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Frequently Asked Questions about Testing of Portable Air Cleaners

The purpose of this document is to provide expert answers to important questions about the ANSI/AHAM AC-1 performance test method, the Clean Air Delivery (CADR) Rate and the AHAM Verifide® certification program for portable air cleaners administered by the Association of Home Appliance Manufacturers. This 2020 update to the AHAM FAQs will also examine key technical aspects of ANSI/AHAM AC-1 and Clean Air Delivery Rate (CADR) such as room size, sensors, particulates, and airflow rate.

Many firms in the portable air cleaner industry make CADR performance claims validated using the ANSI/AHAM AC-1 test method which measures the reduction of pollutants. The test method is widely used and recognized and has been accepted as the foremost test procedure for measuring performance through particulate removal for over 30 years.

The ANSI/AHAM AC-1, like all AHAM and ANSI standards, is subject to periodic review for improvement to consider updated residential environmental conditions. It is transparent and publicly available, not proprietary or limited to one company's private, unaccountable use. The ANSI/AHAM AC-1 method was first developed in the mid-1980's. The test method or "standard" is a peer-reviewed method under the jurisdiction of the American National Standards Institute (ANSI), which monitors standards development bodies and accredits them for producing open, consensus, and peer-reviewed standard test methods. The designation of "AHAM" (the Association of Home Appliance Manufacturers) identifies the organization that takes responsibility for organizing and convening the committee of experts to write and review the standard. AHAM is an ANSI accredited standards development body and has been developing peer-reviewed and widely used consensus test methods for household appliances since the organization's inception in 1967.

This standard has been updated eight times since its first ANSI accreditation in 1988. It is now in a 2015 edition with a 2020 update in process. About every 3 years, the test method is updated with the best available knowledge. The standards committee is composed of manufacturers, research individuals, government labs, private laboratories, and academic professionals in the area of indoor air pollution reduction. In this way, the standard not only is improved but subject to scrutiny and comments from experts across the world. The standard is improved to keep up with current technology and indoor air quality (IAQ) scientific research.

The ANSI/AHAM AC-1 basic framework is used in test methods in Canada, Korea, Japan and China. Dozens of laboratories in many of these countries and others have performed the same type of reduction testing as in ANSI/AHAM AC-1 for decades. Recently, the International Standards Organization (ISO) and International Electrotechnical Commission (IEC) have been studying standards that are based on the principles of ANSI/AHAM AC-1 for the development of global air cleaner standards. IEC 63086-1, Household and similar electrical air cleaning appliances – Methods for measuring the performance; Part 1: General requirements, is currently in the Final Draft International Standard (FDIS) stage prior to publication.

Where does an air cleaner fit in the strategies to improve indoor air quality (IAQ)?

As defined by the EPA - *Indoor Air Quality (IAQ) refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. Understanding and controlling common pollutants indoors can help reduce your risk of indoor health concerns*[1]*.* The EPA talks about controlling pollutants and reducing risks in homes.

The EPA defines strategies as a prioritization of how to improve and reduce the risks of Indoor Air Quality. There are three basic strategies to improve indoor air quality[2]:

1. Source Control
2. Improved Ventilation
    - Source Ventilation
    - General Ventilation with Clean Air
3. Air cleaners

Per the EPA website[3]**:** ***"T****he most effective ways to improve your indoor air are to reduce or remove the sources of pollutants and to ventilate with clean outdoor air. In addition, research shows that filtration can be an effective supplement to source control and ventilation"*

It should be noted that there are some locations or times of the year where outdoor air is dirtier than indoor air. The EPA lists the air cleaner as an important and effective line of defense for improving air quality. The EPA released an ASHRAE Guidance document in 2019[4] and states "*The revised EPA guidance suggests that adding high-CADR portable units to specific spaces can be a practical alternative."*

How are household, portable air cleaners tested?

The critical thing to remember in any testing is that in comparing the performance of air cleaners of different sizes, different shapes, and different technologies, there needs to be a way to separate the performance of the air cleaner machine from natural air cleaning which incurs in indoor air also known as "natural decay."

To accomplish this, under the ANSI/AHAM AC-1 method, contaminants or particle pollutants are released into a test chamber with the air cleaner in the "off" mode and the gradual settling of the air contaminant is measured over time. Then, the test is repeated with contaminants at the same level and the air cleaner in the "on" mode to measure a total air cleaning rate. The natural air cleaning or "natural decay" is subtracted from the total air cleaning to provide just the cleaning by the air cleaner, in other words - "air

[1] https://www.epa.gov/indoor-air-quality-iaq/introduction-indoor-air-quality
[2] https://www.epa.gov/indoor-air-quality-iaq/improving-indoor-air-quality#Source_Control
[3] https://www.epa.gov/indoor-air-quality-iaq/air-cleaners-and-air-filters-home-0
[4] Harriman, Stephens, Brennan - New Guidance for Residential Air Cleaners- ASHRAE Journal Sep 2019

cleaner decay". In this manner, the cleaning performance is an open-ended number system called Clean Air Delivery Rate (CADR). It is a rate of cleaning from high concentration to low concentration.

CADR often is described as the amount of clean air that the air cleaner contributes to the room in a given amount of time. Once a CADR number is determined through testing, it can be applied to most room sizes by mathematical conversions. While the CADR is measured in a chamber of a particular size, its application is not restricted to rooms that are the same size as the chamber.

What is CADR?

CADR is an important tool for comparing the overall performance of different models of air cleaners. Clean Air Delivery Rate (CADR) is a measure of the reduction rate (cleaning speed) of specific particulates by an air purifier or other filtration system in a controlled environment. CADR is measured in cubic feet per minute or in cubic meters per hour. Three particles (engineering tobacco smoke, fine dust and paper mulberry pollen), representing fine, medium and large particles respectively, are cited in AC-1 and used for CADR testing of air cleaners. The higher the CADR numbers, the better the overall ability of the unit to clean your indoor air and the faster the air in the room will be cleaned. CADR represents the filtered airflow, which can be translated to understand square footage or square meters for a room size that can be cleaned. For countries outside the US, a simple conversion method can be used between the English system of measurement and metric system: 1 cfm = 1.699 m^3h

What has the US EPA said about CADR?

The U.S. EPA released a Guide to Air Cleaners in the Home, 2nd Edition, August 2018 and their 3rd Edition, August 2018, Residential Air Cleaners, a Technical Summary[3,5]. In the Technical Summary, EPA highlights "*To use portable air cleaners, furnace filters, or other duct-mounted air cleaners to good effect, it is crucial to understand the difference between two parameters that influence the performance of air-cleaning devices: **efficiency** and **effectiveness**. The efficiency of an air-cleaning device is a fractional measure of its ability to reduce the concentration of pollutants in the air that passes once through the device. The fractional efficiency of a device is measured in a laboratory, where all relevant variables are controlled. The effectiveness of an air-cleaning device or system is a measure of its ability to remove pollutants from the spaces it serves in real-world situations.*

*The most helpful parameter for understanding the effectiveness of portable air cleaners is the **clean air delivery rate (CADR)**, which is a measure of a portable air cleaner's delivery of relatively clean air, expressed in cubic feet per minute (cfm). The CADR is a product of the fractional removal efficiency for a particular pollutant and the airflow rate through the air cleaner.*[1]"

Further, the U.S. EPA recognizes the value of CADR and describes CADR in this manner:

"*A helpful parameter for understanding the effectiveness of portable air cleaners is CADR. The CADR is a measure of a portable air cleaner's delivery of relatively clean air, expressed in cfm. For example, an air cleaner that has a CADR of 250 for dust particles can reduce dust particle levels to the same concentration as would be achieved by adding 250 cfm of clean air to the space.*

It is also important to note that a portable air cleaner's removal rate also competes with other removal processes occurring in the space, including deposition of particles on surfaces, sorption of gases, indoor air *chemical reactions, and outdoor air exchange. Thus, while a portable air cleaner may not achieve its rated CADR under all circumstances, the CADR value does allow comparisons among portable air cleaners***.**"[5]

How is CADR measured?

Test particulates of engineering tobacco smoke, dust or pollen are injected into the test chamber at a known level. Sophisticated, electronic particle-counting devices monitor the exact concentration and size of the particles. The first test is conducted without the air cleaner being turned on. This procedure establishes the natural decay rate of the particles that will be subtracted from the rate established during the second test when the air cleaner is turned on. The Clean Air Delivery Rate (CADR) is the difference between the two rates. By subtracting the natural decay, the air cleaner is not credited with any performance that is attributed to gravity (natural settling) or adsorption onto the walls of the chamber.

Technically speaking, CADR equals the "air cleaner ON removal rate" minus the "natural decay rate" multiplied by the test chamber volume (which is 1,008 cubic feet or 28.4 cubic meters).

CADR in cfm = [Rate air cleaner on - natural decay] x 1008

Particulate size ranges tested for are:

Tobacco smoke	0.09 microns to 1.0 microns
Dust	0.5 to 3.0 microns
Pollen	0.5 microns to 11.0 microns

Room Size ratings based on CADR were developed in consultation with the U.S. government to ensure usefulness and application to the consumer. The Room Size in square feet is calculated based on the removal of at least 80 percent of smoke particles in a steady-state room environment, assuming one air change per hour with complete mixing in the room.

How can I know if the air cleaner is actually cleaning the air?

A number of sources can cause indoor air pollution. This includes contaminants from outdoor air, particulates that you bring in from outside, particles on pets or our clothing, and from sources inside the home such as cooking, smoking, candles burning, and house dust. All portable air cleaners have two important common elements. 1. An Air Flow system and 2. A filtering system. It is these two systems working together that removes pollutants from the room. Neither the quantity nor the velocity of the air flow, nor the efficiency of the filter, by themselves, tell the consumer the amount of cleaned air generated. Some manufacturers of air cleaners advertise the rating of the filter which will tell you if the density of the filter allows for the trapping of very small particles. But to get the complete story you need to know if all or most of the air of the air cleaner passes through the filter. Therefore, filters are important but not sufficient to evaluate the full air cleaner performance.

You often can observe the air cleaner in operation. Larger particles will be noticed collecting on filters of the air cleaner - larger ones on the pre-filters and smaller ones on the primary filters. You will notice that a mesh fiber filter will slowly darken or change color, and that the plates or wires on electronic filters will become coated as collection takes place. You may also notice less dust on your home's surfaces and a

[5] US EPA "Residential Air Cleaners (Third Edition): A Technical Summary, 2018. https://www.epa.gov/sites/production/files/2018-07/documents/residential_air_cleaners_-_a_technical_summary_3rd_edition.pdf

fresher cleaner smell in the air since the air cleaner is now collecting those particles. Eventually, you may notice the airflow will reduce as the filters slowly load with particles. You may notice some slight arcing for an electronic filter which is a sign of high loading. Arcing and low airflow are generally signs that a filter change or cleaning is needed. (Consult the owner's manual). These are all signs your air cleaner is performing less than efficiently.

<u>Room size</u>

Why determine room size based on removal of tobacco smoke?

The engineering tobacco smoke was chosen because of its extremely small size, as well as, for being a common global indoor pollutant. ANSI/AHAM AC-1 uses a specific engineering tobacco smoke to generate the smoke CADR. The size of the smoke particles are 100 to 1000 times smaller than the width of a human hair. Therefore, even if a consumer does not smoke, engineering tobacco smoke is a surrogate for many of the fine particles that may be found in a home.

How large is the AC-1 test chamber used for air cleaner testing and why is it that size?

Most of the household, portable room air cleaner test methods around the world use a chamber volume of about 30 cubic meters. The actual dimensions for most of the chambers are: 10 ½ ft. by 12 ft. by 8 ft. high (1,008 ft^3). In meters, this is 3.2m x 3.7m x 2.4 m high (28.4 m^3). From the test chamber measurements and the smoke CADR of the air cleaner a recommended room size can be calculated, which is expressed in square feet (or square meters) to help consumers understand the room where the appliance will be used. (Note - If your ceiling height is higher than 8 feet, the square foot coverage of the air cleaner will be less than the room size shown for the air cleaner).

The size of the chamber is not specific to any particular air cleaner type. The test chamber is not intended to represent a certain size room in a home. Rather, it is a standard chamber, which can allow for accurate, uniform, and repeatable test measurements. These standard measures are applied to engineering and mathematical equations that can be scaled up or down as appropriate per room size. The key is the amount of clean air produced by the air cleaner, not whether a test chamber is the same as the room in your house.

What is the largest room size that AC-1 evaluates?

The suggested Room Size for an air cleaner is based upon the CADR obtained for reducing engineered cigarette smoke concentrations (See Annex E of the standard). The Room Size is based upon the ability of the air cleaner in smoke CADR to reduce the concentration of particles by 80 % in a room at steady state to a new steady-state when the air cleaner is operating. This includes contributions from room sources and infiltration of air from outside as well as other rooms connected to the one where the air cleaner is in use. A standard first-order differential equation that includes these contributions is utilized for the calculation, and that is summarized as:

$$\text{Room Size (square feet – ft}^2\text{) = cigarette smoke CADR x 1.55}$$

$$\text{Room Size (square meters – m}^2\text{) = Room Size (ft}^2\text{) x 0.093}$$

The maximum allowable CADR that can be measured by the AC-1 method in the chamber is 450, so the maximum room size that the standard can confidently predict performance would be a room of 698 ft^2 (64.8 m^2).

This relationship between cleaning rate in CADR and room size to clean to the 80% level has been verified by scientists at the National Institute of Standards and Technology (NIST) and recognized as reasonable by the U.S. Federal Trade Commission.

How can I know if the air cleaner will clean the size of my room?

The maximum suggested room size of an air cleaner can be calculated by knowing the CADR from the smallest particle or smoke test. The Room Size is determined by mathematical modeling the steady state and is based on the CADR baseline requirement to remove 80% of cigarette smoke particles between 0.1 and 1.0 micrometer on a steady-state (continuous) basis. This gives the consumer a way to relate CADR to the square feet or square meters of a room.

Room Size (ft^2) = CADR (Smoke) x 1.55;

Room Size (m^2) = CADR (Smoke) x 1.55 x 0.093

Sensors

Is this AC-1 test method only appropriate for certain technologies?

Almost any household, portable, room air cleaner can be tested using Method AC-1. An air cleaner that emits water or mists of vapor is adding particles to the room, would cause problems with the instruments and would interfere with the measurements to reduce particles from the chamber. Otherwise, any air cleaner technology, as long as it registers an air cleaning function above the minimum (and below the maximum) level that can be measured, can be tested using this method. This method has been used to evaluate and compare many different types of air cleaning technology over the past 30 years.

Are all the speeds of an air cleaner tested in the AC-1 test method?

No. Because there is no universally accepted way to test the speeds of all air cleaners and because “low” or “medium” in one air cleaner may be different from another, the test is performed in the highest speed setting. Consumers can then make an informed selection based on the air cleaner’s highest performance level. As a comparison, just as your driving patterns may not be the same as what the government tests in a miles per gallon (or km per liter) test, using one standard method is critical to allowing a fair and full comparison in comparing a miles per gallon rating. Certainly, as more air cleaners move to an automatic, self-adjusting mode through the use of sensors, the test methods will be adapted to accommodate these new features. The standards committees are continuing to working on this now, with expected proposals by 2021.

Why does AC-1 use one sensor?

The number of sensors in a testing chamber are irrelevant if the pollutant in the chamber is thoroughly mixed. Over the last 30 years, the AC-1 test method has been replicated in a number of chambers that are similar but of slightly different shapes and sizes to support this assumption. The AC-1 procedure uses a ceiling fan only before the test to make sure the pollutant is thoroughly distributed in the chamber. Then, that ceiling fan is turned off before the test. A small but high volume re-circulation fan is mounted in the chamber against a wall and out of the air-stream path of the air cleaner or the sampling port, so as not to interfere with the testing results. This re-circulation fan is used to keep the pollutant completely mixed in the chamber during the test. Thus, with the thorough mixing as has been specified in the AC-1 method, it does not matter whether you have one or more sampling ports.

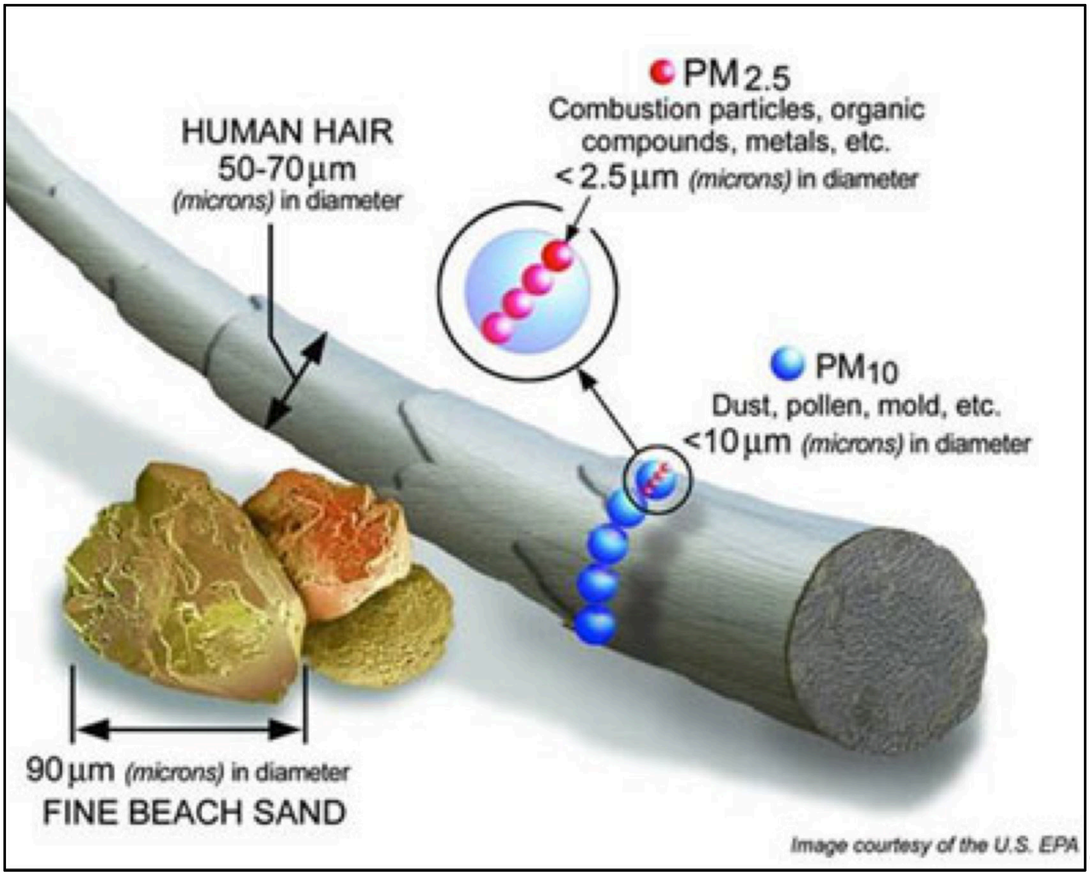
In addition, if multiple sampling ports would be used, there is more complexity for sampling and the issue then becomes how you would correlate the results from multiple sensors on each test. This would have to be validated by many experts in air cleaning and multiple testing labs. There would need to be extensive testing on all types of models of air cleaners in order to ensure that each air cleaner is subjected to the same mixture of pollutant when using multiple sensors. This would involve testing multiple chambers of the similar size in order to ensure that any performance test data was the same from test to test. The AC-1 test method has already been validated on various models, sizes and technologies over more than 35 years and is one of the major benefits of the existing AC-1 test procedure:

> ANSI/AHAM AC-1 has been replicated across many types, sizes and technologies of air cleaners. It has been used in multiple similar chambers in many countries. Testing with reference units across these chambers have shown that the procedure can be not only valid for all air cleaners, but repeatable day to day in one chamber, and reproducible in multiple chambers and testing laboratories. No other testing procedure, of which we are aware, has been subjected to this level of scrutiny and precision. Testing to the ANSI/AHAM AC-1 procedure ensures that consumers have the most accurate information about portable, room air cleaners.

Particles:

What indoor pollutants are measured?

The most common pollutants in people's homes are particles and gases. Testing of particles has been measured and compared using the AC-1 method for CADR for several decades. Particles in our home environment come in many different sizes. Large particles that are between 5 and 11 micrometers in diameter are represented by pollen. Particles in this size are often trapped in the nasal areas, but represent those particles causing allergic reaction in humans from pollen. Mid-sized particles from 1/2 to 3 micrometers are in the very small dust range and are represented by engineered standard fine dust. This dust is sometimes referred to as "Arizona Road Dust" or "ISO fine dust" and closely resembles a type of talcum powder. Particles in this range can be drawn into the upper respiratory passages in the human body. Very small particles which are often less than 1 micrometers in diameter, and which can be drawn deeply into our lungs are represented by cigarette smoke from engineered cigarettes. The engineered cigarettes are produced in large batches for similarity in the particles produced and also represent the very small particles of cooking materials, soot from candles and smoke from power generation plants many hundreds of miles away. The ANSI/AHAM AC-1 method tests three different ranges of particles from the larger pollen grains, to airborne dust, to fine particles like smoke. These test materials are surrogates or proxies for the range of particles often found in the home. The performance of an air cleaner is given for each of these particle ranges as a separate CADR number and the performance can be compared if your family is concerned with one or more of these particle pollutants. As a comparison, the diameter of the smallest human hairs is about 50-70 micrometers and it becomes very difficult for humans to see objects smaller than 40 micrometers without lenses. A 0.1-micrometer particle measured by Method AC-1 is 500 times smaller than the smallest human hairs.



[6]

For the future, methods for testing the reduction of gases by air cleaners are important. Many standards development bodies including AHAM are developing test methods now to help compare the performance but there is no universal test method yet accepted for measuring performance of air cleaners to clean gases or volatile organic compounds.

How does AHAM AC-1 assess PM 2.5?

PM2.5 describes fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller. AHAM AC-1-2019 released a measure for PM 2.5 CADR. This update is going through the ANSI Canvass process and when approved the document will be published as ANSI/AHAM AC-1-2020.

The performance on PM 2.5 sized particles of an air cleaner is represented by a clean air delivery rate (CADR) based on the dust and cigarette smoke performance data. The diversity of particle natures and the sizes of the dust and smoke pollutants gives a well-balanced representation of the ultra-fine and fine particulate matters that define PM 2.5.

PM 2.5 CADR is obtained by combining the CADR of Cigarette smoke particle sizes ranging from 0.1 and 0.5 microns with the CADR of dust particles that fall in the range of 0.5 to 2.5 microns and performing a geometric average calculation.

[6] Figure 1, https://www.epa.gov/pmcourse/what-particle-pollution#what

Using the geometric average of the CADR values.

$$PM\ 2.5\ CADR = \sqrt[2]{[Smoke\ CADR \quad (0.1 - 0.5um) \quad X \quad Dust\ CADR(\ 0.5 - 2.5um)}$$

What about Bacteria or Virus sized particles?

AHAM is not making a representation of effectiveness of reducing bacteria or virus loads with the current CADR measurements. AHAM procedures do not test against virus particles and there is no known peer-reviewed test procedure for air cleaners currently anywhere in the world to do this.

Viruses range in size from 20 to 200 nm and would be classified as Nano-particles. An air cleaner does not remove all particles and infection can result from very few particles. As a result, while an air cleaner can significantly reduce the number of particles of just about anything, the air cleaner cannot prevent infection.

<u>Air Flow Rate</u>

Some methods, such as AC-1, use stirring or mixing fans during test? What is their purpose?

For AC-1, test chambers use a ceiling fan mounted in the center of the ceiling to stir or mix the pollutants <u>before</u> testing. In the AC-1 test, this fan is shut off during the test. A continuously operating recirculation fan assures uniform mixing of the contaminants during the entire set of tests. The recirculation fan is mounted out of the air stream against a wall to reduce the chance of contaminants gathering in a corner. The recirculation fan runs for all tests whether the air cleaner is operating or not. This recirculation fan does not contribute to the measured performance of the air cleaner but creates a fair and comparable environment for small, medium and large air cleaners so that consumers can equally compare the results of all air cleaners.

How does Airflow relate to CADR performance and room size?

CADR is based on the highest fan speed as a uniform standard condition. If you run the air cleaner on a lower fan speed, it is understood that both efficacy and the room coverage will also decrease. At slower speeds, the amount of clean air delivered is at least proportional to the speed reduction. Airflow and CADR should not be confused although both are measured in cubic feet per minute (cfm). CADR is the contribution of clean air to the room, while airflow is just a measure of how much air is moved.

How does CADR help explain Air Exchanges?

Air exchanges per hour (ACH) is a Building Air quality measurement and ACH is really a ventilation term not a filtration term. Ventilation (outdoor) Air requirements are determined using one or more of the following methods.

- CFM (cubic feet per minute) per person
- CFM per square foot (area) of the space
- Air Changes per Hour (ACH)
- Percent of total supply air

These terms may be helpful to a building architect or commercial building manager to best understand the ability to replenish air or maintain good ventilation but do not assist consumers in determining how a portable, room air cleaner will assist in reducing pollutants or comparing one air cleaner from another.

Air Changes per Hour (ACH) is a term used in determining outdoor air flow in buildings. Air exchange is tied to refreshing oxygen content and NOT measuring cleaned air. The filtration process does not refresh the oxygen which is the main reason outdoor air exchanges are measured.

The suggested Room Size for an air cleaner is based upon the ability of the air cleaner in CADR to reduce the concentration of smoke particles in a room at steady-state to a new steady-state concentration 80% less than the original when the air cleaner is operating. The Room Size is based on (1 ACH) one air exchange per hour (based on research done while developing the standard and approved by the NIST and U.S. Federal Trade Commission.).

A (Room Size area (ft^2))= CADR/32(ventilation constant + deposition constant).

Area (ft^2) = CADR / [32(0.01667 + 0.0034)] = 1.557 CADR (cfm).

The defined Room Size claim places all air cleaners in an equivalent position and provides the CADR based size selection at a level that consumers can readily use to make an informed decision for purchase. The Room Size claim shows the calculated area of a room in which 80% steady-state removal is expected and is the focus rather than air exchanges.

AHAM Program

Independent Testing and Validation through the AHAM Verifide® Certification Program

A CADR measurement for reduction of smoke, dust and pollen gives the consumer relevant information on which to compare air cleaners. The suggested room size calculation enables the consumer to purchase an air cleaner that is right for their application. In this way, consumers are not required to purchase using a "bigger is better" mantra but rather a methodology to allow for the best air cleaner for their living space. However, even knowing the smoke, dust and pollen measurement as well as the suggested room size is only valuable if the data is based on rigorous scientific testing in an unbiased third-party testing lab.

This is why AHAM developed more than 30 years ago, the AHAM Verifide® Air Cleaner Certification Program. Under this program, manufacturers submit all models of air cleaners to the program for testing in controlled and verified laboratories. All these labs have been validated to produce accurate information to the latest ANSI/AHAM AC-1 test procedure. The laboratory and technicians are reviewed and qualified to produce the certified results. The results are displayed in a transparent manner on the AHAM Air Cleaner web site https://ahamverifide.org/.

Each unit is not only certified at the time the model enters the program but is verified in a rigorous manner, which includes periodic, unannounced visits by independent auditors to select samples and return these samples to the program laboratory for complete verification testing. In this way, consumers can be assured that the numbers given on advertising and on the AHAM web site are accurate. Air cleaner models that do not retain the original certification performance values must be re-rated to the new level.

Under the AHAM Verifide® Air Cleaner Certification Program, manufacturers are required to display on the retail packaging, sales literature and on their individual web sites the performance data for CADR and room size based on the actual testing. In this manner, the consumer knows the information is independently verified for hundreds of models.

If you have additional questions about the air cleaner testing, standards, or certification, please contact info@AHAM.org.