Build a Better House

Renovations

Maine Indoor Air Quality Council

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Proposed Agenda

Review Building Science Basics

Indoor Pollutants & Health Issues

Existing Condition Assessments

Renovations by Area and Project Type

All above topics in light of four basic building science principals

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Building Science Basics

Bulk Water Management

Heat Flow Management

Air Flow Management

Vapor Management

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The Goal

Healthy Indoor Environment

Energy Efficient

Affordable

Comfortable

Futureproof



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Primum non nocere

"First, do no harm"

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A weatherization crew seals up a leaky house

Adds insulation to the attic

Determines the absence of lead paint

Replaces jalousie windows

Ignores the dirt floor crawl space...

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Renovations and the 2015 IECC Code

Alterations to any building or structure shall comply with the requirements of the code for new construction. Alterations shall be such that the existing building or structure is no less conforming to the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

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The Maine Problem…

- Cold, wet climate
- Humid summer air
- Very old housing stock
- High radon levels
- High asthma rates
- Tight budgets
- Heavy use of #2 fuel oil
- Confusing code situation

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USEPA

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Climate

Precipitation influence in Maine



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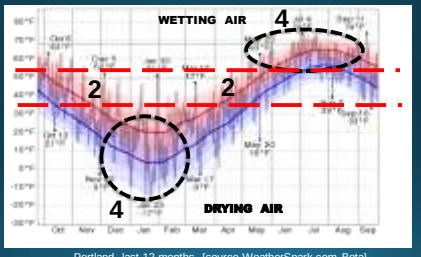
Portland Me Dew Point Climate Graph



Portland, last 12 months, {source WeatherSpark.com Beta}

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Common Indoor Exposures in Maine



Radon



Combustion & Cooking By-products

Biological Contaminants
Vermin and Pesticides
VOC's





Lead Paint
Asbestos



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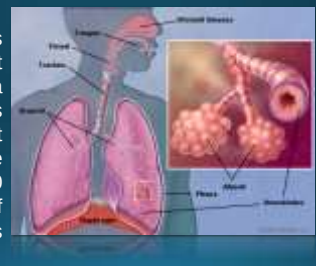
Why Exposures Indoors Matter

Human lungs expose about 1/3 of a singles tennis court, about 750 square feet, 1500 miles of passageways



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Known Health Problems…

General malaise

Asthma, sinusitis, other respiratory diseases

Cancer from radon, asbestos, tobacco smoke
15% five year survival rate from lung cancer

Organ damage from lead and mercury

Injury or death from carbon monoxide poisoning and soot particles

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The Big Indoor Picture

Indoor environments...



Dry and Clean

Pollutant and Pest Free

Planned Ventilation

Comfortable

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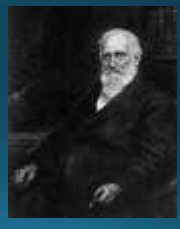
The Importance of Source Control

"If there is a pile of manure in a room, do not try to remove the odor by ventilation. Remove the pile of manure."

Max Joseph von Pettenkofer
1818 - 1901



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Achieving Indoor Air Quality

- Eliminate source of pollutants
- Spot and whole house Ventilation
- Control temperature and humidity
- Operate systems properly

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For a healthy, energy efficient home, sensible considerations include...

1. The current conditions of the inside and outside surfaces of the basement, crawlspace, walls, and roofs
2. The Owners' short and long-term energy goals, current energy costs, and construction budget
3. A strategy for long-term bulk water, heating, cooling, moisture, and ventilation management

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Energy Efficiency & IAQ can be compromised by…

Bad design or poor execution of good design

Poor short or long-term control of Ventilation
Over-humidification

Unvented combustion appliances

Poor operation and maintenance



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IAQ and Renovations… benefits & risks

Chemical / dust exposure to occupants and workers

Added insulation and air sealing:
- improves thermal comfort and reduces winter dryness
- reduces energy use
- reduces attic and wall drying energy

Added insulation may hide existing bulk water leaks

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IAQ and Renovations… more benefits and risks

Air sealing will likely increase indoor relative humidity
…may increase radon levels
…may cause or contribute to combustion backdrafting
…may increase contamination from basement, crawlspace, or an attached garage

Heating appliance replacement with sealed combustion boilers, furnaces, and with heat pumps will lower air leakage rates (stack effect and wind driven ventilation)

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Strategy: Goals Remain the Same...

1. Planned moisture management and ventilation
2. A not too air leaky, well insulated enclosure and foundation?
3. Energy efficient heating, lighting, and appliances

???Owner involvement to keep stuff working?????

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Lines of Responsibility

Contract to renovate a kitchen or bath, and notice a dirt floor in the basement…

Contract to re-side a home with vinyl, and notice no bath fan terminations on the exterior

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PRIOR TO THE RENOVATION



Evaluate the project for existing conditions

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Moisture Inspection

Dirt floor in crawl space or basement

Open sump pit, ledge, visible water

Severely cracked concrete floor

Sagging ceiling tiles in basement

Water stains on floors, walls, or ceilings

Ice dam / roofing failure problems

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Moisture Inspection, cont.

Peeling paint outdoors or indoors

Musty odors, visible mold beyond bath?

Obvious water damage in plumbed areas

Unvented kitchen or baths

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Moisture Issues

Liquid water and chronic moisture cause mold growth and rot

Mold exposure is a common asthma trigger, and may cause sinusitis or rhinitis

Mold can effect the value of a home

30

Rules of Moisture Movement

Moisture flow is from warm to cold

Moisture moves from more to less

Air carries moisture from high pressure areas to low pressure areas

Gravity pulls water down

Water wicks up

Drainage is critical

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Moisture comes from…

Transient construction water
Concrete, drywall, temporary heat
(2 lb. per lb. of fuel)



Site water
Groundwater and rainwater
Plumbing leaks

Condensation
High humidity and cold surfaces

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Moisture comes from…

Basements / crawlspaces
Leaks and Floods

Plumbing, roofs
ice dams, storms

Occupancy

Bathing, cooking, laundry

Breathing

Lots of house plants

Stored fire wood?



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36



37



Courtesy Camroden Associates

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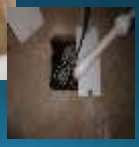
This basement…





…has a sump pump, but it didn't require a sump pump for the first ten years after construction

39



40



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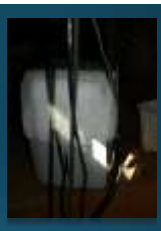

Garden variety dehumidifier

42



Closet on an exterior wall

43



44

44



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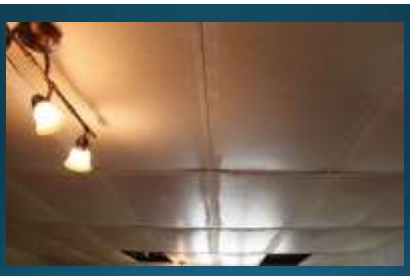

46

Recent boiler replacement??



Before



After

47



48

Which Moisture Strategies?

Prevent site water (bulk moisture) from entering

Planned ventilation and/or dehumidification

Create warm surfaces to prevent condensation

Allow construction moisture sufficient time to dissipate

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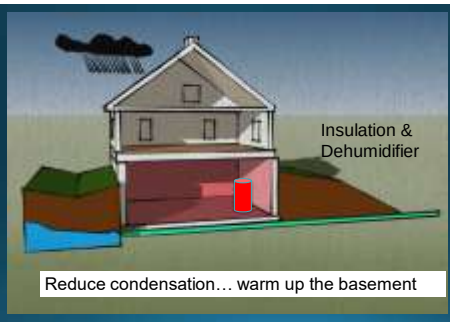
Stop groundwater entry… reduce the need to dehumidify

50



Reduce condensation… warm up the basement

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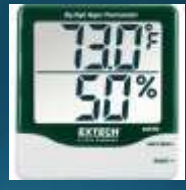
Dial or Digital Hygrometer





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Concrete Moisture Testing

Wet?
Damp?
Dry?



Courtesy Camroden Associates

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Sante Fe Classic by Thermastor™



Removes 110 pints/day

Draws 6.4 amps

Minimum T° 56° F

Auto restart

Others remove 30 pints/day and draw 4.0 amps

54

Mitsubishi Electric

55

Do First Case Study

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VENTILATION ASSESSMENT

Operable windows, air leaky camp?
Bath fans vented to the outdoors?
Kitchen exhaust hood vented to the outdoors?
Balanced system?
Combustion air?

Structural ventilation (attic)?

Blower Door Testing??

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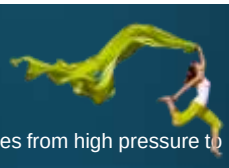
The Rules of Air Movement



Air always moves from high pressure to low pressure

Drivers include:
- Stack effect (hot air rises)
  - Important long-term
- Fans create high and low pressures
- Wind Effect
  - Can overpower both in the short term

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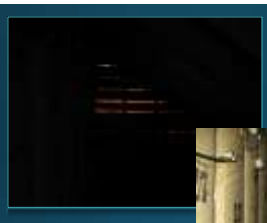

Unplanned air leakage



Poor attic insulation

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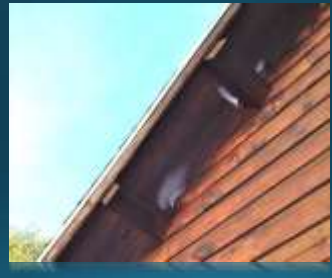

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Courtesy Carnrodan Associates

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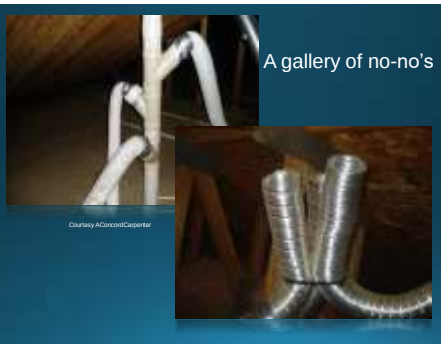
A gallery of no-no's



Courtesy AConcordCarpenter

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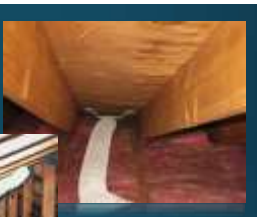
A few more…





Courtesy Inspectapedia

64

Bathroom piggybacked onto the kitchen stove exhaust



Courtesy Gaudet Inspections

65





66

Kitchen Exhaust Hood Fans



Recommended: 100 CFM "exhaust", (no hair greasers), or continuous exhaust 5 ACH of kitchen volume.

IMHO: always use quiet exhaust vent hood on all stoves

Rocis.org/range-hood-document

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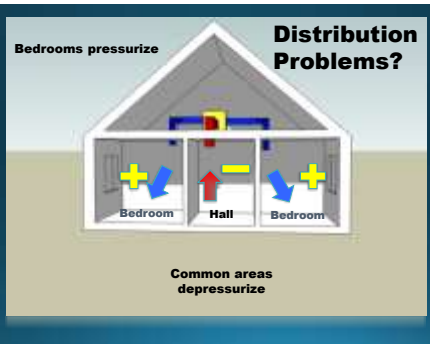
Large Stove Exhaust?? (400cfm & more)







Distribution Problems?



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COMBUSTION SAFETY ASSESSMENT

Boiler breeching in operating condition

Sufficient combustion air provided to boiler

Solid fuel combustion exhaust in operating condition

Sufficient wood stove clearances

Vented or unvented space heaters

Operational alarms

71

Questionable breeching, acceptable repair



72



73

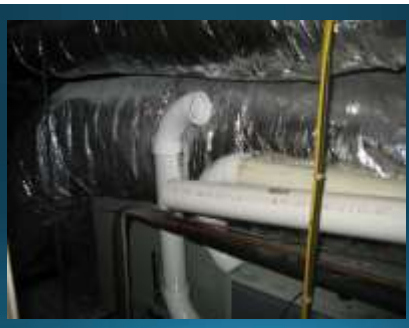




Disconnected deep in a crawlspace

No cleanout below, and water stains!

74



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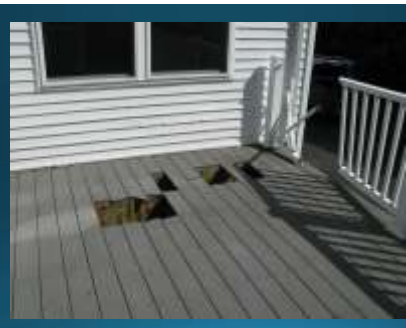

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Black Staining From Combustion Fumes



77

77

Black Staining From Combustion Fumes



Courtesy Camroden Associates

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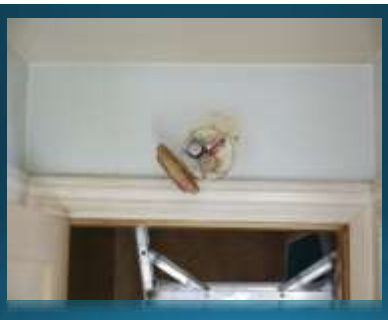

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Unvented?
100% efficient??

Light a pile of newspapers in your living room

Combustion strategies

Specify sealed combustion heating appliances

Provide dedicated combustion air to atmospheric heating appliances

Do not use unvented heating appliances!

Vent all cooking appliances to the outside

Air seal living spaces from attached garages

81

Smoke Alarms



Required in new construction

Required in *permitted* renovations, except…

Roofing, siding, window replacement, plumbing or mechanical system replacement

82

Carbon Monoxide Alarms



Required in new construction and *permitted* renovations with attached garages or combustion appliances

83

Residential Fire Suppression System



84

Automatic Fire Suppression Systems

MUBEC

Sprinkler *not required* if basement ceiling is fire rated

Rating required if joists are less than 2x10 cross sectional area

Local ordinances may require system

85

Fifteen minute break

Mitsubishi Electric

86

Pollutant Assessment

87

LEAD PAINT

Renovations to homes built prior to 1978 must follow USEPA Renovation, Repair and Painting rule (RRP)



Applies to any activity that disturbs paint in pre-1978 housing and child occupied facilities

88

How widespread is lead in paint?

Year House was Built	*% Houses with Lead*
Before 1940	87 percent
1940 - 1959	69 percent
1960 – 1978	24 percent

35% - 40% of Maine housing is pre-1950

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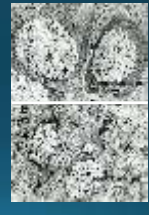
Lead Issues

Lead is a neurotoxin that affects the nervous system, especially in young children

Causes brain and blood disorders

Lead poisoning has been documented in ancient Rome, Greece and China

Still recent cases in USA, many worse than Flint



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RRP Enforcement

Suspension or revocation of RRP Certification
Civil penalties up to $37,500.00 per violation
Criminal penalties up to $37,500.00 and/or imprisonment



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Dealing with lead paint

Educate owners with renovate right pamphlet
Determine presence of lead-based paint
Limit access
Contain dust and fumes
Clean up work area
Provide personnel protection



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Safe Lead Paint Practices



Cover the ground with protective sheeting
Limit work area access
Close nearby doors and windows within 20 feet of the work area
Clean-up and inspect

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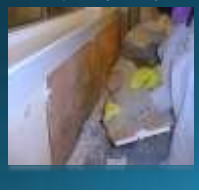
Containment of Hazardous Dust

Full containment with negative air machine

Courtesy Turner Building Science & Design, LLC





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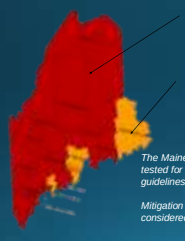
Radon in Maine



Most of Maine has a high radon potential
Likely 4 pci and above

Moderate radon potential
Likely 2-4 pci

The Maine Radon Section recommends that ALL homes be tested for radon. One in three homes tested exceed guidelines.

Mitigation recommended if 4.0 or higher, and should be considered if between 2-4.

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95

Inexpensive and readily available radon test kits and now detectors



Very important if renovation project includes basement finishing or weatherization
Must be performed by homeowner or registered tester

96



Corentium by Airthings™

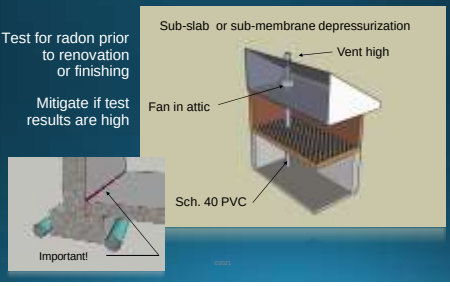
$140.00!

97

Radon mitigation

Test for radon prior to renovation or finishing

Mitigate if test results are high



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Radon pipe taken out the side of the sump pit makes pump service simpler



Courtesy Croix Valley Mitigation

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Radon Solutions



Resource:
www.maineradiationcontrol.org

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Asbestos

Boiler and piping insulation

Vermiculite insulation

Flooring products

Exterior siding and roofing

101



Lung cancer caused by exposure to asbestos

Latency of 15 years minimum

Mesothelioma

102

Asbestos Strategies

Set up exclusion zone around work area

Place drop cloths to collect debris… dispose of debris and drop cloth upon completion

Wet siding during removal

Remove siding in whole pieces if possible

Double bag all debris for disposal

Zonolite Attic Insulation Trust fund to deal with specific brand of Vermiculite

103

Asbestos Siding



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Asbestos and OSHA



Employer/employee relationship triggers OSHA regulations regarding asbestos

Contact local OSHA office with questions

105

Pest Infestation

Gnawed wood
Droppings
Urine stain
Odors
Entrance holes
Shredded paper or other fibrous clumps

106



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Pest Issues

Infestation disturbance can lead to increased allergic reactions, asthma attacks, hantavirus

Major infestations require containment and proper clean up procedures to avoid widespread contamination

Professional help may be necessary

Animals move, and breed

109



Integrated Pest Management

Biological control… a cat, Bacillus thuringiensis

Cultural control… empty the cellar

Mechanical control… a mouse trap, caulking

Chemical control… pesticides in bait stations

110

Possums in the attic



Courtesy Animal Patrol

111

Mechanical rodent control



112

Copper Mesh and Foam





Effective mechanical mouse control

113

Protect Occupant Health During Renovations



Use less toxic chemicals

Create isolation barriers and warning devices

Train workers

Use respiratory protection

MIAQC containment workshop?

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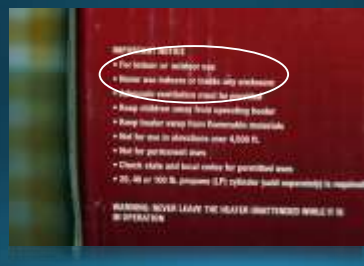
High Hat Heater



115

Caution!



Burning construction debris???



Contaminating, dangerous, and uninsured

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Do 2nd Case Study

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Renovations by Project Type

Photovoltaic Installation

HRV/ERV Installation

HVAC

Finish Basement

Kitchen/Bath Renovation

Siding

Roofing

Windows and Doors

Room Addition

Complete Retrofit

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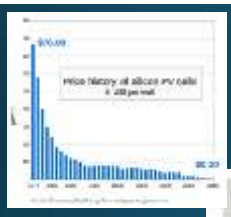
Photovoltaic Installation



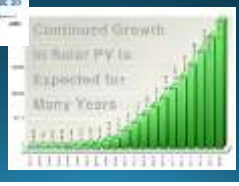
Lower the cost of energy, or

Lower the need for energy

120



Price goes down



Use goes up

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Average Cost*

System Size	Average Cost Pre credit	Average Cost Post credit
2 kW	$5920	$4381
4 kW	$11840	$8762
6 kW	$17760	$13142
8 kW	$23680	$17523
10 kW	$29600	$21904
12 KW	$35520	$26285
20 kW	$59200	$43808

122

Sizing a photovoltaic array

Divide average monthly bill by cost per kilowatt-hour
To arrive at kilowatt-hours per month

Multiply by 12 to arrive at yearly usage

$130.00/.16 = 812.5/kWh per month

12 x 812.5 = 9750kWh/year

123

Sizing a photovoltaic array

1kw array will produce 1200 kWh/year

Average panel is 315 watts

From previous slide...

9750kWh / 1200kWh/yr = 8.125 kw array

8125w / 315w/panel = 25.8 panels

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5 KW
PV Array



Beware the roof

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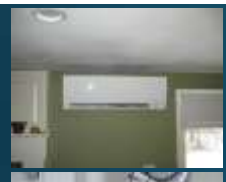





Powered by the sun

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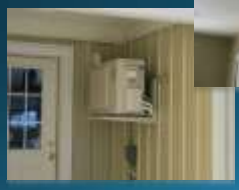
Non combustion space heating…





and cooling

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Harmonic vibration



Dead quiet

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PV powered domestic hot water



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Heat Recovery Ventilation

Energy Recovery Ventilation



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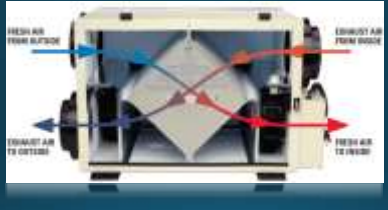

The Concept of Balanced Recovery Ventilation

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Heating
Ventilating
Air Conditioning



132



Changing, Replacing, or Supplementing Heating Systems

Sealed combustion
Clean ducts after major renovations
Perform combustion safety test
Consider non-combustion heating

133





134





Powered make-up air

Tjernlund™ make up air blower
- Wires into boiler controls
- Brings in outside combustion air as the boiler requires

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135

Boiler replacement



Before



After

136

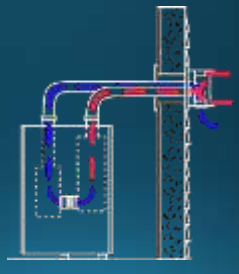
Gas Fired FHW



Heat Exchanger... Smaller loop off boiler

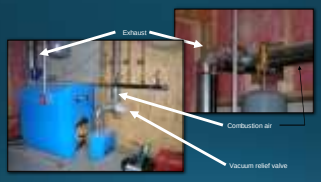
137

Sealed systems use outdoor air in the combustion process… are not affected by negative pressures in the house



138

Oil fired semi-sealed combustion?



Non condensing boiler

©2021

139

Backdrafting water heaters



Courtesy InterNACHI



Courtesy Buell Inspections

140

End of Session One

141

Upcoming at 4:30

Kurt Johnson, Fresh Air Ventilation Systems LLC

Installing ventilation systems in new and existing homes

142

Build a Better House

Renovations II

Maine Indoor Air Quality Council

©2021

143

Thank you, program sponsors...

Northeast Laboratory Services
TC Hefford Basement Systems
Turner Group
RenewAire
Mitsubishi Electric
Maine Indoor Air Quality Council
Fresh Air
DuPont
Green Healthy Maine Homes
Performance Building Supply
RED

©2021

144

Basement Renovations

Relatively inexpensive

The space already exists

Common DIY project

Easy to do wrong

Easy to compromise IAQ



145

Basement IAQ Issues

Constant source of moisture intrusion

Constant easy soil gas entry

At or below dew point temperature of air

Lack of planned ventilation

Poor renovation work likely to degrade IAQ

146

Sources of Moisture

Moisture wicking up from the footing through the wall or through the slab

Outside air leakage through installed insulation

Condenses on cold concrete surface

Diffusion of moisture indoor air through installed insulation

Condenses on cold concrete surface

147

Sources of Moisture

Construction water
- Excess, non-hydrated water in concrete
- Partially dried lumber, wallboard, paint…

Exterior water leaking through cracks in foundation
- Major problem that needs to be addressed prior to finishing basement
- Crack-X™, Hilti™, or similar injection systems

148

When should finishing a basement be avoided?



149

Exterior water management



If you can't manage the water, don't finish the basement

Sumps and stand-by generators are not good alternatives

The law of gravity has never been repealed…

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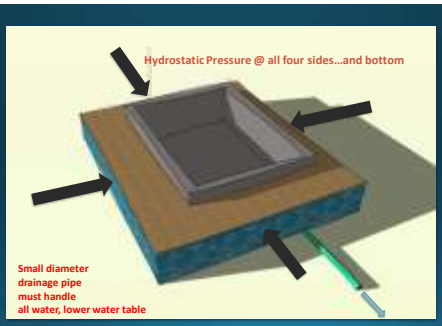
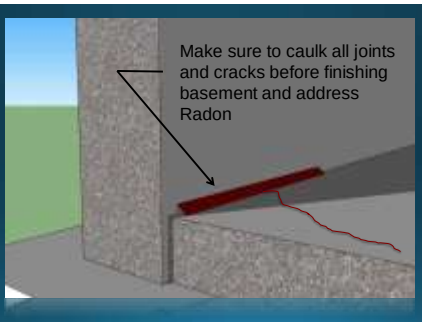
150





Some Considerations

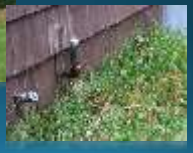
- Preparations
  - Mold, radon, moisture
- Insulation & VDR
- Material selection
  - Studding
  - Strapping
  - Finish paneling
  - Applied finishes
- Ceiling
- Finish flooring
- Moisture management
- Building systems
  - HVAC
  - Laundry
  - Sumps
  - Radon mitigation



Check the exterior



Reverse slope
Grass and vegetation
No overhang
No gutters



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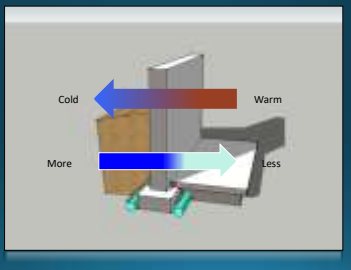
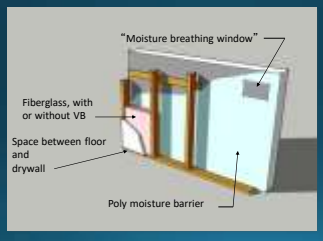
Foundation wall drying pathways



Basement Stud Wall Old Style



Concrete wall will stay wet… cannot dry to the inside

Insulation will stay wet once wetted

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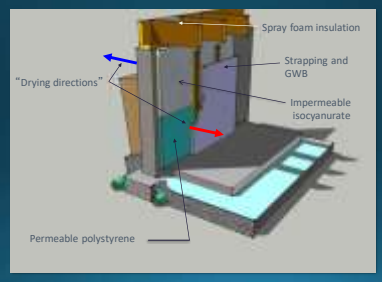


Stud wall rigid foam hybrid

PT plate

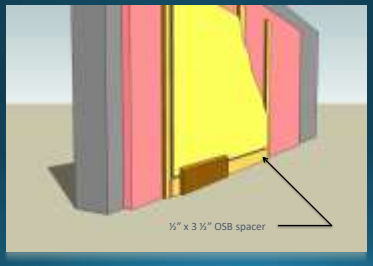
XPS behind studs

Space left for removable baseboard

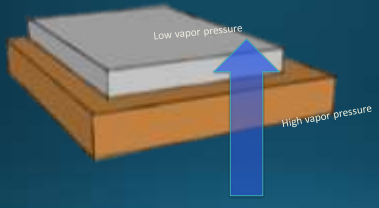
Easy wiring



Sacrificial Baseboard Spacer



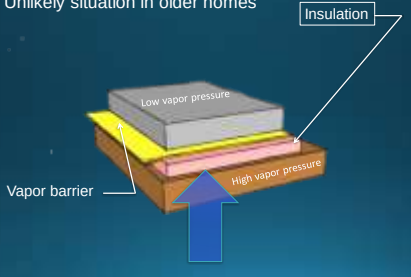
Most likely situation in older homes



Water vapor diffuses through porous concrete… floor will never be quite dry, and always cold

Vapor diffusion is stopped… floor is warm and dry

Unlikely situation in older homes



Acid dyed or polished concrete



Subfloor systems?

Platon™



DriCore™



Rubble Wall: Make it warm and dry





166



167



Spray foam and field stone

Crawlspace insulation



- Insulate the perimeter and seal air leakage
- Don't insulate the ceiling
- Insulate the floor as feasible, or plan on a dehumidifier
- Don't ventilate
  - Code problem
- Fire rating?

©2021

169

Don't open the vents



Winter cold defeats the purpose of insulating the crawlspace



Summer humidity will condense

©2021

Courtesy Foam-Tech

170

Dirt Floor and Weatherization Issue



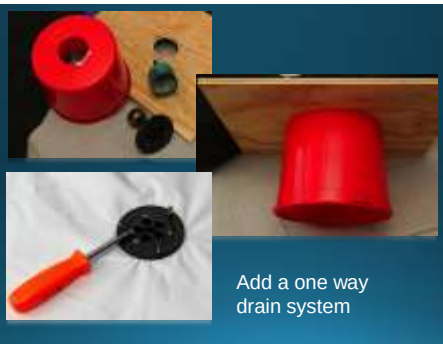
"First, do no harm"

171

Previous slide shows the right way



172



Add a one way drain system

173



174



175

Condensation



Courtesy Camroden Associates

176



Make it warm and dry

177

Or isolate it from the breathing air



178

Basement Summer Solution #2

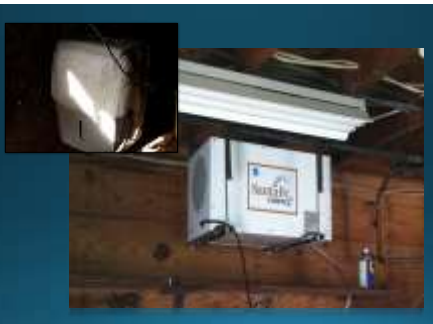
dry air

Air humidity control
Monitor with hygrometers (60%RH or less)

Ventilate basement only on days with low outside RH *Requires owner involvement*

Dehumidify with a drain in place, eliminating batch system

179



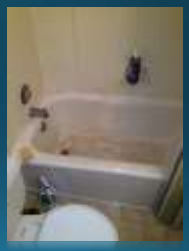
180

Bathrooms

Airseal exterior walls and insulate fully

Exhaust bath fan with vertical wall termination

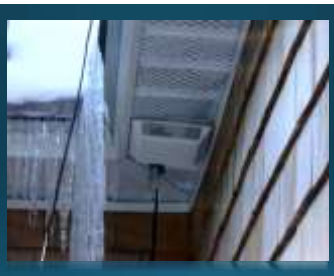
Avoid tubs and showers located against exterior walls



181



182



Poor bath fan termination choice

183

Bathroom venting



184



In-line bath fan

185

A healthy, low demand bathroom renovation

Dual flush toilet
Low flow shower head
Hard durable surfaces
Vented outdoors
Timed fan switch
Low wattage lights



186



Wheelchair accessibility

187

Laundry

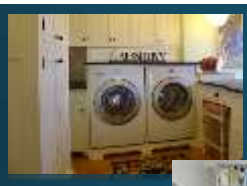
Vent dryer outside
Provide make up air as needed
Install overflow pan beneath washer
Use braided hoses
Use the shut off!

188

Laundry



189



No access to shut off

No drain pan



190

Laundry in the basement





In this case dumping into sump
and not an approved gray water system

191

Kitchens



Low VOC latex paint
Salvaged existing floor
Vented microwave hood

12" cellulose over
Downsized window
R13 HD batts

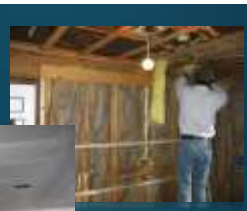
192

1947 Cape No wall insulation



193

R-11 batts with horizontal strapping





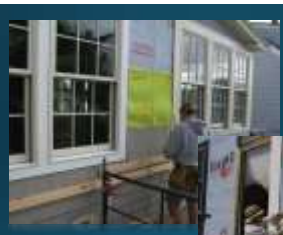
1" isocyanurate between *2x2* strapping

194

Extensive Kitchen Renovation



195





Siding

196

Rain Screen Walls
Water Managed Assemblies

Exterior cladding
Clapboards, vinyl, cement board

Air cavity
1/8" min. to break capillary action

Drainage layer
Building wrap, felt paper, lapped correctly

Sheathing
Water resistant, airtight, structural(?)

197

Air space with strips

Strapping (furring) @ 12" oc

Taped XPS backer over structural sheathing



©2021

198



Continuous airflow behind the siding promotes drying, breaks hydrostatic pressure

199



Three strips of 30# felt @ 16" o.c. used to hold red cedar clapboards 1/8" off housewrap

Repair necessary due to interaction between RC, housewrap, and OSB

200





Flashing details

201

Lap siding flashing



Courtesy James Hardie

202



Courtesy BuildingGreen, Inc

Retrofitting rigid foam on existing walls



Courtesy BuildingGreen, Inc

Be aware of dew point!

203

Climate zone	Minimum R-value for exterior foam installed on an existing 2x4 wall	Minimum R-value for exterior foam installed on an existing 2x6 wall
Marine 4	2.5	3.75
5	5	7.5
6	7.5	11.25
7 and 8	10	15

Courtesy BuildingGreen, Inc

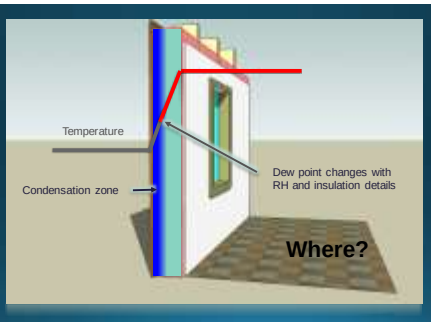
Minimum R-values for exterior foam applications

204



Insufficient exterior XPS sheathing,
dirt floor basement

205



206

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Simple Approximation

In F° … $T_{dp} \approx T_{db} - 9/25(100-RH)$

For example… $T_{db} = 65°$ RH = 50%

$T_{dp} \approx 65° - (9 \times 50/25) \approx 65° - 18° \approx 47°$

48.69° using Decatur.de calculator

©2021

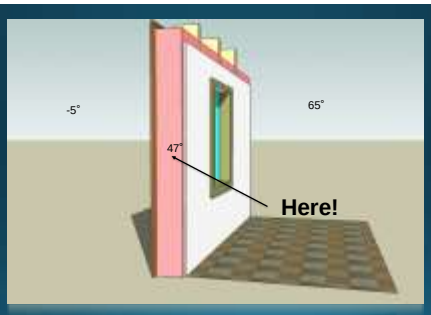
$T_{dp} = 47°$ F

$\Delta T = 70°$ F

47/70 = .67

Dew point temperature is reached approx.
1/3 of the way into the wall from the inside

208



209

Damaging condensation occurs…

When humid exfiltrating air cools down

Diffusing water vapor hits cold surface

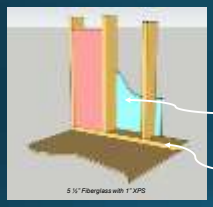
Diffusion is relatively weak, preventing air leakage is critically important

210

Temperature Calculation *within the wall*

1. Determine total R-value
2. Determine ΔT across the wall
3. Starting from outside… $T_{interface} = T_{outside}$ + (percent of total R value x ΔT)

211



Exterior Foam Sheathing System

What temperature here?

What temperature here?

Calculating interface temperatures

212

Total R value = R19 + R5 = R24

ΔT = 68º (68º interior, 0˚ exterior)

Step One

XPS R-value % = 20.8%

.208 x 68˚ = 14.14º

0º + 14.14˚ = 14.14º

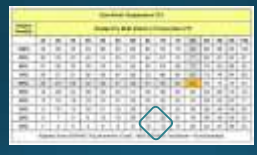
Step Two

Fiberglass R-value % = 79.2%

.792 x 68˚ = 53.86º

0º + 14.14˚ + 53.86º = 68º

213



214

Re-siding



215

ALA Augusta, ME



Courtesy Turner Building Science & Design, LLC

216

Marginal Extra Cost:2” Exterior Foam Retrofit



217

To caulk, or not to caulk…



218

Roofing



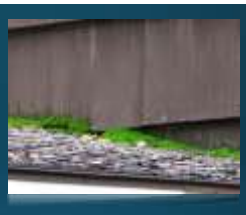


219



220





Siding too close to roofing

221





Flashing

Copper valley flashing (“cricket” or “gusset”) showing “vee” center bend and soldered joints
Note also gap between roofing and cladding

222

Chimney flashing



Chimney pan flashing or "through flashing"



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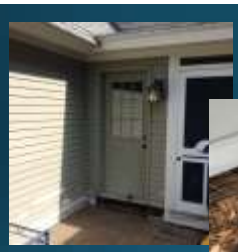
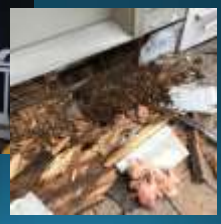
223





Valley over a door…

224

Damned Ice Dams



225

Fiberglass Attic Insulation??



Courtesy Turner Building Science & Design, LLC

226

Infrared Image of Air Leakage into Attic



Courtesy Turner Building Science & Design, LLC

227



228

Roof retrofit



229

Unvented roof



Mechanical systems located in attic

230



Dense packed cellulose in slope with reflective foil

231

Fifteen minute break

Northeast Laboratory Services

232



Window & Door Replacement

233

Window Replacement

Sash replacement

Insert

Full frame window

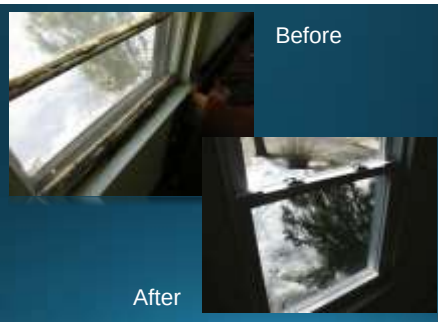


234



Bad Installation

235

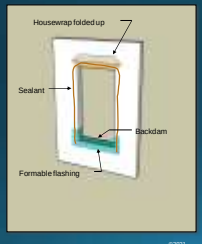


Before

After

236

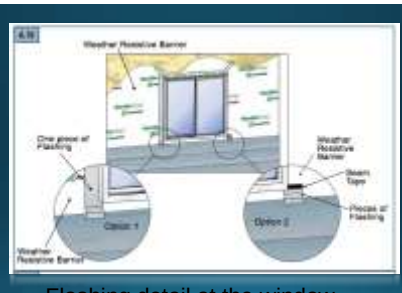
Window Installation



Proper door and window flashing critical to prevent water damage

Follow mfr´s recommendations

237



Flashing detail at the window

238

Room additions



239

Room Addition

- *Adding out is usually easier than adding above*
- *Easier to separate work area from home*
- *Extra cost of site work and concrete*
- *"New Construction" guidelines apply*

240



Blasting not a viable option for room addition

241

"Aging in Place"

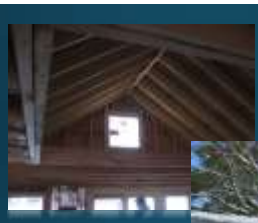
Accessibility
Wider doors, hallways
Improved lighting
Larger bathrooms
Higher outlets

242

Whole House Renovation



243

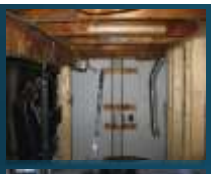


Reframe and sheathe…



Dry it in as soon as possible

244







Then deal with the stuff inside…

245

Landscaping



246

Landscaping

Finish grade 8” min. from wood
ADA requirements must be considered

Keep shrubbery away from intakes and exhausts

Remove tree limbs that hang over the house

247

Tree Shade and Moss



248



Law of Unintended Consequences

Solar Array and Moss

249

Weatherization

Added Insulation
Air Sealing & Caulking
Boiler Repairs
Boiler Replacement
Ventilation & Heat Pumps
Added?



250



Weatherization



251

Don’t do this



252

Weatherization targets



253



DER



Deep Energy Retrofit

254

Deep Energy Retrofit

Basement water management

Gut interior, replumb and rewire, or strip exterior, re-side

Change thermal boundary to roof deck

Insulate and air seal

Point source and whole house ventilation

Sealed combustion, condensing boiler, DHP

255

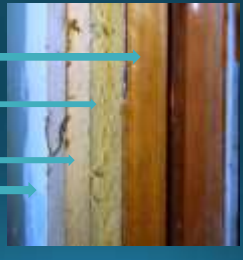


256

Decision: Gut from Interior

Gutted inside

- Added 2 by 2 to 2 by 4
- 6" FG batt & 1" Thermax ™
- ¾" air space
- ½" sheetrock



257

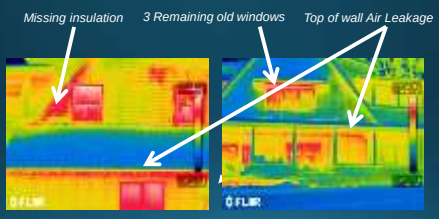
Old Style Blown in Cellulose

Hit or miss retrofit without benefit of IR camera



258

Infra Red Images Prior to Final Dense Pack



259

Visible light images



260

2nd Dense Pack: First floor walls dense packed into FG batts (25 bales) to air seal walls top & bottom as well as increase R value



261

Cellulose Blown Blanket



262



Closed cell foam

263

LEA, Lake Center, Bridgton, ME



Courtesy Turner Building Science & Design, LLC

264

LEA, Lake Center, Bridgton, ME



Courtesy Turner Building Science & Design, LLC

265

LEA, Lake Center, Bridgton, ME



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266

LEA, Lake Center, Bridgton, ME



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267

An effect of long term smoking



268

Garage Additions



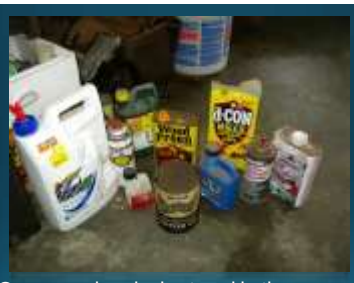
Fire rating required

Gas tight seals required at house door

Garage ventilation should be considered

Separate garage a good design option

269



Common chemicals stored in the garage

270

A separate garage can be easier to build



271

Southern Maine Problem House

New house with siding issues

Re-siding contractor noticed rotten sheathing boards

Further investigation showed the following…

272

Siding came off in sheets



273



High Indoor Humidity

274

Board sheathing compromised



275



Structural elements were compromised

276



Post and Beam Construction

Green timbers shrank away from infill walls, up to ½" for 8"x8"

Moisture laden air leaked through the cracks to the outside

277



Exterior XPS with insufficient thickness

Dew point reached

Exterior sheathing rotted in 5 years

278

End result.. Demolition, Recrimination, and Litigation



279

Recap

Maine's climate, geography, and history present unique challenges, including mold, radon, and lead

Ensure that planned renovations don't create or exacerbate IAQ problems

Plan on pre-renovation inspections

280

Think outside the contract

Don't hesitate to educate the Owners concerning the importance of indoor air quality

Evaluate…
Organize…
Communicate…
Plan…
Act

281

End of Session Two

282


Upcoming at 4:30
TC Hafford Basement Systems
Basement Renovations
283