| Topic | Stakeholder Comment | EPA and DOE Response |
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| **Discussion Questions 1 & 2** | | |
| Scope | Two stakeholders noted that there isn't a current standard definition of "harmful-byproducts", nor a test method to measure emissions of byproducts. These stakeholders suggested that EPA not change the scope.<br><br>One stakeholder agrees with EPA that air cleaners utilizing photocatalyst or plasma may create harmful byproducts during use and recommends these types of product be excluded from ENERGY STAR. They recommended that data be provided to show that products do not form harmful byproducts in real use. They noted a lack of a test method to validate that harmful byproducts are not present but suggested including a mandatory checklist on the ENERGY STAR Qualified Product List (QPL) of all the various air cleaning technologies utilized in the product<br><br>Four stakeholders suggested that EPA refine the definitions of product types included in scope to ensure that unit shipment data includes only those products in scope. They noted a discrepancy between ENERGY STAR market penetration and retailer sales information from the ENERGY STAR Retail Products Platform (ESRPP), which indicates a much higher market penetration in certain regions of the country. | EPA will continue to exclude ozone generators and products that emit more than 50 parts per billion of ozone, per UL 867, due to health concerns with ozone generation as a byproduct of room air cleaner operation.<br><br>Due to a lack of test to verify production of harmful byproducts, EPA will focus on making available on the ENERGY STAR Room Air Cleaners web page consumer buying guidance that can help consumers make the best choices regarding product types that meet their objectives.<br><br>The scope of the Version 2.0 has been edited to reflect these changes and the Unit Shipment Data form will reference the Version 2.0 scope when it has been finalized. EPA believes the scope and definitions in the Draft 1 Specification make it clear which products are eligible for certification to Version 2.0 but appreciates any specific feedback if stakeholders believe there is an opportunity to more clearly differentiate product types and exclusions. |

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| **Discussion Questions 3 & 4** | | |
| Technological Advancements - Motors | Two stakeholders noted that EPA should not set criteria that would require the use of specific technology or dictate design, specifically EPA should not require DC motors. One of these commenters requested that EPA analyze the degree to which certain technologies provide efficiency gains, the costs required to implement those technologies, and what technologies would be required to meet the Version 2.0 criteria in order to assess consumer payback.<br><br>One stakeholder agreed that replacing AC motors with high efficiency DC motors is one of the most direct methods to improve the energy efficiency of an air cleaner product, though the cost of switching to a DC motor is not trivial for manufacturers. Three stakeholders noted that the prevalence of room air cleaners with DC motors in the market is small. One commenter stated that prevalence grows with product cost (more expensive products can more easily implement a DC motor because it is a smaller percentage of the overall product cost).<br><br>Four stakeholders suggested that DC motor technology be reported and listed as a field in the QPL in the upcoming specification revision to better understand DC motor prevalence and efficiency impacts. | EPA will not require DC motors be used to meet the ENERGY STAR requirements for Room Air Cleaners. DC motors and more efficient AC motors were cited by stakeholders as reasons for significant efficiency gains in room air cleaners in the past decade. As a result, EPA cited DC motors in the Discussion Guide as one reason for improvements in efficiency but is not setting criteria based on the type of motor used in a room air cleaner.<br><br>Since stakeholders noted that it would be beneficial to understand the impacts a DC motor may have on efficiency, EPA plans to include educational material on motor type on the ENERGY STAR Room Air Cleaners consumer page. |
| **Discussion Questions 5, 7, & 8** | | |
| Network Connected Products | Three stakeholders requested that EPA provide an adder for network connected products since it provides functionality for the consumer. One of these stakeholders noted that this feature can result in reduced power consumption when the consumer is not home however, this may result in an increase in pollutant levels. They also noted that outdoor air quality data should not be used to adjust air cleaners because it is not representative of the quality of the air indoors. Another stakeholder noted that implementation cost inhibits this technology from becoming mainstream.<br><br>Four stakeholders supported EPA's inclusion of optional connected criteria to provide manufacturers with guidelines on how products should respond to utility signals. They also noted that network connected products can result in reduced energy use, flatten peak demand, and allow grid flexibility to align with renewable energy generation. They also recommended that network connected products are indicated as capable of this feature on the QPL.<br><br>Two stakeholders warned against creating criteria that may inhibit innovation. Specifically, network connection may cause an increase in standby power. If EPA increases stringency of standby requirements, this may result in networked products being unable to meet ENERGY STAR, despite connectivity being a feature that consumers want. | EPA is not aware of any current utility demand response programs for room air cleaners. Also, the energy use of room air cleaners does not appear to represent as significant of an opportunity for demand response programs when compared to large load products, like water heaters or central air conditions. As a result, EPA does not plan to develop connected functionality criteria for this product category at this time but will keep an eye on the potential to include optional demand response criteria in the future.<br><br>However, given the growing prevalence of networking capability among these products and the benefits it may offer consumers, EPA has included a Partial On Mode Network Connected power allowance in the Draft 1 Specification. |

| **Discussion Question 6** | | |
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| Sensors | Two stakeholders stated that EPA should find a way to credit products with sensors.<br><br>Another stakeholder noted that sensors can be an expensive add-on feature that has a much smaller presence at in-store retail channels, though these sensors appear to be a more common feature among devices available online. They also stated that air quality sensors are typically paired with a variable speed feature, a feature that automatically changes fan speed depending on sensed indoor air quality. The implementation of this variable speed feature will be dependent on a manufacturer's implementation/algorithm.<br><br>Two of these commenters noted that a wide variety of sensors are used - with varying sensitivities and accuracies. | EPA appreciates these stakeholder comments. EPA recognizes there does seem to be an increasing amount of room air cleaner models featuring an air quality sensor, however, EPA is hesitant at this time to credit models for including a sensor without understanding the effectiveness of the sensor as a component and, more importantly, the algorithm the room air cleaner uses in response to the sensor's input. Sensing air quality and adjusting a room air cleaner's speed in order the ensure the air quality is maintained above a certain appropriate air quality threshold and at a lower operating level is a promising opportunity to reduce unnecessary energy use. However, the lack of a test method to ensure air quality is maintained when fan speed is controlled by an air quality sensor's feedback, as well as the risk to consumer's health if it is not, weigh too heavily against EPA considering a credit for sensors at this time.<br><br>EPA continues to be interested in this potential energy saving feature and encourages stakeholders to share information and data with EPA to better support the ability to recognize and measure the quality control and energy savings of models with air quality sensors in the future. EPA will continue to watch this segment of room air cleaner products as there is a lot of promise for energy savings. Once there is greater confidence in room air cleaners with sensors and a way to verify they are delivering the promised benefits, then EPA would be more likely to highlight them. |

| **Discussion Question 9** | | |
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| Efficiency & Product Size | Three stakeholders were against EPA taking action to differentiate the size of CADR units, with two noting that it could result in manufacturers being incentivized to cap performance to be placed in a lower size bin, where the criteria is less stringent. Another stakeholder stressed the importance of ensuring that all unit sizes have a fair chance to remain in the market to serve all types of consumers.<br><br>Five stakeholders supported the initiative to separate products by CADR size in order to reflect inherit differences in efficiency associated with CADR size. Four stakeholders noted that sales weighted data for the ESRPP shows a relationship between CADR/W and product size. One of these commenters noted that consumer research indicates that room size and price are top features used to purchase an air cleaner. In general, smaller models are less expensive and tend to outpace larger, more expensive models in terms of unit sales. Larger models typically have more add-on features, like advanced electronic controls and air quality sensors, which may result in some energy savings. They suggested that EPA use the following size bins to set criteria:<br>1. CADR ≤ 100 (small to medium rooms)<br>2. 100 < CADR ≤ 200 (medium to larger rooms)<br>3. CADR > 200 (large to very large rooms) | EPA heard from stakeholders that smaller-CADR products, that offer a lower cost option for small rooms, have more difficulty achieving ENERGY STAR than larger-CADR products. EPA has performed an analysis to review the relationship between product size, or CADR, and the energy efficiency, measured in CADR/W. This analysis confirmed that smaller CADR products appear to be inherently less efficient than larger CADR products. As a result, EPA has set criteria based on efficiency bins. The criteria proposed in the Draft 1 Specification is intended to target the top 25% of models available on the market, in each size bin. EPA believes the proposal to set criteria based on CADR will ensure consumers have a wide range of choices in each size bin of room air cleaners and will not inadvertently choose a product that is under or oversized for their space. |

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| **Discussion Question 24, 25, & 26** | | |
| Contaminant Type Criteria | Five stakeholders agreed that EPA should consider smoke CADR measurements, instead of dust CADR to set energy efficiency criteria. They noted several reasons for switching to smoke CADR:<br>• It is used to calculate which product size would be most appropriate based on a consumer's room size. Consumers rely more on room size rating than CADR when purchasing<br>• It is a common global indoor pollutant<br>• Smoke has the smallest particle size of the three pollutant types tested in the AHAM test method and would result in the most stringent criteria<br>• It is typically used for internal testing to determine product performance and smoke CADR provides repeatable and reproducible tests, where pollen results in more variable test results<br>• Using multiple pollutant types to set criteria may cause confusion for consumers and testing burden for manufacturers<br>Five stakeholders suggested that EPA consider smoke, and larger particle size pollutants as well, when setting efficiency criteria. Four of these stakeholders noted that the filtration of larger particles will require less energy than smaller particle filtration. One noted that EPA could use the average of the three particle CADR/W to determine compliance with ENERGY STAR, which would give a better overview of air purifier efficiency. | EPA appreciates these comments and has adopted efficiency requirements based on smoke CADR/W in the Draft 1 Version 2.0 specification. EPA believes that smoke, which has the smallest particle size of the three pollutants tested in the ENERGY STAR test procedure, is an appropriate pollutant for an efficiency evaluation of all room air cleaner types. Since particles in the smoke size range are the most energy intensive to remove, EPA does not see additional benefit in including criteria for dust and pollen. However, EPA will continue to report the CADR for all three pollutant types to enable consumers to inform consumer purchases. |
| **Discussion Question 24, 25, & 26** | | |
| Testing - Contaminant Type | Two stakeholders opposed DOE and EPA's proposal to fill a test room with multiple contaminants simultaneously, noting:<br>• Smoke CADR is known to be a highly repeatable and reproducible test (because it has a very low natural decay) and should be measured to determine energy efficiency, where large contaminants (e.g., pollen) have much lower repeatability because they settle quicker<br>• Different particle counters are required for each contaminant<br>• AC-1 has a more accurate and simpler testing approach | DOE and EPA appreciate the feedback regarding the feasibility of testing a room air cleaner with multiple contaminants simultaneously. In light of the issues raised, DOE and EPA agree that testing a single contaminant is the least burdensome and most repeatable and reproducible approach. |

| **Discussion Question 11, 12, & 13** | | |
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| Filter Performance - Filter Type | Five stakeholders agreed that EPA should not add filter efficiency criteria and prefer use of the industry-standard ANSI/AHAM test method to determine CADR as the primary air cleaning performance metric. These commenters did not believe EPA should exclude any filter types from shipping with ENERGY STAR products. Reasons provided to not include filter efficiency in ENERGY STAR include:<br>• CADR is not solely dependent on any filter technology and the same CADR could be achieved using different combinations of filters and product designs<br>• This requirement would influence the use of specific components but does not take system efficiency into account<br>• Most filters do not undergo efficiency testing and it would increase testing burden<br><br>Two stakeholders suggested adding a filter efficiency requirement. One of these commenters recommended requiring specific filter types depending on use cases. One stakeholder stressed the importance of using HEPA filters and excluding the melt blown filter type. | Ensuring that product performance is not compromised even as efficiency improves is a key tenet of ENERGY STAR and is the reason EPA considered a filter type requirement. However, EPA understands that product design and filter type both contribute to a product's air cleaning effectiveness, or CADR. As a result, EPA proposes to require that a product be shipped with the filter with which it is tested so the consumer should realize a similar CADR and CADR/W to that reported based on the test method. |

| **Discussion Questions 14, 15, 16, & 17** | | |
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| Noise Criteria | Five stakeholders did not agree with the proposal to set requirements on fan noise. These stakeholders noted the following:<br>• Some manufacturers report metrics on noise on product packaging, but they are based on different test methods and fan speeds making it difficult to compare noise levels across products and thus, making it difficult to set an appropriate minimum noise level<br>• EPA should not implement a noise requirement since this category does not affect energy efficiency<br>• EPA should consider if performance or features, such as noise, may be negatively impacted by more stringent efficiency requirements<br>• Manufacturers themselves have the most interest in ensuring that consumers receive superior performance and are satisfied with the product, regardless of the energy efficiency of the product<br>• The studies that note noise as a concern for consumers may be outdate and it is not known what noise levels would be acceptable to consumers<br>• There is no available sound data to demonstrate an issue with product noise<br>• Decreasing fan speed will decrease noise but will result in larger, more expensive products<br><br>Four stakeholders invited the collection of fan noise in the new specification revision. Another stakeholder said if EPA does require a minimum noise level, the ANSI-AHAM AC-2-2006 is the most appropriate method. A different stakeholder said if EPA does require a minimum noise level, it should be based on international standards, not ANSI-AHAM AC-2-2006. | EPA appreciates these comments. While EPA still has concerns that some consumers will turn off their room air cleaners because of noise when operating at the maximum fan speed, EPA understands different consumers may have preferences when it comes to fan noise and some consumers may prefer it as a source of white noise.<br><br>Consistent with the ENERGY STAR Guiding Principles, EPA seeks to ensure that ENERGY STAR efficiency requirements do not lead to a compromise in product performance. To this end, the Agency reserves the option to consider maximum sound level criteria for ENERGY STAR room air cleaners in the future if significant product performance issues are identified. However, in the Draft 1 Specification, EPA is not including any noise requirements. |

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| **Discussion Question 18** | | |
| Partial On Mode Power (previously Standby Mode Power) | Three stakeholders stated that by decreasing the maximum standby level criteria, products may lose important consumer-preferred functionalities. Four stakeholders encouraged EPA to consider specific features as adders when setting a new standby power level. | Given the growing prevalence of network capability among room air cleaners on the market, the benefits it may offer consumers, as well as the energy savings potential it may provide, EPA has included a Partial On Mode Network Connected power allowance of 1 Watt in the Draft 1 Specification for products that have Wi-Fi capability.<br><br>However, EPA has lowered the Maximum Partial On Mode power requirement from 2 Watts to 1 Watt in Draft 1. EPA-recognized air cleaner laboratories have indicated that testing is done with all features enabled that are enabled by default when the product is shipped - this specifically includes network connectivity. Since products with network connectivity enabled are already able to meet the Version 1.2 standby power requirements, EPA believes that lowering the Maximum Partial On Mode power requirement while offering an allowance for Wi-Fi enabled models, will encourage efficiency in Partial On Mode while not penalizing products that offer a Wi-Fi networking feature. |
| **Discussion Questions 19 & 20** | | |
| Efficiency & Performance - Efficiency Assessment | Five stakeholders recommended the ENERGY STAR efficiency criteria be made more stringent since there are many models at or much higher than the current ENERGY STAR efficiency criteria. Two stakeholders stated ENERGY STAR should evaluate new efficiency levels based on shipment weighted data, not on model data alone and include non-ENERGY STAR models in the evaluation. One stakeholder recommends that ENERGY STAR models be required to claim room size according to the calculation procedure defined in the AHAM Room Air Cleaner Certification Program. | EPA appreciates these comments and notes that using shipment-weighted data runs the risk of failing to support the Agency's intent of defining and recognizing leadership in energy efficiency performance, as it typically would produce a result that continues the status quo.<br><br>In the Version 2.0 Draft 1 Specification, EPA has included efficiency criteria for smoke CADR/W. The criteria proposed in the Draft 1 Specification is intended to target the top 25% of models available on the market, in each size bin.<br><br>EPA will include the room size for each model, as defined by AHAM, on the Certified Product List. |

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| Market Assessment - Market Penetration | Two stakeholders believe EPA should rely on ENERGY STAR shipment-weighted market penetration when evaluating the need for a revision to a specification. Four stakeholders support EPA's efforts to revise the specification based on an ENERGY STAR penetration rate of over 90% in the ESRPP sales of room air cleaners. | EPA appreciates these comments and believes that the ENERGY STAR Retail Products Platform data is informative and valuable for specification development efforts. However, EPA will evaluate the ENERGY STAR market penetration consistent with the ENERGY STAR Guiding Principles and based on the Unit Shipment Data, which provides a national estimate for shipments at all retailers. |
| **Discussion Questions 21, 22, & 23** | | |
| Testing - Contaminant Level | Three stakeholders recommend that the AHAM test method be followed in regard to contaminant levels introduced in the test chamber. They suggested that EPA and DOE should consider connecting power meter equipment during the smoke test, instead of dust, to determine CADR/W specific to smoke.<br><br>One of these stakeholders notes that decreasing the number of particles tested will severely diminish the repeatability and reproducibility of the test.<br><br>Another noted that particle detectors must be able to reliably measure particle count across multiple decades of concentration. Decreasing the initial particle concentration will impact the ability to measure high CADR devices because at the end of the test, there may be insufficient particle counts to provide reliable data. To maintain a stable test method, the final particle count must not fall below a certain threshold, so it may be possible to start at higher concentrations for higher CADR models and lower concentrations for lower CADR models, but the benefits to the consumer of changing the test to do this are unclear. | DOE and EPA appreciate the feedback regarding whether the room air cleaner test would be improved by having a lower starting concentration of contaminant. Based on stakeholder feedback, DOE and EPA expect that reducing the initial concentration may introduce variation in the test and may also limit the ability to properly measure the performance of larger and more efficient room air cleaners. Therefore, DOE and EPA plan to retain the current initial room contaminant concentration level. |
| **Discussion Question 27** | | |
| Testing - Control Speed | Four stakeholders recommend EPA follow the AHAM AC-1-2015 standard and maximum control speed be used as the testing standard. One of these commenters encouraged DOE and EPA to participate in the AC-1 task force to raise the issue of testing at multiple speeds, noting that an ENERGY STAR specification revision is not the best way to make this change. Another stakeholder noted that the approach to use maximum fan speed is consistent with other countries methodologies. They also stated that since manufacturers have differing fan speed options, it would be difficult to determine a fair and consistent setting to test and compare results for multiple brands. | DOE and EPA appreciate the comments regarding the fan speed during testing, and in light of the concerns raised, agree that using the maximum control speed is most appropriate at this time. DOE and EPA also appreciate the invitation to participate in the AC-1 task force and look forward to participating. |

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| **Discussion Question 28** | | |
| Testing - Test Duration | Two stakeholders supported maintaining the current ANSI/AHAM test method duration time - noting that air cleaners that require a test period longer than 20 minutes typically have a very low CADR. Another stakeholder stated that a longer test would require a higher particle concentration and it would not provide more accurate CADR information than the current testing approach.<br><br>One stakeholder suggested reducing the test period and introducing maximum control speed. Another stakeholder believed that products including filters with activated carbon will have a lower CADR/W than a filter that does not have activated carbon. This stakeholder noted that activated carbon will produce lower CADR particle rates. | DOE and EPA appreciate the feedback regarding the test duration and agree that maintaining the current 20-minute test is appropriate given the state of the market and relationship between test duration and initial room concentration during testing. |
| **Discussion Question 29** | | |
| Testing - Filter Condition | Four stakeholders state a used filter test will prove difficult to define specific testing criteria and also note that such a test will be overly burdensome, not objective, and expensive for manufacturers. | DOE and EPA appreciate the feedback regarding a potential used filter test, and agree that testing with a new filter is appropriate, given the variability and burden associated with performing a used filter test. |
| Testing - Test Method | Several stakeholders recommended maintaining the AHAM test procedure, without deviation. These stakeholders also noted that AHAM's specification is most consistent across industry standards and changing from this practice will cause undue burden. One of these stakeholders welcomed EPA and DOE participation in AHAM's task force to review the industry test procedure, rather than to make changes that are specific to ENERGY STAR. They noted that this violates Presidential mandates requiring Federal agencies to rely on consensus standards and will cause confusion for manufacturers and consumers.<br><br>Four stakeholders suggested that DOE refine the testing conditions and methods to better reflect actual product performance. | DOE and EPA appreciate the invitation to participate in the AHAM AC-1 task force and look forward to participating. |