Response to Public Comments Received on the Initial Draft of the Indoor airPLUS Version 2 Construction Specifications

February 2023

Background

This document provides the U.S. Environmental Protection Agency's (EPA's) responses to public comments received on the first draft of Indoor airPLUS Version 2 Construction Specifications. For the purposes of this document, the comments are summarized and paraphrased.

With the intent of advancing indoor air quality (IAQ) protections and raising standards for high-performance homebuilders, while also seeking to encourage broader participation in the affordable housing sector, Indoor airPLUS Version 2 provides a renewed focus on basic strategies to improve IAQ that can be implemented affordably to further impact vulnerable and disadvantaged populations. As such, EPA is proposing a revised Indoor airPLUS program model for residential homes and apartments, including a tiered certification structure with revised and reformatted specifications, all of which are inspected by qualified verification professionals. Version 2 intends to address important challenges and opportunities in newly constructed and substantially rehabilitated buildings of all heights, while also encouraging long-term maintenance and sustained health risk reductions through re-certification of labeled homes that demonstrate ongoing IAQ protections and advancements.

For more background on the development of Indoor airPLUS Version 2, including the proposed specifications and certification system, please see the Indoor airPLUS Version 2 webpage.

Table of Contents

I. Preamble Comments

General Comments

Summary of Comment(s):

Two commenters suggested a Tribal specific addendum to address an individual Tribe's needs, along with concerns including climate change, wildfire threats, and certification opportunities for existing homes. These commenters also asked about the status of the Standards of Performance for New Residential Wood Heaters.

Response(s):

A Tribal specific addendum is not being considered for inclusion in Version 2 at this time, although EPA encourages these stakeholders to consider Indoor airPLUS certification opportunities for Tribal housing under the proposed framework in the 2nd public comment draft. Indoor airPLUS continues to provide specifications for the construction of new and gut rehabilitated homes and multifamily buildings; however, the general existing housing stock is not eligible under the proposed Version 2 framework. EPA believes the proposed specifications and revised certification framework help address diverse challenges in the housing market, including basic IAQ protections, as well as issues of climate change and wildfire threats.

Indoor airPLUS does not manage regulatory issues surrounding residential wood heaters. However, in Version 2, EPA references the requirements for New Source Performance Standards for Residential Wood Heaters.

About the Indoor airPLUS Construction Specifications

Summary of Comment(s):

There were several comments regarding the "About the Indoor airPLUS Construction Specifications." One commenter cautioned against specifications that "co-mingle outcome-based specifications with input parameter-based specifications," and recommended a primary focus on "outcome-based specifications" since the assurance and peace of mind of the homeowner is the stated objective of this rating system." Another commenter suggested that EPA should "decouple" Indoor airPLUS from the ENERGY STAR requirements as a prerequisite to encourage increased program participation.

Response(s):

EPA understands the commenter's caution around employing a combination of prescriptive specifications, and outcome and performance-based specifications. However, the variable nature of building conditions among all building types may render one strategy more effective in ensuring good indoor air quality over another. Within each building component, EPA wishes to employ the best strategy for that particular issue and will therefore continue to use a broad spectrum of strategies to improve indoor air quality.

EPA agrees that allowing homes to achieve an Indoor airPLUS label independent from the ENERGY STAR program may encourage greater participation among builders. However, EPA wishes to maintain a pathway for those builders and homeowners who feel better suited to make additional indoor air quality improvements in conjunction with the valuable gains in energy efficiency through ENERGY STAR.

Therefore, the newly proposed Indoor airPLUS program model addresses those various industry perspectives with a draft certification scheme that introduces a tiered set of certification requirements for two distinct labels. The base "Indoor airPLUS Certification" focuses on fundamental IAQ strategies without an ENERGY STAR prerequisite. The higher tier "Indoor airPLUS Gold" specification maintains the ENERGY STAR prerequisite and includes additional indoor air quality upgrades.

What's New in Version 2?

Summary of Comment(s):

A commenter made a number of suggestions on enhancing this section of the standard including encouraging the use of the advisories, checklist updating and clarification, and adding gray highlighted text to cover the ENERGY STAR elements that exist outside of Section 1. Another commenter recommended clarification of 'balanced ventilation.' Another commenter provided a detailed list of enhancements for this section including a recommendation for a bulleted list of the changes.

Response:

Advisories are now defined in the section on "Terms Used in this Document," with a note that, "Recommendations in some advisories may become requirements in a future revision or version" of the specifications.

In the new Version 2 framework, ENERGY STAR requirements that are aligned with Indoor airPLUS requirements in the Gold tier are italicized in the Gold checklist and specifications, while the previous gray highlighting has been removed. Balanced ventilation is defined in Item 4.6 of the specifications.

EPA agrees with the commenter that providing a more detailed summary of what's new in Indoor airPLUS Version 2 may be helpful to readers. EPA will publish a separate document entitled, "Indoor airPLUS Version 2 Highlights Summary of Proposed Updates" to offer this list of key updates.

Eligibility and Verification Requirements

Summary of Comment(s):

A commenter suggested adding language to the V2 specifications to better address existing homes undergoing gut-rehabilitation. Another commenter stated that range hood performance characteristics are not aligned with ASHRAE 62.2 performance metrics.

Response:

EPA agrees that adding more language in the specifications to address existing portions of structures will be helpful for builders conducting gut rehabilitations and has revised the specifications to reflect that goal. Regarding range hood performance, EPA continues to assess changes to range hood technology and industry standards for potential future requirements. In the 2nd draft for public comment, EPA includes an advisory for recommended capture efficiency in Item 4.8.

Terms Used in This Document

Summary of Comment(s):

A commenter recommended adding 'HVI' (Home Ventilating Institute) to the Abbreviations section. Another commenter requested clarification if the date reference to the International Energy Conservation Code (IECC) Climate Zone map (Figure 301.1) should be updated from 2018 to 2021.

Response:

EPA appreciates the above suggestions, and because HVI standards are referenced in Section 4 of the specifications, 'HVI' has been included on the Abbreviations section. Under the new Version 2 framework the 2021 IECC Climate Zone map is referenced in the specifications.

II. Comments on Section 1. Moisture Control

General Comments

Summary of Comment(s):

One commenter suggested that the ENERGY STAR water management checklist items featured in the Indoor airPLUS specifications should be verified by the rater. That same commenter suggested that a level of air tightness for the home should be a feature of moisture management, and the level should be lower than 3ACH.

Response(s):

EPA agrees that additional verification of water management checklist items is important and has removed the "builder-verified" column in the new versions of the Indoor airPLUS checklists. EPA expects verifiers to work proactively with builders to ensure compliant materials and building techniques are being implemented in Indoor airPLUS labeled homes, including effective moisture management practices. EPA also agrees that air tightness testing may help mitigate moisture issues in some climates, while also helping to control pollutants from outdoors and adjacent units. Building envelope leakage requirements are proposed in Section 5.

1.1 Site Drainage

Summary of Comment(s):

One commenter suggested that excepting a builder from the tamping of back-fill by scheduling a site visit to provide in-fill and final grading after settling has occurred, is a potential point of failure, and that the exception should only remain if gutters are installed that drain away from the foundation.

There was also a comment requesting more guidance around building on steep slopes in relation to the swales and drains requirement.

Response:

It is EPA's preference that items are verified where feasible. However, on a practical level, the program must offer compliance options in situations where final grading is not finished at the time of occupancy. As such, the exception for to address final grading with a scheduled site visit remains in the proposed specifications.

EPA has not included detailed specifications addressing steep-sloped properties, as it is challenging to provide technical guidance within the specifications for all property types and terrains. However, EPA has revised and reformatted Item 1.1 to improve clarity and consistency of compliance. The DOE's Building America Solution Center (BASC) provides additional guidance on grading here: Final Grade Slopes Away From Foundation. These guidance resources will continue to be updated as new Indoor airPLUS program requirements go into effect.

1.2 Foundation Drainage

Summary of Comment(s):

One commenter recommended that graphics be added to the Building America Solutions Center (BASC) site for composite foundation drainage systems.

Response:

EPA recognizes that after the next version of Indoor airPLUS is finalized, there will be a need to revisit the various guidance documents hosted on the BASC webpage. EPA will consider developing additional guidance for composite drainage systems at that time.

1.3 Bulk Water Prevention

This item was previously "1.3 Floor Drain."

Summary of Comment(s):

One commenter noted that although the requirement should be easy to verify, it will be difficult for homes with dirt floor crawl spaces to comply. Another commenter questioned whether a trapped drain in a basement would satisfy the requirement, while another requested an exception for existing slabs. Last, a commenter recommended that the specification "require a backwater valve or check valve."

Response:

EPA recognizes that it may be difficult for homes undergoing a gut renovation with existing slabs, or others with unique crawlspaces, to include a floor drain. At the same time, methods that address bulk water intrusion remain an important feature of moisture management. In response to these concerns, the specification has been edited to require either a floor drain or the installation of a moisture monitoring system. However, it is still advised, though not required, that crawlspaces and combination foundations (e.g., basement with separated crawlspace) have a means of discharging bulk water from each separate foundation area in the case of interior water events.

A trapped drain in the basement floor would meet the requirement for basements. The specifications require trap seals in floor drains to prevent radon, sewage gases, pests, etc. from entering the home through the floor drain. EPA believes that building code has addressed the locations of floor drains needing backflow valve protection. As such, backflow valves for all floor drains will not be required at this time.

1.4 Capillary Break and Vapor Retarder

This item was previously three separate items: "1.4 Capillary Break – Footers; 1.5 Capillary Break – Slab-on-Grade and Basement Slabs; and 1.6 Capillary Break – Crawlspaces."

Summary of Comment(s):

One commenter recommended guidance on the use of sill seal as a capillary break.

Another commenter suggested an exception for gut rehabs.

Another commenter voiced concern that not allowing this requirement to be verified by the builder places an undue burden on the verifier.

Response:

EPA agrees with the commenter that it may be helpful to include recommendations regarding sill seal and has written an advisory to that effect. Advisory A1.4 has been added in both specifications recommending a continuous course of sill sealer between the foundation wall (or slab) and the sill plate.

This requirement only applies to newly installed footings, thereby rendering an alternative path for gut rehabs unnecessary.

EPA recognizes the importance of sequencing and schedules but acknowledges that visual verification by the verifier ensures a higher level of quality assurance. However, as stated in the Guidance section of the specification, items may be verified visually by the verifier on-site during construction/rehabilitation, by reviewing photographs taken during construction/rehabilitation, by reviewing material or equipment documentation, or through equivalent methods as appropriate.

1.4.3 Sub-item

This item was previously "1.6 Capillary Break – Crawlspaces."

Summary of Comment(s):

One comment included a request to define piers "as concrete piers or just the sections that are wood."

Another commenter suggested reducing the 10 mil polyethylene advisory to an 8 mil advisory, an additional advisory for installing double layers in heavy traffic areas, and guidance on preparing the ground for the capillary break installation.

Another commenter suggested restricting the use of a vapor barrier to only polyethylene, eliminating an option for XPS insulation.

Response:

EPA feels that the requirements to seal to walls and piers are sufficiently clear.

In response to the commenters' suggestions of vapor barrier materials and classifications, EPA believes it may be useful to more specifically define the quality required of the vapor barrier and has revised the specifications to require a Class I vapor retarder as defined by the 2021 International Residential Code (IRC). Likewise, EPA includes an advisory to recommend (but not require) more durable products, rated Class A in accordance with ASTM E1745, for crawlspace floors not covered by concrete slab.

1.5 Damp-proofing and Waterproofing Below-Grade Exterior Walls

This item was previously "1.7 Damp-Proofing and Waterproofing Below-Grade Exterior Walls."

Summary of Comment(s):

One commenter requested that "appropriate waterproofing" be defined.

Response:

In the first draft of the Indoor airPLUS Version 2, the abbreviated phrase "appropriate waterproofing" was used in the checklist summary. In the 2nd draft for public comment, EPA will use the phrases "damp-proofed" (for concrete/masonry walls) or "waterproofed" (for wood-framed walls).

1.6 Basement and Crawlspace Conditioning

This item was previously "1.8 Basement and Crawlspace Conditioning."

Summary of Comment(s):

There were several comments in this section. One suggested allowing projects to go through a dry out period and then monitor and only install dehumidification equipment if humidity levels are high. Another commenter suggested locating the dehumidification control in the area being dehumidified (i.e., basement or crawlspace). Another commenter suggested adding an alternative to the advisory involving the installation of a probe extension to monitor humidity from a remote location, that alerts the user if conditions reach higher than 65% RH.

There was also a suggestion to update the specification to reference the 2021 IRC.

Another commenter recommended the checklist to include a link to the FEMA flood zones in the checklist.

There was also a request for clarification on whether crawl spaces with open vents would comply with the specification.

Another commenter suggested that soil gas intrusion be addressed and possibly coordinated across to Items 1.8 and 1.19.

Response:

EPA is concerned about moisture vapor in below grade spaces long after the typical drying out period, particularly in Moist (A) and Marine (C) Zones. The program does not currently include a framework for certification that is contingent upon long-term monitoring of moisture or other contaminants; therefore, a requirement for basement/crawlspace dehumidification equipment will remain for these climates. EPA has added an advisory recommending a humidity sensor be located in the basement or crawlspace if dehumidification with a whole-home heating and cooling (HAC) system is utilized.

This item has been updated to reference the 2021 IECC climate zone map.

While EPA agrees a link to the FEMA flood zone map may be helpful, the Checklist is intended to summarize the requirement that is more fully detailed, with links included, in the specification itself.

To further clarify the first requirement in section 1.6: "seal crawlspace and basement perimeter walls to prevent outside air infiltration," the following sentence has been added: Vented crawlspaces and basements are not permitted.

With respect to the comment on soil gas intrusion, see EPA response in Item 1.19.

1.7 Water-Managed Wall Assemblies

This Item was previously "1.9 Water-Managed Wall Assemblies."

Summary of Comment(s):

One commenter suggested adding an advisory for proper flashing at attached decks.

Another comment suggested specifying that drainage planes should be sealed to the foundation.

Response:

Both Indoor airPLUS specifications include requirements for flashing at all horizontal interruptions, including decks. EPA will consider future advisories and/or guidance surrounding deck ledger flashing.

Water-Resistive Barriers (WRBs) that form the drainage plane on exterior walls may have different requirements for termination, depending on the product and application; therefore, no change is being made. EPA encourages drainage plane installation in accordance with manufacturer's recommendations.

EPA has also proposed alternatives, including interior moisture management inspections, for gut-rehabilitations where the WRB and drainage plane cannot be verified.

1.8 Exterior Window and Door Openings

This item was previously "1.10 Window and Door Openings."

Summary of Comment(s):

One commenter suggested that where flexible tape or liquid applied flashing form the pan, a pitched sill and back stop should be added.

Response:

EPA agrees that a sloped sill and backstop help provide protection in the case of moisture intrusion around windows/doors. EPA's intent is that water is directed away from the fenestration openings and wall assemblies, while being cautious about prescribing specific materials and installation techniques that may not be applicable to all products. However, to recognize best practices, EPA has included this suggestion in an advisory and updated the requirement to clarify which surfaces must be addressed with various pan flashing products.

EPA has also proposed alternatives, including interior moisture management inspections, for gut-rehabilitations where existing fenestrations remain, but exterior flashing cannot be verified.

1.9 Gutters, Downspouts, and Roof Water Drainage

This item was previously "1.11 Gutters, Downspouts and Roof Water Drainage."

Summary of Comment(s):

One commenter asked to specifically allow French drains and splash protection with gravel or other porous material, as an alternative to installing gutters.

Response:

EPA agrees that a French drain in combination with splash protection can be an effective method of moisture management. However, gravel or other coarse material may not necessarily provide splash protection where gutters are not included. Therefore, the installation of cladding materials that are decay and rot-resistant and can tolerate regular wetting extending at least 16 in. above final grade is still required if gutters are not installed. Additionally, Item 1.9.2.4 proposes an alternative for wood siding, including a rainscreen assembly, where the gutter exception is being used.

1.10 Roof to Wall Intersections and Roof Penetrations

This item was previously "1.12 Roof to Wall Intersections and Roof Penetrations."

No comments received regarding this item.

1.11 Roof Valleys and Decking

This item was previously "1.13 Roof Valleys and Decking."

Summary of Comment(s):

One commenter asked EPA to provide guidance on the new requirement to insulate roof drains through roof assemblies, clarify how much insulation is required, and to specify the distance through the roof.

Response:

In the draft for 2nd public comment, EPA does not propose a minimum distance and/or R-value, but has updated the requirement to include insulation "through the roof assembly". However, EPA will consider developing supplemental guidance and has included the following advisory to Item 1.11.2.2: EPA recommends installing 3" of vapor impermeable insulation (i.e., ccSPF) for a length (vertical and/or horizontal) of 3' from the drain penetration at the roof deck. An insulated roof drain example is available on the BASC website: Water Management Details for a Roof Drain.

EPA has also proposed alternatives, including interior moisture management inspections, for gut-rehabilitations where an existing roof remains, but individual components of the assembly cannot be verified.

1.12 Ice Dam Prevention

This item was previously "1.14 Roof Eaves."

No comments received regarding this Item.

1.13 Interior Roof Deck Inspection

This is a new requirement proposed in both Indoor airPLUS specifications.

1.14 Moisture-Resistant Backing Materials

This item was previously "1.15 Moisture-Resistant Backing Materials."

No comments received regarding this Item.

1.15 Appliance Drainage

This item was previously "1.16 Appliance Drainage."

Summary of Comment(s):

One commenter asked where tank-type water heaters and hot water storage tanks are intended to drain and suggested that non-vented clothes dryers include an air gap in the drain.

Response:

EPA has revised the specification to require either a corrosion-resistant drain pain that drains to a conspicuous point of disposal, or a leak detection system for tanks located where water leakage from the tank could cause damage. EPA also notes that the need for an air gap in the drain for non-vented clothes dryers would likely be included in the manufacturer's instructions, which must be followed per the requirement.

1.16 Water Supply Pipes

This item was previously "1.17 Water Supply Pipes."

Summary of Comment(s):

Two commenters stressed the importance of pipe insulation in all climate zones.

One commenter suggested increasing the R value requirement in cold climate zones.

Response:

EPA recognizes potential benefits to insulating water supply pipes in exterior building cavities across all climate zones, but does not believe it necessary in warm climates in Dry (B) Zones. However, an advisory has been added to provide further guidance.

While higher R values for colder climates may be beneficial, EPA recognizes that R4 is a readily available, cost-effective product.

1.17 Water-Resistant Flooring

This item was previously "1.18 Water-Resistant Flooring."

No comments received regarding this Item.

1.18 Class 1 Vapor Retarders

This item was previously "1.19 Class 1 Vapor Retarders."

Summary of Comment(s):

One commenter suggested splitting up the requirements to separately address vapor retarders for soil gases and suggested citing relevant voluntary consensus standards relating to radon.

There was also a comment suggesting that the standard more actively promote a drainage plane or vented rain screen assembly and not allow a Class I vapor retarder on the interior of the wall assembly, regardless of climate zone.

One commenter asked for clarification for tub surrounds since they can be considered a Class I vapor retarder.

Response:

In both Indoor airPLUS specifications, soil gas intrusion is addressed with regard to drains in Item 1.3, as well as in Section 2, which is explicitly dedicated to radon resistance. The ANSI/AARST radon standards are referenced in Section 2.

EPA recognizes the value of a rain screen assembly and therefore included it in an advisory in Item 1.7.

Exterior walls must have an air barrier that aligns with the thermal barrier. Tub surrounds on exterior walls must be installed after the thermal barrier and air barrier are installed; thus, tub surrounds are not prohibited on exterior walls.

1.19 Materials with Signs of Water Damage or Mold

This item was previously "1.20 Materials with Signs of Water Damage or Mold."

Summary of Comment(s):

Two commenters suggested changing the advisory about building materials to a requirement, particularly requiring the root cause analysis when standing water is found.

One commenter suggested adding moisture meter testing to the advisory regarding standing water and building dry-out.

There was also a suggestion to prohibit using combustion appliances during the dry-out period.

Response:

EPA believes that moisture meter testing may be helpful in some instances, but also may be impractical to implement consistently as a requirement. Likewise, the new recommendation in Version 2 for a "root cause analysis" where standing water is found after dry-in is still proposed as an advisory.

However, under the revised Indoor airPLUS specifications, Item 1.19 proposes both an interior and exterior inspection to be performed by the verifier to address visible signs of water damage. These inspections are required for both new construction and gut rehabilitations, but they are particularly important for gut rehabilitations where components in existing building assemblies may be difficult or impossible to verify, unless newly installed. Additional guidance has been included where moisture intrusion is evident and where mold or fungal growth is suspected. While builders are permitted and encouraged to provide photo or video documentation to the verifier to facilitate and streamline the verification process, EPA believes that verifiers are well-qualified to perform such moisture management inspections at appropriate times throughout the construction/rehabilitation process, and that the responsibility for final checklist verification should reside with the verifier.

While non combustion heaters may be preferred, EPA recognizes the need to provide temporary space conditioning by the most effective means available to the builder.

III. Comments on Section 2. Radon

2.1 Radon Testing

This item was previously "2.1 Radon Zone Identification and Strategy."

Summary of Comment(s):

One commenter suggested it is an unnecessary expense to test for radon and/or build radon reduction systems in Radon Zone 2. Arizona has a statewide radon level of 1.9 pCi/L, while Maricopa County and Pinal County have levels of 1.3 pCi/L.

Six commenters suggested that the 1993 EPA Map of Radon Zones is outdated and misleading. Some states like Colorado, Illinois, and Michigan have gathered more data from the field that show the EPA map does not accurately depict radon risk throughout their states. Commenters said lab results have shown EPA's radon map underestimates radon risk by as much as 30% in some areas. Because of emerging data on radon testing since the EPA map was developed, commenters stated all homes should be treated equally by IAP regardless of EPA radon zone location. Commenters noted the emergence of radon testing in the International Green Construction Code, as well as IRC Appendix F. Additionally, the U.S. Department of Housing and Urban Development (HUD) requires radon control for new multifamily building loans.

Response:

The EPA Radon Zone Map was not intended to be the sole source of information for determining if radon testing or mitigation are necessary. EPA continues to recommend that this map be supplemented with any available local data in order to further understand and predict the radon potential for a specific area. Approximately 8% of homes in Maricopa County have radon levels above 4 pCi/L. The only way to know if there is a radon problem is to test, even if homes are located in radon zones 2 and 3.

EPA has long-recommended radon testing in all homes, regardless of radon zone, as an important way to determine if occupants may be exposed to radon above the EPA Action Level of 4piC/l. EPA also recognizes that performance-based approaches to specifications can create opportunities for cost-saving innovations, while improving tested outcomes for the occupants and strengthening program integrity. A simple performance-based test could avoid the installation of a mitigation system where it is unnecessary, while offering assurance to the occupants that radon has been addressed in their Indoor airPLUS labeled home. Taking into consideration the intent of the original EPA radon map, along with emerging test data that confirms radon can be a problem even in Radon Zones 2 and 3, EPA will propose a requirement for radon testing in all Indoor airPLUS labeled homes regardless of geographic location.

2.2 Radon-Resistant Construction

This item has been removed.

Summary of Comment(s):

One commenter recommended that the Indoor airPLUS specifications require ANSI/AARST consensus-based radon standards to be followed for the installation of radon resistant features.

Response:

In the 2nd draft for public comment, Indoor airPLUS proposes to require ANSI/AARST radon standards to be followed for certain testing methods, as well as the installation of radon mitigation systems where the dwellings test above EPA's action level of 4 pCi/L.

Summary of Comment(s):

One commenter recommended a requirement that builders supply homeowners with radon test results and specify what test was performed. The commenter wanted to make it clear the rater does not have to perform the test but can review a certificate from a certified radon testing agency to verify testing was completed and that the home is in compliance.

Response:

In the 2nd draft for public comment, Indoor airPLUS clarifies that the test results shall be included in the Occupant and Maintenance Manuals and supplied to the Verifier for verification. The Verifier is permitted, but not required, to perform the test.

Summary of Comment(s):

One commenter suggested it should be the builder's responsibility to ensure the homeowners have access to the EPA's *Citizen's Guide to Radon*. The Verifier does not have the ability to ensure the homeowner receives the guide.

Response:

In the 2nd draft for public comment, EPA has removed the requirement to supply the *Citizen's Guide to Radon,* while including a requirement for radon testing. Test results must be documented and supplied with the occupant manual and maintenance guides. EPA believes Verifiers should maintain the responsibility for Indoor airPLUS checklist verification and are expected to work proactively with builders to ensure occupant manuals are provided.

Summary of Comment(s):

One commenter stated that it is common in Colorado for builders to use the foundation drainage system as part of the soil gas collection system. The commenter suggested that as long as the radon gas collection system is properly isolated from the conditioned space of the home, there is no reason the soil gas collection system and foundation drainage system need to be separated.

Response:

Where the foundation drainage system drains to daylight and is connected to the soil gas collection plenum under a basement or crawlspace, the foundation drain being open to the atmosphere may prevent the radon reduction system from depressurizing the sub-slab space. In such cases, EPA recommends a backwater or check valve to be installed in the foundation drainage system to improve sub-slab depressurization. However, in the 2nd draft for public comment, EPA proposes a performance-based radon test upon completion, rather than fully prescriptive requirements for the radon reduction system.

Summary of Comment(s):

One commenter asked to clarify how to apply the exception for ventilated garages of multifamily buildings with all dwelling units located above the garage(s). They also asked for guidance on radon fan sizing and suggested radon fans should be listed within the HVI directory.

Response:

In the 2nd draft for public comment, Indoor airPLUS is not proposing prescriptive radon reduction techniques for either single-family or multifamily buildings, but rather that radon concentrations are below the action level of 4 pCi/L, as demonstrated by a performance test in accordance with industry standards. As this applies to multifamily buildings, a measurement shall be conducted in all dwelling units and nonresidential rooms that are occupied, or intended to be occupied, that:

1) have floors or walls in contact with the ground, and
2) are closest to ground over untested ground-contact locations, to include the lowest level of the building over a crawl space, utility tunnel, parking garage or other non-habitable space that is in contact with ground.

Locations not to test (unless for investigative purposes) include hallways, closets, and bathroom or shower areas, unless they are open to other rooms that are occupied for other purposes. See ANSI/AARST MAMF 2017 with 01/2021 revisions for additional requirements and exemptions.

Regarding radon fan sizing, the ANSI/AARST CC-1000 2018 Companion Guide shows examples of common fan sizes for estimating minimum costs when activating systems. EPA will consider additional guidance in the future but is not proposing a requirement regarding the listing of radon fans at this time.

Summary of Comment(s):

One commenter noted that having two radon system monitors to notify occupants of fan failure is costly and repetitive, and requested EPA to consider an either/or option.

Response:

Regarding system monitors, U-tube manometers are standard safety devices in radon reduction systems, which can be improved upon with an audible or remote alarm. While recommended as a prescriptive measure where radon systems are installed, EPA instead proposes a performance requirement for a radon test in all Indoor airPLUS labeled homes in the 2nd draft for public comment.

Summary of Comment(s):

Another commenter proposed editorial updates to some advisories and recommended changing the first Advisory in this section to a Note since it is similar to the note directly above to consult certain resources.

Response:

In the 2nd draft for public comment, EPA has reduced the number of additional notes and advisories, while still pointing to voluntary consensus standards for prescriptive best practices, which can be found at the AARST website.

IV. Comments on Section 3. Pest Barriers

3.1 Termite/Insect Prevention

This item was previously "3.1 Minimize Pathways for Pest Entry."

Summary of Comment(s):

As proposed in the 1st round of public comment, Item 3.1 included requirements to seal exterior penetrations and sill plates, as well as requirements for termite prevention that were previously listed as advisories in Indoor airPLUS Version 1. The termite prevention strategies include requirements for improved concrete foundations in "Moderate to Heavy" termite infestation areas, along with restrictions on foam plastic insulation in "Very Heavy" termite regions, which EPA believes to be provisions in the International Residential Code. EPA proposed to elevate these IAP V1 advisories to full requirements in V2 to improve consistent enforcement of these provisions by the IAP verifier.

One commenter suggested that in Very Heavy termite regions, foam plastic insulation should be permitted to be used to insulate the interior of the Framing Foundation Interface (FFI), including the band joist, so long as the sill is constructed with preservative treated lumber, the front [interior] face of the sill is left exposed for viewing, and a termite barrier is included below the sill, extending through all layers of the foundation wall. Th e commenter also suggested including an expanded advisory regarding the implementation of a bi-annual inspection for termite shelter tubes.

Another commenter proposed installing a three-inch, removable hard board insulation inspection strip as an alternative.

Another commenter suggested embedding a link to the IECC 2018 termite infestation areas in the IAP checklist and also recommended the allowance of foam plastic insulation or identifying "readily available alternatives".

Response:

EPA appreciates the comments recommending alternative approaches to the use of foam plastic insulation below grade in "Very Heavy" termite infestation areas. Under the new tiered framework, EPA is proposing the additional termite prevention measures, including a sealed termite shield extending a minimum of ¾ in. past the edges of the foundation wall assembly, as requirements for the Gold tier. However, EPA proposes to keep them as advisories in the Certified tier. As noted in the summary above, EPA believes these to be aligned with provisions currently in the 2021 IRC, Section R318. EPA continues to seek public input from builders, code officials, product manufacturers, and pest prevention experts on appropriate requirements for Indoor airPLUS that are aligned with model building codes and offer consistent application and enforcement in the improvement of termite prevention strategies.

In the 2nd draft for public comment, EPA has removed the previous list of states that offered a general summary of "Very Heavy" termite probability areas, recognizing that 2021 IRC Figure R318.4 provides only approximate areas for classification. EPA has clarified that the Authority Having Jurisdiction (AHJ) designates such areas according to Table R301.2 of the 2021 IRC.

Regarding inspections for termite shelter tubes, EPA agrees this may be helpful guidance for homeowners and occupants and has included the recommendation in the following advisory, "Install a steel mesh barrier termite control system and implement bi-annual inspections for termite nests and shelter tubes."

3.2 Rodent/Bird Screens for Building Openings

Summary of Comment(s):

One commenter proposed the installation of screens, louvers, or grilles on the supply and return grilles/registers used for conditioning an enclosed crawl space.

Another commenter asked for the allowance of gravity backdraft dampers or louvers for use with exhaust fans. The same commenter also suggested a recommendation for the use of HVI certified duct end terminations.

Several commenters mentioned that dryers must not have screening, which is prohibited by building code (IRC M1502.3). They suggested clarification to avoid conflicting with building codes. Another commenter suggested adding guidance regarding larger openings on screening for ventilation intake openings.

And another commenter pointed out that window screens are not regularly installed at the time of final inspection and recommended that this be a builder verified step. One commenter pointed out the ¼ inch minimum opening for corrosion proof rodent/bird screens.

Response:

Space conditioning vents in closed crawlspaces must be within the building's pressure boundary in accordance with Item 1.6 of the specifications. Therefore, these openings are like the other supply and return openings within the pressure boundary and do not require extra protection for pest intrusion. EPA believes the specifications are in alignment with the 2021 IRC, Section 303.6, which requires openings in screens, louvers, or grilles be no smaller than ¼ inch and no larger than ½ inch. Therefore, no change is proposed.

The 2021 IECC, Section R403.6, requires that outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not running. Termination fittings and static pressure vents can significantly impact the performance of a mechanical or passive ventilation system. The Home Ventilating Institute (HVI) has a test procedure for these devices that provides actual performance data rather than mathematically modelled performance to ensure the installed effectiveness. As this is a ventilation rather than a pest control issue, an advisory concerning the use of HVI certified static vents and termination fittings is addressed as an advisory under item A4.8e iv.

The Consumer Product Safety Commission notes that clothes dryer lint is the cause of a large number of fires. The airflow path from the dryer to the exterior of the building must be kept clear of lint and not blocked by tight screening. However, to protect against larger pest intrusion a guard may be used. To avoid confusion with the ventilation screening requirement, Item 3.2.3 has been changed to read, "Dryer ducts must include a weather-resistant termination guard or louver in accordance with dryer manufacturer instructions. Where dryer vents include a grille, the majority of openings must be no less than ½ inch in any direction."

Regarding screens for operable windows, in the 2nd draft for public comment, EPA is proposing this requirement for the Gold tier, while recommending it as advisory in the Certified tier. As proposed in the Gold tier, screens are required to be "provided" but not necessarily installed at the time of final verification. As with all requirements, items may be verified visually by the verifier on-site during construction/rehabilitation, by reviewing photographs taken during construction/rehabilitation, by reviewing material or equipment documentation, or through equivalent methods as appropriate.

3.3 Multifamily Pest Management

Summary of Comment(s):

One commenter recommended pointing to the EPA's Integrated Pest Management Plan (IPM) for guidance.

Another commenter suggested that floor drains should have a backwater or check valve.

Response:

In the 2nd draft for public comment, Item 3.3.1 has been updated to include EPA's guide on "Integrated Pest Management in Buildings" as a guide for pest management companies, but the intent of the proposed requirement remains to include a pest management plan or documented contract for multifamily properties.

Regarding floor drains in common trash/recycling rooms for multifamily buildings, these are proposed as a requirement in the Gold tier, but included as a recommended advisory in the Certified tier. The specifications require trap seals in floor drains to prevent radon, sewage gases, pests, etc. from entering the home through the floor drain. EPA believes that building code has addressed the locations of floor drains needing backflow valve protection. As such, backflow valves for all floor drains will not be required at this time.

V. Comments on Section 4. Heating, Cooling, and Ventilation Systems

4.1 Heating and Cooling (HAC) Systems

This item was previously "4.1 Heating and Cooling (HAC) Sizing and Design."

Summary of Comment(s):

One commenter suggested spelling out "H-A-C" the first time it is used in the checklist and also suggested an advisory to point participants to best practice guidance on using Manual S for systems that were previously exempt.

One commenter suggested adding a definition for capacity to provide clarity when evaluating over-sizing when variable speed cooling systems are used. Another commenter suggested adding a requirement that heat pump system sizing be based on cooling loads in humid climates.

A final commenter suggested adding a requirement that ACCA Manual P be used.

Response:

EPA agrees that introducing a new abbreviation (HAC) warrants explanation the first time it is being used in the checklist itself. In the checklist portion of the 2nd public comment draft, "Heating and Cooling" is added to Item 4.1.1.1 before "HAC" is used.

Regarding a definition of "capacity," EPA defers to the standards referenced in Item 4.1 for this definition. For buildings pursuing Indoor airPLUS Gold certification, EPA suggested this clarification to the ENERGY STAR team, and that guidance is now provided within the ENERGY STAR HVAC Design Report. While requiring heat pump systems to be sized to meet the cooling load in humid climates does improve the ability of the systems to reduce indoor humidity, Indoor airPLUS continues to align sizing requirements with ENERGY STAR and ACCA Manual S, which also allows heating-dominated climates to exceed cooling load in order to allow higher energy efficiency in the winter. A note is added in the specification to raise awareness of the implications on humidity control.

While EPA appreciates the suggestion to add requirements to also use ACCA Manual P, at this time, it is not included in the 2nd public comment draft as a requirement, but as an Advisory, which may be considered for a requirement in a future program change.

4.2 Humidity Control

This item was previously "4.10 Humidity Control."

Summary of Comment(s):

Fifteen comments were received on this item which has two requirements: one is a requirement for humidity monitoring in all climate zones and one is a requirement to provide active dehumidification in certain climate zones.

With respect to the humidity monitoring requirement, multiple commenters questioned the need for this in dry climate zones, while others questioned the need for the device to "record data". Other commenters suggested added specificity on where the device is located within the home/unit.

With respect to the requirement on humidity control, some commenters suggested pushing the industry further by also adding requirements for active humidification in dry climates, ERVs in Northern climates to help with indoor humidity, and requiring, rather than recommending, dehumidification systems that are separate from the HAC system in humid climates. Other commenters expressed concerns that the requirements may be pushing the industry too far and that limited HAC options are available that can provide this type of dehumidification without over-cooling the space or requiring re-heat. One commenter suggested allowing a ventilating dehumidifier in lieu of balanced ventilation (required in Item 4.5) to reduce the pieces of equipment needed.

Multiple commenters also provided feedback on the advisory in this item. One commenter suggested text could be added to recommend that distilled water is used in humidifiers, to reduce generation of airborne particulates and recommended WUFI models for typical wall sections. Two commenters provided input that the 40% minimum RH recommended was too high; another commenter supported the recommended 40-60% range, but suggested allowing dew points at 60F and proposed other language improvements for the advisory to avoid making misleading statements about humidifiers. They also suggested that humidifiers should be required with controls that compensate for outdoor conditions or with dew point controls.

Response:

With respect to the humidity monitoring requirement, EPA considers this to be critically important in all Indoor airPLUS labeled homes, given that there are also concerns in dry climates, where indoor humidity may be too low. EPA believes that improved occupant awareness of indoor RH, along with long-term data monitoring available for HVAC contractors and other professionals, will help improve sustained outcomes for comfort and health. However, EPA understands that the requirement for the monitor to "record" RH data may be too stringent in all cases, and it is revised as a recommendation in the 2nd public comment draft. In addition, guidance is included on where to locate the monitor within the dwelling unit.

With respect to the requirement to provide active dehumidification, in the 2nd public comment draft, the requirement remains for moist climate zones 1-4, in both Gold and Certified tiers, but clarifies what is meant by a "whole-home" dehumidifier. In response to comments, the requirement for the HAC system to have variable capacity is removed. In addition, the revised requirement clarifies the specific functionality required by HAC systems to comply (i.e. systems that utilize humidity sensor feedback in the control algorithm to provide dehumidification, either automatically or on-demand, even when cooling is not required). In addition, in response to comments, the 2nd public comment draft offers another alternative for dwelling units in climate zone 4a, based on a combination of RH modeling and other prescriptive requirements.

While EPA appreciates the alternative recommendations, the 2nd public comment draft does not add requirements in Gold or Certified specifications to mandate the installation of humidification systems, ERVs, or dehumidification systems that are separate from the HAC system in hot-humid climates. These remain as recommendations in the advisories, with some revisions as requested by commenters, including

the recommendation to use distilled water in humidifiers to avoid increasing particulate matter in the air. An advisory is also now included based on a similar recommendation for blower shut-off from the ZERH program. In response to comment, an advisory is also included to recommend consideration of dew point temperatures when considering how to control indoor humidity. While humidifiers are not required, the current advisory does recommend "automatic controls" that are intended to encompass controls that compensate for outdoor conditions or dew point, as recommended by the commenter.

4.3 Heating and Cooling (HAC) Duct Systems

This item was previously "4.2 Duct System Design and Installation."

Summary of Comment(s):

Two commenters provided feedback that the requirement to vacuum out duct boots, in addition to keeping them covered during construction, was too stringent. One commenter suggested feedback that the requirement to seal duct boots to finished surfaces was also too stringent. One commenter proposed adding an advisory to recommend the best practice of insulating supply ducts in conditioned space to avoid condensation issues.

Response:

Based on the feedback received, the 2nd public comment draft includes a "Duct Inspection" section including a note regarding vacuuming out the duct boots if they are found to have excessive dust and debris. The requirement to seal duct boots to finished surfaces is replaced with an advisory to follow that best practice. An advisory is also added related to insulating supply ducts in conditioned spaces.

4.4 Location of Heating and Cooling (HAC) Air-Handling Equipment and Ductwork

This item was previously "4.3 Location of HAC Air-Handling Equipment and Ductwork."

Summary of Comment(s):

Ten comments were submitted on this item, which contains requirements to bring HAC equipment and ductwork into the building's thermal and air barrier boundary and to also make HAC components "accessible". While the comments received on the 1st public comment draft are described below, it should be noted that in response to feedback, this item contains different requirements in the Certified and Gold specifications in the 2nd public comment draft.

Multiple commenters acknowledged the energy benefits of bringing the ducts into conditioned space but questioned the IAQ benefit. They noted cost concerns and the time needed to change building plans to meet this new requirement. One commenter supported the requirement but proposed adding specific insulation requirements to the exception for jump ducts. Another commenter suggested aligning text with 2021 IECC exceptions. One commenter suggested reconsidering whether Marine climate zones needed to be encapsulated in spray foam to qualify for the embedded duct exception. One commenter suggested changing the duct leakage to outside (DLTO) requirement in the embedded duct exception from 3 to 4 cfm25/100ft2, to align with ENERGY STAR. One commenter questioned whether this language would

conflict with the IECC, with respect to isolating mechanical closets from the interior. One commenter noted concerns with allowing mechanical closets to be located adjacent to the garage, while another commenter noted the challenges with meeting the exception criteria that does allow ductwork in cavities adjacent to the garage. One commenter questioned whether the entire HAC system needed to be "accessible" to the resident or just the filter, as required by ENERGY STAR.

Response:

EPA understands that a requirement to locate ducts within the thermal and air barrier boundary can present challenges and may take time to adjust building plans accordingly. However, there are IAQ benefits from preventing air from outside those boundaries from entering the duct system through leakage. EPA believes this requirement does not create a conflict with IECC. In response to feedback, in the 2nd public comment draft, this remains a requirement in the Gold tier, and is stated as an advisory in the Certification tier. In the Gold specification, another alternative option is added allowing ducts to be located outside the home/unit's thermal and air barrier boundary for dwelling units with tested total duct leakage results < 1 cfm25/100 ft2. Also, to provide alignment with the I-codes, an exception is added in the Gold tier, such that ducts considered within the conditioned space, per the 2018 or 2021 IECC, meet this requirement as long as a minimum of R-8 duct insulation is used and duct leakage to outdoors is measured ≤ 3 CFM25 per 100ft2 with additional requirements for Moist (A), Dry (B), and Marine (C) climate zones.. Furthermore, while two commenters requested changes to the current exceptions (jump duct insulation and duct leakage threshold), since they are based on requirements from DOE's Zero Energy Ready Homes program, those exceptions remain for program alignment, and a note is added to underscore that "ventilation" ductwork is exempt.

While comments were submitted on the restrictions related to locating ducts in closets adjacent to the garage, no changes are proposed for the 2nd public comment draft with respect to garages. Ductwork is not prohibited from being located in cavities adjacent to the garage, as long as they are separated from the garage by a continuous thermal and air barrier. Additionally, the requirement that permits a mechanical closet to be adjacent to the garage has specific requirements to limit air transfer from the garage to the air handling equipment.

To address the concerns related to "accessibility," in the 2nd public comment draft, EPA aligns this requirement with ENERGY STAR, focused on the accessibility to the "filter," rather than all the HAC system components. While the same "accessibility" to all HAC system components is recommended, it is included as an advisory instead. However, Item 1.15.1 must still be met, which requires that the condensate drain pan "drains to a conspicuous point of disposal."

4.5 Pressure-Balanced Bedrooms

This item was previously "4.4 Pressure-Balanced Bedrooms."

Summary of Comment(s):

One commenter asked if there is guidance for the test procedure. Another commenter requested clarification on the "plus or minus" 3 Pa pressure requirements within the checklist.

Response:

In the 2nd public comment draft, EPA is including guidance on the test procedure within the program specifications.

The pressure-balanced bedroom requirements are updated in the 2nd public comment draft to help address climate-specific issues of moisture transfer, with a more stringent limit in Moist zones. Verifier-measured pressure differential of ±3 Pa in Moist (A) zones 1-3 and ±5 Pa in all other climates is required. The checklist is also updated to reflect "plus or minus" (±) 3 and 5 accordingly.

4.6 Dwelling-Unit Mechanical Ventilation

This item was previously "4.5 Dwelling-Unit Mechanical Ventilation."

Summary of Comment(s):

Twenty-two public comments were submitted on this item. In the 1st public comment draft, this item had a requirement for "balanced ventilation" at Verifier-measured rates that exceed ENERGY STAR requirements, with accessible MERV 13 filters. It included some limitations when using the air handler for the supply portion of a "balanced" strategy and included some advisories. While the comments received on the 1st public comment draft are described below, it should be noted that in response to feedback, this item contains different requirements in the Certified and Gold specifications in the 2nd public comment draft.

Two commenters questioned the sone maximums, noting differences compared to Item 4.6 and ASHRAE 62.2. Multiple commenters noted concerns with the increase in ventilation rates beyond ASHRAE 62.2-2010, while three commenters supported the increase and suggested updating the reference to ASHRAE 62.2-2019. Two commenters noted concerns with the new requirement for a MERV 13 filter on the supply of outdoor air, while one commenter cited a study that supports it, and another suggested alternative rating systems be allowed. Three commenters requested more clarity on what "accessible" means. One commenter suggested additional language to ensure the ventilation system was capable of handling the additional pressure drop associated with the MERV 13 filter and that homeowner education should be provided on maintenance. Multiple commenters noted challenges with measuring supply airflow when connected to HAC systems and one commenter recommended allowing measurements from integrated diagnostic tools in lieu of Verifier-measured values. One commenter requested best practice guidance on supplying OA to the return side of the air handler in cold climates, and one commenter requested removing text that this practice is not recommended. Three commenters requested removing the requirement to interlock the air handler operation with the operation of supply systems that are connected to the HAC ductwork, while one noted that the current requirement was unclear. One commenter suggested allowing automated whole-house comfort ventilators to be used in lieu of balanced systems. Multiple commenters suggested allowing supply-only, including ventilating dehumidifiers, or "smart" demand-based ventilation systems in addition to balanced options, or to consider requirements based on climate zone. Multiple commenters read the item as requiring ERVs or HRVs and noted cost and maintenance concerns with those specific types of balanced systems, and questioning the IAQ benefit of "balanced" airflows. One commenter recognized that ERVs and HRVs were not required, and suggested

that requirement for certain climate zones. Other commenters suggested clarifying the definition of "balanced" to align with 62.2 (20% rather than 10%), to explicitly state the systems had to be mechanical in nature (not passive), and to clarify whether simultaneous operation was required. One commenter suggested an advisory to recommend equipment with automated fault detection and diagnostics, as well as automatic balancing. Three commenters noted that the advisory to provide a condensate drain does not apply to all systems and should be clarified or removed. One commenter suggested adding more clarity on the ENERGY STAR requirement related to on/off controls. One commenter suggested adding language about appropriate distribution and maintenance to ensure operation as these aspects also impact IAQ. One commenter suggested adding language from the 2021 IECC to mandate that systems be rated for airflow at rates greater than or equal to design airflow and to allow interpolation between two points when the rating does not occur at the design flow.

Response:

With respect to comments related to the maximum allowable sound levels for in-unit, continuously operating dwelling-unit ventilation systems, the 2nd public comment draft aligns with ENERGY STAR Single Family New Homes and ASHRAE 62.2-2019 and requires that all dwelling units pursuing Indoor airPLUS Certified or Gold adhere to the same maximum of 1 sone.

In response to comments to incorporate the most recent version of ASHRAE 62.2, in the 2nd public comment draft, this item references 62.2-2019 or later versions, instead of 62.2-2013. Regarding concerns raised by a few commenters about the increased ventilation rates associated with following ASHRAE 62.2-2013, Section 4 of the 2019 Standard includes multiple credits to adjust the required outdoor air rates, potentially resulting in the rates increasing by only 10-20% over ASHRAE 62.2-2010. While not proposed for the 2nd public comment draft, Indoor airPLUS will consider adding alternatives that allow "smart" ventilation systems that operate based on indoor contaminant levels, rather than prescriptive outdoor air rates. Advancements in industry standards, IAQ metrics, and additional input from industry and researchers are important considerations for EPA in establishing such alternatives.

With respect to the requirement to filter outdoor air using a MERV 13 filter, no change is proposed in the 2nd public comment draft for the Gold tier except to add "ISO ePM1" (ISO 16890) as an alternative rating. However, for the Certification tier, MERV 11 or higher (or alternatively "ISO ePM2.5") is the newly proposed requirement. Additionally, new text clarifies that only the filter itself must be "readily-accessible" with additionally advisories on ventilation system design to accommodate the associated pressure drop.

In response to a comment requesting homeowner education on maintenance, this is covered in Section 7, Occupant Education. Further, the suggestion to add language about the benefits of improved distribution have been added as an advisory in the 2nd public comment draft.

While multiple commenters noted that the supply airflow can be challenging to measure, particularly when ducted into the return of an air handler, the measurement requirement is not changed, but it should be noted that only the Gold tier requires both supply and exhaust (i.e., "balanced") ventilation to be measured. In the 2nd public comment draft, EPA clarifies that this can also be measured and documented by a certified air-balancing contractor. These measurements include those allowed by ANSI/RESNET/ICC 380, which includes measurements provided by integrated diagnostic tools in the ventilation system.

While manufacturers' recommendations for return air temperature should be included in design considerations, the advisory that cautions against supplying outdoor air through the HAC is removed. Additionally, where the HRV/ERV or a powered supply fan is connected to the HAC ducting, the additional requirement to interlock the systems to ensure simultaneous operation remains, with edits to improve clarity. While commenters have noted their objections to this requirement, EPA is concerned that providing outdoor air into the HAC system without operating the air handler may create other IAQ issues in some instances.

In response to commenters that would like to continue to use "supply" systems, the 2nd public comment draft of the Gold specification clarifies how "supply" systems, including ventilating dehumidifiers, can be paired with local exhaust fans to achieve "balance". It should be noted that in the 2nd public comment draft, only the Gold tier requires balanced ventilation. In response to comments requesting aligning the definition of "balanced" with ASHRAE 62.2, a 20% threshold replaces the previous 10% threshold in the Gold tier. EPA considers the requirement for "balanced" ventilation to be an incremental step forward and believes alignment with Standards and a potentially wider range of thresholds are needed to support project teams. Also, in the 2nd public comment draft, EPA clarifies that a balanced system does not limit system choice to an HRV or ERV, but also allows a combination of separate mechanical supply and exhaust systems, if airflow is measured within 20% or 10 cfm of each other. EPA further clarifies that simultaneous operation of these separate systems is recommended but not required. EPA believes that to successfully achieve improved levels of indoor air quality, the air exchange rate should be relatively balanced to minimize the unintended consequences of depressurization or pressurization. Further, ventilation air from the outdoors should ideally be supplied mechanically and directly to the dwelling unit, with the opportunity for filtration and improved distribution offered by a balanced ventilation strategy. While ERVs and HRVs offer additional energy benefits, they are not being proposed as required prescriptions for Indoor airPLUS certification.

To further improve clarity, sub-section headers have also been added to re-organize the requirements.

In response to commenters, the advisory on installing trapped condensate drains is removed, and the advisory on duct length now also includes exhaust ducts.

While a request for more clarity on the "on/off" control was requested, this is an ASHRAE 62.2 requirement, so clarity on those controls reside within that Standard. In the 2nd public comment draft, the term "override" control is used in alignment with the parallel ENERGY STAR requirement.

With respect to the suggestion to add text on the "rated" airflow of systems, given that fan efficiency targets are not part of either the ENERGY STAR or IAP programs, it is not anticipated that this comment would pose an issue in either Indoor airPLUS Gold or Certified tiers.

And finally, an advisory is included recommending systems with features such as fault detection, automated balancing, and other diagnostics.

4.7 Dwelling-Unit Bathroom Exhaust

This item was previously "4.6 Dwelling Unit Bathroom and Kitchen Exhaust."

Summary of Comment(s):

Eighteen comments were submitted on this item. This item contained numerous requirements and advisories for bathroom and kitchen exhaust fans related to system type, controls, measurement, and sound. While presented as one item in the 1st public comment draft, these requirements are reorganized as two independent items in the 2nd public comment draft, with some differences between Gold and Certified tiers.

With respect to the bathroom exhaust requirements and controls, one commenter noted concerns about drawing in more moisture from the outdoors when using bath exhaust fans in humid climates. A few commenters noted the language was confusing and expressed concern that this control requirement may cause builders to install multiple bath exhaust "strategies" in one bathroom, given the requirement for "balanced" dwelling-unit ventilation. Another commenter suggested reducing the 30-minute delay off requirement to 20 minutes. Another commenter was concerned about the added cost of these controls.

Another commenter suggested aligning the sone levels with ASHRAE 62.2 and aligning language with other codes, like CALGreen.

Another commenter suggested adding an advisory that bathroom exhaust fans be certified at higher static pressures of 0.375" to increase the chances of achieving desired installed performance.

Response:

With respect to comments received on the bathroom exhaust control requirements, in the 2nd draft for public comment, the humidity-sensing or occupancy-based controls for intermittent bath exhaust fans are proposed as a requirement only in the Gold tier. However, to increase the number of products readily-available with these built-in controls, in the 2nd public comment draft, the delay-off time is reduced from 30 to 20 minutes and manual timers are permitted in the Certified tier to improve functionality and user convenience, without requiring fully-automated controls. The 2nd public comment draft also underscores that continuous bath exhaust that is part of a balanced system are not subject to these controls and do not require multiple systems to serve the same bathroom. Additional measures are prescribed in Moist climate zones 1-4 to reduce the impact of drawing in additional moisture from the outdoors in those climates.

EPA believes the current text is compatible with CalGreen requirements, so no other changes were made to address that specific comment.

With respect to the comments received to reduce maximum sone levels, the 2nd public comment draft requires multifamily units under ENERGY STAR MFNC to meet the same 1 sone maximum as ENERGY STAR Single-Family New Homes and ASHRAE 62.2 for continuous bathroom exhaust.

Finally, to further improve performance, an advisory is added to recommend selecting products that have exhaust airflow rated at static pressure of 0.375" or higher.

4.8 Dwelling-Unit Kitchen Exhaust

This item was previously "4.6 Dwelling Unit Bathroom and Kitchen Exhaust."

Summary of Comment(s):

Eighteen comments were submitted on this item. This item contained numerous requirements for bathroom and kitchen exhaust fans related to system type, controls, measurement, and sound. There were also numerous advisories. While presented as one item in the 1st public comment draft, this item is two independent items in the 2nd public comment draft, with some differences between Gold and Certified.

With respect to the kitchen exhaust requirements, one commenter suggested making a clearer statement about the benefits of using demand-controlled exhaust in multifamily units, and another questioned why it was not a requirement. Two commenters misunderstood the text related to recirculating range hoods and questioned why that would be allowed in multifamily units. Another commenter supported the exception, noting challenges in multifamily buildings with providing demand-controlled kitchen exhaust.

One commenter suggested requiring higher kitchen exhaust rates than ASHRAE 62.2, based on recent technical research from LBNL. Two commenters indicated that make-up air requirements for kitchen exhaust should be considered, with one commenter specifically stating it was needed for exhaust rates greater than 200 cfm.

One commenter suggested consistently using the phrase "cooktop" instead of "range" or "stove." Another commenter suggested better phrasing on the types of smart hood controls to mention in the advisory. One commenter objected to the advisory text that indicates induction cooktops are more effective at reducing particle emissions versus other cooktops. Two commenters suggested references to capture efficiency are premature until test procedures complete the consensus review process. Two commenters noted that the advisory on smart hoods may also be premature until they have passed UL safety standards.

Multiple commenters noted the difficulty measuring kitchen exhaust airflow in the field, especially with microwave range hoods, and suggested alternatives, including those currently allowed by ENERGY STAR.

Two commenters noted that more clarity was needed surrounding the conditions for the sone rating and the fan speed setting used during the Verifier measurement of exhaust airflow.

One commenter recommended removing the advisory text that range hoods and microwave-range hoods be “HVI or AHAM certified” and replace with a recommendation that they have independent third-party tests verifying performance.

Response:

With respect to the comments received on kitchen exhaust requirements, the 2nd public comment draft adds a recommendation to specify demand-controlled kitchen exhaust in multifamily housing and an advisory for make-up air. The new draft also uses the terms "cooktop and range" rather than "stove". An advisory is also added to recommend higher kitchen exhaust rates, based on the findings from a recent LBNL study, which illustrates “the potential for establishing different performance standards based on stove type”.

In response to comments, advisories related to capture efficiency and "smart" range hoods are re-phrased based on the current status of certain referenced standards and products. In addition, the advisory on induction cooktops is removed.

In response to the challenges noted in comments with measuring exhaust airflow from microwave range hoods, a non-testing option is added in the 2nd public comment draft, based on ASHRAE 62.2 Table 5.3 and ENERGY STAR guidance on kitchen exhaust.

Further edits in response to comments include expanding the current advisory recommending certified products to include products that have independent third-party testing, in accordance with the same test procedures, and in the Gold tier, clarifying the speed settings at which measurement and sone levels are expected for compliance.

4.9 Common Space Ventilation Requirements and 4.10 Other Ventilation Requirements

These items were previously "4.7 Common Spaces and Other Ventilation."

Summary of Comment(s):

Six comments were submitted on this item, which contains ventilation requirements for common spaces, vented dryers, and central vacuum system outlets. Three commenters submitted comments in support of the requirement that outdoor air serving common spaces contain a filter with a minimum rating of MERV 13. Two commenters submitted objections to the requirement, stating concerns related to increased first costs, maintenance, decreased HVAC efficiencies, and higher static pressure. One commenter suggested MERV 11 as an intermediate solution. Another commenter acknowledged the concerns about static pressure, but noted that new construction can design their systems to accommodate the MERV 13 filter.

One commenter provided feedback on the advisory text, recommending the phrase "Dryer Exhaust Duct Power Ventilator" rather than "booster fan".

Response:

EPA appreciates the concerns noted with moving the industry toward higher filter efficiency. In the 2nd public comment draft, EPA proposes MERV 11 for the Indoor airPLUS Certification tier. However, the MERV 13 filter requirement will remain in the Indoor airPLUS Gold tier, considering the improved IAQ benefits and the apparent increase in market availability of such ventilation products. Similar to other items with MERV rating requirements, the "ISO ePM" rating options have been added.

For improved clarity, this item is now separated into two items: 4.9 for "Common Space Ventilation Requirements" and 4.10 for "Other Ventilation Requirements". In the latter, the term "dryer exhaust duct power ventilator (DEDPV)" is used in lieu of "booster fan" in the 2nd public comment draft.

4.11 Particle Filtration for Ducted Heating and Cooling (HAC) Serving Dwelling Units and Common Spaces

This item was previously "4.8 Particle Filtration for Ducted HAC Serving Dwelling Units and Common Spaces."

Summary of Comment(s) related to particle filtration:

Nine comments were submitted on this item, specifically regarding particle filtration. This item contains numerous advisories and one requirement for a MERV 13 minimum filter for ducted HAC serving dwelling units and common spaces. Two commenters supported the MERV 13 requirement. One commenter suggested allowing a lower MERV rating, if paired with increased run time and if equivalent performance can be achieved. Another commenter noted that the filtration requirement needed to be paired with some minimum requirement for air exchange (ACH) in order to be effective and consistent across homes. Three commenters submitted concerns with increasing to MERV 13 and proposed an intermediate MERV 11 rating instead.

Two commenters noted that HAC systems operate only based on thermostat setpoints which may lead to long periods of time where the indoor air is not being circulated through the filter. They recommended minimum run times to ensure filtration is achieved regularly throughout the year. Two commenters suggested including other standards for filter efficiency, such as ASHRAE 52.2 and ISO 16980.

While minimum filter slot widths were only a recommendation, two commenters provided feedback that the minimum in the advisory should be increased from 2" to 4" depth, while another commenter cautioned against setting minimums because it may inadvertently exclude certain types of products. One commenter suggested multiple language improvements to the advisories, such as adding minimum specifications for gaskets and better guidance for verifying filter sealing.

Response:

EPA appreciates the concerns noted with moving the industry toward higher filter efficiency. As such, in the 2nd public comment draft, EPA proposes MERV 11 for the Indoor airPLUS Certification tier. However, the MERV 13 filter requirement will remain in the Indoor airPLUS Gold tier, considering the improved IAQ benefits and the apparent increase in market adoption of improved filtration products. Similar to other items with MERV rating requirements, the "ISO ePM" rating options have been added. Text is also added in the 2nd public comment draft to assist project teams with reducing the potential impact on static pressure through design. In response to comments received, an advisory is added to recommend HAC systems operate at minimum daily runtimes to provide filtration of indoor air, when the HAC system may not be operating.

Given the likelihood that wider/deeper filter slots will offer long-term benefits and opportunities for improved filtration with less restriction on airflow, the 2nd public comment drafts will include a 2" minimum filter slot requirement in both Certified and Gold tiers, along with a requirement for filter gaskets or sealing mechanisms to prevent air bypass.

Summary of Comment(s) related to electronic air cleaners:

Several commenters expressed concern over ozone emissions from electronic air cleaners, recommending increased stringency specified in the referenced standards.

Two commenters also identified other electronic air cleaning technologies mentioned in Indoor airPLUS Version 2 specifications but without similar restrictions on byproducts. These commenters suggested that it would be pertinent to include references to these technologies as they grow in popularity, particularly due to increased interest in air purification related to the COVID-19 pandemic.

Additionally, commentors suggested that EPA require an advisory label regarding ozone emissions for any electronic air cleaning device, and an advisory label informing occupants about proper servicing and replacement for devices that use UV wavelengths.

Response:

With respect to comments received on electronic air cleaners, EPA recognizes the health hazard that ozone and other byproducts of electronic air cleaners pose and proposes updated ozone emissions limits to align with UL 2998 (0.005 parts per million) instead of UL 867. The same limits are now also referenced for microbial disinfection devices in Item 1.14. EPA acknowledges the importance of user safety while operating and maintaining devices that produce ozone and/or utilize UV wavelengths, and has included related advisories in Items 4.13 and 4.14.

4.12 Particle Filtration for Non-Ducted HAC Systems Serving Dwelling Units

This item was previously "4.9 Particle Filtration for Non-Ducted HAC Serving Dwelling Units."

Summary of Comment(s):

Six comments were submitted on this item, which contained filtration recommendations for non-ducted systems. It was noted in a few comments that this item needs to be clearer that it contains only recommendations and does not contain any requirements. In contrast, one commenter who recognized it was only an Advisory, suggested it be elevated to a requirement to maintain consistent IAQ across all dwelling units. Two commenters noted that it should be clear that the recommendation is not just for MERV 13 filters, but MERV 13 filters or better (or equivalent rating systems). One commenter suggested that the recommendation be clearer on the number of air changes per hour achieved by the system. A final commenter noted a potential redundancy in the text related to ENERGY STAR certified electronic air cleaners.

Response:

EPA appreciates the comments received and has incorporated several updates. In the 2nd public comment draft, EPA is elevating this item to a requirement in Indoor airPLUS Gold, while maintaining it as an advisory in the Indoor airPLUS Certification tier. Options will remain for a transfer fan with a MERV 13 filter or a stand-alone portable air cleaner for each of the two largest living spaces in the home/unit. A new option has also been added to accommodate potential product development in the area of filtration for ductless mini-splits.

4.13 Gas-Phase Air Cleaning Devices

This item was previously "4.11 Gas-Phase Air Cleaning Devices."

No comments received regarding this Item.

4.14 Microbial Disinfection

This item was previously "4.12 Microbial Disinfection."

Summary of Comment(s):

Three comments were received on this item, addressing ultraviolet germicidal irradiation (UVGI) and other electronic air cleaners.

One comment suggested that EPA require that an advisory label should be required on the panel that provides access to the UVGI lamp to prevent accidental occupant exposure. Another commenter noted that the UVGI technologies mentioned in Item 4.12 should have requirements and/or restrictions to reduce indoor ozone emissions. The commenter also expressed concern that allowing UVGI technology without specifications on sizing may lead to improper installation and reduced effectiveness.

Response:

EPA acknowledges the importance of user safety while operating and maintaining devices that utilize UV wavelengths. Safety advisories and operation guidance (such as labelling) are typically included on or with a device by the device manufacturers. Advisory language in Item 4.14 is now updated, recommending that homeowners and occupants are made aware of the hazards of UV exposure and proper usage of the devices.

Item 4.14 is also updated to require that UVGI or other electronic air cleaners not exceed ozone emissions limits specified in UL 2998, if one is being utilized. EPA is not requiring such devices be utilized, and because UVGI and other electronic air cleaners are not standardized their application or placement, EPA is not specifying a set of installation parameters.

Regarding general comments related to proper sizing, system flow rate, and specific applications such as air stream purification, EPA does not specifically recommend the use of UVGI technology for air stream purification, recognizing the exposure period may be too short to kill or deactivate most airborne microorganisms.

VI. Comments on Section 5. Pollutant Control

This section was previously "Section 5. Combustion Pollutant Control."

5.1 Combustion Appliances

Summary of Comment(s):

Regarding homes with solid fuel burning appliances and IAQ monitoring requirements, one commenter requested specifying the IAQ monitor location within the checklist to help reduce confusion, and also suggested a requirement to include information about IAQ monitoring in the homeowner/occupant guide.

Two commenters recommended lowering the $PM_{2.5}$ alert level to a range between 25-30 ug/m^3. Another commenter recommended the use of certified IAQ monitoring devices. One commenter recommended calibrating of IAQ monitors every 2 to 3 years. Another commenter recommended advising the use of IAQ monitors regardless of the fuel types being used in the home.

Another commenter recommended that a Carbon Monoxide (CO) alarm be located in the room where there are solid fuel burning appliances.

Another commenter recommended Indoor airPLUS prohibit combustion appliances in IAP Certified homes, but if they are used, the installation should include the use of a "smart" hood with $PM_{2.5}$ detection.

One commenter recommended defining conditions to allow for unvented room heaters and suggested permitting unvented heaters listed to ANSI Z21.11.2 to be installed because the standard addresses oxides of nitrogen (NOx) and CO.

Another commenter recommended adding venting requirements specifically for "alcohol/ethanol" stoves in the item regarding liquid- or gas-burning appliances.

Response:

With respect to the proposed requirement for IAQ monitoring in homes with solid fuel burning appliances and recommendations to change to the $PM_{2.5}$ alert level from 35 ug/m^3 to 25-30 ug/m^3, EPA was referencing available health-based metrics established by the Agency in the National Ambient Air Quality Standards (NAAQS), which lists a $PM_{2.5}$ threshold of 35 ug/m^3 (24-hour standard). However, because indoor contaminant thresholds for $PM_{2.5}$ are not yet established, Indoor airPLUS is removing the proposed requirement for IAQ monitoring, while requesting additional information from the scientific community on appropriate metrics for *indoor* contaminants. EPA also seeks feedback on the current applicability of IAQ monitoring as a program requirement to promote occupant awareness and action.

In response to the other comments on IAQ monitors, EPA is considering additional guidance on using and understanding consumer-grade IAQ monitors, including the operation, maintenance, and standardization of such devices. Basic guidance for IAQ monitor calibration is included in the advisory, and additional information can be found on EPA's webpages for Low–Cost Air Pollution Monitors or Air Sensor Technology and Indoor Air Quality.

EPA appreciates the suggestion for expanding the inclusion of IAQ monitoring beyond just dwellings with solid fuel burning equipment to all dwellings. As noted above, Indoor airPLUS is removing the previously proposed requirement in the 2nd draft for public comment. However, EPA encourages additional feedback

and information from industry and stakeholders regarding the current state of standardization in consumer grade IAQ monitors, as well as the applicability and appropriateness of an IAQ monitoring requirement as a tool for occupant awareness and improved IAQ protections.

EPA appreciates the comments on carbon monoxide alarms, and the 2nd public comment draft will be revised to add a bullet under "Carbon Monoxide Alarms" in Item 5.2.1.1 to state that a carbon monoxide (CO) alarm(s) shall be installed "in the same room as permanently installed fuel burning appliances."

EPA is aware of research referenced by commenters regarding the particulate emissions from combustion devices within the pressure boundary of the home and appreciates the comment about excluding combustion appliances completely. EPA is not ready to prohibit gas appliances in the specifications at this time, but continues to stress the importance of improved ventilation practices, especially in kitchens. The advisory regarding "smart" range hoods in Item 4.8, Dwelling-Unit Kitchen Exhaust, recommends that the range hood activate automatically based on operation or using air quality sensor technology. Concerning the exclusion of unvented combustion appliances, EPA appreciates the fact that the ANSI Z21.11.2 Standard addresses NOx and CO and is aware that these devices can be aesthetically pleasing. However, EPA believes that the Indoor airPLUS Program should continue to limit the sources of unvented combustion in the home, so will not be permitting unvented heaters to be installed at this time.

Regarding "alcohol/ethanol" fireplaces, EPA considers these to be included in liquid or gas-burning fireplaces. EPA has reorganized these requirements in the 2nd public comment draft in Item 5.1.2, requiring all fireplaces to be mechanically drafted or direct vented, and liquid or gas-burning fireplaces to include permanently affixed glass front or gasketed doors.

5.2 Carbon Monoxide Alarms

Summary of Comment(s):

One commenter recommended defining the proximity to sleeping zones on multiple floors. Another commenter recommended adding a requirement that the CO alarm be hard-wired into the building's electrical system.

Response:

Regarding the placement of CO alarms and their power source, the draft for 2nd public comment intends to generally align with requirements in the 2021 IBC and NFPA 72. It should be noted that Indoor airPLUS proposes these requirements in all dwelling units for additional protection from external sources of CO (e.g. portable generators, outdoor cooking, automobiles).

5.3 Pollutant Control from Smoking and Vaping

This item was previously "Pollutant Control from Smoking for Multifamily Buildings."

Summary of Comment(s):

One commenter said that the smoking/vaping prohibition location in the checklist should be clarified. Another commenter suggested that the definition of the number of units for multifamily smoking areas be reduced from 4 to 2. Another commenter proposed that the advisory regarding prohibiting smoking in multifamily units should include detached housing as well.

Response(s):

EPA appreciates the comments received regarding smoking and vaping, and the 2nd public comment draft has eliminated the criteria for number of units where smoking and vaping are prohibited in multifamily common areas. The checklist has been updated accordingly.

EPA believes that prohibiting smoking in private residences, while certainly recommended, would be an unmanageable provision for the purposes of Indoor airPLUS home labeling, but recommends this as an advisory.

5.4 Pollutant Control through Minimized Infiltration

Summary of Comment(s):

Commenters made a number of observations and recommendations regarding this provision including allowing for an ACH50 limit of 5 ACH50 in some areas, reducing it to 2 ACH50 in others, making the change incremental, allowing for different tightness specifications for different climate zones, providing guidance about how to achieve tighter buildings, allowing for a square foot metric for small dwelling units, and specifying methodologies for determining compartmentalization and Verifier measured air tightness. One commenter suggested slight positive pressurization to reduce infiltration from common spaces and corridors.

Response(s):

Regarding the comment about positive pressurization of dwelling units, EPA recognizes that there may be benefits to a positive pressure condition. However, such provisions would be better addressed by ventilation requirements in Section 4.

EPA recognizes that tighter buildings can provide numerous benefits for controlling indoor air quality such as moisture and pest control. However, EPA also recognizes a wide variety of building practices and code adoption may require a range of options to encourage tighter envelope construction in some jurisdictions. For those reasons the minimized infiltration specification for detached homes >1,000 ft 2 3 ACH50 is proposed in the Gold tier and 5 ACH50 in the Certified tier. In response to the comments and in order to allow for the widest adoption, EPA will amend the tightness limit for detached homes less than or equal to 1,000 square feet to 0.23 CFM50 per square foot in the Gold tier and 0.30 CFM50 in the Certified tier.

5.5 Attached Garages and Parking Structures

Summary of Comment(s):

One commenter proposed that the airflow for attached garages be increased to 100 cfm/bay. There was also a suggestion to include an occupant sensor and run-time control.

Response:

The IMC in Table 403.3.1.1 requires ventilation of 0.75 cfm per square foot. The size of a typical residential garage is 162 ft^2, which would require approximately 120 cfm. Increasing the flow rate in Section 5.5 to 100 cfm per bay for the first two bays is not unreasonable as an alternative to the pressure testing. Because of the increasing volume of the space, increasing the flow rates incrementally based on the number of bays beyond two bays would require excessive and unnecessary airflows. EPA will add to the Advisory regarding extended garage occupancy that the exhaust fan be sized at 0.75 cfm per square foot to align with IMC Table 403.3.1.1.

If a fan is required in the garage, the specifications require the fan to operate continuously or be controlled by an occupancy sensor with a 1 hour delayed off.

EPA also notes that the requirement for an automatic door closer between the attached garage and living space is now proposed only in the GOLD tier, and is proposed as a recommended advisory in the Certified tier.

VII. Comments on Section 6. Building Materials

This section was previously "Section 6. Low-Emission Materials."

Summary of Comment(s):

Several commenters expressed concern that the use of low-emission materials was difficult to confirm and enforce. Many of these commenters suggested ways to enhance compliance. One commenter recommended increasing the scope of relevant subsections to 100% of the surfaces or materials cited as opposed to 90% in the draft specifications. Another commenter requested EPA to require product documentation and disclosure to homeowners, while another recommended no option for builder-only verification, but to require builders to supply product specifications to Verifiers at the beginning of the project.

One commenter requested that EPA make the specifications more user friendly and include a table with emission limits. One commenter suggested that UL 2818 is more stringent on product emissions than the CDPH Standard Method v1.2 and should be listed as a compliance option alongside the CDPH standard. This suggestion was made generally, but also for each of the individual product categories except for carpets and cushions.

Response:

EPA understands that requiring 90% of the surfaces or materials in this section, as opposed to 100%, creates an enforcement metric that can be difficult for Verifiers to quantify under certain circumstances, and the 90% threshold has been eliminated in the 2nd public comment draft.

EPA believes that Verifiers can provide verification of materials with proper coordination between builders and material suppliers. EPA also recommends that Verifiers engage with builders on product documentation requirements at the beginning of the construction cycle, as suggested by commenters.

EPA does not believe it is necessary to require all product documentation to be disclosed to the homeowners. Although such information could be incidental to providing maintenance recommendations to homeowners as part of the section 7.1 requirements, this level of disclosure is not currently required.

EPA agrees that usability is especially important for program compliance, so builders can easily select proper low VOC products. As such, EPA intends to update the supplemental guidance, *How to Find Indoor airPLUS Compliant Low Emission Products*, which provides information on identifying products that are compliant with these specifications.

EPA appreciates the suggestion to include UL 2818 as an additional compliance option that utilizes CDPH Standard Method V1.2 for emission testing. However, EPA recognizes that listing a variety of third-party certifications in the specifications creates requirements with various levels of stringency. The proposed draft intends to improve consistency by referencing foundational standards for both VOC content and emissions, upon which supplemental guidance materials will be based. As such, EPA plans to include UL 2818 (and other standards or 3rd-party certifications that require CDPH emission testing criteria) in supplemental guidance documents.

Regarding the suggestion to include a table with "emissions limits" within the specifications, EPA will consider the inclusion of such a table in supplemental guidance documents, as well as compliant certifications based on such standards.

6.1 Composite Wood

Summary of Comment(s):

Several commenters suggested that the exemption for uncertified structural engineered products make the intended protections against formaldehyde exposure in this section insufficient. Those commenters also recommended that homes should be tested for formaldehyde prior to occupancy.

One commenter noted that laminated products will not be required to meet the hardwood plywood until 2024.

Two commenters made recommendations regarding the requirement to meet TSCA Title VI. One requested that EPA require either TSCA Title VI compliance or to meet specified emission limits. Another commented that the requirement to meet TSCA Title VI requirements is already required by law, and suggested that including this requirement in the specifications gives a false impression that the requirement is providing additional protection against formaldehyde exposure beyond a baseline. The commenter also proposed a requirement that permanently installed cabinets would be made with no-added-formaldehyde NAF adhesives.

Two commenters had recommendations regarding verification. One commenter recommended a requirement that product labels are provided to the occupant, in addition to being retained by the Verifier.

Another expressed concern that verification of compliance with this section could prove difficult for cabinetry.

Response:

EPA agrees since compliance with TSCA Title VI is required by regulation, the utility of referencing existing regulation in the specifications is diminished and raises a potential for confusion between the specifications and the regulations promulgated under TSCA Title VI. Building materials acquired in the United States will be presumed to follow federal regulations, and have therefore been removed from the specifications. This also ameliorates potential difficulty with verification for cabinetry and other products.

Regarding structural engineered products, EPA refers to the 2016 "Formaldehyde Emission Standards for Composite Wood Products" final rule published in 2016 (81 FR 89674). In the preamble to that rule, EPA noted that, "the primary composite wood products using phenol-formaldehyde resins were oriented strand board and softwood, or structural plywood, which were mainly used for exterior sidings," and concluded that, "composite wood products made with phenol-formaldehyde resins are much less likely to emit formaldehyde than products made with urea-formaldehyde resins." EPA maintains the position that structural engineered products do not represent a high enough risk of formaldehyde exposure. The specifications are not intended to provide formaldehyde protection above the regulation, including any requirement for no-added-formaldehyde NAF adhesives. However, products that are rated as "Exterior" or "Exposure 1," in compliance with Voluntary Product Standard PS 1-19, Structural Plywood or Voluntary Product Standard PS 2-18, Performance Standard for Wood-Based Structural-Use Panels, means that adhesives in those products will have moisture resistant properties. Therefore, the requirement for structural plywood and oriented strand board to meet those standards are maintained in the Indoor airPLUS specifications.

In terms of testing for formaldehyde before occupancy, EPA is concerned such a requirement would represent a significant cost burden on builders, especially considering that building materials are presumed to be in compliance with federal regulations.

6.2 Interior Paints, Finishes, and Coatings

Summary of Comment(s):

One commenter recommended the requirements go further to specify products with *no* VOCs. Another commenter suggested adding guidance on "VOC and off gassing threshold equivalencies." Another commenter suggested an option to use UL 2818 to comply with the specification, as an alternative to CDPH Version 1.2—2017.

Response:

Regarding recommendations to use products with "no" VOCs, EPA recognizes the use of the term "Volatile Organic Compounds (VOCs)" rather than "Reactive Organic Gases (ROGs)" has created a misunderstanding when applied to indoor air quality. Many individuals and organizations, including manufacturers of building materials and products, have come to think of VOCs as "only those regulated by EPA for outdoor air," and apply the same definition for indoor air purposes. Because the common

definition of VOCs pertains to the regulation of outdoor air quality, product labels claiming "no VOCs" may not properly assess all of the VOCs emitted from the product, including some chemical compounds that may be relevant for indoor air quality. Therefore, the Indoor airPLUS Version 2 specifications will recommend and/or require the use of "low VOC" or "low emitting" products to discourage the potential overstatement or misinterpretation suggested by "no VOC" products. For more information, see EPA's Technical Overview for Volatile Organic Compounds.

Regarding "off gassing threshold equivalencies," EPA is currently unable to provide guidance on standardized decay curves for the off gassing of all products that may be used in the construction of a home.

Regarding the addition of UL 2818, please see the discussion in the introduction to Section 6.

6.3 Carpets and Cushions

Summary of Comment(s):

A commenter suggested adding guidance to the specifications with "VOC and off gassing threshold equivalencies."

Response:

Regarding "off gassing threshold equivalencies," EPA is currently unable to provide guidance on standardized decay curves for the off gassing of all products that may be used in the construction of a home.

6.4 Adhesives and Sealants

Summary of Comment(s):

One commenter suggested an option to use UL 2818 to comply with the specification, as an alternative to CDPH Version 1.2—2017. Another suggested adding guidance to the specifications with "VOC and off gassing threshold equivalencies."

Response:

Regarding the addition of UL 2818, please see the discussion in the introduction to Section 6.

Regarding "off gassing threshold equivalencies," EPA is currently unable to provide guidance on standardized decay curves for the off gassing of all products that may be used in the construction of a home.

6.5 Hard Surface Flooring

Summary of Comment(s):

A commenter suggested an option to use UL 2818 to comply with the specification, as an alternative to CDPH Version 1.2—2017.

Response:

Regarding the addition of UL 2818, please see the discussion in the introduction to Section 6.

6.6 Gypsum Board

Summary of Comment(s):

A commenter suggested an option to use UL 2818 to comply with the specification, as an alternative to CDPH Version 1.2—2017.

Response:

Regarding the addition of UL 2818, please see the discussion in the introduction to Section 6.

6.7 Insulation

Summary of Comment(s):

One commenter suggested an option to use UL 2818 to comply with the specification, as an alternative to CDPH Version 1.2—2017. Another commenter requested additional guidance for the use of spray foam.

Response:

Regarding the addition of UL 2818, please see the discussion in the introduction to Section 6.

Regarding the use of spray polyurethane foam (SPF), Indoor airPLUS does not include specific requirements or advisories. However, EPA has developed guidance in coordination with the Consumer Product Safety Commission (CPSC) and other agencies in the fact sheet, *Spray Polyurethane Foam Insulation: Health and Safety Recommendations for Consumers*.

For more information, see also EPA's *Contractor-Client Communications Checklist: Guide to Professionally Installing High-Pressure, Two-Component Spray Polyurethane Foam Insulation*.

6.7 Asbestos

This is a new item.

6.8 Lead-Based Paint

This is a new item.

6.8 (formerly) Ventilation after Material Installation

This item has been moved to a recommendation in the introduction to Section 6.

Summary of Comment(s):

One commenter suggested adding an additional requirement to replace filters between finishing and occupancy. Another commenter recommended adding a requirement to supplement ventilation with opened windows and doors as weather and site conditions permit.

Response:

With regard to filters, EPA has included requirements and advisories about filter verification in Section 4.

EPA believes a requirement to open windows and doors to supplement ventilation would be challenging to enforce and may not be practical or appropriate in some circumstances. However, EPA continues to recommend ventilating the building at the highest rate and duration practical during the installation of products that are known sources of contaminants.

VIII. Comments on Section 7. Occupant Education

7.1 Owner and Resident Information Kit

This item was previously "7.1 Owner and Occupant Information Kit".

Summary of Comment(s): Two commenters stated that it was unreasonable to verify that all the involved parties receive the information kit and that this should be a builder responsibility or moved to a separate form. One commenter suggested that a one-page summary of filters, switches, and systems be attached in an obvious place.

Two commenters recommended that the EPA create a resource guide for the IAQ monitors and one suggested that this should be supplied to all parties. Another commenter recommended that RESET certified IAQ monitors be required on each floor of the home, and that healthy home training be provided to the occupant.

Response(s):

Occupant Education is a key component to the success of the Indoor airPLUS certification. Occupants need to be familiar with the IAQ features and benefits of their home. This section is a means to confirm that, at a minimum, an information kit has been included for the owner or occupant. EPA believes that Verifiers play an important role in the verification of all Indoor airPLUS requirements, initiated by consultation with builders on product specifications, and culminating with document retention of program requirements. Verifiers should use professional discretion to ensure builders are consistently providing occupant education resources, with simple documentation in coordination with the builder.

Regarding the suggestion for a one-page summary to be posted by the builder, EPA allows for builder discretion in including an appropriate format for the occupant information kit. However, in the draft for 2nd public comment, Indoor airPLUS is proposing a more explicit list of instruction manuals to be provided for

newly installed appliances and systems, along with operations and maintenance recommendations specifically for owner-occupied units.

There are numerous resources online and from IAQ monitor manufacturers that provide specific information on the operation, maintenance, and application of these devices that can be included with the documentation in the information kit, where such monitors are included with the home. EPA continues to review and develop guidance on consumer grade IAQ monitors but is not prepared to require specific certifications or standards for IAQ monitors at this time.

IX. Comments on Appendices

Abbreviations & Acronyms

Summary of Comment(s):

One commenter recommended including Home Ventilating Institute (HVI) to the list of abbreviations & acronyms.

Response(s):

As "HVI" is referenced directly in the specifications, EPA will include it in the list of abbreviations & acronyms.

References

No comments received regarding this Item.

Climate Zones of the Continental United States Map

No comments received regarding this Item.