 1940	Water	0.001535
Bacillus anthracis	Mixed spores	Sharp 1939	Plates	0.000509
Bacillus anthracis spores	Bacterial spore	Knudson 1986	Plates	0.000031
Criptococcus neoformans	Fungal spore	Wang 1994	Plates	0.000102
Fusarium oxysporum	Fungal spore	Asthana 1992	Plates	0.000112
Fusarium solani	Fungal spore	Asthana 1992	Plates	0.000706
Penicillium italicum	Fungal spore	Asthana 1992	Plates	0.001259
Penicillium digitatum	Fungal spore	Asthana 1992	Plates	0.000718
Rhizopus nigricans spores	Fungal spore	Luckiesh 1946	Air	0.000861
Cladosporium herbarum	Fungal spore	Luckiesh 1946	Air	0.000370
Scopulariopsis brevicaulis	Fungal spore	Luckiesh 1946	Air	0.000344
Mucor mucedo	Fungal spore	Luckiesh 1946	Air	0.000399
Penicillium chrysogenum	Fungal spore	Luckiesh 1946	Air	0.000434

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UV Solutions For Schools And Hospitals

Survey of Elementary School

Results of Ultraviolet Installation	
Solution to problems by using UV and % teachers saying problems disappeared	
Congestion from allergies/colds disappears	78%
Headaches cease	67%
Throat/voice clear	33%
Sweet/fresh air	67%
Coughing ceases	44%
Personal energy level increases	56%
Breathing made easier	33%
Able to work/study in classroom more hours	33%
Increased concentration by teachers/students	33%
Reduced blood pressure	11%
Eliminate/reduced student hyperactivity	33%
Improve teacher/student attendance	44%
Improve student behavior	11%
Academic performance improved	11%
General health improvement	44%

UV Case Study: Elementary School

Over the years, the teachers, staff and students at an elementary school, experienced many complicated symptoms within the school building, suggesting "sick building syndrome."

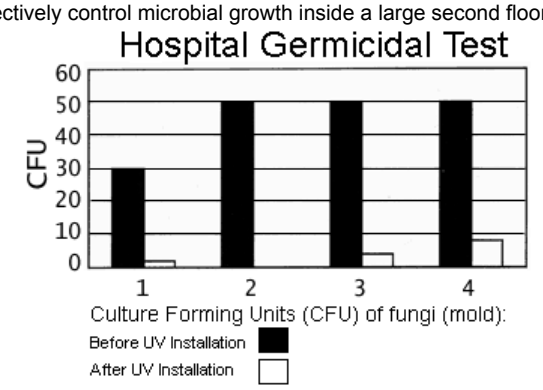
The school had virtually given-up finding solutions. Finally it was determined that ultraviolet mounted in the central air system could be a solution to their complicated pollution problems. The school installed forty-two units in classrooms and the administration building. **The improvement was immediate**.

UV Testing in Large City Hospital

A large city hospital tested UV units to determine if ultraviolet lamps would effectively control microbial growth inside a large second floor air circulating system.

The test locations were both the down and upstream sides of the A/C cooling coil system. Testing was performed using SAB DEX Contact Plates. They first tested for unexposed surface fungi concentrations in the coil region. At each location the fungi (mold) were identified before UV exposure resumed. One location on each side of the A/C coil was cleaned before tests started. Other parts on both sides were left uncleaned. It was determined that the locations had between 30 to 50 Culture Forming Units (CFU) of fungi (mold).

The short-wave ultraviolet lamps were then installed and tested for results. Both clean and uncleaned surfaces were tested for fungi to determine if the ultraviolet light would effectively eliminate surface contamination.



Hospital Test Before Ultraviolet	
Location	Results of A/C Coil
Downstream from coil	30* Colony Forming Unit CFU per plate 3(10%) Alternaria, 4(13%) Aspergillus Niger 3(10%) Bipolaris, 20(67%) Cladosporium
Downstream	50** CFU per plate
Upstream from coil	50** CFU per plate 25(50%) Aspergillus Niger 25(50%) Cladosporium Rhizopus
Upstream	50** CFU per plate
Hospital Test After Ultraviolet	
Location	Results of A/C Coil
Downstream	2 CFU per plate
Downstream	(cleaned) 2 CFU per plate
Upstream	4 CFU per plate
Upstream	8 CFU per plate 1(13%) Aspergillus niger, 2(25%) Aureo badidium 2(25%) Bipolaris, 3(38%) Cladosporium

Results and Conclusions at the Hospital

The ultraviolet lamps were very effective in controlling fungi on both the uncleaned and cleaned cooling coil surfaces. After the ultraviolet was installed, the fungi CFU's per dish was zero at one location, two at another, four at the third and eight CFU's at the last location.

Here is the killing rate break down:
At the coil downstream locations: the killing efficiency was 100% on the downstream-cleaned surfaces and 93% to 96% on the downstream-uncleaned surfaces.
At the coil upstream locations: the killing efficiency was approximately 84 % on the upstream cleaned and 92% on the upstream-uncleaned surface. The kill rate may be higher than reported due to the possibility of unexposed fungi entering the culture plates during sampling.