[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

EERE-2021-BT-TP-0036

RIN 1904-AF26

Energy Conservation Program: Test Procedure for Air Cleaners

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Final rule.

SUMMARY: This final rule establishes definitions, a test procedure, and sampling and representation requirements for air cleaners. Currently, air cleaners are not subject to U.S. Department of Energy (DOE) test procedures or energy conservation standards. DOE is establishing a test procedure for measuring the integrated energy factor of air cleaners. The test method references the relevant industry standard, with certain modifications.

DATES: The effective date of this rule is **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

The incorporation by reference of certain materials listed in the rule is approved by the Director of the *Federal Register* on [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***].

ADDRESSES: The docket, which includes *Federal Register* notices, public meeting webinar attendee lists and transcripts, comments, and other supporting documents/materials, is available for review at *www.regulations.gov*. All documents in the docket are listed in the *www.regulations.gov* index. However, not all documents listed in the index may be publicly available, such as those containing information that is exempt from public disclosure.

A link to the docket webpage can be found at *www.regulations.gov/docket/EERE-2021-BT-TP-0036*. The docket webpage contains instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket, contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov*.

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SUPPLEMENTARY INFORMATION:

DOE incorporates by reference the following industry standards into part 430:

ANSI/AHAM AC-1-2020, "Method for Measuring Performance of Portable Household Electric Room Air Cleaners," ANSI-approved December 2020, including AHAM Standard Interpretation on September 19, 2022 (AHAM AC-1-2020).

AHAM AC-7-2022, "Energy Test Method for Consumer Room Air Cleaners," copyright 2022.

Copies of AHAM AC-7-2022 and AHAM AC-1-2020 can be obtained from the Association of Home Appliance Manufacturers (AHAM), 1111 19th Street NW, Suite 402, Washington, DC 20036; or *www.aham.org/AHAM/AuxStore*.

ASTM E741-11(2017), "Standard Test Method for Determining Air Change in a Single Zone Means of a Tracer Gas Dilution," Approved September 1, 2017.

Copies of ASTM E741-11(2017) can be obtained from ASTM International (ASTM), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, or *www.astm.org*.

IEC 62301 Ed. 2.0, "Household electrical appliances – Measurement of standby power," Edition 2.0, 2011-01.

Copies of IEC 62301 Ed. 2.0 can be obtained from the International Electrotechnical Commission (IEC), 3 Rue de Varembe, Case Postale 131, 1211 Geneva 20, Switzerland; or *webstore.iec.ch*.

See section IV.N of this document for a further discussion of these standards.

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I. Authority and Background

On July 15, 2022, DOE published a final determination (July 2022 Final Determination) in which it determined that air cleaners qualify as a "covered product" under the Energy Policy and Conservation Act, as amended (EPCA).[1] 87 FR 42297.

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Pub. L. 116-260 (Dec. 27, 2020), which reflects the last statutory amendments that impact Parts A and A-1 of EPCA.

DOE determined in the July 2022 Final Determination that coverage of air cleaners is necessary or appropriate to carry out the purposes of EPCA, and that the average U.S. household energy use for air cleaners is likely to exceed 100 kilowatt-hours (kWh) per year. *Id.* Currently, no energy conservation standards or test procedures are prescribed by DOE for air cleaners. The following sections discuss DOE's authority to establish test procedures for air cleaners and relevant background information regarding DOE's consideration of test procedures for this equipment.

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part B of EPCA[2] established the Energy Conservation Program for Consumer Products Other Than Automobiles, which sets forth a variety of provisions designed to improve energy efficiency, referred to as "covered products."[3] In addition to specifying a list of consumer products that are covered products, EPCA contains provisions that enable the Secretary of Energy to classify additional types of consumer products as covered products. (42 U.S.C. 6292(a)(20)) To classify a consumer product as a covered product, the Secretary must determine that classifying the product as a covered product is necessary or appropriate to carry out the purposes of EPCA and the average annual per

[2] For editorial reasons, upon codification in the U.S. Code, Part B was redesignated Part A.
[3] The enumerated list of covered products is at 42 U.S.C. 6292(a)(1)–(19).

household[4] energy use by products of such type is likely to exceed 100 kWh (or British thermal unit (Btu) equivalent) per year. (42 U.S.C. 6292(b)(1))

As stated, DOE has determined that air cleaners are covered products. 87 FR 42297.

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

The testing requirements consist of test procedures that manufacturers of covered products must use as the basis for (1) certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA (42 U.S.C. 6295(s)); and (2) making other representations about the efficiency of those products (42 U.S.C. 6293(c)). Similarly, DOE must use these test procedures to determine whether the

[4] DOE has defined "household" to mean an entity consisting of either an individual, a family, or a group of unrelated individuals, who reside in a particular housing unit. For the purpose of this definition: *Group quarters* means living quarters that are occupied by an institutional group of 10 or more unrelated persons, such as a nursing home, military barracks, halfway house, college dormitory, fraternity or sorority house, convent, shelter, jail, or correctional institution. *Housing unit* means a house, an apartment, a group of rooms, or a single room occupied as separate living quarters, but does not include group quarters. *Separate living quarters* means living quarters: to which the occupants have access either: directly from outside of the building, or through a common hall that is accessible to other living quarters and that does not go through someone else's living quarters, and occupied by one or more persons who live and eat separately from occupant(s) of other living quarters, if any, in the same building. 10 CFR 430.2.

products comply with any relevant standards promulgated under EPCA. (42 U.S.C. 6295(s))

Federal energy efficiency requirements for covered products established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of EPCA. (42 U.S.C. 6297(d))

Under 42 U.S.C. 6293, EPCA sets forth the criteria and procedures DOE must follow when prescribing or amending test procedures for covered products. EPCA requires that any test procedures prescribed or amended under this section shall be reasonably designed to produce test results which measure energy efficiency, energy use or estimated annual operating cost of a covered product during a representative average use cycle (as determined by the Secretary) or period of use and shall not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3))

If the Secretary determines, on her own behalf or in response to a petition by any interested person, that a test procedure should be prescribed or amended, the Secretary shall promptly publish in the *Federal Register* proposed test procedures and afford interested persons an opportunity to present oral and written data, views, and arguments with respect to such procedures. The comment period on a proposed rule to amend a test procedure shall be at least 60 days and may not exceed 270 days. In prescribing or

amending a test procedure, the Secretary shall take into account such information as the Secretary determines relevant to such procedure, including technological developments relating to energy use or energy efficiency of the type (or class) of covered products involved. (42 U.S.C. 6293(b)(2)) If DOE determines that test procedure revisions are not appropriate, DOE must publish its determination not to amend the test procedures.

In addition, EPCA requires that DOE amend its test procedures for all covered products to integrate measures of standby mode and off mode energy consumption into the overall energy efficiency, energy consumption, or other energy descriptor, unless the current test procedure already incorporates the standby mode and off mode energy consumption, or if such integration is technically infeasible. (42 U.S.C. 6295(gg)(2)(A)) If an integrated test procedure is technically infeasible, DOE must prescribe separate standby mode and off mode energy use test procedures for the covered product, if a separate test is technically feasible. (*Id.*) Any such amendment must consider the most current versions of the IEC Standard 62301[5] and IEC Standard 62087[6] as applicable. (42 U.S.C. 6295(gg)(2)(A))

DOE is publishing this final rule consistent with its authority and these obligations.

[5] IEC 62301, *Household electrical appliances—Measurement of standby power* (Edition 2.0, 2011-01).
[6] IEC 62087, *Audio, video and related equipment—Methods of measurement for power consumption* (Edition 1.0, Parts 1–6: 2015, Part 7: 2018).

B. Background

DOE has not previously conducted a test procedure rulemaking for air cleaners. As stated, DOE determined in the July 2022 Final Determination that: coverage of air cleaners is necessary or appropriate to carry out the purposes of EPCA; the average U.S. household energy use for air cleaners is likely to exceed 100 kWh per year; and thus, air cleaners qualify as a "covered product" under EPCA. 87 FR 42297.

On January 25, 2022, DOE published a request for information (January 2022 RFI) seeking comments on potential test procedure and energy conservation standards for air cleaners. 87 FR 3702.

On August 23, 2022, the American Council for an Energy-Efficient Economy (ACEEE), Appliance Standards Awareness Project (ASAP), AHAM, Consumer Federation of America (CFA), Natural Resources Defense Council (NRDC), New York State Energy Research and Development Authority (NYSERDA), and Pacific Gas and Electric Company (PG&E), collectively, the "Joint Stakeholders," submitted a "Joint Statement of Joint Stakeholder Proposal On Recommended Energy Conservation Standards And Test Procedure For Consumer Room Air Cleaners" (Joint Proposal), which includes negotiated energy conservation standards for air cleaners and the related test procedures.[7]

[7] Available as document number 16 in the docket for this rulemaking.

DOE published a notice of proposed rulemaking (NOPR) for the test procedure on October 18, 2022 (October 2022 NOPR), presenting DOE's proposals to establish a test procedure for air cleaners. 87 FR 63324. DOE held a public meeting related to this NOPR on November 9, 2022 (hereafter, the NOPR public meeting).

DOE received comments in response to the October 2022 NOPR from the interested parties listed in Table I.1. This list excludes non-substantive comments submitted to the docket.[8]

Table I.1 List of Commenters with Written Submissions in Response to the October 2022 NOPR

Commenter(s)	Reference in this Final Rule	Comment No. in the Docket	Commenter Type
Anonymous	Anonymous	19	Individual
Robert Frey	Frey	22	Individual
Madison Indoor Air Quality	MIAQ	26	Manufacturer
Dyson, Inc.	Dyson	27	Manufacturer
Northwest Energy Efficiency Alliance	NEEA	28	Efficiency Organization
Asthma and Allergy Foundation of America	AAFA	29	Health Organization
PG&E, San Diego Gas & Electric, and Southern California Edison; collectively, the California Investor-Owned Utilities	CA IOUs	30	Utilities
Carrier Global Corporation	Carrier	31	Manufacturer
Home Ventilating Institute	HVI	32	Trade Association
Air-Conditioning, Heating, & Refrigeration Institute	AHRI	33	Trade Association
ACEEE, ASAP,	Joint	34	Efficiency

[8] EERE-2021-BT-TP-0036-0021.

AHAM, CFA, NRDC, NYSERDA	Commenters		Organizations, Consumer Organization, and Trade Association
Daikin U.S. Corporation	Daikin	35	Manufacturer

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[9] To the extent that interested parties have provided written comments that are substantively consistent with any oral comments provided during the NOPR public meeting, DOE cites the written comments throughout this final rule. Any oral comments provided during the webinar that are not substantively addressed by written comments are summarized and cited separately throughout this final rule.

II. Synopsis of the Final Rule

In this final rule, DOE establishes a new test procedure at 10 CFR part 430, subpart B, appendix FF (appendix FF) for air cleaners that would include methods to (1) measure the performance of the covered product and (2) use the measured results to calculate an integrated energy factor (IEF) to represent the energy efficiency of an air cleaner.

[9] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop test procedures for air cleaners. (Docket No. EERE-2021-BT-TP-0036, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

The test procedure established by this final rule includes measurements of smoke clean air delivery rate (CADR) and dust CADR, which are used to calculate $PM_{2.5}$[10] CADR, and active mode and standby mode power consumption, which are used to calculate annual energy consumption (AEC). $PM_{2.5}$ CADR and AEC are required to calculate IEF. Newly established appendix FF also includes measurements of pollen CADR and calculation of effective room size for representation purposes. For consistent and uniform measurement of these values, DOE is incorporating by reference the industry standards AHAM AC-7-2022, AHAM AC-1-2020, and IEC 62301 Ed. 2.0. Specifically, DOE is specifying the following provisions from within the referenced industry standards:

(1) From AHAM AC-7-2022, the following items:

(a) Definition of "conventional room air cleaners" in 10 CFR 430.2, which is used to specify the scope of the air cleaners test procedure in the new appendix FF;

(b) Definitions of terms that are relevant to the test procedure;

[10] "$PM_{2.5}$" refers to particulate matter that are nominally 2.5 micrometers (μm) in width or smaller. "Smoke" refers to cigarette smoke as defined in section 3.3.1 of AHAM AC-1-2020, which means smoke produced by burning cigarette tobacco with air forced through the cigarette's filter having particle sizes detected from 0.01 μm to 1.0 μm diameter.

(c) Test setup requirements for electrical supply and test chamber, which additionally include a reference to AHAM AC-1-2020;

(d) Instrumentation requirements for power measuring instruments and temperature and relative humidity measuring devices;

(e) Active mode and standby mode power measurements; the standby mode power measurement method additionally includes a reference to IEC 62301 Ed. 2.0 for the test conduct; and

(f) Calculations for $PM_{2.5}$ CADR, AEC, and IEF.

(2) From AHAM AC-1-2020, test methods for determining the pollen CADR, smoke CADR, and dust CADR; calculation of effective room size; and test chamber construction and equipment.

This final rule also specifies the sampling plan and representations for air cleaners at 10 CFR 429.67. DOE also specifies rounding requirements for the measured and calculated values of the air cleaners test procedure.

DOE has determined that the new test procedure described in section III of this document and adopted in this final rule will produce measurements of energy use that are representative of an average use cycle and are not unduly burdensome to conduct. Discussion of DOE's actions are addressed in detail in section III of this document.

Additionally, DOE provides estimates of the cost of testing in section III.L of this document. DOE notes that there are currently no energy conservation standards prescribed for air cleaners.

The effective date for the new test procedure adopted in this final rule is 30 days after publication of this document in the *Federal Register*. Beginning on the compliance date of any energy conservation standards for air cleaners, any representations with respect to the energy use or efficiency of these products, including those made for certification purposes, must be made in accordance with the test procedure established in this final rule.

III. Discussion

A. General Comments

In the October 2022 NOPR, DOE presented its proposed test procedure for air cleaners and requested stakeholder feedback on several topics including test procedure scope, industry standards, definitions, test conditions, instrumentation, active and standby mode tests, representations, and sampling plan. 87 FR 63324. While DOE addresses topic-specific comments in the following sections, general comments are summarized in the following paragraphs.

An anonymous commenter stated that the government should not impose regulations on air cleaners because of its private use, commerce, and own power costs. Individuals use such devices for many different purposes, including medical needs, stress

inducing factors, or maintaining overall health. The anonymous commenter stated that regulation would force consumers to shut down machines that they need in order to function efficiently on a daily basis. Additionally, the anonymous commenter suggested rules could stop the manufacturing and commerce of certain products and create difference between different manufacturers within the market by forcing a net loss to some companies and not others. According to the anonymous commenter, a large pivotal governmental role in regulating areas of commerce goes against the free market put in place. Lastly, the anonymous commenter stated that the operation of the device depends on the user including power and electricity cost, and it is up to the individual, not the government, of what funds should be allocated in certain areas of the individual's choosing. (Anonymous, No. 19 at p. 1)

DOE determined in the July 2022 Final Determination that coverage of air cleaners is necessary or appropriate to carry out the purposes of EPCA, and that the average U.S. household energy use for air cleaners is likely to exceed 100 kWh per year, thereby establishing air cleaners as a type of consumer product that is a covered product under EPCA. 87 FR 42297. EPCA specifies that the Secretary may, in accordance with its provisions for amended and new test procedures, prescribe test procedures for any consumer product classified as a covered product under 42 U.S.C. 6292(b). (42 U.S.C. 6293(b)(1)(B)) As discussed in section I.A of this document, 42 U.S.C. 6293(b)(2) provides that if the Secretary determines, on her own behalf or in response to a petition by any interested person, that a test procedure should be prescribed or amended, the Secretary shall promptly publish in the *Federal Register* proposed test procedures and afford interested persons an opportunity to present oral and written data, views, and

arguments with respect to such procedures. DOE has fulfilled this requirement by publishing the October 2022 NOPR after receiving the Joint Proposal submitted by the Joint Stakeholders. Furthermore, the range of interested parties that submitted the Joint Proposal indicates widespread support for establishing a test procedure and standards for air cleaners. DOE is finalizing a test procedure for air cleaners in this document. Additionally, this test procedure will not impact the use, availability, manufacturing, or manufacturers of air cleaners because this rulemaking is not establishing any energy conservation standards. If DOE develops energy conservation standards for air cleaners, it would not require consumers to shut down the products they already own. Additionally, DOE will evaluate the impact of any potential standards on the use, availability, manufacturing, or manufacturers of air cleaners. DOE has analyzed the impact of this rulemaking on small businesses, as discussed in section IV.B of this document. Furthermore, while DOE is not specifying any regulation regarding individual use of funds, certain performance metrics in the air cleaners test procedure established by this final rule may assist consumers in their purchasing decisions.

The Joint Commenters stated that they are largely supportive of DOE's proposed test procedure and urged DOE to finalize the test procedure quickly. (Joint Commenters, No. 34 at p. 2) During the October 2022 webinar, ASAP stated that it appreciates that DOE has worked swiftly to publish this proposal, which is based on the recommendations presented by the Joint Stakeholders earlier this year. (ASAP, Public Meeting Transcript, No. 25 at p. 5)

The Joint Commenters also commented that the Joint Proposal was reviewed and supported by small and large manufacturers and achieved consensus by both types of manufacturers. (Joint Commenters, No. 34 at p. 7)

The Joint Commenters requested that DOE publish final rules adopting the air cleaner test procedure and standards before December 31, 2022, otherwise each of the Joint Stakeholders reserved the right to rescind support for the standards and compliance dates in the Joint Proposal. The Joint Commenters commented that the Joint Proposal urged DOE to rely upon the exception in section 8(d)(2)(ii) of the Process Rule to finalize the test procedure quickly and eliminate the time between finalizing the test procedure and the end of the comment period on a direct final rule on energy conservation standards for room air cleaners. (Joint Commenters No. 34, at pp. 1–2; AHAM, Public Meeting Transcript, No. 25 at p. 48)

The CA IOUs commended DOE for moving quickly on the rulemaking and aligning with the Joint Stakeholder recommendations submitted in August 2022, which included broad support for adopting AHAM AC-7-2022 as the test procedure for air cleaners and the IEF metric, expressed in terms of $PM_{2.5}$ CADR per watt (CADR/W), as the preferred performance metric. The CA IOUs expressed appreciation for the fact that DOE aligned with the Joint Stakeholder recommendation, and the CA IOUs requested that DOE show the same consideration by publishing an expeditious direct final rule based on these recommendations. (CA IOUs, No. 30 at pp. 1–2)

Daikin supported DOE's test procedure for conventional air cleaners due to a growing demand for these products. Daikin also supported DOE's efforts to quickly finalize this regulation to prevent additional U.S. states from implementing policies that may be different than the Federal policy. (Daikin, No. 35 at p. 1)

As discussed throughout this document, DOE has addressed feedback from the Joint Commenters and other stakeholders in finalizing the test procedure for air cleaners. Additionally, DOE has worked as expeditiously as feasible, within its obligations under EPCA, to finalize the test procedure for air cleaners. DOE is considering energy conservation standards in a rulemaking proceeding separate from this test procedure rulemaking.

B. Scope of Applicability

DOE defines air cleaner as a product for improving indoor air quality, other than a central air conditioner, room air conditioner, portable air conditioner, dehumidifier, or furnace, that is an electrically-powered, self-contained, mechanically encased assembly that contains means to remove, destroy, or deactivate particulates, VOCs, and/or microorganisms from the air. It excludes products that operate solely by means of ultraviolet light without a fan for air circulation. 10 CFR 430.2.

In the October 2022 NOPR, DOE proposed to establish test procedures for a subset of products that meet the definition of "air cleaner" as established by the July 2022 Final Determination. Specifically, DOE proposed to define the scope of the proposed new test procedure as covering products defined as "conventional room air cleaners" in

the AHAM AC-7-2022 Draft[11] standard. The proposed scope of the test procedure aligned with the available industry standard and encompasses a majority of the air cleaner market. 87 FR 63324, 63328. Further, this scope is consistent with the scope in the Joint Proposal. (Joint Proposal, No. 16 at p. 5) In the October 2022 NOPR, DOE additionally noted that DOE may consider test procedures for other types of air cleaners in a future rulemaking. 87 FR 63324, 63328.

Section 2.1.1 of AHAM AC-7-2022 defines a "conventional room air cleaner" as a consumer room air cleaner that is a portable or wall mounted (fixed) unit that plugs in to an electrical outlet; operates with a fan for air circulation; and contains means to remove, destroy, and/or deactivate particulates.

Sections 2.1.3.1 and 2.1.3.2 of AHAM AC-7-2022 further define "portable" and "fixed," respectively, as follows:

Portable: can be easily moved from one place to another for use; and has no provision for permanent mounting. Tools are not required for the product installation or removal.

[11] At the time of publication of the October 2022 NOPR, AHAM AC-7-2022 was available as a Final Draft standard. As discussed in section III.C.1 of this document, the published AHAM AC-7-2022 is substantively the same as AHAM AC-7-2022 Draft referenced in the October 2022 NOPR, other than two minor edits to the instrumentation requirements. This document refers to AHAM AC-7-2022 Draft when referring to the October 2022 NOPR discussion and AHAM AC-7-2022 otherwise. AHAM AC-7-2022 Draft that was referenced in the October 2022 NOPR is available at: *www.aham.org/ItemDetail?iProductCode=30014&Category=PADSTD&WebsiteKey=69a0a5fb-295a-4894-acd0-5785f146b899*.

Fixed: permanently connected to the electrical supply source; permanently mounted, such that tools are required for the product installation or removal; or, sized so that it is not easily moved from one place to another.

In the October 2022 NOPR, DOE proposed to specify in section 1 of the proposed new appendix FF that the test procedure applies to "conventional room air cleaners" and to define that term in 10 CFR 430.2 through reference to section 2.1.1 of AHAM AC-7-2022 Draft. DOE further proposed to add references to sections 2.1.3.1 and 2.1.3.2 of AHAM AC-7-2022 Draft to the proposed definition of conventional room air cleaners to reference the definitions of portable and fixed conventional room air cleaners. 87 FR 63324, 63328.

In the October 2022 NOPR, DOE requested comment on its proposal to define the scope of the proposed new air cleaner test procedure as those air cleaners that meet the definition of a conventional room air cleaner as defined in section 2.1.1 of AHAM AC-7-2022 Draft. DOE also requested comment on its proposal to reference sections 2.1.1, 2.1.3.1, and 2.1.3.2 of AHAM AC-7-2022 Draft in 10 CFR 430.2 for the definitions of conventional room air cleaner, portable conventional room air cleaner, and fixed conventional room air cleaner, respectively. *Id*.

AHRI commented that it supports DOE's proposed definitions in AHAM AC–7–2022 for "conventional room air cleaner," "portable," and "fixed" with a CADR limit of 600 cubic feet per minute (cfm). (AHRI, No. 33 at p. 1) Daikin commented that it generally agreed with the scope and definitions used to describe the specific air cleaners

in the scope of the proposed test procedure with a CADR limit of 600 cfm. (Daikin, No. 35 at p. 1)

Carrier stated its agreement with DOE's proposal to define the scope of the test procedure to conventional room air cleaners, but commented there could be confusion if DOE were to adopt section 2.1.1 of AHAM AC-7-2022 verbatim because it does not explicitly state whether ceiling mounted air cleaners are included. Carrier requested that "ceiling mounted" air cleaners be added to the section 2.1.1 definition of a "conventional room air cleaner." (Carrier, No. 31 at p. 2)

During the NOPR public meeting, Acuity Brands asked whether a wall mounted product that is permanently connected to the electrical supply source and a ceiling mounted product would be included in the scope of the test procedure. (Acuity Brands, Public Meeting Transcript, No. 25 at p. 12)

During the NOPR public meeting, LifeAire asked if an in-duct system would be within the scope of the test procedure. (LifeAire, Public Meeting Transcript, No. 25 at p. 13)

DOE notes that wall mounted air cleaners are included, but ceiling mounted air cleaners are not included in the definition of conventional room air cleaner as defined in section 2.1.1 of AHAM AC-7-2022. DOE is not aware of any test method to test ceiling mounted air cleaners. DOE notes that section 3.1.5 of AHAM AC-1-2020 indicates that uniform testing practices and statistical examinations of air cleaners designed to be

mounted on the ceiling have not been conducted. Given the potential confusion regarding whether ceiling mounted units are considered conventional room air cleaners and the lack of a test method for ceiling mounted units, DOE is excluding these air cleaners from the definition of conventional room air cleaners in this final rule. Additionally, in-duct air cleaners do not meet the definition of conventional room air cleaners and are not in the scope of the test procedure.

MIAQ stated its support for the proposed definition of a conventional air cleaner as it appears in section 2.1.1 of AHAM AC-7-2022. (MIAQ, No. 26 at p. 1) MIAQ and HVI both requested that "incidental air cleaning products," be excluded from the proposed air cleaner test procedure and defined the term as a consumer product that would meet the definition of an air cleaner, but which provides an additional function, not related to air purification, within the same housing, such as a vacuum cleaner, fresh air ventilator, range hood (ducted or non-ducted), refrigerator, or desiccant dehumidifier, and whose air purification function is incidental to its other functions. (MIAQ, No. 26 at pp. 1–2; HVI, No. 32 at p. 1)

DOE notes that "incidental air cleaning products" do not meet the definition of an air cleaner as defined in 10 CFR 430.2. Specifically, as discussed in the July 2022 Final Determination, the definition of an air cleaner states, in part, that it is a product for improving indoor air quality, which excludes products that may provide some air cleaning as an ancillary function. 87 FR 42297, 42302. Given that the types of products described by MIAQ and HVI do not meet the definition of an air cleaner as specified in

10 CFR 430.2, DOE has determined that it is unnecessary to specify any additional exclusions in the air cleaners test procedure in the newly established appendix FF.

MIAQ requested clarification about whether DOE is referencing the definition of consumer room air cleaner in section 2.1 of AHAM AC-7-2022 Draft, thereby excluding "duct type" devices, "lamps," and other devices as defined in 10 CFR 430.2. MIAQ stated that based on section 2.1.3.3 of AHAM-AC-7-2022 Draft, heat recovery ventilators (HRV), energy recovery ventilators (ERV), and supply fans would be excluded and that to avoid ambiguity, MIAQ proposed adding the words "system in the room" to the definition provided in section 2.1 of AHAM AC-7-2022 Draft to read as follows: "Consumer room air cleaner means a consumer product for improving indoor air quality that: (1) Is an electrically-powered, self-contained system in the room, that has a mechanically encased assembly." (MIAQ, No. 26 at p. 2) MIAQ also recommended adding reference to section 2.1 of AHAM AC-7-2022 Draft for the definition of consumer room air cleaner because it lists exclusions (*e.g.*, "duct type," "lamps," and the devices defined in 10 CFR 430.2) that are not explicitly listed in the sections referenced in this rulemaking. MIAQ further recommended referencing sections 2.1.3.4 and 2.1.3.5 of AHAM AC-7-2022 for definitions of combined product and lamps, respectively. (MIAQ, No. 26 at p. 4)

DOE clarifies that it is not referencing the definition of consumer room air cleaner as defined in section 2.1 of AHAM AC-7-2022. DOE already specifies a definition for air cleaner in 10 CFR 430.2, which is similar to the definition of consumer room air cleaner specified in AHAM AC-7-2022, but includes a broader scope. As such, for the

scope of this test procedure rulemaking, the definition of conventional room air cleaner is adequate to define the products subject to this test procedure. Accordingly, in the October 2022 NOPR, DOE proposed to reference only section 2.1.1 of AHAM AC-7-2022 for the definition of conventional room air cleaner. However, because the definition of conventional room air cleaner in section 2.1.1 of AHAM AC-7-2022 includes the term "consumer room air cleaner," which is defined in section 2.1 of AHAM AC-7-2022, DOE understands that this could cause confusion. Therefore, to avoid any such confusion, DOE is including the wording of the definition for conventional room air cleaner at 10 CFR 430.2 and removing the phrase "consumer room air cleaner" and replacing it with the term "air cleaner," rather than referencing section 2.1.1 of AHAM AC-7-2022 within the definition. This definition at 10 CFR 430.2 is substantively the same as what DOE proposed in the October 2022 NOPR, along with the exclusion of ceiling mounted air cleaners as discussed previously. DOE is including the references to sections 2.1.3.1 and 2.1.3.2 of AHAM AC-7-2022 that were proposed in the October 2022 NOPR for the definitions of "portable" and "fixed" in the newly established appendix FF.

During the NOPR public meeting, Electrolux noted that the definition of conventional room air cleaner specifies the removal, destruction, or deactivation of particulates and it was not clear if an air cleaner that is removing smoke or gases would be included as part of this definition. (Electrolux, Public Meeting Transcript, No. 25 at p. 14) DOE notes that an air cleaner that can remove, destroy, or deactivate particulates, including smoke, would meet the definition of a conventional room air cleaner, if it meets the remaining criteria specified in the definition..

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing its definitions of conventional room air cleaner, portable conventional room air cleaner, and fixed conventional room air cleaner.

Section 2 of AHAM AC-1-2020 indicates that due to the defined limits of measurability based on statistical accuracy, for a 95 percent confidence limit, the standard is applicable only to air cleaners with minimum CADR ratings as follows: 25 cfm for pollen CADR; 10 cfm for dust CADR; and 10 cfm for cigarette smoke CADR. Additionally, section 2 of AHAM AC-1-2020 indicates that the theoretical maximum limits for CADR are determined by the maximum number of initial available particles, the acceptable minimum number of available particles, an average background natural decay rate (from statistical study), the size of the test chamber, and the available minimum experiment time. Based on these parameters, section 2 of AHAM AC-1-2020 specifies the test procedure being applicable only to air cleaners with maximum CADR ratings of 600 cfm for dust and cigarette smoke and 450 cfm for pollen.

The recommended standards presented in the Joint Proposal are applicable to conventional room air cleaners with a minimum $PM_{2.5}$ CADR of 10 cfm. (Joint Proposal, No. 16 at p. 9)

As discussed, DOE's established scope for the test procedure pertains to conventional room air cleaners that are portable or wall mounted and plug into an electrical outlet. This is consistent with the scope of the AHAM AC-7-2022 and AHAM AC-1-2020 industry standards, which DOE is referencing for the CADR and power

measurement tests, as discussed in later sections of this document. Given that DOE proposed to reference the AHAM industry standards for the DOE air cleaner test procedure, in the October 2022 NOPR, DOE requested comment on whether it should also specify the acceptable CADR range from AHAM AC-1-2020 as part of its test procedure scope. Specifically, DOE stated that it would consider specifying that the test procedure is applicable for conventional room air cleaners with smoke CADR or dust CADR between 10 to 600 cfm, inclusive. 87 FR 63324, 63328.

In the October 2022 NOPR, DOE requested comment on whether it should reference section 2 of AHAM AC-1-2020, which specifies that the standard is applicable for air cleaners only within rated CADR ranges of 10 to 600 cfm for dust and cigarette smoke. Additionally, DOE requested comment on whether this CADR range should be specified for $PM_{2.5}$ CADR instead of for dust CADR and smoke CADR. *Id.*

Carrier commented that DOE should specify that the test procedure scope include only CADR ranges of 10 to 600 cfm, and that larger air purifiers with a CADR greater than 600 cfm should be included only if and when AHAM AC-1-2020 is updated to be able to test such air cleaners. Carrier recommended that the CADR range should be specified for $PM_{2.5}$ CADR, since it is used for calculating the IEF in AHAM AC-7-2022. (Carrier, No. 31 at p. 2)

MIAQ supported DOE's proposal to reference section 2 of AHAM AC-1-2020 specifying that the standard applies to air cleaners only within rated CADR ranges of 10 to 600 cfm for dust and cigarette smoke. MIAQ additionally recommended keeping the

dust CADR and smoke CADR range separate from $PM_{2.5}$ CADR since the dust CADR and smoke CADR are used in a geometric average, and in some cases, a product could have a $PM_{2.5}$ CADR rating within limits, while either smoke CADR or dust CADR could fall outside the limit. MIAQ commented that based on the hard limit for a theoretical maximum CADR rating based on the number of particles, background decay, size of the test chamber, and experiment run time, the CADR range of 10 to 600 cfm for dust and cigarette smoke should be enforced. (MIAQ, No. 26 at pp. 2–3)

MIAQ also commented that the pollen CADR limit should be listed, and that limits should be set similar to the theoretical maximum CADR values for smoke and dust. (MIAQ, No. 26 at p. 9)

AHRI commented that it recommends that DOE add a 600 cfm limit to $PM_{2.5}$ CADR in the regulatory language for the test procedure and consider covering larger air cleaners with future language. (AHRI, No. 33 at p. 1)

AHRI commented that it supports DOE's proposal to reference section 2 of AHAM AC–1–2020, specifying that the standard is applicable for air cleaners only within rated CADR ranges of 10 to 600 cfm for dust and cigarette smoke. AHRI stated that it agrees with DOE that this CADR range should be specified for $PM_{2.5}$ CADR, instead of for dust CADR and smoke CADR. (AHRI, No. 33 at p. 2)

Daikin commented that DOE must specify a CADR range that is verifiable and subject to regulation. Daikin commented that a minimum CADR limit is not required in

identifying DOE's coverage because every air cleaner below a CADR of 600 cfm should be included in the scope of regulation. Daikin additionally commented that based on the limitation of the AHAM standards, DOE should include a maximum CADR limit of 600 cfm. (Daikin, No. 35 at p. 2) Daikin also recommended that DOE develop a standard for large air cleaners (*i.e.,* with capacities greater than 600 cfm) prior to the next cycle of this regulation. (Daikin, No. 35 at p. 1)

During the NOPR public meeting, Daikin recommended that the test procedure scope should be clarified to include the CADR thresholds, which is prescribed based on the allowable limits of the test procedure and test room. (Daikin, Public Meeting Transcript, No. 25 at pp. 10–11 18) Daikin also asked if there was a way to accommodate air cleaners that have a CADR greater than 600 and suggested the CADR thresholds should be based on the $PM_{2.5}$ CADR metric. (Daikin, Public Meeting Transcript, No. 25 at pp. 16–17)

Carrier agreed with Daikin that there should be some way to accommodate larger-capacity air cleaners in the test procedure. (Carrier, Public Meeting Transcript, No. 25 at p. 17)

The CA IOUs commented that the CADR limitation of 10 to 600 cfm for both cigarette smoke and dust is due to limitations of the test chamber, particulate density, and other aspects of the test standard. While it is appropriate to reference this limitation in applicability to this test procedure, the CA IOUs disagree that a cfm limitation should apply to air cleaners as a whole. The CA IOUs stated they understood that AHAM and

IEC discussed the challenges associated with testing units outside this scope and were working to resolve these concerns; therefore, the CA IOUs requested that DOE not delay the advancement of this proposed test procedure while test methods were developed and refined for very large-capacity units. (CA IOUs, No. 30 at p. 3)

The Joint Commenters stated that products that perform beyond the maximum CADR values need to be tested in a larger chamber for accurate assessment of their CADR. The Joint Commenters commented that the technical aspects for defining a repeatable and reproducible test method for a larger chamber are currently under evaluation in an AHAM task force and an IEC *ad hoc* working group, noting that once the issues are resolved there may be updates to AHAM AC-1. The Joint Commenters stated that they continue to support the 600 cfm limit for smoke CADR and dust CADR and do not currently recommend extending the test method to units with performance greater than 600 cfm for smoke CADR and dust CADR. The Joint Commenters clarified that their recommendations are restricted to consumer room air cleaners and noted that their comments specifically reference the current scope of AHAM AC-1-2020. (Joint Commenters, No. 34 at p. 7)

DOE appreciates the comments regarding the testing of air cleaners with a CADR greater than 600 cfm. However, given the theoretical limits of the test chamber specified for testing air cleaners, DOE has determined that it is appropriate to specify the minimum (10 cfm) and maximum (600 cfm) allowable CADR limits as part of the air cleaners test procedure scope in newly established appendix FF. The test chamber currently specified for testing cannot accommodate units with smoke CADR or dust CADR greater than 600

cfm; accordingly, units with either CADR greater than 600 cfm are not in the scope of this test procedure.

Additionally, because $PM_{2.5}$ CADR is a calculated value, determined as the geometric mean of smoke CADR and dust CADR, it would not be the appropriate metric for which to define scope limits within newly established appendix FF. A maximum CADR limit for a given particulate is dependent on the maximum number of initial available particles, the acceptable minimum number of available particles, an average background natural decay rate (from statistical study), the size of the test chamber, and the available minimum experiment time. Each of these factors is based on the particles that are used for a given test, which are either smoke or dust. Therefore, DOE concludes that the scope limits must be defined using smoke CADR and dust CADR, rather than $PM_{2.5}$ CADR. Specifically, DOE is specifying in section 1 of newly established appendix FF that the test procedure is applicable for conventional room air cleaners with smoke CADR and dust CADR between 10 to 600 cfm. DOE is also finalizing its determination that it is unnecessary to specify an allowable pollen CADR range in addition to the smoke or dust CADR range because pollen CADR is within the allowable range for dust and smoke.

C. Industry Standards Incorporated by Reference

1. AHAM AC-1-2020 and AHAM AC-7-2022

As discussed, AHAM published AHAM AC-1-2020 for measuring the performance of portable household electric room air cleaners. AHAM AC-1-2020 is a voluntary industry-developed test procedure that provides test methods to measure the

relative reduction of smoke, dust, and pollen suspended in the air in a specified test chamber when an air cleaner is in operation. The test method is conducted by introducing a known initial concentration of a given particulate in the chamber, without the air cleaner in operation, to measure its natural decay. Next, the particulate is reintroduced in the chamber with the air cleaner in operation to measure the particulate decay with the air cleaner operating. The difference in the logarithmic rate of decay with the air cleaner in operation and without the air cleaner in operation, multiplied by the volume of the chamber, provides the CADR value of the test unit. AHAM AC-1-2020 additionally specifies methods to measure an air cleaner's active mode power consumption when conducting the pollen, smoke, or dust performance test in the test chamber, as well as methods to measure standby mode power consumption.

AHAM AC-1-2020 is currently referenced by the U.S. Environmental Protection Agency (EPA) in the ENERGY STAR Product Specification for Room Air Cleaners, Version 2.0, Rev. May 2022 (ENERGY STAR V. 2.0 Specification).[12] Further, the ENERGY STAR V. 2.0 Specification is referenced by air cleaner standards in Washington, D.C. and the States of New Jersey, Nevada, and Maryland.[13]

As discussed, since development of the October 2022 NOPR, AHAM's air cleaner task force has finalized a new test method, AHAM AC-7-2022, that specifies the test methods for measuring air cleaner efficiency. The power measurement test methods

[12] Further information on the ENERGY STAR V. 2.0 Specification is available online at *www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%202.0%20Room%20Air%20Cleaners%20Specification%20%28Rev.%20May%202022%29.pdf*.

[13] Further information on State air cleaner standards and timelines is available online from ASAP at *appliance-standards.org/product/air-purifiers*.

specified in AHAM AC-7-2022 use the existing power measurement test methods specified in AHAM AC-1-2020, updated to reflect current air cleaner technologies and functionalities. Additionally, AHAM AC-7-2022 specifies the methods to determine $PM_{2.5}$ CADR, which is calculated based on the geometric average of smoke CADR and dust CADR values; AEC; and IEF (expressed in CADR/W), which defines the efficacy (*i.e.*, energy efficiency) of an air cleaner. DOE has participated in the meetings of the AHAM task force group responsible for developing AHAM AC-7-2022 and has provided input on several topics during its development. DOE also conducted testing according to AHAM AC-7-2022 and provided input to the AHAM task force based on its observations and experience during testing.

AHAM AC-7-2022 additionally references AHAM AC-1-2020 in several sections to specify requirements for the test chamber equipment and setup, as well as to conduct the in-chamber active mode power consumption test. All but one section refer to "ANSI[14]/AHAM AC-1," "AHAM AC-1," "AC-1," or "ANSI/AHAM AC-1-2020." DOE understands each of these references to be denoting the AHAM AC-1-2020 version of the standard, since it is included as a normative reference in AHAM AC-7-2022. In contrast, section 5.7.1 of AHAM AC-7-2022 references "ANSI/AHAM AC-1-2022," specifically by stating that potassium chloride (KCl) is allowed as an alternate to cigarette smoke in ANSI/AHAM AC-1-2022. (*See* section III.G.1 of this final rule for DOE's consideration of the use of KCl as an alternative to cigarette smoke). DOE notes, however, that ANSI/AHAM AC-1-2022 is not published—DOE understands AHAM will be revising

[14] American National Standards Institute (ANSI).

the standard in 2023—and the text of the AHAM AC-1-2022 standard was not available publicly for DOE to review at the time of the analysis for this final rule.

In the October 2022 NOPR, DOE proposed to incorporate by reference the then-latest draft of AHAM AC-7-2022 into 10 CFR 430.3 and to reference the relevant sections of this industry standard in the DOE test procedure at proposed new appendix FF. 87 FR 63324, 63329. DOE also proposed modifications to certain aspects of AHAM AC-7-2022 Draft, as discussed in the relevant sections of the October 2022 NOPR. (*Id.*)

Specifically, DOE proposed to reference AHAM AC-7-2022 Draft to specify the test methods for determining $PM_{2.5}$ CADR, AEC, and IEF. AHAM AC-7-2022 Draft specifies definitions, test conditions, and test methods for determining active mode power, standby mode power, out of chamber active mode power, and $PM_{2.5}$ CADR. DOE initially determined that the measurement of $PM_{2.5}$ CADR and power consumption as specified in AHAM-AC-7-2022 Draft would produce test results that measure the energy efficiency of an air cleaner during a representative average use cycle or period of use and would not be unduly burdensome to conduct. *Id*.

DOE additionally proposed to incorporate by reference AHAM AC-1-2020 to reference the test methods for determining pollen CADR, smoke CADR, and dust CADR and for each instance where AHAM AC-7-2022 Draft references AHAM AC-1-2020. *Id*. at 87 FR 63329–63330.

DOE additionally proposed to incorporate by reference IEC 62301 Ed. 2.0, which is referenced in AHAM AC-7-2022 Draft, for the instrumentation requirements and standby mode power measurement. *Id*. at 87 FR 63330.

DOE additionally proposed to incorporate by reference ASTM E741-11(2017), which is the current version of the standard referenced in section 3.3 of AHAM AC-7-2022 Draft, with regard to determining the test chamber air exchange rate. *Id*.

In the October 2022 NOPR, DOE stated its intention to update the reference to the final published version of AHAM AC-7-2022 in the test procedure final rule, should it publish prior to the final rule, unless there are substantive changes between the draft and published versions, in which case DOE may adopt the substance of AHAM AC-7-2022 Draft or provide additional opportunity for comment on the changes to the industry consensus test procedure. *Id*.

In the October 2022 NOPR, DOE stated that if AHAM AC-7-2022 referenced an updated version of AHAM AC-1-2020 and if the update version is both published and substantively the same as AHAM AC-1-2020, DOE would consider adopting the published version of AHAM AC-7-2022, including the reference to AHAM AC-1-2022. Additionally, DOE considered whether it should include reference to the use of KCl as an alternate to cigarette smoke, as currently specified in AHAM AC-7-2022 Draft. *Id*.

DOE requested comment on its proposal to adopt the substantive provisions of AHAM AC-7-2022 Draft with certain modifications. DOE requested comment on its proposal to incorporate by reference AHAM AC-1-2020, which is referenced in AHAM AC-7-2022 Draft, as well as to specify provisions related to the measurement of pollen CADR, smoke CADR, and dust CADR. *Id*.

DOE requested comment on its proposal to reference IEC 62301 Ed. 2.0, which is referenced in AHAM AC-7-2022 Draft for the instrumentation and testing provisions for measuring standby mode power consumption. DOE requested comment on its proposal to reference ASTM E741-11(2017), which is referenced in AHAM AC-7-2022 Draft for determining the test chamber air exchange rate. *Id*.

MIAQ commented in support of DOE's proposal to adopt the substantive provisions of AHAM AC-7-2022 Draft with certain modifications. MIAQ also commented in support of DOE's proposal to incorporate by reference AHAM AC-1-2020, which is referenced in AHAM AC-7-2022 Draft, as well as to specify provisions related to the measurement of pollen CADR, smoke CADR, and dust CADR. (MIAQ, No. 26 at p. 3)

Daikin supported DOE's decision to rely on ANSI standards developed by an accredited standards development organization and noted that the standards referenced by DOE in the October 2022 NOPR are developed by industry experts and stakeholders. Furthermore, Daikin stated that the AHAM AC-1-2020 standard is widely used by air

cleaner manufacturers and adopted by EPA for its ENERGY STAR program. (Daikin, No. 35 at p. 2)

Carrier commented that it supports DOE's proposal in the October 2022 NOPR to align the air cleaners test procedure with industry standards. Carrier supported referencing AHAM AC-7-2022 Draft, IEC 62301 Ed. 2.0, and AHAM AC-1-2020, with some deviation. (Carrier, No. 31 at p. 1)

The Joint Commenters noted that their Joint Proposal urged DOE to adopt AHAM AC-7-2022 as the test procedure or to use it as the basis for the Federal test procedure. (Joint Commenters No. 34, at p. 2) The Joint Commenters stated that they believe AHAM AC-7-2022 satisfies EPCA's criteria in 42 U.S.C. 6293(b)(2) of being reasonably designed to produce test results that measure energy efficiency of air cleaners during a representative average use cycle and are not unduly burdensome to conduct. Therefore, the Joint Commenters stated their support for DOE's proposed test procedure, which is largely consistent with, although not identical to, AHAM AC-7-2022. (Joint Commenters, No. 34 at p. 2)

The Joint Commenters noted that DOE proposed to adopt the substantive provisions of AHAM AC-7-2022 in its final draft form with some modifications. The Joint Commenters commented that they support adoption of AHAM AC-7-2022, which had been published at the time of their comments, as the DOE test procedure, though they stated that minor differences exist in the instrumentation provisions compared to the version that DOE referenced in the October 2022 NOPR. The Joint Commenters

commented that these minor differences are known to other stakeholders and should not prevent DOE from adopting the final, published version of AHAM AC-7-2022. (Joint Commenters, No. 34 at p. 2)

The Joint Commenters stated that they support incorporating by reference AHAM AC-1-2020 because, though an updated version of AC-1 is in process, it will not be completed in time for DOE to meet the timelines in the Joint Proposal. (Joint Commenters, No. 34 at p. 2)

AHRI recommended that DOE implement AHAM AC-7-2022 Draft without modifications beyond the consideration of break-in conditions, as discussed in the relevant section. (AHRI, No. 33 at p. 2)

NEEA stated its support of DOE's proposed test procedure for air cleaners, which would adopt AHAM AC-7-2022. NEEA commented that AHAM AC-7-2022 includes significant improvements over the test method in ENERGY STAR V. 2.0, including introduction of a $PM_{2.5}$ CADR metric, which would allow testing of a wider range of product classes. NEEA commented that AHAM AC-7-2022 also specifies a method for calculating AEC, which includes assumptions regarding active operation and low power mode, detailing how to use AEC to calculate IEF. NEEA added that including low power mode represented an improvement over AHAM's previous test procedure. NEEA commented that improvements could be made as some elements of the AHAM test procedure were still in development, but stated such ongoing work should not delay

adoption of DOE's proposed test procedure; NEEA cited the example of AHAM developing details for determining smoke CADR, such as the use of KCl to represent cigarette smoke, as one such issue that should not delay adoption. (NEEA, No. 28 at pp. 1–2)

AAFA commented that DOE should consider aspects of the AAFA/Allergy Standards Limited asthma & allergy friendly® Certification Program, designed to help people make better choices when buying products to remove allergens and improve indoor air quality. (AAFA, No. 29 at pp. 2–3)

DOE recognizes, as stated by the Joint Commenters, that AHAM AC-7-2022 specifies minor updates to the instrumentation provisions compared to the AHAM AC-7-2022 Draft that DOE referenced in the October 2022 NOPR. DOE discussed these updates to the instrumentation provisions in the NOPR public meeting and also discusses them in the relevant sections of this document. (Public Meeting Transcript, No. 25 at p. 26) As discussed elsewhere, the updates to the instrumentation provisions do not impact test results. Therefore, DOE is adopting AHAM AC-7-2022, with some modifications, in this final rule.

AAFA's certification program, which is also based on a modified version of the AHAM test standard, specifically focuses on particulates related to asthma and allergens. DOE has determined that the test procedure based on AC-7-2022, including the $PM_{2.5}$ CADR, measures the energy efficiency of air cleaners during a representative average use

cycle and is not unduly burdensome to conduct. DOE recognizes the utility of air cleaners offering specific particulate removal capabilities and will consider such capabilities when determining appropriate energy conservation standards for air cleaners.

In conclusion, for the reasons discussed here and in the October 2022 NOPR, DOE is referencing AHAM AC-7-2022, AHAM AC-1-2020, IEC 62301 Ed. 2.0, and ASTM E741-11(2017) in this final rule, with certain modifications, as proposed in the October 2022 NOPR.

2. Other Industry Standards

In this final rule establishing an initial test procedure for measuring the energy efficiency of air cleaners, DOE is focusing on the functionality most broadly implemented in air cleaners on the market in the United States; *i.e.*, the removal of particulate matter through mechanical filtration means, which may include ionization particulate capture as well. Certain microorganisms, depending on their size, also may be removed from the air by such devices. In light of the ongoing COVID-19 pandemic and other health concerns, DOE recognizes the utility to consumers of additional means for reducing concentrations of microorganisms in the air, including destruction or deactivation of the microorganisms.

An example of a test method for air cleaners that reduce concentrations of airborne microorganisms is AHAM AC-5-2022, which AHAM published in March 2022. Under this test method, air cleaners are tested in a manner similar to AHAM AC-1-2020,

except microorganisms, rather than particulates are aerosolized and introduced into the chamber. AHAM AC-5-2022 specifies different types of bacteria, bacteriophages, and mold spores that could be used for testing. Although DOE did not propose provisions in the October 2022 NOPR to measure the efficacy of an air cleaner's removal of microorganisms, DOE welcomed comment on the impact the type of microorganism selected for testing has on the CADR for microbes (m-CADR) value (*e.g.*, Phi-X 174 *vs*. MS2). 87 FR 63324, 63331. DOE also welcomed comment on whether measurements taken every two minutes for a duration of 10 minutes, as specified in section 7.3 of AHAM AC-5-2022, are sufficient to determine m-CADR. *Id*. DOE additionally requested comment on the duration for which a sample must be collected during each measurement point. *Id*. DOE also observed from test results that the natural decay curve for microorganisms could be increasing during the first 10–15 minutes and welcomed feedback on whether this is reasonable. *Id*.

The CA IOUs commented that DOE should continue outreach on other test standards (*e.g.*, AHAM AC-4 and AC-5), but not at the expense of completing this rulemaking within the timeframe recommended in the Joint Proposal. The CA IOUs expressed appreciation that DOE asked stakeholders for more information regarding microbiological (AHAM AC-5) and gaseous (AHAM AC-4) test standards, but the Joint Proposal did not propose a metric based on such testing and the CA IOUs believe it to be unnecessary at this time. (CA IOUs, No. 30 at p. 3)

AHRI advised DOE against referencing AHAM AC-5-2022 and stated that the appropriate test standards are already in use for determining m-CADR. (AHRI, No. 33 at p. 3)

The Joint Commenters stated that DOE should not at this time prescribe a test for gases or microorganisms because the Joint Commenters have not proposed standards based on them. The Joint Commenters commented that if DOE has specific questions about AHAM AC-5, it should request that the AHAM AC-5 task force reconvene to discuss technical matters. The Joint Commenters noted that AHAM AC-5-2022 was published in March 2022, meaning little test data is available. (Joint Commenters, No. 34 at p. 4)

MIAQ recommended that DOE focus on mechanical filtration of particulates as the basis of its energy regulations because including microorganisms and volatile organic compounds (VOCs) as part of CADR results would add undue testing and expense to the manufacturer for products that may not include any means for reducing these constituents (*i.e.*, carbon filter for VOCs). MIAQ commented that specific constituents should be considered outside the scope of this testing and that introducing any regulations or requirements for microorganism reduction may add additional EPA regulation work and documentation and could classify the product as a pesticidal device. MIAQ added that AHAM AC-4 and AHAM AC-5 could be used as a basis for the evaluation of CADR ratings for these specific use cases, but AHAM AC-4 and AHAM AC-5 should be

considered supplemental rather than required as part of this regulation. (MIAQ, No. 26, at pp. 3–4)

AHRI commented that stakeholders have not been provided sufficient information to provide substantive data on the need for testing with more than one microorganism. AHRI requested that DOE provide additional clarification on the purpose of this proposal and data to support their investigation. AHRI commented that the addition of new microorganisms is likely to affect CADR ratings and, as a proposed regulated metric, this effect should be carefully considered. AHRI commented that if DOE is unable to provide data to support this proposal, any further recommendations should be reviewed by the consensus body developing AHAM AC-5-2022. (AHRI, No. 33 at p. 3)

Daikin commented in support of further investigation and clarity on using the AHAM AC-5-2022 standard in relation to this regulation, as it believes that different types of microorganisms are expected to affect CADR ratings, and stated that it did not have any recommended action. Daikin further commented that if DOE intended to stem the misuse of incorrect efficacy claims related to certain infectious pathogens based on different laboratory pathogens, then Daikin would support further investigation and clarity. (Daikin, No. 35 at p. 2)

DOE is still evaluating the repeatability, reproducibility, and representativeness of AHAM AC-4-2022 and AHAM AC-5-2022. Accordingly, and consistent with stakeholder comments, DOE is not prescribing a test method for testing gaseous contaminants or microorganisms at this time.

D. Definitions

As discussed, DOE specifies a definition for air cleaners at 10 CFR 430.2. Additionally, as discussed in section III.B of this document, DOE is referencing, but not incorporating by reference, section 2.1.1 of AHAM AC-7-2022 in 10 CFR 430.2 to specify the definition for "conventional room air cleaner" and reference within this definition sections 2.1.3.1 and 2.1.3.2 of AHAM AC-7-2022 to define "portable air cleaner" and "fixed air cleaner," respectively. These definitions are relevant to establish the scope of the new appendix FF.

In addition to these definitions, in the October 2022 NOPR, DOE proposed to specify certain additional definitions in the proposed new appendix FF that would be required to test air cleaners according to the new test procedure. 87 FR 63324, 63332.

DOE proposed to reference sections 2.2, 2.3, 2.4.1 through 2.4.2.4, and 2.6 through 2.8[15] of AHAM AC-7-2022 Draft to specify definitions for the following terms in section 2 of the proposed new appendix FF. *Id*.

- Function means a predetermined operation undertaken by the air cleaner. Functions may be controlled by an interaction of the user, of other technical systems, of the system itself, from measurable inputs from the environment and/or time. In AHAM AC-7-2022, functions are grouped into four main types: primary functions, secondary

[15] DOE notes in the preamble of the October 2022 NOPR it stated that it proposed to reference sections 2.2, 2.3, 2.4.1 through 2.4.2.4, and 2.6 through 2.8 of AHAM AC-7-2022 Draft, but the definitions it proposed to reference from the AHAM standard are listed in sections 2.2, 2.3, 2.4.1 through 2.4.2.4, and 2.6 through 2.9. 87 FR 63324, 63332. Additionally, the proposed CFR language contained the reference to definitions from section 2.9 of AHAM AC-7-2022 Draft. Id. at 63352.

functions, user oriented secondary functions, and network related secondary functions.

- Primary function means an air cleaning function that reduces the concentration of one or more types of indoor air pollutants.

- Secondary function means a function that enables, supplements, or enhances a primary function. For air cleaners, secondary functions are other functions which are not directly related to air cleaning. Examples may include a vacuum, heating, humidification, or additional ambient room lights (*e.g.*, night light).

- User oriented and network function (*i.e.*, control functions) may include network connection, Wi-Fi, clocks, radio, remote controls, or other programmable functions that may continue to be enabled when the primary function is inactive.

- Mode means a state that has no function, one function, or a combination of functions present.

- Active mode means a product mode where the energy using product is connected to a mains power source and at least one primary function is activated.

- Low power mode as per IEC 62301 Ed. 2.0 means a product mode that falls into one of the following broad mode categories: off mode(s), standby mode(s), network mode(s), inactive mode.

- Standby mode means a mode offering one or more of the following user-oriented or protective functions which may persist for an indefinite time:

  (a) To facilitate the activation of other modes (including activation or deactivation of active mode) by remote switch (including remote control), internal sensor, or timer.

  Informative Note: A timer is a continuous clock function (which may or may not be associated with a display) that provides regular scheduled tasks (e.g., switching) and that operates on a continuous basis.

  (b) Continuous functions, including information or status displays (including clocks) or sensor-based functions.

- Inactive mode means a standby mode that facilitates the activation of active mode by remote switch (including remote control) or internal sensor, or which provides continuous status display.

- Off mode means a mode in which a consumer room air cleaner is not providing any active or standby mode function and where the mode may persist for an indefinite time, including an indicator that only shows the user that the product is in the off position.

- Network mode means any product modes where at least one network function is activated (such as reactivation via network command or network integrity communication) but where the primary function is not active.

- Clean Air Delivery Rate (CADR) is the measure of the delivery of contaminant free air, within a defined particle size range, by an air cleaner, expressed in cubic feet per minute (cfm). CADR is the rate of contaminant reduction in the test chamber when the air cleaner is turned on, minus the rate of natural decay when the air cleaner is not running, multiplied by the volume of the test chamber as measured in cubic feet. Note: CADR values are always the measurement of an air cleaner performance as a complete system and have no linear relationship to the air movement *per se* or to the characteristics of any particle removal methodology.

- Integrated energy factor (IEF) is the energy the air cleaner uses when it is in standby mode, as well as its active mode energy. This is fully defined as the measured $PM_{2.5}$ CADR per watt.

- $PM_{2.5}$ means particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers (µm) as measured by a reference method based on 40 CFR part 50 Annex I and designated in accordance with 40 CFR part 53 or by an equivalent method designated in accordance with 40 CFR part 53.

- $PM_{2.5}$ CADR is from ANSI/AHAM AC-1-2020; Annex I. The performance on $PM_{2.5}$ 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 to 0.5 µm with the

CADR of dust particles that fall in the range of 0.5 to 2.5 µm and performing a geometric average calculation.

$$PM_{2.5}CADR = \sqrt{Smoke\ CADR\ (0.1 - 0.5\ \mu m) \times Dust\ CADR\ (0.5 - 2.5\ \mu m)}$$

AHAM AC-7-2022 Draft also includes definitions for other terms that DOE did not propose to incorporate into the proposed new appendix FF. Generally, these other terms are inconsistent with or not relevant to the scope of the DOE test procedure. *Id*.

DOE requested comment on its proposal to include definitions for the aforementioned terms, via reference to AHAM AC-7-2022 Draft. *Id.* at 87 FR 63333.

Carrier expressed support for DOE's proposal to reference sections 2.2 and 2.3, sections 2.4.1 through 2.4.2.4, and sections 2.6 through 2.8 of AHAM AC–7–2022 Draft for the defined terms in the proposed new appendix FF, with the only additional recommendation to include "ceiling mounted" in the definition for a "conventional room air cleaner." (Carrier, No. 31 at p. 3) For the reasons discussed in section III.B of this document, DOE is not including "ceiling mounted" in the definition of conventional room air cleaners.

AHRI commented that, if no substantive changes are made to the definitions between the draft and final standard, AHRI supports DOE's proposal to reference the definitions from AHAM AC-7-2022 in the new appendix FF. (AHRI, No. 33 at p. 4)

DOE notes no changes were made to the definitions in section 2 between the AHAM AC-7-2022 Draft and the published AHAM AC-7-2022.

DOE notes in the preamble of the October 2022 NOPR it stated that it proposed to reference sections 2.2, 2.3, 2.4.1 through 2.4.2.4, and 2.6 through 2.8 of AHAM AC-7-2022 Draft, but the definitions it proposed to reference from the AHAM standard are listed in sections 2.2, 2.3, 2.4.1 through 2.4.2.4, and 2.6 through 2.9, which is the definition for $PM_{2.5}$ CADR. 87 FR 63324, 63332. Additionally, the proposed CFR language contained the reference to definitions from section 2.9 of AHAM AC-7-2022 Draft. *Id.* at 63352. Given that the preamble language included the definition and the proposed CFR language contained the reference to section 2.9 of AHAM AC-7-2022 Draft, DOE is finalizing its inclusion in newly established appendix FF of the definitions for the aforementioned terms via reference to sections 2.2, 2.3, 2.4.1 through 2.4.2.4, and 2.6 through 2.9 of AHAM AC-7-2022.

E. Test Conditions

Section 3 of AHAM AC-7-2022 specifies test conditions for the measurement of active mode and standby mode power consumption and includes references to certain sections of AHAM AC-1-2020 as appropriate. Specifically, sections 3.1 through 3.6 of AHAM AC-7-2022 specify requirements for active mode and standby mode electrical supply, test chamber ambient temperature, test chamber air exchange rate, test chamber particulate matter concentrations, chamber equipment, and test unit preparation

(including conditioning of the air cleaner prior to testing, placement of the air cleaner for testing, and network connection setup requirements), respectively.

DOE proposed in the October 2022 NOPR to reference the test condition requirements specified in sections 3.1 through 3.6 of AHAM AC-7-2022 in the proposed new appendix FF. 87 FR 63324, 63333. The following sections summarize each of the requirements specified in AHAM AC-7-2022 along with any stakeholder comments received in response to this proposal.

1. Electrical Supply

Section 3.1 of AHAM AC-7-2022 specifies the electrical supply requirements for active mode and standby mode testing. These requirements specify that active mode power supply test voltage and frequency must be set to the nameplate voltage ± 1 percent. If a range of voltage is provided on the nameplate, then the voltage for the country for which the measurement is being determined shall be used per Table 1 of AHAM AC-7-2022 (± 1 percent). Table 1 specifies 120 volts and 60 hertz for units in North America. For standby mode testing, the power supply test voltage and frequency are to be set as noted in Table 1 of AHAM AC-7-2022 (± 1 percent), which specifies 115 volts and 60 hertz for units in North America. DOE notes that these power supply requirements are generally consistent with DOE test procedures for other consumer products for which standby mode and active mode are tested. Accordingly, in the October 2022 NOPR, DOE proposed to reference section 3.1 of AHAM AC-7-2022 Draft for the electrical supply requirements in the proposed new appendix FF. 87 FR 63324, 63333.

DOE requested comment on its proposal to reference section 3.1 of AHAM AC-7-2022 Draft for the electrical supply requirements for active mode and standby mode power measurement in proposed new appendix FF. *Id.*

MIAQ recommended aligning the supply voltage for active mode and standby mode, as lower supply voltage may cause lower efficiency of switch-mode power supplies. MIAQ added that when measuring standby or low power modes, such a minor efficiency change may be more significant as the power limit thresholds continue to be lowered. (MIAQ, No. 26 at p. 5)

AHRI commented that it supports DOE's proposal to reference section 3.1 of AHAM AC-7-2022 Draft for the electrical supply requirements for active and standby mode power measurement. (AHRI, No. 33 at p. 4)

Regarding the supply voltages specified for active mode and standby mode testing, the proposed voltage specifications are consistent with the respective industry standards that DOE proposed to incorporate by reference (and that are being incorporated by reference in this final rule). That is, section 3.1 of AHAM AC-7-2022 specifies that the active mode power supply test voltage must be the nameplate voltage (±1 percent) or, if a range of voltages are provided on the nameplate, 120 volts (±1 percent). Section 3.1 of AHAM AC-7-2022 additionally requires 115 volts (±1 percent) for the standby mode power supply test voltage. DOE notes that this requirement is also consistent with the test method specified in ENERGY STAR V. 2.0. DOE is adopting these voltage

requirements in this final rule given the potential near-term compliance timeline recommended in the Joint Proposal and the consequent burden that would be associated with re-testing all units that are currently certified to ENERGY STAR V. 2.0 within a short period of time if DOE were to require the same voltage requirements for both active and standby mode in appendix FF. Additionally, as discussed, EPCA requires DOE to consider the most current version of IEC 62301 in prescribing or amending test procedures that integrate measures of standby mode and off mode energy consumption into the overall energy efficiency, energy consumption, or other energy descriptor. (42 U.S.C. 6295(gg)(2)(A)) Section 4.3.1 of IEC 62301 Ed. 2.0 specifies a test voltage of 115 volts (±1 percent) for standby mode power consumption testing in North America in the instance where the test voltage is not otherwise specified in an external standard, with no consideration of the nameplate voltage included. By incorporating by reference in the newly established appendix FF the standby mode supply power test voltage requirements from AHAM AC-7-2022, which are consistent with those in IEC 62301 Ed. 2.0, DOE is in part satisfying EPCA's requirement that the test procedure account for standby mode and off mode energy consumption..

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the electrical supply specifications for the newly established appendix FF, as proposed in the October 2022 NOPR.

2. Ambient Conditions

Section 3.2 of AHAM AC-7-2022 specifies the test chamber ambient temperature requirements for active mode and standby mode tests. The active mode ambient

temperature requirement is 70 ± 5 degrees Fahrenheit (°F) (21 ± 3 degrees Celsius (°C)) with a relative humidity of 40 ± 5 percent. The standby mode ambient temperature requirement is 70 ± 9 °F (21 ± 5 °C), with no relative humidity requirement specified. DOE notes that the active mode test requirements are similar to the ambient conditions specified for certain other consumer products that affect room air besides heating or cooling (*e.g.*, DOE's ceiling fan test procedure specifies maintaining the room temperature at 70 ± 5 °F and the room relative humidity at 50 ± 5 percent during testing),[16] and as such, DOE expects that these conditions would also produce representative test results for air cleaners. Additionally, section 5.7.2 of AHAM AC-7-2022, which specifies the supplemental test to measure active mode power consumption outside a test chamber, also references section 3.2 of AHAM AC-7-2022 to specify that the same ambient conditions must be maintained when testing outside the chamber.

DOE recognizes that standby mode testing is likely to be much less sensitive to ambient room temperature or humidity compared to active mode testing, such that the wider tolerance on ambient temperature and the lack of a humidity requirement for standby mode testing are appropriate. DOE understands that test laboratories already have the expertise and equipment necessary to maintain these specified ambient temperature and relative humidity test conditions—within the specified tolerances—when testing air cleaners within the test chamber, as well as the expertise and equipment necessary for maintaining temperature within the specified tolerance for standby mode. In the October 2022 NOPR, DOE proposed to reference these ambient temperature and

[16] *See* section 3.3.1(1) of 10 CFR, part 430, subpart B, appendix U, "Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans."

relative humidity requirements from AHAM AC-7-2022 Draft in the proposed new appendix FF. 87 FR 63324, 63333.

DOE requested comment on its proposal to reference section 3.2 of AHAM AC-7-2022 Draft for the ambient temperature and humidity requirements for active mode and standby mode power measurement. *Id.*

MIAQ recommended aligning the ambient temperature for both active mode and standby mode. (MIAQ, No. 26 at p. 5)

As discussed in the October 2022 NOPR, DOE recognizes standby mode testing to be much less sensitive to ambient room temperature or humidity compared to active mode testing of air cleaners. Additionally, the wider tolerance for the ambient conditions for standby mode testing would allow such testing to be conducted outside the specialized active mode test chamber, which would significantly reduce test burden by allowing greater testing throughput in the specialized active mode test chamber.

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the ambient test condition specifications in new appendix FF, as proposed in the October 2022 NOPR.

3. Test Chamber Air Exchange Rate

Section 3.3 of AHAM AC-7-2022 requires that, per section 4.3 of AHAM AC-1-2020, the test chamber air exchange rate must be less than 0.03 air changes per hour as

determined by ASTM E741 or an equivalent method. DOE does not have information on typical air changes within a representative room, but this condition is necessary to ensure consistent test chamber conditions by minimizing the air exchange rate, and DOE has tentatively determined that the industry-accepted specification for the air exchange rate, as reviewed by the AHAM task force, would be appropriate for air cleaner testing. Accordingly, in the October 2022 NOPR, DOE proposed to additionally reference section 4.3 of AHAM AC-1-2020 within the proposed provisions of section 3 of the proposed new appendix FF. 87 FR 63324, 63333. As discussed, DOE also proposed to incorporate by reference ASTM E741-11(2017), the most recent version of that industry standard. *Id*.

DOE requested comment on its proposal to reference section 3.3 of AHAM AC-7-2022 Draft for the test chamber air exchange rate requirements, including its reference to ASTM E741-11(2017), in the proposed new appendix FF. *Id*.

AHRI stated its support for DOE's proposal to reference ASTM E741-11(2017), referenced in AHAM AC-7-2022 Draft. AHRI commented that the test chamber air exchange rate per AHAM AC-1-2020 should be less than 0.03 air changes per hour (ACH) as determined by ASTM E741-11(2017). (AHRI, No. 33 at p. 3)

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the test chamber air exchange rate requirements, as proposed in the October 2022 NOPR, in the new appendix FF.

4. Test Chamber Particulate Matter Concentrations

Section 3.4 of AHAM AC-7-2022 specifies the acceptable range of particle concentrations for the initial test condition for the smoke and dust tests, via reference to AHAM AC-1-2020. The acceptable ranges in section 3.4 of AHAM AC-7-2022 correspond with the ranges provided in section 4.4 of AHAM AC-1-2020. DOE recognizes that initial particle concentration is a necessary requirement for repeatability and reproducibility by ensuring consistent test chamber conditions prior to measuring decay rate, and in the October 2022 NOPR, DOE tentatively determined that the industry-accepted specification for the initial particle concentrations, as reviewed by the AHAM task force, would be appropriate for air cleaner testing. 87 FR 63324, 63333–63334. Accordingly, DOE proposed to reference section 3.4 of AHAM AC-7-2022 Draft and additionally reference section 4.4 of AHAM AC-1-2020 within the proposed provisions of section 3 of the new appendix FF. *Id.* at 87 FR 63334.

DOE requested comment on its proposal to reference section 3.4 of AHAM AC-7-2022 Draft for the initial particulate concentrations in the test chamber. *Id*.

DOE did not receive any comments on this topic. For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the provisions specifying the initial particulate concentrations in the test chamber, as proposed in the October 2022 NOPR, for the new appendix FF.

5. Test Chamber Construction and Equipment

Section 3.5 of AHAM AC-7-2022 references Annex A of AHAM AC-1-2020 to specify the test chamber construction and equipment positioning during testing. Annex A of AHAM AC-1-2020 provides requirements for chamber size, framework, constructions and material for the walls and flooring, as well as additional equipment that must be used in the chamber for conducting tests. DOE believes these requirements are relevant to ensure that testing is conducted in a representative chamber and that it is repeatable and reproducible.

In the October 2022 NOPR, DOE proposed to reference in the proposed new appendix FF section 3.5 of AHAM AC-7-2022 Draft, which references Annex A of AHAM AC-1-2020 for the details of the test chamber construction and equipment. 87 FR 63324, 63334.DOE requested comment on its proposal to reference section 3.5 of AHAM AC-7-2022 Draft, which references Annex A of AHAM AC-1-2020 to specify the test chamber construction and equipment requirements. *Id*.

DOE did not receive any comments on this topic. For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the test chamber construction and equipment specifications in the new appendix FF, as proposed in the October 2022 NOPR.

6. Test Unit Preparation

Section 3.6 of AHAM AC-7-2022 specifies three requirements regarding test unit preparation: conditioning of the air cleaner prior to measurement in section 3.6.1; test

unit placement for testing in section 3.6.2; and network connectivity requirements in section 3.6.3.

For the conditioning requirements, section 3.6.1 of AHAM AC-7-2022 specifies that air cleaners must be operated for 48 hours in maximum performance mode to break in the motor prior to conducting any active mode tests. It further specifies that this break-in must be conducted with replacement filters and that after the break-in period is completed, all original and as-received filters must be reinstalled, and non-replaceable components should be cleaned according to manufacturers' instructions prior to performing the active mode test. Additionally, section 3.6.1 of AHAM AC-7-2022 specifies that installation of a UV device that is energized during air cleaning function and lamp assembly within the air cleaner shall be according to manufacturer's instructions and the burn-in time for the UV lamp shall also be 48 hours, run concurrently with the break-in period of the motor.

In the October 2022 NOPR, DOE requested comment on its proposal to reference section 3.6.1 of AHAM AC-7-2022 Draft for the air cleaner conditioning requirements in the proposed new appendix FF. 87 FR 63324, 63334.

DOE also requested comment on whether the 48-hour burn-in time for air cleaners with UV lights is sufficient or if the burn-in time duration should be increased. *Id.*

AHRI commented that it supports DOE's proposal to reference section 3.6.1 of AHAM AC-7-2022 Draft for the air cleaner conditioning requirements. AHRI commented that it is imperative to specify and standardize conditions for break-in because they may affect ratings. AHRI recommended including in the testing conditions maintaining a relative humidity below 60 percent in noncondensing conditions, maintaining temperatures above 32 °F and below 80 °F, and maintaining a testing environment that is free of contaminants, particulate matter, and chemicals. (AHRI, No. 33 at p. 4)

Daikin commented it agrees to include section 3.6.1 of AHAM AC-7-2022, but that section 3.6.1 of AHAM AC-7-2022 is lacking crucial details about the break-in procedure. Daikin stated that the standard specifies a break-in duration, but it does not specify where to run the unit during the break-in period. Daikin commented that it does not expect a laboratory to use the test chamber for the break-in procedure. Consequently, if the laboratory places a test unit outside the chamber, Daikin stated that the unit should be placed in a location with acceptable air quality and absent particulate matter and chemicals (*e.g.*, isopropyl alcohol (IPA)) that may affect test repeatability. Daikin commented that unless DOE can prove that the break-in location has no impact on the measured performance ratings, it is good practice to standardize break-in conditions and avoid unnecessary confounding factors where feasible. Daikin recommended the following broad ambient conditions during break-in to ensure repeatability: room temperature to be between 32 °F and 80 °F and relative humidity to be less than 60-percent, non-condensing conditions, and the break-in room to be a clean, ventilated space, absent of chemicals and particulate matter that may be found in a test laboratory

conducting air quality tests. Daikin recommended that DOE provide more detailed and repeatable break-in room requirements for future versions of the standard. (Daikin, No. 35 at pp. 2–3)

DOE notes that the ambient conditions suggested by AHRI would require the use of a test chamber for the duration of the break-in period, which is 48 hours. This would significantly increase burden compared to using the test chamber only for the active mode measurement, as proposed. Regarding Daikin's recommended ambient conditions for conditioning the air cleaner, DOE appreciates the comment and will continue to investigate these issues as part of the AHAM task force. At this time, the proposed use of a replacement filter during the break-in period is intended to prevent changes in ratings caused by using a pre-used filter during the active mode portion of the test. DOE also does not have any information to suggest that it is necessary to have the same ambient conditions during break-in as during the active mode test, and therefore is not adopting condition requirements for the break-in period.

MIAQ stated its support for a 48-hour burn-in time for air cleaners with UV light-emitting diode (LED) lights. (MIAQ, No. 26 at p. 5)

The Joint Commenters commented that they believe a 48-hour burn-in time for air cleaners with UV lights is sufficient because the lamps are not being used for smoke or dust removal and the 48-hour burn-in time does not add additional burden to the test setup. (Joint Commenters, No. 34 at p. 5)

AHRI commented that because lamps are not used for smoke and dust removal, the 48-hour burn-in time is equivalent to the other components and does not create additional test burden. AHRI recommended following manufacturers' instructions for burn-in time and commented that unless otherwise stated by a manufacturer, the 48-hour burn-in time for air cleaners is appropriate. (AHRI, No. 33 at p. 4)

Consistent with the comments summarized in the preceding paragraphs, DOE agrees that a 48-hour burn in time for units with UV lamps, as specified in section 3.6.1 of AHAM AC-7-2022, is suitable to ensure a representative and repeatable test condition without being unduly burdensome because UV lamps are not used for smoke and dust removal and this burn in time is consistent with the break-in period required for air cleaners generally.

Carrier commented that in terms of burn-in time for air cleaners with UV lights, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 185.1[17] and the National Electrical Manufacturers Association (NEMA) require a 100-hour burn-in requirement for testing UV lights and that, as a result, Carrier suggested that DOE adopt a 100-hour burn-in, instead of the 48 hours defined in section 3.6.1 of AHAM AC-7-2022 Draft. (Carrier, No. 31 at p. 3)

DOE notes that the ASHRAE test standard listed by Carrier is specifically intended to evaluate UV-C lamps to inactivate airborne microorganisms; whereas, the

[17] Standard 185.1-2020 -- Method of Testing UV-C Lights for Use in Air-Handling Units or Air Ducts to Inactivate Airborne Microorganisms (ANSI Approved). Available at: *https://www.techstreet.com/standards/ashrae-185-1-2020?product_id=2185612.*

DOE test procedure is not introducing microorganisms in the test chamber, and UV-C lamps without a fan for air circulation do not meet the definition of an air cleaner and therefore are not within the established scope of this the procedure. Additionally, a 100-hour UV burn-in period would significantly increase burden, and Carrier did not provide any data or information to suggest what additional benefit would be gained over the proposed 48-hour burn-in period.

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the air cleaner conditioning requirements, as proposed in the October 2022 NOPR, in the new appendix FF.

7. Test Unit Placement for Testing

Section 3.6.2 of AHAM AC-7-2022 specifies that the air cleaner must be placed in the test chamber in accordance with section 4.6 of AHAM AC-1-2020, which states that the air cleaner must be installed per manufacturer's instructions in the center of the test chamber, facing the test window, positioned with its air discharge as close as possible to the test chamber center. Section 4.6 of AHAM AC-1-2020 further requires that if the manufacturer's instructions "do not specify"[18] and the air cleaner is not a floor model, the air cleaner must be placed on the table for testing. AHAM AC-1-2020 does not provide further specificity as to how to determine if an air cleaner is a floor model, which may potentially cause ambiguity in determining whether a particular air cleaner would need to

[18] DOE understands the language "If manufacturer's instructions do not specify" to mean that the manufacturer's instructions do not clearly indicate the placement of the air cleaner on a floor, table, or another flat surface.

be placed on the table. DOE notes that section 5.7 of IEC 63086-1[19] requires that if placement of an air cleaner is not specified by the manufacturer and the air cleaner's height is less than 0.7 meters from the floor, the unit shall be placed on a table of 0.7 meters in height. In all other instances, IEC 63086-1 specifies that the air cleaner shall be placed on the floor of the test chamber.

In the October 2022 NOPR, DOE proposed to reference section 3.6.2 of AHAM AC-7-2022 Draft in the proposed new appendix FF. 87 FR 63324, 63334. DOE also considered including the additional test unit placement requirement from IEC 63086-1. *Id.* at 87 FR 63334–63335. By referencing a measurable metric (unit height) to determine the installation configuration of the air cleaner in the absence of manufacturer's instructions, DOE stated that IEC 63086-1 may provide greater certainty regarding how to test certain air cleaner models, which could contribute to a more reproducible and representative test measurement. *Id*. In the October 2022 NOPR, DOE considered specifying the height limit for placement on the table in the test chamber as 28 inches, given that 0.7 meters is approximately 27.6 inches. *Id*. Additionally, DOE considered whether it should include any requirement for air cleaners shipped with casters; specifically, whether such air cleaners should be tested on the floor regardless of the unit's height. *Id*.

[19] IEC 63086-1:2020, "Household and similar electrical air cleaning appliances - Methods for measuring the performance - Part 1: General requirements."

In the October 2022 NOPR, DOE requested comment on its proposal to reference section 3.6.2 of AHAM AC-7-2022 Draft, which references section 4.6 of AHAM AC-1-2020 for the test unit placement instructions, in the proposed new appendix FF. *Id.*

DOE also requested comment on whether it should consider including the requirement from IEC 63086-1 that specifies that if the placement of the air cleaner is not specified by the manufacturer and the air cleaner's height is less than 28 inches, then the unit must be tested on the table. Specifically, DOE requested comment on whether the language in AHAM AC-7-2022 Draft stating that "if the air cleaner is not a floor model" is clear to follow, without any ambiguity, or whether a quantitative metric such as unit height would be better to ensure consistent test setup. *Id.*

DOE also requested comment on whether it should include any placement instructions for air cleaners shipped with casters. *Id*.

Carrier commented that in cases where the manufacturer does not specify placement and fails to designate the unit as a floor model, DOE should include the requirement from IEC 63086-1 specifying that if the placement of the air cleaner is not specified by the manufacturer and the air cleaner's height is less than 28 inches, then the unit must be tested on the table. (Carrier, No. 31 at p. 4)

MIAQ recommended following the manufacturer's instructions; for example, if the air cleaner is called a "floor model," it should be tested on the floor, however if it lacks the specification as a "floor model," it should be tested on the table. MIAQ also

commented that if an air cleaner included casters for portability, then the unit should be tested on the floor, unless otherwise specified in the manufacturer's instructions. (MIAQ, No. 26 at p. 6)

AHRI commented that AHAM has published an interpretation of AC-1-2020 (October 3, 2022)[20] that specifies test unit placement instructions and recommended that DOE reference this publication. (AHRI, No. 33 at p. 4)

The Joint Commenters stated that AHAM addressed several of DOE's requests for comments on unit placement and section 4.6 of AHAM AC-1-2020 by adding an interpretation to AHAM AC-1-2022 on October 3, 2022. The Joint Commenters commented that questions addressed include (1) whether to include additional test unit placement requirements, (2) whether to include a requirement for air cleaners shipped with casters, and (3) whether to specify placement of the air cleaner if placement is not specified by the manufacturer and the air cleaner's height is less than 28 inches. The Joint Commenters stated that a published copy of AHAM-AC-1-2020 with interpretation was provided to DOE on November 14, 2022. The Joint Commenters commented that they urge DOE to adopt the interpretation as part of its incorporation by reference. (Joint Commenters, No. 34 at p. 5)

As noted by the Joint Commenters, AHAM has added an interpretation to the AHAM AC-1-2020 standard that includes the unit placement specifications from IEC

[20] See AHAM's comment during the public meeting. (AHAM, Public Meeting Transcript, No. 25 at p. 24)

63086-1, which provides greater clarity on the air cleaner placement when no manufacturer instructions are specified. The AHAM AC-1-2020 interpretation also notes that units with casters should be interpreted as floor models even when manufacturer instructions do not specify placement instructions.

DOE has determined that the updated AHAM-AC-1-2020 standard with the included interpretation that specifies the unit placement specifications from IEC 63086-1 is consistent with and adequately addresses the unit placement concerns discussed in the October 2022 NOPR. Accordingly, DOE is maintaining its reference to section 3.6.2 of AHAM AC-7-2022 for unit placement in the new appendix FF, but section 3.6.2 of AHAM AC-7-2022 references AHAM AC-1-2020, which includes the additional AHAM Standard Interpretation that specifies the same requirements as those specified in IEC 63086-1 and discussed in the October 2022 NOPR. For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the test unit placement instructions by referring to the AHAM Standard Interpretation in AHAM AC-1-2020.

8. Network Functionality

Section 3.6.3 of AHAM AC-7-2022 specifies requirements for setting up air cleaners with network functionality, including requirements for the network connection and for establishing the connection between the air cleaner and the network. This section specifies that air cleaners must be tested on a Wi-Fi network and that if the unit has additional network capabilities (*e.g.*, Bluetooth®), these capabilities shall remain in their default, as-shipped configuration. Additionally, section 3.6.3 of AHAM AC-7-2022 specifies that the network shall support the highest and lowest data speeds of the air

cleaner's network function, and that the live connection must be maintained for the duration of the active mode and standby mode tests. AHAM AC-7-2022 also specifies that if the air cleaner needs to install any software updates, testing must wait until these updates have occurred; otherwise, if the unit can operate without updates, the updates may be bypassed.

DOE is aware of at least one air cleaner on the market[21] that cannot be operated by the user, unless it is connected to an active network connection. On such a model, control of the air cleaner is provided exclusively through a mobile phone application. Accordingly, in the October 2022 NOPR, DOE proposed to reference the AHAM AC-7-2022 Draft network connection requirements in the proposed new appendix FF. 87 FR 63324, 63335.

DOE requested comment on its proposal to reference section 3.6.3 of AHAM AC-7-2022 Draft regarding network connection requirements during active mode and standby mode tests. DOE also requested comment on the impact on repeatability and reproducibility when testing air cleaners with network functionality while connected to a network. *Id*.

Additionally, DOE requested comment on whether the software update requirements are adequately specified or whether DOE should explicitly state that software updates must always be executed prior to running the tests. *Id*.

[21] *See*, for example: *auraair.io/pages/aura-air-1*.

MIAQ commented that products with network connectivity should be network-connected for active and standby tests. MIAQ added that not including an available network connection would not represent actual real-world usage, and that network connectivity on a device would be the worst-case test scenario regarding power consumption and therefore needed to be considered. (MIAQ, No. 26 at p. 6)

MIAQ commented that products should always be tested with the latest software/firmware updates to ensure the latest bug fixes and changes are applied. MIAQ commented that software bugs associated with wireless connectivity may cause undue power consumption during the test and that updating software to the latest publicly available revision may avoid testing pre-loaded firmware that allows the device to consume less power. MIAQ stated that, if available, the firmware/software version should be recorded as part of the test for trackability. (MIAQ, No. 26 at pp. 6–7)

The CA IOUs recommended that DOE should expressly state that the tester must always execute software updates before running the tests. The CA IOUs stated they understood that the conducting of these software updates was the intent of AHAM AC-7 section 3.6.3.8. (CA IOUs, No. 30 at p. 3)

The Joint Commenters commented that they support DOE's proposal to reference section 3.6.3 of AHAM AC-7-2022 regarding network connection requirements. The Joint Commenters stated that they believe the text of section 3.6.3 of AHAM AC-7-2022 provides the most consistent, representative, and repeatable method for energy measurements. The Joint Commenters also stated that the intent of section 3.6.3.8 of

AHAM AC-7-2022 is for software updates to be conducted prior to running the tests, as is industry practice. The Joint Commenters commented that if DOE wishes to indicate that the updates are mandatory, the Joint Commenters do not oppose that clarification. (Joint Commenters, No. 34 at p. 6)

In response to DOE's request for comment on whether the software update requirements are adequately specified, AHRI stated it does not have specific concerns. However, AHRI added that if there are different opinions on the need for when to perform software updates, it recommended addressing this issue during a certification rulemaking. (AHRI, No. 33 at p. 5)

In consideration of these comments, DOE has determined that installing the most recent software update prior to testing would ensure the most consumer-representative test results because consumers are most likely to update software if an update is available and, this would also ensure repeatable test results. Because section 3.6.3.8 of AHAM-AC-7-2022 does not adequately specify that the most up-to-date software shall be used, DOE is incorporating in the new appendix FF section 3.6.3.8 of AHAM AC-7-2022 with the additional requirement that software updates shall be conducted prior to initiating any testing. This added specificity will ensure reproducible and representative test results for units that can accommodate software updates.

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the network connection requirements, as proposed in the October 2022 NOPR, in the new

appendix FF and additionally clarifying that software updates shall be conducted prior to initiating any testing.

F. Instrumentation

Section 4 of AHAM AC-7-2022 specifies requirements for instrumentation used for measuring voltage and power by referencing IEC 62301 Ed. 2.0 and specifies the accuracy required for power-measuring equipment.

Sections 4.1.1 through 4.1.3 of AHAM AC-7-2022 specify requirements for power measurement uncertainty, frequency response, and long-term averaging, by referencing requirements in sections 4.4.1 through 4.4.3 of IEC 62301 Ed. 2.0. Along with these requirements, section 4 of AHAM AC-7-2022 specifies the accuracy of instruments used for measuring voltage and power to be accurate to within ± 0.5 percent of the quantity measured. Section 4 of AHAM AC-7-2022 also specifies requirements for the accuracy of the temperature-measuring device (error no greater than ± 0.6 °C (± 1 °F) over the range being measured) and the relative humidity-measuring device (resolution of at least 1 percent relative humidity, and an accuracy of at least ± 3 percent relative humidity over the temperature range of (21 ± 3) °C [(70 ± 5) °F]).

In the October 2022 NOPR, DOE had referenced section 4.1.5 of AHAM AC-7-2022 Draft, which specified that the accuracy of the temperature-measuring device must have an error no greater than ± 1 °F (0.6 °C) over the range being measured (*i.e.*, the allowable error was specified primarily in °F compared to the published AHAM AC-7-

2022, which specifies the allowable error primarily in °C). Section 4.1.6 of AHAM AC-7-2022 Draft, which DOE referenced in the October 2022 NOPR, also specified that the relative humidity-measuring device shall have resolution of at least 1 percent relative humidity and shall have an accuracy of at least ± 6 percent relative humidity over the temperature range of (24 ± 3) °C [(75 ± 5) °F]. 87 FR 63324, 63335.

DOE understands these instrumentation specifications to be appropriate for producing repeatable, reproducible, and representative test results for air cleaners, and that test laboratories currently have instrumentation that meets these proposed specifications. Therefore, in the October 2022 NOPR, DOE proposed to reference the instrumentation requirements specified in section 4 of AHAM AC-7-2022 Draft, including the applicable provisions from sections 4.4.1, 4.4.2, and 4.4.3 of IEC 62301 Ed. 2.0 in the proposed new appendix FF. *Id*.

DOE requested comment on its proposal to incorporate by reference section 4 of AHAM AC-7-2022 Draft regarding instrumentation requirements, including the applicable provisions from relevant sections of IEC 62301 Ed. 2.0. DOE requested comment on any changes to these requirements between publication of the October 2022 NOPR and publication of AHAM AC-7-2022, the reasons for these changes, and the impact of these changes on the overall air cleaners test procedure. *Id*.

AAF Flanders (AAF) recommended tightening the accuracy of the relative humidity measuring device from the ± 6 percent specified in AHAM AC-7-2022 Draft

because some of the media used in filters could be affected by humidity. (AAF, Public Meeting Transcript, No. 25 at p. 23) AAF also commented that the updated humidity instrumentation requirements in the published version of AHAM AC-7-2022 should be incorporated into the DOE test procedure. (*Id.* at p. 27)

The Joint Commenters stated that the published version of AHAM AC-7-2022 includes two editorial changes compared to AHAM AC-7-2022 Draft that was referenced in the October 2022 NOPR: (1) the °C temperature was added in section 4.1.5; and (2) the relative humidity accuracy was improved in section 4.1.6. The Joint Commenters commented that these editorial changes clarify the test and will improve accuracy. (Joint Commenters, No. 34 at p. 6)

MIAQ stated support for DOE's proposal to reference IEC 62301 Ed. 2.0 as cited in AHAM AC-7-2022 Draft for the instrumentation and testing provisions used to measure standby mode power consumption. (MIAQ, No. 26 at p. 3)

As discussed, the proposed editorial change to the temperature-measuring device accuracy requirements would not change the allowable tolerance, and the tighter tolerance for the relative humidity-measuring device is achievable. Accordingly, DOE is finalizing the instrumentation requirements in this final rule by referencing section 4 of AHAM AC-7-2022.

G. Active Mode Testing

1. Particulate Used for Testing and CADR Measurements

AHAM AC-7-2022 specifies calculating IEF using $PM_{2.5}$ CADR. Whereas, the ENERGY STAR V. 2.0 Specification specifies its metric based on smoke CADR, and the ENERGY STAR Product Specification for Room Air Cleaners, Version 1.0[22] specified its metric based on dust CADR (as did the subsequent Version 1.2).

Given the historic use of both smoke and dust particulates to define a metric for air cleaners, DOE proposed in the October 2022 NOPR to incorporate by reference section 2.9 of AHAM AC-7-2022 Draft to specify testing with smoke and dust and calculating $PM_{2.5}$ CADR. 87 FR 63324, 63337. Additionally, DOE proposed to reference sections 5 and 6 of AHAM AC-1-2020 for conducting the smoke CADR and dust CADR tests in the proposed new appendix FF. *Id.*

Section 2.9 of AHAM AC-7-2022 specifies the method used to calculate $PM_{2.5}$ CADR, which is based on the measured smoke CADR and dust CADR values. Section 2.9 of AHAM AC-7-2022 discusses that the diversity of particle natures and the sizes of the dust and smoke pollutants give a well-balanced representation of the ultra-fine and fine particulate matters that define $PM_{2.5}$. Specifically, $PM_{2.5}$ CADR is obtained by combining the smoke CADR (which includes particle sizes ranging from 0.1 to 0.5 µm)

[22] Further information on the ENERGY STAR Product Specification for Room Air Cleaners, Version 1.0 Specification is available online at *www.energystar.gov/sites/default/files/specs//private/room_air_cleaners_prog_req.v1_0pdf.pdf.*

with the dust CADR (which includes particle sizes ranging from 0.5 to 2.5 µm) and performing a geometric average calculation as follows:

$$PM_{2.5}CADR = \sqrt{Smoke\ CADR\ (0.1 - 0.5\ \mu m) \times Dust\ CADR\ (0.5 - 2.5\ \mu m)}$$

The tests to determine smoke CADR and dust CADR are specified in sections 5 and 6 of AHAM AC-1-2020. These sections of AHAM AC-1-2020 specify the procedure for introducing the smoke and dust particulates, conducting the natural decay test, and measuring the decay with the air cleaner in operation. However, $PM_{2.5}$ CADR specifies a narrower range of allowable particle sizes for the smoke CADR and dust CADR, than the smoke CADR and dust CADR tests in sections 5 and 6, respectively, of AHAM AC-1-2020. That is, the allowable particle size for smoke particles is 0.1 to 1 µm for the smoke CADR test in AHAM AC-1-2020, while it is 0.1 to 0.5 µm for the $PM_{2.5}$ calculation in AHAM AC-7-2022. Similarly, the allowable particle size for dust particles is 0.5 to 3 µm for the dust CADR test in AHAM AC-1-2020, while it is 0.5 to 2.5 µm for the $PM_{2.5}$ calculation in AHAM AC-7-2022.

While the allowable smoke and dust particle size ranges for the smoke CADR and dust CADR tests in sections 5 and 6, respectively, of AHAM AC-1-2020 are larger (*i.e.*, 0.1 to 1 µm for smoke particles and 0.5 to 3 µm for dust particles) than the allowable smoke and dust particle size ranges for the calculation of $PM_{2.5}$ CADR (*i.e.*, 0.1 to 0.5 µm for smoke particles and 0.5 to 2.5 µm for dust particles), the subset smoke CADR and dust CADR used to calculate $PM_{2.5}$ are nearly identical to the smoke CADR and dust

CADR calculated according to sections 5 and 6 of AHAM AC-1-2020, as shown in the figures included in the Joint Proposal.[23]

Finally, as discussed in section III.C.1 of this document, section 5.7.1 of AHAM AC-7-2022, states that KCl is allowed as an alternate to cigarette smoke per ANSI/AHAM AC-1-2022, which is a standard that has not yet published.

Accordingly, in the October 2022 NOPR, DOE also proposed that $PM_{2.5}$ CADR may alternatively be calculated in the proposed new appendix FF using the full range of particles used to calculate smoke CADR and dust CADR according to sections 5 and 6 of AHAM AC-1-2020, respectively. 87 FR 63324, 63337. DOE added that it may revisit allowing the use of both approaches to calculate $PM_{2.5}$ CADR in a future standards rulemaking. *Id.*

DOE requested feedback on its proposal to incorporate by reference section 2.9 of AHAM AC-7-2022 Draft to calculate $PM_{2.5}$ CADR based on measurements of smoke CADR and dust CADR.

DOE also requested comment on its proposal to reference sections 5 and 6 of AHAM AC-1-2020 to specify the test methods for determining smoke CADR and dust CADR, respectively. *Id*.

[23] The figure appears on page 6 of the Joint Proposal.

DOE also requested comment on whether it should consider specifying that KCl is an allowable alternate to cigarette smoke in the measurement of smoke CADR, even if AHAM AC-1-2022 is not published by the time DOE publishes its final rule. DOE requested data and information on the implications of using cigarette smoke and KCl interchangeably when performing air cleaner performance tests. DOE requested data and information on how a CADR value obtained using KCl compares to the CADR value obtained using cigarette smoke. 87 FR 63324, 63330.

AHRI commented that $PM_{2.5}$ CADR is the preferred regulated metric. (AHRI, No. 33 at p. 6)

Carrier stated its support for DOE's proposal to incorporate by reference section 2.9 of AHAM AC–7–2022 Draft to calculate $PM_{2.5}$ CADR based on measurements of smoke CADR and dust CADR. (Carrier, No. 31 at p. 4)

AHRI commented that AHAM developed the $PM_{2.5}$ CADR calculation based on smoke and dust measurements using geometric averaging. AHRI commented that $PM_{2.5}$ is more meaningful to consumers than dust CADR and does not require additional testing. AHRI stated that because particulate matter is the primary pollutant of concern, $PM_{2.5}$ CADR is the most appropriate metric. (AHRI, No. 33 at p. 6) AHRI commented that $PM_{2.5}$ has been successfully used for decades to represent particles in air filtration

and testing. AHRI additionally stated that ASHRAE 52.2[24] considers $PM_{2.5}$ to be one of the 12 particles used for testing, and commented that spectrometric measurements of $PM_{2.5}$ are highly accurate and successful. (AHRI, No. 33 at p. 2)

DOE agrees that the $PM_{2.5}$ CADR metric is the most appropriate metric to use for assessing CADR performance. $PM_{2.5}$ CADR is an established industry metric that can provide consumer-relevant and representative results as compared to a CADR metric based on a single particulate because the range of particle sizes included in $PM_{2.5}$, also referred to as fine particles, pose the greatest risk to health.[25]

Frey commented that DOE was relying on outdated science on high efficiency particulate air (HEPA) filtration. Frey discussed that in the early 1990s, research showed that 0.3 µm particles were not the most difficult particles to capture, and that HEPA-level filtration was much less efficient with smaller particle sizes.[26] Frey urged DOE to take into account real-world filtration statistics that show filtration 26 times better than HEPA at particles of 0.3 µm in size. Frey stated that when removing dangerous pathogens, the higher the efficiency, the better, and that HEPA was not the best standard for such a task. (Frey, No. 22 at p. 1)

[24] Standard 52.2-2017 -- Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI Approved). Available at: *https://www.techstreet.com/standards/ashrae-52-2-2017?product_id=1942059.*

[25] "Particulate Matter (PM) Pollution." EPA. Available at: *https://www.epa.gov/pm-pollution/particulate-matter-pm-basics*

[26] Frey provided two attachments regarding particle filtration.

DOE notes that the air cleaners test procedure is intended to test conventional room air cleaners regardless of the technology used. That is, DOE is not establishing a test procedure only for air cleaners that utilize HEPA filters. Additionally, the test does not measure performance exclusively for 0.3 µm particles or the removal efficacy for 0.3 µm particles. Instead, particles introduced into the test chamber range in size from 0.1 µm to 2.5 µm, which are much broader in range than 0.3 µm particles.

The CA IOUs noted that the Joint Proposal proposed to use the dust CADR results from AHAM AC-1-2020 for the dust particulate test for already-tested products, which would help manufacturers meet the short-compliance timeline that is specified in the Joint Proposal. The CA IOUs stated that retesting products to AHAM AC-7-2022, which specifies a narrower range of allowable particle size, for the Tier 1 energy efficiency standard that is proposed in the Joint Proposal with a compliance deadline of December 31, 2023 would be challenging, and DOE's proposal to extend this same testing option to cigarette smoke in addition to dust was understandable as the retesting burden is the same. However, the CA IOUs commented that DOE should specify this requirement only for the Tier 1 energy efficiency standards, which would ensure that when the Tier 2 energy efficiency standards take effect, all products would be certified using the same test procedure. The CA IOUs added that if DOE found limiting the use of AHAM AC-1-2020 to only Tier 1 too challenging, the CA IOUs were amenable to allowing the full range of particulate size for the Tier 2 standards as well. (CA IOUs, No. 30 at pp. 3–4)

The Joint Commenters commented that they agree DOE should permit sections 5 and 6 of AHAM AC-1-2020 for smoke CADR and dust CADR to be applied in the calculation of $PM_{2.5}$ CADR for the Tier 1 standard proposed in the Joint Proposal. The Joint Commenters stated that the smoke CADR and dust CADR in sections 5 and 6 of AHAM AC-1-2022 are nearly identical to the subset particulate size used to calculate the $PM_{2.5}$ CADR. The Joint Commenters further commented that allowing this alternative for Tier 1 will ensure that manufacturers are not required to re-test using AHAM AC-1-2020 Annex I[27] to demonstrate compliance with a new standard on such a short timeline and can meet the expedited compliance date. Additionally, the Joint Commenters stated that they do not object to also applying this alternative to the Tier 2 standards in the Joint Proposal given that the results are essentially identical. (Joint Commenters, No. 34 at p. 6–7)

AHAM stated during the NOPR public meeting that there is very high correlation between $PM_{2.5}$ CADR calculated using the narrower and broader particle size range as the smoke and dust particle count tapers off after 0.5 µm. AHAM also stated that the purpose of allowing both ranges to be used is to allow manufactures to use previously certified data. AHAM noted that the particle size range was adjusted in AHAM AC-7-2022 to ensure preciseness of the $PM_{2.5}$ CADR metric. (AHAM, Public Meeting Transcript, No. 25 at p. 29)

[27] Note that Annex I of AHAM AC-1-2020 specifies the calculation of $PM_{2.5}$ CADR, which is the same as that specified in section 2.9 of AHAM AC-7-2022.

MIAQ commented that in section 2.9 of AHAM AC-7-2022, the $PM_{2.5}$ CADR calculation shows the narrower particle size range for smoke CADR and dust CADR ratings used to calculate the combined $PM_{2.5}$ CADR. MIAQ suggested updating the equation to reflect the particle sizes referenced in sections 5 and 6 of AHAM AC-1-2020 for smoke CADR and dust CADR. (MIAQ, No. 26 at p. 7)

Carrier commented that there is insufficient data to demonstrate there is no impact from using the larger particle size range for the smoke CADR and dust CADR as defined in sections 5 and 6 of AHAM AC-1-2020 compared to the smaller particle size range for the $PM_{2.5}$ calculation in AHAM AC-7-2022. Therefore, Carrier stated it does not agree with DOE's proposal to allow the wider range to be used as an alternate means, and requests that DOE only allow the particle size range as defined in AHAM AC-7-2022. (Carrier, No. 31 at p. 4)

As stated in the October 2022 NOPR, DOE proposed that $PM_{2.5}$ CADR may alternatively be calculated using the full range of particles used to calculate smoke CADR and dust CADR according to sections 5 and 6 of AHAM AC-1-2020, respectively. 87 FR 63324, 63337. Given the results of the two approaches are similar, DOE noted explicitly that this was an alternate calculation that stakeholders *may* (emphasis added) choose to use, but noted it may revisit allowing the use of both approaches to calculate $PM_{2.5}$ CADR in a future standards rulemaking. *Id.* DOE maintains this position in this final rule and is not specifying a mandatory requirement at this time to calculate $PM_{2.5}$ CADR using the full range of particulate size as specified in sections 5 and 6 of AHAM AC-1-2020. That is, DOE is referencing section 2.9 of AHAM AC-7-2022 for the calculation of $PM_{2.5}$ CADR and

additionally specifying the alternate calculation using the full range of particulate sizes that may optionally be used to determine $PM_{2.5}$ CADR. DOE will consider the applicable required use of either $PM_{2.5}$ CADR approach in a future standards rulemaking.

Regarding DOE's request for comment on using KCl as an alternative to cigarette smoke, MIAQ noted that AHAM expressed concerns with current methodology that would specify KCl as an allowable alternate to cigarette smoke in the measurement of smoke CADR and asked DOE to reference AHAM's comments and ensure alignment. (MIAQ, No. 26 at p. 3)

Daikin recommended that DOE specify using KCl instead of cigarette smoke to conduct the smoke CADR test. Daikin stated that using KCl would increase repeatability of the test due to the uniformity of the aerosolized matter and increase reproducibility because laboratories are better equipped to control KCl test particles. According to Daikin, unlike cigarette smoke, it is easier to clean test chambers after a test using KCl, and KCl does not introduce harmful residues and carcinogens. Daikin commented that test conditions for KCl testing could be different than those for smoke tests. Daikin recommended that DOE test, evaluate, and determine specific test conditions for KCl with the help of test laboratories. (Daikin No. 35 at p. 2) During the NOPR public meeting, Daikin requested more information about the test conduct and room concentration for using KCl as an alternative to cigarette smoke. (Daikin, Public Meeting Transcript, No. 25 at pp. 19-20)

The CA IOUs expressed support for adding a reference to KCl as an alternative to cigarette smoke, noting that although AHAM AC-1-2020 did not sufficiently define the full specification for KCl, it will be included in the to-be-published AHAM AC-1-2022. The CA IOUs recommended that for expediency, DOE should forgo specifying KCl as an alternative to cigarette smoke until the final version of AHAM AC-1-2022 is published with sufficient details regarding the use of KCl. (CA IOUs, No. 30 at p. 3)

Carrier stated its support for DOE's proposal to specify that KCl serve as an allowable alternate to cigarette smoke in the measurement of smoke CADR, even if AHAM AC-1-2022 Draft is not published before the final rule. Carrier offered the opinion that KCl will become the most widely used method for determining the $PM_{2.5}$ CADR, but that an understanding of the impact to CADR of cigarette smoke verses KCl will be necessary to properly establish an energy conversation standard. Carrier noted that it currently does not have data for the purposes of correlation. (Carrier, No. 31 at pp. 3-4)

The Joint Commenters commented that they support the concept of adding KCl as an alternate to smoke, as specified in a draft of AHAM AC-7-2022. However, the Joint Commenters further stated that there is not yet sufficient testing knowledge to specify KCl as an alternative. The Joint Commenters stated that while AHAM plans to complete the required testing, it will not be completed in time for DOE to include KCl as an alternative in the final test procedure while adhering to the timeline in the Joint Proposal. The Joint Commenters recommended that DOE forgo including KCl as an alternative until AHAM AC-1 has been updated to include the relevant specifications. The Joint

Commenters stated that they hope DOE will consider amending the test procedure after AHAM AC-1 has been updated. (Joint Commenters, No. 34 at p. 5) During the public meeting, AHAM noted that they are in the process of updating AHAM AC-1-2020 and it will clearly specify what is need for KCl to represent cigarette smoke, including how the aerosolizer should be set up, the particle distribution and concertation requirements, and any additional specifications that may be required. AHAM noted that the standard will likely come out after DOE's test procedure final rule. (AHAM, Public Meeting Transcript, No. 25 at p. 21)

AHRI recommended that DOE implement AHAM AC-7-2022 Draft without modifications to the standard beyond the consideration of break-in conditions. AHRI commented that it prefers the $PM_{2.5}$ CADR metric utilizing KCl over the smoke and dust CADR as the regulated metric because the necessary technology is already available and that utilizing $PM_{2.5}$ CADR would simplify the testing process. AHRI stated that KCl is safer, easier to control, cleaner, and less expensive due to the lack of cleaning fees incurred. AHRI recommended that DOE consult with the appropriate standards committees and testing laboratories to determine the appropriate testing conditions for air cleaner performance tests. AHRI also commented that it prefers $PM_{2.5}$ CADR using KCl as the regulated metric compared to smoke or dust CADR. (AHRI, No. 33 at p. 2)

DOE recognizes the benefits of using KCl over cigarette smoke such as safer and cleaner test chamber conditions; however, given that the specific parameters to use KCl as an alternate to cigarette smoke are still under development and DOE lacks data that correlates $PM_{2.5}$ CADR using KCl and cigarette smoke, DOE is not specifying the use of

KCl as an alternative for cigarette smoke at this time. For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing referencing sections 5 and 6 of AHAM AC-1-2020 to specify the test methods for determining smoke CADR and dust CADR respectively, as proposed in the October 2022 NOPR. DOE is also finalizing referencing section 2.9 of AHAM AC-7-2022 to calculate $PM_{2.5}$ CADR and including an exception for alternately calculating $PM_{2.5}$ CADR using the smoke CADR and dust CADR as calculated according to sections 5 and 6 of AHAM AC-1-2020.

2. Performance Mode for Testing

Section 5.3 of AHAM AC-7-2022 specifies that all products shall be tested with the air cleaner set to the highest flow rate setting, also known as maximum performance mode. Additionally, section 5.3 of AHAM AC-7-2022 specifies that for products that have air cleaning functionality beyond mechanical filtration (*i.e.*, ionization, UV, *etc.*) the test unit shall be configured such that these features are enabled and set to the maximum level during active mode testing. Section 5.6 of AHAM AC-7-2022 additionally specifies that even though a product may have automatic mode, it shall be tested in its maximum performance mode and settings.

In the October 2022 NOPR, DOE proposed to reference section 5.3 of AHAM AC-7-2022 Draft regarding test unit setup requirements for testing in maximum performance mode. 87 FR 63324, 63338.

DOE requested comment on its proposal to reference section 5.3 of AHAM AC-7-2022 Draft to test units in maximum performance mode. *Id.*

Electrolux requested clarification regarding air cleaners with a turbo mode and whether turbo mode would be used during testing, or if testing would cover only the highest fan speed set manually. (Public Webinar Transcript, Electrolux, No. 25 at pp. 33–34)

DOE notes that section 5.3 of AHAM AC-7-2022 specifies that the maximum performance mode flow rate setting is the highest fan speed setting as identified in the manufacturer's instructions that would allow the product to operate indefinitely. Therefore, a turbo mode setting that has the highest flow rate for a certain period of time before transitioning to a lower flow rate without user input would not be considered for the maximum performance mode setting.

MIAQ commented that testing units in maximum performance mode represented the best solution for testing a worst-case power consumption scenario. MIAQ additionally stated that AHAM was working on a test plan for automatic mode. (MIAQ, No. 26 at p. 8)

The Joint Commenters commented that that there is no universally accepted way to test the speeds of all air cleaners. The Joint Commenters recommended that all air cleaners be tested at the maximum performance setting, which includes the highest continuous speed for the air cleaner, allowing consumers to make an informed selection based on the air cleaner's highest performance level. The Joint Commenters stated that the AHAM standards committee is working to develop a procedure for assessing automatic mode. However, the Joint Commenters stated that they believe it is worthwhile

for DOE to proceed with the currently available test methods for now in order to achieve national standards and energy savings immediately. The Joint Commenters stated that they would not support DOE waiting to implement standards until an automatic-mode test is developed. (Joint Commenters, No. 34 at p. 8)

Daikin stated that it does not fully agree with the use of maximum power mode as the only power consumption or performance and efficacy test for air cleaners. Daikin commented that it is Daikin's understanding that DOE and AHAM are working together on identifying a test procedure for automatic mode operation. Daikin commented that it supports such an investigation and requested DOE to consider a lower operation mode (or a range of operation modes and contaminant loading) to ascertain a more realistic in-field air cleaner performance. Daikin commented that a maximum operation mode is not representative of field operations and such a metric can mislead consumers in making important decisions on buying air cleaners. (Daikin, No. 35 at p. 3)

Daikin commented that the October 2022 NOPR stated an intention to adopt the maximum performance mode test because there is no current consensus on the automatic mode test, but that the majority of air cleaners operate at medium speed or in automatic mode. Daikin added that if the intent of the regulation is to regulate the energy consumption of these devices and provide certified ratings in DOE's database leading to comparisons of CADR for different unit's maximum performance mode might not be appropriate and DOE might benefit from developing consensus around automatic mode testing. (Daikin, Public Meeting Transcript, No. 25 at pp. 34–35) Daikin also commented that the IEF metric is not representative of actual energy consumption because the unit is

not expected to run at the maximum performance level at all times. (Daikin, Public Meeting Transcript, No. 25 at pp. 41–42) Daikin also asked if a sound rating will be measured during the maximum performance mode test. (Daikin, Public Meeting Transcript, No. 25 at p. 31)

Carrier asked if DOE had considered testing air cleaners at minimum or medium air flow to understand the operation in the system at these settings. Carrier commented that, in practice, many air cleaners are not operated at maximum air flow for noise or other reasons and they are operated at lower flow rates, saving energy at the same time. (Carrier, Public Meeting Transcript, No. 25 at p. 36)

AHRI commented that it would be ideal if the metric considered multiple modes of operation or the identity of the tested mode so that consumers have an accurate picture of product operation. (AHRI, No. 33 at p. 6)

NEEA recommended that DOE pursue future enhancements to the test procedure to account for performance in automatic mode, but that implementation of the test procedure should proceed to avoid delays in implementation of the energy conservation standard and so that near-term energy savings can be achieved. (NEEA, No. 28 at p. 2)

As discussed in the October 2022 NOPR, DOE determined that the requirement to perform testing at the maximum performance level provides the best balance among repeatability, reproducibility, and representativeness of test results at this time. 87 FR, 63324, 63338.

DOE notes that industry-accepted test methods for other modes, such as automatic mode or low speed mode, do not currently exist. DOE is participating in the AHAM task force that is developing a test method for testing air cleaners with automatic mode. Currently, DOE is not aware of a test procedure for air cleaners in automatic mode that measures energy efficiency during a representative average use cycle and that is not unduly burdensome to conduct. In the absence of such a test method for automatic mode, DOE maintains its determination that testing at the maximum performance level provides the best balance among repeatability, reproducibility, and representativeness of test results at this time. DOE additionally notes that it is not including testing provisions for a sound rating because sound is not a direct performance measure of air cleaning (unlike smoke, dust, or pollen).

DOE is finalizing the requirement to test units in maximum performance mode, as proposed in the October 2022 NOPR. Accordingly, DOE is referencing sections 5.3 through 5.7.4 of AHAM AC-7-2022 for conducting the active mode test.

3. Secondary Functions

Section 5.4 of AHAM AC-7-2022 specifies the configuration for secondary functions, which are unrelated to air cleaning (*i.e.*, humidifier, ambient light, *etc.*). As these functions do not contribute to the air cleaning capabilities of the unit, they are switched off or disconnected for the duration of the test. If it is not possible to switch off or disconnect such functions, AHAM AC-7-2022 states that these functions shall be set to their lowest power-consuming mode that is selectable when running the air cleaner at its maximum performance mode or highest fan speed. For customized control displays,

AHAM AC-7-2022 specifies that the test unit shall be configured to its default or as-shipped control setting intensity level, unless the panel lights are adjustable in intensity and are shipped in the off mode, in which case the control panel is run in the least-intensity mode that would keep it on for the test. In the October 2022 NOPR, DOE proposed to reference this requirement for the configuration of secondary functions. 87 FR 63324, 63338.

Section 5.5 of AHAM AC-7-2022 specifies the configuration of control functions during active mode testing. Control functions include any programmable functions that may continue to be enabled when the primary function is inactive (*i.e.*, clocks, Wi-Fi, remote controls, *etc.*). AHAM AC-7-2022 states that control functions are intended to be on and connected to any communication network during active mode testing.

In the October 2022 NOPR, DOE proposed to reference this requirement to specify that control functions shall be in on mode and connected to any communication network during active mode testing as specified in section 5.5 of AHAM AC-7-2022 Draft. *Id*. DOE requested comment on its proposal to reference sections 5.4 and 5.5 of AHAM AC-7-2022 Draft to specify the configuration of secondary functions and control functions during active mode testing. *Id*.

AHRI commented that it supports DOE's proposal to reference sections 5.4 and 5.5 of AHAM AC-7-2022 and advised DOE that it is acceptable to power off secondary functions if doing so has no impact on particle removal. (AHRI, No. 33 at p. 6)

As specified in section 5.4 of AHAM AC-7-2022, DOE agrees that it is acceptable to power off secondary functions, if it is possible to turn them off and doing so would not have an impact on air cleaning, because it allows determining the power consumption associated with air cleaning only, without the inclusion of any other functions (*e.g.,* a night light). Further, DOE does not have, nor did interested parties provide, information on consumer usage of secondary functions in air cleaners. Therefore, for the reasons discussed here and in the October 2022 NOPR, DOE is finalizing in the newly established appendix FF the configuration of secondary functions and control functions during active mode testing, as proposed in the October 2022 NOPR.

4. Power Measurement Procedure

Section 5.7 of AHAM AC-7-2022 specifies the methods for measuring active mode power. These methods include measuring the power consumption when operating the test unit within the test chamber at the same time as the smoke CADR and dust CADR tests or by measuring the power consumption during a supplemental power test outside a test chamber.

More specifically, section 5.7.1 of AHAM AC-7-2022 specifies that the power consumption measurement can be conducted simultaneously with the smoke CADR or dust CADR test from section 5.2.5 or 6.2.5 of AHAM AC-1-2020, respectively. Section 5.7.2 of AHAM AC-7-2022 specifies an alternative method for measuring active mode power consumption, referred to as the "supplemental" test. This test can be used to determine the active mode power consumption outside the test chamber used for smoke

CADR and dust CADR testing. The supplemental power test specifies the same unit configuration and records power over a period of 15 minutes at no greater than one second intervals, averaging the power consumption over 13 minutes starting after the initial two minutes. AHAM AC-7-2022 additionally specifies that if the test unit has pollutant indicators and they do not light up when no pollutant is present in the air, but light up when detecting pollutants, then the test unit cannot be tested outside the chamber to measure active mode power consumption.

Finally, sections 5.7.3 and 5.7.4 of AHAM AC-7-2022 specify the equations to determine the average active mode power consumption and the annual active mode energy use, respectively.

As presented in the October 2022 NOPR, DOE performed testing at a third-party laboratory to investigate the similarity in power measurement between a test conducted simultaneously with the CADR measurement and a supplemental test performed outside a test chamber. 87 FR 63324, 63338–63339.

Table III.1 Difference in Power Consumption between Smoke Test and Supplemental Test

Unit Number	Smoke Test Power (W)	Supplemental Test Power (W)	Percent Difference
1	44.2	43.9	– 0.7%
2	51.5	54.0	+ 4.9%
3	55.0	55.6	+ 1.1%
4	24.6	25.4	+ 3.3%
5	18.8	18.9	+ 0.5%
6	42.6	42.6	+ 0%
7	5.9	5.8	– 1.7%
8	38.2	37.4	– 2.1%
9	37.9	38.3	+ 1.1%
10	58.1	57.8	– 0.5%
11	84.8	81.7	– 3.7%
Average Difference		**+ 0.2%**	

As indicated in Table III.1, the percent difference between power consumption measured during the smoke CADR test and the supplemental out-of-chamber test ranged from –3.7 percent to +4.9 percent, with an average of +0.2 percent. Based on these data, in the October 2022 NOPR, DOE tentatively determined that the power consumption of the out-of-chamber supplemental power test is closely comparable to the in-chamber smoke, and likely dust, CADR tests because measured power using the maximum performance mode is not significantly impacted by whether a particle is present. 87 FR 63324, 63339. Accordingly, DOE proposed to reference sections 5.7.1 through 5.7.4 of AHAM AC-7-2022 Draft to measure active mode power either in the test chamber (section 5.7.1) at the same time as the smoke or dust CADR test or outside the chamber (section 5.7.2) as a supplemental power test and to calculate average power (section 5.7.3) and annual active mode energy use (section 5.7.4). *Id.*

DOE requested comment on its proposal to reference sections 5.7.1 through 5.7.4 of AHAM AC-7-2022 Draft, which specify methods for measuring active mode power at the same time as the smoke or dust CADR test when the test unit is operating within the chamber and measuring the power consumption during a supplemental power test outside a test chamber, respectively. *Id.*

The CA IOUs stated their agreement with DOE's proposal to reference sections 5.7.1 through 5.7.4 of AHAM AC-7-2022 because it would allow power measurement at the same time as CADR in certain settings. (CA IOUs, No. 30 at p. 4)

The Joint Commenters commented that they agree with DOE's proposal to reference sections 5.7.1 through 5.7.4 of AHAM AC-7-2022. The Joint Commenters stated that investigative testing by AHAM showed a -0.2 percent difference between the two methods, which they noted aligns with DOE's testing. (Joint Commenters, No. 34 at p. 7)

Daikin commented on the continued system performance over a system's lifetime. Daikin asked if there were any considerations around sustained CADR performance over a system's lifetime. (Daikin, Public Meeting Transcript, No. 25 at p. 49) DOE's test procedure is intended to measure the performance of a new product. DOE does not have any data or information to suggest how CADR may change over the lifetime of an air cleaner, if at all.

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the methods for measuring active power at the same time as the smoke CADR or dust CADR test when the test unit is operating within the chamber or measuring the power consumption during a supplemental power test outside a test chamber, respectively, as proposed in the October 2022 NOPR.

5. Pollen CADR

To enable consistent and meaningful energy representations of metrics most desirable to consumers, DOE proposed in the October 2022 NOPR to include an additional test to determine pollen CADR. 87 FR 63324, 63339. Similar to dust CADR and smoke CADR, pollen CADR provides a measurement of the air cleaner's performance to remove pollen from indoor air. Pollen CADR typically increases with increasing air cleaner energy use, and therefore DOE believes this is an appropriate metric to measure. Further, according to the AAFA, more than 50 million people in the United States experience various types of allergies each year, and allergies are the sixth leading cause of chronic illness in the United States.[28] Further, pollen is one of the most common environmental allergens to trigger an allergic reaction. Accordingly, many air cleaners are marketed as providing pollen removal. DOE notes that the ENERGY STAR V. 2.0 Specification requires reporting of pollen CADR. DOE stated in the October 2022 NOPR that it is important that any representation related to an air cleaner's pollen CADR performance be made based on testing conducted in a repeatable and representative manner. Accordingly, in the October 2022 NOPR, DOE proposed to include the pollen

[28] Asthma and Allergy Foundation of America. Allergy Facts and Figures. *www.aafa.org/allergy-facts/.*

CADR measurement test specified in section 7 of AHAM AC-1-2020. 87 FR 63324, 63339.

Section 7 of AHAM AC-1-2020 specifies the test procedure for determining paper mulberry pollen CADR. The method for measuring pollen CADR is the same as dust CADR and smoke CADR; however, the test duration is only 10 minutes compared to 20 minutes for the smoke test and dust test. The reduced test duration is specified because pollen decays faster than both dust and smoke and thus only 10 minutes is necessary to determine pollen CADR. All other test conditions remain the same including the test chamber, use of a recirculation and ceiling fan, and test equipment.

DOE stated in the October 2022 NOPR that because this test is currently specified in the ENERGY STAR V. 2.0 Specification, DOE expects it would minimally increase test burden compared to the tests required for smoke CADR and dust CADR. *Id.* at 87 FR 63339.

In the October 2022 NOPR, DOE requested comment on its proposal to reference section 7 of AHAM AC-1-2020 for the pollen CADR measurement test. *Id*. at 87 FR 63339–63340. DOE also requested comment and data on the relationship between the pollen CADR measurement and the energy use of the air cleaner. *Id*. at 87 FR 63340.

DOE further requested comment on whether it should specify measurement of active mode power consumption when conducting the pollen CADR measurement test. DOE also requested comment on whether it should consider specifying a pollen

CADR/W metric and whether such a metric should be based on active mode power consumption or include energy consumption in both active mode and standby mode. *Id*.

MIAQ commented that there would be little additional burden to measure active power consumption when conducting the pollen CADR measurement test and such a measurement may provide additional energy consumption metrics for a higher power consumption rate as compared to smoke, dust, or $PM_{2.5}$. (MIAQ, No. 26 at p. 9)

MIAQ commented that the CADR/W metric for pollen was not necessary but could be considered in a manner similar to the AHAM metrics for smoke CADR, dust CADR, $PM_{2.5}$ CADR, and pollen CADR and the corresponding energy consumption metrics in CADR/W for each of the different pollutants, which would allow for a range of pollutants to be included. On the issue of including energy consumption for active mode or both active mode and standby mode, MIAQ commented that if this metric were used, it should follow the same methodology as that used for smoke, dust, or $PM_{2.5}$. (*Id.*)

The Joint Commenters commented that they do not believe a pollen CADR/W metric is necessary because they did not propose a standard based on pollen. (Joint Commenters, No. 34 at p. 3)

AHAM asked if manufacturers must use the DOE test procedure if they make a pollen CADR claim. AHAM also asked if there will be a reporting requirement for pollen CADR or standards for pollen CADR in a future rulemaking. AHAM further asked what

DOE is basing its authority upon to include a measurement that is not related to the $PM_{2.5}$ CADR metric. (AHAM, Public Meeting Transcript, No. 25 at pp. 43–44)

The CA IOUs commented that a power measurement during a pollen CADR test is unnecessary because the Joint Proposal did not propose a pollen-based standard. (CA IOUs, No. 30 at p. 3)

Carrier commented that the inclusion of pollen CADR is unnecessary and that manufacturers who would like to publish a value for pollen CADR can do so using the industry standard. (Carrier, No. 31 at p. 2) Carrier also commented that DOE should not specify a pollen CADR/W metric because this could create confusion in the market, as consumers may unknowingly attempt to compare an IEF based on pollen CADR to an IEF based on $PM_{2.5}$ CADR. Carrier commented that specifying a pollen CADR/W metric could increase design burden if the minimum IEF requirement for pollen CADR and $PM_{2.5}$ CADR are not correlated properly. (Carrier, No. 31 at p. 5)

AHRI stated that pollen CADR creates additional test burden and should not be added to the DOE test procedure requirement. AHRI further commented that DOE has the authority to regulate a single metric for a function and the smoke CADR currently used in energy calculations renders use of pollen CADR redundant. AHRI also commented that employing the same metric with different conditions may be confusing to end users and stated that testing must be representative of average use cycles or periods of use and cannot add burden without value. (AHRI, No. 33 at pp. 6-7)

First, in response to AHAM's comment on whether DOE may consider standards for pollen CADR in a future rulemaking, DOE notes, based on a review of products available on the market, that most manufacturers provide pollen CADR information on marketing materials. And, as discussed previously, similar to dust and smoke CADR, increasing pollen CADR typically requires increasing air cleaner energy use. As a result, DOE may consider pollen CADR in a future standards rulemaking. To that end, DOE is establishing a test procedure for pollen CADR in this final rule. (*See* 42 U.S.C. 6295(o)(3)(A) (requiring that DOE prescribe a test procedure prior to establishing an amended or new standard).)

DOE understands that if a pollen CADR/W metric is specified for a unit that also has the IEF listed in terms of CADR/W, it could cause some confusion in the marketplace. Accordingly, DOE is adopting the test to determine pollen CADR as specified in section 7 of AHAM AC-1-2020 but is not adopting a pollen CADR/W metric. DOE notes that manufacturers would be required to use the DOE test procedure if they make pollen CADR representations, including in marketing materials.

Regarding regulated metrics for air cleaners, DOE is not adopting reporting requirements or standards for any measured metrics in this test procedure final rule. DOE is establishing relevant capacity metrics and energy efficiency metrics for air cleaners in this test procedure and will consider the appropriate regulated metrics and subsequent reporting requirements as part of separate energy conservation standards or certification rulemakings.

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the pollen CADR measurement test, as proposed in the October 2022 NOPR.

6. Consumer Use Hours

Section 5.7.4 of AHAM AC-7-2022 specifies the calculation for E_{active}, which is used to convert the power consumption measurement to an energy consumption value. To calculate E_{active}, AHAM AC-7-2022 estimates that an air cleaner spends 5,840 annual hours in active mode, which is equivalent to 16 hours per day.

In the October 2022 NOPR, DOE proposed to align with the estimated active mode annual hours specified in AHAM AC-7-2022 Draft (corresponding to 16 hours per day) and consistent with the ENERGY STAR V. 2.0 specification. 87 FR 63340.

DOE requested comment on its proposal to reference section 5.7.4 of AHAM AC-7-2022 Draft, which specifies the calculation of active mode energy consumption using an estimated 5,840 hours per year in active mode. *Id.*

MIAQ expressed support for DOE's proposal to reference section 5.7.4 of AHAM AC-7-2022 Draft; however, MIAQ noted that as technology progresses, the estimated 5,840 hours per year in active mode would no longer be acceptable (*e.g.*, on-demand usage). (MIAQ, No. 26 at p. 9)

DOE understands that the annual active mode hours may need to be periodically updated to keep up with technology trends. EPCA requires that, at least once every 7

years, DOE evaluate test procedures for each type of covered product to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(1)(A)) DOE welcomes stakeholders to submit any relevant data and information regarding consumer usage hours in different modes of operation.

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the calculation of active mode energy consumption using an estimated 5,840 hours per year in active mode, as proposed in the October 2022 NOPR.

H. Standby Mode Testing

Section 6 of AHAM AC-7-2022 defines the setup and procedures to measure air cleaner standby mode power consumption. In the October 2022 NOPR, DOE proposed to incorporate by reference all subsections of section 6 of AHAM AC-7-2022, which establish conditions of measurement, preparation of the air cleaner model for testing, test procedure, test results, and the annual combined low power mode energy consumption calculations. 87 FR 63324, 63340.

Section 6.3 of AHAM AC-7-2022 references section 5.3 of IEC 62301 Ed. 2.0 for the procedure to measure standby mode power. Sections 6.4.1 and 6.4.2 of AHAM AC-7-2022 define measurements for inactive mode power, P_{IA}, and off mode power, P_{OM},

respectively. DOE proposed to reference section 6.4 of AHAM AC-7-2022 Draft. *Id.* at 87 FR 63340–63341.

Section 6.5 of AHAM AC-7-2022 defines an annual combined low power mode energy consumption calculation based on P_{IA} and P_{OM} as follows:

$$E_{TLP} = \{(P_{IA} \times S_{IA}) + (P_{OM} \times S_{OM})\} \times K$$

where:

P_{IA} = air cleaner inactive mode power, in W, for air cleaners capable of operating in inactive mode; otherwise, $P_{IA} = 0$,

P_{OM} = air cleaner off mode power, in W, for air cleaners capable of operating in off mode; otherwise, $P_{OM} = 0$,

S_{IA} = annual hours in inactive mode and defined as S_{LP} if no off mode is possible, $[S_{LP}/2]$ if both inactive mode and off mode are possible, and 0 if no inactive mode is possible,

S_{OM} = annual hours in off mode and defined as S_{LP} if no inactive mode is possible, $[S_{LP}/2]$ if both inactive mode and off mode are possible, and 0 if no off mode is possible,

K = 0.001 kWh/Wh conversion factor for Wh to kWh,

S_{LP} = 2,920 air cleaner inactive mode annual hours.

Consistent with the active mode energy consumption calculation, AHAM AC-7-2022 specifies 2,920 annual hours in standby mode, which is equivalent to 8 hours per day and is consistent with the estimated standby mode hours specified in the ENERGY STAR V. 2.0 Specification. Accordingly, in the October 2022 NOPR, DOE proposed to reference these requirements for standby mode. *Id*.

DOE requested feedback on its proposal to reference section 6 of AHAM AC-7-2022 Draft to determine annual combined low power mode energy consumption. *Id*.

During the Public Meeting, an unidentified stakeholder asked if the secondary functions would be disabled during standby mode testing. (Public Meeting Transcript, No. 25 at p. 39) As discussed in section III.D of this document, DOE is incorporating by reference from section 2 of AHAM AC-7-2022 definitions for "secondary function" and "standby mode." Because the definition of standby mode excludes secondary functions (*i.e.*, functions that enable, supplement, or enhance a primary function and which are not directly related to air cleaning, including a vacuum, heating, humidification, or additional ambient room lights (*e.g.*, night light)), any such secondary functions would be disabled during standby mode testing.

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the annual combined low power mode energy consumption determination, as proposed in the October 2022 NOPR.

I. Integrated Energy Factor Metric

As discussed, EPCA requires that DOE's test procedures for all covered products integrate measures of standby mode and off mode energy consumption into the overall energy efficiency, energy consumption, or other energy descriptor, unless such integration is technically infeasible. (42 U.S.C. 6295(gg)(2)(A))

DOE's analysis shows that it is technically feasible to integrate active mode and standby mode energy consumption into an overall performance metric for air cleaners. Specifically, active mode and standby mode power consumption can be combined into the AEC metric using the respective estimated annual usage hours. Further, to express air cleaner performance as a function of its power use, DOE's analysis shows that an integrated metric, such as IEF, is technically feasible. This approach is similar to other DOE test procedures, such as room air conditioners (*see* section 5.2.2 of 10 CFR 430, appendix F) and dehumidifiers (*see* section 5.4 of 10 CFR 430, appendix X1), which specify a metric that is expressed as space conditioning function provided per unit power.

In the October 2022 NOPR, DOE proposed to incorporate by reference section 7 of AHAM AC-7-2022 Draft, which provides a calculation to determine AEC and IEF for air cleaners as follows:

$$AEC = E_{active} + E_{TLP}$$

$$IEF = \left[\frac{CADR\ (\frac{ft^3}{min})}{(AEC\ (\frac{kWh}{year}) * \frac{1\ year}{5{,}840\ hours} * \frac{1000\ Wh}{1\ kWh})}\right]$$

Where:

CADR = $_{PM2.5}$ Clean air delivery rate from the combined smoke and dust test [cfm].

E_{active} = air cleaner active mode test energy consumption (in kWh per year).

E_{TLP} = low power mode annual energy consumption (expressed in kWh per year). 87 FR 63324, 63341–63342.

DOE requested comment on its proposal to reference section 7 of AHAM AC-7-2022 Draft for the AEC and IEF calculations. *Id*. at 87 FR 63342.

DOE did not receive any comments regarding the proposed methodology for determining AEC and IEF. AAF commented that the report that would be generated from the test procedure should include a statement indicating that measured CADR is only for the highest air flow setting for the device, and that it may not reflect performance at lower air velocities. (AAF, Public Meeting Transcript, No. 25 at pp. 31-32)

DOE is not adopting any reporting requirements as part of this final rule. Reporting requirements will be addressed in a future certification rulemaking. For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the AEC and IEF calculations, as proposed in the October 2022 NOPR.

J. Effective Room Size

DOE is aware that air cleaner manufacturers typically include several representations in marketing materials for their air cleaner models (*e.g.*, smoke CADR, dust CADR, pollen CADR, CADR/W, room size, *etc.*). DOE has observed that room size is represented in different ways among various models and different values of suitable room sizes may be specified even for the same model. As an illustrative example, DOE identified a model that is marketed for a large room up to 912 square feet, when completing one air change per hour and taking up to 60 minutes to clean air, while the same air cleaner is also represented as being suitable for a room size of 190 square feet with 4.8 air changes per hour and taking about 12.5 minutes to clean air. Further, this unit is rated in the AHAM Verifide[29] program as being applicable for a room size of 190 square feet. It is unlikely that the acceptable room size for an air cleaner of a given capacity can be increased proportionally, potentially to infinity, in such a manner, without having an impact on the cleaning performance of the air cleaner.

Room size would strongly impact the capacity of the air cleaner that would be required to clean the air in the desired room. For instance, if the air cleaner is too small compared to the size of the room it is being used in, it will be ineffective, thus providing low efficiency. Conversely, if an air cleaner is too big for the room that it is operated in, it will clean the air very quickly and still continue operating, leading to increased energy use. Therefore, it is important that an air cleaner be selected such that its capacity (expressed in terms of its CADR) is appropriate for the size of the room that it is intended

[29] AHAM Verifide. *ahamverifide.org/directory-of-air-cleaners/.*

to be used in. Additionally, for any air cleaner, the represented values of CADR and IEF are inherently a function of the room size that the unit is expected to operate in (*i.e.*, the represented CADR value is inherently a function of the test chamber size, number of air exchanges provided, and the initial concentration of the contaminant). Accordingly, DOE considers room size to be an important metric that must be represented accurately and consistently to provide meaningful information to consumers.

Section 8.6 and Annex E of AHAM AC-1-2020 specify a calculation for the effective room size based on standard construction criteria for rooms and a history of the natural decay rate of small particles as determined for cigarette smoke. Specifically, the room size calculation is based on the ability of the air cleaner to reduce the concentration of particles, expressed in CADR, in a room at steady state to a new steady-state concentration that is 80 percent less than the original when the air cleaner is operating. The calculation includes additional assumptions such as a mixing factor equal to 1.0, an air exchange rate of 1 per hour, a cigarette smoke particle natural decay equal to the average background natural decay (from statistical study), a ceiling height of 8 feet, and a cigarette smoke particle generation or influx rate such that a cigarette smoke particle concentration of 1 is maintained at the initial steady state. Based on its estimations, AHAM AC-1-2020 specifies that the effective room size, in square feet, that can be serviced by an air cleaner is 1.55 times the smoke CADR value of the air cleaner.

In the October 2022 NOPR, DOE proposed to include this calculation as a represented value for room size. 87 FR 63324, 63342. Specifically, DOE proposed to include in 10 CFR 429.67 that the effective room size be calculated as the product of 1.55

and the basic model's represented value of smoke CADR. DOE further proposed that this represented value of effective room size, in square feet, be rounded to the nearest whole number. *Id*.

DOE requested comment on its proposal to include a calculation from AHAM AC-1-2020 for the effective room size that can be serviced by an air cleaner. DOE requested comment on whether it is appropriate to use smoke CADR as the metric to calculate effective room size or if it should be based on $PM_{2.5}$ CADR instead, in which case, DOE requested comment on whether multiplying $PM_{2.5}$ CADR by 1.55 to determine effective room size in square feet is appropriate or if a different constant would need to be used instead. *Id*.

The Joint Commenters commented that they recommend communicating room size to consumers via a uniform test method, AHAM AC-1-2020 and urged DOE and the Federal Trade Commission (FTC) to coordinate. The Joint Commenters suggested that the recommended room size appear on the EnergyGuide label. The Joint Commenters stated that regardless of whether DOE or FTC specifies the test procedure, the relevant agency must use the test method specified in AHAM AC-1-2020, which calculates the recommended room size in square feet based on the removal of at least 80 percent of smoke particles in a steady-state room environment (assuming the room experiences incoming pollutants at the rate of one air change per hour) and with complete mixing in the room. (Joint Commenters, No. 34 at p. 3)

The Joint Commenters commented that DOE and FTC should not consider using a $PM_{2.5}$ CADR or other CADR value in place of the smoke CADR value used in the AHAM test method because the $PM_{2.5}$ CADR is not measured directly. The Joint Commenters stated that AHAM AC-1-2020 uses a specific engineering tobacco smoke to generate the smoke CADR, which has particles that are 100 to 1000 times smaller than the width of a human hair. The Joint Commenters commented that 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. The Joint Commenters noted that the relationship between cleaning rate in CADR and room size to clean to the 80-percent level has been verified by scientists at the National Institute of Standards and Technology and recognized as reasonable by the FTC. The Joint Commenters stated that they strongly urge DOE and/or the FTC to use smoke CADR to determine the recommended room size. (Joint Commenters, No. 34 at p. 4)

The CA IOUs expressed a concern at the different methodologies used to derive and promote recommended room sizes. The CA IOUs also suggested that the FTC's EnergyGuide label should list the room size as determined by AHAM AC-1-2020 because it is an appropriate and accepted methodology. The CA IOUs commented that DOE should coordinate with the FTC on its open rulemaking relating to the EnergyGuide label for air cleaners. The CA IOUs commented that room size is often the first prominent feature on an air cleaner product listing and a guiding metric for consumers to identify the most appropriate product, but that the top three consumer report-rated air cleaners listed on the Amazon.com website use different methodologies or have inconsistent recommendations for room size measurements. The CA IOUs further stated

that for consumers to make an informed decision, a single recommendation including the proper context was critical for this product. (CA IOUs, No. 30 at pp. 2–3)

Carrier commented that an effective room size should be a represented value and suggested that the room-size calculation should be based on $PM_{2.5}$ CADR, since this is used in the IEF calculation. Carrier stated a belief that multiplying the $PM_{2.5}$ CADR by 1.55 should yield consistent results with the AHAM AC-1-2020 calculation. (Carrier, No. 31 at p. 5)

Daikin recommended that DOE should focus on $PM_{2.5}$ as its primary pollutant of concern, especially in displaying regulated performance ratings. Consequently, Daikin commented that the room size metric should be based on $PM_{2.5}$ CADR. (Daikin, No. 35 at p. 3)

Dyson stated that AHAM AC-1-2020 currently precludes a reasonable one-size fits all room size calculation in a mandatory regulatory context. Dyson commented that DOE should refrain from including room size coverage in the scope of the air cleaner test procedure at this time. Dyson cited several reasons: (1) manufacturers currently offer nuanced estimates of room size coverage customized for different spaces to help consumers make shopping decisions. Collapsing room-size coverage claims to a single basis would prevent consumers from using the comparison, especially in large, commercial spaces (*e.g.*, offices, schools); (2) AHAM AC-1-2020 uses a recirculation fan during the test that may not be present in real-world spaces, yet the result from this test is used to extrapolate room coverage onto larger volumes than the test chamber with the

result that machines with poor lateral whole-room air circulation receive an artificial "boost"; (3) available data have not shown how AHAM AC-1-2020 room coverage translates to purification of real spaces, or how consistent that is across different rooms and product designs. The increase in measured CADR in actual larger chambers may not scale by the same factor for differently designed units; (4) the measured CADR of an air cleaner per AHAM AC-1-2020 was intrinsically linked to the test chamber physical volume, meaning the result was not "air cleaned per minute," but rather "active decay minus natural decay multiplied by the volume of the test chamber" or "air cleaned per minute in that room, with the recirculation fan"; and (5) the lack of test provisions for air cleaners with automatic, sensor-response modes makes DOE's room coverage proposal overly simplistic, as automatic modes and sensors are common in today's air cleaner marketplace. Dyson noted an air cleaner with automatic mode solves this concern, but this distinction is absent with the proposed AHAM AC-1-2020 test method, which only specifies the machine to be run constantly in the highest fan speed operating mode (Dyson, No. 27 at pp. 1–2)

DOE recognizes that manufacturers may want to provide nuanced estimates of room size coverage for different usage scenarios. DOE also recognizes that the use of a recirculation fan during testing may not be present in all real-world spaces, but the recirculation fan is necessary during testing to maintain a homogenous environment within the test chamber to enable repeatable and reproducible results. DOE also notes that while automatic mode and sensors are common in today's air cleaners, the test procedure adopted in this document measures the performance of air cleaners in maximum performance mode without the use of any sensors and the measured room size

metric is based on the conditions in which the air cleaner is tested (*i.e.,* maximum performance mode). Additionally, the $PM_{2.5}$ CADR and IEF measurements are representative only for a given set of conditions (*e.g.*, test chamber size, initial particulate concentration, *etc.*). Accordingly, it is necessary that the effective room size specification is representative of the other rated parameters, such as $PM_{2.5}$ CADR, AEC, and IEF.

Additionally, while DOE had requested comment on whether it should consider specifying the effective room size calculation in terms of $PM_{2.5}$ CADR, as opposed to smoke CADR, which is used to calculate effective room size in AHAM AC-1-2020, DOE has determined that using smoke CADR is appropriate because smoke CADR is determined directly through testing, whereas $PM_{2.5}$ CADR is a calculated value. The effective room size calculation specified in AHAM AC-1-2020 is also provided specifically for smoke CADR, and it is possible that some assumptions would need to be changed if the effective room size were to be calculated using a different metric.

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the representation of the effective room size, as proposed in the October 2022 NOPR. Further, DOE intends to coordinate with FTC regarding labeling requirements for air cleaners during the ongoing rulemaking (*see* 87 FR 64399).

K. Sampling Plan

In the October 2022 NOPR, DOE proposed the following sampling plan and rounding requirements applicable to any representations of energy consumption or energy

efficiency of air cleaners. 87 FR 63324, 63342. The sampling requirements would be included in the proposed 10 CFR 429.67. Specifically, DOE proposed that the general sampling requirements of 10 CFR 429.11 for selecting units to be tested be applicable to air cleaners. *Id*. In addition, DOE proposed that for each air cleaner basic model, a sufficient sample size must be randomly selected to ensure that a representative value of energy consumption for a basic model is greater than or equal to the higher of the mean of the sample or upper 95 percent confidence limit (UCL) of the true mean divided by 1.10. For IEF or other measure of energy consumption where a higher value is preferable to the consumer, the representative value shall be less than or equal to the lower of the mean of the sample or the lower 95 percent confidence limit (LCL) of the true mean divided by 0.90. *Id.* The mean, UCL, and LCL are calculated as follows:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

$$UCL = \bar{x} + t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

$$LCL = \bar{x} - t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

where:

$\bar{x}$ is the sample mean;

n is the number of units in the test sample;

x_i is the i^{th} sample;

s is the sample standard deviation; and

$t_{0.95}$ is the t statistic for a 95 percent one-tailed confidence interval with n-1 degrees of freedom.

This proposed sampling plan for air cleaners is consistent with sampling plans already established for portable air conditioners,[30] dehumidifiers,[31] and other similar products that are portable and/or provide space conditioning functionality.

DOE also proposed that all calculations be performed with the unrounded measured values, and that representations of pollen CADR, smoke CADR, dust CADR, and $PM_{2.5}$ CADR values of a basic model be calculated as the mean of the CADR for each tested unit of the basic model, rounded to the nearest whole number. *Id*. at 87 FR 63343. DOE further proposed that AEC be rounded to the nearest 0.1 kWh/year and the IEF be rounded to the nearest 0.1 CADR/W. As noted previously, DOE proposed that the effective room size be rounded to the nearest whole number. DOE proposed that these rounding instructions would be included in the proposed sampling plan for air cleaners. *Id*.

DOE did not propose any certification or reporting requirements for air cleaners in the October 2022 NOPR. DOE would propose certification requirements through a separate rulemaking in the future, as needed.

[30] 10 CFR 429.62.
[31] 10 CFR 429.36.

DOE requested comment on the proposed sampling plan and rounding requirements for smoke CADR, dust CADR, $PM_{2.5}$ CADR, AEC, and IEF. *Id*.

AHRI recommended the expedited adoption of $PM_{2.5}$ CADR and suggested that DOE define the test procedure around a single $PM_{2.5}$ CADR test as opposed to a calculated rating. AHRI also advised DOE to ensure that data is meaningful to end users regardless of the results and the consumers should be able to understand the rating system and make informed decisions based on the information provided. (AHRI, No. 33 at p. 7) AHRI recommended that DOE use $PM_{2.5}$ CADR given that DOE is limited to one metric per product. AHRI commented that $PM_{2.5}$ CADR should be prioritized over other CADR including smoke, dust, AEC, and IEF as it can be considered more representative than the other more specific particulates. AHRI stated that using $PM_{2.5}$ CADR would reduce overall test burden because it allows for testing more units while requiring that fewer tests be run, thereby lowering testing costs. AHRI commented that air quality considerations necessitate that the metric be standardized. AHRI commented that DOE should not prohibit manufacturers from making claims where needed for specific particles, but recommended against DOE regulating them. (AHRI, No. 33 at p. 8)

DOE's statutory authority does not limit the number of parameters that are required to be reported as part of the certification and compliance requirements. That is, interim variables that are used for calculating the final metric, such as smoke CADR and dust CADR, may be reported. DOE is not establishing certification or reporting requirements for air cleaners in this final rule, but may consider proposals to establish

certification requirements and reporting for air cleaners under a separate rulemaking regarding appliance and equipment certification.

The CA IOUs recommended that DOE align the rounding for AEC with CADR and round to the nearest whole number instead of 0.1 kWh per year. The CA IOUs stated that DOE's proposal to round CADR values to the nearest whole number for reporting would be consistent with AHAM AC-1-2020. (CA IOUs, No. 30 at p. 4)

The Joint Commenters commented that they recommend DOE specify rounding AEC to the nearest whole number to be consistent with AHAM AC-1-2020's rounding of CADR and room size to whole numbers. (Joint Commenters, No. 34 at p. 4)

The National Institute of Standards and Technology (NIST) requested information on the proposed rounding of CADR to the nearest whole number when the precision of the method is to ±10 cfm. NIST asked for clarification on whether rounding would be to the nearest 10 cfm. (Public Webinar Transcript, NIST, No. 25 at p. 48)

In consideration of stakeholder comments, DOE has determined that it is more appropriate to round AEC to the nearest whole number, as determined from the accuracy of the test measurement instrumentation. Accordingly, DOE has updated the rounding requirements for AEC to be rounded to the nearest whole number. Additionally, DOE is maintaining rounding CADR to the nearest whole number, which is also consistent with the rounding requirements specified in AHAM AC-1-2020.

Additionally, while DOE proposed in the October 2022 NOPR that the sampling requirements would be included in the proposed 10 CFR 429.67, DOE is finalizing the sampling requirements in 10 CFR 429.68 because 10 CFR 429.67 presents certification requirements for certain commercial air conditioning and heating equipment. Relatedly, DOE is also updating paragraphs (a) and (b)(1) in 10 CFR 429.11, which lists the general sampling requirements for selecting units to be tested to change the referenced sections from 10 CFR 429.14 through 10 CFR 429.65 to 10 CFR 429.14 through 10 CFR 429.68.

For the reasons discussed here and in the October 2022 NOPR, DOE is finalizing the sampling plan, as proposed in the October 2022 NOPR, while updating the rounding requirements for AEC to be rounded to the nearest whole number.

As discussed previously, manufacturers will not be required to test according to the DOE test procedure until compliance is required with any future applicable standards for air cleaners that are established.

L. Test Procedure Costs

EPCA requires that test procedures proposed by DOE not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3)) DOE references industry standards AHAM AC-7-2022, AHAM AC-1-2020, and IEC 62301 Ed. 2.0 to measure pollen CADR, smoke CADR, dust CADR, and active mode and standby mode power consumption. DOE also uses these measured values to calculate $PM_{2.5}$ CADR, AEC, and IEF as specified in AHAM AC-7-2022 and effective room size as specified in AHAM AC-1-2020. The

following paragraphs discuss DOE's evaluation of estimated costs associated with this proposal.

Based on quotes from third-party laboratories, in the October 2022 NOPR, DOE estimated average testing costs to be approximately $3,000 to test one unit according to AHAM AC-1-2020 at such a laboratory. 87 FR 63324, 63343. These costs would include the tests to determine pollen CADR, smoke CADR, dust CADR, active mode power, and standby mode power. DOE typically requires at least two units to be tested for each basic model. Therefore, DOE estimated that manufacturers would incur testing costs of approximately $6,000 per basic model (because of the minimum sample size of two units, as specified in 10 CFR 429.11(b)). *Id*.

DOE requested comment on its initial determination of the costs for testing according to the proposed new air cleaner test procedure. DOE also requested comment on the potential impact to manufacturers from the proposed new air cleaner test procedure. *Id*.

Carrier commented that DOE's estimated average testing cost is low. Carrier commented that its recent experience has been $2,500 per aerosol, which would amount to $7,500 per unit or $15,000 per basic model. (Carrier, No. 31 at pp. 5–6)

As discussed, DOE's estimates of $3,000 per test unit and $6,000 per basic model were based on DOE's recent experience performing testing of air cleaners at qualified third-party laboratories. DOE recognizes that these costs may not be reflective of the

costs incurred by all manufacturers who use third-party test laboratories. Accordingly, DOE has revised its estimate from the October 2022 analysis and determines that the cost required to conduct the air cleaner test procedure established by this final rule could range from $3,000 to $7,500 per unit and $6,000 to $15,000 per basic model.

M. Effective and Compliance Dates

The effective date for the adopted test procedure will be 30 days after publication of this final rule in the Federal Register. As previously stated, there are currently no energy conservation standards for air cleaners. Beginning on the compliance date of any energy conservation standards for air cleaners, any representations with respect to the energy use or efficiency of these products, including those made for certification purposes, must be made in accordance with the test procedure established in this final rule.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Executive Order (E.O.) 12866, "Regulatory Planning and Review," as supplemented and reaffirmed by E.O. 13563, "Improving Regulation and Regulatory Review, 76 FR 3821 (Jan. 21, 2011), requires agencies, to the extent permitted by law, to (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent

practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public. DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB) has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this final regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit "significant regulatory actions" to OIRA for review. OIRA has determined that this final regulatory action does not constitute a "significant regulatory action" under section 3(f) of E.O. 12866. Accordingly, this action was not submitted to OIRA for review under E.O. 12866.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq*.) requires preparation of a final regulatory flexibility analysis (FRFA) for any final rule where the agency was first required by law to publish a proposed rule for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, "Proper Consideration of Small Entities in Agency Rulemaking," 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website: *www.energy.gov/gc/office-general-counsel*. DOE reviewed this final rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003.

On October 18, 2022, DOE published a notice of proposed rulemaking (NOPR) for the test procedure (October 2022 NOPR) presenting DOE's proposals to establish a test procedure for air cleaners. 87 FR 63324. As part of the October 2022 NOPR, DOE conducted its initial regulatory flexibility analysis (IRFA). The following sections outline DOE's determination that this final rule does not have a "significant economic impact on a substantial number of small entities," and that the preparation of a FRFA is not warranted.

DOE did not receive any written comments that specifically addressed the impacts on small businesses or that were provided directly in response to the IRFA request for comment.

DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. The size standards are listed by North American Industry Classification System (NAICS) code as well as by industry description and are available at *www.sba.gov/document/support-table-size-standards*. Manufacturing air cleaners is classified under NAICS 335210, "Small Electrical Appliance Manufacturing." The SBA sets a threshold of 1,500 employees or fewer for an entity to be considered as a small business for this category. DOE used available public information to identify potential small manufacturers. DOE accessed the AHAM's database of Certified Room Air Cleaners,[32] ENERGY STAR's data set of Certified Air Purifiers (Cleaners),[33] California Air Resources Board's (CARB) CARB-Certified Air Cleaning Devices,[34] and retailer websites to create a list of original equipment manufacturers (OEMs) that manufacture the products covered by this final rule. Once DOE created a list of OEMs, DOE used market research tools to determine whether any met the SBA's definition of a small entity—based on the total number of employees for each company including parent, subsidiary, and sister entities—and gather annual revenue estimates. Between the October 2022 NOPR and the test procedure final

[32] Association of Home Appliance Manufacturers. *Certified Room Air Cleaners*. Available at *www.ahamdir.com/room-air-cleaners/* (Last accessed January 24, 2022).
[33] Energy Star. *ENERGY STAR Certified Air Purifiers (Cleaners)*. Available at *www.energystar.gov/productfinder/product/certified-room-air-cleaners/results* (Last accessed May 31, 2022).
[34] The California Air Resources Board. "List of CARB-Certified Air Cleaning Devices." *ww2.arb.ca.gov/list-carb-certified-air-cleaning-devices* (Last accessed January 1, 2022).

rule publication, DOE conducted additional research to identify manufacturers and to review the scope of manufacturer product offerings. Due to the identification of additional manufacturers and updates in scope of test procedure coverage, the manufacturer counts have been updated since the October 2022 NOPR.

Based on DOE's analysis, DOE identified 43 companies that are OEMs of air cleaners covered by this test procedure. DOE screened out companies that do not meet the small entity definition and, additionally, screened out companies that are largely or entirely foreign owned and operated. Of the 43 companies, four were identified as small, domestic businesses.

In this final rule, DOE establishes a new test procedure for air cleaners at appendix FF to 10 CFR part 430, subpart B "Uniform Test Method for Measuring the Energy Consumption of Air Cleaners." DOE notes that manufacturers will not be required to test according to the DOE test procedure until a future energy conservation standard for air cleaners is established and compliance is required.

Based on quotes from third-party laboratories, in the October 2022 NOPR, DOE estimated average testing costs to be approximately $3,000 to test one unit according to AHAM AC-1-2020 at such a laboratory. 87 FR 63324, 63343. These costs would include the tests to determine pollen CADR, smoke CADR, dust CADR, active mode power, and standby mode power. DOE typically requires at least two units to be tested for each basic model. Therefore, DOE estimated that manufacturers would incur testing

costs of approximately $6,000 per basic model (because of the minimum sample size of two units, as specified in 10 CFR 429.11(b)). *Id.* As discussed in section III.L, DOE has considered comments from one manufacturer suggesting that these costs could be as high as $7,500 per unit and $15,000 per basic model. DOE has considered these potentially higher costs as a more conservative estimate in its analysis.

For the four small, domestic OEMs, DOE estimated the cost to rate their basic models and compared those costs to annual revenues. Using DOE's initial estimates from the October 2022 NOPR, DOE found that testing costs would be less than one percent of their revenue over the typical five-year period between the publication date and compliance date of a future energy conservation standard for a newly covered product. This conclusion applies to three out of the four identified small OEMs even when considering the potentially higher cost of $15,000 per basic model. For one of the identified OEMs, the more conservative cost estimate of $15,000 per basic model would correspond to around 2.3 percent of the company's conversion period revenue, as discussed in the following paragraphs.

For the first company identified, it will incur a testing cost of $60,000 for its 10 models as a result of amendments to the test procedure (or, as a more conservative estimate, $150,000). This company has an annual revenue of $272.64 million. A testing cost of $60,000 is approximately 0.004 percent of the company's conversion period revenue (or, as a more conservative estimate, a testing cost of $150,000 is approximately 0.01 percent of the company's conversion period revenue).

For the second company identified, it will incur a testing cost of $60,000 for its 10 models as a result of amendments to the test procedure (or, as a more conservative estimate, $150,000). This company has an annual revenue of $1.31 million, and the testing cost of $60,000 is approximately 0.92 percent of the company's conversion period revenue (or, as a more conservative estimate, a testing cost of $150,000 is approximately 2.3 percent of the company's conversion period revenue).

For the third company identified, it will incur a testing cost of $24,000 for its 4 models as a result of amendments to the test procedure (or, as a more conservative estimate, $60,000). This company has an annual revenue of $19.55 million, and the testing cost of $24,000 is approximately 0.02 percent of the company's conversion period revenue (or, as a more conservative estimate, a testing cost of $150,000 is approximately 0.05 percent of the company's conversion period revenue).

For the fourth company identified, it will incur a testing cost of $36,000 for its 6 models as a result of amendments to the test procedure (or, as a more conservative estimate, $90,000). This company has an annual revenue of $3.63 million, and the testing cost of $36,000 is approximately 0.20 percent of the company's conversion period revenue (or, as a more conservative estimate, a testing cost of $150,000 is approximately 0.5 percent of the company's conversion period revenue). Based on the limited number of small entities affected and the *de minimis* cost impacts, DOE certifies that this final rule does not have a "significant economic impact on a substantial number of small entities," and determines that the preparation of a FRFA is not warranted. DOE will transmit a

certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of air cleaners must certify to DOE that their products comply with any applicable energy conservation standards. To certify compliance, manufacturers must first obtain test data for their products according to the DOE test procedures, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment. (*See* generally 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been approved by OMB under OMB control number 1910-1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Certification data will be required for air cleaners; however, DOE is not establishing certification or reporting requirements for air cleaners in this final rule. Instead, DOE may consider proposals to establish certification requirements and reporting for air cleaners under a separate rulemaking regarding appliance and equipment certification. DOE will address changes to OMB Control Number 1910-1400 at that time, as necessary.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

In this final rule, DOE establishes a new test procedure that it expects will be used to develop and implement future energy conservation standards for air cleaners. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq*.) and DOE's implementing regulations at 10 CFR part 1021. Specifically, DOE has determined that adopting test procedures for measuring energy efficiency of consumer products and industrial equipment is consistent with activities identified in 10 CFR part 1021, appendix A to subpart D, A5 and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, "Federalism," 64 FR 43255 (August 4, 1999), imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in

the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE examined this final rule and determined that it will not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, "Civil Justice Reform," 61 FR 4729 (Feb. 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation (1) clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under

any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this final rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a regulatory action resulting in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a),(b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at *www.energy.gov/gc/office-general-counsel*. DOE examined this final rule according to

UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105-277), requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This final rule will not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights" 53 FR 8859 (March 18, 1988), that this regulation will not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M-19-15, Improving Implementation of the Information Quality Act

(April 24, 2019), DOE published updated guidelines that are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf*. DOE has reviewed this final rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any significant energy action. A "significant energy action" is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use if the regulation is implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This regulatory action is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by

the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

L. Review Under Section 32 of the Federal Energy Administration Act of 1974

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788; "FEAA") Section 32 essentially provides in relevant part that, where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the Chairman of the Federal Trade Commission (FTC) concerning the impact of the commercial or industry standards on competition.

The test procedure for air cleaners established in this final rule incorporates testing methods contained in certain sections of the following commercial standards: AHAM AC-7-2022, AHAM AC-1-2020, and IEC 62301 Ed. 2.0. DOE has evaluated these standards and is unable to conclude whether it fully complies with the requirements of section 32(b) of the FEAA (*i.e.*, whether it was developed in a manner that fully provides for public participation, comment, and review). DOE has consulted with both the Attorney General and the Chairman of the FTC about the impact on competition of using the methods contained in these standards and has received no comments objecting to their use.

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule before its effective date. The report will state that it has been determined that the rule is not a "major rule" as defined by 5 U.S.C. 804(2).

N. Description of Materials Incorporated by Reference

AHAM AC-1-2020 is a voluntary industry-accepted test procedure that provides test methods to measure the relative reduction of particulate matter, including smoke and dust, suspended in the air in a specified test chamber when an air cleaner is in operation. Specifically, the test procedure codified by this final rule references sections 5 and 6 of AHAM AC-1-2020 to determine the smoke and dust CADR of the air cleaner test unit. AHAM AC-1-2020 is also referenced in several sections of AHAM AC-7-2022 that DOE is referencing in its test procedure.

AHAM AC-7-2022 is a voluntary industry-accepted test procedure that measures active mode and standby mode power consumption of air cleaners. Specifically, the test procedure codified by this final rule generally references AHAM AC-7-2022 including provisions for: definitions, test conditions, instrumentation, active mode and standby mode power measurement, and calculation of $PM_{2.5}$ CADR, AEC, and IEF.

These standards are reasonably available from AHAM at *www.aham.org/AHAM/AuxStore*.

IEC 62301 Ed. 2.0 is an international standard that specifies methods of measurement of electrical power consumption of household appliances in standby mode(s) and other low power modes, as applicable. The new appendix FF references AHAM AC-7-2022, to specify the standby mode power consumption test method, which further references IEC 62301 Ed. 2.0 for the measurement of air cleaners standby power consumption. IEC 62301 Ed. 2.0 is reasonably available from IEC (*webstore.iec.ch*).

ASTM E741-11(2017) specifies techniques using tracer gas dilution for determining a single zone's air change with the outdoors, as induced by weather conditions and by mechanical ventilation. The new appendix FF references AHAM AC-7-2022 to specify the test chamber air exchange rate, which further references ASTM E741-11(2017) as the method to measure test chamber air exchange rate. ASTM E741-11(2017) is reasonably available from ASTM (*www.astm.org*).

V. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this final rule.

List of Subjects

10 CFR Part 429

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Intergovernmental relations, Reporting and recordkeeping requirements, Small businesses.

10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Incorporation by reference, Intergovernmental relations, Small businesses.

Signing Authority

This document of the Department of Energy was signed on February 21, 2023, by Francisco Alejandro Moreno, Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on February 21, 2023.

X FRANCISCO MORENO

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Date: 2023.02.21 17:07:58 -05'00'

Francisco Alejandro Moreno
Acting Assistant Secretary for Energy Efficiency and Renewable Energy
U.S. Department of Energy

For the reasons stated in the preamble, DOE amends parts 429 and 430 of Chapter II of Title 10, Code of Federal Regulations as set forth below:

PART 429 -- CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

1. The authority citation for part 429 continues to read as follows:

Authority: 42 U.S.C. 6291–6317, 28 U.S.C. 2461 note.

§429.11 [Amended]

2. Amend paragraphs (a) and (b)(1) of §429.11 by removing the text "§429.14 through §429.65" and adding in its place "§429.14 through §429.68".

3. Add §429.68 to read as follows:

§429.68 Air cleaners.

(a) *Sampling plan for selection of units for testing.* (1) The requirements of §429.11 are applicable to air cleaners; and

(2) For each basic mode of air cleaners, a sample of sufficient size shall be randomly selected and tested to ensure that –

(i) Any represented value of annual energy consumption or other measure of energy consumption of a basic mode for which consumers would favor lower values shall be greater than or equal to the higher of:

(A) The mean of the sample:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Where:

$\bar{x}$ is the sample mean;

n is the number of samples; and,

x_i is the i^{th} sample.

Or,

(B) The upper 95 percent confidence limit (UCL) of the true mean divided by 1.10:

$$UCL = \bar{x} + t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

Where:

$\bar{x}$ is the sample mean;

s is the sample standard deviation;

n is the number of samples; and,

$t_{0.95}$ is the t statistic for a 95 percent one-tailed confidence interval with n-1 degrees of freedom (from appendix A).

And

(ii) Any represented value of the integrated energy factor or other measure of energy consumption of a basic mode for which consumers would favor higher values shall be less than or equal to the high:

(A) The mean of the sample:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Where:

$\bar{x}$ is the sample mean;

n is the number of samples; and,

x_i is the i^{th} sample.

Or,

(B) The lower 95 percent confidence limit (LCL) of the true mean divided by 0.90:

$$LCL = \bar{x} - t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

Where:

$\bar{x}$ is the sample mean;

s is the sample standard deviation;

n is the number of samples; and,

$t_{0.95}$ is the t statistic for a 95 percent one-tailed confidence interval with n-1 degrees of freedom (from appendix A).

And

(3) Any represented value of the pollen, smoke, dust, and $PM_{2.5}$ clean air delivery rate (CADR) of a basic model must be the mean of the CADR for each tested unit of the basic model. Round the mean clean air delivery rate value to the nearest whole number.

(4) Any represented value of the effective room size, in square feet, of a basic model must be calculated as the product of 1.55 and the represented smoke CADR value of the basic model as determined in paragraph (a)(3) of this

section. Round the value of the effective room size, in square feet, to the nearest whole number.

(5) Round the value of the annual energy consumption, in kWh/year, of a basic model to the nearest whole number.

(6) Round the value of the integrated energy factor of a basic model to the nearest 0.1 CADR/W.

(b) *Certification reports.* [Reserved]

PART 430 -- ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

4. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291-6309; 28 U.S.C. 2461 note.

5. Amend §430.2 by adding, in alphabetical order, the definition of "Conventional room air cleaner" to read as follows:

§430.2 Definitions.

* * * * *

Conventional room air cleaner means an air cleaner that--

(1) Is a portable or wall mounted (fixed) unit, excluding ceiling mounted unit, that plugs into an electrical outlet;

(2) Operates with a fan for air circulation; and

(3) Contains means to remove, destroy, and/or deactivate particulates. The term portable is as defined in section 2.1.3.1 of AHAM AC-7-2022 (incorporated by reference; see §430.3) and fixed is as defined in section 2.1.3.2 of AHAM AC-7-2022.

* * * * *

6. Amend §430.3 by:

a. Redesignating paragraphs (i)(1) through (7) as (i)(3) through (9);

b. Adding new paragraphs (i)(1) and (2) and paragraph (j)(4); and

c. In paragraph (p)(7), removing the text "and CC" and adding, in its place, the text "CC, and FF".

The additions and revisions read as follows:

§430.3 Materials incorporated by reference.

* * * * *

(i) * * *

(1) ANSI/AHAM AC-1-2020, ("AHAM AC-1-2020"), *Method for Measuring Performance of Portable Household Electric Room Air Cleaners*, ANSI-approved December 14, 2020, including AHAM Standard Interpretation dated September 19, 2022; IBR approved for appendix FF to subpart B.

(2) AHAM AC-7-2022, *Energy Test Method for Consumer Room Air Cleaners*, copyright 2022; IBR approved for §430.2 and appendix FF to subpart B.

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(j) * * *

(4) ASTM E741-11 (Reapproved 2017) ("ASTM E741-11(2017)"), *Standard Test Method for Determining Air Change in a Single Zone Means of a Tracer Gas Dilution* Approved Sept. 1, 2017; IBR approved for appendix FF to subpart B.

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7. Amend §430.23 by adding paragraph (hh) to read as follows:

§430.23 Test procedures for the measurement of energy and water consumption.

* * * * *

(hh) *Air Cleaners.* (1) The pollen clean air delivery rate (CADR), smoke CADR, and dust CADR, expressed in cubic feet per minute (cfm), for conventional room air cleaners shall be measured in accordance with section 5 of appendix FF of this subpart.

(2) The $PM_{2.5}$ CADR, expressed in cfm, for conventional room air cleaners, shall be measured in accordance with section 5 of appendix FF of this subpart.

(3) The active mode and standby mode power consumption, expressed in watts, shall be measured in accordance with sections 5 and 6, respectively, of appendix FF of this subpart.

(4) The annual energy consumption, expressed in kilowatt-hours per year, and the integrated energy factor, expressed in CADR per watts (CADR/W), for conventional room air cleaners, shall be measured in accordance with section 7 of appendix FF of this subpart.

(5) The estimated annual operating cost for conventional room air cleaners, expressed in dollars per year, shall be determined by multiplying the following two factors:

(i) The annual energy consumption as calculated in accordance with section 7 of appendix FF of this subpart, and

(ii) A representative average unit cost of electrical energy in dollars per kilowatt-hour as provided by the Secretary, the resulting product then being rounded off to the nearest dollar per year.

Appendix EE to Subpart B of Part 430 [Reserved]

8. Add reserved appendix EE to subpart B of part 430.

9. Add Appendix FF to subpart B of part 430 to read as follows:

Appendix FF to Subpart B of Part 430–Uniform Test Method for Measuring the Energy Consumption of Air Cleaners

Note: Beginning on the compliance date of any energy conservation standards for air cleaners, any representations made with respect to the energy use or efficiency of these products, including those made for certification purposes, must be made in accordance with the results of testing pursuant to this appendix. Manufacturers may choose to test in accordance with this appendix to certify compliance with any energy conservation standards prior to the applicable compliance date for those standards.

0. Incorporation by Reference

DOE incorporated by reference in §430.3 the entire standard for AHAM AC-1-2020, AHAM AC-7-2022, ASTM E741-11(2017), and IEC 62301. However, only enumerated provisions of AHAM AC-1-2020, AHAM AC-7-2022, and IEC 62301 apply to this appendix, as follows:

0.1 AHAM AC-1-2020

(a) Sections 4.2 through 4.6;

(b) Sections 5 through 7;

(c) Section 8.1;

(d) Annex A;

(e) Annex I; and

(f) AHAM Standard Interpretation.

0.2 AHAM AC-7-2022

(a) Sections 2.2 and 2.3, sections 2.4.1 through 2.4.2.4, and sections 2.6 through 2.9;

(b) Sections 3.1 through 3.6.3;

(c) Section 4;

(d) Sections 5.3 through 5.7.4; and

(e) Sections 6 and 7.

0.3 IEC 62301: Household Electrical Appliances - Measurement of Standby Power

(a) Sections 4.4.1 through 4.4.3; and

(b) Section 5.3.

1. Scope of Coverage

This appendix contains the test requirements to measure the energy performance of a conventional room air cleaner, as defined at §430.2, with smoke CADR and dust CADR between 10 to 600 cubic feet per minute (cfm), inclusive.

2. Definitions

The definitions in sections 2.2, 2.3, 2.4.1 through 2.4.2.4, 2.6 through 2.8, and 2.9 of AHAM AC-7-2022 apply to this test procedure, including the applicable provisions of Annex I of AHAM AC-1-2020 as referenced in section 2.9 of AHAM AC-7-2022.

3. Test Conditions

Testing conditions shall be as specified in sections 3.1 through 3.6.3 of AHAM AC-7-2022, including the applicable provisions of sections 4.2 through 4.6 and Annex A of AHAM AC-1-2020 as referenced in sections 3.2.1, 3.3, 3.4, 3.5, and 3.6.2 of AHAM AC-

7-2022 and the applicable provisions of ASTM E 741-11(2017) as referenced in section 3.3 of AHAM AC-7-2022. Additionally, the following requirements are also applicable:

3.1. *Placement for Testing.* The air cleaner test unit shall be placed in the test chamber as specified in section 3.6.2 of AHAM AC-7-2022. Additionally, the placement instructions specified in AHAM Standard Interpretation in AHAM AC-1-2020 are also applicable.

3.2. *Air Cleaners with Network Mode Capability.* The air cleaner software update requirements specified in section 3.6.3.8 of AHAM AC-7-2022 are applicable. Additionally, software updates shall be conducted, if available, prior to initiating any testing. Software updates shall not be bypassed, even if the unit will operate without updates.

4. Instrumentation

Test instruments shall be as specified in section 4 of AHAM AC-7-2022, including the applicable provisions of sections 4.4.1 through 4.4.3 of IEC 62301.

5. Active Mode CADR and Power Measurement

Measurement of smoke CADR, dust CADR, and pollen CADR shall be as specified in sections 5 through 7 of AHAM AC-1-2020, respectively. Measurement of active mode power shall be as specified in sections 5.3 through 5.7.4 of AHAM AC-7-2022, including the applicable provisions of sections 5.2.5 and 6.2.5 of AHAM AC-1-2020 as referenced in section 5.7.1 of AHAM AC-7-2022. Additionally, the following requirement is also applicable:

5.1. *Calculation of $PM_{2.5}$ CADR.*

5.1.1 $PM_{2.5}$ CADR should be calculated as specified in section 2.9 of AHAM AC-7-2022.

5.1.2. $PM_{2.5}$ CADR may alternately be calculated using the smoke CADR and dust CADR values determined according to sections 5 and 6, respectively, of AHAM AC-1-2020, according to the following equation:

$$PM_{2.5}CADR = \sqrt{Smoke\ CADR\ (0.1 - 1\ \mu m) \times Dust\ CADR\ (0.5 - 3\ \mu m)}$$

6. Standby Mode Power Measurement

Standby mode power consumption shall be measured as specified in section 6 of AHAM AC-7-2022, including the applicable provisions of section 5.3 of IEC 62301.

7. Total Energy Calculation

Annual energy consumption, expressed in kilowatt-hours per year, and integrated energy factor, expressed in CADR per watt, shall be calculated as specified in section 7 of AHAM AC-7-2022.