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OFFICE OF  
AIR AND RADIATION

## Summary of Rationale for the ENERGY STAR<sup>®</sup> Room Air Cleaner Specification

### I. Introduction and Background

This memorandum provides a summary of EPA's rationale in developing the new ENERGY STAR room air cleaner specification. It contains the following information:

- Summary of the key requirements of the specification
- Key milestones in the development of the specification
- Summary of key comments provided by stakeholders throughout the development process
- EPA's rationale for deciding on key elements of the Final specification

### II. Summary of Key Requirements

The following are the key requirements of the room air cleaner specification:

- Qualifying product categories were chosen based on the method used to clean indoor air. Cleaning technologies eligible for the ENERGY STAR include: fan with filter; fan with filter and electrostatic plates; fan filter with ion generator; ion generator; and hybrid as defined within the specification.
- Product types that cannot qualify as ENERGY STAR include: combination products and ozone generators, as defined within in the specification.
- Qualifying models must produce a minimum 50 Clean Air Delivery Rate (CADR) for Dust and a minimum efficiency performance requirement of 2.0 CADR/watt (Dust).
- In addition to the CADR/watt and standby power requirements, models that emit ozone as a byproduct of air cleaning must not exceed 50 ppb (ozone) in accordance with UL Standard 867.
- Qualifying models must meet a maximum standby power requirement of 2 watts.
- The following test procedures are required for ENERGY STAR qualification:

- CADR must be tested and measured in accordance with the most recent version of the ANSI/AHAM AC-1 Standard.
- Based on the AC-1 Standard, EPA developed an energy consumption protocol which is provided within the specification.
- Based on International Electrotechnical Commission (IEC) Standard 62301, a standby power test protocol is provided within the specification.
- Manufacturers must include the ENERGY STAR mark on either the top/front of the model, on product packaging, in product literature, and on the manufacturer’s Internet site where information about ENERGY STAR qualified models is displayed.
- Manufacturers must include the following disclaimer with the ENERGY STAR mark:
 

“This product earned the ENERGY STAR by meeting strict energy efficiency guidelines set by the US EPA. US EPA does not endorse any manufacturer claims of healthier indoor air from the use of this product.”
- Manufacturers must also include the following language within the ENERGY STAR qualified model instruction manual and on their company Web site where information about ENERGY STAR qualified products is displayed:
 

“The energy efficiency of this ENERGY STAR qualified model is measured based on a ratio between the model’s CADR for Dust and the electrical energy it consumes, of CADR/Watt.”

### **III. Key Milestones of Specification Development**

EPA originally initiated the development of an ENERGY STAR specification for room air cleaners in February 2001. This effort was temporarily halted to address other program priorities. However, due to continued interest from industry stakeholders, EPA resumed discussions with manufacturers and reopened the specification process in December 2002. The following are some key milestones of the more recent 18-month effort:

- Industry stakeholder meeting held in conjunction with the International Housewares Show in Chicago, IL on January 14, 2003.
- Three draft versions of the specification released for stakeholder comment prior to finalization.
- Launch of the specification in June 2004; partners begin labeling qualified models on July 1, 2004.

### **IV. Summary of Stakeholder Input**

In developing the product specification EPA considered comments provided during the January stakeholder meeting as well as written comments submitted to EPA by equipment manufacturers and other industry stakeholders. All stakeholder comments were posted to the ENERGY STAR Web site, with permission of the submitter, throughout the development process. The key comments are summarized below, along with EPA’s responses.

## Labeling and Program Requirements

- Some stakeholders were concerned with the shipment data reporting requirement and felt that this information was proprietary and confidential.

EPA Response: EPA collects this information in order to measure program effectiveness and to determine the energy savings attributed to the sales of ENERGY STAR qualified products. This is a requirement of ENERGY STAR Partners in all product categories. EPA has worked closely with manufacturers and third-party organizations to develop a format for providing data through a third party that is aggregated without revealing the source.

In the case of air cleaners, manufacturers may decide to submit shipment data to the Association of Home Appliance Manufacturers (AHAM) who can then provide EPA with aggregated data. EPA assured stakeholders that individual reports will not be requested and EPA will work closely with manufacturers and AHAM to determine the best way to collect information while protecting the confidentiality of manufacturer-specific data.

- One stakeholder questioned the requirement to place an ENERGY STAR label on the top or front of the product.

EPA Response: The ENERGY STAR mark identifies the most efficient products available in the marketplace and by seeing this label, the consumer is assured of the product's significant energy and costs savings. Consistent use of the ENERGY STAR mark across the many different product categories helps the consumer to identify energy-efficient products and make informed purchasing decisions.

- There was some concern from EPA's Indoor Environment's Division (IED) that manufacturers might use the ENERGY STAR mark as an endorsement from EPA supporting the air cleaning performance of a qualified model. This concern stemmed from instances where manufacturers have used quotes or information published by IED to justify the need for an air cleaner.

EPA Response: IED neither supports nor rejects claims made by manufacturers regarding air cleaning performance. Instead, efforts are made to provide the consumer with the facts surrounding air cleaner performance through EPA's Web site and various outreach materials. The CADR/watt requirement was developed to compare air cleaner models and reward those that use less energy while ensuring some level of air cleaning performance is maintained based on existing industry standards. The ENERGY STAR should not be used to promote or make claims to the air cleaning performance of a qualified model or its ability to alleviate allergies and other health concerns.

In response to IED's concerns, EPA added a requirement that partners "agree not to use quotes or statements related to indoor air quality that misrepresent the views of the EPA Indoor Environments Division in public documents or on the company Web site." Partnering manufacturers should refrain from taking any statements made by IED out of context for purposes of selling air cleaners.

To further alleviate any confusion of the customer as to what the ENERGY STAR label represents, EPA developed disclaimer language required to be used by each manufacturing partner regarding qualified models. The following disclaimer language was presented in the second draft version and is required to be placed on the same panel as the ENERGY STAR label on product packaging: "The performance of this ENERGY STAR qualified model is

measured based on a ratio between the model's CADR for Dust and the electrical energy it consumes, or CADR/watts."

This statement was later revised to clearly state EPA's position on additional claims regarding air cleaning performance: "Room air cleaners earn the ENERGY STAR mark by meeting strict energy efficiency guidelines set by the US EPA. US EPA does not endorse manufacturer claims regarding healthier indoor air, or associated health benefits, from the use of this product."

This statement was further revised to streamline and clarify the messaging: "This product earned the ENERGY STAR by meeting strict energy efficiency guidelines set by the US EPA. US EPA does not endorse any manufacturer claims of healthier indoor air from the use of this product." To alleviate some of the labeling burden on the manufacturers, EPA developed an ENERGY STAR disclaimer label that includes this statement.

In addition, the following disclaimer must be placed on product literature and manufacturer Web sites to make a clear distinction between ENERGY STAR performance and health and/or air quality improvement claims made by the manufacturer: "The energy efficiency of this ENERGY STAR qualified model is measured based on a ratio between the model's CADR for Dust and the electrical energy it consumes, or CADR/watt." The statement must be placed in close proximity to the ENERGY STAR mark and any text describing the ENERGY STAR program and/or qualified products.

## **Definitions and Qualifying Products**

- Stakeholders felt that EPA should use the definitions provided in the ANSI/AHAM AC-1 test procedure for the different types of air cleaners.

EPA Response: EPA agreed that it was important to be consistent with the AC-1 and adopted the air cleaner definitions provided within Section 3 of the standard.

- However, some stakeholders felt that it was not necessary to differentiate between the different types of air cleaners and that all models are tested to the same requirements regardless of filter type, technology, etc.

EPA Response: EPA felt that it was important to differentiate the different types of air cleaner technologies for purposes of understanding which models could qualify as ENERGY STAR. These definitions are in line with the definitions provided in the AC-1 standard. However, EPA did remove the definitions for the different filter media types since there is no direct relevance within the ENERGY STAR specification.

- Some stakeholders requested that the term "cord connected" be removed from the definition of an air cleaner. They argued that the specification should apply to all AC-mains connected types of portable room air cleaners, including "plug-ins".

EPA Response: EPA used the term "cord-connected" to be consistent with the definition provided in the AC-1 test standard. Furthermore, the scope of AC-1, provided in Section 2 of the standard, states: "This standard method applies to portable household electric cord-connected air cleaners as defined in Section 3 [Definitions]." This specification relies heavily on test methods provided in AC-1 and therefore it is important to be consistent with the definitions and requirements also provided in that standard.

EPA continues to be interested in cordless or other product types not addressed by this specification and may consider them in future versions of the specification. Furthermore, if language provided in AC-1 regarding the definition of an air cleaner changes, EPA will consider adopting the new definitions after careful review of these product types and their performance levels.

- Many stakeholders pointed out that under the definition of air cleaner, units without fans would not be allowed to qualify as ENERGY STAR. If these units can be tested to ANSI/AHAM AC-1 then they should be allowed to qualify. A recommendation was made to allow any air cleaner model capable of producing airflow to draw contaminants with a measurable CADR to qualify as ENERGY STAR.

EPA Response: EPA agreed that since fan-less air cleaners can be tested under AC-1 then they should be allowed to qualify as ENERGY STAR as long as they meet the minimum CADR/watt requirement. However, EPA also included a minimum 50 CADR requirement to ensure that sufficient airflow is demonstrated by these product types.

- There was some stakeholder interest in labeling combination products (i.e., air cleaners with humidifiers) as ENERGY STAR.

EPA Response: While EPA continues to be interested in combination products, both primary and secondary functions would need to be considered when testing the product's energy efficiency. Currently, air cleaning performance for this product type is measured with the secondary function turned off under AC-1. Therefore, the energy used by this secondary function is not taken into consideration. Based on stakeholder interest EPA may look into including these product types in future version of the specification once additional energy data is made available.

- There were a number of concerns regarding the inclusion of ozone generating air cleaners. These product types have been in the center of controversy regarding their impacts on consumer health in addition to their air cleaning performance.

EPA Response: To address these concerns, EPA added a UL safety requirement that for those products that emit ozone as a byproduct of air cleaning, the resulting ozone production must not exceed 50 ppb, in accordance with UL Standard 867. Furthermore, the minimum 50 CADR airflow requirement should eliminate those products that rely solely on ozone generation to clean the air (e.g. ozone generators), which are the focus of these concerns.

### **Energy Efficiency Performance Requirements**

- Many stakeholders were concerned with EPA's proposed use of CADR for Tobacco Smoke to measure the ability of the air cleaner to remove particulates from the air (e.g., CADR/watt ratio). This was primarily due to the fact that AC-1 doesn't measure the removal of the gaseous contaminants found in Tobacco Smoke. Some stakeholders also argued that air cleaners designed to capture larger particles such as pollen, which is more common within households, use smaller and more efficient motors but will not do well in CADR Tobacco Smoke tests. There were a number of suggestions provided to EPA in considering the performance of air cleaners including: (1) using a kWh/year measurement; (2) using an airflow-to-energy consumption ratio (CFM/watts); and (3) using CADR for Dust or Pollen instead.

Conversely, some stakeholders felt that tobacco CADR was the better indicator of air cleaning performance.

EPA Response: EPA initially chose tobacco smoke CADR because it is recognized by the U.S. Federal Trade Commission as having a reasonable scientific basis for making high-level performance claims. However, due to the challenges of measuring effective tobacco smoke removal (e.g., gaseous constituents), EPA decided to use dust as the proxy instead for testing and reporting CADR for ENERGY STAR qualification (CADR/watt).

Based on the product performance data provided to EPA, there is approximately 1% difference on average between dust and tobacco CADR ratings. This is due to the fact that dust particles are easier to hold on a filter due to their larger size; however, more airflow is required to bring the heavier particles to the air cleaner. Tobacco smoke particles are smaller and lighter and apt to remain airborne longer so the air cleaner must work harder to capture these particles. Based on these similarities and the controversy surrounding gaseous constituents of smoke, EPA decided to go with dust CADR.

- EPA received varying responses regarding the proposed 2.0 CADR/watt requirement. Some manufacturers requested that EPA lower this minimum level to 1.5 CADR/watts while others agreed with the level or even asked that it be raised to 2.5 CADR/watts. Stakeholders also were concerned that the chosen 2.0 CADR/watt level may not represent 25% of the market, which was EPA's stated goal. Some stakeholders recommended that EPA pursue 100% of the market instead of only 25%, which will result in greater exposure for the ENERGY STAR mark and program.

EPA Response: Since energy consumption data is not available for public review, EPA relied on industry supplied data to determine the appropriate level for ENERGY STAR qualification. The 2.0 CADR/watt level represents the information that was provided by manufacturers on their respective products and is the top 25% of performers within this database.

Initially, EPA sets levels to include only the top 25% of performers in the marketplace. These products yield the greatest energy savings and provide consumers with a tool for identifying those products that will ensure them high quality as well as savings on their utility bills. It is EPA's hope that those manufacturers who do not initially have ENERGY STAR qualified products will strive to meet these levels by improving quality and component efficiencies creating increased competition in the marketplace and slowly moving the market toward higher efficiency.

### **Testing and Verification**

- A number of stakeholders felt that it was important that EPA have a verification procedure in place so that products can be challenged and audited for performance claims, similar to what AHAM currently has in place.

EPA Response: EPA has testing efforts in place in order to evaluate the performance of ENERGY STAR qualified products sold in the marketplace. EPA may select an ENERGY STAR qualified model at random, or follow-up on claims regarding a specific model in question, and conduct testing to verify its reported performance. EPA has undertaken such efforts across all ENERGY STAR product categories to maintain the credibility and integrity of the ENERGY STAR brand in the marketplace.

EPA also added a Verification Test Protocol section within the specification that allows EPA to select a product at random and test it to ensure it performs within 3% of initially reported performance for ENERGY STAR qualification.

EPA did receive some concerns regarding the stringency of a 3% tolerance and agreed to increase it to 5% based on numerous discussions with manufacturers and a re-evaluation of the performance data submitted to EPA. This tolerance only applies to verification of existing ENERGY STAR qualified models found in the marketplace. Products qualifying as ENERGY STAR for the first time would need to meet or exceed the minimum 2.0 CADR/watt requirement. EPA felt that the 5% tolerance for verification was a reasonable level taking into account instrumentation errors and other slight variations in manufacturing and testing the products.

Lastly, a product performance review process, which provides the steps that EPA will take when handling claims made against a particular ENERGY STAR qualified models, was also included within the specification.

- One stakeholder felt that the current AC-1 test procedure is outdated and flawed. Furthermore, they felt that if EPA used this procedure then the ENERGY STAR program would promote less effective air cleaners. The inability of AC-1 to measure permanent particle removal and specifically, ultra-fine and gas particles means that only about 20% of all indoor particulates are actually captured and measured by this procedure. The stakeholder encouraged EPA to look for other means of measuring air cleaner performance under this specification.

EPA Response: EPA adopted AC-1 because of its general acceptance by the air cleaning industry and due to the fact that there is no other accepted, certified, and widely used alternatives for testing air cleaner performance. EPA continues to be open to the idea of developing a new test procedure but did not want to delay implementation of the air cleaner specification to perform the necessary research to develop, review, and test it within the marketplace. If presented with a potential new test procedure and comparisons of various air cleaner performances EPA may reopen the specification at a later date to consider using the new test method.

- There was some concern from manufacturers that the current testing and qualification requirement at high speed may not reflect how the product is actually being used by the consumer. Many cited reports of consumer usage most frequently at low and medium speeds. One manufacturer reported that based on their research 95% of entire usage is on low and medium speeds. Using the high speed level is not realistic for measuring air cleaner performance.

EPA Response: EPA kept the high speed testing requirement largely based on the fact that CADR values are measured and collected at high speed under the current AC-1 test procedure. Performance at high speed is a relative indicator of performance at lower speeds. In addition, requiring manufacturers to test at multiple speeds would create an additional cost burden for qualifying models as ENERGY STAR, without really affecting the outcome in terms of qualification.

- EPA received some comments regarding the appropriateness of using the IEC Standard 62301 to measure standby power while the test method was still in draft form.

EPA Response: To address the concern of referencing a draft test procedure that could change, EPA adopted certain testing and reporting requirements provided in the Draft IEC standard for measuring standby power in air cleaners. If changes are made to the IEC standard in its final form EPA will revisit those that might impact the requirement of the ENERGY STAR specification.

- A suggestion was made that the time in which a manufacturer is required to test the air cleaner match that of AC-1, which is 15 minutes. In addition, EPA should define the required sample size; AC-1 requires 3 samples to be tested.

EPA Response: EPA had initially suggested a minimum 20-minute operation with 1-minute intervals for measuring energy consumption. To be consistent with the existing AC-1 procedure, this testing requirement was changed to match its requirements for energy consumption testing.

### **Effective Date**

- Many stakeholders felt that the originally proposed January 1, 2004 effective date did not provide sufficient time for manufacturers to assess the proposed ENERGY STAR levels and prepare their product lines for qualification and labeling.

EPA Response: EPA proposed the January 1 effective date with the hope that the ENERGY STAR air cleaner program could be launched at the International Housewares Show at the end of March. Balancing stakeholder concerns with the goal of launching the program at this venue, EPA extended the effective date to March 15, 2005.

However, upon receipt of a number of comments and questions from stakeholders on the Draft 2 version, EPA decided to extend the effective date further to allow for additional discussions with industry. EPA then took the opportunity to meet with manufacturers during the Housewares Show to address outstanding issues and discuss an appropriate effective date. Based on these meetings a July 1, 2004 effective date was agreed upon and included in the final specification.

To address the general concern regarding lead time, EPA assured the manufacturers that additional time will be allowed for incorporating the ENERGY STAR logo into existing production runs (e.g., literature, product packaging).

## **V. EPA Rationale for Specification**

EPA uses a consistent set of criteria in the development and revision of specifications for ENERGY STAR qualified products. These criteria guide EPA in its decision making and help EPA ensure that ENERGY STAR will continue to be a trustworthy symbol for consumers to rely upon as they purchase products for the home or business and so that their purchases will deliver substantial environmental protection. These criteria include:

- Significant energy savings and environmental protection potential on a national basis;
- Product performance is maintained or enhanced;
- Qualified products will be cost-effective to the buyer;

- Efficiency can be achieved with several technology options, at least one of which is non-proprietary (i.e., not exclusive to proprietary technology);
- Product differentiation and testing are feasible; and
- Labeling would be effective and recognizable in the market.

Below EPA addresses the room air cleaner specification relative to each of these criteria.

- *Expected Energy Savings and Environmental Benefits.* This ENERGY STAR product category offers the following annual unit energy savings:
  - Models that earn the ENERGY STAR are 35% more energy-efficient than standard models.
  - Each ENERGY STAR qualified room air cleaner can save the consumer 215 kWh/year, or \$16 annually on utility bills. These savings could add up to as much as \$150 over the life of the air cleaner.

While developing the specification requirements, EPA projected that ENERGY STAR qualified air cleaners could save 0.13 millions of metric tons of carbon by 2010. This is equivalent to removing carbon dioxide pollution from 92,000 cars. The total dollar savings to consumers was projected to be \$300 million from 2003 – 2010.

EPA also included a 2 watt minimum standby requirement to ensure that each ENERGY STAR qualified air cleaner provides the consumer with total energy savings, in each operational mode.

- *Product Performance is Maintained or Enhanced.* EPA included the industry standard metric for air cleaning performance, Clean Air Delivery Rate (CADR), as part of the ENERGY STAR minimum performance requirement (CADR/watt) to ensure that this primary function was not sacrificed for lower energy consumption.

*Cost-effectiveness.* In general, ENERGY STAR performance requirements are easily attainable without significant increased cost to the manufacturer in redesigning a product to meet these levels. By adopting existing test procedures, EPA anticipated that testing for ENERGY STAR qualification will not be an increased cost burden to the manufacturers who wish to participate in the program.

EPA also performed a few simple payback calculations for room air cleaners. The simple payback calculation considers the initial cost of the high efficiency equipment to the consumer versus the annual energy savings from the use of the product. High efficiency is defined by the minimum ENERGY STAR performance level of  $\geq 2.0$  CADR/watts. Any unit with a performance level below 2.0 CADR/watts is considered standard, or non-ENERGY STAR. Below are some examples of potential cost savings to the consumer based on data provided by manufacturers and gathered via the Internet. Assumptions used in these calculations include the following: price of electricity = 7.6 cents/kWh, average lifetime of an air cleaner unit = 8.5 years, product usage = 24 hours, 7 days/week. Paybacks will vary based on utility rate and hours of use (e.g., for the sake of simplicity, continuous operation was used).

**CADR (100-150) category:** A non-ENERGY STAR model “A” is priced at \$99.99 while ENERGY STAR model “B” is priced at \$119.99.

Average annual energy savings = \$83/year  
Projected payback = 0.24 years.

**CADR (200-250) category:** A non-ENERGY STAR model “A” is priced at \$139.99, while ENERGY STAR model “B” is priced at \$169.99.

Average annual energy savings of \$146/year per unit.  
Projected payback = 0.21 years

- *Several Technology Options, including some with Non-proprietary Technology.* Several options exist for improving the energy performance of room air cleaners. The specification allows for a number of different technologies – fan and fanless, electrostatic and mechanical, programmable and manual, HEPA and ULPA filters – to qualify as ENERGY STAR as long as the model meets the minimum efficiency requirements.
- *Product Differentiation and Testing Procedure.* While developing the specification, EPA had access a database of energy performance and CADR data provided by air cleaner manufacturers and other industry stakeholders. In setting the minimum CADR/watt requirement, EPA used this database to draw a qualification line that included approximately 25% of the models listed, representing a range of top performers in the marketplace.

The specification uses the latest version of the ANSI/AHAM AC-1 standard, which is already being used by manufacturers to test CADR. As part of this procedure, manufacturers were already testing energy consumption to ensure that the motors were fully operational before performing the CADR tests. EPA worked closely with Intertek, the laboratory used by many manufacturers to test to AC-1, to develop an energy consumption test method to include in the specification, largely based on how the air cleaners are already being tested.

Lastly, EPA adopted the test method included in the IEC Standard 62301, which was still in draft form at the time of specification development, to measure standby. The specification will reference this international test procedure when it is finalized.

- *Labeling.* While the measurement of energy usage is not new to air cleaner manufacturers, the total watts that the product uses was never disclosed on product packaging nor was it used for purposes of comparing products. Energy consumption of an air cleaner has never been a deciding factor in the marketplace.

As such, EPA believes the ENERGY STAR mark serves an important role in the marketplace due to the absence of any other objective basis for end users to identify and manufacturers to promote highly efficient room air cleaners. By placing the ENERGY STAR label on the product, product packaging, and in literature it is EPA’s hope that the consumer can easily identify those models that can provide them energy savings in addition to air cleaning performance.

ENERGY STAR retailer partners represent well over 50% of room air cleaner sales including Home Depot, Lowe’s, and Sears. Many of these retailers have developed full lines of products for the “indoor home environment”. Air cleaners joins a list of ENERGY STAR qualified product offerings, which includes dehumidifiers, room air conditioners, ceiling fans,

and programmable thermostats. These retailers expressed interest in applying the label to air cleaners so that the consumer could identify those models that provide both comfort and energy savings within their existing suites of products.

There were a number of concerns regarding potential confusion about the relationship between ENERGY qualification and air cleaning performance. To inform and educate the consumer, qualified room air cleaners will carry a EPA-developed disclaimer label which explains that the ENERGY STAR represents the top energy performers and does not represent EPA's endorsement of air cleaning performance.