Weatherization is Sexy

Not really, but we'll do our best….

Claire Betze & Jon Riley

BUILDINGWORKS
A Holistic Integrative Approach to Building Performance

Casco Bay INSULATION

Why Do We Weatherize?

Reduce Operating Costs

Improve Comfort

Improve Indoor Air Quality

Protect Our Investment

Fight Climate Change

The “House as a System” Approach Proactively Addresses:

Moisture & Ventilation

Air Infiltration

Insulation

Heating & Cooling

Combustion Safety

Pre and Post Weatherization Envelope

How can we achieve this dramatic change safely?

Proactively Improve Moisture Management BEFORE you Weatherize

Wet basements and crawlspaces must be addressed…

Moisture & Ventilation are a BIG Deal!

And bath exhaust fans should be installed or upgraded…

Or Suffer the Consequences!

Green Building Advisor/Reuben Saltzman, Structure Tech

Air Leakage has the Greatest Impact on Comfort and Building Durability

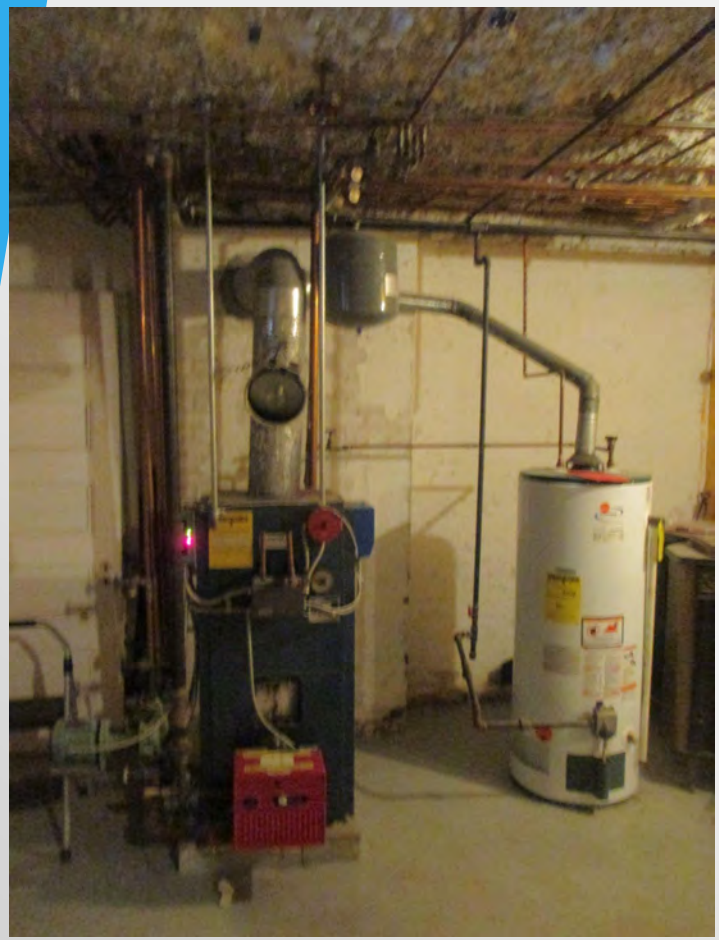
"Stack Effect"

The heated air inside the home is naturally buoyant and puts pressure on the upper envelope of the home

The positive pressure forces the heated air out through gaps and cracks in the pressure barrier.

For every cubic foot of heated air that leaves through the top, a cubic foot of cold, unconditioned air must enter from below

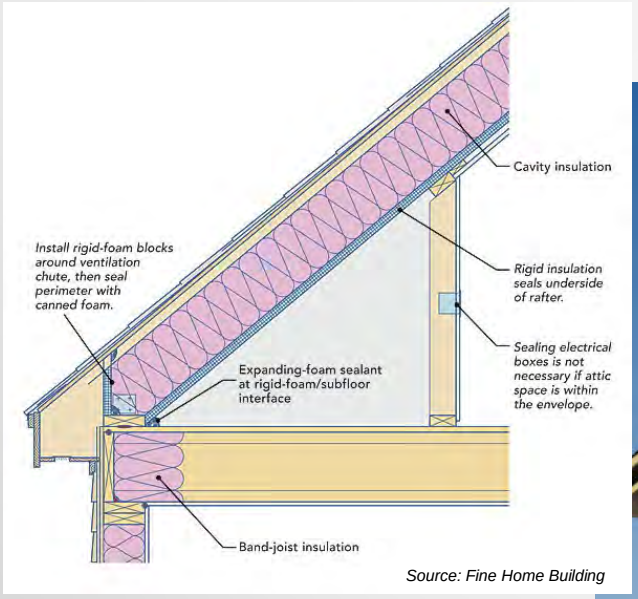
Combustion Safety is a BIG Deal Too!



Conventional boilers and wood fired appliances need free air movement – we need to cut a hole in your house…

Wait, what?!

Insulation has the 2nd Greatest Impact on Comfort and Building Durability

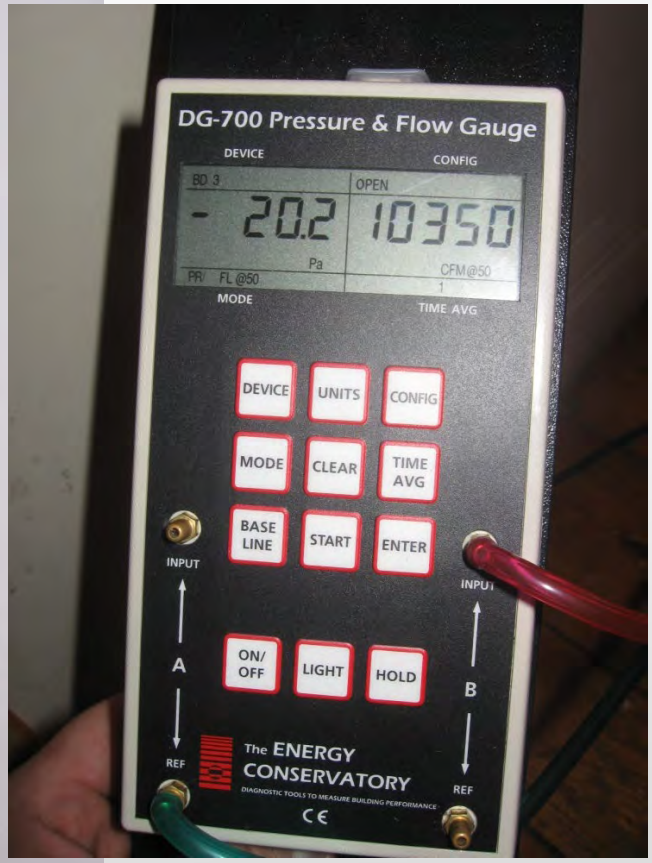


Source: Fine Home Building


Source: U.S. EPA

What type, how much, and where the heck do I put it?

Start with an Energy Audit



Independent or “all-in-one”?

The Energy Audit should cover….

Owner Discussion – Complaints, Concerns, Future Plans

Site Conditions Survey – Drainage, Roof Water Mgmt, Safety

Ventilation/Moisture Inspection and Discussion

Building Envelope – A Deep Dive not a Drive By!

Blower Door Testing with Thermal Imaging

Mechanical Systems/Combustion Safety Test

Report that Prioritizes Energy Improvements

Site Conditions Survey

Drainage

Roof water management

Ice dams

Vegetation

Site Conditions Survey

Exterior vents

Other opportunities?

Basement and Crawlspaces

These areas are connected to the living space above - Yuk!

Basement and Crawlspaces

A crawlspace wet enough to warrant rubber boots

A wide open basement bulkhead entry

Impacts on Indoor Air Quality

Indoor air quality offenders in the basement negatively impact indoor air quality throughout the home

Attics

Safety

Insulation Type

Location

Attics

How much insulation?

Is the attic access sealed and insulated??

Where Do the Bath Fans Vent?

Nowhere!

Dirty Fiberglass = Air Movement

What’s Happening at the Roof?

Basement moisture?

Improperly vented bath fans?

Flashing or roof failure?

Insufficient attic venting?

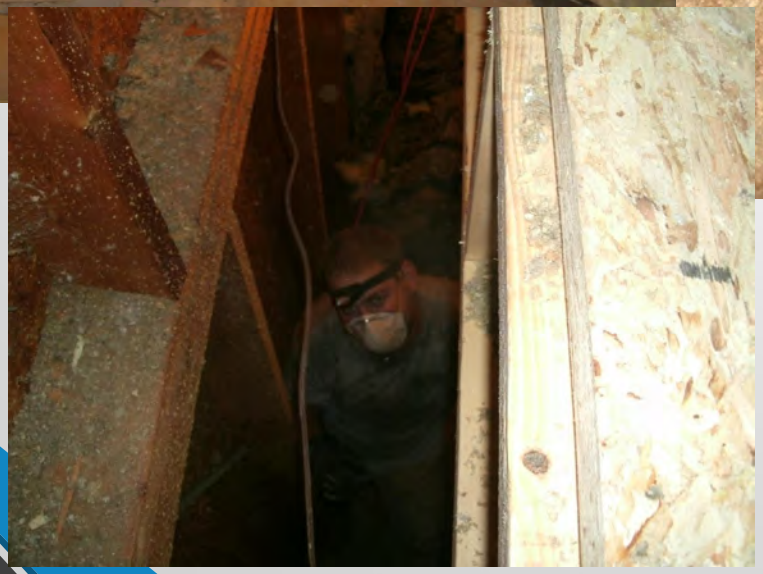
Unlined chimney?

All of the above.

Thermal Bypasses

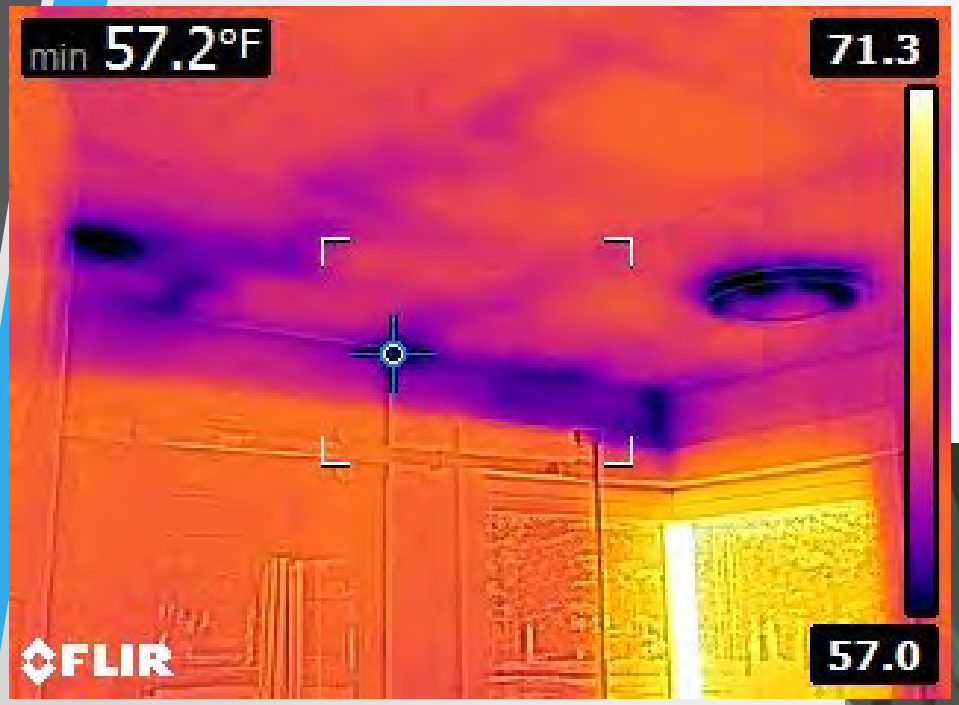
Common where new additions meet old homes

Big Holes = Big Heat Loss

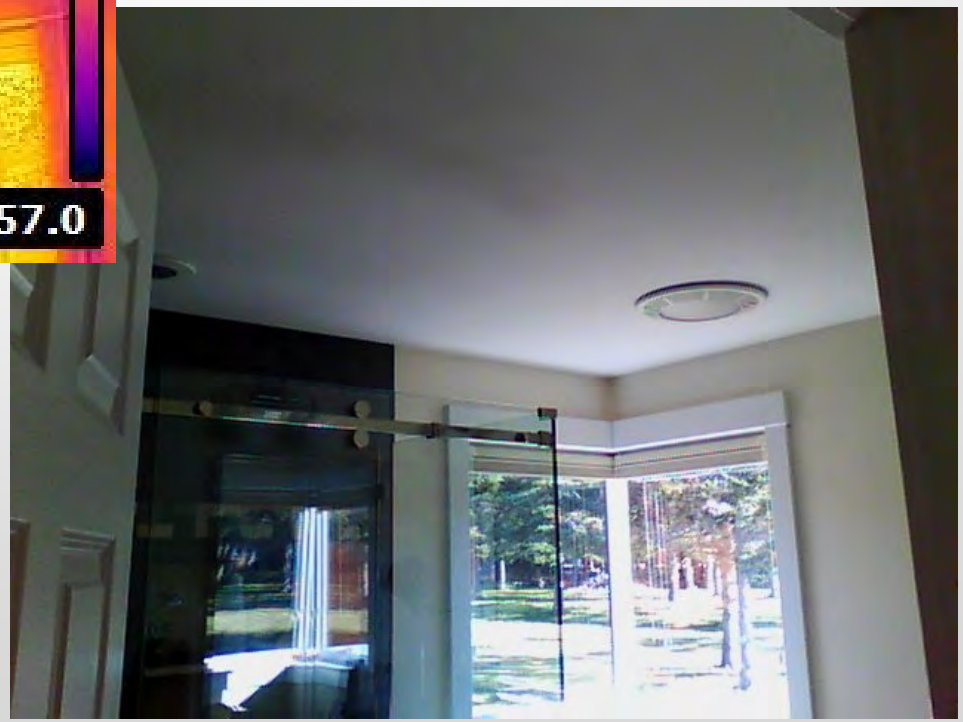


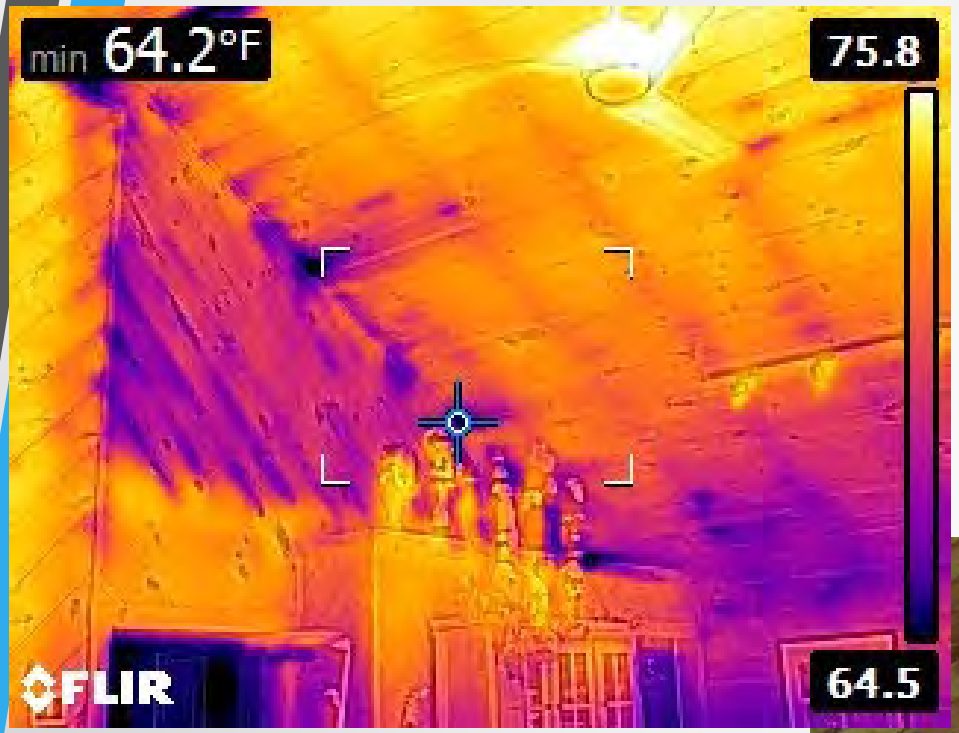
Blower Door Testing

Thermal Imaging With Infrared Camera

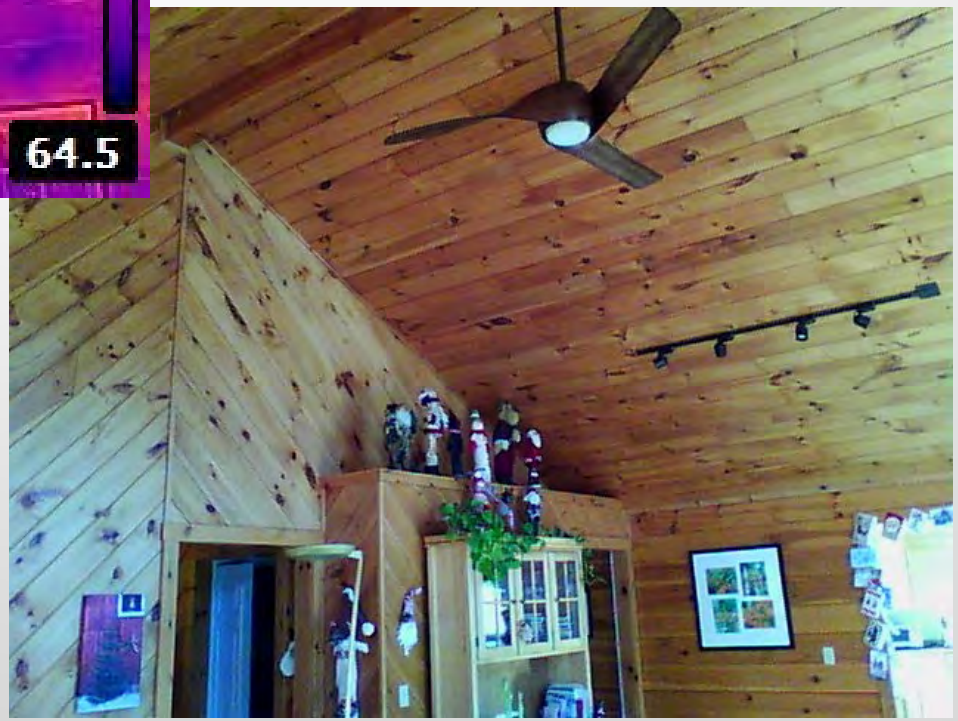


Air leaks at ceiling penetrations and roof-wall intersection

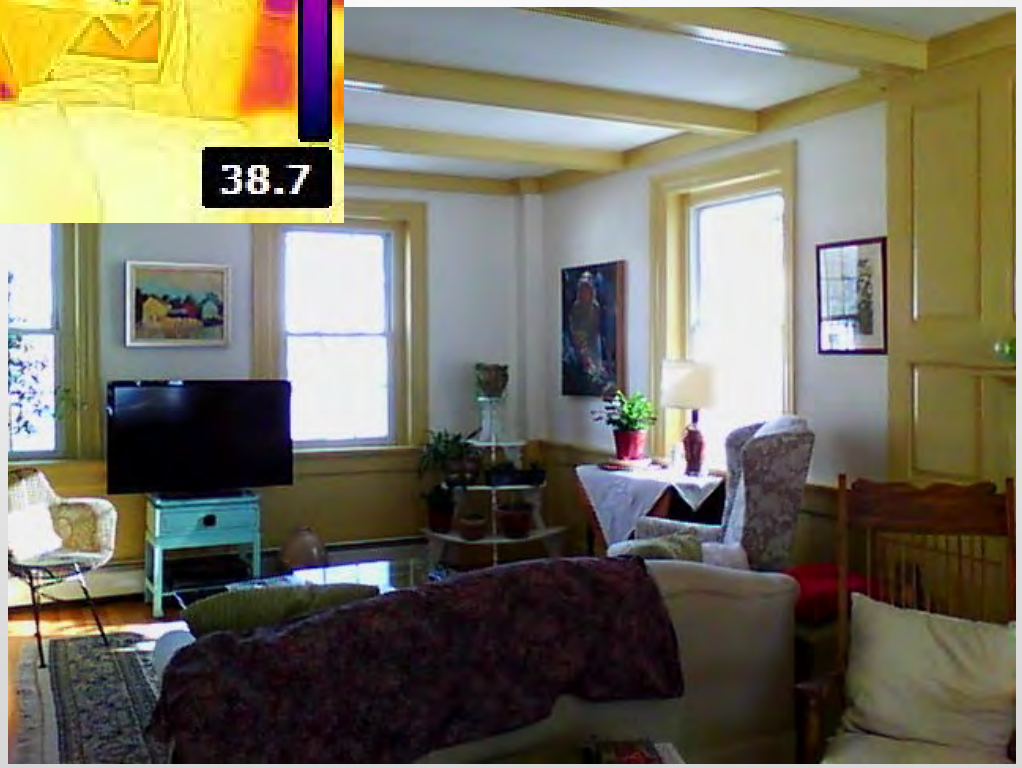




Major air leakage at joints of pine interior finish and uninsulated wall adjacent to attic



No insulation in the exterior wall assembly



Existing Mechanical Systems

Uninsulated heat distribution pipes in contact with cold concrete

Aging, inefficient equipment for space heating and hot water

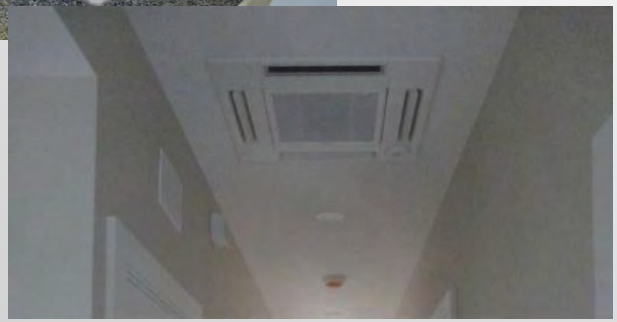
Combustion Safety

When we weatherize leaky basements….

Combustion air is often needed

New Mechanical System Opportunities

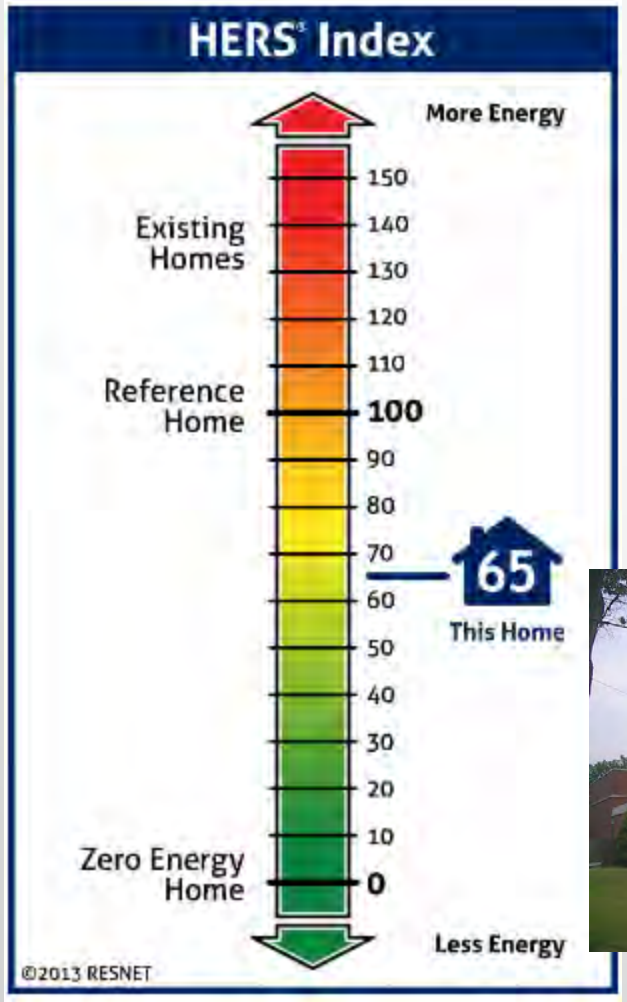
Best paired with a weatherized building envelope



Ventilation and Tighter Building Envelopes

“Build Tight - Ventilate Right”

Third Party Documentation & Certification



This home is 78% LESS efficient than the reference home.

This home is 35% MORE efficient than the reference home.

Building Envelope Weatherization Measures

Weatherize the Basement

Basements and crawlspaces should generally be included in the building envelope

To do this safely, we need to mitigate moisture first…

Moisture Mitigation

First step – direct roof water away from the foundation walls

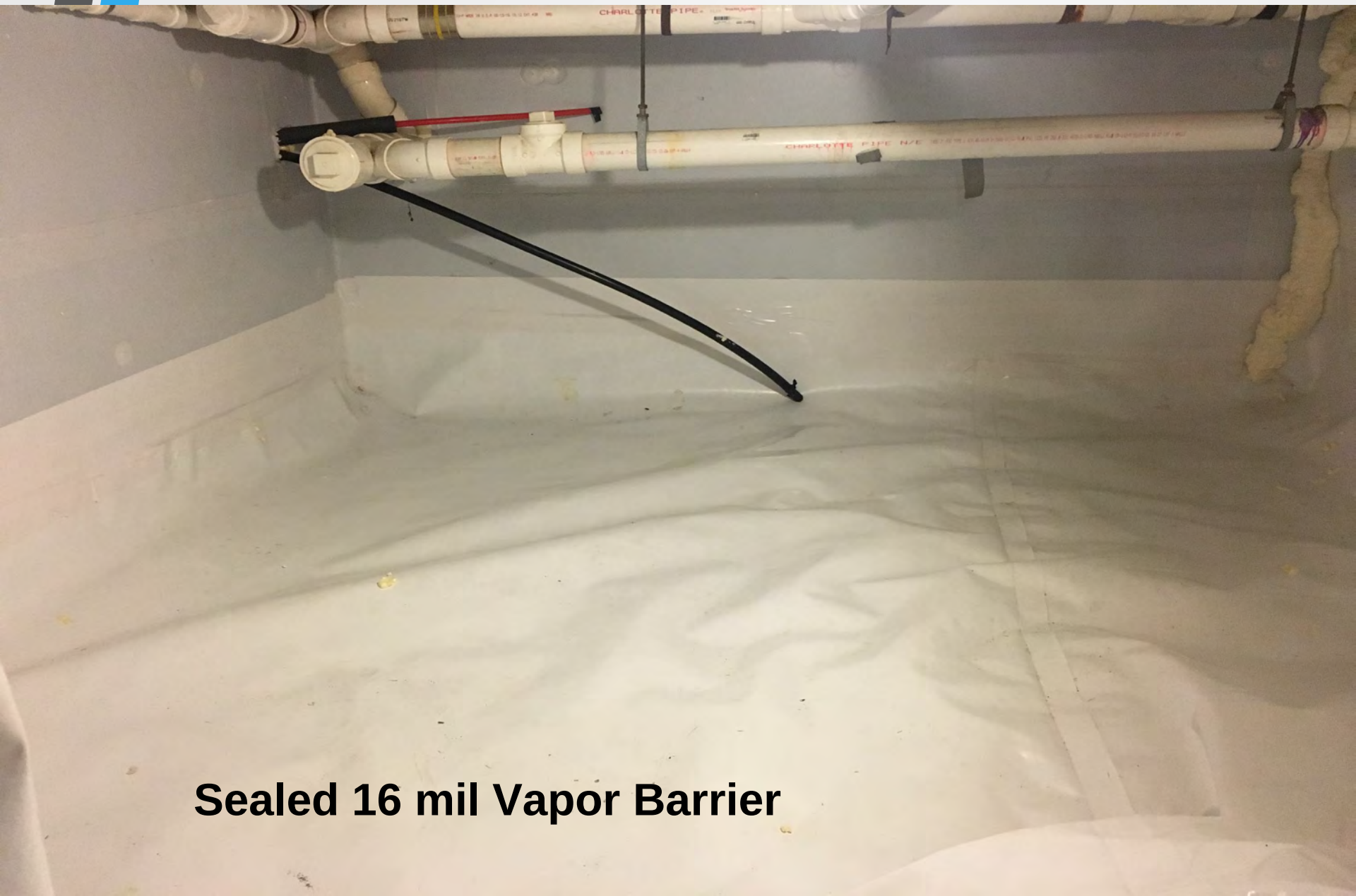
Moisture Mitigation - Dehumidification

Avoid “Circular” Dehumidification

Moisture Mitigation – Sump Basins

Sealed Sump Basins Should Be Installed

Moisture Mitigation - Encapsulation



Sealed 16 mil Vapor Barrier

Poured Foundation Walls

2” White Faced Thermax Rigid Foam Board, R-13

Rubble Foundation Walls

2” Closed Cell Spray Foam with Thermal Barrier, R-13

Crawlspaces – Clean and Encapsulate

Replace the Basement/Crawlspace Door

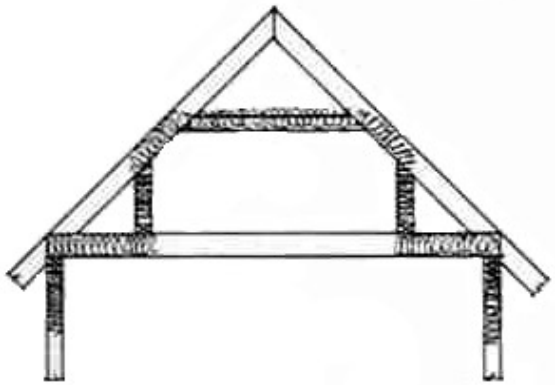
Therma-Tru Smooth-Star

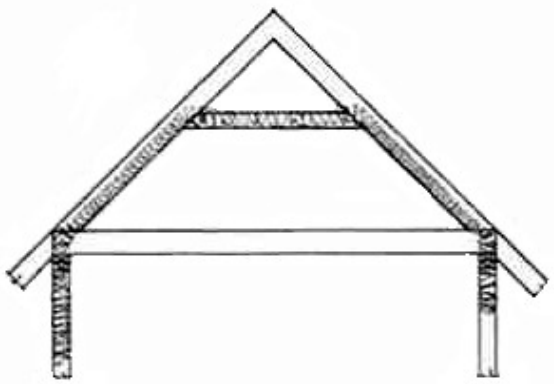
Insulated

Fiberglass – no rust

Composite jamb options

To the Attic!





How is the attic space being used?

What is the most effective way to define the building envelope?

Clean the Space

Fiberglass does not effectively stop air movement (heat loss).

Identify Air Sealing Opportunities….

And Seal Them Up

Don’t Forget the Chimney…

Verify and/or Install Attic Venting

If possible….

Treat the Attic Hatch

Insulation Dam

Rigid Foam Applied to Hatch Cover

Weatherstripping Applied to Hatch Opening

Upgrade the Bath Exhaust Fan

May require an electrician

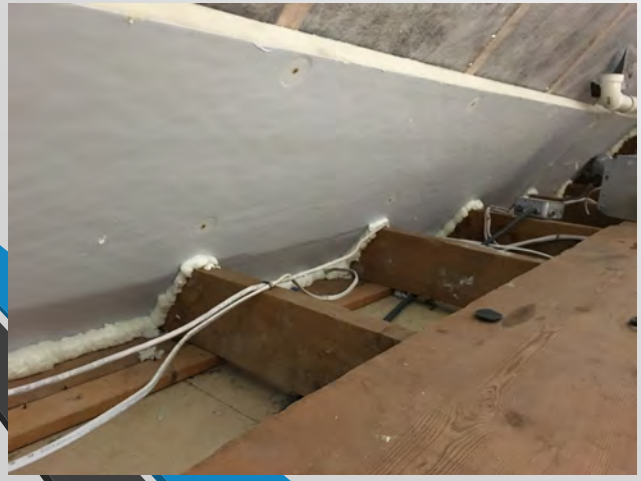
Should be ducted to the closest gable end wall, if possible

Use rigid metal ductwork, sealed with mastic

Install Cellulose

16” Loose Fill Cellulose, R-49

Conditioned Attic Space



Existing Exterior Walls

After the attic and basement have been weatherized

Ideally completed as part of a larger siding or renovation project

Additions on Old Homes – A Balancing Act

Case Study

Island Farm House

1800’s Cape with Ell added in 1990’s

3,620 sf - Wicked Leaky

Island Farm House

Original Cape

Enclosed Slopes and Flat Attic

Basement with Rubble Wall Foundation

Crawlspace with dirt floor

Ell Addition

Trussed Roof with Flat Attic, hatch access

Crawlspace with poly and dirt floor

Oil-fired Boiler, cast iron radiators & baseboard

Water heating – indirect, off boiler

Basement

Wet Conditions

Open Sump

Wet and Wide Open Bulkhead

Basement

Seepage at base of foundation

Old cistern

Crawlspaces

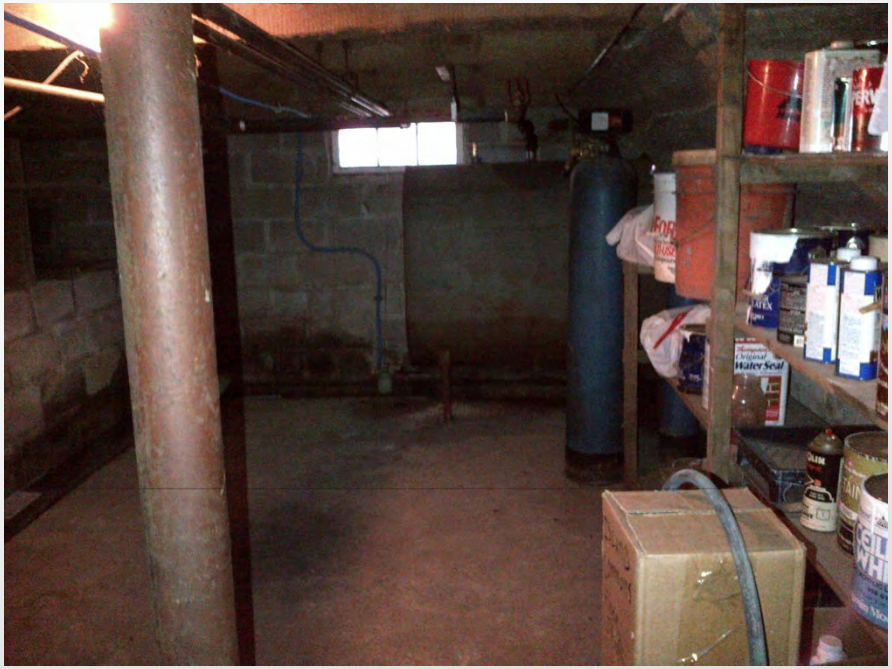
Bulk Moisture Sources

Impact to structure

Impact to Indoor Air Quality

Basement & Crawlspaces

Impacts to Indoor Air Quality



Unvented central vacuum
Moisture impact to oil tank

Crawlspace @ 1990s Ell

Damp, Musty Conditions

Unsealed poly vapor barrier, rigid foam on foundation walls

Crawlspace @ 1990s Ell

Leaking pipes

Incomplete & unsealed vapor barrier

Attic

Insulation type, level, quality of installation

Attic

Insulation type, level, quality of installation

Attic

Thermal Bypasses – utilities, chases

Attic

Thermal Bypasses - building connections

Heating and Hot Water Systems

Oil-fired boiler

Hot water distribution pipes attached directly to concrete

Energy Audit Findings

- Structural repairs needed, leaks
- Bulk moisture – dirt floors, water seepage, open bulkheads
- Indoor air quality impacts – central vac exhaust
- Little to no insulation or ineffective insulation, NO air sealing
- LOTS of air leakage
- Water heating options
- Heating system – fine tune operation

Recommendations

Holistic and Phased Approach

Phase 1 – Building Durability and Water Issues

Phase 2 – Moisture Mitigation & Indoor Air Quality

Phase 3 – Ventilation and Bldg Envelope Improvements

Phase 4 – Water Heating

Phase 5 – Heating System Improvements

Address Water and Bulk Moisture Issues for Building Durability

Site drainage

Vapor barrier and sealed cover over old cistern

Bulkhead door

Address Water and Bulk Moisture Issues for Building Durability

Vapor barrier and sealed cover over sump

Address Moisture and Indoor Air Quality

Central vac exhausted to outside
New double wall oil tanks

Ventilation

Install high quality, efficient bath fans with timer controls

Combustion Safety

“Fan in a Can” for positive pressure in basement

Building Envelope Improvements

Air Sealing Measures

Mineral wool covers over recessed can lights, sealed to attic floor

Utility penetrations sealed at attic floor

Building Envelope Improvements

Air Sealing & Insulation

Air seal chimney chase and wrap with mineral wool

Install 14” of cellulose, R-49

Building Envelope Improvements

Attic Access

Insulated, sealed, and weatherstripped hatch cover

Phase 1 – Building Durability

- Address drainage issues
- Install insulated doors at bulkheads
- Structural repairs, fix leaks

Phase 2 – Moisture Mitigation & IAQ

- Exhaust central vacuum to outside
- Install vapor barriers
- Install make-up air for boiler
- Insulate foundation walls and sills

Phase 3 – Ventilation & Building Envelope Improvements

- Install high quality bath fans w/ timer controls
- Air Seal & Insulate - attics, basements, crawlspaces
- Radon testing

Results

Air Leakage Reduced by 48% from equivalent of 31” to 22” diameter hole

Improved Comfort, Indoor Air Quality and Building Durability

Substantially Reduced Heating Costs

Thank You !

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