



How do you define sustainability?

Meeting the needs of the world's
current population without
compromising the ability of future
generations to meet their needs.

“the ability of an ecosystem to
maintain a defined/desired state of
ecological integrity over time”

~ US EPA



What is sustainable development?

Sustainable development is concerned with the development of a society where the costs of development are not transferred to future generations, or at least an attempt is made to compensate for such costs.

Pearce (1993)

Sustainable Design Seeks...

...to design, construct and operate buildings to reduce negative impacts on the environment, and increase the health and comfort of building occupants, with the goal of improving building performance.

The Building Industry

- **Buildings account for 35% of CO₂ emissions**
- **Use over 75% of PVC**
- **Use 25% of harvested virgin wood**
- **Use 40% of energy resources**
- **Construction & demolition generate >25% of municipal solid wastes**

What are we dealing with?

Since 1950...

- **The average house size in the U.S.: Increased 105%**
- **Living space per occupant: Increased 276%**
- **Area of forest required to provide annual wood need:**
 - global average = 0.7 acres per person**
 - US citizen = 1.7 acres**

What are we dealing with?

Consider the environmental pollutants generated by construction...

- **Total annual U.S. construction & demolition debris: 136 million tons**
- **Vinyl used in construction annually: More than 7 billion pounds**
- **Ozone-depleting substances used for U.S. building systems: 60%**

What are we dealing with?

- **Americans spend 90% of their time indoors. There are currently more than 17 million asthma sufferers in the U.S and 38% of the American population are affected by allergies.**
- **Over the last twenty years... The prevalence of asthma increased 75%**
- **The number of school days children miss annually in the U.S. from asthma reached 10 million**
- **Annual deaths from asthma in the U.S reached 5,300.**
- **Annual U.S. direct health care costs for asthma; More than \$9.8 billion (plus indirect costs from lost productivity of \$2.8 billion)**

Volatile Organic Compounds (VOCs)

- **Organic compounds contain carbon-hydrogen bonds**
- **Can occur naturally or be manufactured**
- **Most synthetic organic compounds are petrochemicals**
- **Organic compounds that readily release vapors at room temperature are VOCs**

Types of VOCs

- **Primary VOCs: propane, butane, benzene, xylene, paraffins, toluene, and styrene**
- **Intermediate: formaldehyde, phenols, acetone, isopropanol, acetaldehyde**
- **End products: solvents, waxes, lacquers, synthetic detergents, synthetic fibers, and paints**

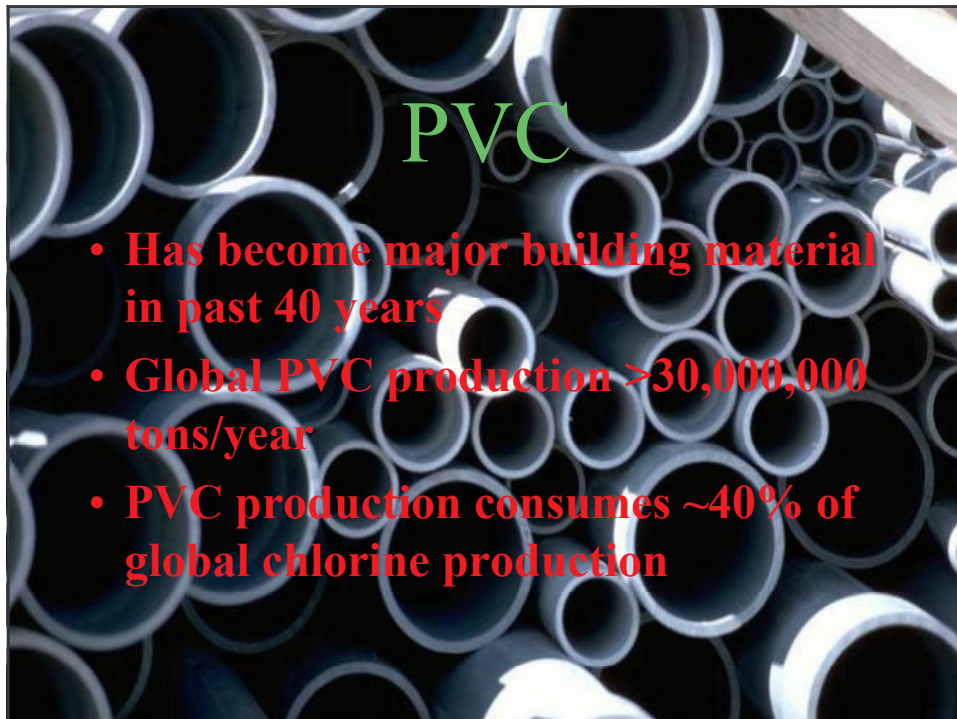


Formaldehyde

- Used widely as a component of glues/adhesives, and as preservative in paints and coatings
- UF resins in pressed wood products are the most significant formaldehyde source in homes
- MDF has highest resin to wood ratio

Effects of formaldehyde

- Short term exposure: watery eyes; burning sensations of the eyes, nose, and throat; coughing; wheezing; nausea; and skin irritation
- Long term exposure: studies of industrial workers have suggested that formaldehyde exposure is associated with nasal cancer and nasopharyngeal cancer, and possibly with leukemia. (EPA, 1987; IARC, 2004)

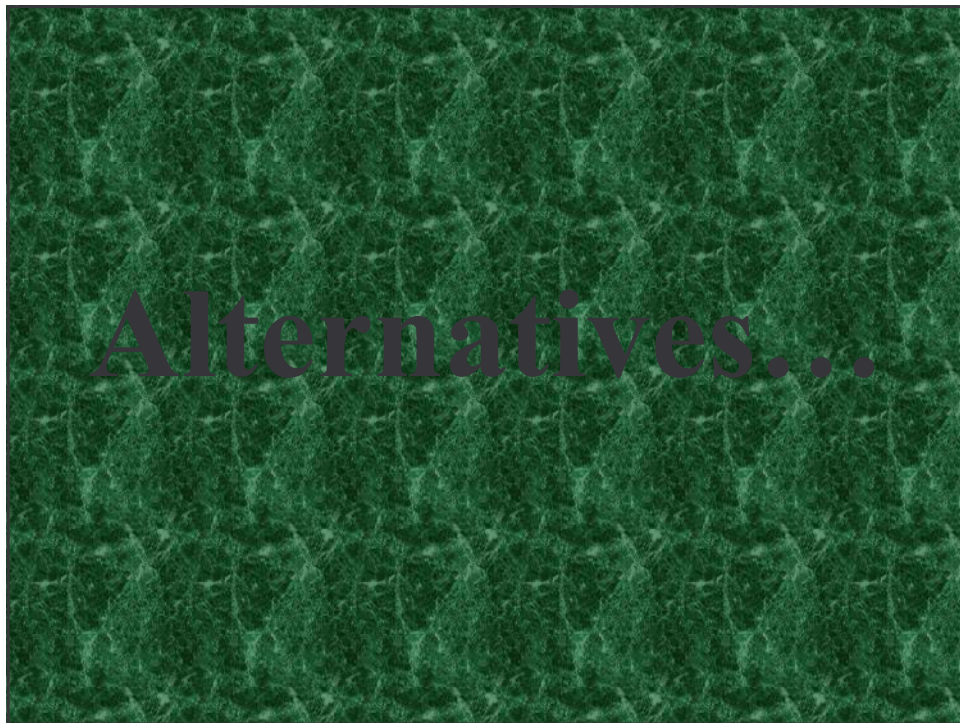


Hazards of PVC

- Hazardous by-products are formed throughout PVC lifecycle
- Production: huge quantities (1,000,000 tons/year) of chlorine-rich hazardous wastes are released during production
- Combustion: incineration of vinyl products in waste stream, recycling of metal-vinyl products, accidental fire create and release more by-products into environment

PVC effects

- **Persistence:** resists natural degradation, builds up. Ubiquitous global pollutant – “Absolutely every person on earth is now exposed to these substances.” (Thornton, HBN)
- **Bioaccumulation:** fat soluble. Magnify up food chain.
- **Toxicity:** Cancer, Endocrine disruptor, reproductive impairment, child development/birth defects, neurotoxicity, immune system suppression.



Sustainable Design Principles

- Site: Optimize site potential**
- Water: Protect and conserve water**
- Energy: Minimize nonrenewable energy consumption**
- O&M: Optimize operational & maintenance practices**
- IEQ: Enhance indoor environmental quality**
- Materials: Use environmentally preferable products**

These principles of sustainable design were developed by an inter-agency working group which convened after the release of E.O. 13123, Greening the Government Through Efficient Energy Management.

Potential Benefits

- **Reduced Operating Costs**
- **Efficient Operations & Maintenance**
- **Increased Building Value (commercial sector)**
 - **Buildings leasing faster**
- **Increased Productivity**
 - **5-14%**
- **Increased Employee/Occupant Satisfaction**
 - **Daylighting, thermal comfort, indoor environmental quality**

Potential Benefits

- **Conservation of Natural Resources**
- **Reduced Waste**
 - **During construction and operation**
- **Increased Local Business Opportunities**
 - **Use of local materials; community involvement**
- **Community Perception**
 - **Increase in environmental awareness**
- **Reduced Liability Risk**
- **Staying Ahead of Regulation**

Thank You

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