

Interior Design for Health & Productivity

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What is Health?

“Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”

–World Health Organization

Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948.



©Life, Ralph Crane 1959

Why is a healthy interior important?



- Americans spend **90%** of their time indoors
- IAQ can be up to **10 times** worse than outdoor air
- Air pollutants are **2-5 times** more concentrated inside than outside.
- Children in the US miss over **6 million** school days a year due to asthma.
- Studies have found **456 industrial chemicals** in the blood, urine, and breast milk of 115 people.

Many of the causes of an unhealthy interior are preventable.

introduction

Productivity & Indoor Environment

A design problem...

- Students in daylit schools scored up to 25% better on standardized tests
(Heschong Mahone, 2003)



*J.J. Pickle Elementary School/St. John Community Center
Austin Energy Green Building Program Three Star Rating*

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Productivity & Indoor Environment



A design problem...

- National survey of 30 green schools (Kats, 2006)

Table A: Financial Benefits of Green Schools (\$/ft²)

Energy	\$9
Emissions	\$1
Water and Wastewater	\$1
Increased Earnings	\$49
Asthma Reduction	\$3
Cold and Flu Reduction	\$5
Teacher Retention	\$4
Employment Impact	\$2
TOTAL	\$74
COST OF GREENING	(\$3)
NET FINANCIAL BENEFITS	\$71

Productivity & Indoor Environment



A design problem...

- Verifone lighting, HVAC, and envelope upgrade:
 - 40% reduction in absenteeism
 - 5% increase in productivity
 - 50% energy savings

(Romm and Browning, 1997)

Productivity & Indoor Environment



©Life, Alfred Eisenstaedt 1940

A design problem...

- Indoor air and dust samples from 120 homes on Cape Cod.
- Found 30 of the 89 endocrine disrupting chemicals screened for.
 - Phthalates (e.g., PBA) in 100% homes.
 - Parabens in 90% homes.
 - Concentrations of polybrominated diphenyl ether (PBDE) flame retardants 10x higher than European homes.

(Silent Spring Institute, Household Exposure Study, 2003)

Productivity & Indoor Environment: Approach

Commercial ...

- Synergies between energy/water efficiency and IAQ
- **Focus:** flexibility, modularity, minimize finishes, health and performance regulations
- **Evaluation:** Productivity, Absenteeism, Staff Retention, Exam Scores

Residential ...

- Synergies between energy/water efficiency and IAQ
- **Focus:** vernacular, low-tech, minimize finishes, operable windows, local materials
- **Evaluation:** Health outcomes, Allergies, Chemical Sensitivities

design

Biophilia



- Connection to nature
- Indoor plants and water features
- Sense of place
- Access to outdoors
- Site elements

“The connections that human beings subconsciously seek with the rest of life.” – E. O. Wilson

design

Durability



Chipotle Mexican Grill, 4-star AE GBP

- Design for the life of the building
 - Temporary (less than 10 years)
 - Medium life (20-40 years)
 - Long life (50-99 years)
 - Permanent (100+ years)
- Design temporary/medium life elements for deconstruction
- Design for reuse

Health/Productivity Benefits

- *Reduction in noise, disruption, dust, during churn*
- *Durable finishes often are lower emitting*

design



Flexibility

- Design to ease configuration
- Modular planning grid and generic spaces
- Modular/demountable walls and furniture
- “soft space”
- Master plan horizontal/vertical future expansion

Health/Productivity Benefits

- *Reduction in noise, disruption, dust, during churn*
- *Help occupants control spatial surroundings*

Acoustics



Ruiz Library, AE GBP 3 Stars

- Source reduction (outdoor/indoor)
 - Mechanical equipment, transformers, generators, heliports, paging systems
 - Isolate loud indoor areas, vibration
 - Curfew
- Acoustical finishes
- Acoustical isolation and deck to deck partitions where necessary
- Elevate white noise

Health/Productivity Benefits

- *Reduce stress, workplace errors*
- *Improve sleep, job satisfaction*

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Holt Residence, AE GBP 5 Stars

Materials

- Minimize finishes
- Avoid persistent, bioaccumulative toxic chemicals (PBTs)
 - Mercury
 - Lead
 - Hexavalent Chromium
 - Dioxin
- Specify low emitting finishes, furniture
 - Paint
 - Carpet
 - Fabric
- Specify local, natural materials

Health/Productivity Benefits

- *Many common building materials contain known or suspected carcinogens, mutagens, neurotoxins, and endocrine disruptors*

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Free of Toxic Chemicals



EPA Region 7 Headquarters, Kansas City, MO

INDOOR AIR QUALITY IMPACTS ON HEALTH

CATEGORY	SOURCES	SYMPTOMS
Irritation	Formaldehyde, VOC's combustion gases, particulates, man-made fibers, and pesticides	Irritation of skin, upper airway, eye, nose and throat, headache, erythema
Pulmonary	Asbestos, combustion gases, Formaldehyde, ozone, particulates	Rapid breathing, fatigue, increased infections, pulmonary edema, asthma, allergies, flue-like symptoms
Cardiovascular	Carbon monoxide, particulates	Headache, fatigue, dizziness, aggravation of existing pulmonary conditions, heart damage
Nervous System	Carbon dioxide, carbon monoxide, Formaldehyde, VOC's	Headache, blurred vision, fatigue, malaise, nausea, impaired judgement
Reproductive	Formaldehyde, VOC's	Menstrual irregularity, birth defects
Cancer	Asbestos, radon, combustion gases, VOC's particulates	Cancer of the lung, stomach, colon

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Lighting

- Maximize daylighting and views
- Low mercury, efficient, long life
- Task lighting
- Circadian Rhythm



City View at the Park, AE GBP 4 Stars

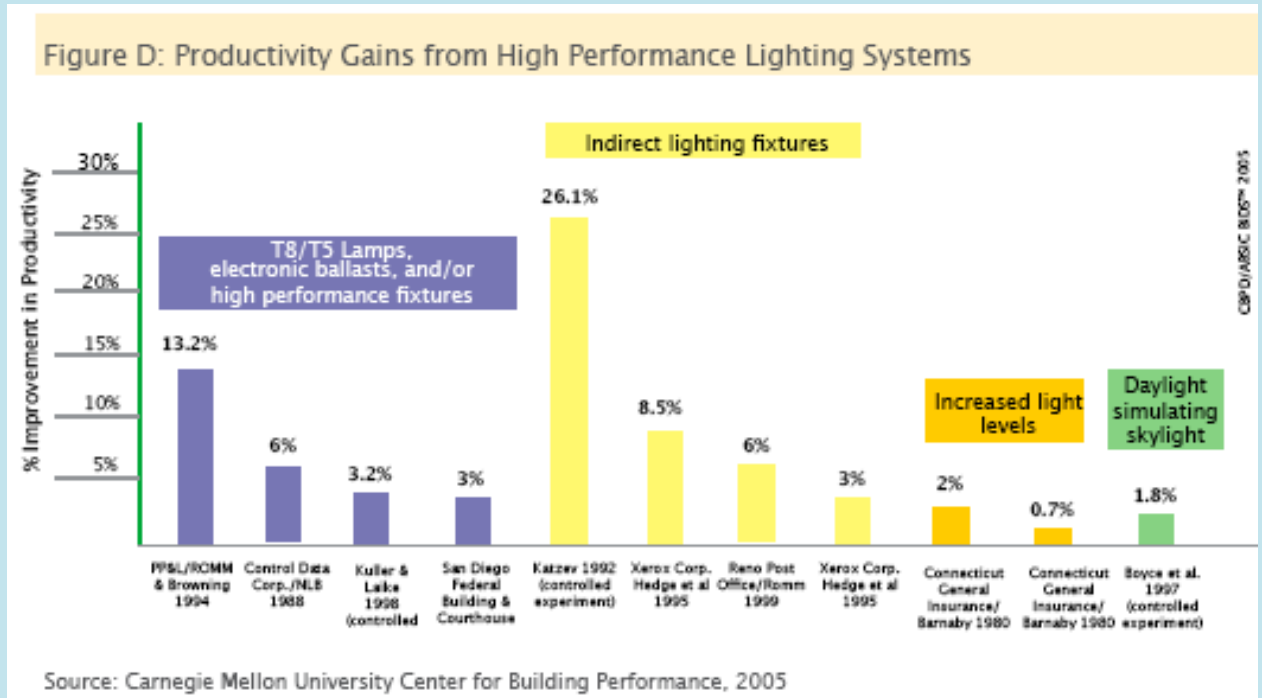


Image source: Kats, 2006

design

Wayfinding



- Views/access to exterior
- Open staircases
- Colors
- Local art
- Pedestrian access to surrounding neighborhood
- Gym/shower/changing rooms

Health/Productivity Benefits

- *Increased ability to focus, reduce absenteeism*
- *Encourage physical activity, increase daily outdoor activity*

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Entryways

- Grilles/Mats
- Location of air ducts, entries, operable windows
- Outdoor contaminants
 - Emissions
 - Pesticides
 - Herbicides
 - Fertilizer
 - Dust
 - Mold

Health/Productivity Benefits

- *70% dirt, dust, grit enters building via shoes*
- *Idling cars and trucks, pest and landscaping applications, etc. can enter the building through air ducts, doors, windows, polluting indoor air*



Saltillo Lofts, AE GBP 3 Stars

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Ventilation



- Commissioning
- Thermal comfort
- Operable windows
- 100% Outdoor Air (with heat recovery)
- MERV 13 air filters
- Displacement ventilation

Health/Productivity Benefits

- *Indoor air pollutants can cause eye, nose, and throat irritation, and can contribute to asthma*
- *Indoor air can be 10x more polluted than outside air*

construction

Neighborhood Impact



- Erosion and sedimentation plan
- Control construction dust
- Spill control plan
- No idling
- Diesel controls/alternatives
- Curfew

Health/Productivity Benefits

- *Construction industry responsible for 4% PM10 particulate emissions, linked to asthma, bronchitis, and cancer.*
- *Runoff in urban areas 4th largest source of water pollution*

construction

Longterm Impact



Pedernales Lofts, AE GBP 5 Stars

- Protect vegetation and onsite water quality
- Brownfield/HAZMAT remediation
- Construction sequencing
- Protect permanent ductwork
- Envelope commissioning

Health/Productivity Benefits

- *Protect ductwork and absorbent materials from construction activities*
- *Protect occupants from future pollutants: chemicals, hazardous materials, mold*

Cleaning



- Avoid finishes requiring toxic cleaning chemicals/waxes
- Use green cleaners
- Use low emitting equipment
- Staff training

Health/Productivity Benefits

- *Traditional cleaning chemicals can contribute to poor IAQ and ailments such as asthma, eye and skin irritation, central nervous system impairment*
- *Minimize work disruptions during cleaning*

Integrated Pest Management



Greater Austin Wildlife Services

- Develop IPM program
 - IPM coordinator
 - Include in contractor bids
- Eliminate pesticides
 - EPA Categories I, II
 - Linked to cancer
 - Interfere with human hormones, birth defects, endocrine disruptors
 - Inert ingredients (e.g., phthalates, formaldehyde)
- Use structural/cleaning methods

Health/Productivity Benefits

- *Health risk from chemical pesticides: nausea, dizziness, headaches, vomiting, skin irritation, cancer, birth defects, neurological*

operations

Chemical Isolation



- Smoke free campus
- Isolate areas with emissions: janitor, dark room, copy room
 - Deck-to-deck partition
 - Negative pressurization
 - Dedicated exhaust
- Source reduction

“People more readily equate pollution with large-scale contamination and environmental disasters, yet the products and activities that form the backdrop to our everyday lives—electronics, cleaners, beauty products, food packaging—are a significant source of daily personal chemical exposure that accumulates over time.”

- Rebecca Gasior Altman (2008)

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Tools

CHPS, <http://www.chps.net/>

Cradle to Cradle Certification,
<http://www.c2ccertified.com>

GREENGUARD, <http://www.greenguard.org>

Green Guide for Health Care, <http://www.gghc.org>

Green Seal, <http://www.greenseal.org>

LEED, <http://www.usgbc.org>

Pharos Project, <http://www.pharoslens.net/>

Local Tools

Austin Energy Green Building Program,
[http://www.austinenergy.com/Energy%20Efficiency/
Programs/Green%20Building/index.htm](http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/index.htm)

Mueller Green Resources Guide,
<http://www.muelleraustin.com/pdf/mgrg.pdf>



LCRA Dalchau Service Center, AE GBP 3 Stars

Thank You!

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