Second Wave of Sustainability for Human-Centric Lab Design

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Definition of the WELL Standard

• The WELL building standard is a performance based system for measuring, certifying and monitoring features of the build environment that impacts human health and well-being through the mind, air, water, light, comfort, nourishment, sound, materials, movement and community.
Objectives of Sustainable WELL Standard

• The goal of the WELL standard is to combine building designs that focus on energy efficiency and carbon footprint reduction with an approach that benefits the occupants’ health and well-being.

• Sustainable design involves utilizing the WELL standards of Mind, Air, Water, Light and Comfort to promote better health outcomes.
Key Concepts in Sustainable WELL Design

Mind
Air
Water
Light
Comfort
Mind

Biophilic Design, Aesthetic Design Elements
Biophilia posits that humans have an affinity towards the natural world

Stephen Kellert, a Yale professor who pioneered biophilic design, described six biophilic design elements
- Environmental features
- Natural shapes and forms
- Natural patterns and processes
- Light and space
- Place-based relationships
- Evolved human-nature relationships
Biophilic design encompasses a holistic approach to incorporating nature into build design including utilizing:

- Nature in the space
- Natural analogues
- Nature of the space

- Natural lighting and views of natural landscapes can enhance productivity

- Biophilic designs may also feature high ceilings to create an open and free flowing environment
Biophilic Design

• Installing water features will improve the overall space environment

• Building occupants with an outside view have been shown to have higher tolerance to work-related stress

• Biophilic design elements can encompass many areas, not simply putting nature into a building

• Build design can imitate the natural world
Aesthetic Design Elements

• The WELL Standards holistic approach emphasizes the importance of placing aesthetically pleasing design elements in the work environment.

• The physical space can have a role in the building occupant’s encouragement of positive emotions and serve as a positive motivator for productivity increase.
Filtration

• Utilizing high-efficiency particulate air (HEPA) filtration systems can prevent intrusion from potentially harmful airborne pathogens such as volatile organic compounds (VOC)

• Some reports say that HEPA filters can help with dust and pollen allergies

• Contrary to conventional filters, HEPA filters become more efficient with more use

• HEPA filters can also be used in vacuum cleaners which reduces the amount of airborne pathogens that may settle on the floor and on fabric materials
Dedicated Outdoor Air Systems

• A dedicated outdoor air system (DOAS) can further improve the space environment

• DOAS work by utilizing parallel systems of outside air ventilation and internal load handling

• DOAS’s can significantly reduce contagion risk as compared to traditional variable air volume systems

• Chilled beam technologies can work well with a DOAS
Active chilled beam systems can enhance occupant comfort by providing a more consistent temperature.

When combined with a DOAS, a chilled beam system can handle the sensible load in a building with low noise and a high level of comfort.

Chilled beam systems are also remarkably energy efficient.
Displacement Ventilation

- Displacement ventilation can work well with DOAS
- Drastically improved indoor air quality can positively impact people’s comfort
- Energy savings by almost 50%
- Displacement ventilation can also act as an effective means of contaminant removal
Natural Ventilation

• Operable Windows
  • Installing operable windows can provide much needed ventilation and reduce the load on the HVAC systems
  • Occupant comfort can be enhanced by utilizing natural ventilation

• Natural Ventilation
  • Natural ventilation can occur if exhaust openings and vents are placed to take advantage of natural air currents
  • If this does not provide enough cooling, a fan assisted strategy may be used
  • Natural ventilation must also be monitored to ensure airborne contaminants are mitigated
Airflow Patterns
Airflow Patterns
Water

Regular Testing, Filtration, Environmental Benefits
Regular Testing

• WELL design requirements specify 6 categories of assessment for judging a building’s water quality
  • Fundamental water quality
  • Inorganic contaminants
  • Organic contaminants
  • Agricultural contaminants
  • Public water additives
  • Periodic water quality testing
• Regular testing of water quality while incorporating these elements can help prevent contaminated water from entering the building supply
Contaminants

• Contaminants can drastically impact water supplies and negatively affect health

• Common contaminants include pesticides, agricultural waste, hard metals, such as lead and mercury, and industrial runoff, such as polychlorinated biphenyls

• WELL Design lists dozens of contaminants that must be kept below certain levels to ensure a safe water supply, e.g., mercury must be kept below .002 mg/L
Filtration

• Several filters can be used to improve water quality and building occupants’ health

• Reverse osmosis filters (ROF) are effective for removing inorganic contaminants from the water supply

• ROF are also among the most popular, economical filters on the market
Filtration

- Kinetic Degradation Fluxion (KDF) filters may also be used to filter inorganic materials.
- KDF filters are more expensive but are very adept at removing heavy metals from the water supply.
- KDF filters extend the life of carbon filters.
Impact of light

- Brightness contributes to perception of spaciousness and appeal
- Light of high intensity promotes alertness, lack of it signals to go to rest
- Excessive brightness can cause visual discomfort and glare
- Window shades and light dimmers reduce glare and energy
- Adequate levels of sunlight is critical for health and psychological well-being
Light

• Visual Lighting
  • Ambient lighting with 215 lux intensity
  • Independent lighting control for 500 s.f.
  • Provision of task light for ambient light below 300 lux

• Brightness Management
  • Contrast limitation between rooms
  • Contrast limitation between task surfaces
  • Brightness distribution across ceilings
Solar Glare Control

• View Window Shading
  • Internal
  • External
  • Electrochromic glass

• Daylight Management
  • Internal
  • External
  • Interior light sleeves
  • Film of micro-mirrors
  • Electrochromic glass
Right to Light

• Depth
  • 75% 25 ft. from window

• Access
  • 75% 25 ft. from window
  • 95% 41 ft. from window or atrium

• Depth
  • 55%/50% with 300 lux sunlight
  • 10% 1,000 lux 250 hrs./yr.
ILLUMINANCE DISTRIBUTION
Average Annual Conditions
March 21 12:00
Sunny Sky without Sun
(0-3000 lux)
Comfort

- Focus on enhancing acoustic, olfactory and thermal comfort to prevent stress and facilitate well-being
- Thermal comfort
- Noise exterior/interior
  - Sound-reducing surface and reverberation time
- Olfactory comfort
- Radiant thermal comfort
BUILD DESIGN HAS AN IMPORTANT ROLE TO PLAY IN THE INTERNAL BUILDING ENVIRONMENT

UTILIZING THE WELL CONCEPTS OF MIND, AIR, WATER, LIGHT AND COMFORT CAN CREATE A SUSTAINABLE BUILDING MODEL THAT WILL HAVE POSITIVE ECONOMIC, ENVIRONMENTAL, AND PRODUCTIVITY EFFECTS

WELL DESIGN SPECIFICATIONS CAN ENHANCE OCCUPANT COMFORT AND SAFETY

Conclusion
Questions?

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