December 6, 2018

Dear ENERGY STAR team,

Thank you for forming an inclusive process of feedback for the determination of criteria for the ENERGY STAR Version 2.0 Room Air Cleaners Specification. We have carefully considered the questions raised in the Version 2.0 Room Air Cleaners Discussion Guide, and we are pleased to be able to submit the following responses.

1. Are there other product types EPA should consider excluding based on health concerns?
   - As noted in the July 2018 document published by the EPA, Residential Air Cleaners: A Technical Summary, air cleaners utilizing photocatalyst or plasma may create harmful byproducts during use. 3M recommends that these products be excluded from the ENERGY STAR program unless comprehensive data is provided to show an individual product does not form harmful byproducts in real use, in typical homes, under conditions of typical VOC content and concentration.
2. How would EPA verify that these contaminants are excluded? Are they reported in the owner's manual?
   - 3M is not aware of current products using photocatalyst or plasma technologies reporting the potential for byproduct formation in the product owner's manual. One path to verification would be to include a mandatory checklist on the ENERGY STAR application of all the various air cleaning technologies utilized in the product, similar to how the California Air Resources Board ozone certification program requires the identification of whether air cleaner products are mechanical filtration or may have ozone byproduct. We note, however, the lack of a broadly accepted industry test method for determining the presence of byproducts in a simulated home-use condition.
3. Request for Data: EPA welcomes stakeholder data on the efficiency of non-ENERGY STAR products. No response provided
4. Other Technological Advancements: EPA is interested in understanding the prevalence of DC motor products in the market today and in the near future. EPA is also interested in feedback on new technology that may be implemented, or a new product type that may increase a product's energy efficiency.
   - From our work both in the US and globally, 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. However, it should be noted that converting from an AC motor to a DC motor is not a trivial or inexpensive undertaking; in addition to the increased cost of the motor itself, a DC motor requires an electronic control board to power and control the motor, which further adds cost. Likely due to these added costs, and from our internal market surveys and competitive analysis, we have identified relatively few air cleaners in the home center and mass retail markets which incorporate DC motors. The prevalence increases for more expensive devices which are more commonly found online and in specialty channels, and for larger and more expensive devices found at retail, in which the DC motor cost may be a smaller percentage of the overall product cost.
5. Prevalence and efficacy of connected products: EPA would appreciate feedback on the prevalence and efficacy of network-connected room air cleaners in adjusting settings to respond to local air quality. No response provided
6. Prevalence and efficacy of sensors: EPA would like feedback on both the prevalence of sensors in room air cleaners and their efficacy in adjusting settings to respond to room conditions.
   - Air quality sensors also tend to be an expensive add-on feature, and like DC motors, they have a much smaller presence among most air cleaners available at common home center and mass retail channels. Air quality sensors do appear to be more common among devices available online. On air cleaners utilizing an air quality sensor, the AQ sensor is typically paired with an "automatic" fan speed mode, in which the air cleaner will adjust the fan speed up and down according to the indoor air quality. It is noted, however, that a wide range of different air quality sensors are employed, with varying sensitivities and qualities. The settings for the automatic change of fan speed also appear to be determined on a manufacturer by manufacturer, or even product by product, basis.

7. Consumer value of network-connected air cleaners: EPA would like to understand better the full consumer value offered by a network-connected product. In particular, EPA seeks insights into health, comfort, and energy savings benefits.
    - No response provided
8. Demand Response: EPA received a request to establish optional connected criteria/demand response criteria to give guidelines for partners on how their products respond to utility signals. EPA seeks feedback on grid benefit as well as any health risks associated with decreasing the product's operation speed due to a demand response event? □ No response provided
9. What motivates consumer purchases for specific sizes of air cleaners? What drives higher efficiency in larger units? If EPA were to bin products by size, what boundaries for the CADR size bins should EPA consider when proposing new criteria?
    - Based on 3M-sponsored consumer research, room size and price are two of the top air cleaner features for consumers selecting a new air cleaner. Most commonly, smaller room size (and thus smaller CADR) models sell for lower cost than larger room size models, and at least in some channels the lower cost/size air purifiers can significantly outpace higher cost/size in terms of unit sales. Larger units with higher CADR and room size are typically more expensive, but they also commonly include additional value-add features like more advanced electronic controls, air quality sensors, and others, and they may additionally include an energy saving value-add feature like a DC motor. In such a situation, the inclusion of a DC motor may be a smaller percentage of the overall product cost than if it was included on a more simple, basic, and smaller device.
    - One suggestion for creating CADR size bins is a three-bin approach:
        1. CADR $\leq$ 100 (small to medium rooms)
        2. 100 < CADR $\leq$ 200 (medium to larger rooms)
        3. CADR > 200 (large to very large rooms)
10. The Agency understands that smoke pollutants can have the greatest health risk for the general population (all ages, all degrees of allergenicity). In addition, some room air cleaners may be designed to optimize the removal of a specific pollutant type that is of the greatest concern for a consumer – smoke, dust, or pollen. EPA would appreciate stakeholder feedback on establishing energy efficiency requirements for smoke and pollen removal efficiency, in addition to dust. Do consumers select products based on pollutant type addressed? Does addressing all three types of pollutants extend greater benefit to consumers?
    - Based on our consumer insights work and understanding, consumers rely more on room size rating than on CADR for selecting an appropriate air cleaner. Since smoke CADR is used to determine the appropriate room size and has in our experience always been the most stringent criteria, 3M recommends setting energy efficiency criteria based on the smoke CADR. Additionally, we believe that one the strengths of the ENERGY STAR air cleaner program is the simple but highly effective metric of the CADR to watt ratio based on a single pollutant. We do not believe that widening the criteria to include multiple pollutants with potentially different energy efficiency ratios will drive consumer value, and it only serves to complicate and put undue burdens on the application process. Furthermore, the pollen CADR is well-known to have a much higher variability, as witnessed by a resubstantiation window twice as wide as either smoke or dust, so setting energy efficiency on the pollen CADR may produce unstable and unreliable results.
11. For products that use a filter, EPA is considering requiring a specific filter type (i.e., HEPA) or a minimum filter efficiency to ship with products that qualify for ENERGY STAR. Should EPA identify these using the ANSI/AHAM definition or another industry accepted definition?
    - 3M strongly supports the industry-standard ANSI/AHAM test method for determining CADR. One of the strong values of measuring CADR is that it measures neither the filter efficiency nor the airflow of a product, it measures the combined air cleaning speed of the entire room air purifier system. The same CADR may be achieved in different combinations of filter efficiency and product design, but in the end the same CADR means the different combinations still clean the air at the same speed. Adding filter-specific criteria, including an efficiency requirement, would bring additional burden to manufacturers without providing a tangible consumer or energy efficiency benefit. For these reasons, we recommend against applying any specific filter criteria to the ENERGY STAR program.

12. Are there filter types EPA should consider excluding from being shipped with ENERGY STAR products?
    - Due to our response to Question 11, we do not believe any filter types should be excluded from being shipped with ENERGY STAR products.
13. Do most room air cleaner filters undergo efficiency testing, or is this typically only carried out for those that meet the HEPA standards?
    - All 3M room air cleaner filters undergo efficiency testing to the extent necessary to substantiate and maintain confidence in product claims for filter efficiency levels. From our survey of the market, it appears multiple other companies also provide filter efficiency claims on their products, including both HEPA and non-HEPA filters. Through competitive testing and analysis, we have identified that the basis and test method for efficiency testing tends to vary, at times significantly, within the market.
14. Do manufacturers include metrics on air cleaner noise on product packaging? If so, what metrics?
    - 3M currently does not include metrics on air cleaner noise on product packaging. Through our evaluation of other brands' air cleaners over a period of years, we have observed air cleaners claiming noise based on different fan speeds, different test methods, and sometimes narrow portions of the overall noise distribution. With such a wide range of noise criteria and the lack of claimed noise by multiple brands, we have found it nearly impossible to compare noise ratings/levels from multiple brands and products without purchasing and testing the devices ourselves.
15. Is ANSI-AHAM AC-2-2006 the most appropriate method on which to base a noise floor?
    - If a noise metric is deemed critical to the ENERGY STAR program, yes, we believe the ANSI-AHAM AC-2-2006 is the most appropriate method to use.
16. Is there an appropriate sound performance floor for room air cleaners such as one based on that for a room air conditioner?
    - Due to the lack of a broadly used, consistent noise testing method, it seems premature to assign a numerical sound performance floor for the ENERGY STAR Version 2.0 Room Air Cleaners Specification, particularly if a final version is expected to publish in summer, 2019. If such criteria are strongly desired, 3M recommends a market-wide testing survey to be undertaken to better understand the range of noise levels of existing products, both ENERGY STAR and non-ENERGY STAR, as well as consumer research into the acceptable noise levels for air cleaners in the home. Our consumer insights work has shown noise to be a polarizing issue: some consumers are sensitive and want only very minimal noise, while others much appreciate a steady, "white noise."
17. What options are available to manufacturers to reduce a product's noise when at maximum fan speed?
    - The primary option to reduce a product's noise when the mechanical parts exist is to decrease the fan speed. In designing a new air cleaner, a lower noise can be achieved by designing the air purifier to be larger in size – typically by using a larger size filter to reduce the airflow resistance at a given airflow, and a larger diameter fan and housing to provide a higher air volume at the same fan speed. Clearly, these strategies increase the product size which also increase the product cost. As much of the noise in a room air cleaner tends to be created by the fan and airflow turbulence, it is often difficult to reduce noise with other strategies without negatively impacting the airflow and thus CADR.
18. What functions, if any, delivered in standby mode may be limited by a decreased standby limit? □ No response provided
19. Are there other trends that EPA should consider regarding the room air cleaner market?
    - The current ENERGY STAR program allows for a simple, fair, and meaningful comparison for consumers who are selecting and air cleaner model to purchase. It uses the data from the ANSI/AHAM CADR test without forcing consumers to participate in the AHAM Room Air Cleaner Certification Program. However, one troubling trend in the market is the continued presence and perhaps expansion of air cleaner devices which use methods other than the ANSI/AHAM method to determine the appropriate room size rating for air cleaner devices. In some cases, the recommended room size exceeds the "AHAM" room size rating by a factor or two or more. In such instances, consumers may be significantly confused about how to effectively compare multiple models for this very important purchasing decision factor. As a result, 3M highly recommends that all ENERGY STAR models be required to claim room size according to the calculation procedure defined in the AHAM Room Air Cleaner Certification Program.

20. EPA welcomes stakeholder data, industry trends, and other information that may provide additional insight into the room air cleaner market.
    - No response provided
21. DOE and EPA welcome feedback on an adjustment in contaminate level to potentially be more representative of typical consumer conditions.
    - As noted in previous questions, 3M supports a change to using smoke CADR as the primary contaminant for determining energy efficiency ratios for air cleaners, for multiple reasons. One important factor to consider in adjusting the particle concentration is whether existing particle detectors can reliably measure particle count across multiple decades of concentration (100X or even 1000X change is observed during a CADR test). In our experience, decreasing the initial concentration will impact the test method's ability to measure high CADR devices, as the end of the test may run into a range of insufficient particle counts to provide reliable data. The key purpose of the CADR test is to determine the air cleaning rate/speed of air cleaners, and in our experience the current initial concentration for smoke CADR provides testing results which are fairly insensitive to particle concentration across a wide range of CADR, i.e. concentration data well-fits an exponential decay model as would be theoretically expected. While we recommend against changing the contaminant level, we defer to any guidance provided by AHAM on this topic.
22. DOE and EPA are interested in feedback on the feasibility of varying contaminate levels depending on test unit features (e.g., size, power draw, other) that may indicate the expected contaminate level for that particular unit in the field.
    - If contaminant levels were to be varied, the most obvious feature to use in adjusting the contaminant level is the CADR. To maintain a stable test method and results, the final particle count at the end of the test should not fall below a certain threshold, so it would theoretically be possible to have a higher starting concentration for higher CADR models and a lower starting concentration for lower CADR models, with the end goal of similar concentration at the end of the test. However, it is currently unclear what benefit this would have for consumers, testing laboratories, or manufacturers.
23. DOE and EPA are interested in the potential of testing at different contaminate levels to further differentiate the room air cleaner market.
    - Similar to our responses on questions 21 and 22, if the test criteria focus on the recommended smoke CADR, we have not seen evidence supporting that different contaminant levels have a significant impact on the CADR for typical air cleaner models. We cannot speak to the concentration effect of dust or pollen CADR.
24. DOE and EPA welcome feedback on whether dust contamination is most representative of typical consumer usage, and whether pollen and cigarette smoke, or a different contaminate not currently tested, should also be considered for the ENERGY STAR performance criteria.
    - Based on our consumer insights work and understanding, consumers rely more on room size rating than on CADR for selecting an appropriate air cleaner. Since smoke CADR is used to determine the appropriate room size and is also widely considered to be the most stringent criteria (i.e. lowest CADR) of the current three CADR contaminants, 3M recommends setting energy efficiency criteria on the smoke CADR. Additionally, the typical particle size distribution of smoke CADR shows a sizable portion of particles falling between about 0.1 and 0.5 microns, which fall well within the PM2.5 realm and well within the range of particles generally considered to have more significant health effects.
25. DOE and EPA are interested in feedback on the impact of contaminate particle size on test repeatability.
    - Through our extensive experience in the room air cleaner category, including both internal and external testing, we have found the smoke CADR to be a highly repeatable and reproduceable test. Several key factors that allow for the high repeatability are the very low natural decay of smoke particles as well as repeatable cigarette smoke generation. Larger contaminants, in particular pollen, have shown to have a much lower repeatability, with a large factor owing to the very high settling rate of the larger particles.
26. DOE and EPA also welcome feedback on the applicability and repeatability of filling a test room with multiple contaminates simultaneously to measure the full range of performance for a product, and how that may impact test burden.
    - No response provided

27. DOE and EPA welcome feedback on an appropriate control speed setting for testing room air cleaners.
    - 3M supports continuing to use high (maximum) speed for testing room air cleaners. This approach directly matches the AHAM CADR certification program testing and is also consistent with energy efficiency criteria for room air cleaners in other countries, including China and Taiwan. Additionally, the fan speed settings for speeds other than the maximum speed tend to be somewhat arbitrarily set by manufacturers, so determining a fair and consistent setting to use for comparing multiple brands or different air cleaner products would prove challenging.
28. DOE and EPA welcome feedback on the applicability of a longer rating test period for air cleaners to incentivize advanced technologies.
    - 3M supports maintaining the current ANSI/AHAM CADR test method and the existing testing period duration. The key output of the ANSI/AHAM CADR method is a measure of the cleaning rate of the air cleaner device, and in our extensive experience the existing ANSI/AHAM method and duration is quite effective at measuring the cleaning rate. Per the ANSI/AHAM AC-1-2015 test method, the minimum CADR that can be determined is 10 cfm. In our experience, air cleaners requiring a longer testing period than 20 minutes to effectively measure the CADR have a very low CADR. However, 3M remains open to the possibility of new technologies that may require a longer testing period, as long as the test is still measuring the air cleaning rate (the CADR) in a robust and repeatable method.
29. DOE and EPA welcome feedback on the applicability of a used filter test and how performance may vary as filter usage time increases.
    - One of the strong values of the current ENERGY STAR testing criteria is the direct connection to the industry standard for measuring air cleaner performance, the ANSI/AHAM CADR test. The ANSI/AHAM CADR test is fairly quick to run in multiple replicates and exhibits good repeatability. Our experience through multiple air filtration products with various capacity and life tests has shown that multiple testing and environmental factors can significantly impact the performance over time for an air filter, including the particle size distribution, the solid/liquid state and chemical composition of the contaminant, the concentration and duration of contaminant loading, etc. To create a fair, representative, repeatable test method for "used filters," which can be tested at multiple laboratories (both final 3rd party certification plus manufacturers' internal laboratories) is an extremely complex and generally multi-year process. 3M supports the continued use of clean filters for ENERGY STAR testing criteria.

Please do not hesitate to contact us for clarification or with any additional questions or comments.

Sincerely,

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