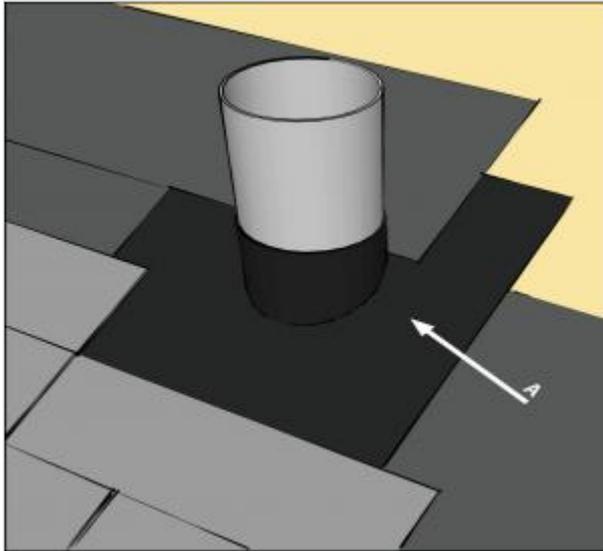


# Roof Deck Valleys and Penetrations Sealed

Last Updated: 03/15/2016

## Scope



Install self-sealing bituminous membrane or equivalent at all valleys and roof deck penetrations

Install a self-sealing membrane in roof valleys and around penetrations to minimize the possibility of roof leaks.

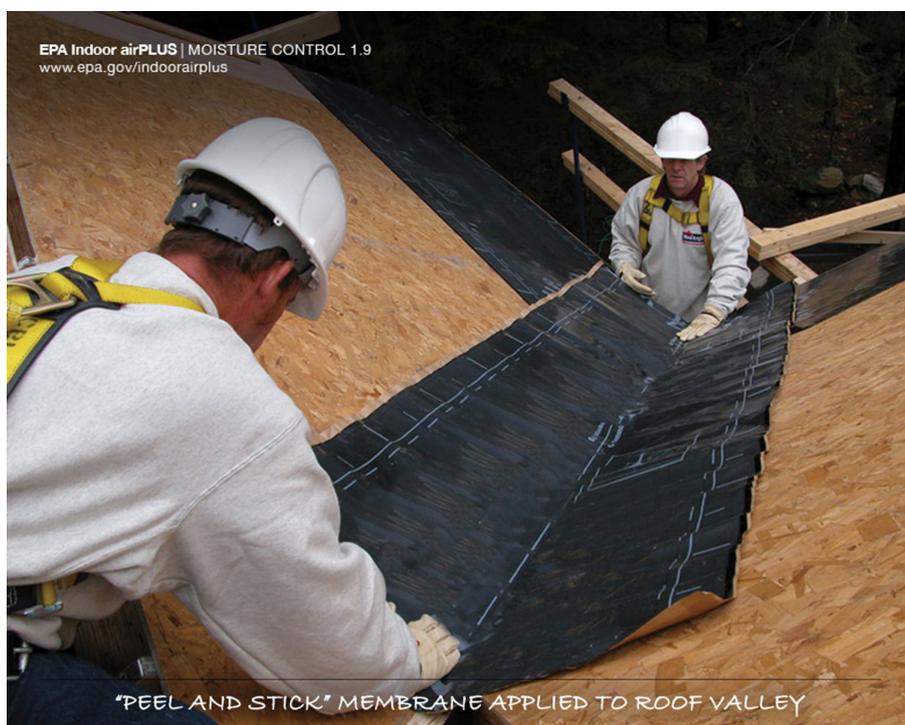
- Choose a self-sealing membrane such as a bituminous peel-and-stick material or equivalent at all valleys and roof deck penetrations.
- In valleys, install this layer directly on the roof sheathing surface beneath the roofing felt.
- Around penetrations such as pipes or vents, install one piece to surround the pipe from the down-slope side of the pipe, then install the upslope piece to overlap the upper edge of the down-slope side. Integrate with the weather-resistant barrier.
- IRC requirements for roof valley flashing vary by roofing material type, see the [IRC 2009](#), [2012](#), or [2015](#) for specific requirements.

See the [Compliance Tab](#) for related codes and standards requirements, and criteria to meet national programs such as DOE's Zero Energy Ready Home program, ENERGY STAR Certified Homes, and Indoor airPLUS.

## Description

The roof is the house's primary defense against water intrusion from rain, snow, and ice. This "lid" of the home must be structurally sound and must be designed and constructed to shed water effectively and consistently through all seasons, extreme weather events, and atmospheric conditions. Water that seeps into the house through the roof can quickly ruin insulation, create conditions for mold growth and pest invasion, and even set into motion structural rot. Over time even the smallest leak in a roof can result in a significant amount of water damage, and not just in the attic. Once inside the home, water can travel laterally as well as vertically along framing members to cause damage in ceilings, walls, floors, and even basements.

Valleys and penetrations through the roof decking are among the most vulnerable areas for water intrusion. Valleys should be carefully sealed along the entire length to keep water out of sheathing seams. To help prevent water entry at these vulnerable points, install a self-sealing bituminous membrane or the equivalent along all valleys and properly integrate this membrane into the adjoining roofing materials ([ENERGY STAR 2015](#)). Self-sealing embrane should also be installed, along with flashing, around all penetrations through the roof including direct penetrations like plumbing stack vents and structural penetrations like dormer windows. Most roofing membranes are made of a heavy, flexible bituminous material that has been impregnated with a petroleum-based solution like tar which makes the material waterproof. Most membrane products come with a "peel and stick" adhesive backing. When properly installed these products provide long-lasting protection from water intrusion ([ENERGY STAR 2015](#)). Note: The U.S. Environmental Protection Agency (EPA) uses the phrase "or equivalent" to indicate that a variety of products can be used. Regardless of the product's composition, it must be water impermeable and must durably adhere to the roof deck. Please check with the manufacturer's material classifications and installation instructions to ensure the material you choose will adequately protect the roof from water intrusion ([EPA 2011](#)).



**Figure 1** - Peel and stick membrane applied to roof valley. These workers are properly installing a self-sealing bituminous membrane to a valley on the roof deck. Note the material is centered along the valley to ensure maximum protection. ⓘ

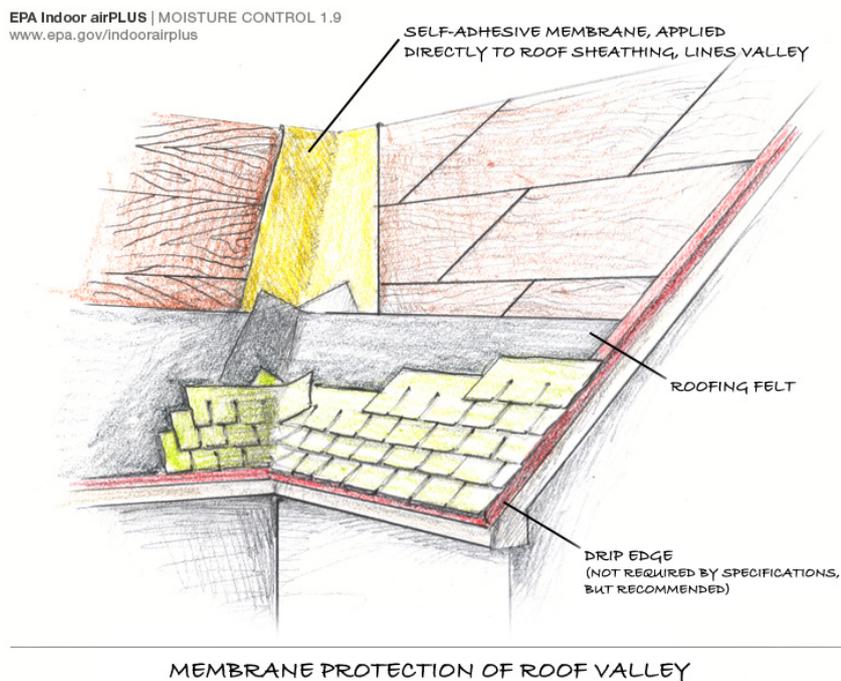
### How to Install Self-Sealing Bituminous Membranes along Valleys of Roof Decks

1. Clean the roof deck sheathing along to valley to ensure it is free of loose nails, wires, and debris. Although the membrane is made from relatively strong material, it can be torn or punctured. Make sure the area is dry and free of oil and dust to ensure the membrane will adhere properly.
2. Measure the length of the valley to be covered.
3. Cut the self-sealing bituminous membrane to length. For extremely long valleys, cut the material in shorter, more manageable lengths.
- 4.

Install the membrane directly on the roof sheathing material (typically plywood). Apply from the lowest point to the highest, overlapping membrane sections by 6 inches in shingle fashion to allow water to flow unobstructed down the length of the valley. The membrane must be straight and centered with the valley line.

*Installation note:* Some peel-and-stick membrane products come with a lengthwise split along the protective backing that can give you a guideline for centering the product while you peel and install it along first one side of the valley then the other.

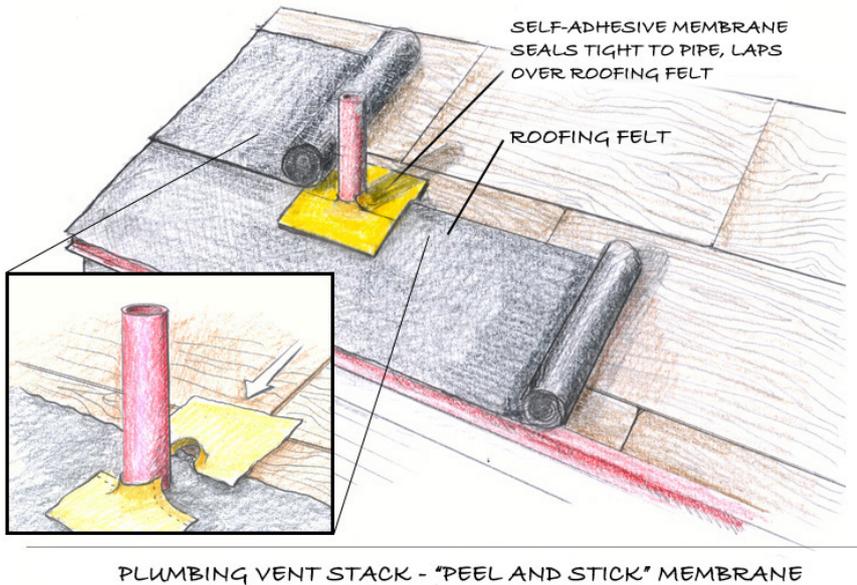
5. Make sure the membrane lays flat with no gaps, creases, or folds. Secure the material in place with a heavy roller.
6. Install the underlayment over the membrane and continue with installation of the roof cladding (see Figure 2).



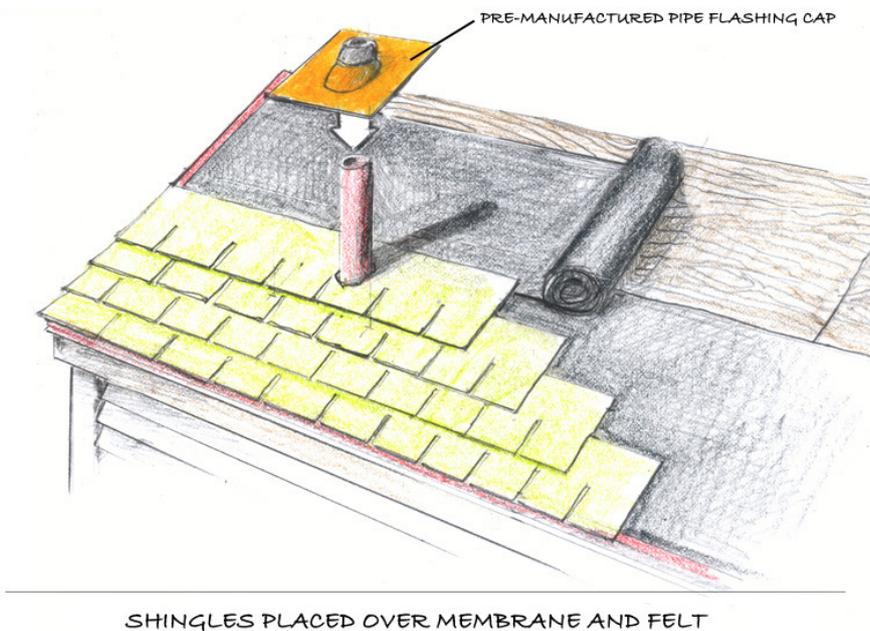
**Figure 2** - Use bituminous seal-sealing membrane to seal roof valleys. The self-adhesive membrane is installed directly on the plywood roof deck beneath the underlayment (roofing felt) and shingles. 

### How to Install Self-Sealing Bituminous Membranes around Direct Penetrations in the Roof

1. Clean the roofing area after the pipe or vent has been installed through the roofing deck. Make sure roof deck around the penetration is free of loose nails, wires, debris, dust, oil, or water.
2. Starting at the eave of the roof below the penetration, install the underlayment (roofing felt) up to the penetration.
3. Measure the area to be covered and cut a piece of membrane to fit around the lower half of the penetration, allowing for at least 6 inches of membrane on each side and below the penetration. See Figure 3.
4. Install the self-adhesive membrane so that it seals tight around the pipe and laps over the roofing felt, as shown in Figure 3. Use a heavy hand roller to secure in place. Some manufacturers require that a primer be applied before the membrane is installed.
5. Measure and cut a piece of membrane to fit around the upper side of the pipe. Install so that it seals tightly around the pipe and the edges overlap the top edge of the first piece of membrane, as shown in Figure 3.
6. Continue installing underlayment above the penetration to overlap this membrane.
7. Install shingles or roofing material up to the penetration.
8. Install a pre-manufactured pipe flashing over the pipe and shingles, as shown in Figure 4.
9. Continue installing shingles above the pipe to cover the top edge of the flashing.



**Figure 3** - Seal around piping and other roof penetrations with self-sealing bituminous membrane that is layered shingle-fashion with the roof underlayment. 



**Figure 4** - Install a pre-manufactured pipe flashing cap around the pipe and integrate installation so that the upper edge of the flashing is covered by rows of asphalt shingles above the piping. 

#### How to Seal around Structural Penetrations in the Roof

1. Clean the roofing area after the dormer or other structure has been installed through the roofing deck. Make sure the roof deck around the structure is free of loose nails, wires, debris, dust, oil, or water.
2. Install underlayment to the edge of the structure and secure in place.
3. Install the step flashing and secure in place.
- 4.

Apply self-adhesive membrane material directly over the vertical rise of the step flashing and up the side of the penetration.

5. Install the underlayment material around the penetration, securing it in place and attaching it to the membrane with tape.
6. Continue installing the roofing material.
7. Alternately, the self-adhering membrane can be installed prior to the step flashing as described in the guide [Step and Kick-Out Flashing at Roof-Wall Intersections](#): Apply to the roof deck and lap up side wall, install metal step flashing, cover top of metal flashing with self adhesive tape flashing, install housewrap and siding over tape flashing.

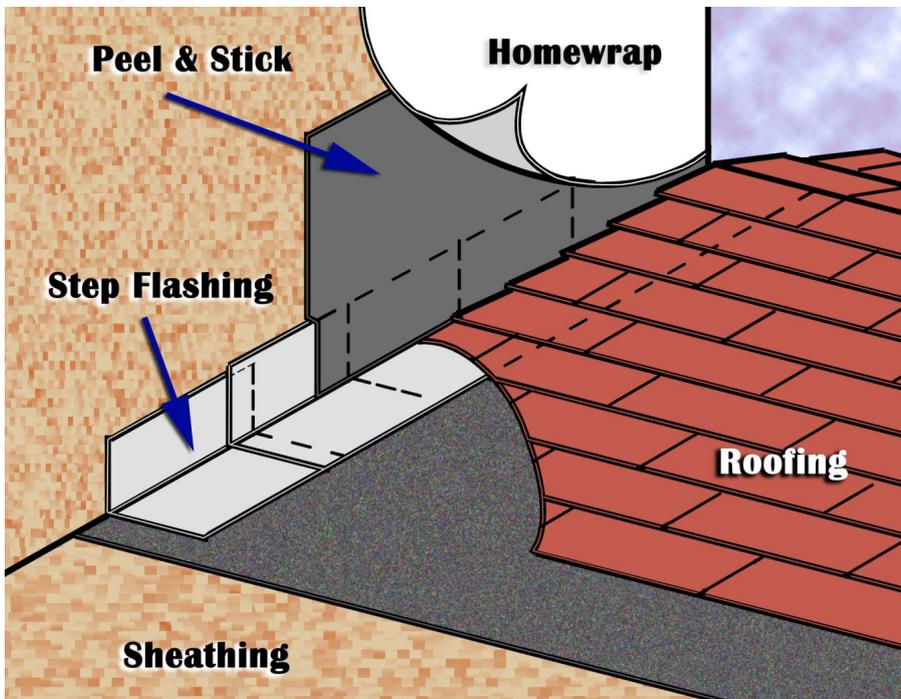


Figure 5 - Protect roof-wall intersections with step flashing and self-adhesive bituminous membrane. 

## Ensuring Success

To ensure that the roof valley is well sealed, the area must be cleaned prior to installation of the self-adhesive bituminous membrane. Only a complete seal will help keep water from finding a way through the valley and entering the house. Also, once applied, the membrane must be rolled flat so that no folds or creases are present.

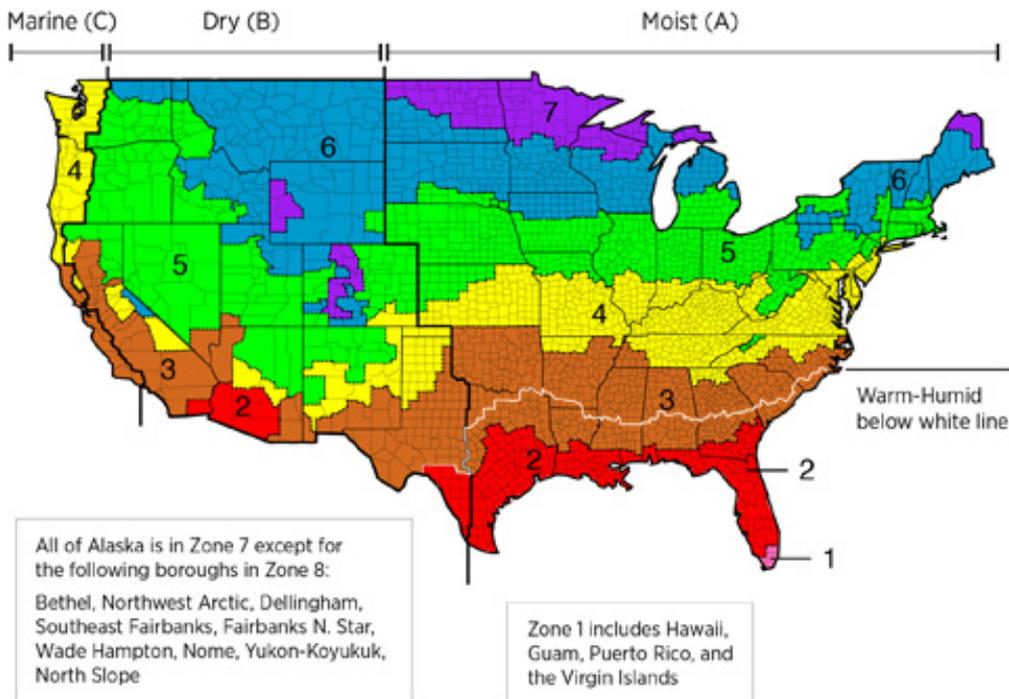
# Climate

## [ENERGY STAR Version 3/3.1 \(Rev. 08\)](#)

Water Management System Builder Requirements, Water-Managed Roof Assembly. Self-sealing bituminous membrane or equivalent at all valleys & roof deck penetrations. Not required in dry climates as shown in 2009 IECC Figure 301.1 and Table 301.1.

## [2009 IRC](#), [2012 IRC](#), [2015 IRC](#)

Section R905.3.8 Flashing. In locations where the average daily temperature in January is 25°F or less, metal valley flashing underlayment must be solid-cemented to the roofing underlayment for slopes less than 7/12 or be self-adhering polymer modified bitumen sheet.



International Energy Conservation Code (IECC) Climate Regions

# Training

## Right and Wrong Images



Display Image: [ES\\_WMSBC\\_3.3\\_PG48\\_107b\\_32311\\_0.jpg](#)

Reference: [Water Management System Builder Checklist Guide](#)

Author(s): EPA

Organization(s): EPA

*Guide describing details that serve as a visual reference for each of the line items in the Water Management System Builder Checklist.*



Display Image: [ES\\_WMSBC\\_3.3\\_PG48\\_107b\\_32311\\_0.jpg](#)

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Reference: [Water Management System Builder Checklist Guide](#)

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# CAD

None Available

# Compliance

The Compliance tab contains both program and code information. Exact code language is copyrighted and may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

## [ENERGY STAR Certified Homes](#)

ENERGY STAR Certified Homes (Version 3.0, Revision 08), Water Management System Builder Requirements

3. Water-Managed Building Materials:

3.3 Self-adhering polymer-modified bituminous membrane at all valleys & roof deck penetrations.<sup>3, 15</sup>

Footnotes:

(3) Not required in Dry (B) climates as shown in 2009 IECC Figure 301.1 and Table 301.1.

(15) As an alternative, any applicable option in 2009 IRC Section R905.2.8.2 is permitted to be used to meet Item 3.3 and any option in 2009 IRC Section R905.2.7.1 is permitted to be used to meet Item 3.4. EPA recommends, but does not require, that products meet ASTM D1970.

**Builders Responsibilities:** It is the exclusive responsibility of builders to ensure that each certified home is constructed to meet these requirements. While builders are not required to maintain documentation demonstrating compliance for each individual certified home, builders are required to develop a process to ensure compliance for each certified home (e.g., incorporate these requirements into the Scope of Work for relevant sub-contractors, require the site supervisor to inspect each home for these requirements, and / or sub-contract the verification of these requirements to a Rater). In the event that the EPA determines that a certified home was constructed without meeting these requirements, the home may be decertified.

ENERGY STAR Revision 08 requirements are required for homes permitted starting 07/01/2016.

## [DOE Zero Energy Ready Home](#)

Exhibit 1: Mandatory Requirements. Certified under ENERGY STAR Qualified Homes Version 3.

## [2009 IRC, 2012 IRC, 2015 IRC](#)

Section R905.3.8 Flashing. Flashing and counterflashing to be provided at the juncture of roof vertical surfaces per manufacturer's instructions. If metal, it cannot be less than 0.019 inch (No. 26 galvanized sheet gage) corrosion-resistant metal. Valley flashing must extend at least 11 inches from the centerline each way and have a splash diverter rib not less than 1 inch high at the flow line formed as part of the flashing. Sections of flashing must have an end flap at least 4 inches. For 3/12 roofs and greater, valley flashing must have a 3-ft wide underlayment of one layer of Type I underlayment running the full length of the valley, in addition to any other required underlayment. Metal valley flashing underlayment must be solid-cemented to the roofing underlayment for slopes less than 7/12 or be self-adhering polymer modified bitumen sheet in areas where the average daily temperature in January is 25°F.

Section R 905.2.8.2 Valleys – For asphalt roofs, open valley linings should be lined with a strip of corrosion-resistant metal (listed in Table R905.2.8.2) that is at least 24 inches wide or two layers of mineral-surfaced roll roofing with the bottom layer strip at least 18 inches wide and the top layer at least 36 inches wide. For closed valleys (where the valley is covered with shingles) the valley should be lined as described for open valleys or with one ply of smooth roll roofing at least 36 inches wide or with self-adhering polymer modified bitumen. Requirements vary for other roofing types. See Section R905.4.6 for metal roof valley flashing requirements, Section R 905.6.6 for slate roof valley flashing, Section R 905.7.6 for wood shingle roof valley flashing, and Section R 905.8.8 for wood shake roof valley flashing.

## More Info.

Access to some references may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

### Case Studies

None Available

### References and Resources\*

1. [Ask the ENERGY STAR Team Questions, Version 3](#)  
**Author(s):** EPA  
**Organization(s):** EPA
2. [DOE Zero Energy Ready Home National Program Requirements](#)  
**Author(s):** DOE  
**Organization(s):** DOE  
**Publication Date:** August, 2015  
*Standard requirements for DOE's Zero Energy Ready Home national program certification.*
3. [ENERGY STAR Certified Homes, Version 3 \(Rev. 08\) National Program Requirements](#)  
**Author(s):** EPA  
**Organization(s):** EPA  
**Publication Date:** September, 2015  
*Document outlining the program requirements for ENERGY STAR Certified Homes, Version 3 (Rev. 08).*
4. [Technical Guidance to the Indoor airPLUS Specifications](#)  
**Author(s):** EPA  
**Organization(s):** EPA  
**Publication Date:** October, 2015  
*Website providing technical guidance to help home builders and their subcontractors, architects, and other housing professionals understand the intent and implementation of the specification requirements of the IAQ labeling program.*
5. [Water Management System Builder Checklist Guide](#)  
**Author(s):** EPA  
**Organization(s):** EPA  
**Publication Date:** February, 2011  
*Guide describing details that serve as a visual reference for each of the line items in the Water Management System Builder Checklist.*

\*Publication dates are shown for formal documents. Dates are not shown for non-dated media. Access dates for referenced, non-dated media, such as web sites, are shown in the measure guide text.

### Contributors to this Guide

The following Building America Teams contributed to the content in this Guide.

[U.S. Environmental Protection Agency](#)

[Pacific Northwest National Laboratory](#)