Favorable Environment

- It is necessary for all types of shelter to protect against unfavorable elements to maintain or enhance health
  - Adequate space
  - Safe water supply
  - Approved means of sewage and solid waste
  - Absence of pests
  - Absence of excessive noise
  - Favorable thermal environment
  - Protection of food supply
  - Absence of indoor air pollution
  - Solid structure
  - Absence of toxic substances
  - Sufficient lighting

Indoor Air Quality

- Of the air we breathe, 80% to 90% is indoor air
- Previous shelter construction was designed to segregate the indoors from outside elements
- This energy-efficient mindset led to:
  - Retention of higher temperatures
  - Higher humidity levels
  - Decreased ventilation
  - Increased odor retention
- This set up the proliferation of microorganisms
- Combine that with materials that gave off high VOCs and the result is increase incidence of illness
Indoor Air Pollution Sources

- Mold and bacteria
- Carbon monoxide fumes from attached garage
- Chemicals released from building and furnishing materials
- Tobacco smoke (fig 10-18)
- Gases including radon seeping through foundation

Fig 10-16

Smoker Lungs
Indoor Air Quality

- EPA estimates that indoor air pollutants cause 6,000 deaths each year (mostly in the form of cancer)
- Indoor air must be turned over at a rate of ½ hour to 5 hours
- Any combustion must be ventilated directly outside
- This is a problem in developing countries where they use biomass fuels for stovetop cooking.
  - Exposes family to may pollutants
- Sick Building Syndrome vs. Building Related Illness

Poor Indoor Air Quality

- Related to exacerbation of asthma and bronchitis
- Associated with:
  - Legionnaires’ disease
  - Hypersensitivity pneumonitis
  - Multiple chemical sensitivity
- Sick Building Syndrome vs. Building Related Illness

Green Building Design

- Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building’s life-cycle from site to design, construction, operation, maintenance, renovation and deconstruction.
- Green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:
  - Efficiently using energy, water, and other resources
  - Protecting occupant health and improving employee productivity
  - Reducing waste, pollution and environmental degradation
- Green buildings may
  - incorporate sustainable materials in their construction
  - create healthy indoor environments with minimal pollutants
  - and/or feature landscaping that reduces water usage
Green Building Design
Although concepts of green design date back throughout history, the contemporary green building movement formed in the 1990s.


Green Building for Schools video

Components of Green Building
- Energy Efficiency and Renewable Energy
- Water Efficiency
- Environmentally Preferable Building Materials and Specifications
- Waste Reduction
- Indoor Air Quality
- Smart Growth and Sustainable Development

Components of Green Building

Energy Efficiency and Renewable Energy
- EPA and U.S. Department of Energy’s ENERGY STAR® program promotes partnerships with homebuilders, office building managers, product manufacturers, and many other organizations to improve the energy efficiency of homes, buildings, and various building components and appliances.
- Cool Roofs
  - A high solar reflectance is the most important characteristic of a cool roof as it helps to reflect sunlight and heat away from a building, reducing roof temperatures.
  - A high thermal emittance also plays a role, particularly in climates that are warm and sunny.
Components of Green Building

**Green Roofs**
- A green roof, or rooftop garden, is a vegetative layer grown on a rooftop. Green roofs provide shade and remove heat from the air through evapotranspiration, reducing temperatures of the roof surface and the surrounding air.
- On hot summer days, the surface temperature of a green roof can be cooler than the air temperature, whereas the surface of a conventional rooftop can be up to 90°F (50°C) warmer.

Components of Green Building

**Water Efficiency**
- EPA’s WaterSense program promotes and enhances the market for water-efficient products and services and educates homeowners, businesses, landscapers and others.
  - High efficiency toilets
  - Water saving faucets and shower heads
  - Weather- or Sensor-based irrigation control systems

Components of Green Building

**Environmentally Preferable Building Materials and Specifications**
- EPA’s Industrial Materials Recycling Program provides information on how industrial materials, such as coal combustion products, foundry sand, and construction and demolition debris, can be recycled to meet the material needs of our construction industry.
- Industrial materials can be recycled in construction applications because they have many of the same chemical and physical properties as the virgin materials they replace.
- In some cases, they can even improve the quality of a product.
- Low or no toxic emissions in the production of or building use of materials
Components of Green Building

Waste Reduction

- Engineers in the building-materials business have designed all kinds of products to save lumber by using optimal value engineered (OVE) joists and beams that require minimal trimming and boring for mechanical runs.
- Green builders can go as far as recycling job-site waste and using it for mulch in the newly planted yard.

Indoor Air Quality

- Air-tight houses are critical to energy efficiency, but an unwelcome result is indoor air quality that is five times more polluted than the air outdoors.
- Green builders often use some kind of fresh-air ventilation to exhaust the stale indoor air to the outside, bring in fresh air and conserve energy.

Smart Growth and Sustainable Development

- Some of the factors involved are orientation of the house to maximize natural sunlight for heat and light, as well as shade for cooling.
- As a result, the home’s furnace and air conditioning don’t have to work as hard to maintain a comfortable house.
- Another goal is making a minimal impact on the area in which the house is built.
- Forget clear-cutting the entire lot; take down only the trees and bushes that would interfere with construction. The remaining trees can help cool the house in the summer and act as a windbreak in the winter.
- And locating the home near shopping and other services will keep the amount of driving down; a win for the entire environment.
LEED Certification

- **Leadership in Energy and Environmental Design**
  - LEED is an internationally recognized certification system that measures how well a building or community performs across all the metrics that matter most
    - energy savings, water efficiency, CO₂ emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts
  - Created by the USGBC to provide guidance to builders, maintenance, and operators to establish best practices in regards to environmental impact
- LEED Building example
- [www.harford.edu/greenhcc](http://www.harford.edu/greenhcc)