Avoiding Indoor airPLUS Pitfalls for Your PHIUS Projects

VERSION 1 (REV. 03)
Indoor airPLUS adds additional health protections to your ENERGY STAR value proposition.

**Comprehensive Indoor Air Quality Protection**

- Radon
- Pests
- Materials
- CO +
- HVAC +
- Moisture +
Indoor airPLUS + PHIUS+

Indoor airPLUS qualification can help ensure that tight passive homes do not contribute to unhealthy living environments.

Compatible program values and certification processes:

• Both programs are based on building science principles that use a systems approach to improve home performance issues.

• Both programs require completion of verification checklists by a qualified Home Energy Rater (additional training required for PHIUS).

• Visual inspection items can be verified during the same on-site visits.
Ensuring Multi-Certification Success

• Get started early – integrate IAP features at the pre-planning and design phases.

• Identify a Home Energy Rater who has training/experience with both IAP and PHIUS+.
  • PHIUS consultants are encouraged to participate in IAP webinars and review online resources to learn more about the program. 
    https://www.epa.gov/indoorairplus

• Reach out to Rater, Provider, or EPA (Indoor_airPLUS@epa.gov) with technical and programmatic questions.
Revision 3

- Released October 2015.
- Further alignment with ENERGY STAR Rev. 8.
- Clarified multiple requirements.
- Provided additional advisories (e.g., adhesives & sealants).
- Updated list of compliant products for Section 6 and developed a new resource, *How to Find Indoor airPLUS Compliant Low Emission Products.*
Indoor airPLUS Categories

1. Moisture Control
1.1 Site and Foundation Drainage

NOTE: Completion of the ENERGY STAR requirements now satisfies the following Indoor airPLUS requirements:

✓ Slope patio slabs, walks and driveway; tamp back-fill to prevent settling; AND slope the final grade away from the foundation (Builder-W 1.1 and 1.2).

✓ Swales or drains designed to carry water away from the foundation are permitted to be provided as an alternative to the slope requirements for any home, and shall be provided for a home where setbacks limit space to less than 10 ft. (Builder-W 1.1 and 1.2).

✓ Install protected drain tile at the footings of basement and crawlspace walls. Surround each drain tile pipe with washed or clean gravel wrapped with fabric cloth, or install an approved Composite Foundation Drainage System (CFDS) (Builder-W 1.8).

Additional Indoor airPLUS Requirements:

• Install a drain or sump pump in basement and crawlspace floors, discharging to daylight at least 10 ft. outside the foundation or into an approved sewer system.

Exceptions:

✓ Slab-on-grade foundations.

✓ In areas of free-draining soils — identified as Group 1 (Table R405.1, 2009 IRC) by a certified hydrologist, soil scientist, or engineer through a site visit — installation of a drain or sump pump is not required.

• In EPA Radon Zone 1, if a drain tile discharges to daylight install a check valve at the drain tile outfall (see Specification 2.1).

• Seven sections:
  ★ Moisture Control
  ★ Radon Control
  ★ Pests
  ★ HVAC Systems
  ★ Combustion Pollutants
  ★ Materials
  ★ Home Commissioning
How to use the Construction Specifications

• Relevant ENERGY STAR checklist items are summarized and referenced at the beginning of each measure.

• Additional Indoor airPLUS requirements are listed separately. These include:
  • Items that provide additional indoor air quality protections.
  • Requirements that exclude an ENERGY STAR exception.

• Advisories, notes, and exceptions listed where applicable.
How to Complete the Verification Checklist

- ENERGY STAR certification is required to achieve Indoor airPLUS qualification.
- Check one box per line.
- Check “N/A” for specifications that do not apply for specific conditions (e.g., climate) according to the exceptions described.
- Check either “Builder Verified” or “Rater Verified” for all other items.

<table>
<thead>
<tr>
<th>Home Address:</th>
<th>City:</th>
<th>State:</th>
<th>Zip:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section</td>
<td>Requirements (Refer to full Indoor airPLUS Construction Specifications for details)</td>
<td>Must Correct</td>
<td>Builder Verified</td>
</tr>
<tr>
<td>ENERGY STAR V3</td>
<td>ENERGY STAR Version 3 Program Requirements must be followed and the home shall be ENERGY STAR certified in conjunction with Indoor airPLUS qualification.</td>
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Indoor airPLUS Checklist located within PHIUS+ Workbook

• Track IAP and PHIUS+ requirements side-by-side
• Extract worksheet when ready to submit for certification
1. Moisture Control
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- Moisture is a leading cause of health, comfort and durability concerns in homes.
- 19% of U.S. households have at least one person with asthma.
- There is a 20-50% increased risk of asthma in damp houses.
- The economic cost of asthma amounts to more than $56 billion annually.
- Mold grows where there is moisture.
- Molds produce allergens, irritants, and in some cases, potentially toxic substances.
1.1 Site and Foundation Drainage

✓ **Slope hard surfaces and final grade away from the foundation.**
✓ **Install drain tiles at the footings of basement and crawlspace walls.**
  
  • Install a drain or sump pump in basement and crawlspace floors.
  
  • **Exception** for free-draining soils.
  
  • Check valve to be installed for homes in Radon Zone 1.
Resource for Assessing Soil Drainage

http://websoilsurvey.nrcs.usda.gov/app/
1.3 & 1.4 Below-grade Foundation Walls

- Waterproof crawlspace and basement perimeter walls.
- All floors above unconditioned spaces shall be insulated.

- Insulate crawlspace and basement perimeter walls
- Seal crawlspace and basement perimeter walls
- Provide conditioned air by either
  - A dedicated supply (1 cfm per 50 square feet) OR
  - Crawl space exhaust (only in non-Radon zone 1)

- No exceptions for below-grade damp-proofing / water-proofing. Required for IAP label.
- No exception for basement conditioning based on load.
  - Exceptions for:
    - Location within flood zone
    - Raise pier foundation w/ no walls
    - Dry & marine climates
ICC Climate Zone Map

County-level information from DOE:
http://energy.gov/eere/buildings/climate-zones
FEMA Flood Map Service Center

Address-level tool: https://msc.fema.gov/portal/search
2. Radon

SURGEON GENERAL’S WARNING:
Radon Causes Lung Cancer. You Should Test Your Home.
Indoor Air Quality (IAQ)

2. Radon

- Radon is a cancer-causing radioactive gas created by the natural breakdown of uranium in soil.
- Radon can be found all over the US.
- 1 in 15 homes have radon above 4 pCi/L.
- You are most likely to get your greatest exposure to radon at home.
- Radon is the second leading cause of lung cancer after smoking.
2.1 Radon Control

Note: These maps indicate average risk by county. However, high levels of radon can be found in any home. See: [www.epa.gov/radon/zonemap.html](http://www.epa.gov/radon/zonemap.html) or for an interactive map, see: [http://www.wxplushealth.org/geoexplorer](http://www.wxplushealth.org/geoexplorer).
Radon Zones – 1, 2, 3?

For an easy-to-use map: Weatherization Plus Health GeoExplorer
http://www.wxplushealth.org/geoexplorer
2. Radon

• Radon is an important concern for all home types:
  • Existing & new construction
  • Tightly-sealed & leaky homes
• Research has not yet been performed to evaluate whether passive construction affects radon mitigation
• Labeling programs take precautionary approach toward radon mitigation

• IAP specification only stipulates radon controls for homes within Zone 1
• Passive radon controls are sufficient; active systems not required
• Passive controls will not decrease the energy efficiency of the home
2.1 Radon Control

- Construct homes built in EPA Radon Zone 1 with radon-resistant features.

- Advisory:
  - Passive Systems recommended in Zones 2-3.
  - Educate homeowners.

For more on radon-resistant construction, see: https://www.epa.gov/radon/radon-resistant-construction-basics-and-techniques
2.1 Radon Control
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Guidance for homes with vaulted or sealed/conditioned attics:

2 options:

1. Radon fan installed in an approved exterior location (active system)

2. Electrical receptacle installed in an accessible attic or other exterior location near the radon vent pipe
5.4 Attached Garages

1. **Isolated** from conditioned spaces:
   - Common walls and ceilings are **air-sealed**.
   - No HVAC equipment or ducts in garage.
   - Weather stripping and an automatic **door closer** is installed on connecting doors between living space and garage.

2. **Appropriate ventilation strategy or pressure testing** ensures separation from living space.

These requirements apply to all homes, even when the homebuyer is committed to electric vehicle ownership.
Self-closing door mechanisms

• Not expected for overhead door, just door between garage and living space
• Self-closing/spring hinge is sufficient
• Many low cost options available
5.4 Attached Garages

- Isolate attached garages from conditioned spaces:
  - Air-seal common walls and ceilings.
  - Use weather stripping on all doors between living spaces and attached garages.

- Install an automatic door closer on all connecting doors between living spaces and attached garages.

- In homes with exhaust-only whole-house ventilation either:
  - Equip the attached garage with an exhaust fan with a minimum installed capacity of 70 cfm that is vented directly outdoors; OR
  - Conduct a pressure test to verify the effectiveness of the garage-to-house air barrier.
6. Low Emission Materials
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Potential Issues:

- Indoor levels of many chemical pollutants can be **2-5 times higher than outdoor levels**.

- Volatile Organic Compounds (VOCs) include a variety of chemicals, some of which may have short- and long-term adverse health effects, including eye, nose and throat irritation, headaches, loss of coordination, nausea, damage to liver, kidney, and central nervous system.
What are the Requirements?

Indoor airPLUS – Section 6
Low-emission Materials

6.1 – Composite Wood
Structural panels, cabinetry, shelving, trim, doors, stair treads, flooring, etc.

6.2 - Interior Paints and Finishes
Site-applied coatings only, but not simply “low-VOC”.

6.3 – Carpet and Carpet Adhesives
CRI Green Label

6.4 – Adhesives and Sealants
Recommended but not yet required.
How to Find Indoor airPLUS Compliant Low Emission Products

- Guidance on identifying compliant low-emission products and 3rd party labels.
- [https://www.epa.gov/indoorairplus/indoor-airplus-compliant-low-emission-products](https://www.epa.gov/indoorairplus/indoor-airplus-compliant-low-emission-products)
- RESNET 2016 in-depth presentation: Plain Speak on How to Find the Right Products
The U.S. Environmental Protection Agency (EPA) Indoor airPLUS checklist provides links to technical guides that align with measures included in the EPA Indoor airPLUS program requirements. The numbers and titles included in this checklist follow the same order and numbering as those in the EPA Indoor airPLUS Verification Checklist. At this time, only measures associated with the DOE Zero Energy Ready Home program are displayed in the accordions below. Completing these requirements fulfills the "Indoor Air Quality" section of the DOE Zero Energy Ready Home Program. To view the full program requirements see EPA’s Construction Specifications document. Portions of the programmatic footnotes have been added to the Scope tabs in the guides. For additional DOE Zero Energy Ready Home program requirements and information, visit the DOE Zero Energy Ready Home Website.
Resources and Tools
Marketing and Technical Support for Partners

- Builder and consumer resources
- Partner locator
- Website widgets
- Construction requirements
- Technical guidance

www.epa.gov/indoorairplus
Indoor airPLUS

A new opportunity for leading builders to create better environments inside and out

Learn more at:

www.epa.gov/indoorairplus

OR contact the Indoor airPLUS Team at

indoor_airPLUS@epa.gov