ENERGY STAR® Program Requirements
Product Specification for Room Air Cleaners

Eligibility Criteria
Draft: Version 1.2

Following is the Draft **Version 1.2** product specification for ENERGY STAR qualified room air cleaners. A product must meet all of the identified criteria if it is to earn the ENERGY STAR.

1) Definitions: Below are the definitions of the relevant terms in this document.

A. Room Air Cleaner: An electric cord-connected, portable appliance with the primary function of removing particulate matter from the air and which can be moved from room to room.

1. Fan with Filter: Air cleaner that operates with an electrical source of power and contains a motor and fan for drawing air through a filter(s).

2. Fan with Filter and Electrostatic Plates: Air cleaner which operates with a fan and filter(s) that incorporates electrically charged plates or wires to electrostatically collect particulate matter.

3. Fan Filter with Ion Generator: Air cleaner that incorporates an ion generator in addition to a fan and filter.

4. Ion Generator: Air cleaner that incorporates an ion generator only.

5. Hybrid: An air cleaner embodying more than one distinctive cleaning modality.

6. Combination Product: An air cleaner that includes a secondary function, other than air cleaning technology, within the same housing such as a humidifier or dehumidifier.

7. Ozone Generator: A device intended to reduce or eliminate microorganisms within a room solely by means of introducing ozone into the room environment.

B. Clean Air Delivery Rate (CADR): The measure of the delivery of specified, particulate-free air produced by a household electric, cord-connected room air cleaner. More technically, CADR represents the rate of particulate contaminant reduction in the test chamber when the unit is turned on, minus the rate of natural decay when the unit is not running, times the volume of the test chamber as measured in cubic feet [$\mathbf{(RCR - RND) * V}$]. Each type of particulate contaminant receives a test value, which includes: CADR for Dust; CADR for Tobacco Smoke; and CADR for Pollen. **Note:** CADR always measures a unit's performance as a complete system and has no linear relationship to the air movement per se or to the characteristics of any particular filter medium.

C. Standby Mode: The lowest power consumption mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when an air cleaner unit is connected to the main electricity supply and used in accordance with the manufacturer's instructions. For purposes of this specification, this is also defined as the mode at which energy is consumed by the air cleaner to support only the secondary consumer features such as: clocks, remote controls, and other programmable functions while the primary function is inactive.

D. Standby Power: The average power in standby mode, measured in Watts.

2) Scope:

A. Included Products: Products that meet the definition of a Room Air Cleaner as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B. Qualifying air cleaner models shall produce a minimum 50 CADR for Dust to be considered under this specification.

B. Excluded Products: Combination products and ozone generators, as defined in Sections 1.A.6 and 7, are not eligible for ENERGY STAR.

3) Qualification Criteria:

A. CADR/Watt Requirement: To qualify for ENERGY STAR, calculated CADR/Watt shall be equal to or greater than 2.0 CADR/Watt (Dust).

B. UL Safety Requirements for Ozone Emitting Models: To qualify for ENERGY STAR, measured ozone shall not exceed 50 parts per billion (ppb).

C. Standby Power Requirement: To qualify for ENERGY STAR, measured standby power shall not exceed 2 Watts.

D. Significant Digits and Rounding:

a. All calculations shall be carried out with actual measured or observed values. Calculated results shall be rounded using the following principles:

- **CADR and Energy Consumption and Standby Power:** According to guidance provided in ANSI/AHAM AC-1-2006.

- **Ozone Generation:** Only the final result of a calculation shall be rounded. Calculated results shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

b. Unless otherwise specified, compliance with specification limit shall be evaluated using exact values without any benefit from rounding.

4) Test Requirements:

A. Each individual model which is intended to be marketed and labeled as ENERGY STAR shall be tested and meet the requirements of this specification to be qualified as ENERGY STAR . Qualification based on product family is not acceptable under this specification. Each model shall be tested to the following requirements:

a. Single Sample Approach: One unit will be selected, obtained, and tested. The measured performance of this unit and of all units sold must be equal to or better than the ENERGY STAR specification requirements.

$CADR_{Test} \geq$ ENERGY STAR CADR Criteria

Measured $Ozone_{Test} \leq$ ENERGY STAR Ozone Criteria

$Standby\ Power_{Test} \leq$ ENERGY STAR Standby Power Criteria

Or,

b. Multi-Sample Approach: A sample of four units of each model shall be selected for testing. Test results from the four units will be used to determine if the model meets the ENERGY STAR specification, as follows.

The following will be calculated on the sample of four units:

Mean (*x*)	$x = \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)$	n = 4 (number of units tested) X_i = measured energy efficiency or consumption from test *i*
Standard Deviation (s)	$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - x)^2}{n-1}}$	
Standard Error (s_x)	$s_x = \frac{s}{\sqrt{n}}$	
Lower Confidence Limit (*LCL*)	$LCL = EES - ts_x$	*EES* = energy efficiency specification (CADR) *t* = 3.182 (97.5% one-sided student's t statistic for a sample size of 4)
Upper Confidence Limit (*UCL*)	$UCL = ECS + ts_x$	*ECS* = energy consumption specification (Standby power or estimated ozone measurement)
5% tolerance on *LCL*	$LCL(0.05) = 0.95 * EES$	
5% tolerance on *UCL*	$UCL\ (0.05) = 1.05 * ECS$	

For CADR, the *LCL* and *LCL*(0.05) are compared, and the greater value is compared to the mean (*x*). The model meets the ENERGY STAR specification if the sample mean is equal to or greater than the lower control limit.

$$Mean\ (x) \geq LCL\ or\ LCL\ (.05),\ whichever\ is\ greater$$

For Standby power or estimated ozone measurement, the *UCL* and *UCL*(0.05) are compared, and the smaller value is compared to the mean (*x*). The model meets the ENERGY STAR specification if the sample mean is equal to or less than the upper control limit.

$$Mean\ (x) \leq UCL\ or\ UCL\ (.05),\ whichever\ is\ smaller$$

Note: Given that the CADR test relies on particle counting, it involves substantial statistical uncertainty which is not dependent on test or sensor design. EPA's concern is that requiring every unit sold to meet the CADR requirement despite this uncertainty may encourage manufacturers to rate their units more conservatively, which in turn could result in consumers purchasing larger size units than required for their space and consuming more energy than needed. To address this, EPA is adding the option of testing multiple samples of the same unit for qualification and basing their ratings on the results of the mean of the test samples as defined above.

Models qualified using a single sample will also be verified by testing a single sample. Models qualified using multiple samples will be verified with multiple samples.

B. When testing room air cleaners, the following test methods shall be used to determine ENERGY STAR qualification:

Table 1: Test Methods for ENERGY STAR Qualification	
ENERGY STAR Requirement	**Test Method Reference**
CADR/Watt	ANSI/AHAM AC-1-2006: *Method of Measuring the Performance of Portable Household Electric Room Air Cleaners*
Ozone Generation	UL 867 Ed. 4.0 *Electrostatic Air Cleaners*
Standby Power	IEC 62301 Ed. 1.0 *Household electrical appliances - Measurement of standby power*

5) Effective Date: The ENERGY STAR Room Air Cleaner specification shall take effect on **July 1, 2004**. To qualify for ENERGY STAR, a product model must meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.

6) Future Specification Revisions: EPA reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that ENERGY STAR qualification is not automatically granted for the life of a product model.