



TRAIN THE TRAINER

Air Sealing and Attic Prep

WEATHERIZATION ASSISTANCE PROGRAM STANDARDIZED CURRICULUM – August 2010

Learning Objectives

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AIR SEALING & ATTIC PREP

By attending this session, participants will:

- Understand basic principles of air leakage.
- Recognize typical air leakage sites in attics.
- Be familiar with the various tools and materials used in air sealing and attic preparation.
- Understand high-temperature issues and how to treat them.
- Understand safety concerns related to wiring.
- Know how to leave an attic air sealed and prepared for insulation.

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Air Leakage Review

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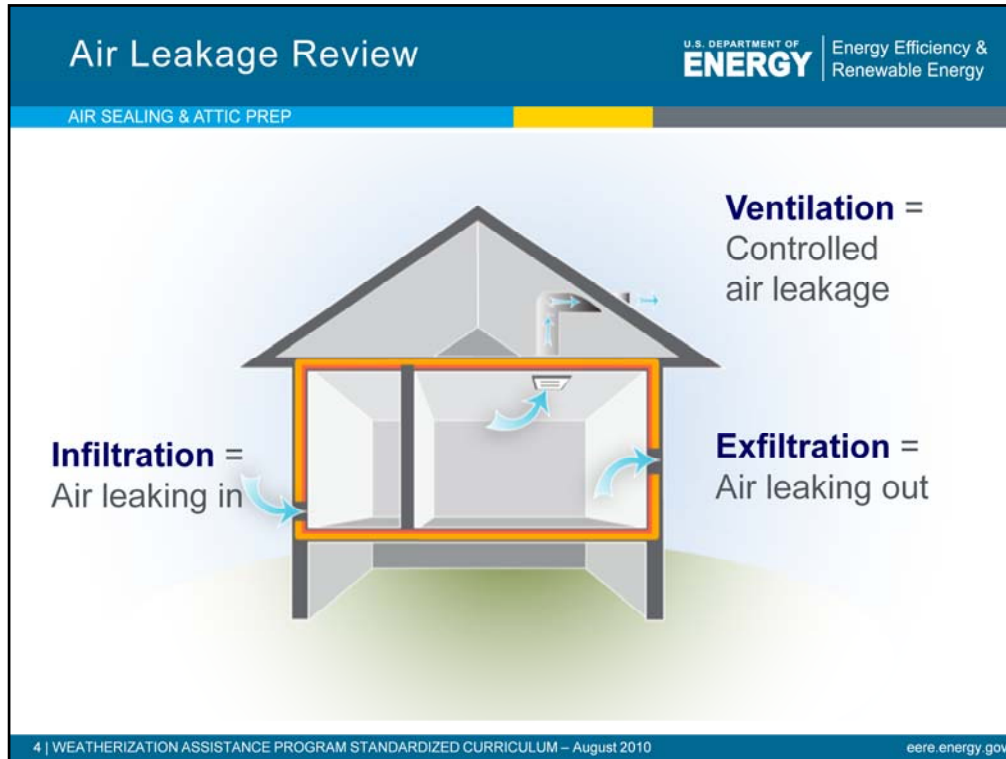
- Air flow is measured in cubic feet per minute.
- Also written as ft³/min, or CFM.
- 1 CFM **OUT** = 1 CFM **IN**.
- Air flow takes the path of least resistance.
- Air moves from **high**-to **low-pressure** areas.
- Air moves from **high**-to **low-temperature** areas.

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- Airflow is measured in ***cubic feet per minute***, also written as ft³/min, or CFM. A cubic foot is a little larger than a basketball.
- 1 CFM out = 1 CFM in – The same volume of air that leaks out of a home also leaks into the home, often at a different location.
- Air takes the path of least resistance – Air leakage leads to moisture issues when warm, relatively moist air leaks into colder areas and condenses on building surfaces.
- Air moves from high to low pressure areas.
- Air moves from high to low temperature areas.

Air leakage affects energy use because conditioned air leaks out and unconditioned air seeps in. Air leakage increases the total volume of air that must be cooled or heated to maintain comfortable indoor temperatures.



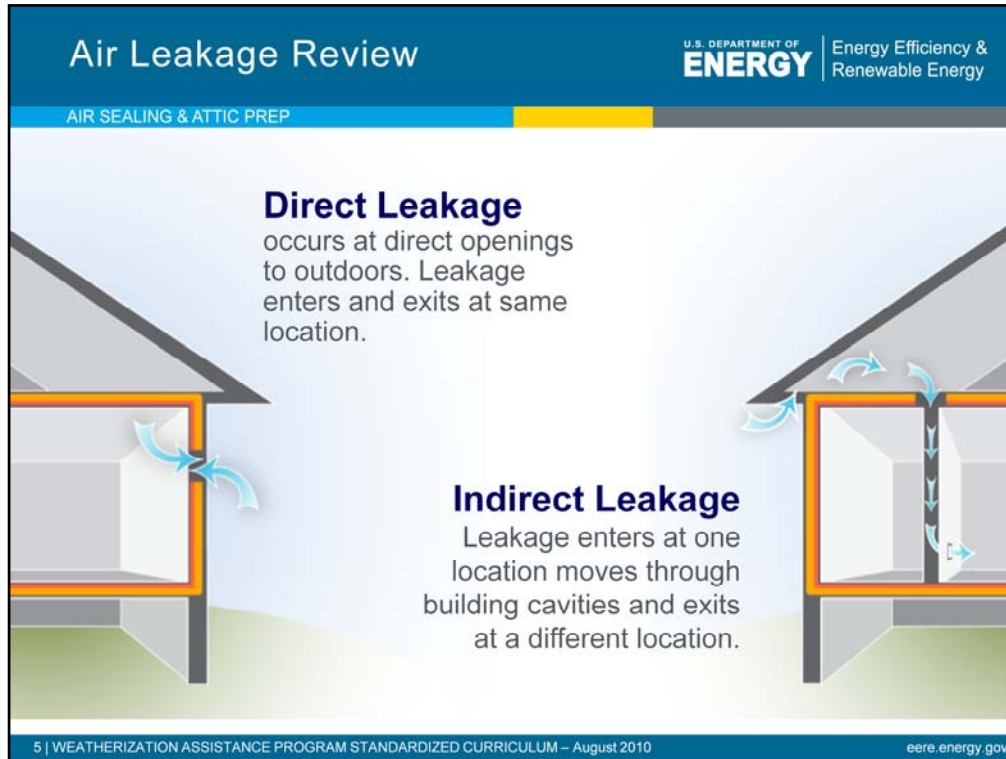
- **Infiltration** – Air leaking in.
- **Exfiltration** – Air leaking out.
- **Ventilation** – Controlled air leakage.

What are some common examples of each type of air leakage?

Infiltration: Cold air coming in under a door in the winter

Exfiltration: Warm air rushing up through recessed can lights into the attic in the winter

Ventilation: Bathroom fan, hood fan, heat recovery ventilation (HRV)



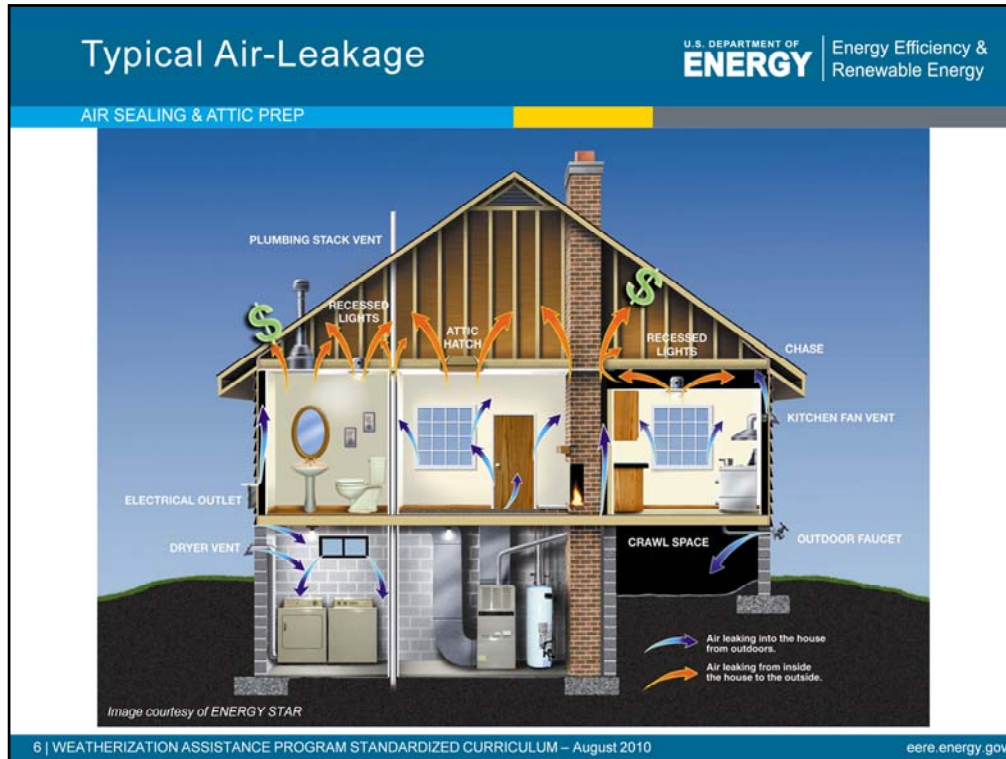
- **Direct Leakage** occurs at direct openings to the outdoors.
 - Air enters and exits at the same location. Direct leakage is common around doors and windows.
- **Indirect Leakage** begins at one location. Air moves through building cavities and exits at a different location.
 - Indirect leakage is common in older homes where interior walls have no top plates.
 - Another typical location is where a porch roof joins the side of a house. Often the siding is left off where the porch roof and house intersect. Cold air in the porch attic flows into the floor cavity of the home and into wall cavities or soffits.
 - A cold wall or floor in the winter indicates indirect leakage. The blower door can track these leaks.

What are some typical spots for direct leakage?

Dryer vents, around doors and windows, and any place there are penetrations in the building envelope.

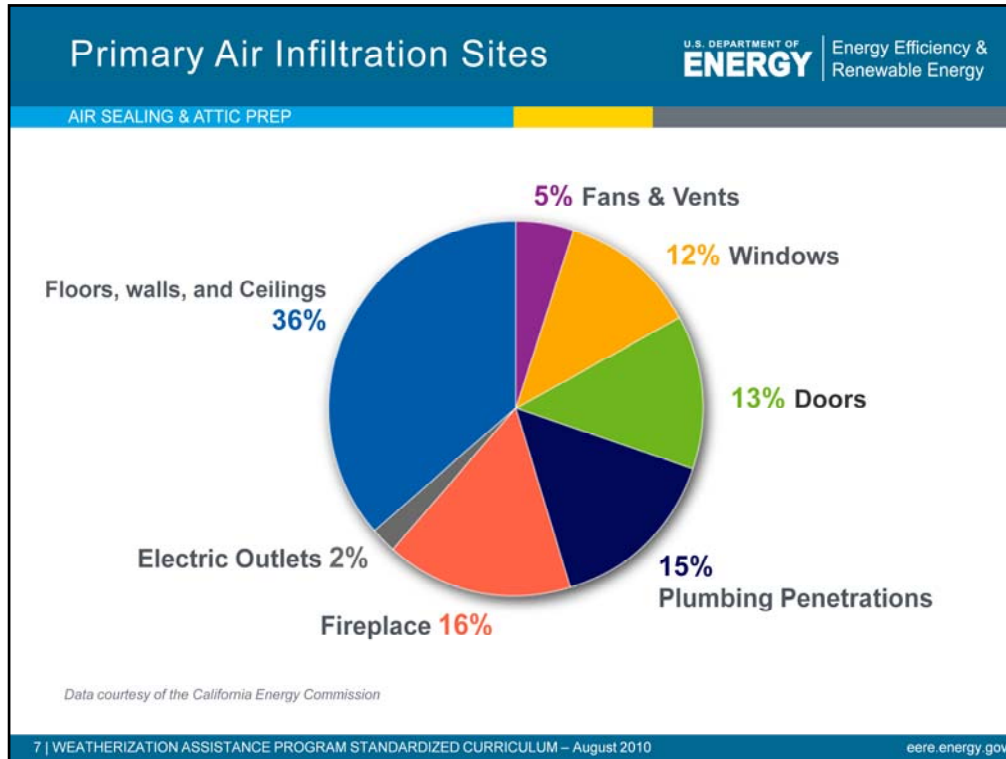
What is an example of indirect air leakage?

Air leaking through an outlet, up the wall, through the floor joists, and out the soffit or through the attic and out the roof vent.



Air leaks are commonly found in certain areas of the home.

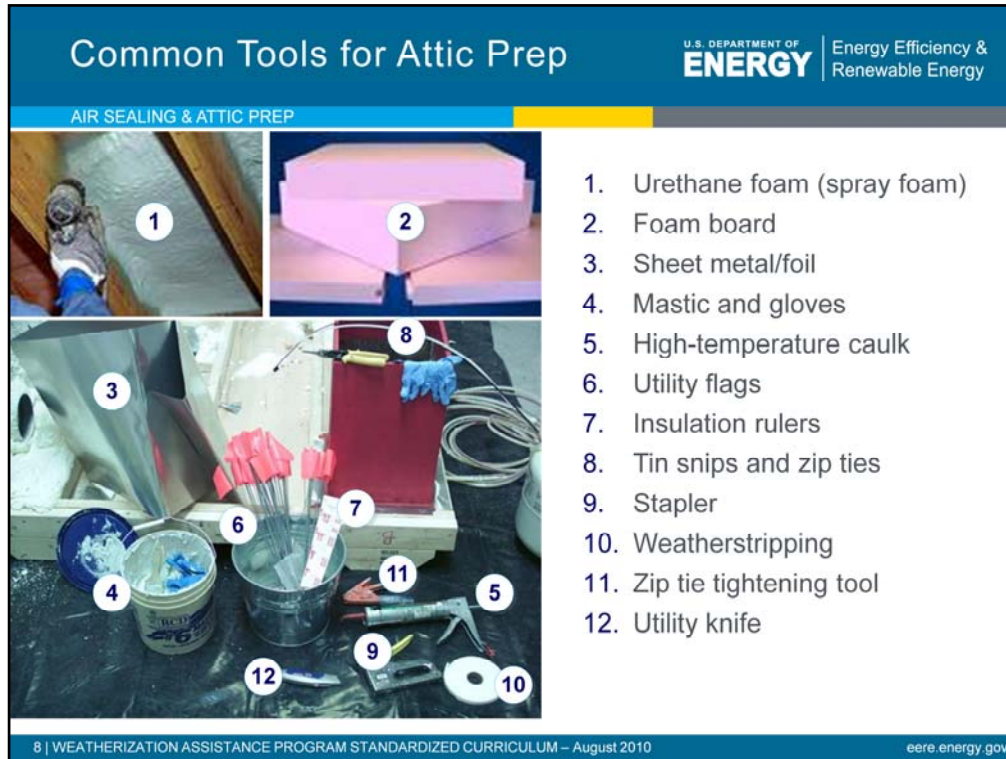
- The attic is where most conditioned air is lost.
- Typical air leakage sites in the attic are:
 - Recessed lights.
 - Attic hatches.
 - Dropped soffits.
 - Wall tops.
 - Flues.
- Doors and windows, plumbing and electrical penetrations, and sill plates are other common trouble spots.



The graph shows those typical leakage sites another way.

- The attic is not separated out, but it's the largest piece of the "floors, walls, and ceiling" category that makes up over one-third of all air leakage.
- Many people think replacing windows is crucial. According to this graph, windows come in 5th, behind floors, walls and ceilings, fireplaces, plumbing penetrations, and doors, in terms of air leakage.

What do you think is the more cost-effective approach: sealing air leaks in the attic, walls, and ceiling, or replacing windows?



Installers have two main goals in the attic:

- Find and seal air leaks.
- Prepare the attic to receive blown-in or another form of insulation.

Here are some common tools and their purposes:

Point out various tools and ask what they're used for.


- *Spray foam: Sealing gaps between ¼" and 3", sealing around foam board or other materials used to block large gaps.*
- *Foam board: Blocking between floor joists, on wall tops, and other large areas.*
- *Sheet metal/foil/flashing: Building dams around flues and chimneys.*
- *High-temperature caulk: For use around flues and chimneys.*
- *Utility flags: Mark can lights and juncture boxes so they can be found after everything is covered with blown-in cellulose insulation.*
- *Insulation rulers: To monitor depth of insulation.*
- *Zip ties & tightening tool: For attaching ducts.*
- *Mastic and gloves: Duct sealing.*
- *Stapler: For attaching utility flags and rulers to joists.*
- *Weatherstripping: For sealing the attic hatch.*
- *Tin snips: Trimming sheet metal and flex-duct.*
- *Utility knife: Cutting sheetrock to cover recessed can lights—and when don't you need a utility knife handy?*

Is anything missing from this picture?

Flashlight.

Dust mask and other safety gear.

Finding Air Leaks



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Check typical hot-spots:


- Flues and plumbing vents.
- Wire pathways.
- Recessed fixtures (lights and fans).
- Chimney penetrations.

Signals:

- Blower door, smoke.
- Dirty or discolored Insulation.



Photos courtesy of the US Department of Energy



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No one wants to spend more time than necessary in an attic. To make the job go smoothly and quickly, bring all the tools you need, and use your knowledge of the home and of building science to quickly locate and seal air leaks.

Check typical hot spots:

- Flues and plumbing vents.
- Wire pathways .
- Recessed fixtures (lights and fans).
- Chimney penetrations.

Signals:

- Blower door, smoke.
- Dirty or discolored insulation.

When you see dirty insulation, what could that indicate?


That air is being filtered through that insulation as it pours through a leak in the air barrier.

Inspect the area near any dirty insulation.

General Guidelines


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The Daily Green

GAPS $\leq 1/4$ "
Caulk



Energy Blast Services

GAPS $1/4$ " – 3"
Spray foam



OTHER
Foam board, fiberglass in plastic bags, etc.

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Main qualities of air sealing materials:

- Stop air flow.
- Last as long as the surrounding building materials.
- Safe to work with and live with.

General guidelines for sealing materials:

- Gaps $\leq 1/4$ " = Caulk
- Gaps $1/4$ "–3" = Spray foam
- Other = Foam board, fiberglass in plastic bags, etc.

Drywall Repair

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Sometimes sealing air leaks requires repairing damaged drywall.



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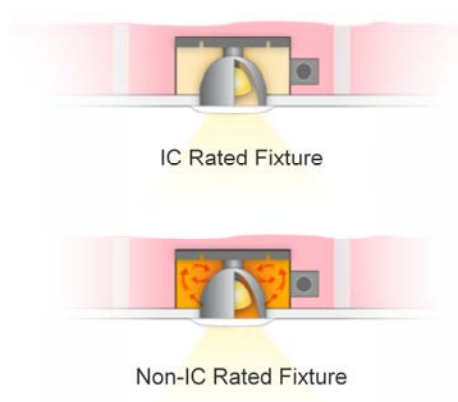
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High Temperature Issues

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Recessed Light Fixtures



IC Rated Fixture

Non-IC Rated Fixture

Flues



High-temp caulk

Maintain appropriate clearances

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Recessed light fixtures

- **IC rated** recessed light fixtures can be completely covered with insulation.
- If the fixtures aren't IC rated, covering them with insulation can cause dangerous heat build-up in the fixture. In a best-case scenario, this will substantially shorten the life of every bulb that goes in that fixture. The worst-case scenario: fire.

Flues

- Air sealing around flues requires sheet metal or some other non-combustible material and high-temperature caulk.
- Build dams around chimneys, flues, and other high-temperature components to keep blown-in cellulose a safe distance away, typically 3 to 6 inches, depending on the vent pipe material.

Wiring

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- No insulation over knob & tube wiring.
- All home electrical systems should be properly grounded.
- Wiring splices enclosed in junction boxes and marked with a flag visible above attic insulation.



Make sure that wiring is safe before insulating the attic or walls:

- There should be no insulation over ***knob & tube wiring***.
- All home electrical systems should be properly grounded.
- Wiring splices should be enclosed in junction boxes and marked with a flag visible above attic insulation.

Leave Attic Ready for Insulation

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Flags indicate juncture boxes, recessed lights.

Dam maintains clearance around flue.

Photo courtesy of the US Department of Energy

- Place shields around fixtures & flues.
- Anticipated ventilation installed.
- Wiring safe.
- Juncture boxes and recessed lights marked.

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Leave the attic ready for insulation:

- Place shields around fixtures & flues.
- Any additional ventilation installed.
- Be sure wiring is safe.
- Mark juncture boxes and recessed lights. Imagine an electrician in this attic if the juncture boxes and recessed fixtures hadn't been marked with surveyor's flags. The effectiveness of the weatherization work will suffer if workers need to displace insulation to find what they're looking for.

Summary

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- Blower doors and smoke sticks help locate air leaks.
- Dirty insulation is a sign of air leakage.
- Check typical hot spots, including duct and wiring chases, flues, and plumbing penetrations.
- Use appropriate air sealing materials for the job.
- Maintain clearance from combustibles.
- Do not insulate over unsafe wiring.
- Mark junction boxes and fixtures before insulating.

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