HOUSES: FROM THE GROUND UP
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UNIT 1

THE FOUNDATION
I. FOUNDATION TYPES

A. Crawl

B. Slab

C. Basement
   1. Full
   2. Garden level/lookout
   3. Walkout

II. FOUNDATION VARIABLES

A. Climate
   1. Northern
   2. Southern

B. Soil Types

C. Water Table

III. FOUNDATION ELEMENTS

A. Purpose of the Foundation
   1. Transfers weight to ground
   2. Anchors house to ground
3. Raises house above wet ground

4. Provides level surface to build on

B. Three Components of the Foundation

1. Soil

2. Wall (vertical)
   a. Resists soil pressures

3. Footing
   a. Purpose: to stop uneven settling
      b. All foundations settle

C. Spread

1. Whenever the footing is wider than the wall placed above it to “spread” concentrated loads

D. Shallow Frost Protected

IV. FOUNDATION MATERIALS

A. Stone

B. Block Foundation

1. First manufactured foundation

2. Lightest concrete foundation available
3. Predictable module

4. Stone foundations had separated units, which made transporting it easier. However, installation was difficult because various-sized stones had to be aligned and leveled.

C. Poured Wall Foundation

1. Forms are built and mixed concrete is poured inside
   a. Wood forms
   b. Steel/aluminum forms

D. Wood Foundation

1. Chemically treated lumber was created to prevent wood rot
   a. Copper salt is pressed into the wood
   (1) No longer a health risk

E. Insulated Concrete Form (ICF)

1. The form is a two-inch thick foam

2. Concrete is poured into the form. The form is left in place and serves as an insulator.

3. Costlier and tougher to install than other types of foundations
   a. Requires bracing
   b. Proven performance
F. T-Mass Foundation

1. Inner and outer walls are concrete with one piece of foam in the middle and
   a. can be pre-manufactured offsite, or
   b. poured onsite.

V. FOUNDATION PROBLEMS

A. Mismatched Foundation to Soil Condition

B. Wall Damage

1. Horizontal
2. Diagonal
3. Structural

C. Floor Issues

1. Cracks
   a. Shrinkage
   b. Settling
   c. Control joints

D. Wall Remedies

1. Proper grading
2. Retrofit drain tile
3. **Wall stabilizing methods**

   a. Plate anchors

   b. I-beam supports

4. **Preventive water control**
UNIT 2

THE SHELL OF THE HOUSE
I. WHAT IS THE HOUSE SHELL?

A. The Skeleton of the House

1. The shell defines the shape of the structure and provides a surface to apply the interior and exterior finishes

II. TYPES OF HOUSE SHELLS

A. Masonry Shell

1. Began as a pile of stones, but soon the walls were plastered with clay and straw

2. Cinder block can be used in place of cut stone (limestone, or even coral)

3. Insulated concrete forms (ICF)

B. Wood-Framed House

1. Post and beam/timber frame

2. Balloon frame

   a. Exterior wall extends from foundation to roof

   b. By 1920, the balloon frame was rarely used

      (1) Insufficient long lumber

         (a) Over-harvesting of old growth

      (2) Fire risk

         (a) Fire blocking was introduced in the early 1900s

      (3) Development of platform framing
3. **Wood platform frame**

   a. Assembled wood platform, laid studs, and then lifted up

      (1) Traditionally wood, today can be steel stud

      (2) Each story built as a separate component

   b. Automatically serves as a fire block

   c. Moisture and movement

      (1) Water content

      (2) Shrinkage

**III. FLOORS**

**A. Structure**

1. **Load**

   a. Live

   b. Dead

2. **Span**

   a. Engineered lumber

      (1) Glulam

      (2) Micro lam beams
3. Sheathing
   a. Plywood
   b. Oriented strand board (OSB)
   c. Particle board

B. Types

1. Joists
2. I-joists
3. Trusses
4. Concrete, aka spancrete

C. Issues

1. Squeaks
2. Solutions
UNIT 3

THE ROOF
I. STRUCTURE

A. Hand Framed

B. Truss Framed

C. Roof Sheathing

1. Sheathing materials
   a. Plywood
   b. Oriented strand board (OSB)
   c. Boards

2. Panel connections

D. Ventilation

1. Soffit venting

2. Mushroom vents—R61

3. Turbine vents

4. Ridge vents

II. TYPES OF ROOFS

A. Low Sloped Roof

B. Shed Roof

1. Skillion
C. Gable Roof

D. Hip Roof

E. Dormer

F. Mansard Roof

G. Butterfly Roof

H. Gambrel Roof

III. ROOF TERMS

A. Ridge

B. Vent

C. Eave

D. Underlayment

E. Deck

F. Dormer

G. Valley

H. Rake

I. Flashing
IV. SURFACE MATERIALS

A. Underlayment

1. Tar paper

2. Ice and water barrier

B. Asphalt

1. Materials of asphalt shingles
   
   a. Fiberglass
   
   b. Cellulose

2. Construction
   
   a. Three-tab
   
   b. Architectural

C. Wood Shingles

D. Wood Shakes

E. Clay Tiles

F. Concrete Tiles

1. Simulated clay tiles
G. Metal Roofs

1. Standing seam

2. Metal tile roofs

H. Low Sloped Roofs

1. Materials
   
a. Single ply

   b. Multiple ply

   c. Ballasted

V. ROOF PROBLEMS

A. Stains

B. Flashing Failure

C. Age

1. Cup/curl

2. Bubbled

3. Missing

4. Excessive granular displacement
UNIT 4

WINDOWS AND DOORS
I. CONSTRUCTION OF A WINDOW

A. Sash

1. The sash holds the glass

B. Frame

1. The frame is fixed and holds the sash

2. Combination

   a. Wood is inside for appearance and vinyl or fiberglass is on the outside for weather protection

C. Materials

1. Wood

   a. Perceived to be expensive

   b. Aesthetically pleasing

2. Vinyl

   a. Perceived to be cheap

   b. Today it is as good as other types and is much less expensive

3. Fiberglass

   a. Simulates wood

   b. Pricier
II. Types of Windows

A. Types of Windows

1. Awning window: A window that is hinged along the top allowing the sash to swing out and up

2. Casement window: A window unit that is hinged along one of the vertical sides allowing the window to swing out and away from the wall plane

3. Double hung window: A window made up of two sashes in a vertical configuration, both of which can slide vertically in its track
   a. Single hung window: A window made up of two sashes in a vertical configuration, one of which is fixed in place, one of which slides vertically in its track

4. Sliding window: A window made up of two sashes, can be configured to have one fixed and one operable, or both operable. Sashes slide horizontally in the frame to open.

5. Hopper window: A window that is hinged along the bottom, allowing the sash to swing in and down

6. Picture window: A non-opening sash

7. Bow window: A combination of three to five window units that project away from the plumb line of the wall they are set into. These units are assembled with a 10-degree angle to give a more curved, fluid look.

8. Bay window: A combination of window units that project out away from the plumb line of the wall they are set into, usually in a three-unit assembly with 30- to 45-degree angles between units

9. Curved window: A window unit with a curved frame and sash. These units can be assembled with up to a 90-degree angle.
10. Garden window: A window that projects out from the plumb line of the wall in an isometric shape. All sides but the bottom have glazing.

11. Skylight window: A fixed or operable window-like unit installed on the roof

III. EFFICIENCY OF WINDOWS

A. Double and Triple Glazed

1. Double: two layers of glass with air space between each glass piece

2. Triple: three layers of glass with air space between each glass piece

B. Low-E Glass

1. A metallic casting on the glass to restrict the passage of radiant heat

C. Gas-Filled

1. Argon

2. Krypton

D. Heat Mirror

1. Plastic panel inserted between two pieces of glass with air space in between the glass pieces
IV. WINDOW PERFORMANCE RATINGS

<table>
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<tr>
<th>ABC Window Company</th>
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<tr>
<td>MODEL ABC</td>
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<tr>
<td>Vinyl-Clad Wood Frame</td>
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<tr>
<td>Double Glazing – Argon Fill – Low E</td>
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<td>Product Type: Vertical Slider</td>
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<th>ENERGY PERFORMANCE RATINGS</th>
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<td>U-Factor (U.S./I-P)</td>
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<tr>
<th>ADDITIONAL PERFORMANCE RATINGS</th>
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<tr>
<td>Visible Transmittance</td>
</tr>
<tr>
<td>0.51</td>
</tr>
<tr>
<td>Condensation Resistance</td>
</tr>
<tr>
<td>51</td>
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</table>

A. **U-Factor**

U-factor measures how well a product prevents heat from escaping. The rate of heat loss is indicated in terms of the U-factor (U-value) of a window assembly. U-factor ratings generally fall between 0.20 and 1.20. The insulating value is indicated by the R-value which is the inverse of the U-value. The lower the U-value, the greater a window’s resistance to heat flow and the better its insulating value.

B. **Solar Heat Gain Coefficient**

Solar Heat Gain Coefficient (SHGC) measures how well a product blocks heat caused by sunlight. The SHGC is the fraction of incident solar radiation admitted through a window (both directly transmitted and absorbed) and subsequently released inward. SHGC is expressed as a number between 0 and 1. The lower a window’s solar heat gain coefficient, the less solar heat it transmits in the house.

C. **Visible Transmittance**

Visible Transmittance (VT) measures how much light comes through a product. The VT is an optical property that indicates the amount of visible light transmitted. VT is expressed as a number between 0 and 1. The higher the VT, the more light is transmitted.
D. **Air Leakage**

Air Leakage (AL) is indicated by an air leakage rating expressed as the equivalent cubic feet of air passing through a square foot of window area (cfm/sq. ft.). Heat loss and gain occur by infiltration through cracks in the window assembly. The lower the AL, the less air will pass through cracks in the window assembly.

E. **Condensation Resistance**

Condensation Resistance (CR) measures the ability of a product to resist the formation of condensation on the interior surface of that product. The higher the CR rating, the better that product is at resisting condensation formation. While this rating cannot predict condensation, it can provide a credible method of comparing the potential of various products for condensation formation. CR is expressed as a number between 0 and 100.

V. **EGRESS**

A. **Required Locations**

1. Basements

2. Sleeping rooms

B. **Considerations**

1. Window well

2. Below deck

VI. **HAZARDOUS LOCATIONS FOR WINDOWS**

A. **Recent Code Influence**

www.iccsafe.org

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1 This rating is optional and manufacturers can choose not to include it.
VII. GENERAL OVERVIEW OF DOORS

A. Types

1. Sliding glass/swinging glass

2. Flush solid – no veneer, extremely rare

3. Flush solid core – veneer over wood or composition material

4. Flush hollow – most common interior door types – core of cardboard grid

5. Stile and rail (panel door)
   a. Solid lumber
   b. Veneer over solid lumber
   c. Variety of patterns

B. Interior

1. Purposes
   a. Privacy
   b. Sound control
   c. Aesthetics

2. Utility
   a. Pocket door
   b. Bi-fold
c. Gliding

d. Accordion

C. Exterior

1. Purposes
   
a. Weather
   
b. Privacy
   
c. Security
   
d. Fire

2. Materials
   
a. Wood
   
b. Steel
   
c. Fiberglass

D. Garage Door

1. Materials
   
a. Wood
   
b. Metal
   
c. Fiberglass

2. Code considerations
UNIT 5

THE MECHANICALS
I. HVAC

A. Terminology

1. Convection
   a. Warmer air rises
   b. Warmer water rises

2. Conduction
   a. Within a solid
   b. Materials in contact

3. Radiation
   a. Warmer object to cooler object via waves
   b. Air in between is not warmed

4. Evaporation

B. Heating

1. Open wood-burning fireplaces were used first in the United States because there was a lot of low-cost lumber available to be burned

2. Later, closed systems were used that could burn wood, charcoal, or coal at a controlled rate (Franklin stove)
   a. More sophisticated closed systems could heat the house, be used as a cook stove, and supply hot water to a gravity storage system
3. **Gravity furnace**

   a. “Octopus furnace”

   b. Insulated fire box produces heat and rises as hot air

   c. Large ducts are directed to the parts of the home that are to be warmed

   d. Usually found in basements

   e. Many of these units still exist in northern states

   f. Inefficient heat distribution

   g. Cost challenges to upgrade

       (1) Asbestos

       (2) Duct work

4. **Gravity boiler (can be steam or water)**

   a. Heats water, which rises as steam or water and eventually cools to return to the boiler by gravity, to be reheated and continue the cycle

   b. Heat transfer through radiators

   c. Initially, wood or coal fired that may have been converted to oil or natural gas

       (1) May be insulated with asbestos

       (2) May have lead plumbing

5. **Forced air furnace (may include air conditioning and control humidity)**

   a. Rapid response to demand
b. Can include zone control

c. Can have variable, automatic temperature control

d. Service contracts available

e. Considerations

(1) Normally, natural gas fueled but can be propane or oil fired

(2) Efficiency and approximate age can be recognized visually

6. Radiant heating

a. Cast iron radiators can be very inefficient

b. Baseboard

c. In-floor

(1) Hydronic

■ can be placed in and below concrete floors;
■ can even be placed on top with a special self-leveling concrete as a retrofit;
and
■ are systems that hang between floor joists in wood floors.

(2) Electric

d. Considerations

(1) Removal can be costly and difficult

(2) Compatible with existing boilers

(3) New boiler systems have a lower installation cost
(4) Now used for cooling
   ■ Dehumidifier
   ■ Geothermal energy source
   ■ Low operating cost
   ■ Long service life

7. Solar
   a. Passive
   b. Active

C. Air Conditioning

1. Affordability

2. Window

3. Split systems

4. Combo systems

5. Energy efficiency
   a. SEER
   b. EER

D. Blended

1. Air source heat pump
   a. Older units not suitable for colder states
   b. Newer units efficient to 17 degrees F
   c. Japanese have units that are efficient down to 4 degrees F
2. **Ground source heat pumps or geothermal heat pumps**

   a. Water or an antifreeze solution is pumped through pipes or coils that are placed in the ground below the frost level

   b. The liquid absorbs or gives off heat to match the constant ground temperature

   c. High initial cost

   d. Low operating cost

   e. New systems are reducing costs

**E. Ventilation System**

1. **Air exchangers/heat recovery ventilators**

2. **Energy recovery ventilator**

**II. PLUMBING**

**A. System Parts**

1. **Supply**

   a. Hot and cold

2. **Drain, waste, and vent**

   a. Seals against sewer gases

   b. Gravity to sewer

   c. Vents to atmosphere

   d. Difference in septic and sewerage systems
B. Materials

1. Lead

2. Cast iron

3. Galvanized

4. Copper

5. Plastic
   a. Rigid (PVC or ABS)
   b. Flexible

C. Water Heater

1. Tank (traditional)
   a. Size
   b. Efficiency

2. Tankless systems
   a. Efficiency
   b. Standard in Europe
III. ELECTRICAL

A. Electrical System Overview

B. Electrical Safety

1. Circuit breakers and fuses

2. Grounded circuits

3. Ground-fault circuit interrupters
   a. Wet area safety
   b. Not for shock prevention
   c. Found either at outlet or main panel

4. Arc-fault circuit interrupter
   a. Now required in bedrooms
   b. Found in main panel

C. Electric Circuits

1. 110 volt
   a. Lights and appliances
   b. Radiant panels

2. 220 volt
   a. Dedicated circuits
b. Heavy electrical demand

(1) Dryer

(2) Oven/range

(3) Shop tools

D. Wiring

1. Knob and tube

2. Plastic tube
UNIT 6

THE ENERGY ENVELOPE AND INTERIOR AND EXTERIOR SURFACES
I. THE ENERGY ENVELOPE

A. What Does This Term Encompass?

“The energy envelope is a critical component of any facility since it both protects the building occupants and plays a major role in regulating the indoor environment. Consisting of the building’s roof, walls, windows, and doors, the envelope controls the flow of energy between the interior and exterior of the building.”

(www.eere.energy.gov)

Heat energy travels from an area of high concentration to an area of low concentration. The building envelope tries to stop this traveling to keep the occupants of the structure comfortable.

B. Insulation

1. Two strategies

   a. Filter and slow the passage of air

   (1) Insulation materials such as fiberglass, cellulose, rockwool, saw dust, corn cobs, and old newsprint are installed in balloon-framed wall cavities to slow down the dissipation of heat from the structure

   b. Redirect heat energy (“Radiant Barriers”)

   (1) Radiant products were brought to the forefront by NASA to protect astronauts from the extreme temperature swings of outer space, Clark Beck perfected the aluminum foil barrier. This product kept more than 95 percent of the heat energy from reaching the astronaut’s body

2. Materials

   a. Older houses

   (1) Saw dust

   (2) Corn cobs

   (3) Newsprint

   (4) Whatever was available
b. Current

(1) Fiberglass
   - Batt
   - Roll
   - Loose fill
   - Sprayed

(2) Cellulose
   - Loose fill (blown in)
   - Sprayed

(3) Rock wool
   - Loose fill

(4) Vermiculite
   - Loose fill

(5) Sheet foam
   - Expanded poly (bead board)
   - Extruded poly

(6) Spray foam

C. R-Values

1. Definition: Resistance to heat flow
2. **Bigger number = more resistance**

<table>
<thead>
<tr>
<th>Insulation Type</th>
<th>R-Value per inch of thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiberglass batt or blanket</td>
<td>3.2/in. of thickness</td>
</tr>
<tr>
<td>High performance fiberglass batt or blanket</td>
<td>3.8/in. of thickness</td>
</tr>
<tr>
<td>Loose-fill fiberglass</td>
<td>2.5/in. of thickness</td>
</tr>
<tr>
<td>Loose-fill rock wool</td>
<td>2.8/in. of thickness</td>
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<tr>
<td>Loose-fill cellulose</td>
<td>3.5/in. of thickness</td>
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<tr>
<td>Perlite or vermiculite</td>
<td>2.7/in. of thickness</td>
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<tr>
<td>Expanded polystyrene board</td>
<td>3.8/in. of thickness</td>
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<tr>
<td>Extruded polystyrene board</td>
<td>4.8/in. of thickness</td>
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<tr>
<td>Polyisocyanurate board, unfaced</td>
<td>5.8/in. of thickness</td>
</tr>
<tr>
<td>Polyisocyanurate board, foil-faced</td>
<td>7.0/in. of thickness</td>
</tr>
<tr>
<td>Spray polyurethane foam</td>
<td>5.9/in. of thickness</td>
</tr>
</tbody>
</table>

*Source: [www.thebestinsulation.com/addon/insulation-calculator](http://www.thebestinsulation.com/addon/insulation-calculator)*

II. **VAPOR RETARDERS**

A. **New Technologies**

1. **DryRight™** — The pores in the facing material open in the presence of excessive moisture and close with low humidity.

2. Spray foam technology is also changing and two new choices have recently been added to the mix.

   a. Icynene has developed an open cell foam that is water blown, yet it develops a remarkable R5 to the inch of material

   b. Retro foam is also a recent offering. This urea formaldehyde-based foam expands slowly and with little pressure, which makes it a great source for insulating closed cavities
III. INTERIOR WALL COVERINGS

A. Materials

1. Log
2. Board
3. Lath and plaster
4. (Drywall) Sheetrock®
   a. Water resistant
   b. Fire resistant
   c. Mold resistant

IV. EXTERIOR WALL COVERINGS

A. Materials

1. Drop siding (historical)
2. Wood siding
   a. Clapboard
   b. Beveled
3. Brick
4. Stucco
5. Stone

6. Hardboard (masonite)

7. Asbestos slate tile

8. Aluminum

9. Vinyl

10. Steel

B. Value Considerations

1. Consumer identification

2. Buyer expectation
UNIT 7

INTERIOR ENVIRONMENTAL ISSUES
I. LEAD

A. Lead Exposure

1. About two-thirds of homes built before 1940 contain lead. Half of the homes built between 1940 and 1960 contain lead. Some houses built between 1960 and 1978 may contain lead.

2. Lead-based paint was completely banned from use in all homes in 1978.

3. Three major sources of lead exposure are as follows:
   a. Painted, stained, and varnished surfaces, both interior and exterior
      (1) Imported children’s toys and furniture
   b. Urban soil and dust
   c. Drinking water
      (1) Lead in drinking water usually indicates radon in drinking water

B. Health Problems

1. Entry into our bodies
   a. Inhalation
   b. Ingestion

2. Damage to adults
   a. Difficulties during pregnancy
   b. Other reproductive problems in both men and women
c. High blood pressure

d. Digestive problems

e. Nerve disorders

f. Memory and concentration problems

g. Muscle and joint pain

3. **Even more serious damage to children:**

a. Damage to the brain and nervous system

b. Behavior and learning problems (hyperactivity)

c. Slowed growth

d. Hearing problems

e. Headaches

**C. Treatment**

1. Remove from exposure

2. Proper diet can reduce lead absorption

3. Hospitalization

**D. Testing for Lead Presence**

1. To thoroughly analyze, each painted surface should be tested
2. **Two basic methods:**
   
   a. XRF (x-ray fluorescence)
   
   b. Laboratory testing

3. **Alternate method: home test kit–contains rhodizonate or sodium sulfide**

**E. Title X**

1. In 1992, Title X, the residential lead-based paint hazard reduction act, was approved by Congress and signed into law. Title X mandated disclosures (to sellers and landlords) and distribution of a pamphlet. Title X does not require testing or removal of lead-based paint.

**F. Removal Strategies**

1. Control dust

2. Work wet

3. Clean up thoroughly

4. Disposal

5. Prohibited practices

**II. RADON**

**A. What is Radon?**

1. Radon is one of the noble gases.

2. Because radon is colorless and odorless, it is impossible to detect without specialized testing.
3. From radioactive decay of uranium, it breaks down to radium, then to radon, and then to polonium, bismuth, and beyond.

4. Radon progeny emit gamma radiation: 20–30 times more intense than x-rays.

B. Sources

1. Most soils

C. Health Effects

1. Divided opinions
   Bernard L. Cohen, a U.S. researcher who has continuously been studying radon’s affect for about 30 years, in 50 percent of the nation’s counties, covering 90 percent of the population, states that cancer deaths in smokers go down in the strongest radon regions

2. Second leading cause of lung cancer
   a. Smokers are more vulnerable
      (1) Studies suggest 7 to 15 times more likely to develop cancer
   b. Second-hand smoke
   c. EPA position
      (1) 20,000 cancer deaths from exposure in home

D. Entry Sources

1. Below-grade walls
   a. Negative pressure pulls gases into the house through cracks and voids

2. Stone
   a. Granite and quartz countertops
E. Radon Testing

1. Methods
   
a. Canister
      
      (1) “Snapshot” of specific volume at location of test kit
   
b. Electronic monitoring
      
      (1) Immediate results
      
      (2) Long-term data collected

2. Locations
   
a. Best practices
      
      (1) Three feet above floor, three feet in from wall
   
b. Conditions
      
      (1) Sealed house 24 hours prior

3. Results
   To obtain up-to-date recommended actions regarding radon results, see www.epa.gov.

4. Impact on real estate transactions
   
a. Results may require disclosure
   
b. Relocation buyers most likely to require test
   
c. Who pays for remediation?
F. Remediation Strategies

1. Existing homes
   
   a. Ventilation
   
   b. Filtration
   
   c. Control entry cracks
   
   d. Sub-slab depressurization
      
      (1) Tap existing drain tile or sump basket
      
      (2) Retrofit system to accommodate

2. New construction
   
   a. Code required in some states

III. MOLD

A. General

1. Mold is everywhere. It needs to be stopped from being viable in houses.

2. The dreaded black mold: stachybotrys
   
   a. Stachybotrys is dangerous indoor mold. It is the most talked about mold in the United States. It can even be viable after exposure to 500-degree temperatures
      
      (1) A true killer in the USA—the bad news!
(2) Doesn’t spread easily—the good news!

- Needs high moisture, low nitrogen atmosphere
- Demands cellulose as food
- Found on sheetrock and wood, not tiles and synthetic surfaces

B. Controlling Moisture

1. Sources of water
   
a. Above grade
      
      (1) Roofs
      
      (2) Window/door
      
      (3) Siding
      
      (4) Foundation/structure connection
   
b. Below grade
      
      (1) Basement wall
      
      (2) Testing for capillary action
      
      (3) Penetrations
   
c. Interior
      
      (1) Condensation
      
      (2) Plumbing
2. Strategies

a. Flashing details
   (1) Roofs
   (2) Window/door

b. Water management system
   (1) Proper grading
   (2) Water proofing
   (3) Drain tile

c. Control humidity
   (1) Reduce production
   (2) Increase ventilation

C. Mold Remediation Strategies

1. Professional
   a. Best choice?

2. Home owner
   a. Remove moldy materials
   b. Vacuum with HEPA filtration
c. Wash/scrub affected area

   (1) Dedicated chemical solutions

d. Let dry

e. Vacuum with HEPA filtration

IV. ASBESTOS AND OTHER NASTY STUFF

A. Asbestos

1. Mineral fiber

2. Commonly used in the following:

   a. Insulation

   b. Fire-retardant products

3. Likely source materials

   a. Furnace insulation

   b. Asbestos shingles

   c. Floor tiles

B. Formaldehyde

1. What is it?

   a. Chemical in many glue products

   b. Released as gas
2. Likely sources

a. Particle boards

b. Fiber boards

c. Hardwood paneling

d. Carpets, drapes, fabrics
UNIT 8

THE GREEN REVOLUTION
I. THE DEFINITION OF GREEN

A. The U.S. Green Building Council’s (USGBC) Definition of Green Design

“To significantly reduce or eliminate the negative impact of buildings on the environment and on the building occupants, green building design and construction practices address: sustainable site planning, safeguarding water and water efficiency, conservation of materials and resources, and indoor environmental quality.” (www.usgbc.org)

B. The National Association of Home Builders’ (NAHB) Definition of Green Building

“The process of green building incorporates environmental considerations into every phase of the home building process. That means that during the design, construction, and operation of a home, energy and water efficiency, lot development, resource efficient building design and materials, indoor environmental quality, homeowner maintenance, and the home’s overall impact on the environment are all taken into account.”

II. MARKETPLACE REALITY

A. Consumer Awareness

B. Client Expectations

C. Opportunity

III. KEY COMPONENTS

A. Sustainable Sites and Site Selection

1. Avoid environmentally sensitive locations

2. Build on a greyfield site

3. Build on a brownfield site

4. Build on an infield site

5. Build on undeveloped property
B. Building Envelope

1. Insulation type and efficiency
2. Foundation design
3. Windows and doors

C. Heating and Cooling Equipment

1. Efficiency
2. Type

D. Indoor Environmental Quality

1. Ventilation
   a. Air exchanger
2. Material/product selection

E. Materials and Resources

1. Sustainable products

F. Water Efficiency

1. Shower equipment
2. Toilet design
IV. RATING SYSTEMS

A. ENERGY STAR

1. Home energy raters provide energy-efficiency strategies and tests for existing and new residential and commercial construction.

2. A Professional Engineer (PE) is required to validate each statement of energy performance for it to be used with the ENERGY STAR label.

3. To earn the ENERGY STAR, a home must meet guidelines for energy efficiency set by the U.S. EPA.