



BUILDINGENERGY 15

MARCH 3-5, 2015
SEAPORT WORLD TRADE CENTER BOSTON, MA

CONFERENCE + TRADE SHOW FOR RENEWABLE ENERGY AND GREEN BUILDING PROFESSIONALS

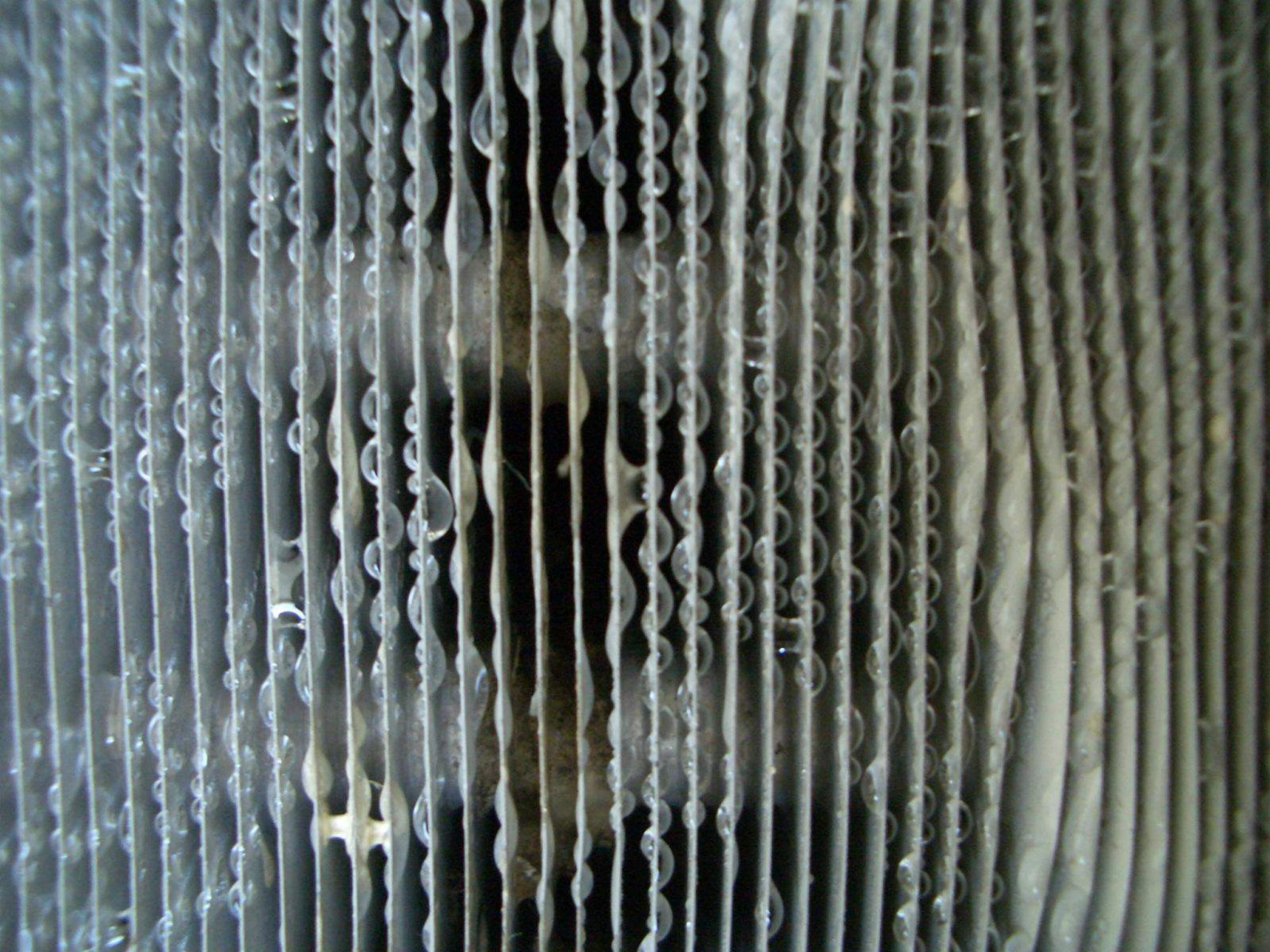
H2 Uh Oh: Moisture Risks and How to Manage Them

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Consider water



<http://www.epa.gov/iaq/pdfs/moisture-control.pdf>



Who has had to solve a
moisture problem in buildings?



“Start where the client’s at”

– Florence Hollis

Casework: A Psychosocial Therapy

Remember who you are
designing, building or maintaining
for









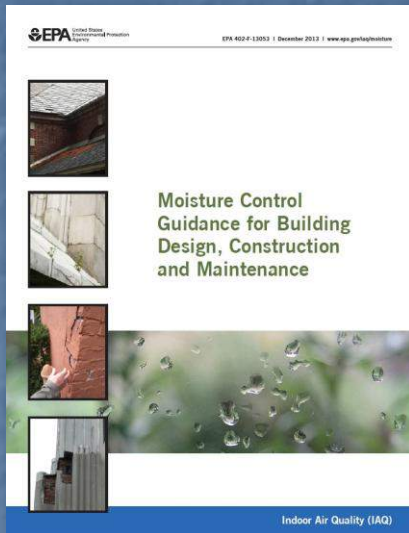




**Do To The Cold Weather
Please Leave The Faucets
Running**

Avoiding moisture and mold problems

Developed: 2004 - 2013 Released: February 2014



Site
Enclosure
Mechanical
Systems

Foreword: How to Use this Guidance

Acknowledgements

Chapter 1

Moisture Control In Buildings

- Introduction
- Health Implications of Dampness in Buildings
- Moisture Damage in Buildings
- Moisture Problems are Expensive
- How Water Causes Problems in Buildings
- Moisture Control Principles for Design
- Moisture Control Principle #1: Control Liquid Water
- Moisture Control Principle #2: Manage Condensation
- Moisture Control Principle #3: Use Moisture-Tolerant Materials

The Basics Of Water Behavior

Chapter 2

Designing for Moisture Control

- Introduction
- Designing Effective Moisture Controls
- Building Commissioning
- Who Should Read this Chapter
- Site Drainage
- Foundations
- Walls
- Roof And Ceiling Assemblies
- Plumbing Systems
- HVAC Systems

Chapter 3

Constructing to Prevent Moisture Problems

- Introduction
- Pre-Construction Planning
- Site Drainage Construction
- Foundation Construction
- Wall Construction
- Roof and Ceiling Assembly Construction
- Plumbing System Installation
- HVAC System Installation

Chapter 4

Operating and Maintaining Moisture-Controlled Environments

- Introduction
- Site Drainage Maintenance
- Foundation Maintenance
- Wall Maintenance
- Roof and Ceiling Assembly Maintenance
- Plumbing System Operation and Maintenance
- HVAC System Operation and Maintenance

Appendix A - The "Pen Test"

Appendix B - Roof Inspection Checklist

Appendix C - Testing Moisture During Construction

Appendix D - Air Pressure Mapping

Appendix E - HVAC Inspection Checklist

Appendix F - Site Drainage Maintenance

Appendix G - Dampness & Mold Evaluation

Glossary

Holistic Design Team



- Architects
- Engineers
- Builders
- Owners
- Buildings and grounds
- Occupants
- LEED consultant

Commissioning?



"a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria" - *The Commissioning Process ASHRAE Guideline 0*

"The role of standards and guidelines. Are they a substitute for understanding a problem or a protection against the consequences of ignorance" - *Tim Padfield*

A few thoughts on the OPR:

- “Start where the client’s at” - *Florence Hollis Casework: A Psychosocial Therapy*
- People expect their building to work
- ...

Indoor Climate

- Thermal comfort zone for people:
 - Air temperature: 70 degrees F to 85 degrees F
 - Air relative humidity: 20% to 80% (at 70 F, 30 – 63 F dew points)
 - Surface temperatures in buildings vary
- In swimming pools or spas?
- In museum or archival storage?
- In chip manufacturing plant?
- In lithium battery plant?

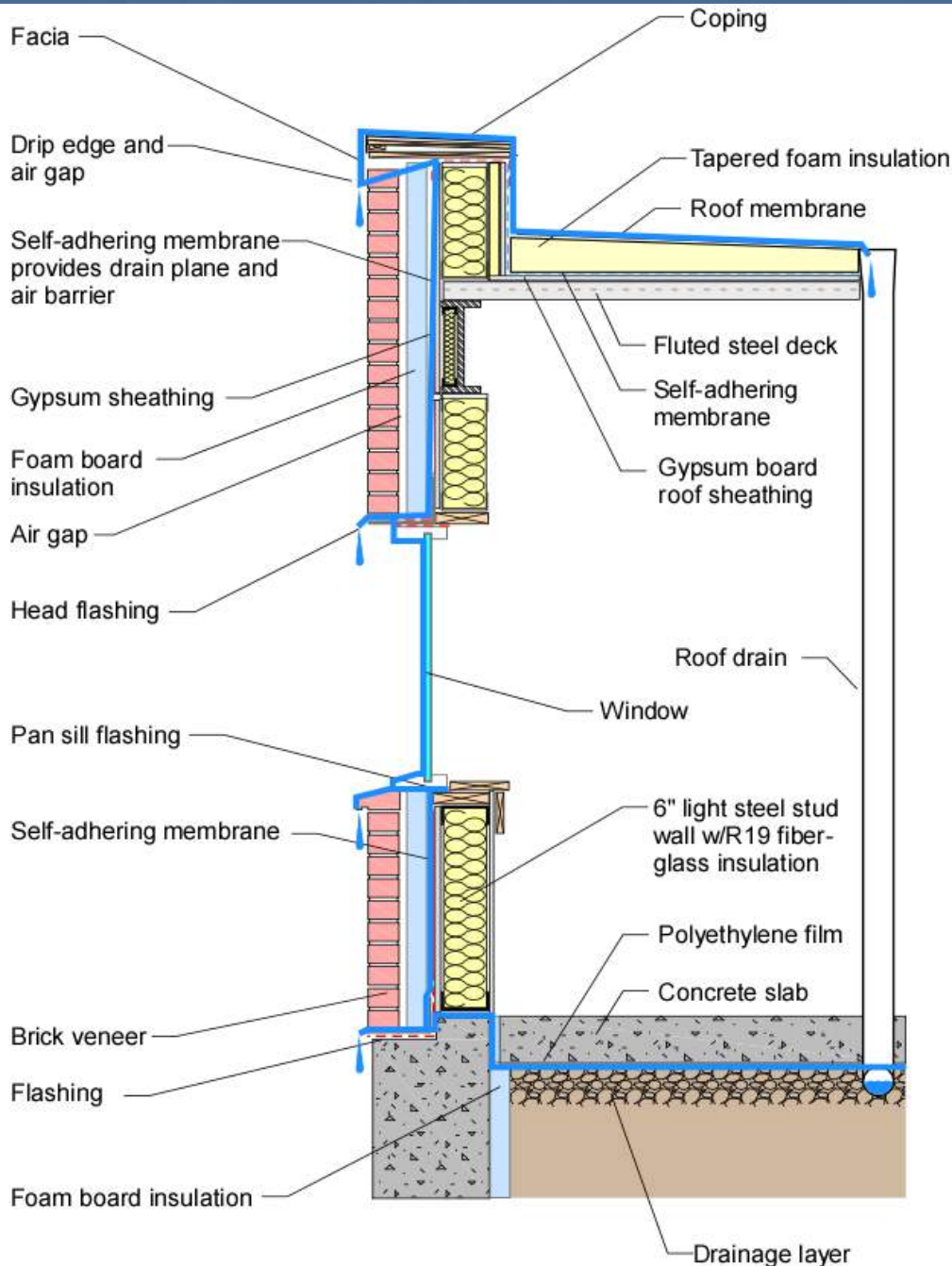


North American
Conditioning
Climates
(Lstiburek)

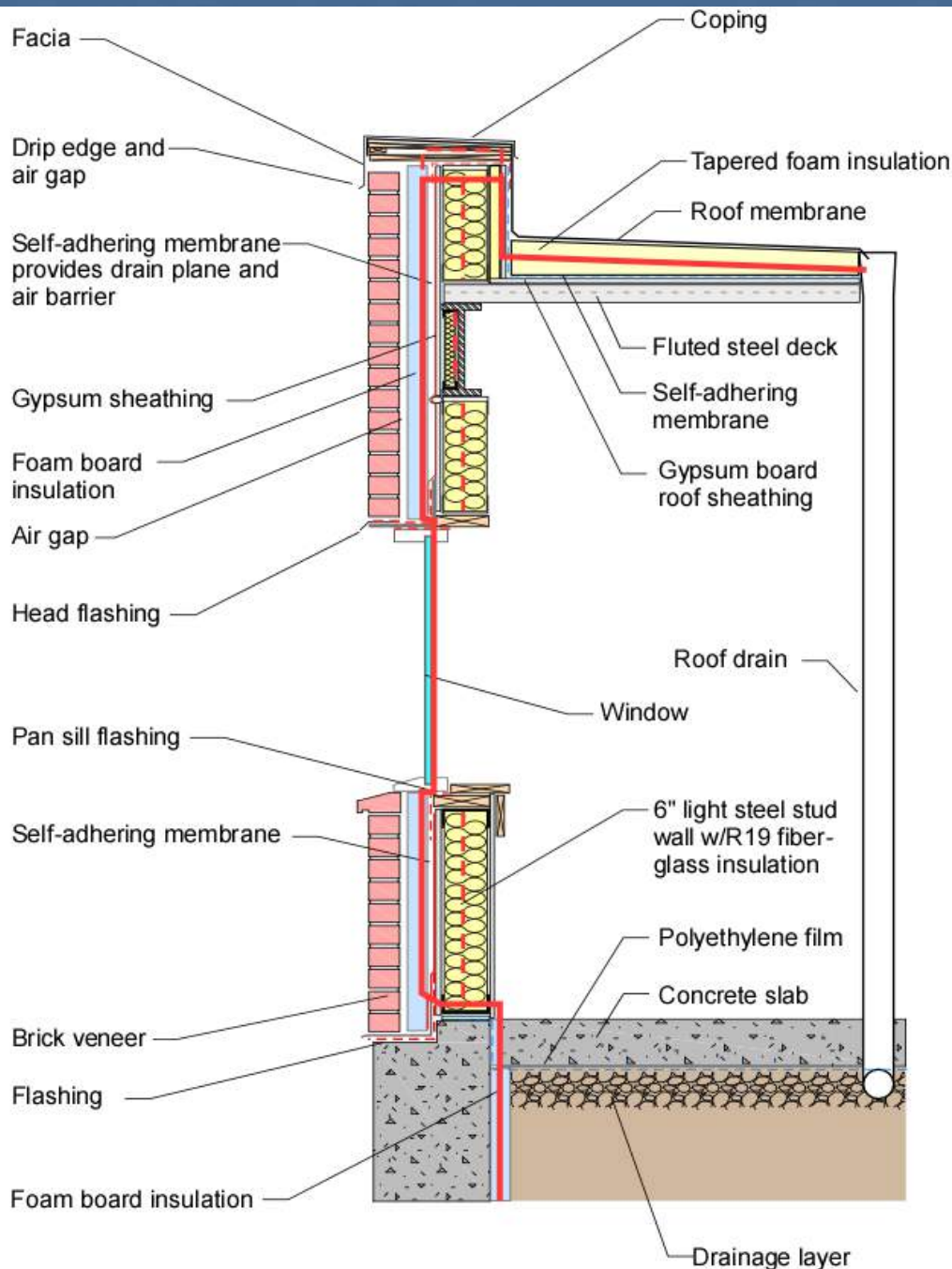
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To Avoid Problems the Enclosure Must:

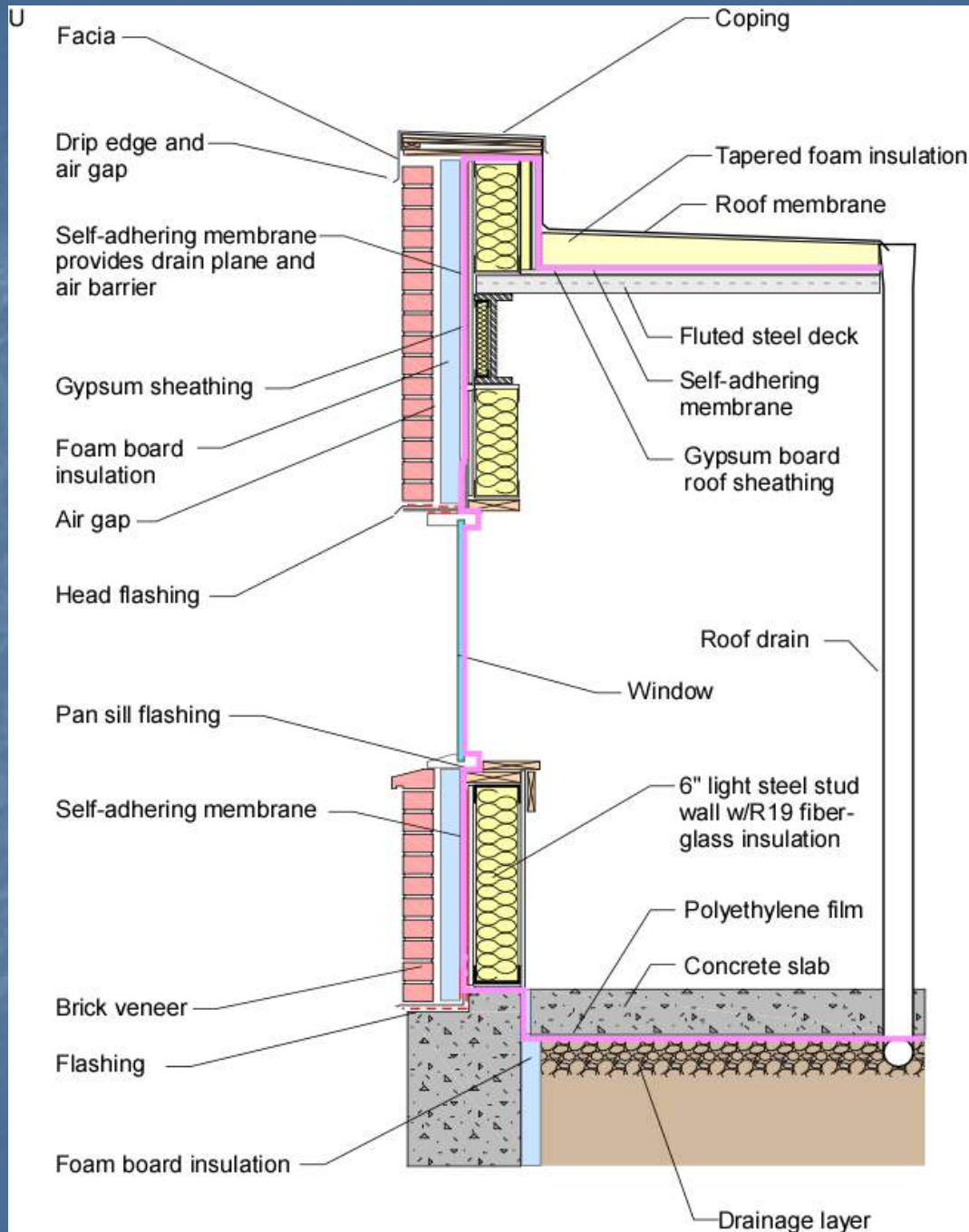
- Manage the flow of rainwater/groundwater
- Manage the flow of air
- Manage the flow of heat (and sunlight)
- Manage the flow of water vapor
- Manage the migration of creatures



Tracing rainwater protection from the center of the roof to the center of the foundation



Tracing continuity of insulation from the center of the roof to the bottom of the foundation.



Tracing continuity of air barriers from the center of the roof to the center of the foundation floor.

Avoiding Condensation

- Enclosure:
 - Make it airtight
 - Put all the materials with low perm (perm less than 2) on one side or the other of cavity
 - Make one of the low materials at least two inches foam board
- AC and ventilation:
 - Indoor dewpoint 55 F or less, except in buildings without air conditioning
 - Ventilation dries an air conditioned building when OA dewpoint is <55 F

What goes into the specs and drawings?

- Moisture control
- Air barriers
- Insulation
- Condensation control
- Verification (Enclosure Commissioning?)

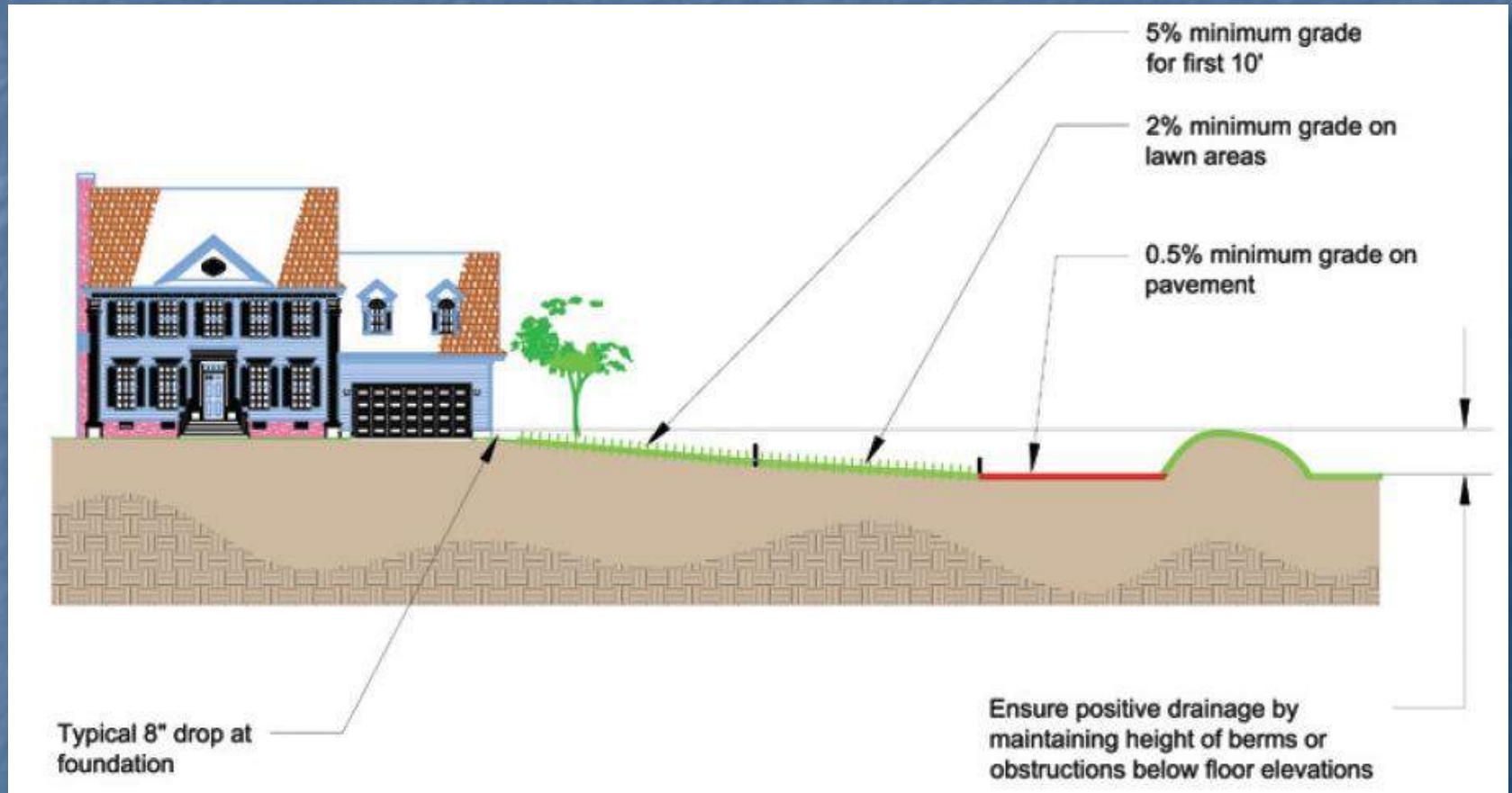
Moisture Control

- How important is moisture control to the owner, to you?
- Provide moisture control detail in construction documents:
 - Building
 - During construction
 - O&M
 - Verification, testing and remedies

Manage moisture at the site

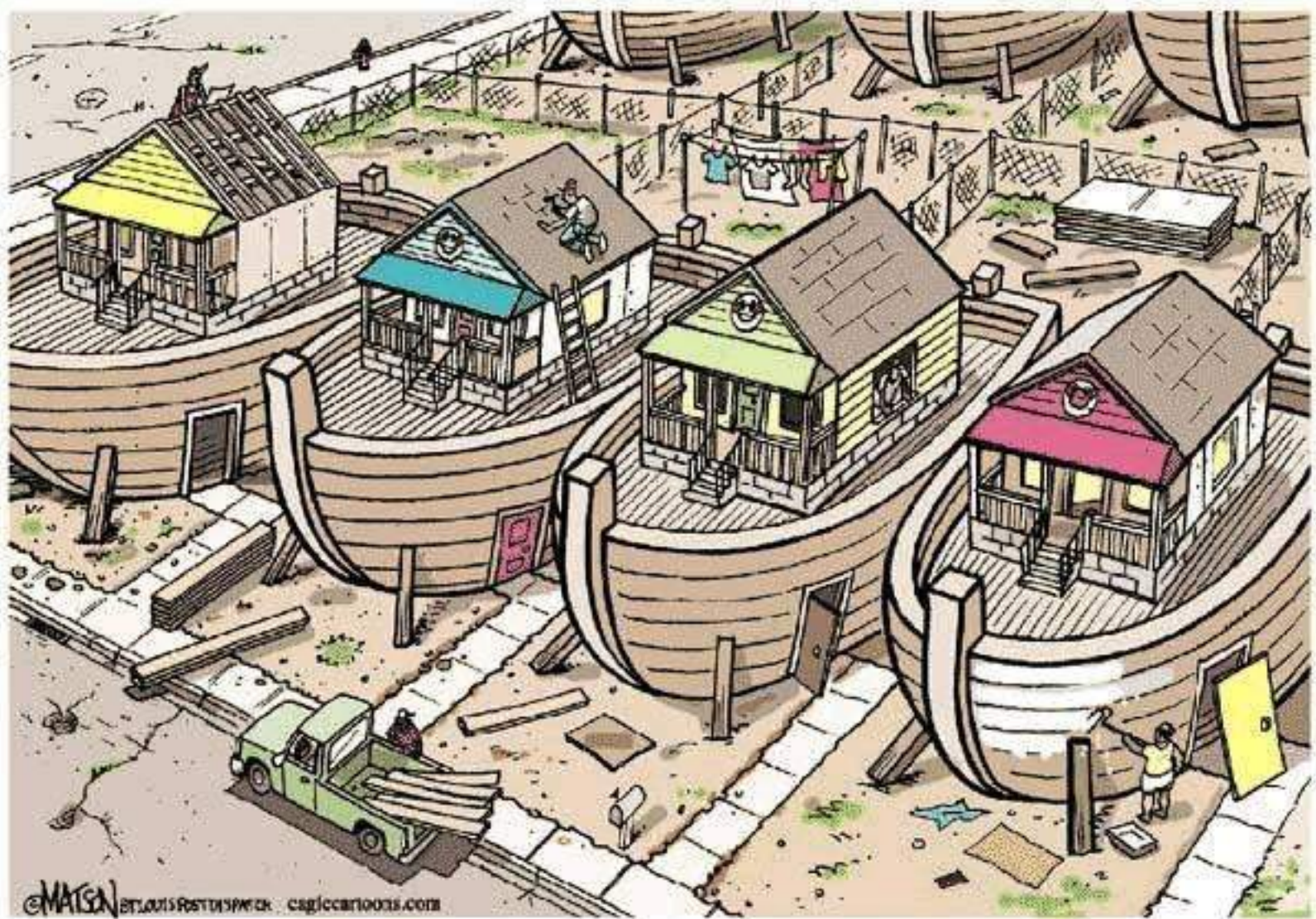


Site drainage





**Engineering solution
for picking a poor
site**



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MORE REALISTIC F.E.M.A. GUIDELINES FOR REBUILDING IN NEW ORLEANS

Drain the site...

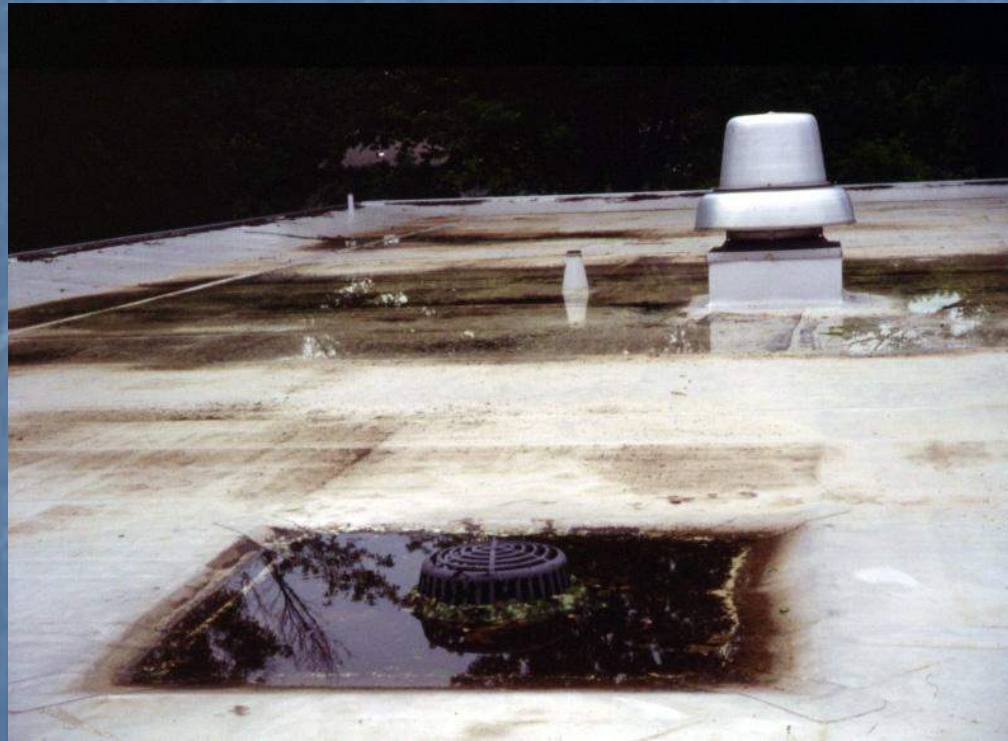


...into the building?



Drain the rain...

From roofs



Most roof leaks are at
the penetrations and
edges







12/22/2011

12/22/2011

**Cheap but
effective rain
protection for
parapet**





From walls



A photograph of a ceiling with acoustic tiles and recessed lighting fixtures. The ceiling is composed of square acoustic tiles with a textured, perforated surface. Several rectangular recessed lighting fixtures are embedded in the ceiling, some of which are illuminated. The ceiling meets a wall at a corner, and the wall also appears to have acoustic tiles. The lighting is warm and ambient.

**Where roofs
run into walls**

**Retrofit through wall
flashing - \$150 -
\$400/foot**

















Drain the walls

















Drain the windows

**The old way – carved
stone pan flashing**

Pan Sill Flashing





Blueskin

Blueskin

Blueskin

Blueskin

Blueskin

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Blueskin



GRACE Roof Detail Membrane

GRACE Roof Detail Membrane



Self adhering membrane
makes pan sill flashing
and extends air barrier
to the window frame



info@carlisle-cw.com
CW-705
& Vapor Barrier

Carlisle
Corporation
800.527.1000

800.527.1000

800.527.1000

Drain the foundation





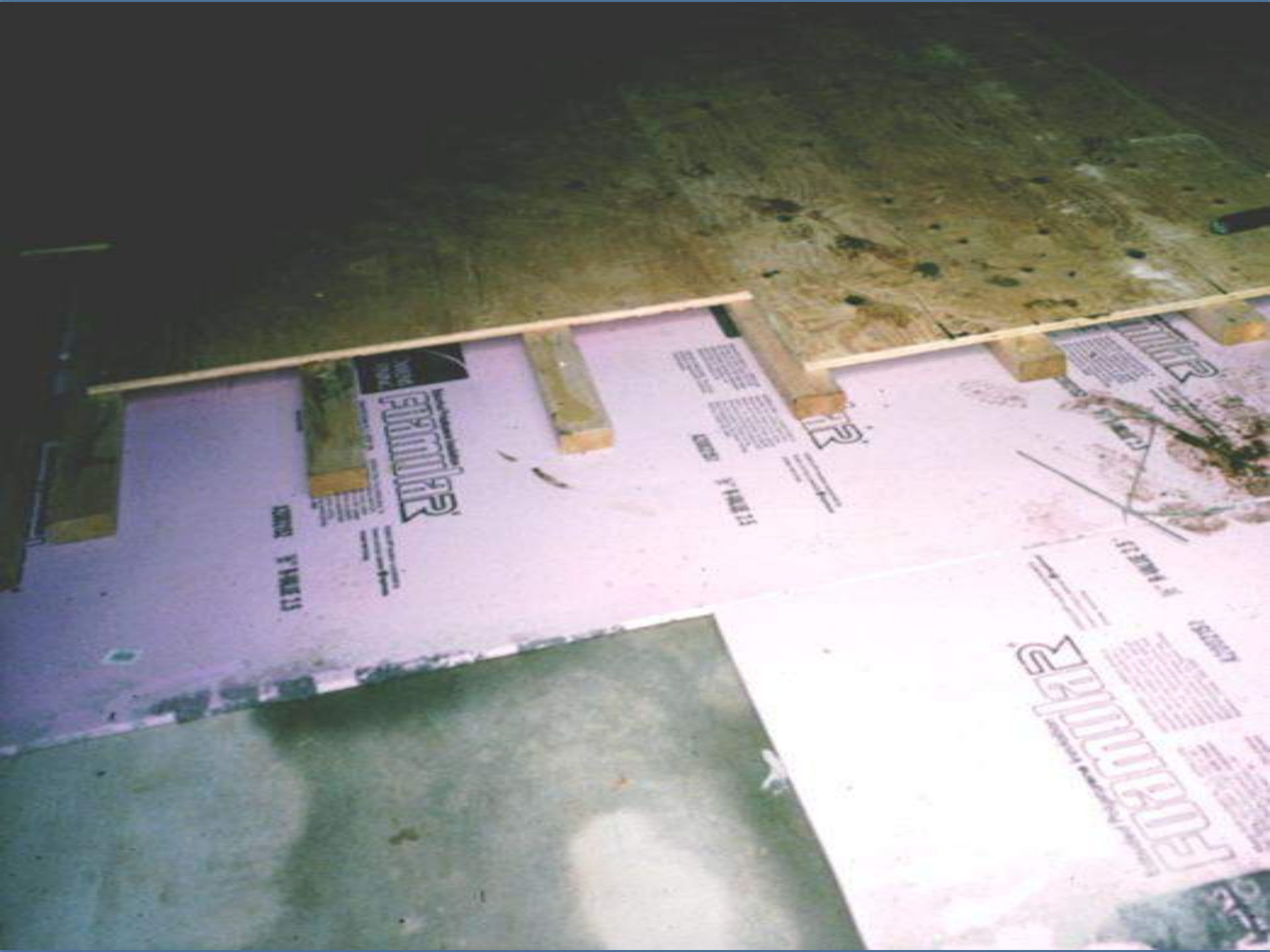




134 4 10

This third century Roman
ceramic tile floor has lasted
for nearly 2000 years.





ST. JOHN'S COLLEGE

FURMILAR

ST. JOHN'S COLLEGE

FURMILAR

ST. JOHN'S COLLEGE

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Drain the basement?









Basement Rules

- Drainage and capillary break
- No paper or wood products touch foundation materials
- Keep warm summer air from contact with earth chilled surfaces using foam insulation
- Put a drain in the floor

Retrofit rainwater protection





Capillary suction
wicks water
through porous
materials.




Capillary Break



JUN 20 2002

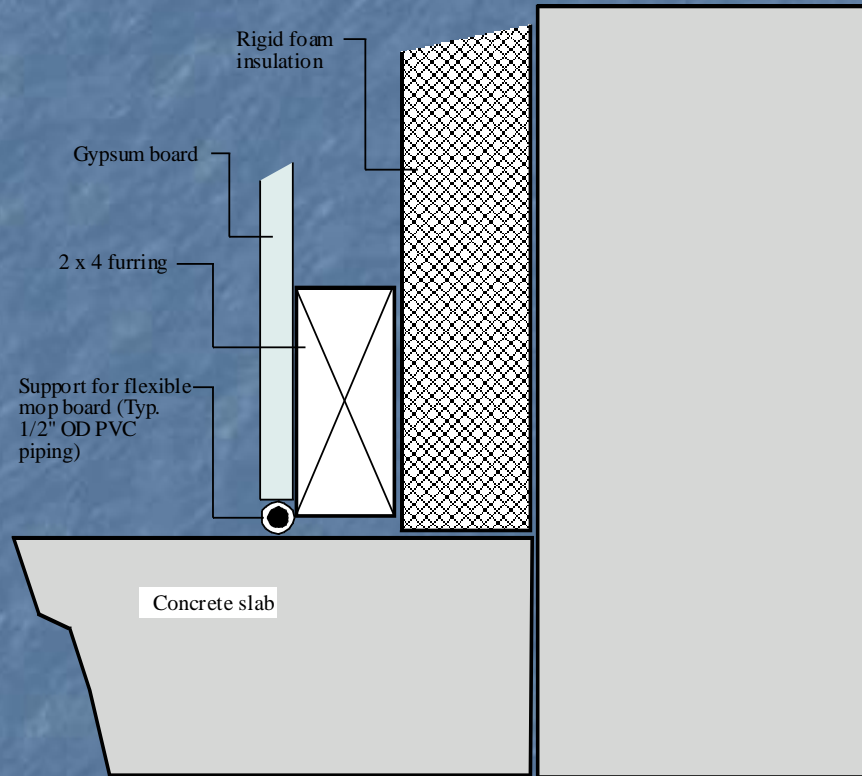


waterlok

The image shows three light-colored wooden blocks standing upright on a dark, rectangular tray. The tray is partially covered with a dark, granular substance, possibly a sealant or resin, which is spread across the bottom and up the sides of the blocks. The blocks have a curved, notched shape on their right side. The background is a light-colored wall with electrical outlets and a brown paper bag. To the right, there is a clear glass and a plastic bottle. The word "thoroseal" is written in blue text on the left side of the tray.

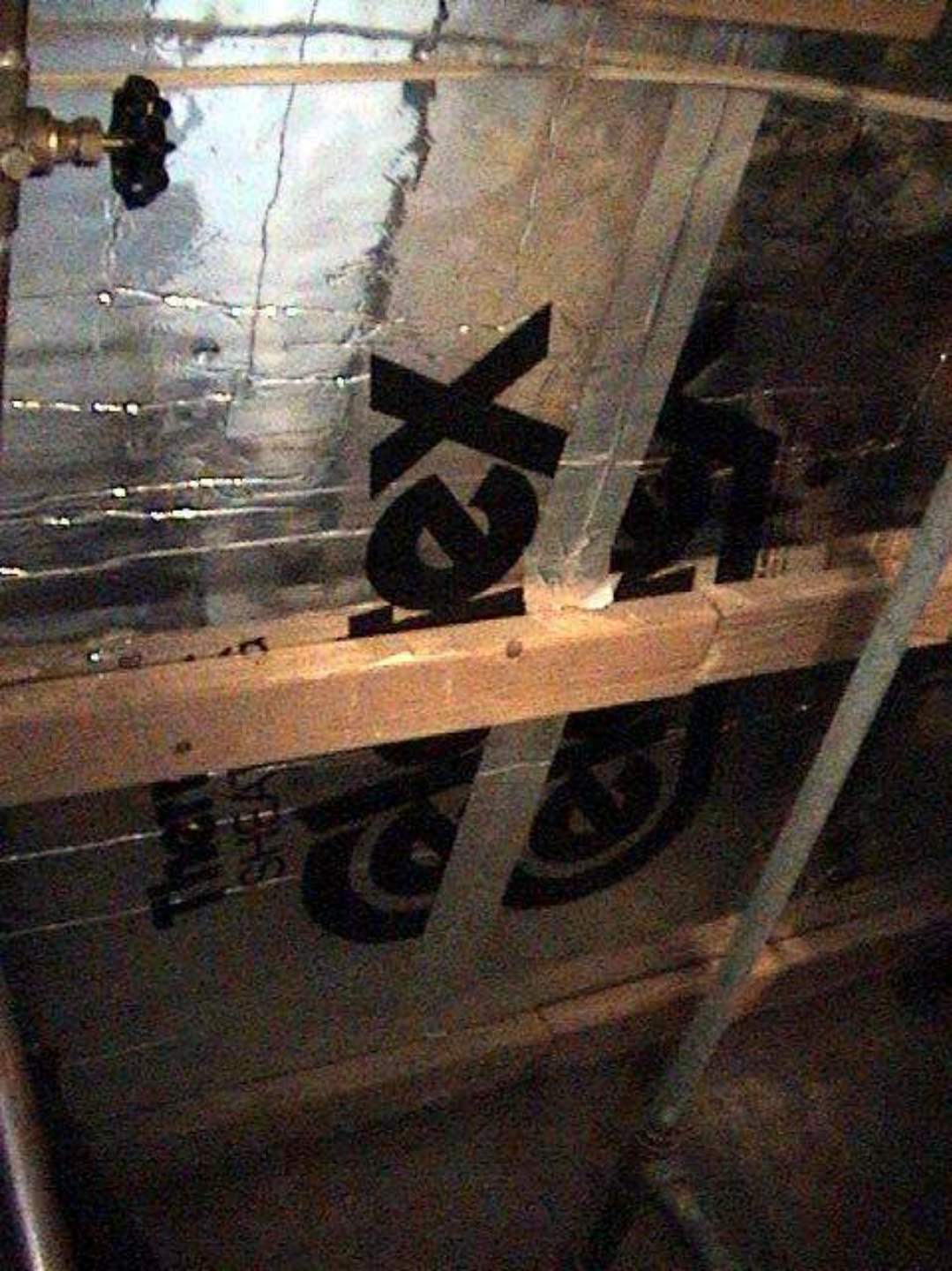
thoroseal

Be careful finishing below grade space



Foam board keeps warm, humid summer air from cold concrete – prevents condensation







Crawlspace guidance

Make the crawlspace part of the inside

- Keep water out
 - use perimeter drainage to keep out rainwater and ground water
 - use a vapor barrier to prevent water vapor entry from the soil
 - repair plumbing leaks
- If crawlspace is dry - seal vents
- In cold climates insulate the crawlspace walls
- Exhaust air from beneath groundcover to prevent entry of soil air laden with radon or other contaminants



Gold fiber glass
Building insulation
Save energy
enjoy comfort

Marville

Marville

Marville

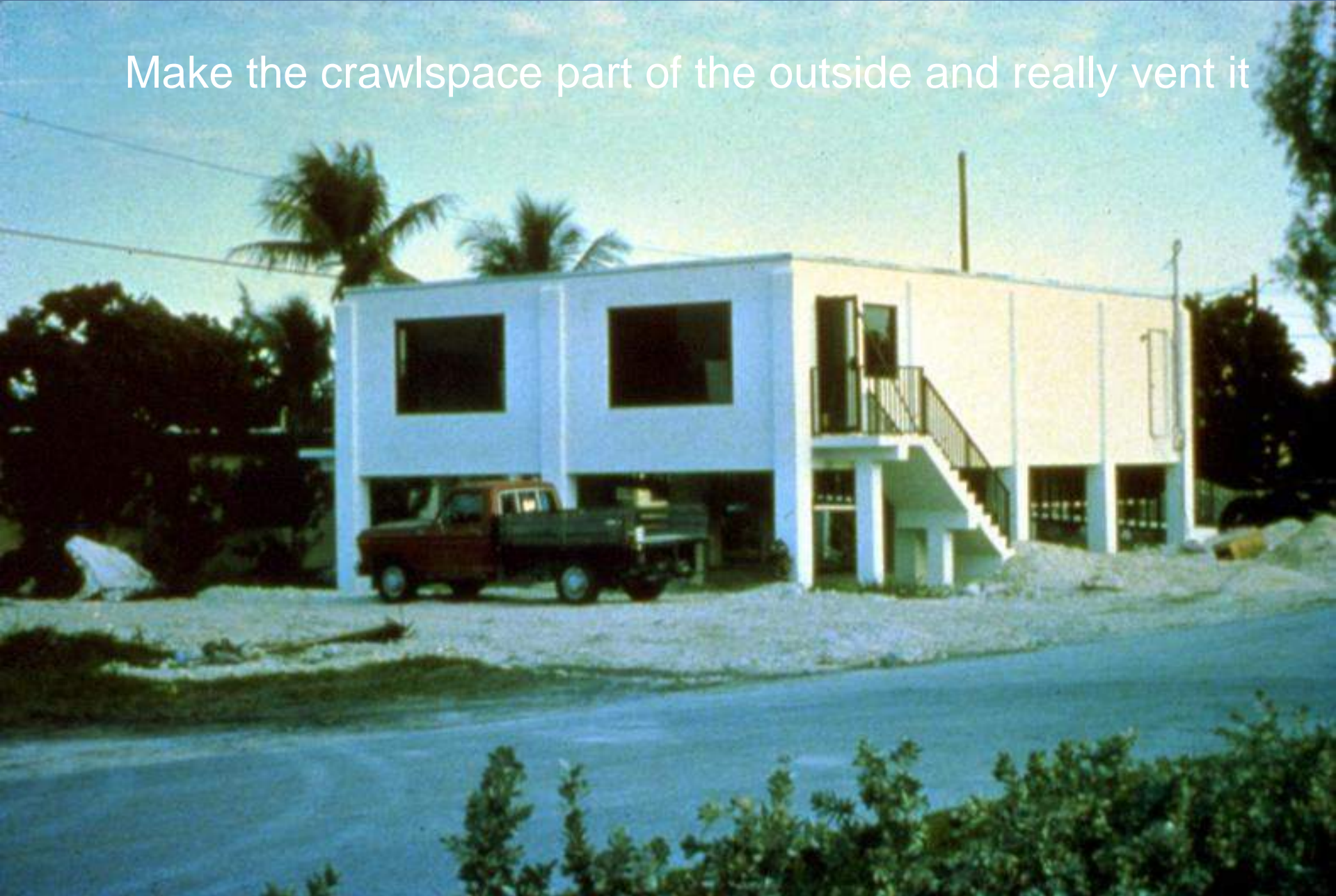
Styrofoam

Styrofoam

Styrofoam



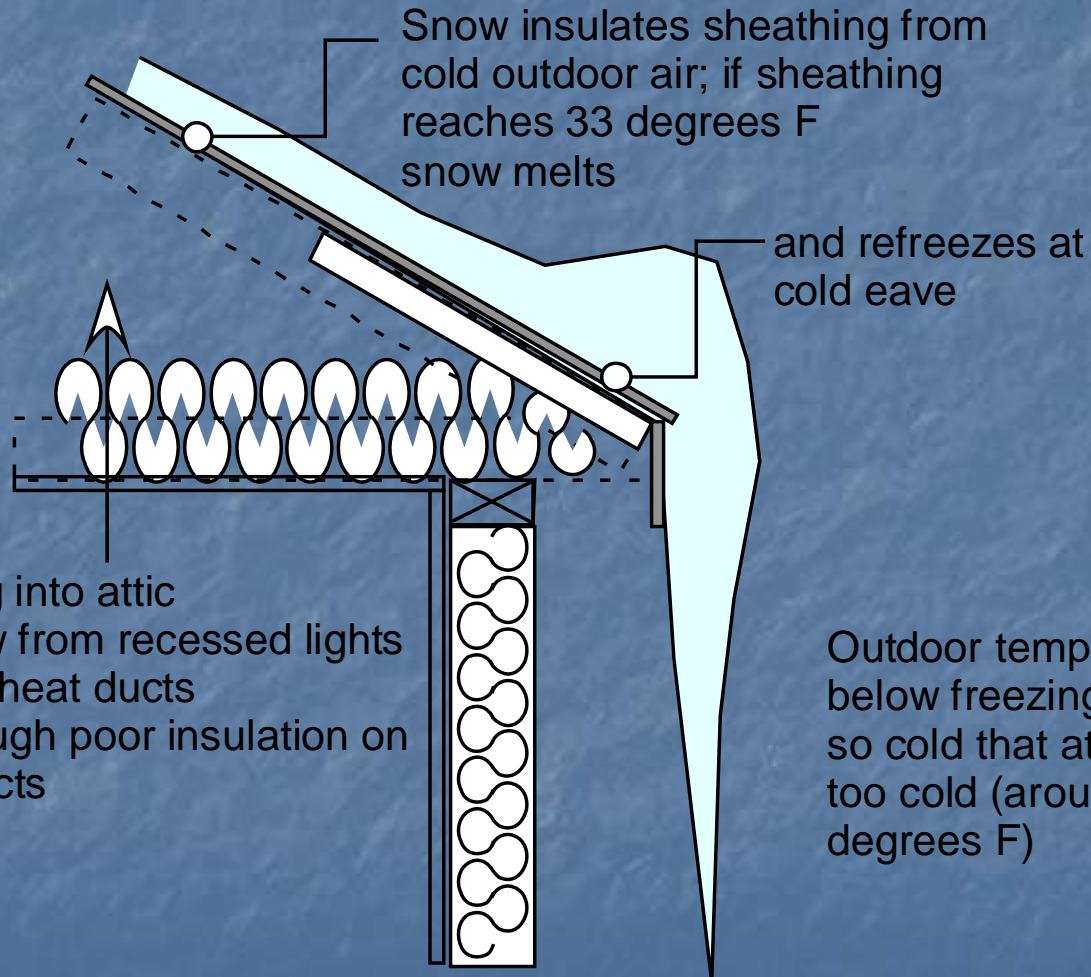
Make the crawlspace part of the outside and really vent it





And don't spray the building...

Ice Dams







Roll film











RESERVED











Plumbing

- No plumbing in insulated walls or ceilings
- Provide access to plumbing
- Test supplies, drains, appliances and fixtures



Condensation -
humidity and
chilled surfaces



