



PDHonline Course G254W (2 PDH)

Principles of Sustainable Design for Buildings (Live Webinar)

Instructor: J. Paul Guyer, P.E., R.A., Fellow ASCE, Fellow AEI

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PRINCIPLES OF SUSTAINABLE DESIGN FOR BUILDINGS

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PRESENTER

J. PAUL GUYER, P.E., R.A.

Registered Mechanical Engineer, Civil Engineer, Fire Protection Engineer and Architect with 35 years building design experience and an additional 9 years experience as a senior staff advisor to the California Legislature on capital outlay and infrastructure issues, including sustainability. Has held numerous local, state and national positions with the American Society of Civil Engineers and the National Society of Professional Engineers.

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Design and construction of buildings and related infrastructure create major direct and indirect impacts on the environment. For example, in the United States, buildings:

- ❑ Consume 39% of total energy use
- ❑ Consume 12% of total water consumption
- ❑ Consume 68% of total electricity consumption
- ❑ Cause 38% of carbon dioxide emissions

In recognition of this growing issue the concept of "sustainable design" has arisen in recent years. Unfortunately this approach is frequently described as "integrated" or "synergistic" or "holistic" or similar terms that are not particularly definitive.

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The concept of "sustainable design" is evolving and imprecise. The federal government has suggested....

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"Sustainability is an ideal. The real-world implementation of sustainable building relies upon balancing the environmental, economic, and social impacts. It also relies upon a commitment to continual improvement in efforts to achieve the ideal. In striving for sustainability, decisions and their implementation should be continually monitored, assessed, and adjusted, as necessary, in a process that incorporates continual improvement. Appropriate Sustainable Building Requirements will depend on the size, complexity, and potential direct and indirect impacts of the proposed building.

Small projects may want to cite performance requirements for specific product categories such as interior finishes, lighting, or landscaping. Most projects, however, will want to provide greater latitude in the design/build response. Therefore, it is more typical to cite performance requirements for the building as a whole."

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This seminar is about an approach to sustainable design that is structured and lends itself to the building design process. It consists of....

- ❑ PRINCIPLES
- ❑ OPPORTUNITIES
- ❑ RESOURCES

Principles are the objectives of sustainable design. Opportunities are things that may be done to optimize a specific project in recognition of one of the Principles. Resources are published manuals, guides and data bases that are available to assist in optimizing implementation of an opportunity.

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The first question is, what are the **PRINCIPLES** of “sustainable design”....

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The federal government has recognized that “Sustainable design is an evolving field.” Within that framework of uncertainty, these are how federal facilities managers defined the **PRINCIPLES** of sustainable design for buildings in 2006:

- ❑ EMPLOYING INTEGRATED DESIGN
- ❑ OPTIMIZING ENERGY PERFORMANCE
- ❑ PROTECTING AND CONSERVING WATER
- ❑ REDUCING THE ENVIRONMENTAL IMPACT OF MATERIALS
- ❑ ENHANCING INDOOR ENVIRONMENTAL QUALITY

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This is another definition **PRINCIPLES** of sustainable design found in authoritative literature....

- ❑ OPTIMIZATION OF SITE POTENTIAL
- ❑ OPTIMIZING ENERGY USE
- ❑ PROTECTION AND CONSERVATION OF WATER
- ❑ SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS
- ❑ ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY
- ❑ OPTIMIZATION OF OPERATIONS AND MAINTENANCE PRACTICES

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A comparison shows fairly good agreement....

<ul style="list-style-type: none"> ❑ EMPLOYING INTEGRATED DESIGN ❑ OPTIMIZING ENERGY PERFORMANCE ❑ PROTECTING AND CONSERVING WATER ❑ REDUCING THE ENVIRONMENTAL IMPACT OF MATERIALS ❑ ENHANCING INDOOR ENVIRONMENTAL QUALITY 	<ul style="list-style-type: none"> ❑ OPTIMIZATION OF SITE POTENTIAL ❑ OPTIMIZING ENERGY USE ❑ PROTECTION AND CONSERVATION OF WATER ❑ SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS ❑ ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY ❑ OPTIMIZATION OF OPERATIONS AND MAINTENANCE PRACTICES
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In this discussion we will use the principles on the right because of the imprecision in the term “integrated design”, the importance of “site potential”, and the fact that “operations and maintenance practices” are often driven by design decisions.

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These, then, will be the principles **PRINCIPLES** of sustainable design we will use in this discussion....

- ❑ OPTIMIZATION OF SITE POTENTIAL
- ❑ OPTIMIZING ENERGY USE
- ❑ PROTECTION AND CONSERVATION OF WATER
- ❑ SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS
- ❑ ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY
- ❑ OPTIMIZATION OF OPERATIONS AND MAINTENANCE PRACTICES

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In this presentation we will be looking at the **OPPORTUNITIES** that may exist in the building design and construction process that will optimize a specific project in recognition of these **PRINCIPLES**, and **RESOURCES** that may be available to provide guidance in applying these **OPPORTUNITIES**.

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PRINCIPLE: *OPTIMIZATION OF SITE POTENTIAL*

OPPORTUNITIES....

❑ Minimize Development of Open Space

- Renovate and/or expand an existing building
- Use previously disturbed land

❑ Control Erosion Through Landscaping Practices

- Use vegetation, grading and soil stabilization measures to minimize erosion
- Capture and retain storm water runoff on site and incorporate retention features such as pervious pavement in project design
- Reduce runoff of site using vegetated swales and depressions

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PRINCIPLE: *OPTIMIZATION OF SITE POTENTIAL*

OPPORTUNITIES....

❑ Consider Energy Implications in Site Selection and Building Orientation

- Site buildings to maximize opportunities for use of active and passive solar systems
- Take advantage of natural ventilation
- Optimize daylighting opportunities
- Examine the potential impacts future development adjacent to the site may have on opportunities such as solar systems and daylighting

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PRINCIPLE: *OPTIMIZATION OF SITE POTENTIAL*

OPPORTUNITIES....

❑ Use Building Design and Landscaping Techniques to Reduce Heat Islands

- Use new and existing trees to shade parking lots, walkways and other open areas
- In warm, sunny climates consider covering parking lots, walkways and other areas that are paved or constructed with low reflective materials
- Use roofing systems with a top layer of light colored and/or high-reflectance and high emissivity material to reduce cooling load
- Use roofing products that meet or exceed *Energy Star* standards

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PRINCIPLE: *OPTIMIZATION OF SITE POTENTIAL*

OPPORTUNITIES....

❑ Minimize habitat disturbance

- Minimize land disturbance and retain prime vegetation to the extent possible
- Reduce building and paving footprints
- Minimize disturbance of site around building perimeter, such as by locating it closer to existing utilities
- In cold climates, site parking lots and walkways so they have sun exposure to assist in melting snow
- In cold climates, use ice and snow removal methods that are non-toxic

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PRINCIPLE: *OPTIMIZATION OF SITE POTENTIAL*

OPPORTUNITIES....

❑ Restore degraded sites

- Minimize land disturbance and retain prime vegetation
- Optimize utilization of native and drought-resistant plants

❑ Design for Sustainable Transportation

- Site the building to coordinate with public transportation systems
- Use porous paving materials where practicable
- Reduce on-site parking to encourage use of public transit
- Incorporate features to encourage bicycling, car pooling, walking
- Provide refueling/recharging facilities for alternative energy vehicles

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PRINCIPLE: *OPTIMIZATION OF SITE POTENTIAL*

OPPORTUNITIES....

❑ Coordinate Site Sustainability with Safety and Security

- For example, site features such as retention ponds and berms can also limit access to a building
- Existing and new trees and vegetation can conceal buildings and people for security reasons

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PRINCIPLE: OPTIMIZATION OF SITE POTENTIAL

RESOURCES....

(Hint: "Googling" the publication title will usually get you to a site that provides access to the publication....sometimes at no cost, sometimes at a cost.)

- ☐ Federal Green Construction Guide for Specifiers
- ☐ U.S. Army, ERDC - CERL - Sustainable Design and Development Resource website
- ☐ DOE Office of Energy Efficiency and Renewable Energy (EERE), Building Technologies Program
- ☐ DOE Office of Energy Efficiency and Renewable Energy (EERE), High Performance Buildings Database
- ☐ DOE Greening Federal Facilities Guide
- ☐ GSA LEED Applications Guide
- ☐ EPA Managing Your Environmental Responsibilities: A Planning Guide for Construction and Development

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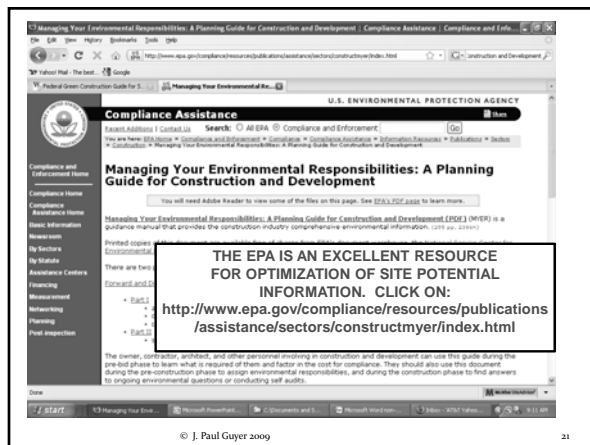
The Federal Green Construction Guide for Specifiers

To address the need for a comprehensive guide for procuring green building products and construction services within the Federal government, EPA has partnered with the Federal Environmental Executive and the Whole Building Design Guide (WBDG) to develop model green construction specification language to be used to supplement full project specifications and to green agency guide specifications. The *Federal Green Construction Guide for Specifiers* is assisting Federal agencies in meeting environmental mandates, the Federal Leadership in High Performance and Sustainable Buildings MOU, and EPA and DOE program recommendations. In addition, the *Guide* provides system and metrics for Construction *Guide* provide flexibility in application. A new version reflecting public comments will be released in winter 2006.

THE FEDERAL GREEN CONSTRUCTION GUIDE FOR SPECIFIERS IS A RESOURCE FOR OPTIMIZATION OF SITE POTENTIAL (AND OTHER) INFORMATION. CLICK ON: <https://fedgreenspecs.wbdg.org>

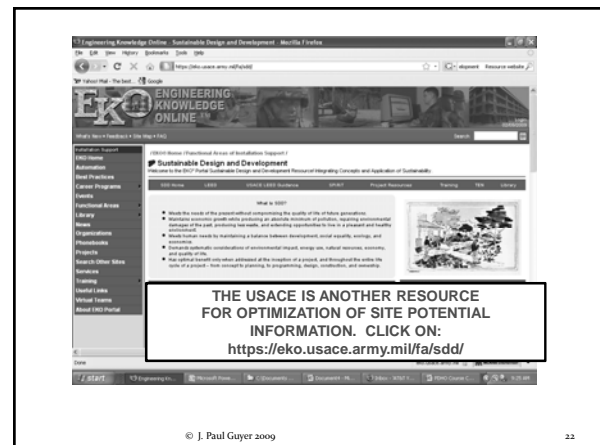
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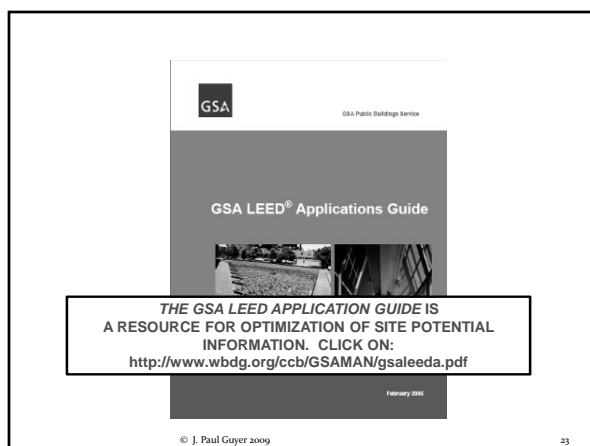
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PRINCIPLE: OPTIMIZING ENERGY USE

OPPORTUNITIES....

- ☐ Reduce Cooling, Heating and Lighting Loads by Using Climate-Responsive Design and Conservation Practices

- Use passive solar design
- Orient, size and specify windows to maximize energy efficiency
- Use high performance materials in building envelope based on thermal properties and durability
- Locate landscaping with solar energy and building load requirements in mind

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PRINCIPLE: *OPTIMIZING ENERGY USE*

OPPORTUNITIES....

❑ **Employ High-Efficiency and Renewable Energy Sources**

- Solar water heating
- Photovoltaic devices
- Biomass
- Geothermal heat pumps
- Consider purchasing electricity from renewable and low-pollution sources

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PRINCIPLE: *OPTIMIZING ENERGY USE*

OPPORTUNITIES....

❑ **Specify Efficient HVAC and Lighting Systems**

- Specify systems and equipment that meet or exceed 10 CFR 434
- Lighting systems < 1 watt/SF
- Energy Star® approved products, exceed DOE standards
- Consider energy recovery systems
- Consider co-generation, fuel cells, thermal storage, etc.

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PRINCIPLE: *OPTIMIZING ENERGY USE*

OPPORTUNITIES....

❑ **Optimize Building Performance and System Control Strategies**

- Employ energy modeling programs early in design process
- Use sensors to control systems based on occupancy, schedule, daylight and natural ventilation
- Evaluate use of modular components such as boiler, chillers, etc. to optimize part-load efficiency
- Use smart controls and building automation systems

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PRINCIPLE: *OPTIMIZING ENERGY USE*

OPPORTUNITIES....

❑ **Monitor Project Performance**

- Use a building commissioning plan extension throughout life of the project
- Use metering to confirm building energy and environmental performance throughout life of the project

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PRINCIPLE: *OPTIMIZING ENERGY USE*

RESOURCES....

(Hint: "Googling" the publication title will usually get you to a site that provides access to the publication....sometimes at no cost, sometimes at a cost.)

- ❑ Federal Green Construction Guide for Specifiers
- ❑ LEED® Version 2.1 Credit / WBDG Resource Page Matrix
- ❑ Energy Design Resources
- ❑ Energy Star®
- ❑ DOE Federal Energy Management Program
- ❑ DOE High Performance Buildings
- ❑ DOE National Renewable Energy Laboratory
- ❑ Renewable Energy Policy Project
- ❑ Center for Renewable Energy and Sustainable Technology
- ❑ GSA LEED® Applications Guide
- ❑ GSA LEED® Cost Study
- ❑ GSA P100 Facilities Standards for the Public Buildings Service

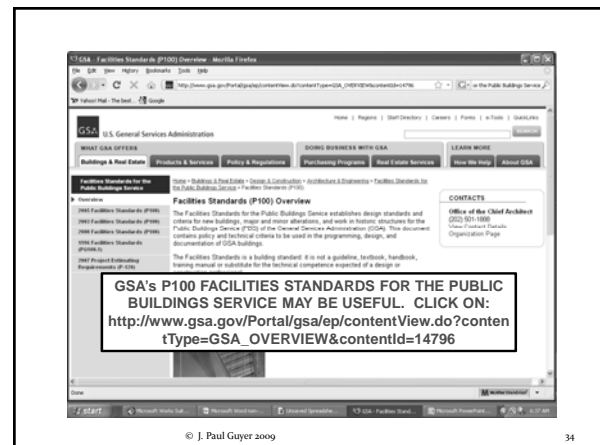
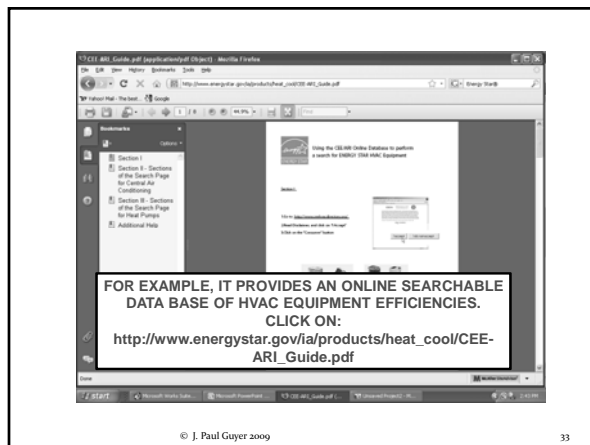
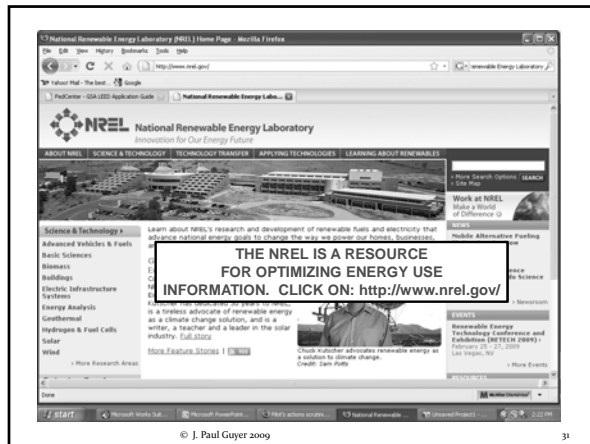
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THE DOE IS AN EXCELLENT RESOURCE FOR OPTIMIZING ENERGY USE INFORMATION. CLICK ON: <http://www1.eere.energy.gov/femp/>

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PRINCIPLE: PROTECTION AND CONSERVATION OF WATER

OPPORTUNITIES....

☐ Reduce, Control, Treat Surface Runoff

- Use vegetated swales and depressions to reduce runoff
- Reduce and filter surface runoff
- Use integrated pest management to reduce water pollution from pesticides
- Consider incorporating green roofs into project
- Consider transient storm water events in the overall management of surface water runoff (such as use of retention and groundwater recharge basins)
- Use EPA's Green Infrastructure guidelines

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PRINCIPLE: PROTECTION AND CONSERVATION OF WATER

OPPORTUNITIES....

☐ Use Water Efficiently

- Incorporate efficiency in construction specifications
- Use ultra water-efficient plumbing fixtures and integrate other water saving devices into building
- Landscape with drought resistant native plants
- Meter water usage
- Install water-conserving water towers with delimiters to reduce evaporation and drift
- Eliminate leaks by caulking around pipes and plumbing fixtures and conducting annual checks of hoses and pipes
- Specify EPA WaterSense labeled water-efficient products

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PRINCIPLE: PROTECTION AND CONSERVATION OF WATER

OPPORTUNITIES....

❑ Protect Water Quality

- Install water quality ponds or oil/grit separators as part of runoff filtration system
- Eliminate materials can release lead pollutants
- Use non-toxic cleaning products

❑ Recover Non-Sewage and Greywater for On-Site Use

- Use non-sewage waste water for on-site landscape irrigation, where approved by local officials
- Use groundwater and roof drainage water for on-site uses
- Use groundwater from sump pumps

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PRINCIPLE: PROTECTION AND CONSERVATION OF WATER

OPPORTUNITIES....

❑ Design Waste Treatment and Recycling Programs

- Use biological waste treatment systems to treat waste on-site
- Treat greywater, ground water and roof water to an acceptable standard for re-use of site

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PRINCIPLE: PROTECTION AND CONSERVATION OF WATER

RESOURCES....

(Hint: "Googling" the publication title will usually get you to a site that provides access to the publication...sometimes at no cost, sometimes at a cost.)

- ❑ Federal Green Construction Guide for Specifiers
- ❑ DOE Federal Energy Management Practices for Water Conservation
- ❑ International Storm Water Best Management Practices Database
- ❑ LEED® Version 2.1 Credit / WBDG Resource Page Matrix
- ❑ EPA Office of Water
- ❑ EPA Office of Wastewater Management
- ❑ EPA National Pollutant Discharge Elimination System
- ❑ EPA Water Use Efficiency Program
- ❑ USCG Beneficial Landscaping Guidance
- ❑ EPA Storm Water Management for Construction Activities
- ❑ EPA Low Impact Development
- ❑ Water Wiser – The Water Efficiency Clearinghouse

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THE DOE IS AN EXCELLENT RESOURCE FOR PROTECTION AND CONSERVATION OF WATER INFORMATION. CLICK ON: http://www1.eere.energy.gov/femp/water/water_bmp.html

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EPA'S WATER-SENSE SITE MAY BE USEFUL. CLICK ON: <http://www.epa.gov/watersense/>

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EPA'S WASTEWATER MANAGEMENT SITE MAY BE USEFUL. CLICK ON: <http://www.epa.gov/owm/>

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ Renovate Existing Facilities, Products and Equipment

- Evaluate renovation and/or expansion of an existing building instead of constructing a new building
- Use reconditioned products, furniture and equipment whenever economically practical and resource efficient
- Consider reusing components of an existing building (such as windows, doors, etc.) in construction of a new building or renovation of an existing one

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ Evaluate Environmental Preferability Using Life Cycle Assessment (LCA) Tools

- Consider trade offs among multiple environmental impacts (resource depletion, global warming, etc.)
- Utilize LCA tools such as ATHENA and BEES
- Consider trade offs among life-cycle stages (raw materials acquisition, manufacturing, transportation, installation, use and waste management)
- Consider USDA Biobased Products

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ Maximize the Recycled Content of All New Materials

- Use EPA-designated recycled content products
- Purchase products described in EPA's Environmentally Preferable Purchasing Program
- Consider environmental factors along with price and performance in purchasing decisions (the "EPP" process)
- Emphasize pollution prevention as part of the purchasing process
- Examine multiple environmental attributes throughout the product life cycle

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ Maximize the Recycled Content of All New Materials (continued)

- Compare environmental impacts when selecting products
- Collect accurate and meaningful information about environmental performance of products
- Evaluate use of materials and products with the highest percentage of recycled content
- Evaluate use of materials and products with low energy content

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ Specify Materials Harvested on a Sustainable Yield Basis

- Use timber products verified from sustainably managed forests
- Evaluate substitution of bio-based materials or products (such as agricultural fiber sheathing) for inert or non-recycled alternatives
- Specify rapidly renewable materials that regenerate in 10 years or less (such as bamboo, cork, wool and straw)

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ Encourage the Use of Recyclable Assemblies and Products

- Evaluate the use of demountable or deconstructable products and assemblies
- Establish a waste management plan in cooperation with users to encourage recycling
- Consider providing locations at the project site for organic waste composting

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ **Limit Construction Debris**

- Require development and implementation of a plan for sorting construction waste for recycling
- Use products that minimize disposable packaging and storage
- Consider designing a facility for ultimate deconstruction (rather than demolition)

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ **Eliminate the Use of Materials that Pollute or are Toxic During Their Manufacture, Use or Reuse**

- Use materials and assemblies with the lowest level of volatile organic compounds (VOCs)
- Eliminate the use of asbestos, lead and PCBs in products and materials
- Eliminate the use of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) as HVAC refrigerants

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ **Eliminate the Use of Materials that Pollute or are Toxic During Their Manufacture, Use or Reuse (continued)**

- Consider specification of products and materials whose manufacture does not pollute or create toxic conditions for manufacturing workers
- Avoid ground-level ozone in buildings to protect health of building occupants and prevent damage to vegetation and ecosystems

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

OPPORTUNITIES....

❑ **Give Preference to Locally Produced Materials with Low Embodied Energy Content**

- Consider locally produced products and materials to reduce impacts associated with transportation from remote locales
- Consider the use of products and materials that have minimal embodied energy (energy required for their manufacture, harvest, extraction, transportation, installation and/or use)

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PRINCIPLE: *SELECTION AND USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS*

RESOURCES....

(Hint: "Googling" the publication title will usually get you to a site that provides access to the publication....sometimes at no cost, sometimes at a cost.)

- ❑ Federal Green Construction Guide for Specifiers
- ❑ ASTM E2129 Standard Practice for Data Collection for Sustainability Assessment of Building Products
- ❑ ISO 14040 Series: Life Cycle Assessment Standards
- ❑ DOD Green Procurement Requirements Overview
- ❑ DOD Green Procurement Program (GPP)
- ❑ GSA Facilities Standards for the Public Buildings Service
- ❑ GSA Construction Waste Management Data Base
- ❑ LEED® Version 2.1 Credit
- ❑ NREL U.S. Life-Cycle Inventory (LCI) Database
- ❑ DLA Green Procurement Program

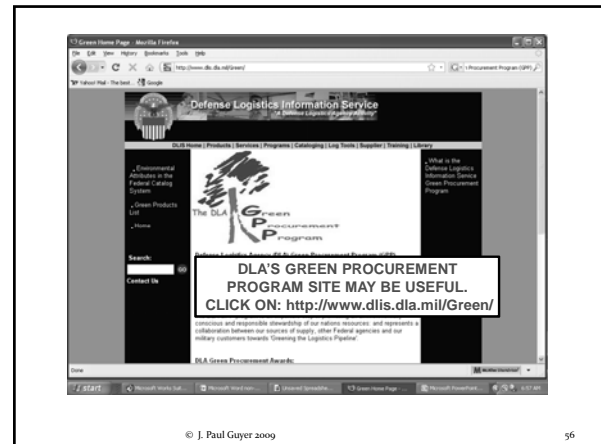
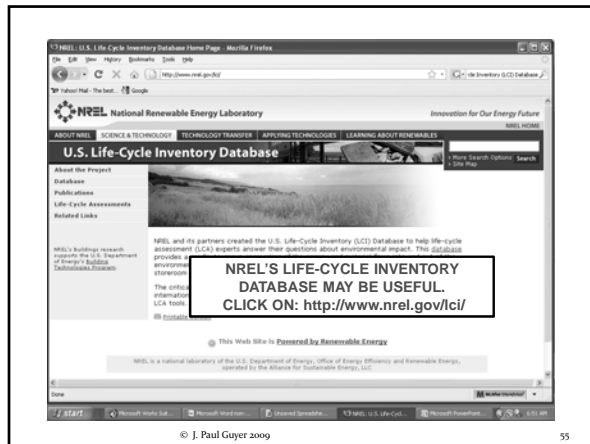
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The screenshot shows the EPA's Environmentally Preferable Purchasing (EPP) website. A prominent text box in the center reads: "THE EPA IS AN EXCELLENT RESOURCE FOR ENVIRONMENTALLY PREFERABLE PRODUCTS INFORMATION. CLICK ON: <http://www.epa.gov/epp/index.htm>". The website layout includes a header with the EPA logo and navigation links, and a sidebar with categories like "EPP Home", "Basic Information", and "Federal EPP Efforts".

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PRINCIPLE: ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY

A COMMENT:

☐ **Keep your eye on the ball....**

- Understand what you are doing when you are designing a building. Do not forget that your primary objective is to design and construct a building that is functional, efficient and contributes to a constructive environment for occupants and visitors.
- Yes, sustainability is important....but it is not the primary objective of your project. If it were we would have lots of buildings that were environmentally efficient and dysfunctional from the standpoint of function, efficiency and occupant response.
- That having been said....enhancement of indoor environmental quality is a principle of sustainability.

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PRINCIPLE: ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY

☐ **So you need to focus on enhancement of indoor environmental quality....**

☐ **Facilitate Quality Indoor Environmental Quality (IEQ) through Good Design, Construction and Operations and Maintenance (O&M) Practices**

OPPORTUNITIES....

☐ **Value Aesthetic Decisions**

- In addition to code requirements, appreciate the importance of providing windows in occupied spaces for natural ventilation and view.
- Appreciate the aesthetic dimension of buildings.

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PRINCIPLE: ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY

OPPORTUNITIES....

☐ **Provide Thermal Comfort**

- Use *ASHRAE Standard 55 - Thermal Environmental Conditions for Human Occupancy* as the basis for thermal comfort
- Consider the use of under-floor air distribution using an access-flooring system for flexibility, focused personal comfort control and energy utilization efficiency
- Understand the importance of moisture control in roof and wall assemblies
- Evaluate options and benefits to be derived from specifying high-thermal performance windows

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PRINCIPLE: ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY

OPPORTUNITIES....

☐ **Supply Adequate Levels of Ventilation and Outside Air**

- Design ventilation systems to meet or exceed the requirements of *ASHRAE Standard 62 – Ventilation for Acceptable Indoor Air Quality*
- Protect key ventilation system components (ducts, etc.) from contamination during construction
- Commission HVAC systems to ensure they perform as designed (CFMs, temperatures, etc.).
- HVAC systems should be installed with filters with Minimum Efficiency Reporting Value (MERV) of 7

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ Supply Adequate Levels of Ventilation and Outside Air (continued)

- Evaluate thermal efficiencies that can be realized with separate outside and conditioned air distribution systems
- Ensure that outside air intakes are located away from contamination sources such as loading docks, fume exhausts from the building, etc.
- Prevent vehicles from idling near outside air intakes
- Consider installing purge fans at contaminant sources, such as parking garage exist kiosks

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ Supply Adequate Levels of Ventilation and Outside Air (continued)

- Consider installation of a permanent air quality monitoring system to ensure acceptable air quality levels are maintained ($\text{CO}_2 < 1000$ PPM, $\text{CO} < 2$ PPM, etc.)
- Consider building security when locating and designing outside air intakes
- Ensure that air filters are of the proper type and are changed/cleaned on a regular schedule

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ Prevent Airborne Bacteria, Mold, and Other Fungi

- Ensure HVAC system is designed to control interior humidity at the 1% humidity ratio and mean coincident dry bulb temperature, under both extreme and low load conditions
- Building envelope must contain moisture barriers to prevent moisture infiltration
- Ensure the spore count in interior air is less than that in outdoor air, and should be < 700 spores/ m^3

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ Limit Spread of Pathogens

- In hospitals and other facilities at risk of pathogen contamination, ensure proper maintenance procedures are maintained
- In hospitals and other facilities at risk of pathogen contamination, consider designing restrooms without doors (with appropriate access paths and screens to block sightlines from occupied spaces such as corridors, offices and waiting rooms) to reduce chance of acquiring infection

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ Avoid Use of Materials Containing High Levels of Pollutants

- Limit the use of cleaners, paints, adhesives and sealants containing high levels of volatile organic compounds (VOCs)
- Avoid products such as wall panels, cabinetry and carpet that contain formaldehyde
- In existing buildings where asbestos is present, remove it or contain it (such as by encapsulation) to prevent future exposure
- In areas where radon is a significant presence, include measures to control and mitigate its buildup

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ Avoid Use of Materials Containing High Levels of Pollutants

- Provide safe and secure storage spaces for cleaning supplies
- If a portion of a building is being renovated, consider isolating it and maintaining a negative pressure in it during construction to dust, fumes and odors disturbing remaining occupants
- Ensure that office equipment does not emit objectionable odors pollutants or noise

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ **Assure Acoustic Privacy and Comfort**

- Minimize noise using sound-absorbing materials
- Provide walls, floors and ceilings with high sound loss transmission coefficients
- Consider sound masking or "white-noise" systems that introduce an unobtrusive background sound that reduces interference from distracting office noise.
- Note that an unobtrusive level of noise from an HVAC system can in some cases effectively provide good sound masking

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ **Create a High-Performance Luminous Environment**

- Use daylighting wherever practicable
- Supplement natural light with high-efficiency lamps, ballasts, fixtures and controls
- Use magnetic fluorescent lamps with high-frequency electronic ballasts to reduce flickering
- Reduce direct glare from natural and man-made light sources, particularly where reflective surfaces are in the field of view....such as computer screens
- Use task lighting and light colors on walls

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ **Provide Quality Water**

- Comply with *EPA Safe Drinking Water Act* for levels of metals and bacteria in potable water systems
- Provide proper flushing and decontamination during commissioning of new and renovated potable water systems
- Conduct periodic maintenance flushing of potable water systems to control drinking water quality issues
- Control domestic water temperature above 140° in tanks and 122° at faucets to prevent legionellae growth
- At cooling towers, consider a closed-loop rather than open system reduce potential for contamination

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ **Control Disturbing Odors**

- Directly exhaust copying and housekeeping areas and provide return air grilles to control odors and limit ozone generation
- For operations and products that produce odors and cannot be eliminated, provide architectural and HVAC isolation
- Ensure maintenance procedures remove trash and recyclables on a regular basis and do not permit undue storage on site
- If smoking is not prohibited in a building space, ensure that it has a lower static pressure than adjacent spaces, complies with *ASHRAE Standard 62*, and is isolated from the return air system of surrounding spaces.

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

OPPORTUNITIES....

❑ **Be Aware of Exposure to Electric and Magnetic Fields (EMF)**

- EMF may be perceived as harmful, however there is currently insufficient evidence to make a conclusive judgment
- Sources of information are *EMF RAPID-Electric and Magnetic Fields Research and Public Information Dissemination Program* and the *World Health Organization, Electromagnetic Fields Website*

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PRINCIPLE: *ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY*

RESOURCES....

(Hint: "Googling" the publication title will usually get you to a site that provides access to the publication....sometimes at no cost, sometimes at a cost.)

- ❑ ASHRAE Guideline 1-Guideline for the Commissioning of HVAC Systems
- ❑ ASHRAE Standard 52-Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
- ❑ ASHRAE Standard 55-Thermal Environmental Conditions for Human Occupancy
- ❑ ASHRAE Standard 62-Ventilation for Acceptable Indoor Air Quality
- ❑ ASHRAE Standard 90.1-Energy Efficient Design of New Buildings
- ❑ GSA P100 Facilities Standards for the Public Buildings Service
- ❑ EPA Indoor Air Quality website
- ❑ OSHA Indoor Air Quality website
- ❑ LEED® Green Building Rating System
- ❑ IAQ Building Education and Assessment Model (I-BEAM) software

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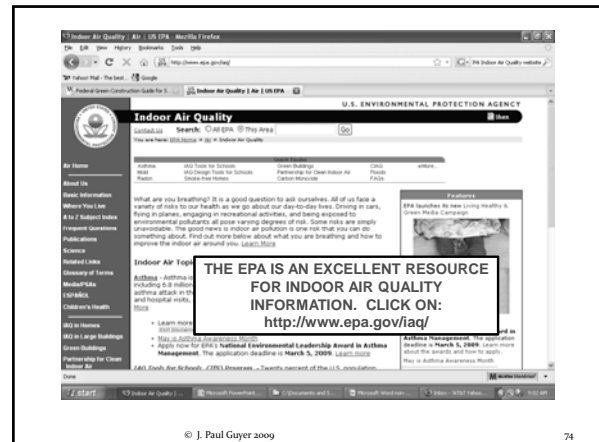
PRINCIPLE: ENHANCEMENT OF INDOOR ENVIRONMENTAL QUALITY

RESOURCES (continued)....

- ❑ NIST Multizone Modeling website
- ❑ Indoor Air Quality Information Clearinghouse
- ❑ DOE/EPA Sustainable Building Technical Manual
- ❑ DOD Minimum Anti-Terrorism Standards for Buildings
- ❑ EPA Ventilation and Air Quality in Offices
- ❑ EPA National Center for Environmental Research
- ❑ DHHS Guidance for Protecting Building Environments from Airborne Chemical, Biological or Radiological Attacks
- ❑ EPA The Inside Story: A Guide to Indoor Air Quality
- ❑ IESNA RP-5 Recommended Practice of Daylighting
- ❑ Greenguard Environmental Institute Certified Products
- ❑ GreenSeal Product Recommendations
- ❑ NAVFAC Information on Legionella or Legionnaire's Disease
- ❑ MOIST 3 software
- ❑ EPA Cleaning Products Pilot Project (CPPP)

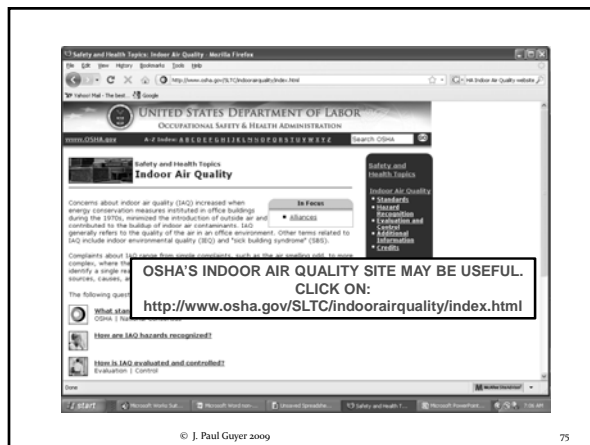
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Now we will look at some of the specifications language suggested in the *Federal Green Construction Guide for Specifiers*....

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02 41 13 (02220) Selective Site Demolition

PART 3 – EXECUTION

3.1 DECONSTRUCTION

1. Inspect and evaluate for reuse existing structures on site.
2. Disassemble existing construction scheduled to be removed for recycling or reuse.
3. Demolition will not be permitted [unless approved in writing by Owner].
4. Salvage materials for recycling and reuse as indicated on drawings.
 - A. Materials scheduled for reuse on site include: [xxxxx].
 - B. Materials scheduled for reuse off site: As specified in Section 01 74 19 (01351) - Construction Waste Management.
 - C. Materials scheduled for recycling off site: As specified in Section 01 74 19 (01351) - Construction Waste Management.

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06 90 00 (06700) Alternative Agricultural Products**PART 1 – GENERAL****1.2 DEFINITIONS**

1. Definitions pertaining to sustainable development: As defined in ASTM E2114.
2. Alternative Agricultural Products: Bio-based industrial products (non-food, non-feed) manufactured from agricultural materials and animal by-products.
3. Biobased Materials: As defined in the Farm Security and Rural Investment Act, for purposes of Federal procurement of biobased products, "biobased" means a "commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials." Biobased materials also include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by The Biomass Research and Development Act of 2000..

- A. Biobased content: The amount of biobased carbon in the material or product as a percentage of weight (mass) of the total organic carbon in the material or product.
4. Renewable resource: a resource that is grown, naturally replenished, or cleansed, at a rate which exceeds depletion of the usable supply of that resource.

- A. Rapidly renewable material: Material made from plants that are typically harvested within a ten-year cycle.

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06 90 00 (06700) Alternative Agricultural Products**1.3 SUBMITTALS**

1. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

A. Recycled Content:

1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

B. Local/Regional Materials:

1. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
2. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
4. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

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06 90 00 (06700) Alternative Agricultural Products**A. VOC data:****1. Adhesives:**

- a. Submit manufacturer's product data for adhesives. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
- b. Submit Green Seal Certification to GS-36 and description of the basis for certification.
- c. [Submit manufacturer's certification that products comply with SCAQMD #1168.] [Submit manufacturer's certification that products comply with SCAQMD Rule 1168 in areas where exposure to freeze/thaw conditions and direct exposure to moisture will not occur. In areas where freeze/thaw conditions do exist or direct exposure to moisture can occur, submit manufacturer's certification that products comply with Bay Area AQMD Reg. 8, Rule 51 for containers larger than 16 oz and with California Air Resource Board (CARB) for containers 16 oz or less.]

2. Prefabricated Composite Panels and Sheathing: Provide documentation that composite products [are third-party certified as meeting ANSI standard requirements for formaldehyde emissions] [contain no added urea-formaldehyde resins.]

B. Biobased materials:

1. Indicate type of biobased material in product.
2. Indicate the percentage of biobased content per unit of product.
3. Indicate relative dollar value of biobased content product to total dollar value of product included in project.

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06 90 00 (06700) Alternative Agricultural Products**PART 2 - PRODUCTS****2.1 MATERIALS****1. Strawboard Sheathing:**

- A. Biobased Content: Minimum [26] [xxxx] percent agricultural waste straw with no added formaldehyde binders.

2. Compressed Straw Wall Panels: Solid straw panels compressed with heat and pressure for interior partitions, surfaced with [paper to receive finish] [other surface finish as specified]. Panels are to be pre-cored their entire length with two 3/4" holes at 12" on center for electrical utilities.

- A. Biobased content: Panel core manufactured from minimum [26] [xxxx] percent agricultural waste straw with no added formaldehyde binders.

3. Biocomposite: Product shall be [Class I] [Class II] fire-rated. Color and style as selected by Architect from manufacturer's standards.

- A. Biobased Content: Minimum [26] [xxxx] percent agricultural products such as soy-based flours and resins.

4. Landscaping materials, including mulch: As specified in Division 29 (2).

5. Soy-based form release agent: As specified in Division 03 (3).

6. Furniture with biobased adhesive: As specified in Division 12 (12).

7. Ceiling Tile: As specified in Division 09 (9).

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06 90 00 (06700) Alternative Agricultural Products**PART 3 – EXECUTION****3.1 INSTALLATION OF SHEATHING**

1. Install in accordance with manufacturer's printed instructions and as specified in Section 06 16 00 (06160) - Sheathing.

3.2 INSTALLATION OF COMPRESSED STRAW WALL PANELS

1. Install in accordance with manufacturer's printed instructions and as follows:

- A. Verify that receiving surface is clean, dry, and ready to receive panels.
- B. Layout and secure metal channel track to floor and ceiling.
- C. Slide compressed straw wall panels into track, securing with [self tapping screws] at [12"] on center, both sides.
- D. Panel Joints: Join with [manufacturer's prefabricated joint clips] [gypsum board tape and mud compound] [other as specified] and prep to receive finish material.

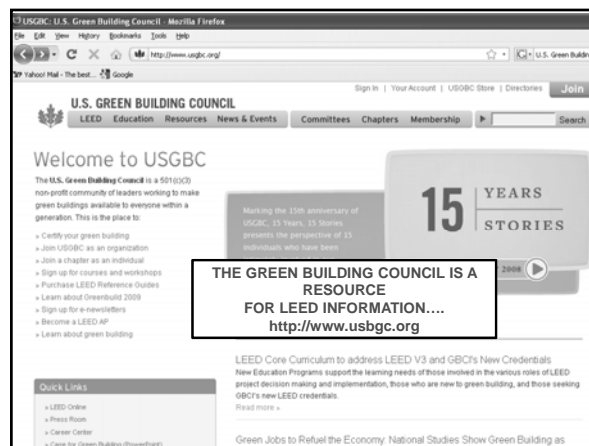
3.3 INSTALLATION OF BIOCOMPOSITE

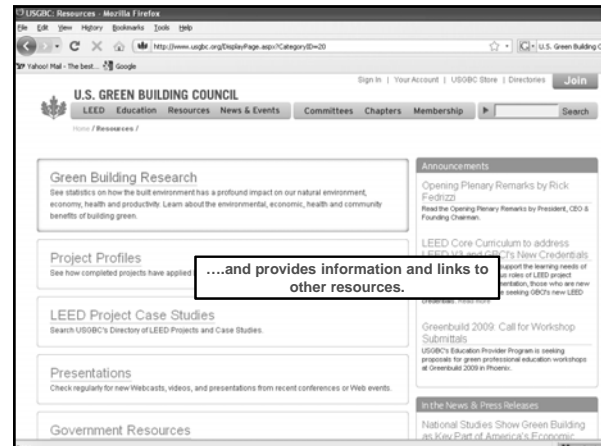
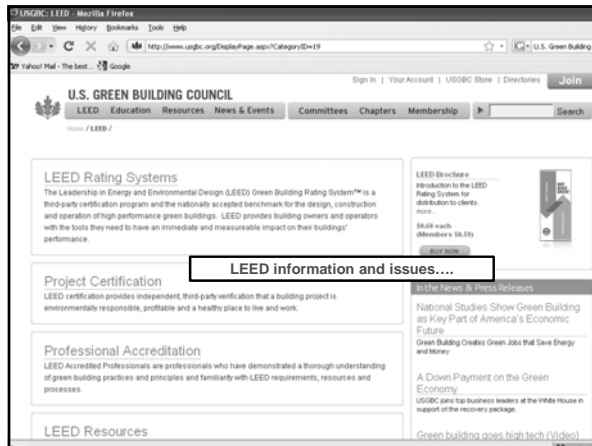
1. Install in accordance with manufacturer's printed instructions and as follows:

- A. Provide clear, water-resistant sealer on exposed surfaces.

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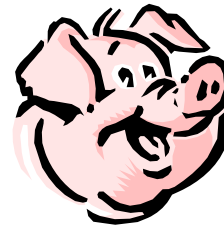
AN AFTERWORD:

HOW TO USE THE INFORMATION YOU HAVE RECEIVED IN THIS PRESENTATION

- ❑ Use the framework presented as a checklist at the start of a project to identify sustainability issues on which you should focus your limited time and resources.
- ❑ This framework of **Principles, Opportunities and Resources** is not definitive; the concept of "Sustainability" is too broad and imprecise for any discussion of this scope to be definitive. But it is a start....
- ❑ There is a lot more definitive, readily accessible information available to you....such as at EPA, ASHRAE, LEED, etc. Make use of it....
- ❑ and finally....

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That's all folks!

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